Tomorrow in sight: from design to delivery

European Innovation in Ambient Assisted Living

Proceedings of the 4th AAL Forum – Eindhoven, 24 – 27 September 2012

Ad van Berlo, Herjan van den Heuvel, Henk Herman Nap, Ilse Bierhoff, Wil Rijnen (eds.)

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On the cover: End-user evaluations participant talking about his experience with the social companion robot and smart home environment developed in the FP7 CompanionAble project during the AAL Forum VIP tour.

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INTRODUCTION

FORUM PROGRAMME COMMITTEE

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Ad van Berlo (Smart Homes)	The Netherlands

Committee Members

Ignacio Baanante (ISCIII)	Spain
Jerome Boudy (Institut Mines-Télécom SudParis)	France
Nicola Filizola (AAL Association)	Belgium
Nena Georgantzi (AGE Platform Europe)	Belgium
Gerda Geyer (FFG - Austrian Research Promotion Agency)	Austria
Krzysztof Głomb (Cities on Internet Association)	Poland
Urs Guggenbuehl (Fed. Office for Prof. Education and Technology)	Switzerland
Péter Hanák (BME EMT)	Hungary
Martin Jaekel (AAL Association)	Belgium
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Alain Thielemans (IWT)	Belgium
Reiner Wichert (Fraunhofer-Allianz AAL Department)	Germany

FOREWORD

The 4th AAL Forum was held in Eindhoven – the hotspot for technology research and development. The theme of the Forum 2012 was 'Tomorrow in sight: from design to delivery'. We need to move beyond demonstrations and pilots and put AAL solutions into practice and bring them to market. The Forum 2012 invited us to discover the extensive progresses made by the AALJP projects and to further boost AAL across Europe.

The Forum was co-organized by the AAL Joint Program (AALJP), the Dutch Ministry of Health, Welfare and Sport, the province of Noord-Brabant, the city of Eindhoven, Brainport Eindhoven Region which was awarded with the title 'the world's smartest region' by the Intelligent Community Forum, and Smart Homes – the Dutch Expert Centre on Home Automation, Smart Living and e-Health.

The Forum was a big success with over 1400 participants – more than doubling the number of the previous year. All participants showed great interest in the developments and research in the field of AAL products and services. In total, 215 speakers and 43 chairpersons communicated their findings and future directions in the unique setting of the UFO-shaped Evoluon conference centre. In addition, 68 exhibitors with 24 AAL project booths and 44 booths from industry, government and research institutes provided an interactive experience of the state-of-the-art in AAL.

The event stimulated networking and community building among all stakeholders. Bridges were built with investors and other relevant EU programmes. Unique to the Eindhoven edition of the AAL Forum were the site visits, where participants experienced actual projects in the region. Also new was the participation of 160 older adults who actively joined the sessions and served as a valuable sounding board for AAL researchers, developers, and business professionals.

Concluding the Forum, we would like to state that besides the necessary continuous effort in AAL research and development, the AAL community needs to put effort in actually bringing products and services to market. We see great opportunities for the adoption of AAL solutions in the market and were impressed by the positive energy and devotion of the Forum contributors. Now, to move forward, we need to work on cost-effective procurement models that cross European borders in health care policies and financing.

Let us continue our passion in this interesting and highly needed work field and welcome you, your family, friends and colleagues to the fifth AAL Forum 2013 in Norrköping, Sweden.

Henk Herman Nap – Stichting Smart Homes

Eindhoven, July 2013

WELCOME NOTES

WELCOME FROM THE CHAIRMAN

Ad van Berlo[1]

In ancient Rome, the forum was a central place in town, where people came together, met, and discussed the important issues of the day. Today a forum is more likely to be a discussion platform on the internet. In the AAL Forum 2012 in Eindhoven we want to combine the best of the old and the new.

It will be the fourth annual meeting place for researchers, engineers, product designers and developers, marketing specialists, and care & welfare workers to discuss progress in the area of Ambient Assisted Living. But it will be much more than just discussing. We want the AAL community in Europe to bring and get the five I's:

Information *exchange from different disciplines and areas, leading to more* ***Inspiration*** *for researchers and designers, evoking more* ***Imagination*** *on finding new and better solutions, having* ***Interaction*** *with representatives of other institutions, companies and governments, which at the end must lead to new paths for* ***Innovation***.

The AAL Forum 2012 Programme Committee has produced a programme which includes many short presentations on AAL policies, programmes and special topics. It will also showcase the wide variety of projects we are working on, from social interaction to support of family carers, mobility and robotics, tele-monitoring and integrated care, dementia and fall prevention. Special attention will be given this year to bringing these new developments to real business. There will be sessions that will help to overcome the barriers to exploitation, and a special track on venturing. Investors will meet SMEs in pitching sessions, and explore new investment opportunities with companies that will take part in the exhibition.

This year's forum will also have older adults participating in the sessions, meet with you and give you feedback on their opinions and wishes. Therefore, we are sure that the AAL Forum 2012 will strongly contribute to further growth of markets of AAL products and services that really matter and that older adults are really looking for.

Welcome to the AAL Forum 2012!

[1] Chairman of the AAL Forum 2012 Programme Committee and Manager R&D at Smart Homes

WELCOME FROM THE AALA

Mike Biddle[1]

Europe is changing – amidst the financial instability and quest for economic growth – the demographic shift to an older population has already begun. The basic facts about the ageing of Europe's population are well-known and show an imminent and significant change in society and the economy for which the EU is still not well-prepared.

Fortunately, all is not lost because research, development and innovation can help to turn these changes into an opportunity – so it is with great pleasure and pride that I welcome you to the AAL Forum 2012 in Eindhoven, as the next step on this journey.

This is the fourth annual event for the Ambient Assisted Living Joint Programme (AAL JP) and we are pleased to be part of a vibrant and growing community with over 100 projects in our portfolio. Our activity started in 2008, with 23 countries working together to develop a joint programme of activity to improve the quality of life for older adults through the application of Information and Communication Technology (ICT).

To successfully introduce the validated products, services and solutions that are needed; the real needs and desires of older adults and their carers need to be addressed. No single European country can achieve this by working alone but by working together with close support and joint funding from the European Commission. We have started to show how cost-effective health and social care could be delivered in the future, and lead to a growth opportunity for European businesses.

The title of our Forum is "tomorrow in sight: from design to delivery" – to do this we need to collaborate and move beyond technology demonstration to achieve scale. I look forward to the ideas and exciting discussions that will take place at our Forum so that we can work together to accomplish this.

[1] President of the AALA

WELCOME TO THE NETHERLANDS

Marlies Veldhuijzen van Zanten-Hyllner[1]

I am proud that the AAL forum is being held in the Netherlands this year. As senior citizens we are members of mainstream society and more and more of us will remain active for a longer time, making a valuable contribution to the community at large. But for most of us sooner or later there comes a time when we must rely on care from others.

I believe it is important that we care for our elderly properly, listen to their needs and devote attention to them. Care is and will always be people's work. The relationship that exists between the person who needs care and the person who provides it is an extremely important one. Senior citizens are becoming an increasingly larger group. Technology is an important factor in order to continue supporting them. Technology can help older persons to continue living at home for longer time and to remain in touch with his or her surroundings and it can help to make the care giving process easier and more attractive. Smart and practical products can make the care provider's work easier.

Care and innovation are inextricably linked in today's world. Innovation is important for care and also for the business community. The AAL programme is aimed at developing innovative ICT solutions. AAL projects exhibit a unique form of cooperation between healthcare, business and government. This forum serves as a valuable meeting place for learning about projects and users.

I wish you a pleasant and enlightening forum. I hope it will result in our senior citizens being able to benefit in the years ahead from all of the ICT products and services that you will develop.

---

[1] State Secretary for Health, Welfare and Sport

WELCOME TO THE PROVINCE OF NORTH-BRABANT

Brigite van Haaften-Harkema[1], Bert Pauli[2]

The AAL Forum 2012 perfectly matches the ambitions of the Province of North-Brabant to deal with the societal challenges we are faced with today: turning the threat of demographic changes into opportunities, developing a future-proof care system and working on the quality of life for our citizens.

Not something we can deal with just on the scale of a province of 2.5 million inhabitants. For serious innovation and up-scaling of innovative AAL solutions we need to operate on a European level with partners like the European Commission, the CORAL network and of course the AAL Joint Programme. The AAL Forum 2012 also matches our ambitions to create opportunities for innovative businesses. As a regional government we aim to empower – as a catalyst – our stakeholders in this process.

In our province we have been working for years with the concept of social innovation, in programmes like Smart Care and Liveable Communities. It is all about breaking down silos and working together in a process of open innovation. Governments, companies, universities, civil society and end-users alike are all ‘learning by doing’. With the purpose to overcome the barriers that prevent large-scale implementation of smart solutions for independent living, health and integrated care. Meanwhile, we are looking with great interest to Brussels, where the European Commission started the horizontal European Innovation Partnership on Active and Healthy Ageing. North-Brabant is actively involved and we learn a lot from this partnership. North-Brabant has strong economic clusters, opening up opportunities for innovative applications and services in the field of Active & Healthy Ageing.

Of course, all these efforts come down to the Province of North-Brabant caring about its citizens. We need more quality of life for senior adults, disabled persons and people with chronic illnesses.

All hands on deck to work on a future-proof health and welfare economy of the 21st century and to create opportunities for innovative businesses!

---

[1] Member of the Noord-Brabant Provincial Executive (Culture and Society)

[2] Member of the Noord-Brabant Provincial Executive (Economic Affairs and Administration)

WELCOME TO EINDHOVEN

Rob van Gijzel[1]

Eindhoven is proud to host the Ambient Assisted Living Forum this year. For a period of four days about 1,000 visitors and exhibitors will dedicate themselves to an issue that is relevant throughout Europe - and beyond: the aging population.

People are getting older and the elderly are more likely to need care than young(er) people. With the median age of the population on the rise, an increasingly smaller workforce will have to carry the cost of care for the elderly. The European Union has recognized that this situation is untenable and believes that this trend should be reversed through a collective effort. Therefore, the European Union encourages the development of knowledge about this subject and the implementation of solutions. There is one clear goal: to add two healthy years to the lives of EU citizens. A great ambition. If we manage to delay the moment that millions of seniors start needing care by two years on average, the entire EU will save billions of Euros. That is an attractive prospect for any country, especially now.

But there are additional reasons to develop ways to allow the elderly to live independently longer. Just think of the well-being of an aging population. Older people want to be independent for as long as possible. The AAL program is an important contributing factor in this process. There is also an important economic aspect. The aging population offers great business opportunities. By taking the lead in the development and manufacturing of environment-related solutions for an aging population, research institutes and companies can stay ahead of the competition and bring products to market faster. That is good news for Europe.

It is no coincidence that the AAL Forum is being held in the Evoluon in Eindhoven. Our area – Brainport Eindhoven Region – is home to a multitude of companies and research institutes that develop solutions for an aging population. In addition, our region is famous worldwide as a hotspot of high-level knowledge technology, innovation and design. It is for good reason that Eindhoven was named Intelligent Community of the Year in 2011. And the Evoluon, which was built in 1966, has served as an educational technology museum for many years. It is a perfect location to meet and learn and offer each other inspiration.

I hope you have a very pleasant and productive stay.

[1] Mayor of the city of Eindhoven and Chairman of the Brainport Foundation

CONFERENCE SESSIONS

TRACK A RATIONALE: AAL POLICIES

Since 2008, the AAL JP has been funding projects to develop AAL solutions through 5 distinct calls for proposals. The outcome of these projects will contribute to achieving the overarching goal of the European Innovation Partnership on Active and Healthy Ageing (EIP AHA), which by 2020 aims to increase the number of healthy life years in Europe by two years. Track A will consist of a Plenary session with a European perspective and sessions on Regional Policies, Policies in European countries and Policies outside Europe.

Track A consists of the following four sessions:

Session A1 – AAL and the Active and Healthy Ageing EIP – opportunities to connect and grow

Since 2008, the Ambient Assisted Living Joint Programme (AAL JP) has been funding projects to develop AAL solutions through 5 distinct calls for proposals. The outcome of these projects will contribute to achieving the overarching goal of the European Innovation Partnership on Active and Healthy Ageing (EIP AHA), which by 2020 aims to increase the number of healthy life years in Europe by two years. The AAL JP has contributed to the Strategic Implementation Plan for the EIP AHA and is hosting the action group as pre-conference activity of the AAL Forum in Eindhoven.

The Innovation Partnership provides a unique opportunity for the AAL JP to foster important integration of various players that are essential for the successful implementation of AAL solutions and thus contribute to the (commercial) success of AAL JP projects. Thus this session will allow a close discussion between EIP-AHA, the AAL JP and the different important players in the AAL field.

In the introductory presentation to this session, the main elements of the EIP AHA (objectives, goals, scope, partners, governance, etc.) will be explained. The introductory presentation will be followed by an interactive discussion with panel and audience. The panel will include members of the European Commission, SME and industry representatives, end-user associations, research organisations and National Funding Agencies. They will discuss the joint benefits that the AAL JP and the AHA EIP can achieve together and how they can most effectively interact. This discussion will also seek to put the joint efforts of the AAL JP and the EIP AHA in the current economic context, identify the opportunities for future growth and discuss the possibilities to overcome the market entrance barrier. Two members of the of European Parliament will give a reflection on the discussion.

Speakers/panellists:

- Marja van Bijsterveld, Minister for Education, Culture & Sciences of the Netherlands
- Brigite van Haaften, Provincial executive for Welfare & Healthcare of Noord-Brabant
- Neelie Kroes (video message), Vice President of the European Commission
- Paul Timmers, Director Sustainable & Secure Society, DG CONNECT, European Commission
- Jeroen Wals, Chief Technology Officer, Philips Healthcare Solutions, Eindhoven
- Inger Hagen, Forget-me-not, Norway
- Barbara Kuss, Forschungsinstitut des Roten Kreuzes, Austria
- Rick Hutley, Vice President Innovation, Cisco, San Jose, USA
- Lambert van Nistelrooij, Member op European Parliament
- Kartika Liotard, Member op European Parliament

Session A2 – Regional policies

Regions in Europe fulfil an essential role in the implementation and up scaling of innovative AAL solutions and services, a process of innovation with many divers stakeholders. Dozens of European regions developed regional policy and gathered a lot of experience and good practices on this matter. Most of them want to exchange experiences and learn from other European regions how to innovate and overcome barriers. Many European regions are currently involved in the process of connecting, building a European community and collaborating in European projects; to connect their innovation clusters with the rest of Europe, to exchange knowledge and experience, to put issues on the political agenda, to raise awareness and to make it happen. The format will be an interactive workshop of 180 minutes (2x90), consisting of a keynote speech and 5 cycles of inspirational pitches by experts, followed by round table discussions of 10-12 participants.

Questions and items to be discussed:

- How to build interregional cooperation in an informal network and community?
- How to build new networks in regions? What are key factors for success?
- How can the regional government contribute to this process?
- How to activate stakeholders in Europe and build bridges between networks and experts?
- What's the role of the regions in the action groups of the European Innovation Partnership on Active and Healthy Ageing?
- How do different cultures and political contexts of regions effect the engagement in informal networks?
- What do regions need to become engaged?

- How to put social innovation on the regional agenda?
- What are the key factors for success and how can the EC contribute?

Regional policy is the core business of the organisers of this session: the Community of Regions for Assisted Living (CORAL), it's Interreg IVC project CASA and the e-Health network of the Assembly of European Regions (AER). Purpose is to give a next boost to the cooperation of European regions on policy for AAL and AHA within the framework of both CORAL, AER, Interreg IVC and the European Innovation Partnership on Active and Healthy Ageing (EIP AHA). And to give the exchange of knowledge and experience in this field more profundity.

Speakers/panellists:

- Annamaria Zonno, CORAL, the Community of Regions for Assisted Living and expert international relations of the region Puglia, Italy.
- Peter Wintlev-Jensen, Head of Sector for ICT for Inclusion at DG CONNECT of the European Commission and European Innovation Partnership on Active and Healthy Ageing
- Marieke van Beurden, project manager Brainport Health Innovation, Eindhoven, NL
- Henriette van Eijl, policy officer DG Enterprise and Industry of the European Commission

Session A3 – AAL national policies in Europe

For the past 4 years, the AAL Joint Programme has been driven by AALA Partner States, which have committed to develop solutions for the ageing population. 23 European countries are now participating and in close cooperation contributing to this programme. Over the years, several AALA Partner States such as Austria, Germany, UK, Spain, The Netherlands and Denmark (among others) have developed specific national policies and strategies in the field of Ambient Assisted Living (AAL). Some of these countries also run national funding programmes dedicated to research and development of AAL solutions. In other AALA Partner States, AAL solutions are funded in the context of a programme with a wider scope (such as eHealth for instance) and as a consequence no specific national AAL policies or strategies have been formulated.

Looking ahead and thinking about the future directions of the AAL JP, the AAL Forum in Eindhoven presents a good and timely opportunity for all AALA Partner States to present and discuss their respective national situations.

This session entitled "National Policies" aims at fostering a common understanding of the collaborative work in the future within the AAL JP and give time to reflect on the directions taken on a national level within Europe. Furthermore, it will provide an opportunity to present and discuss the different priorities, approaches and existing synergies also beyond the AAL JP.

The discussion will be around a set of questions e.g.:

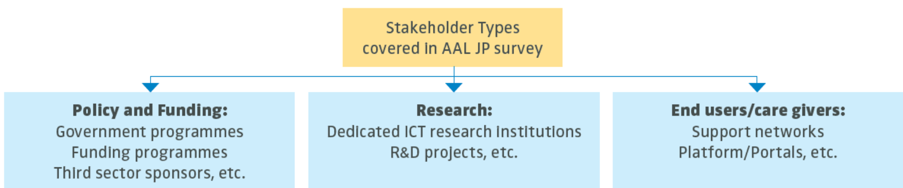
- How can National policies support the future direction of the AAL JP?
- Where do you see the strongest synergies with other countries?
- What have been the national benefits of participation in the AAL JP?
- Which problems arising from the cooperative nature of the AAL JP can and should be solved?
- How does Horizon 2020 / EIP AHA connect with national AAL policies?

Speakers/panellists:

- Sita Kishna, Ministry of Health, Welfare & Sports, The Netherlands
- Mike Biddle, Technology Strategy Board, UK
- Stephan Arnold, Federal Dpt. of Internal Affairs / Social Security, Switzerland
- Kerstin Zimmermann, Federal Ministry for Transport, Innovation and Technology, Austria
- Ann-Mari Finemann, Vinnova, Sweden

Session A4 – International AAL policies outside of Europe

The AAL JP has brought together a wide range of Partner States to build an AAL community in Europe, and now is the time to consider how we can connect with wider international opportunities to address the global market. To date, the links between the AAL JP and AAL activities outside of Europe have been ad hoc, even though there are numerous related activities on other continents and collaborations between the AAL communities exist. A recent more systematic survey of international AAL activities by the AAL JP has analysed the current situation in countries facing demographic change. The AAL JP survey has particularly focussed on the following three types of organisations in countries outside of Europe:



Among others, a number of countries including Japan, South Korea, Australia, the USA, Canada or China have dedicated policy institutions and programmes, research institutes and end-user platforms to address questions associated with an ageing population. Taking into account the different political contexts, an exchange between European and international policy and programme directors has hence the potential to benefit AALA Partner States, our international guests and ultimately older adults in different parts of the world.

In this session, representatives from non-European countries will present their policies / initiatives, funding instruments , organisations and institutes, potential markets and end-user needs.

Speakers/panellists:

- Japan - Akihiro Nakajima, Attaché for Innovation, Embassy of Japan in Belgium
- South Korea - Jung Yoon Soon, Health and Social Affaires Attaché, Embassy of South Korea in Belgium
- Canada - Jutta Treviranus, Professor/Director Inclusive Design Research Centre & Inclusive Design Institute OCAD University
- Brazil - Adriana Z F Feal, Chairman of the Commission on Elderly's Right in São Paulo

TRACK B RATIONALE: AAL PROGRAMME

When looking at the AAL projects themselves, finished in Call 1 and running in 2-4 (Call 5 is just being evaluated), several things can be learnt and taken to future developments, such as exit strategies when doing trials.

Track B consists of the following five sessions:

Session B1 – Feedback session to the AAL JP: focus on lessons learnt, mistakes, barriers, benefits

The session will not be based on presentations, but on world café interaction. The aim of the session is to provide feedback on different AAL-relevant aspects to the Ambient Assisted Living Joint Programme.

There will be three sections in the room which are reserved to three specific AAL-relevant aspects: market, end-users, technology. Each of the three aspects will be discussed on the project, the programme and the general levels. Attendees will be split in three groups. Each group will stay for 25 minutes in a topical area, then the group moves on to the next aspect. So each group will discuss each of the three AAL-relevant aspects.

It is assumed that the majority of attendees will be persons who are actively involved in AAL JP funded projects. Project partners, but also other attendees of the forum, are cordially invited to inform the Ambient Assisted Living Joint Programme about their experiences and opinions. Each topic will be discussed on the project's, the programme's and the general/societal level.

Session B2 – Pre-announcement and further preparation of Call 6

During this session the topic of Call 6, working title "ICT-based solutions for Supporting Occupation in Life" will be pre-announced. An introduction to the wider topic is given by a key-note speaker and a member of the AAL Content Working Group. Apart from pre-announcing the call topic to the wider AAL community, this session aims at discussing the topic with all stakeholders present at the AAL Forum 2012 identifying all important sub-topics and aspects that need to be taken into account for the formulation of the call.

Session B3 – AAL national programmes

The Ambient Assisted Living Joint Programme is a common funding activity of 23 partner countries. The backbone of the programme is formed by national funding activities. In this session we will show some of these funding activities highlighting different national approaches and expertise's, including facts and figures.

Session B4 – What's next? The new AAL wave (future calls)

A central element for the follow up AAL JP is just to consider the thematic map to be covered by future calls in light of the policy strategic goals at EU and MS, the AAL Association and other stakeholders, in particular users and industry. The experience of the thematic coverage by the 5 past calls (and the 6th under decision process) offers a basic reference to analyse for a new stage. Other elements to consider refers to detected gaps, emerging priorities and market trends as well as synergistic approaches and complementarity with other initiatives.

Session B5 – Ethical aspects: focus on exit strategies

It is commonly accepted that AAL projects must consider ethical aspects. Several guidelines provide the framework for dealing with different aspects of applied ethics when involving end-users in projects and when developing AAL solutions.

In this session we will focus on exit strategies during the concluding phase of the project, the interrelatedness to the topical area of a project, as well as the methods applied in end-user involvement. We will discuss exit strategies that have already been adopted and those which are planned for adoption. The aim of the session is to present a variety of exit strategies and discuss their pros and cons.

Information about the importance of exit strategies has been spread by the AAL JP. Requirements regarding exit strategies may differ significantly, both from project to project and also according to the specific topic investigated. When designing the involvement of primary end-users in a project, it should be taken into account that end-users may become accustomed to the special attention and services they receive during the project. When people become deeply involved, the termination of the project may itself create problems. Provisions for dealing with such issues are necessary in order to avoid distress and negative reactions among end-users as the project is concluded.

The session aims at demonstrating a variety of exit strategies, taking into account the different topical areas within the AAL JP and, consequently, the different implications of the exit strategies.

TRACK B NOTES

SESSION B1: TECHNOLOGY

Tamás Szabó[1]

Round table feedback session to the AAL JP - Focus on lessons learnt, mistakes, barriers, benefits. Chair: Lóránt Vajda for Technology (BME-EMT, Hungary)

Main message

Technology in ambient assisted living projects: the session dealt with technology acceptance within elderly people, robots in intelligent home environments and crucial aspects about how to increase the benefit of such projects for elderly to inspire them using high-tech solutions.

Summary of introduction

Simple solutions should influence the ambient assisted living projects at first and later after an extended testing phase developers can move on to more complex requirements. Older people tend to like new technology, but they are afraid of failure when using them. The benefits of the solutions should be made clear and simple user interfaces are preferred.

Key Points:

- AAL projects should be started with clear visions about the requirements coming from end users.
- More end users and user groups should be involved than technology participants.
- Robustness of the systems must be increased and should be tested on field for a longer time with a larger number of participants.
- The benefits coming from the use of new technology must exceed the efforts put in to learn the use of the devices.

Conclusions

“Technology done, services none”; there are a wide variety of AAL projects aiming to ease the everyday life of elderly but they are not tested well, most of them are in the prototype status after deployment too. The crucial requirement is to increase the robustness of the projects because most of the older people feel failure if they are not able to use the new technology properly at the first time.

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SESSION B1: END-USERS

Gerda Geyer[1]

Round table feedback session to the AAL JP - Focus on lessons learnt, mistakes, barriers, benefits. Chair: Gerda Geyer, Austrian Research Promotion Agency

Main message

The aim of the session was to provide feedback on different AAL-relevant aspects to the Ambient Assisted Living Joint Programme. The meeting room was divided into three areas, each reserved for one of the three specific AAL-relevant aspects: market, end-users and technology. Each of the three aspects was discussed at project, programme and general level. Attendees were split into three groups. Each group remained in a topical area for 25 minutes before moving on to the next aspect, allowing each group to discuss each of the three AAL-relevant aspects. Each topic was moderated by a chair. Participants were invited to post the most important aspects and statements on a pinboard.

Summary of introduction

At the beginning of each of the three group discussions on end-user related aspects, the chair gave a brief introduction to the AAL JP's view on end-user involvement. She explained that the inclusion of at least one end-user organisation was an eligibility criterion for collaborative projects funded under the AAL JP. She gave the definition of end-users adopted in the AAL JP, which distinguishes between three different categories of end-users: primary, secondary and tertiary end-users. She concluded by naming some of the key expectations of the AAL JP in relation to the involvement of end-users.

Main findings

Project level

Overall, the level of involvement of end-users in projects funded by the AAL JP was highly appreciated. It was mentioned that there was no point in developing anything without involving end-users. However, quite a lot of participants in the discussion felt that the timing of end-user involvement in many cases was still not optimal. In fact, a main issue in the discussion was the need for early involvement of end-users in

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projects. Participants felt that especially prior to the launch or at the beginning of a project there is often not enough involvement of end-users. This results in problems on both sides: On the one hand, when the technological solution is more or less defined, it is difficult to change it. On the other hand, it is essential that when a project is started, it is already clear what the end-users want. It was also mentioned that there was insufficient time to include end-users in the proposal writing phase to better adapt the technologies to meet their needs. It was recommended that end-users should be involved already in the first 6 months - the earlier they are involved, the lower the risk. Some participants reported that they have made the experience that inclusive design at an early stage should involve the primary end-users and not intermediaries.

Another participant highlighted the benefits of the involvement of end-users in AAL JP projects by saying it makes a difference whether technologists make the pudding and end-users are the cream or vice versa.

A second major issue in the discussions concerned methodological issues. Older adults tend to be unfamiliar with R&D processes - they do not know what sensors are or what measuring means. Therefore, involving end-users is very much about trust building and not overwhelming them with too much input, while being very clear in communication issues. This holds true also for obtaining the informed consent of the end-users involved. Quite often, the process takes longer than anticipated.

Language issues can also prove challenging. If end-users from different countries are involved, translations are required. It is, however, sometimes difficult to obtain funding for this. Also, even when people speak the same language, they often use different terminology and understanding is not always obvious and easy.

Last but not least, it was mentioned that project consortia should remember to focus on organisations that are going to use the technology at the operational level (primary or secondary end-users).

Programme level

The key question discussed at the programme level was the pre-R&D project phase. Can we fund the stage before a project starts, and if so, how? One participant asked if it would be possible to have properly acknowledged feasibility studies to gather information on user needs before embarking on development projects.

The background of this idea is that when you start a project, it has to be clear that the users actually want to have what you are proposing. As a matter of fact, consortia have to limit resources in the proposal phase because it is quite normal that only one out of seven proposals will be accepted. It was discussed whether offering workshops on the programme level would be an option but it was not felt that this would be enough. It was proposed that projects be divided into two parts, the initial one being a feasibility stage. This first stage could be driven by end-users, designers etc. Another suggestion was that a micro-trial with one test person could also produce very valuable results.

Another important topic was the necessity for a change of paradigm within organisations. It was reported that sometimes the hierarchical level of people engaged in consortia was too low to guarantee an impact on the project's results. In fact, without top level management commitment, it is difficult to change processes etc. in organisations. It was therefore concluded that the AAL JP should try to obtain top-level commitment from organisations. It could even be a precondition for funding to conduct a micro-test with organisations to see whether they are ready to implement change.

Other recommendations to the programme included involving older adults; providing them with the knowledge required to help them use the technologies; and having equal participation rules for developers and end-users (care organisations) with respect to funding, time and resources.

Societal level

At the societal level, discussions mainly focused on the fact that important groups of end-users still have to be interested in AAL. What they need is information and evaluation evidence. It was mentioned that primary end-users are very important, but tertiary end-users are still not involved to a sufficient extent. In fact, in many cases it is the tertiary end-users who take the decisions. Institutions (mostly secondary end-users) are not ready as well, and nurses have to have a lot of information to be convinced about the benefits of ICT usage. It was felt that the key problem is the organisation itself because people do not want to take management responsibility in care homes. Most important here is a behavioural change.

Conclusions

It makes a difference whether technologists make the pudding and end-users are the cream or vice versa. Projects could be divided into two parts. Feasibility studies could constitute the first stage. Ask for greater commitment from secondary end-users – a paradigm change is needed within the institutions.

SESSION B1: BUSINESS

Aliaksei Andrushevich[1]

Round table feedback session to the AAL JP - Focus on lessons learnt, mistakes, barriers, benefits. Chair: Pascal Fabing (Luxinnovation, Luxembourg)

Main message

How can AAL Solutions reach the market? What are the lessons learnt at project level, at AAL Joint Programme level and at societal level?

Summary of introduction

The main points addressed were followings:

- Project: what kind of stakeholders should be involved? How to set up a value proposition during the project? What kind of feedback is expected by stakeholders?
- Programme: how to tackle market barriers (fragmentation of markets; regulation; understanding needs versus reaching payers)
- Societal: may AAL solutions lead to savings? May quality of life be increased while reducing costs?

Main findings

- Project partners encounter difficulties in getting appropriate feedback on the clients' willingness to pay. In many cases, the "system" makes the decision not the primary users. It is also difficult to involve policy makers in projects.
- Decision makers (buyers) are not informed well enough about already existing solutions.
- People delivering care (formal / informal) should drive the innovation process (workflow innovation). AAL Solutions may have an impact on the whole value chain: may the AAL solution imply more work for the carers? What should the elderly do themselves and what should be done by professionals? Separation of tasks or one main interlocutor for the elderly? How involving informal carers? The value proposition should address these issues.
- Ethical issue: should the focus be on more years (cure) or better years (prevention)? Some initiatives are encouraging new trade-offs (i.e.: Norway:

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a fund - formed by reducing hospital budgets by 10%- is dedicated to activities within municipalities for preventing health problems; in Denmark: municipalities can apply for a special health technology fund; in the Netherlands: municipalities have the responsibility to facilitate the participation of elderly in their community)

- Strong need to find public-private models where the end-customers are ready to pay more.
- Some successful projects could transform their business model to a Hardware as a Service model.
- Increasing quality of life and achieving savings seems a real challenge, even if studies in the UK confirm that it is possible. There is still a lack of evidence on large statistical numbers. There should be in-situ tests with and without ICT solution, on a large number of people and with 3-6 months duration in order to estimate the "value" of a solution. Living labs may play a role for such real-life tests.

TRACK B PAPERS

THE AAL RESEARCH AND INNOVATION WORLD IN SPAIN

José L. Monteagudo[1], Ignacio Baanante[1], Rafael de Andrés[1]

Abstract

AAL domain has consolidated as one of the most active areas on ICT applications research and innovation in Spain. It is attracting the interest of technological institutes, academic groups, SMEs, telcos, health and social researchers. This communication offer an overview of the national funded AAL research in Spain showing its role for the emergency of the sector and its evolution before and after the AAL JP become active.

1. Introduction

Along last years, research activity on Ambient Assisted Living (AAL) field has become increasingly relevant in Spain. Certainly, it has gained more visibility after the European AAL Joint Program (AAL JP) entered in action. However, projects in the AAL domain have been performed under National Programs since more than ten years ago. This R+D+I has been mainly promoted and supported by the public sector through different programs and instruments under the common framework of the successive National Plans of Research, Development and Technological Innovation (PNIDi). The last PNIDi (2008-2011, extended to 2012 too), has provided coverage to AAL matters through four main action lines:

a) The Strategic Action on Health Research (AES), managed by the ISCIII (National Institute of Health Carlos III, a body with its own legal personality of the Ministry of Economy and Competitiveness – MINECO - via the Secretariat of State for Research, Development and Innovation - SEIDI), coordinated with the Ministry of Health, Social Services and Equality.
b) The Strategic Action on Telecommunications and the Information Society , managed by the SETSI (Secretariat of State for Telecommunications and Information Society) of the Ministry of Industry, Energy and Tourism (MINETUR).
c) The dedicated calls on "Dependency, universal accessibility and improvement of wellness and quality of life of the citizens" of the Strategic Action on Health, managed by the IMSERSO (Institute of Aged Persons and Social Services, a legal body with its own legal personality of the Ministry of Health, Social Services and Equality).
d) The Innovation Programs managed by the Secretariat General for Science, Technology and Innovation (SGCTI) and the CDTI (Centre for Industrial

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Technological Development, a body with its own legal personality of this Secretariat General attached to SEIDI).

The ISCIII and the SETSI are actually the Spanish co-funding agencies for the AAL JP. The resulted national scientific and technological ecosystem generated around AAL is quite complex and dynamic resulting from the convergence of different actors from different sectors. This communication offers an overview of AAL research activity in Spain along the 2001-2011 time framework. It allows a first view of the evolving situation before and after AAL JP projects started to run in 2009.

2. Methods

We have based the study on research projects in the AAL field, during the 2001-2011 time framework, in Spain.The collected projects were classified in three groups:

a) National: Projects funded only by national (public or private) entities
b) EU: Projects co-funded by EC (except AAL JP)
c) AAL JP: Projects funded under the 1, 2, 3 AAL JP Calls

The Information Services of the General Under Directorate of Research Evaluation and Promotion at ISCIII has provided us data on funded projects for the 2009-2011 calls under the Strategic Action on Health Research at the National Plan of Research, Development and Innovation (2007-2011) including AAL JP.Detailed information about national projects was gathered using the data base of research activities on ageing at the Observatory of the IMSERSO-CSIC (www.imsersomayores.es). Other information sources have been the Statistical reports on AAL JP Calls available at the AAL web site (www.aal-europe.eu). The initial row set included 352 projects for analysis. They were reviewed and filtered to identify properly labeled “AAL” projects. The final selection resulted in a set of 126 Projects, distributed as: 75 National; 21 EU, and 30 AAL JP.

3. Results

3.1 Research activity

Figure 1 shows de evolution of the number of active projects in the 2001-2011 framework, for the three categories of National, EU and AAL JP projects. The evolution of global research activity shows how most relevant research activity emerge in 2006 and growth in 2007 and 2008 to reach a plateau in 2009. This growth, before 2009, was mainly supported by projects funded under National and EU FP. After 2009, AAL JP appears to play a growing role in leading the AAL research activity in Spain.

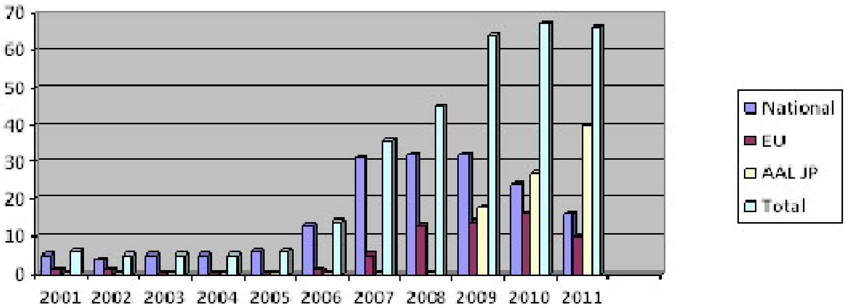

Figure 1. Graph showing the number of active projects each year from 2001 till 2011. The National, EU, AAL JP and Total number are displayed by separate bars.

3.2 Research actors' profile

The analysis of the participants in National funded projects shows a profile (Figure 2) that differs significantly when compared with the participants profile at the AAL JP funded projects (See Figure 3)

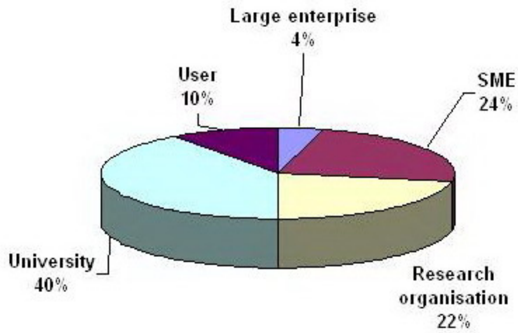

Figure 2. Spanish participant's profile in AAL projects funded under National calls

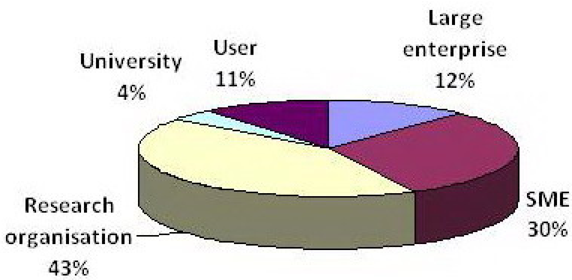

Figure 3. Spanish participant's profile in projects funded under calls 1 to 3 of AAL JP

The University groups are clearly dominant in the National Programs (40%) as compared with only 6% in AAL JP. Even the addition of University plus Research Organizations results on 47 % in AAL JP against the 62% in National programs. On the other hand, total industry (SME plus big industry) account for the 42% of participation in AAL JP, whereas it is only 28% in National funded projects.It is interesting to note that “Users Organizations “ group shows the same low level (10-11%) of participation in both type of projects.

3.3 National projects key words

The key words used as label descriptors for the content of the National projects have been ranked following their frequency of use. Table 1 shows the top key words for the subsets of the projects funded at 2001-2008 and at 2009-2011 periods, i.e. before and after AAL JP.It can be observed a clear shift on projects from technology to a needs oriented labeling.Regarding the 2001-2008 group, technology related key words (ICT, New technologies, Telecare) are highly ranked, whereas descriptors like Aged persons, Handicapped, and Quality of life, are at lower posts. For the 2009-2011 projects, Technology is maintained in first place but Personal Autonomy, Dementia, Handicapped and Quality of life have climbed to high places over ICT that go down to lower levels.

Table 1: Key words used by projects, ranked by frequency of use in the subsets of National Projects before AAL JP (2001-2008) and after AAL JP running (2009-2011)

	2001- 2008	**Rank**	**2009-2011**	**Rank**
The top key words used as descriptors in the National Projects	ICT	1	New Technologies	1
	New Technologies	2	Personal Autonomy	2
	Telecare	3	Dementia	3, 4, 5
	Dependent Persons	4	Handicapped	
	Aged Persons	5,6,7	Quality of Life	
	Accessibility/Usability		ICT	6,7,8
	Internet		Cognitive	
	Quality of life	8	Stimulation	
	Handicapped	9	Leisure	9,
	Technical aids	10	Accessibility	10,11,
	Personal Autonomy	11	Domotics	12
	Telemedicine	12	Psychosocial	
			Intervention	
			Remote Monitoring	

4. Discussion and conclusions

National support to AAL research in Spain has been most relevant in the period 2006-2008 raising a plateau at 2009. Then, global research intensity has been maintained in the same level but moving to the AAL JP environment. It was reflected on the high level of participation at the AAL JP calls. Linked to that, there was a change in the profile of major research actors, from academic to industrial whereas user organizations remained in a low level of participation.Also it can be noted a clear shift in the focus of the research projects from technology to needs drive, as denoted by the type and frequency key words used for content descriptors by the own projects. The above analysis reflects major changes on AAL research scenario in Spain before and after AAL JP was running. However, it remains open the question about the real impact of the AAL JP on national AAL research community and the mutual interaction with National Programs. It would require further analysis after AAL JP projects completion, and to consider the new emerging research and innovation context in Europe but also the particular economic and social environment.

Acknowledgement

Many thanks to Elena Sanz (SGEFI at ISCIII) for her help in providing data.

AN ECOSYSTEM OF PRODUCTS AND SERVICES FOR AMBIENT INTELLIGENCE – THE AAL4ALL PERSPECTIVE

Liliana Ferreira[1], Filipe Sousa[1]

1. Introduction

Developed societies are currently facing severe demographic changes: the world is getting older at an unprecedented rate. In 2000, about 420 million people, or approximately seven percent of the world population, were aged 65 or older. By 2050, that number will be nearly 1.5 billion people, about 16 percent of the world population. This demographic trend will also be followed by an increase of people with physical limitations. New challenges will be raised to the traditional systems of health care, not only in Portugal, but also in all other European states. There is an urgent need to find solutions that allow extending the time people can live in their preferred environment by increasing their autonomy, self-confidence and mobility. The AAL4ALL project presents an idea for an answer through the development of an ecosystem of products and services for Ambient Assisted Living (AAL) associated to a business model and validated through large scale trial. This manuscript presents the AAL4ALL project and analyses the current needs and opportunities of AAL solutions in development in Portugal.

Although technologies for AAL are already available and often in use for different purposes, these first offers for primary and secondary end-users are monolithic, incompatible and thus expensive and potentially not sustainable. AAL4ALL is a project currently being developed in cooperation with 34 Portuguese interdisciplinary partners, ranging from areas as industry to academic, R&D and social disciplines. The goal of the project is the mobilization of an industrial ecosystem of products and services in the scope of AAL, and focused on the definition of specific standards.

The project started by specifying the requirements of users and informal and formal carers by using dedicated surveys. These data is used to understand how ICT technologies are already part of the daily activities of these target users and to define new markets for care products and services. The results obtained allow the identification and characterization of the adopted AAL solutions and their acceptance by users and carers. This procedure will contribute to the development of a user-centric model, capable of answering the needs of the user while ensuring an optimal integral assistance, improving the quality of life and the well-being of the individuals and their caregivers. The first survey conducted to this objective was the user dedicated survey. It was conducted in Portugal and focused on the population over 55

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years old. The main objectives were the identification of the participants functional limitations and level of dependency on basic and instrumental daily activities; the establishment of a relationship between the readiness to the use of AAL technology and the different levels of dependency and functionality and the establishment of a relationship between the readiness to the use of AAL technology and the specific needs of health care. The results of the users' questionnaire have shown that the population is willing to learn how to use AAL solutions. From the 1220 respondents of all regions of the country, 73% were females and 27% males, 8% had completed a higher education degree and 9% completed the secondary school. The interviewed sample has medium or high confidence on the AAL solutions and is willing to pay for them. The main identified needs and difficulties of the users are mobility limitations in using stairs and the access to information about bureaucracy, voluntary activities, and taxes. The most significant fears reported by the inquired population were the fear of falling in general and of fires and burglary.

Conclusion

There are currently several AAL products and services available in Portugal; however, most of them are monolithic and developed to fulfill a specific use. In order to answer the population needs, we believe that considerable work must be done in integrating the different available products into a single and flexible solution. Previous studies show that most of the developed AAL solutions are concentrated on health and safety needs, and only a minority focus on independent living. There is, thus, the need for research focused on mobility, participation and leisure solutions targeted to the elder and handicapped population.

Acknowledgment

Project AAL4ALL, co-financed by the European Community Fund through COMPETE - ProgramaOperacionalFactores de Competividade.

WHERE DO WE GO FROM HERE?A PRELIMINARY EVALUATION OF THE EU AMBIENT ASSISTED LIVING PROGRAMME

Peter Roelofsma[1], Gabrijela Reljic[2], Dieter Ferring[2]

1. Introduction

There is a large variety of the innovative AAL systems being developed to support elderly persons in their daily living. However, to tackle the innovation of both existing and new systems, it is necessary for them to undergo the process of evaluation. It is of the utmost importance to assess the usefulness of the systems, to underline their particular advantages and disadvantages, to compare their similarities and differences in order to come to proper recommendations for future system development. In addition, with the increasing rate of the system developments and without thorough evaluation, it might be difficult for the users to find the adequate system that fully addresses their needs.

2. Taxonomy for AAL systems

This paper extends on our earlier explorative work using a grounded theory approach that demonstrated the possibility to arrive at a set of dimensions that can be used as taxonomy to classify existing and new AAL systems. Such a systematic classification of AAL systems is useful both for potential users as well as for researchers and developers. A set of AAL systems from the AAL programme were examined leading to a preliminary taxonomy for AAL systems comprising ten dimensions (e.g., subject type, settings). These dimensions can be selected for a quick scan of a specific system, but they can also be used for new developments and system verification and validation. An important notion of this AAL taxonomy is that it views the human factor as an explicit part of the system. This implies that the AAL taxonomy involves both technical as well as human factors issues. The AAL taxonomy can be used both retrospectively for evaluation purposes as well as prospectively as part of a front end system engineering approach.

In this paper the taxonomy will be used as a tool for exploring the Ambient Assisted Living (AAL) programme of recent years. Accordingly, the necessity of technological innovations out of a user perspective can be discussed and the goals of the programme assessed. We will deal with the ten dimensions of the taxonomy of the AAL systems including its targeted end-users, the settings and contents of AAL use, privacy issues

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as well as the research methods and tools applied in the evaluation of specific projects. All these points reflect contexts crucial for understanding the relative success of AAL projects.

2.1 System subject type

The dimensions under the Subject type refer to the target population group for which the system is primarily designed as most of the AAL systems were designed for a specific target group. More specifically, in the first call 26% of the systems were developed for Dementia problems, 17% for Fall detection and 17% for Specific Motoric & Mobility Issues. Thirteen percent of the systems were developed for supporting medication or other goods supplies while 9% were developed for COPD lung diseases and 4% for chronic heart failures. Moreover, 13% of the system were not developed for a specific sub group of elderly persons but for general group, for example, to support overall physical activity (PA). It is interesting to note that, in some case, the system description does not involve specific target groups so further examination for this type of information is therefore often needed. One question in this context is to what extent future developments should focus on building systems that can be used for a more general population or focus strictly on specific target groups. There are several advantages and disadvantages and different potential solutions in both approaches.

2.2 System settings

The dimension setting in the taxonomy refers to the environment where the system is used. Systems can be designed for a specific setting: elderly peoples' home and its surroundings, or for a more general setting, e.g. clinical and non-clinical settings, urban or rural environment etc. It is sometimes difficult to find the exact description regarding the focus of setting in the existing AAL documentation.

2.3 System function types (causal variables)

This dimension refers to the type of functional content that the system has implemented to achieve its aimed effects. In particular, it refers to the causal functional variables through which the system aims to find increased wellbeing and independence of elderly people. Systems can give support on physical, cognitive and emotional functions. One issue is to what extent systems make sufficient use of existing functional taxonomies as developed and validated by psychologists in the last century, e.g. Fleishman & Quaintance's Taxonomy of human performance. Also within the dimensions function types the AAL documentation is sometimes inadequate.

2.4 System measures (effect variables)

This dimension refers to the measures that the system generates which are used to assess the effect of the causal variables of the system. These measures could either be self-report measures such as interviews, questionnaires, survey approaches; human performance measures or general observation measures such as sensors for behavioural and/or physiological data. The focus on adequate human performance measures for system is stressed.

2.5 System cause-effect relation type

This dimension refers to the existing evidence that using the system will produce desired effect. More specifically, it addresses the reliability and validity of evidence-based relations between the cause and the effect system variables.

Most systems seem to be using small pilots and case-based reviews to validate the effect. However, it is well known that the validity of such approaches is limited. Few systems use relational or quasi experimental approaches, but also these approaches have crucial validity problems. While reviewing the projects of the first AAL call, it appeared that most systems were not validated through experimental procedures like random controlled trials or transfer validation studies. This all leads to the important methodological question of how to verify and validate AAL systems. Several solutions for the AAL domain are given.

2.6 Theoretical basis

This dimension refers to the theoretical basis behind the system’s intervention. Based on our review, for many systems the theoretical basis of the intervention can be made more explicit. The theoretical background of the system can refer to micro or macro level issues, since both are important for system development. The first step in the evaluation of the theoretical background should thus focus on the individual user perspective followed by the analysis of its larger impact at the socio-economic level. Bronfenbrenner’s socio-ecological model, for instance, represents a promising frame for evaluating AAL programmes in such a way.

2.7 System’s ambient intelligence

This dimension refers to the level of intelligence in a system. AAL Systems should be ambient intelligent systems. Ambient systems monitor behaviour to assess and diagnose the subject situation. Next, on the basis of the analyses, optimal support is provided and/or action choice options are given, e.g. the optimal intervention. According to our analysis seems that quite a few AAL systems lack sufficient ambient intelligence, and some are even more comparable to ‘advanced webpages’.

2.8 System documentation

This dimension refers to the level and quality of the systems documentation, including functional, technical documentation as well as the manuals. Quite a few AAL systems lack sufficient documentation. In many situations there is insufficient functional or technical design documentation. Often adequate user manuals are lacking. This may be due to the business reasons; however for future development the importance of building earlier well documented work is stressed.

2.9 Usability and ease of system training

This dimension refers to the focus on simple, easy and self-explaining AAL solutions. Some of the systems still can improve on this dimension. This is partly related to dimension 8 and 7 since lack of human performance measures and insufficient documentation may lead to the reduction of system use.

2.10 System safety issues

This dimension refers to what extent the user safety can be adequately managed. One question is to what extent the AAL system uses existing validated techniques for assessing management safety profiles. Such techniques, for example like the TRIPOD have recently, become relatively popular to be used in the health and care domain and are in particular relevant in the context of patient safety. This issue is still somewhat neglected in several AAL systems.

3. Concluding remarks

Based on this examination, it appears that there is low consensus on how to describe an AAL system. This may lead to insecurity about questions like 'What is an AAL system?' and 'What is the difference between an AAL system and an ICT system for assisted care?' Quite a few AAL systems in the EU programme are lacking sufficient ambient intelligence. Cause-effect relations of the system variables are sometimes lacking adequate descriptions. It was sometimes unclear for which specific subgroup(s) the system could be used or for which setting the system was designed and what the theoretical basis is for the intervention used. Two preliminary conclusions were drawn from our review: (I) AAL systems need a sufficient evidence-based foundation, and (II) the field of AAL research needs a theoretical and methodological framework leading the future AAL system development, research and applications.

EXIT STRATEGY OF A LARGE SCALE AAL RELATED PROJECT AS A BEST PRACTICE EXAMPLE

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Abstract

Projects in the area of AAL-type of solutions usually need active involvement of different end user groups like elderly people in their role of primary users, different types of secondary users such as relatives, care givers, nurses, physicians, therapists and trainers, and in some cases also representatives of tertiary target groups such as organisations offering different care or health services to seniors. Depending on the type of project one or more of these target groups get involved in the R&D and validation process causing the need to define and implement exit strategies for the ending phase of the project forat least one end user group.

1. Introduction

Wikipedia says: "An exit strategy is a means of leaving one's current situation, either after a predetermined objective has been achieved, or as a strategy to mitigate failure. An organisation or individual without an exit strategy may be in a quagmire. At worst, an exit strategy will save face; at best, an exit strategy will peg a withdrawal to the achievement of an objective worth more than the cost of continued involvement" [1].
Originally exit strategies have been applied in military strategy and in strategic business management in order to remove troops by minimizing "blood and treasure" or to withdraw from a business, e.g by transition of ownership [2]. In general terms an exit strategy defines a good end of a project, but also can take into account the continuation of a solution after end of project on a commercial, but also non-commercial basis. This contribution describes objectives, methods, outcomes and lessons learned during the project "Long Lasting Memories - LLM"[5] [4][5] and how the latter can be adapted and applied to project SOFTCARE[6] [6], which gets funding from the AAL joint programme[7] (AAL-2008-1-115). The LLM-service is an integrated solution offering ICT-based physical and cognitive training within an

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[5] Long Lasting Memories (LLM), ICT PSP/2008/1, nr. 238904

[6] SOFTCARE, AAL nº AAL-2008-1-115

[7] AAL: AMBIENT ASSISTED LIVING JOINT PROGRAMME - ICT for ageing well (http://www.aal-europe.eu/)

assistive smart home environment targeting elderly people and the project received funding by the European Union under the CIP ICT-PSP programme[8] [3]. The service was pilot tested in five European countries (Austria, Cyprus, France, Greece and Spain). Testing was performed in different settings: private homes, day care centres and clinical institutions [7]. Within five pilot phases with a duration of two months each more than 800 elderly end-users performed physical and mental training, being supported by an assistive environment. In the role of secondary end-users trainers, therapists, care-givers and family members participated in the validations, and last but not least different types of institutions hosted or supported the service.

2. Experiences of large scale project Long Lasting Memories

In every project where vulnerable people are involved considering ethical aspects is of high priority [9]. Due to the complexity of the project and the duration of the end user involvement a special exit strategy was developed by partner GSI[9] for application within the LLM-project in order to define different sub strategies for the different types of user groups [8]. This strategy is described in a dedicated deliverable and covers the elderly end-users who used the system for a period of two months each and who mostly liked the service and got accustomed to use it, trainers, therapists and carers who monitored and supported the trainings and became familiar with and used to the system during five pilot phases with a total duration of ten months, and several care and service institutions who hosted and operated the service for their clients and their staff. The exit strategy defined the procedure, how to phase out all concerned parties starting with an informed consent [14] stating that the users are trial partners within a timely limited project and ending with strategies for continuing the service after the end of the project for tertiary partners (care and research institutions) who plan to use the service further on before LLM will become a commercially available product.

3. Methodology

Basically an exit strategy for a research or market validation project is caused by ethical considerations taking in account the involvement of end users who can generate dependencies to the solutions or products they have been using during their involvement into the project and further on considering that these persons are often vulnerable elderly or sick persons. Far in excess to this motivation there exist other needs to extend exit strategies, such as economic and commercial criteria of the vendor and customer, which is in most cases a commercial or non-commercial service provider but also to cover impacts an system developers and staff of service providers.
Within project LLM the consortium took into account the following impacts:

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[8] CIP ICT-PSP: Competitiveness and Innovation framework Programme - ICT Policy Support Programme (http://ec.europa.eu/information_society/activities/ict_psp/about/index_en.htm)
[9] Global Security Intelligence Ltd GSI, UK (www.globalseci.com)

- Impacts on end users
- Impacts on pilot providers
- Impacts on solution’s developers
- Impacts on solution from a commercial point of view
- Impacts on privacy and data protection

3.1 The impact on end users takes into consideration the following criteria:

1) Vulnerability of the participants
    a. are the participants themselves particularly vulnerable (children, elderly, disabled, frail)?
2) Criticality of the solution/product/service within the daily life of the participants
    a. What aspect of the person’s life is impacted? Health solutions would be considered HIGH, while leisure and entertainment solutions would be considered LOW.
3) Frequency of use of the solution/product/service
    a. How frequently does the user engage with the solution (daily, weekly, monthly, less often)?
4) Availability of alternatives for the solution in the marketplace
    a. Are there alternative solutions on the market to meet the specific needs represented by the piloted solution?

3.2 Considerations concerning impacts on pilot providers

These have to distinguish between two different types: pilot providers being partners within a project consortium fulfilling an active role in the project, and pilot providers who are supporting various sites which are not partners in the project. Responsibility of a pilot partner is to evaluate what the impacts are on their own operation or on the duty when interfacing to an “external” pilot organisation. For each pilot site a specific exit strategy has to be developed by evaluating some key questions:

1) Has the solution been successful with the end users?
2) Is there a demand for a continuation of the solution at the site?
3) Does the solution fulfil a previously unmet need for the users?
4) Does there exist an alternative service that can fulfil all or most of all user needs covered by the piloted solution?
5) Does the pilot organization have budget available to pay
    a. fees for supporting the service on an ongoing basis?
    b. for upgrades to the solution
6) Is there a willingness of the solutions’ end users who participated in the pilot to pay a fee to address budgetary issues?
7) Does the piloting organisation have staff available
    a. to perform assistance, training etc. after the pilot ends?
    b. to provide appropriate support (like monitoring health or care issues) on an ongoing base?

3.3 Impacts on solution's developers

The most important issue to be addressed in the exit strategy are any concerns regarding ongoing support after end of project if the solution will be continued, especially:

1) Is there staff available to
    a. provide support in a live use mode?
    b. to provide updates to the solution in an ongoing basis?
2) Is there funding for these activities
3) What level of funding is required to enable such activities

3.4 Impacts on solution from a commercial point of view

This set of criteria is important within projects, whose focus is primarily targeted on market validation by performing medium and large scale pilot tests as it is done usually within project of programs like the CIP ICT-PSP, but it may also be an issue within AAL-type projects which have a strong focus on end-user validation.

When performing pilot tests in real life environments there may be the demand by the partners providing the solution or the product to continue this tested service after end of project due to economic aspects depending of the size of the test-installations. In such cases the following aspects have to be considered:

1) To continue support, what sort of infrastructure is needed to enable payments?
2) What portions of the solution must be provided to meet the user's needs, and what aspects may not be needed anymore (if any)?
3) Are there implications with respect to the continuing use of third-party software elements in continuing the solution?
4) If the solution is withdrawn from the already established sites, what is the impact on the plan of commercialization of the solution?
5) Is there an expectation that has been set, through formal or informal discussions with users, carers or relatives for continuation of the solution?

3.5 Privacy and data protection impacts:

During field validations or pilot studies handling of data of the trial subjects, like personnel information, health records, behaviour patterns etc. has to be done according European and national laws, which allow in a lot of cases exceptions to the regulations for the usage of this data as long as it is used only for scientific studies and evaluations; one major demand is providing an informed consent for all trial participants which is informing the involved subjects about the objectives and purposes of the project and where these people approve the handling and usage of data related to them.

For continuing an AAL-service after end of a project this approach must not be applied any more, but handling of data has to be done strictly confirming to the appropriate laws:

1) Has fulfilment of complete data protection rules already been foreseen?
2) Who will implement them?

3) Who will pay for them?
4) Who will perform all needed registrations and approvals?

4. Discussion

Within project SOFTCARE a wrist worn fall detection and behaviour pattern monitoring system with an integrated alarm and voice communication facility has been developed [12] [13]. The solution is going to be tested by four elderly persons who are looked after by the Austrian Red Cross and by the Seniors' Centre Schwechat[10]. The validation plan defines that two elderly persons being clients of the mobile care taking department of the Red Cross will get a SOFTCARE installation at their own homes. During this time the SOFTCARE alarming solution will be integrated into the care takers alarm and communication system and validated over a four week's period of field testing. In a similar way two installations will be placed at the Senior's Centre Schwechat, two residents living there in sheltered homes will use the solution for a four week's period, alarms will be routed to the centre's care givers. The exit strategy applied within project LLM is going to be adapted to the needs of the SOFTCARE project. Based on the fact that SOFTCARE involves only a small number of pilot users compared to LLM and that the field validation phase will last only one month per user, this adapted exit stategy will mainly focus on the ethical needs required for the involvement of vulnnerable participants describing the project and the strictly limited test phase in the informed consent. To handle the impact on the pilot providers, solution developers, commercial aspects and data potection impacts, checklists and questionaires are going to be developed in order to cover these issues.

5. Conclusion

The exit-strategy focussed on AAL- and health-related projects developped within project Long Lasting Memories includes not only ethical issues but also issues concerning the work of service providers, issues of possible coniuation of the validate solution after end of project on commecial and non-commercial base and generally economic issues. As a best practice example it can be used for a huge variety of projects, from small scale validation settings up to very large scale pilot trials.

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ETHICAL ASPECTS AND EXIT STRATEGIES IN THE SOMEDALL PROJECT

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Abstract

It is commonly accepted that the participation of end-users is very important in projects and development processes when the aim is to develop new services and new technology for elderly people. Quite often the support of other family members and relatives must be taken into account also. The objective of the SoMedAll project is to develop a platform for offering social media services for elderly people with a variety of easy-to-use user interfaces. Because of the importance of end-users the ethical issues and exit strategy must be under consideration.
Based on the experience in former projects and in SoMedAll it can be stated that elderly people are interested in developing new technology based services and to participate as end-users if they feel that it is beneficial for themselves or for ageing people in the near future. This means that developers and researchers have a responsibility to inform end-users carefully and respect questions made by them. There might be a need to give for example following information:

- *Which are the objectives of the study*
- *Expected results*
- *Time schedule (when and how long their participation is needed)*
- *What are the expectations for them*
- *Which kind of skill or experience are needed*
- *Costs for end-users, if any (is it time consuming to participate or not)*
- *Advantages and discomfort, if any*
- *Support and guidance available if and when needed*
- *Exit strategies described form end-user point of view (what is left for end-users after project and development work)*
- *Is it possible to keep the service or product developed during the project (generally this is a question that is considered at the end of project)*
- *Ethical issues and questions which can be pointed out*

Quite often researchers search people to represent end-users in different projects using their personal contacts or partners contacts. One possibility is also to make contact with NGOs (non-governmental organisation), social and welfare organisations etc. As can be seen within AAL projects it is important to have end-user organisations as partners and associated partners to ensure that the user point of view will be taken strongly into account. This means that exit strategies should be realised including also ethical issues during the whole project. For companies developing the

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product further and offering or selling it for elderly as users or clients the information on ethical factors is important.

1. Introduction

SoMedAll project produces a platform that offers social media focused on the needs of the elderly with a variety of user interfaces including web, PC, IPTV , tablet and mobile phone (possible equipment that arealready at home) taking into account the skill levels of the users. During the project a prototype service and test use of it will be implemented among the elderly over national borders in Italy and Finland. Usability and the impact of theservices to the life quality of the elderly will be described.

The planned social media services will include plenty or personal data, from multimedia contents tousage data. Also during the project personal data is interviewed from project participants. The projectis taking into account all legal regulations (privacy, copyright etc.) related to the different information types, during the project and during the lifetime of the service, local regulations included.

2. Methods

In the project elderly people have an important role as the source and producers of information. Their opinions are and will be gathered during the beginning and evaluation phases. In the first stage their opinions and stories were discussed and used to create different kind of scenarios how to use social media based services.

Because it was important to collect data from people with different lifestyles and living conditions four methods was used. Methods used in co-operation with elderly people in this project are:1) *Owela* (Open Web Lab), 2) *interviews* and 3) *social media club* group meeting and 4) observation. Owela is a participatory web laboratory for developing and evaluating digital media concepts and services. Social media club was a group of people meeting with each other invited by researchers to discuss possibilities and technology to be used as a tool for social media based services. It is quite often forgotten to mention that observation is one practical tool to collect data.

Purpose in Italy and in Finland has been that elderly people are active participants in the evaluation of the system and services in both countries.

3. Results

In the project plan of SoMedAll is stated that all personaldata in our project is classified based on the confidentiality and required precautions are taken topreserve the privacy. Accordingly our system will include built-in mechanisms for management of the data privacy and security. Other ethical issues are not mentioned so clearly, but already in the beginning of the project it would be important to build up an exit strategy and find out which kind of ethical rules or guidelines should be used. It should be described in the project plan with couple sentences. Anyway in this project the aim has in practise to been respect users' opinions and follow feed-back given by them. It has been also important to give them proper guidance how to use the prototype platform and service in pre-testing phase. It is also ethical issue to plan the testing and evaluation so that people feel to be in safe during testing and evaluation sessions. This means that these sessions and periods must be planned and carried out properly.

Ethical issues are discussed during the processes and include user involvement. Exit strategies were not included to the project plan, but this point of view has been implemented to the discussions within project group. Because the project will be finished by the end of 2012 there is a need to analyse the ethical questions and create an exit strategy during following weeks. One important activity might be to arrange a closing seminar for people who have participated as representatives of end-users, home care personnel and as specialist in the project.

4. Discussion/conclusions

In the SoMedAll project elderly people have an important role as the source of information. They opinions will be gathered also during the evaluation phase. Elderly people participate every phases and their opinions are expected and wanted. As end users they have had a key role during the planning phase of the services which can be used in the environment of social media. Later on the project elderly people will have an active role in the evaluation of the system and services. We have realised already in the starting phase that ethical issues must be taken into account. We have also found out that ethical issues and questions might vary between countries. One aim in our project is to analyse, is there any cultural differences which could be barrier for new markets concerning social media based services and products in partner countries. Cultural factors may effect on differences compared to ethical issues, too. Exit strategies have not been planned in the beginning of the project but this topic has been taken into account in project meetings and discussed. Finalisation of the strategy needs to be done during the final months.

(IM)MATERIAL INTERVENTIONS: TOWARDS A BROADER CONCEPTUALIZATION OF EXIT STRATEGIES IN AAL PROJECTS

M. Rauhala[1], S. Oechsner[1], P. Ala-Siuru[2], M. Peyrot[3], E. Leinonen[2]

1. Introduction

In this presentation we will introduce and discuss the meaning of the exit strategy of avoiding harm to the participants in the AAL context. Our reflection is based on a longstanding experience in ethics management of technology development projects which rely on close cooperation with future users. Whereas it is widely known that no participant in a technology research and development project should be subject to any risk of physical harm (at least beyond risk of minimal harm) we suggest that there may be a need to focus on a wider notion of harm, including those of social, financial, and psychological harm as part of a sustainable exit strategy.

The notion of exit strategy as laid down in the session description is rather narrow; from our perspective an AAL project's exit strategy needs a more comprehensive approach, taking into account multiple layers. These layers include an interpretation of intervention as having material and immaterial dimensions. We argue for a need of an increased awareness of the immaterial dimensions of interventions and exit strategies in particular as a part of responsible post-project management.

Using the LILY[4] project and one of its exit strategies as an example, we will explore the meaning of intervention in a technology project and how our interpretation of the type of intervention has implications for an ethically appropriate and responsible exit strategy. Beyond the LILY strategy we will discuss what alternative way, based on the notion of immaterial intervention, could be taken in order to leave or "exit" the research field and part from the participants in an appropriate and responsible way.

LILY is a cooperative project bringing together SMEs, research and municipal institutions from France and Finland with the objective to create a sustainable senior-centered system for the comprehensive innovative management of independence and participation in the 'Self-Serve Society', improving the quality of life, autonomy and participation. LILY's primary target group isolder people (third age, 55+ older), the secondary and tertiary target groups arecare givers, social workers and family members as well as public and private services respectively. The envisioned

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toolsinclude a task assistance module for the organization of transport and appointments, adaptive broadcasting of eServices, and augmented video conferences. These tools will give users the possibility of auto-organization of events and appointments, facilitate transport to and participation in social events and they will on a broader scale support them in the organization of their activities of daily living, especially focusing on a social and relational aspect.

The tools and services will be tested on two pilot sites. In Finland, the first user group currently consists of up to 10 persons (age group 65+) in the Raahe city area (includingVihanti). The second and third user groups will be formed later in other RAS[1]-managed areas (Siikajoki and Pyhäjoki). It is planned that the participants in the pilot will receive mobile phones and/or tablets/touch screen computers for test purposes during the project's lifetime. In France, the homes of the participants will be equipped with the VisAge screen. The user group is defined as individuals living alone, whose homes are equipped with a telephone but no computer with internet access.

The material interpretation of a technology intervention focuses on the tangible aspects of the system that are introduced to a participant's sphere of life. Following this interpretation the scope of a responsible exit strategy would centre on the effects of the installation of a system in a home, its use, and removal. Various financial aspects, such as costs incurring from running a trial system, reimbursing the participants, can be included in the contemplation of an exit strategy. Typically, the intervention and its expected effects and post-project situation of the participants with regard to the system are accounted for in an informed consent process. The informed consent process is likely to address the post-project situation from the perspective of the system and its relationship to the user following participation. The LILY project's exit strategy is a case in point.

In LILY the users will be given the option of prolonging the services they had at their proposal during their participation under certain conditions. While during the project the devices are owned and serviced by the project, after its conclusion the study participants are given a number of options for the continuation of the services. After the project's lifetime the devices remain in the property of the project and the users have a right to use the devices for a certain time period for research purpose, or they can own the devices with certain arrangements with the research bodies (RAS, OUAS[2] or UOULU[3]). Another possibility is that users buy similar devices themselves. The software developed is free to use for a certain time period (for research purposes) or licensed by the owners (there could be reimbursement via the social help mechanisms which RAS can give to eligible users i.e. voucher system). This mainstream exit strategy is grounded in a material interpretation of the introduction of new devices and services into the lives and homes of older people. If a technological system is introduced, used and tested and then removed, the material absence is obvious and

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material exit strategies need to be in place to account for the "loss". Yet, we suggest that there are further consequences of technology intervention that just as much need to be taken into account in order to avoid harm, consequences that call for a different set of (immaterial) exit strategies. An immaterial interpretation of a technology intervention is wider than the material one. While the material interpretation can overlook the social and psychological dimensions of research participation, the immaterial interpretation takes into account the more subtle layers of potential benefit and harm. In this way, the relationships that are formed, the attention given to a participant, trust and confidentiality built, the social networks that are created, and the sudden discontinuation of these, are seen as ethically relevant. Therefore, the immaterial interpretation of the technology intervention would call for strategies to prevent the harm that such a discontinuation could cause for a participant.

2. Conclusion

In the AAL context, exit strategies that have focused on potential dependencies participants may develop while contributing to a technology project or making use of services rely implicitly on an immaterial interpretation of intervention. In this presentation we have suggested that this path requires closer exploration and systematic study in order to enable ethically motivated researchers to better take responsibility of the well-being of the participants and of ending the research relationship in an appropriate way, leaving the participants unharmed.

TRACK C RATIONALE: BUSINESS AND INVESTMENT

One of the main objectives of the AAL JP is to strengthen the industrial base in Europe and enhance competitiveness. Therefore, the AAL Forum 2012 will present a big share of the programme in innovation, business and investments. Also, items such as social innovation, living labs, pre-commercial procurement and interoperability will be discussed. Special attention will be given to venturing. Entrepreneurial innovators, their corporate counterparts and venture capital investors will presenting their particular view on the sector, their strategy and business opportunities.

Track C consists of the following nine sessions:

Session C1 – Economic and social impact of innovation support programs

The Ambient Assisted Living Joint Programme currently finances over 100 Projects, all of which should enter the market within 2 to 3 years after the end of the funding period. Experience shows that it is not easy to bridge the gap between R&D and successful commercialisation of the developed products and services. There has been a lengthy discussion in the AALJP how to overcome these problems. Different workshops have already been organized to support the project consortia to plan the business part of the projects. The project consortia were also given the opportunity to present their case to Investors at the AAL Investment Forum in Odense and to participate in a competition in Lecce at the AAL-Forum. Although these measures helped to develop the business thinking of the project consortia, it still needs a coordinated effort to develop the business aspects of the AAL-projects and bring the project results successfully to the market.

Session C2 – Economic and social impact of innovation support programs

The Ambient Assisted Living Joint Programme currently finances over 100 Projects, all of which should enter the market within 2 to 3 years after the end of the funding period. Experience shows that it is not easy to bridge the gap between R&D and successful commercialisation of the developed products and services. There has been a lengthy discussion in the AALJP how to overcome these problems. Different workshops have already been organized to support the project consortia to plan the business part of the projects. The project consortia were also given the opportunity to present their case to Investors at the AAL Investment Forum in Odense and to participate in a competition in Lecce at the AAL-Forum. Although these measures helped to develop the business thinking of the project consortia, it still needs a coordinated effort to develop the business aspects of the AAL-projects and bring the project results successfully to the market.

The session will house a panel of experts in the development, (international) growth and ultimately the sale, exit or further expansion of high-technology companies with a clear market potential. These experts, many of whom direct financiers and some experienced (ex-)entrepreneurs, will share with the audience their vision on how to collaborate most effectively with high-growth enterprises and maximize joint results. This panel discussion will be followed by presentations of two major venture investors.

Session C3 – Social innovation: connecting the dots…

Many innovation programmes and investments suffer from the gap between what we know we can do, and what is actually being adopted and used. The result is that vital innovative technology can remain unused and miss its full potential to improve health outcomes and reduce costs at scale. For innovative ICT to reach its true potential we need to understand how to connect the innovations to society and the people in it. Connecting the dots will mean that ICT innovations can truly transform our society and its needs.

In this session we will hear from some exciting programmes and initiatives that have transformed services in their sector. This is set against the European Policy context of social innovation, including the Social Innovation Europe (SIE) programme and examples of social innovation networks and entrepreneurship throughout Europe. In the discussion we can explore how this can help your innovation.

Session C4 – The way to the market: AAL2Business

The AAL Joint Programme has launched a support action that aims at facilitating market access for the projects that are funded by the Programme. This support action is called AAL2Business, which is coming to the end of its pilot phase in September 2012. The AAL Forum is thus the ideal place to discuss the findings of this pilot phase.

The session will present the work of VTT and its consortium partners, who carried out during this pilot phase (45 min). In addition, the initiative TechnolAge led by Ernst & Young will present its analysis of successful business models in the field of Active Ageing. The remaining 20 minutes are reserved for discussion between a moderator, a panel of experts and the audience.

Session C5 – Value network analysis and business model opportunities

AAL services and in general, eHealth and mHealth services are believed to be an indispensable part of the solution for the increasing elderly population in most Western European countries. Despite numerous successful pilot projects, the uptake of this kind of services is less promising. Most services can't cope with one or more of the seven barriers of AAL services. Identified barriers are: 1. Regulations, 2. Financing, 3. Lack of (medical) evidence, 4. Standardization and uniformization, 5. Support by the care givers, 6. Cultural acceptance and support by the care recipients, 7. Service offer and knowhow.

Barriers to be addressed within this session are:

- Standardization and Uniformization: Towards a national data sharing platform to reveal the real value of AAL related data.
- Financing: The boundary conditions of business model development and change processes in young ventures: How do these ventures deal with the challenges of a new, emerging industry?
- Service offer and knowhow: Dynamic Capabilities as result of a failure in the value proposition of an AAL service. (Tele-senior service)

Session C6 – Living Labs, user-driven approach to facilitate AAL service innovation and accelerate successful market entry

Living labs are becoming more prominent innovation-instruments for addressing the societal challenges: improve the quality of life (of elderly and their family), optimize the quality and productivity of caregiving and strengthen the industrial base throughout Europe. These user-driven open innovation ecosystems have the ability to merge research and innovation processes within the local, real-life context of patients, caregivers, etc. The living lab approach bridges the different gaps between technology ideation and development on the one hand, and market entry and fulfilment on the other.

In this session we want to discuss the success stories and bottlenecks of Living Labs as a new mainstream innovation method to facilitate AAL service innovation and accelerate successful market entry (also cross border).

Session C7 – How do we build an AAL ecosystem of plug'n play products and services?

Home monitoring solutions for chronically ill people are gaining momentum in Europe. Recently Denmark have decided that telemedicine and AAL solutions to be using Continua Health Alliance framework and guidelines. Why is Denmark doing so? What impacts will that have for the market uptake?

EU has invested significant to create platforms, middleware, roadmaps and several use cases to create the building blocks for an AAL market. So far without a significant market uptake. Which path should AAL follow? How can we learn from the telehealth market? Is this a way to follow? Can the European Innovation Partnership – Active & Healthy Ageing action group on Interoperability & Standardization make a difference? The objective is to raise an European debate on how to switch the AAL standardisation and interoperability efforts from R&D projects in to real market standards

Speakers/panellists:

- Reiner Wichert, Fraunhofer IGD, Head of Fraunhofer AAL Alliance, Germany
- Marco Eichelberg, Oldenburg, Germany
- Claus F. Nielsen, DELTA, Kopenhagen, Denmark
- Peter Wintlev-Jensen, EC DG Connect, Brussels
- Mario Romao, Continua Health Alliance, Chair European Working Group

Session C8 – Pre-commercial procurement

Supporting Independent Living for the Elderly through Robotics (SILVER) is a development project funded by the European Commission under the Seventh Framework Programme for research and technological development (FP7). The project started in January 2012 and will run for 42 months. The SILVER project will address to the challenge of finding new technologies or services by applying innovative approaches in public procurement policies. In this project the innovative solutions enable elderly people to continue independent living even with physical or cognitive disabilities. In Europe the PCP has so far been an under-utilized tool for promoting innovation.

The first objective of the project is to establish and execute an agreed PCP process to run a cross-border PCP call for tender with the participating countries. This PCP process should also be able to be used as a base on which participating countries can design national PCP calls outside of the SILVER project.

The second objective is to use the PCP process developed in the project to identify new technologies and services to address the challenge of Supporting the Independent Living of the Elderly through Robotics, by undertaking a joint PCP call for tender.
The aim is that in the future public organizations in participating countries and the EU are familiar with the PCP tool and use it to meet their needs. It is anticipated that making this PCP call new solutions are implemented in elderly care that in 2020 make it possible to care for 10% more care recipients with the same number of care givers. The aim is also to increase the quality of life for the elderly by making them more independent and increasing their health by assisting them to train their remaining capacities.

Session C9 – Webtool for AAL business cases: make the benefit of your innovation visible

When having an idea for new products, or methods to improve care, , it is important to know if the innovation is worth the investment in time and money. Can we earn back the investment and how? What are the costs and benefits for all parties involved, i.e. client/consumer, service or care provider, manufacturer, health insurance company. In a business case all important variables are considered in a structured way. This will increase insights in the effects of the innovation and give input to further improve the innovation.

The Dutch agency for Healthcare Research, ZonMw, has asked TNO to develop several tools to build business cases for innovations in long-term care, primary care and psychiatric care. This summer an English version of the web tool for long-term care has become available. The web tool is available for free via the internet. A short instruction video explains the use of the tool. With these tools health care providers and advisors can assess the effects of an innovation in an early stage to fund their decisions for investments. The assessment will make clear what the investment will offer in terms of productivity, quality of care and services, money, or work satisfaction.

A business case can be used to convince partners within a consortium or support the decision-making process within the organization, but also to present the benefits of the innovation to external investors or public funding parties. Making a societal business case is an important step on the road to market for each new product or service.

Recently, for four on-going AAL innovation projects, a business case is being composed by the Dutch project leaders with the help of the web tool “Business case Long-term Care". The experiences in the four participating projects and one or more of the resulting business cases will be shared with the audience.

TRACK C PAPERS

AAL4DS - CAN AAL TECHNOLOGY HELP PEOPLE WITH DOWN SYNDROME TO LIVE BETTER LIVES?

Juan Carlos Augusto[1]

Abstract

AAL has been extensively developed in the last few years, especially in relation to people with dementia and elderly people in general. However, there are segments of the population which are equally deserving of assistive technologies and yet have not attracted so much attention from our community. For example, there is very little research and focus on people with Down Syndrome, still they can benefit from AAL for similar reasons and yet they have their own specific needs and interaction capabilities which mean they may not necessarily benefit from current AAL systems without re-engineering. This paper discusses how AAL technology can be relevant to people with Down Syndrome at different stages of their lives.

1. Introduction

Various organizations from government, the private sector and academia are becoming more interested on the opportunities opened by technology to assist people in their daily lives. The area of Ambient Assisted Living [1] is emerging as a growing forum where people can share progress and problems on the use of technology to support people with some degree of special needs, usually related to health and social care areas. There is interesting research on supporting people with different conditioning profiles [2,3] still much more is still to be explored, in particular there is no much reported on the specific case of supporting people with Down Syndrome (DS), the focus of this article.

Support is useful for people with DS to strengthen their positive characteristics and help them develop healthier and happier as positive individuals immersed in society where they can realize their aspirations. Possible areas to look at how technology may help people with DS and their carers are listed in Figure 1 and can be briefly described as follows:

- **Cognitive Support:** can provide stimulus to learn and develop reasoning skills

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- **Emotional Support:** can help to communicate their emotions, particularly in what it relates to their specific condition and how it affect them
- **Physical Support:** can provide specific infrastructure and challenges to strengthen and develop their bodies
- **Health and Hygiene Support:** can help with monitoring conditions, preventing, and developing healthy habits
- **Social Support:** can help them communicate and stay in touch with the community at large
- **Security Support:** can protect them when they are vulnerable
- **Entertainment and Leisure Support:** can add options for their relaxation and enjoyment

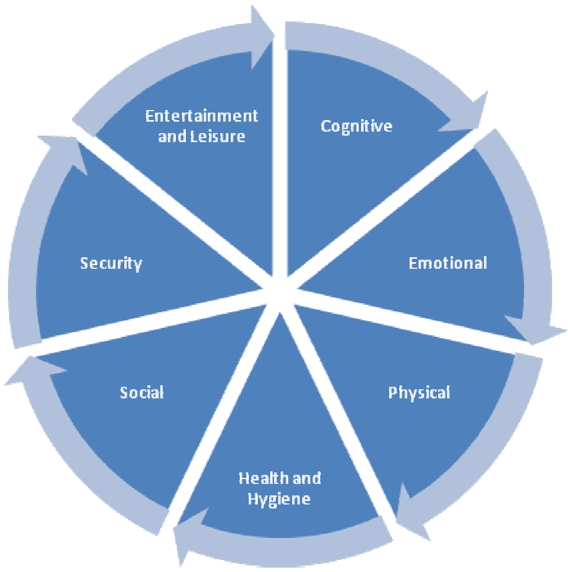

Figure 1. Potential Areas of Support

Each stage of life will require different levels of support. And this will impact in the type of technological solutions we can think off as well as the way they are developed. Table 1 provides a first attempt at linking these two dimensions together.

Table 1. Areas of support according to stages of life

	Baby Toddler	Early stages of formal education (e.g. Primary school)	Middle stages of formal education (e.g. Secondary school)	Tertiary stages of formal education (Apprenticeships and University)	Adult life (supporting independent living)	Later Stages of Life
Cognitive	X	X	X	X	X	X
Emotional			X	X	X	X
Physical	X	X	X	X	X	X
Health and Hygiene			X	X	X	X
Social			X	X	X	X
Security					X	X
Entertainment and Leisure	X	X	X	X	X	X

2. Quantitative and qualitative assessments of improvement

It is clear that living a fulfilling life is more complex than achieving a list of milestones but in some of the areas of support measuring the extent of achievement is sometimes done through a list of milestones. See for example in the Appendix, the one the UK health system will provide to parents with the Personal Child Health Record (informally, the ‘red book’). Can something similar be done for the areas listed in Figure 1? Can these be used as generic requirements to guide, inspire and inform technicians on providing supporting technology for people with DS? Interacting with focus groups and organizations directly involved with DS can provide a scale to understand whether the new technology developed is meaningful and helpful for people with DS.

Acknowledgments

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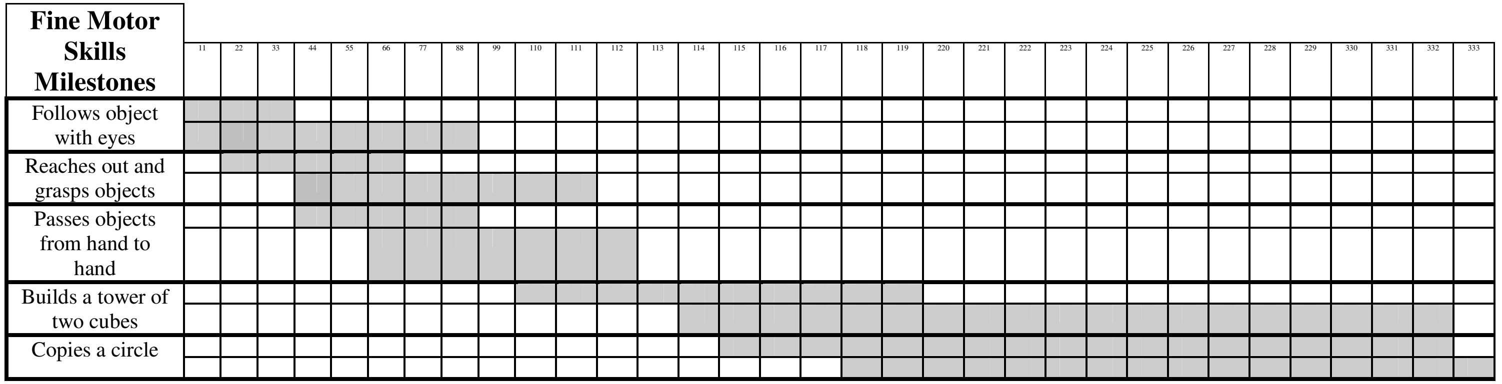
Appendix

Gross Motor Skills Milestones	11	22	33	44	55	66	77	88	99	110	111	112	113	114	115	116	117	118	119	220	221	222	223	224	225	226	227	228	229	330	331	332	333
Holds head steady																																	
Sits alone																																	
Stands alone																																	
Walks alone																																	

Note: all those which can extend for a long period are only indicated until 33 months



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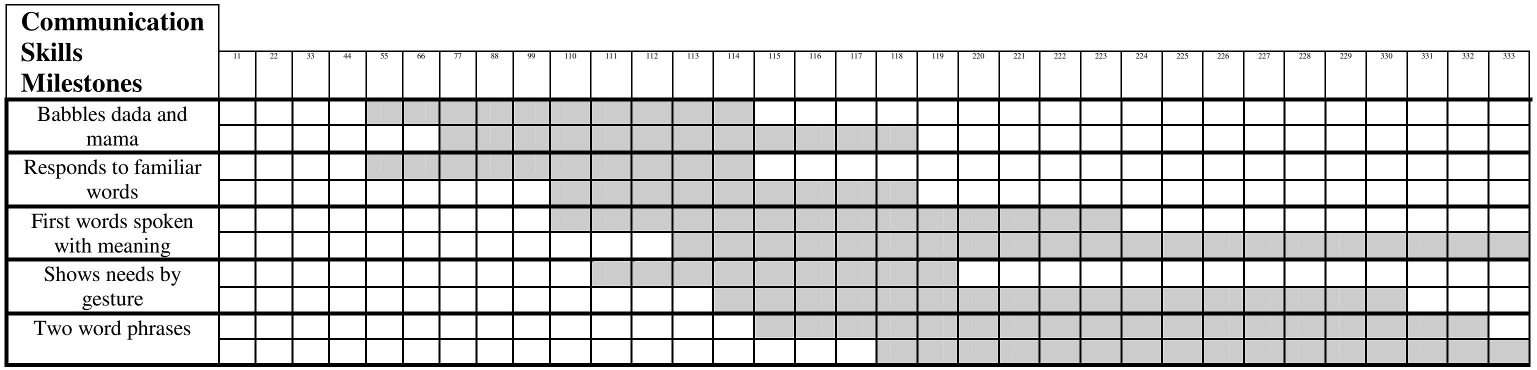

Note: all those which can extend for a long period are only indicated until 33 months

Personal and Social Skills Milestones	11	22	33	44	55	66	77	88	99	110	111	112	113	114	115	116	117	118	119	220	221	222	223	224	225	226	227	228	229	330	331	332	333
Smiles when talked to																																	
Feeds self with biscuit																																	
Drinks from cup																																	
Dry by day																																	
Bowel control																																	

Note: all those which can extend for a long period are only indicated until 33 months

ICT FOR INDEPENDENT LIVING… IS THERE A SUSTAINABLE BUSINESS? AN ATTEMPT TO UNDERSTAND THE REASONS OF THE SLOW UPTAKE OF THE MARKET.

Silvio Bonfiglio[1]

Abstract

There is a growing interest in the business community with regard to ICT products / services addressed to the elderly; it is due to the demographic trend and to the rising expectation the older adults have in respect of the Quality of Life. ICT could play an important role in changing the way social care services are delivered to the citizens and its economic impact could be relevant. The market potential is very appealing and there is much room for the development of solutions capable of meeting a wider spectrum of new user needs and/or meeting currently addressed needs in a more advanced and adequate manner. Nevertheless heavy barriers are refraining the uptake of the "ICT for Ageing Well" market and the sector does not promise a fast return of the investment to the industrial / business community. As a result the sector is still technologically driven with an offer too research-oriented. In this paper – derived from the analysis we did in two AAL Projects (EASYREACH and NOBITS[2]) - we investigate about the existing barriers limiting the effective exploitation of the outcomes of the intensive research and development work carried out in this field.

1. Introduction

The "ICT for ageing well" market is still in its nascent phase. There have been several pilot trials (e.g. of smart houses, telecare services) but these services have not yet become mainstream and there is very little usage in practice. According to a market research [1], more than 20,000 assistive technology (AT) products are available in Europe; nevertheless their acceptance has been slower than might had been expected and the adoption of AT solutions seems to be very unevenly spread across Member States. There are peculiar characteristics in this market segment explaining these difficulties. In e-care the business models are different from those of the consumer sector. While in this last one the value is linked to a pure financial return, for e-care the overall context varies, as intangible elements need to be taken into consideration in addition to specific monetary terms e.g. the social benefits, such as quality of life of the elderly persons, peace of mind of the family's members. Another specificity is

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[2] EASYREACH (Fostering social interactions of home-bound and less educated elderly people) www.easyreach-project.eu - and NOBITS (Nostalgia Bits) are two running projects of the Call 2 (2009) of the Ambient Assisted Living (AAL) JP; both projects are expected to be completed during 2013.

represented by the financing structure in e-care which is very differentiated: services paid by public or private insurance, by health management organizations or associations and out-of pocket payment by the users themselves or by their families as well, either in terms of co-payment or self-purchase. Moreover the consistency and sustainability of current funding systems across Europe varies considerably, with evident disparities in terms of financing and reimbursement mechanisms, public versus private delivery mix, degree of population coverage and satisfaction. Fortunately we see also encouraging elements [1]:

- The majority of older people are showing a growing interest in more advanced solutions;
- The use of Internet among the EU15 older population in the 65-74 years segment has more than doubled; in the same way among the 50+ citizens the availability of a PC at home increased from 36% of 2001 to 57% in 2007 and the Internet access at home from 22% to 47%;
- The older population shows a growing "financial power": in the developed countries the over 50s own ¾ of all the financial assets and account for half of all discretionary spending power. Moreover the consumption of the 50+ people in Europe increased 3 times as fast as that of the rest of population *("I'd better have a nice life instead of saving money all the time")*.;
- The increased awareness of the problem by the Institutions, the political community and by the opinion leaders that could represent an important step forward in the uptake of the AAL market.

We notice also higher consciousness of the persons directly involved i.e. the senior citizens: they want to live longer but at the same time to live their third age in a better, more participative way. With the forecast of representing in 2050 the 30% of the overall European population, the 65+ citizens have all the rights in pretending for them a relevant role in the society and a better quality of life. Older adults have the right to continue to represent a resource for the community rather than a problem. From a technological perspective the situation seems very encouraging since we see a continuous advance of Information and Communication Technology in various areas fostering the social inclusion of the older adults and helping them to live as much as possible independently and autonomously. Nevertheless analysts still notice a gap between the potential benefits that the ICT infrastructure can provide and the exploitation of these benefits throughout a large part of the older population. The forecast projecting for the coming decades an Europe less populated and older represents the major driver for the "ICT for Ageing Well" market; national healthcare and social care services will be faced with a tremendous crisis if nothing will be done to change the way how healthcare and social care services are delivered to the citizens. ICT could play an important role in the solution of this problem.

2. Method

In developing a business strategy in the AT field we started with a better characterization of the addressed users (i.e. the elderly people) and we considered their “consumer-related behaviour” and their attitude towards the technology. The psychological barriers represent often the main cause refraining the older adults to learn about ICT devices / solutions and to make use of them. Several studies analyzed the aspects which influence their adoption of a product and their decision process:

- Older adults are not influenced by trends;
- The perception towards technology is changing; even if slowly, elders are adopting technology mainly when they see the benefit of it;
- The attitude towards technology is also influenced by the age (typically 55+ elders are “technology adopters”, 65+ are “showing interest”, people aged 75+ “do not want to know anything about technology”).

The method we used in characterizing the older population was a “gerontographic model” [2] that combines physiological, psychological and social ageing variables. On the basis of this model the elderly population was segmented into four groups according two axes related to the health status and to the social mindset (see fig.1).Healthy indulgers enjoy life and are willing to spend; in the same way the Ailing Outgoers have self-esteem, they are socially active, like to learn new things, to preserve independence, to maintain connected, to address the problems linked to their ageing. Often an outgoing social mindset is linked to a positive approach towards technology so – regardless of the health status – the market potential for ICT assistive devices / services is larger when addressing the “healthy indulgers” and the “ailing outgoers” that jointly – according to a market research [2] - represent the 47% of the older population. Healthy hermits and frail reclusive have a negative attitude towards technology, little interest and have few consumer needs. Older adults can move from a profile to another; the process – often age independent - is linked to special events in the life of the elderly (e.g. the death of a relative).

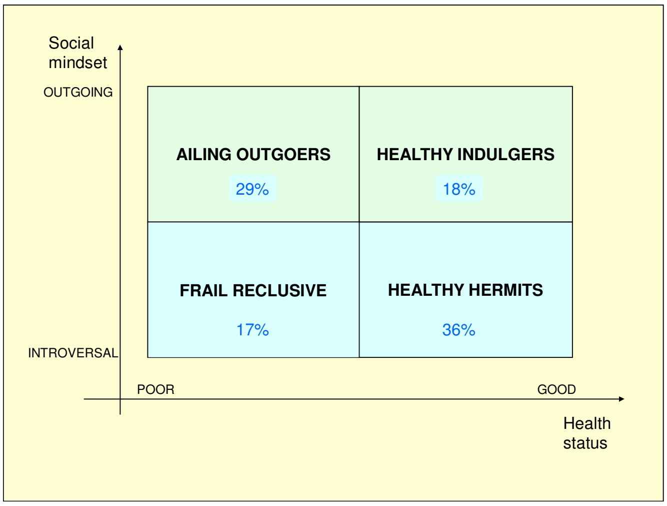

Figure 1. The "gerontograhic model" of the older population

According to another study (the SeniorWatch report [1]) the percentage of ICT users among the 50+ European population grew from the 40% of 2001 to 45% in 2007; in this group the "experienced frontrunners" (i.e. computer users with professional or advanced skills and/or using a computer at least once a week) went up from 27% to 40%, while the "late beginners"(i.e. computer users with less than advanced skills and using a computer less often than once a week) went down from 13% of 2001 to 5% of 2007.Among non-users, it seems that there was not a big change between 2001 and 2007: roughly 30% of the 50+ population is against technology (digitally challenged) and 30% - even if they do not use ICT devices – show a certain interest and are open to learn ("technologically open minded").

50+ population			
		2001	**2007**
USERS	**Experts**	**27%**	**40%**
	Beginners	**13%**	**5%**
	TOTAL USERS	**40%**	**45%**
NON USERS	**Open mind**	**28%**	**27%**
	Digitally challenged	**32%**	**28%**
	TOTAL NON USERS	**60%**	**55%**
TOTAL		**100%**	**100%**

While a lot has been done with regard to the "technologically open minded" portion of the older population, there is still a problem in reaching the "digitally challenged" segment. Analysts put in evidence how "the match between technologies on offer and actual user needs is far from optimal". Lack of acceptance, lack of usability or even of usefulness are often diagnosed as reasons for limited technology diffusion in this area. Functional restrictions could represent an additional barrier to older people to utilise ICT products and services for their purposes. A recent Eurobarometer survey [3] indicates that EU citizens with health problems, illnesses or disabilities are a lot less likely to have access to the Internet (25% compared to the global 43%).The second step in the study we carried out in the NOBITS and EASYREACH AAL Projects was to identify the main barriers limiting the effective exploitation of the results of the intensive research and development work done in Europe in the Assistive Technology area. From a technical perspective we noticed that some products show a lack of accessibility and usability causing a limited acceptance of ICT devices and solutions by the elderly. To design for the older portion of the population is not an easy task: elderly people do not build up a homogeneous group; they have different degree of impairments, different level of education and computer literacy; they are characterized by a diversified and wide range of interests and needs and – across Europe – by different cultural background and languages. From a business perspective this fragmentation - which offers great opportunities to SMEs - at the same time represents an obstacle to build an economy of scale and discourages the investments of the big multi-national groups. Additional barriers – not product-related - are equally important: financial issues such as initial investments and reimbursement policies, legal and legislation issues, lack of standardization, cultural issues, not enough awareness at all the levels and lack of sustainable business models.

LACK OF AWARENESS AT ALL LEVELS

- by the elderly (digital literacy, limited use of Internet, misconceptions towards technology, poor acceptance due to complexity of the solutions,...).
- by the Institutions and the policy makers (focus on short-term cost s rather than on long term benefits, limited exchange of good practice experiences, lack of an Europe-wide initiative, low awareness of the opportunities offered by ICT...)
- by the developers (low awareness of the user needs)

REGULATION ISSUES (involvement of multiple institutions, Lack of a global e-health policy , lack of legislations, reimbursement policies, integration of telecare into the conventional healthcare system).

LEGAL ISSUES (privacy issues , security of data, responsibility allocation in case of failures in the products/solutions, medical phone consultation even illegal in some countrirs, ethical issues not well developed, ...).

FUNDING CHALLENGES (Public funds and supports for assistive technology not sufficiently targeting older people, self-purchasing currently limited to social alarm and showing a price-sensitiveness that will make difficult the acceptance of "high-priced" assistive ICT solutions; challenge to prove economic impact ,...)

LACK OF STANDARDIZATION (inter-operability standards to foster entrance of new players and market growth)

LACK OF ACCEPTANCE BY THE USERS (poor appeal of the products / services; benefits not so evident, difficult to use, lack of "design for all" practice and ageing needs not yet in mainstream products,...)

LACK OF EFFECTIVE BUSINESS MODELS (involvement of various players, market too fragmented, high cost of development and validation and uncertainty of a sustainable business, lack of coordination across the whole service delivery chain, high fragmentation of the industry and of the research and innovation,...)

ORGANIZATIONAL AND INFRASTRUCTURAL CHALLENGES (Assistive ICT technology implies an effort in technology and service integration ; it is not just purchasing a new tool. Infrastructures for delivering ICT-based services into the home are not well established,...)

3. Results and recommendations

As a result of the above reported analysis we elaborated a set of proposals with regard to new business models that could contribute to the sustainability and viability of the business. We see the need of a synergic effort of all the players and of the implementation of "collaborative business models". Innovation in Ambient Assisted Living (AAL) is strongly driven by technology and technology as an enabler is adequately available to support comprehensive AAL solutions. However, as of today, there is no comprehensive solution for AAL commercially available or in operation on a wider than prototype scale. Thus, extra value can be created if the wide range of demands of the senior citizens could all be addressed by a network of enterprises, offering an "all inclusive", easy-to-use AAL solution. Therefore collaborative business models can make a valuable contribution in realizing comprehensive AAL solutions. There is another important reason suggesting a collaborative approach: to share – together with the opportunities - the risks linked to a business such that of the AAL sector characterized by an unconsolidated market in its nascent phase, unclear external environment (political, regulation, financial conditions), doubtful and long term return of the investments, etc. In the AAL market large companies and SMEs as well could play both an important role; the first due to the need of a multidisciplinary development approach and to the significant efforts to be devoted to standardization initiatives ensuring the interoperability of the solutions while the European SMEs could have enormous opportunities due to the fragmented characteristics of the market and certainly they could add values by adapting the solutions to the local context and according to the profile of the specific user.

All the solutions must be developed with a fast time to market, must be interoperable and easily integrated. A contribution to the e-care sector could be given by the focus on reference architectures for AT services. Open architectures will allow heterogeneous devices of different vendors to be interoperable and easily integrated with short development cycle and lower development costs. It will offer opportunities for a sustainable business. In such way the interest of new players and the building up of a global market will be facilitated.

4. Conclusions

As evidenced by several analysts the European social care system is experiencing a critical situation and in the current context the provision of social care services using innovative ICT solutions offers the great opportunity of a containment of the costs while maintaining the expected levels of quality of care. Among the economic benefits we have to include the creation of new jobs produced by the uptake and growth of the e-care industry with an important role of the SMEs.

Sustainability and viability of the business are still to be proved and efforts are needed in the identification of effective business models. A threat could be represented by the overall economic situation and by the earning capacity of the older part of the population since it is clear that currently social care solutions have to adopt a "private" or a mixed "public-private" approach with regard to the payment of the related costs. Furthermore a negative aspect is represented by a lack of commitment by the large enterprises in this sector due to the slow uptake of the market and the doubtful return of the investments (at least in the short-medium terms). Better leveraging of the potential provided by ICT represents a challenge but at the same time an economic opportunity. It has become evident that market forces alone have been insufficient to ensure the realization of this potential [4]. Several barriers have to be removed and often they are not linked to the shortage of suitable and advanced technologies but – preponderantly – are related to political, legal and cultural issues. All the stakeholders need to find the way to cooperate in a common effort. Essentially e-care services have to create value for all stakeholders by devising appropriate supporting business models. Failing to do so will just create a situation where social care professionals and institutions would lose trust in these solutions and, as a consequence, refrain from exploiting the benefits brought by these e-care systems and solutions.

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GOING BEYOND PILOTS

Carlos García Gordillo[1], Pedro Muñoz Sahagún[2]

Abstract

A large part of the research and development efforts conducted under the auspices of European R&D funds have not made it to the market. The causes are twofold. First, R&D has been mostly top-bottom driven, starting with an idea striving to look for a market. Secondly, it is assumed that somebody else, but not the individual end user, is going to pay for the product or service being developed. If we want to succeed in the marketplace, we should identify demand, rather than needs, and how much the end users are willing to pay for the product or service. At the same time, a target group as broad as possible should be identified including, but not limited to, the older population.

1. Going beyond pilots

Last year an official at the Ministry of Health from the UK, addressing a conference on business developments in technology for disabled and older people said, "I see more pilots in this gathering than in British Airways". And yes, he hit the nail on the head. For some reason, most developments financed under the AALJP, or for that matter under any other EU program directed at ameliorating the living conditions of older people, have foundered and have never gotten off the ground.

Why is it that most of those ideas that have been found valuable, not only by their promoters but also by the EU agencies in charge of selecting them, have not made it to the market? Why haven't they become success stories?

The obvious answer can be found in their faulty business models. How many proposals incorporate, at the onset, at least the draft of a business model? Unfortunately very few. In most cases the business model is constructed to fit an already developed product. The business model becomes an afterthought, a justification of something already developed rather than a guiding principle for the development of the original idea.

Let us be critical with the organizers of this event. We have been instructed that the oral presentation should cover the following subjects:

- What is the real need? How big is the need?

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[1] Freelance Management Consultant, Spain
[2] Hospital La Fuenfría, Spain

- What is the innovation itself?
- Why should it come on the market?
- How did you design your concept – user involvement?
- What did you do to meet standards and interoperability?
- Answer specific questions on ethics.

Is there any mention of the cost effectiveness of the idea? Is there any mention of the target price for the product or service or, more importantly, who is going to pay for it? We may have overlooked something but "Why should it come on the market" does not directly address any of these fundamental questions. And neither does "What is the real need?" or "How big is the need?"

"Why should it come to the market?" surreptitiously means that there is already a product or service, and we will look to the market for the possible demand. It is a top-bottom driven question. Our investigation should be bottom-up driven. What we should be doing is to ask first what the market demands are and, only then, investigate how to meet the demand with a product or service.

This brings us to the other two questions, probably related to the cost effectiveness issue, that we are directed to answer: "What is the real need?" and "How big is the need?" Let me say that one thing is "need" and a very different thing is "demand". People are ready to pay for their demands, whether these correspond to their needs or not. In the marketplace only products or services that meet a demand will have a chance of success, regardless of the real needs of the population to which the product or service is directed.

There is a second problem. Most of us assume that the public purse is going to foot the bill of a product or service directed at the older population. This is based on the belief that we can demonstrate that, for society as a whole, our solution is cost effective. What we really mean is that our product or service will save health care services, social care services, families and individuals huge amounts of money and/or time.

But really, who is going to pay? The National Health Service, the private health insurer, the municipality in charge of social care, the family, the individual, an NGO, who? Because the truth of the matter is that each of the previous possible payers has an independent budget. Why should, for instance, the National Health Service foot the entire bill for something that is going to save money for the social care services of a municipality that may even be governed by a different political party? Out of the previous list of possible payers, there is only one that is going to benefit in full from our product or service: the individual. He or she is the only one paying the bills anyway, through direct payment, indirectly via taxes that finance public services, or by premiums that pay for private insurance care schemes. There is another group that could benefit from a product or service designed to meet the needs of older and disabled people. It is the vast array of providers that cater for them. We are referring to shops, restaurants, entertainment, transportation, and the like. This group, mostly SMEs, could profit by establishing a special bond with the world's ageing population.

Addressing this group of economic actors meets another of the EU's strategic goals in funding R&D, but taking it one step further. Not only will SMEs get involved in the R&D process, but also we will produce a result that fulfils the basic need of the small and medium enterprises in Europe: maintaining and broadening their customer base. If the outcome of our project is a product or service designed to meet the needs of the older population while making use of the network of European SMEs, then we will have a winning card.

Our point is that, given that individuals are the end users of our services and products, we have to be brave and recognise that they will have to pay for it directly or indirectly. If, on top of that, a broad base of providers can benefit from the result of our investigation, we will have the support of other actors interested in paying for their use. Put together the interest and demands of those two big target groups and we have a success story. Our business model should be developed in conjunction with the development of the product or service. It should involve individuals and the companies that cater for them and identify their demand, as opposed to their needs. It will be the moment to address a simple question "How much would you pay for this?" Needs and cost for the end users and providers should be at the core of our development strategy and of our business plan.

ACCURATE-BUSINESS (CURA-B): CONNECTING CARE AND BUSINESS

Arend Roos[1]

1. Introduction

How do we meet the challenges which are posed to us by ageing societies? In most European regions this is a concern, shared by policy makers, providers of health care and entrepreneurs. From four of these regions the CURA-B project is started. Ten partners from West-Flanders, Zeeland, Suffolk and Nord-Pas de Calais are uniting in order to bridge the gap between the worlds of business and care. They are focusing on enabling the innovative power of entrepreneurs to strengthen services in health and social care markets. The project partners are deeply convinced that both care and business need each other in meeting the future challenges, and that those types of collaboration will strengthen the regional economies.

The project stimulates developments in the fields of 'telecare' and 'wellbeing for elderly'. Stakeholders from all regions are involved in its activities.

The project CURA-B consists of three activities:

1. Mapping the context (2011)
In this first stage, enterprises and providers of care are interviewed in order to gain a better understanding about the context of the project. How are care and business related right now? How do they perceive each other? What are the impediments for innovation processes? Are there best practices worth to be spread with the other regions?
Further, a desk research is conducted in all partner countries. The result is a consolidated report on the financial, organizations and legal context of healthcare in France, the UK, Flanders and The Netherlands. This study is written in order to help SMEs in order to enter the markets of healthcare and social care in the four countries.

2. *Bridging the gap (2012)*
In this stage several stakeholders in the four regions will be connected. Based on the outcomes of the research phase, workshops, focus groups and conferences are organized in order to bring people together and discuss about the results of the first activity. Also the potential for crossborder trading and other actions between the four regions are explored.

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From these activities some first ideas arise of feasible pilots, to be started in the next activity.

3. Bringing into practice (2013)
In the last stage there some pilots will be launched, based on the results of both preceding activities. It's the intention of the project that these pilots are results from co-creation between care, business and end-users of patients. E.g. in West-Flanders there is the ambition to start a pilot for non-medical services in homecare, and in Suffolk one of the pilots will be setting up a diagnostic facility in pediatric diabetes.

During the June 2012 meeting the project partners decided that it also would be useful to have some first explorations towards regional knowledge hubs in the field of innovation in health, care and wellbeing. In a joined effort these actions will be undertaken the next year and a half. Establishing such networks, also across the borders of the regions, will secure sustaining the results of the project.

Results activity 1
Currently the first activity has been completed. The field research yielded an interesting insight in the obstacles towards innovation, both from SME and provider perspective. From the research, it became clear that a lot of work has to be done yet in engaging end-users in the design process. This is a concern both from providers and SMEs.

In some regions SMEs experience difficulties in engaging health care professionals in their design processes. It is not easy for them to contact the right persons, and procurement processes are not always clear enough to them. In the light of that, it is interesting to hear provider say that SMEs involve them too little in design processes.

Roughly, project partners have concluded that apart from the activities that we planned to follow the research, there is also need for establishing regional networks, in which persons from healthcare, social care, government and SMEs meet each other. These network could serve as the fertile soil upon which the new pilots can flourish. This objective, and influencing policy where needed, has been added to the project goals,

Activity 2
With those objectives in mind activity 2 was started. In all regions thematic working groups have been started, based on what regional partners thought to be the best approach and what topic was actually appealing to the target audience.

It is good to see that in some regions where those activities have been organized already, automatically follow-up actions were initiated. So is an FP7-proposal on ICT for health in preparation in Northern-France and was the East of England Assistive Technology Group initiated, as a formal platform for providers and business to discuss AT-matters.

From the research the function of CURA-B in these activities was to be defined as threefold: to inform, to inspire and to connect. And that's what CURA-B has started to do now and which leads to surprising results and enthusiasm from diverse stakeholders. Even the first pilot project already has been defined and started: a diagnostic service in pediatric diabetes in the West-Suffolk Hospital.

AN AMBIENT TECHNOLOGY FOR REST/ACTIVITY FRAGMENTATION

Lorcan Walsh[1], Julie Doyle, John Loane,
Andrea Kealy, Brian O'Mullane

Abstract

The increased fragmentation in the temporal dynamics of behavioural states have been associated with age and with lower levels of cognition. Furthermore sleep fragmentation has been associated with impaired alertness, attention, changes in mood and loneliness. This paper describes the use of ambient motion detection technology for quantifying the fragmentation of rest and activity in older adults.

1. Introduction

The world's population is ageing, and this is set to intensify over the next forty years. This demographic shift will result in significant economic and societal burdens (particularly on healthcare systems). The need for a proactive, preventative approach to delivering healthcare is long recognised, yet it remains a challenging problem. Recent work has focussed on enabling older adults to age in place in their own homes. This may be realised through the recent technological advancements of affordable healthcare sensors and systems which continuously support independent living, particularly through longitudinally monitoring deviations in behavioural and health metrics. Overall health status is contingent on multiple factors including, but not limited to, physical health, mental health, and social and emotional wellbeing; sleep is implicitly linked to each of these factors.

Sleep is a fundamental physiological process with important restorative functions. Sleep problems have been shown to be detrimental to human health. In humans, short (seven hours or less) and long (nine hours or more) durations of sleep have been shown to be significant predictors of death in prospective population studies [1]. Sleep disturbances may be indicative of poor health and functional deficits, especially in older adults [2]. Total sleep time is reduced in the elderly [3] and this is not due to a reduced need for sleep, but in a diminished ability to sleep [4]. Sleep complaints are commonly reported by over 50% of those aged 65 and older [3]. These complaints include getting less sleep, frequent awakenings, waking up too early, excessive daytime sleepiness, and napping during the day [3]. Additionally, high incidences of balance, ambulatory and visual difficulties (after controlling for medication use) have

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been reported in older adults with sleep problems [5,6]. Artificially imposed sleep fragmentation has been associated with impaired alertness, attention, changes in mood, and loneliness [7,8]. Additionally, altered sleep/arousal profiles have been found in people with sleep disorders, neurological diseases and in older adults [9].

Recently, the increased fragmentation in the temporal dynamics of behavioural states (specifically sleep and arousal) have been associated with age and with lower levels of cognitive performance in older adults using wrist actigraphy [10, 11]. However, this technology requires the adherence and active participation of the user in wearing the sensor. Although this approach may be automated, quantifiable and objective, its use is not appropriate for neither cognitively impaired older adults nor long-term data collection. Fragmentation of these behavioural states can be quantified using ambient motion detectors placed in the homes of older adults. The analysis of longitudinal data will elucidate whether changes in the temporal dynamics of motion/non-motion (serving as a proxy to activity/rest), collected unobtrusively, may be used for the detection of a deteriorating health status in older adults.

The Great Northern Haven (GNH) in county Louth, Ireland, consists of 16 purpose-built smart homes focussed towards supporting AAL for older adults. Over 2200 sensors and actuators are fitted throughout the development, and approximately 100 sensors in each home measure electricity usage, motion levels, water usage, brightness levels, light switch usage and contact sensors (see Figure 1). To date, over two years of data from a number of older adults using the embedded sensors have been collected and models are being built to detect patterns in activities of daily living and health. GNH is a unique development in that it is not a test bed for research. These are real peoples' homes and as such, the data collected is extremely rich.

In this work, metrics which quantify the fragmentation of rest/activity from the activity data in the GNH smart home data set are described. This work investigates the longitudinal variations in these metrics both within and across multiple subjects.

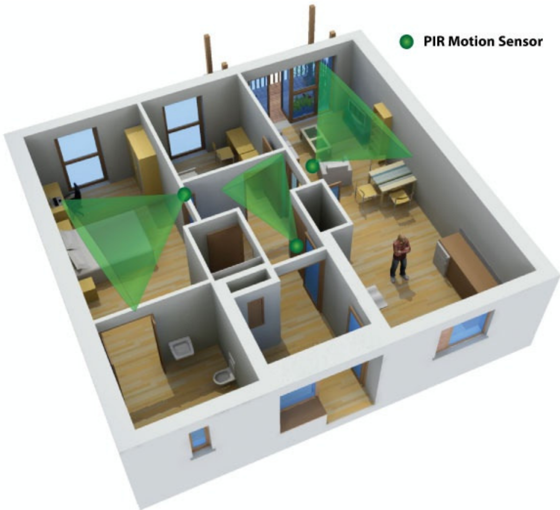

Figure 1. PIR placement in an apartment in Great Northern Haven.

2. Methods

Data set
Data presented in this paper relates to three subjects whose overall health status, as assessed by a Registered Nurse, was gradually improving (Subject CA04), gradually declining (Subject CA12), and rapidly declining (Subject CA11) between July 2010 and July 2012.

PIR description
Passive Infra-red (PIR) motion detection is widely used for detecting the presence of an intruder and is commonly seen in house alarms. The lens in the PIR unit focuses environmental infrared radiation onto a pyroelectric sensor. It is the change in the amount of infrared emitted in the environment which triggers an event which is in turn interpreted as motion. Thus, sudden changes across any of the cells in the pyroelectric sensor are interpreted as motion. The circuit is designed using a differential amplifier so that universal changes in environmental infrared levels are not misinterpreted as motion. The PIR device installed in each apartment in GNH is the B.E.G. Luxomat PD2. attached to the Intel Digital Health Group's (B.E.G. Ireland, Dun Laoghaire, Ireland). Each PIR will trigger for the period when movement is detected. The PIR status will remain triggered until up to ten seconds after movement has occurred. A status message records when the PIR has finished triggering.

Data Aggregation System
All triggers generated by each PIR are recorded, via a wired connection, to a central computer which uploads each PIR event to a cloud based mysql database. Periodic

status updates, indicative of PIR status, are also recorded to ensure valid data collection. The event time, apartment number, and PIR location are recorded.

Variability in In-home Activity

An activity density map visualization, showing the number of seconds of activity recorded over all PIRs for each hour, of the PIR activity data over June 2011 for Subject CA04 is presented in Figure2. This shows a consistent, strong indicator of activity in the morning at approximately 10 am and again at 7pm. A smaller indicator is present at approximately 2pm. These times are consistent with meal preparation and eating. Periods late at night, early in the morning, and in the later afternoon show low levels of activity. Previous research has demonstrated this data, and the variability in this data, more thoroughly [12]. The variation in this activity data, per hour, over an entire month is shown in Figure 3. This supports the previous findings regarding periods of increased activity; however a large variation in the activity levels exists.

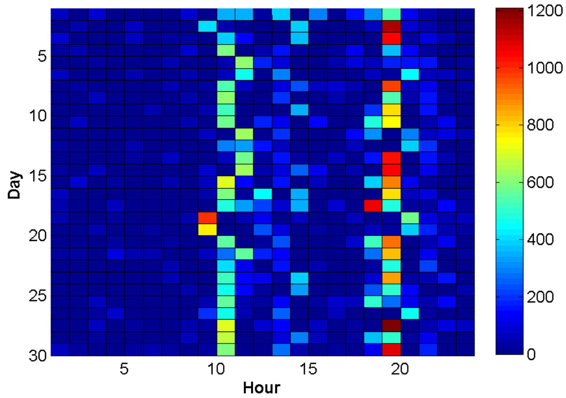

Figure 2. Actogram of GNH Data for subject CA04 in June 2011.

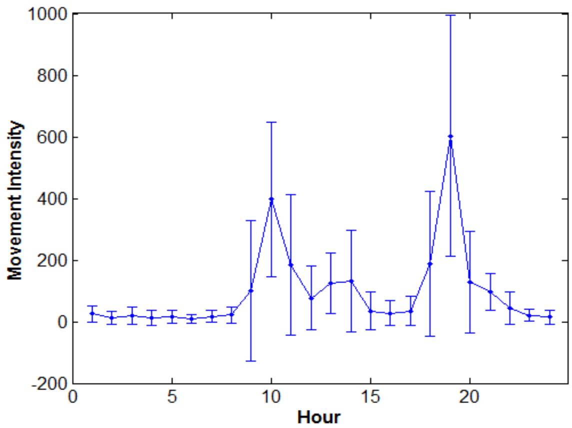

Figure 3. Mean and standard deviation of activity for Subject CA04 in June 2011.

Actogram
An actogram, a traditional method of visualizing activity and rest levels within the sleep and chronobiology research community, is shown in Figure 4 (A). This displays the intensity of movement (calculated as the number of seconds of movement recorded by all PIRs, on a per minute basis) for each minute over all days. The data is double plotted allowing a comparison of the variation in activity across multiple days. For example, data is plotted for a 48 hour period on each horizontal bar, beginning on day 21 until the end of day 22. The data from the beginning of day 22 is plotted again, one line down.

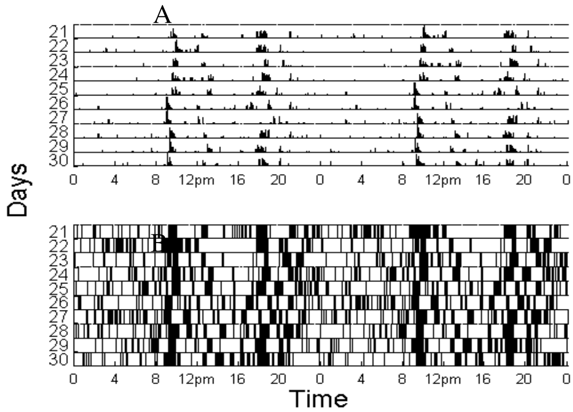

Figure 4. Actogram using movement intensity (A) and rest/activity (B) for Subject CA04 in June 2011.

Quantification of rest/activity fragmentation
Actograms and activity density maps provide a visual analysis of the consistency of rest/activity profiles. Many methods have been proposed to quantify this data, including cosinor analysis [13], non-parametric analysis [14], and state transition analysis [11, 12]. To date, these systems have used wrist-based accelerometer devices (wrist actigraphs), however ambient PIR-based approaches are more suitable for long-term monitoring, particularly amongst sensitive populations.

An approach similar to the state transition analysis proposed by Lim et al. [11, 12] was applied to the GNH data set. Firstly, the actogram data was modified into two states: rest (movement intensity = 0) and activity (movement intensity > 0) as given in Figure 4 (B). Subsequently, the number of continuous runs of rest or activity of length *t* are calculated. Finally, the percentage of runs of rest/activity greater than or equal to *t* are calculated (as shown using a histogram in Figure 5).

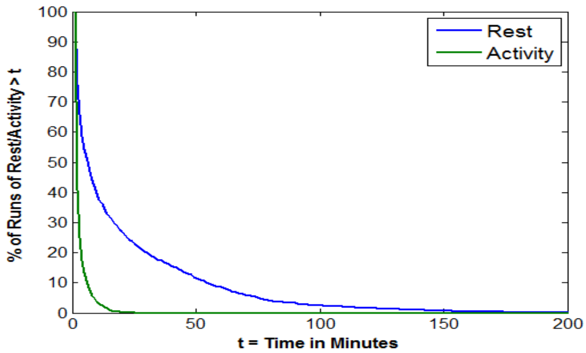

Figure 5. Histogram of the percentage of length of runs of rest/activity for Subject CA04 over June 2011.

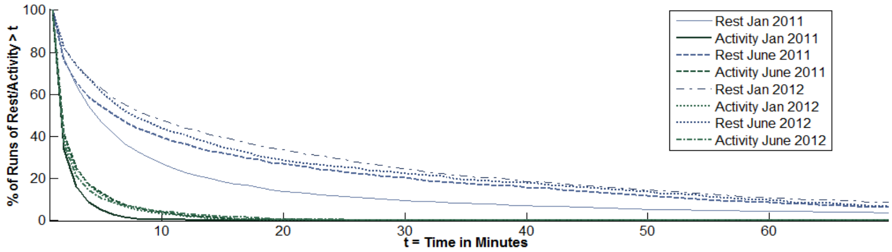

Figure 6. Histogram of the percentage of length of runs of rest/activity for Subject CA04 for four periods of one month over two years.

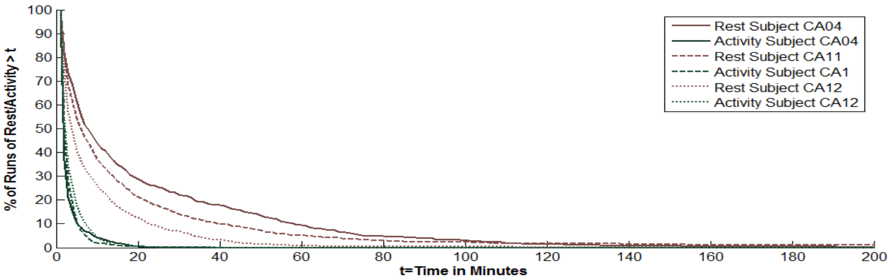

Figure 7. Histogram of the percentage of length of runs of rest/activity for all three subjects over June 2012

3. Results

Histograms of the percentage of length of runs of rest/activity for Subject CA04 for four periods of one month over two years is given in Figure 6. The slope of the line for the latter three periods, for both rest and activity, are reasonably similar which are possibly indicative of stable rest/activity routines. Figure 7 presents the histogram of the percentage of length of runs of rest/activity for all three subjects over the period of one month (June 2012). Similar profiles are evident in the activity data, however large differences are evident between the rest data.

4. Discussion and Conclusions

Sleep fragmentation has been associated with impaired alertness, attention, changes in mood, and loneliness and altered sleep/arousal profiles have been found in people with sleep disorders, neurological diseases and in older adults. This work presents an ambient method which can be used to quantify the fragmentation of in-home rest/activity profiles using PIR sensors.

Future work will investigate extracting metrics which quantify the level of fragmentation and allow inter- and intra- subject comparisons. Such metrics must cater for differing levels of overall activity within the house (although this information is, in itself, indicative of overall health). Previous work by Lim et al. [11, 12] suggests charting the probability of transition between rest and activity for each length of run, *t*, breaking the resulting graph into regions, and reporting the slope of each region. A direct comparison to the data from Lim et al. is not possible due to the differences in the sensitivities of motion detection device. The Lim et al. study used wrist actigraphy, while the system presented in this paper used an ambient technology which will not capture minor movements.

Central to the development of such algorithms includes the detection, and removal, of periods where the resident leaves the house and also when visitors are present. Further challenges include developing algorithms which cater for such missing data.

Future work will investigate the longitudinal variation in the fragmentation of rest and activity and their relationship to cognition (MMSE), loneliness (De Jong), and sleep quality (PSQI).

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WEBTOOL FOR AAL BUSINESS CASES – CALCULATE THE BENEFITS OF YOUR INNOVATION

Ir. Marian Schoone[1], Evelien Rijken[2], Cindy Wings[3], Inge Jochem[4], Robbert Smit[5]

1. Introduction

The healthcare sector is currently facing a number of major challenges. Due to the increasing demand for care and the decreasing number of healthcare professionals, the balance within the sector is under threat. One of the ways to solve this problem is to continually implement innovations which, for example, enable greater efficiency, increased productivity or reduction of the demand for care. TNO stands for innovation for life by supporting innovations in healthcare to increase their success.

There are many different ways to increase the efficiency of long-term care. As it involves time and labour-intensive tasks that have to be carried out over a long period of time, more efficient solutions offer great opportunities for savings. Important aspects in this respect include remote care, increased self-care, independence or collective independence of client and informal carer. Another important element in long-term care and care for the elderly and chronically ill is the quality of life. The care and services are not primarily focused on treatment of the illness, but much more on the client's ability to function in society. These innovations on the cutting edge of healthcare and welfare may involve participation and social contacts. Care close to home is preferred by most people and stimulated by policy makers. The proportion of primary care is increasing, although the proportion of home care is increasing as well. This requires increased co-operation between (the traditionally separated) preventative medicine, healthcare and welfare. It requires healthcare providers to be more like entrepreneurs and recognise new opportunities. Domotics and robotics can be used to compensate for the future shortage of healthcare providers and to enable clients to remain at home for a longer time. Examples are innovations in the context of Ambient Assisted Living (AAL), where the focus is on creating an environment for self-care, independence and participation.

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2. Making a business case

When having an idea for new products, or methods to improve services for healthcare and well-being, such as the developments described above, it is important to know if the innovation is worth the investment in time and money. Can we earn back the investment and how? What are the costs and benefits for all parties involved, i.e. client/consumer, service or care provider, manufacturer, health insurance company. In a business case all important variables are considered in a structured way. This will increase insights in the effects of the innovation and give input to further improve the innovation.

The Dutch agency for Healthcare Research, ZonMw, has asked TNO to develop several tools to build business cases for innovations in long-term care, primary care and psychiatric care. This summer an English version of the web tool for long-term care has become available. With these tools health care providers and advisors can assess the effects of an innovation in an early stage to fund their decisions for investments or to convince others of their idea. The assessment will make clear what the investment will offer in terms of productivity, quality of care and services, money, or work satisfaction.

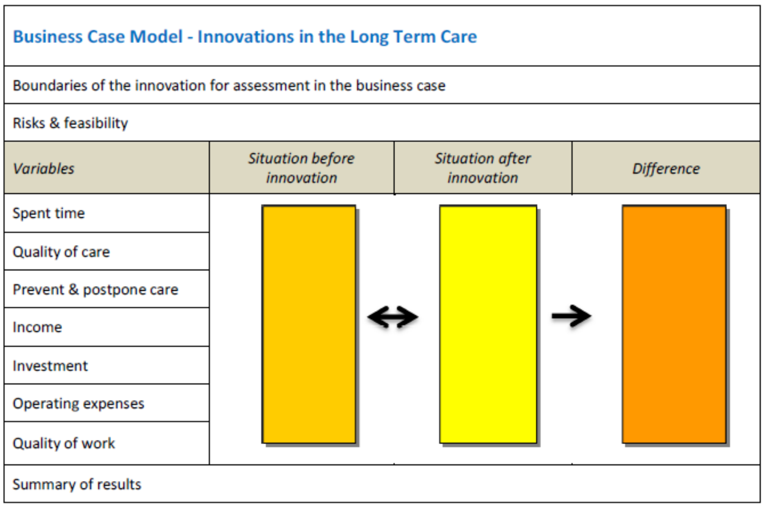
Purpose of this instrument
Using the instrument www.businesscase-longtermcare.com, you can create a business case relating to innovations in long-term care. On a step-by-step basis, you can assess the difference between the old and new situations for a number of variables. In such cases, a business case can serve a number of purposes: to convince people within your own organisation or from collaborating parties of the added value of the new working method, to give an overview of the changes to quality of work, spent time and income share between the collaborating parties and convincing the outside world (e.g. health insurers) about the benefits of the innovation.

Who is the instrument intended for?
This instrument is suitable for all parties involved in innovation of long-term care and related products and services. Implementers of the innovation can use this instrument, as well as external advisors, to create a business case to support the innovation. It is of great importance that you work together as much as possible with the disciplines involved in the implementation and conduct of the innovation. As the implementation of innovations affects the nature and the quality of the care and service, it is of essential importance that representatives of the clients are involved in this process whenever possible.

3. What is a business case?

A business case is a description that compares the costs/efforts and benefits/effects of an innovation. In other words, a business case systematically displays the advantages and disadvantages of innovations.

With the aid of a number of questions, descriptions and estimates are made for the variables spent time, quality of work, income and changes to care.



The diagram below displays the steps involved in making a business case for innovations in long-term care. The far-left column shows the variables that relate to the business case. These variables are divided into modules. There is a column for the current situation (before), a column for the situation after the innovation (after), and a difference column (before-after).

4. Create a business case with businesscase-longtermcare.com in three steps

Step 1: Description of the context of the innovation
The first step is to mark out the boundaries of the innovation for assessment in the business case. In this step, you record what and who is involved in the innovation. The motive for creating the business case is also recorded. The most important part of this preparatory step is to determine the areas included in the business case by indicating the most important work processes. Furthermore a quick feasibility assessment is part of this step.

Step 2: Assessment of the situation before implementation of the innovation
The second step is the assessment of the initial situation, before implementation of the innovation. In order to create a complete business case, the following sections must be completed:

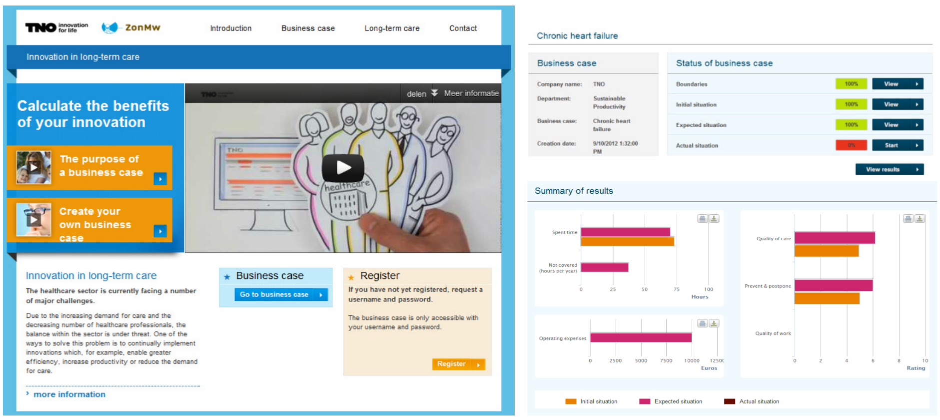
- *Spent time*: For all disciplines involved, determine how much time is spent on care and services.

- *Quality of care*: Give a rating for the quality of care, quality of life and client satisfaction.
- *Investment & operating expenses*: Calculate the required investment and the costs for daily conduct of care and services.
- *Income*: Indicate the difference in income by indicating which activities are covered by insurance or other forms of reimbursement and which are not.
- *Prevent & postpone*: Describe which prevention-related effects the innovation can have on acute care needs, postponement of care needs and independence.
- *Quality of work*: Give a rating for the quality of work and employee satisfaction.

Step 3: Assessment of the situation after implementation of the innovation
The third step is the assessment of the situation after implementation of the innovation. All sections described in step 2 are filled in again. Either use the section 'expected situation' for virtual assessment of the impact before the innovation is implemented, or use the section 'actual situation' for effect measurement when the new situation has been in effect for some time. The virtual assessment supports the decision process and the effect measurement supports the evaluation process.Once the third step is completed an overview of the most important details and calculations of the business case will appear in the summary.

5. Availability of the webtool

The web tool is available for free via the internet. A short instruction video explains the purpose and use of the tool. The picture below shows the home-page and result screen of the webtool.

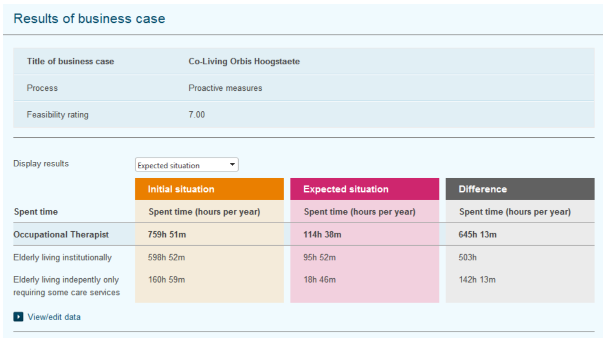


Recently, for four on-going AAL innovation projects, a business caseis being composedby the Dutch project leaders with the help of the web tool businesscase-longtermcare.com.

Business case 1: Co-LIVING; virtual collaborative social living community for elderly

The main goal of the CO-LIVING project is the development of an ICT-based Virtual Collaborative Social Living Community for Elderly (Co-Living) people, aiming to stimulate and prolong their independent and active living in an outward environment through an advancement in elderly people social interaction, contributing thus positively to their wellbeing. The main target group is the big group of healthy elderly, able to move around and that canstill contribute actively. Co-Living is based on an innovative Social Community network (SoCo-net), integrating wireless ICT services for social interaction and care, wellness, support and monitoring of mobility.

One of the outcomes of the Co-Living environment may result in less care consumption of the elderly and will offer an interaction platform for activities attendants that will result in less time-consuming contacts and positive work experience for the care givers (occupational therapists). The business case shows this aspect in the section "spent time" (see figure below). The tasks included in the business case are only the tasks in which the time spent is influenced by the innovation (Co-Living). It is not a complete overview of all tasks of an occupational therapist. This is why the difference between the time spent in the expected situation is far less than the time spent in the expected situation. The ratio between 'spent time' in initial and actual situation will be less extreme when all tasks are taken into account, but still saving time.



Results of business case

Title of business case	Co-Living Orbis Hoogstaete
Process	Proactive measures
Feasibility rating	7.00

Display results: Expected situation

	Initial situation	Expected situation	Difference
Spent time	Spent time (hours per year)	Spent time (hours per year)	Spent time (hours per year)
Occupational Therapist	759h 51m	114h 38m	645h 13m
Elderly living institutionally	598h 52m	95h 52m	503h
Elderly living indepently only requiring some care services	160h 59m	18h 46m	142h 13m

View/edit data

Business case2: CVN; Connected Vitality, the personal telepresence Network

CVN aims to link groups of senior citizens into a video communication network, enabling them to choose the activity as well as levels of social interaction according to their individual needs, abilities and lifestyle. Different modules will include: contact and activities, linking elderly with family, friends and relatives to support the social needs over distance; care contact, linking elderly with their care professional and

supporting the care plan; community, linking elderly with the community based on shared interests, hobbies, pastimes and personal experiences.
With the creation of a new generation of multipoint videoconferencing formats tuned to the personal preferences of elderly. In which up to 50 people can interact and conduct social meaningful activities with each other, a new vision on meaningful contact over distance will arise.
Added value of CVN is expected in the area of quality of contacts resulting in better quality of care, quality of life and quality of work for all users. Besides it will be able to influence the self reliance of the elderly users resulting in preventing and postponing demand of care. The business case shows this aspect in the sections "Quality of Care", "Quality of Work" and "Prevent and Postpone" (see figure below).

Quality of care	Average rating	Average rating	Average rating
Rating	4.94	6.18	1.24
View/edit data			
Quality of work	Average rating	Average rating	Average rating
Rating	6.78	7.36	0.58
View/edit data			
Prevent & postpone	Average rating	Average rating	Average rating
Rating	5.00	6.00	1.00
View/edit data			

A business case can be used to convince partners within a consortium or support the decision-making process within the organization, but also to present the benefits of the innovation to external investors or public funding parties. Making a societal business case is an important step on the road to market for each new product or service.

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TRACK D RATIONALE: SPECIAL TOPICS

A number of topics have been considered as very important, new, cutting edge and they will get special attention in this track: Intergenerational aspects, creativity and design thinking, age-friendly Europe and robotics. Also a group of 40 young researchers and Ph.D.'s will work together during a full day prior to the Forum and present their work.

Track D consists of the following six sessions:

Session D1 – AAL & inter-generational engagement

2012 is the European Year of Active Ageing and Solidarity between Generations. Generations are not only defined by age groups or family relations.

For a good understanding of the impact of 'generations' in the context of AAL, it is important to have a closer look at the background, views and values of different generations from a socio-cultural and economic perspective. Furthermore we will discuss implications for cross generational engagement in AAL and the ways in which ICT can support this. This is an important step in changing a burden-based vision of an ageing society to an asset-based vision in AAL. How will this open up new markets for innovation and AAL? Examples of intergenerational engagement with different objectives will be shown in the session.

Session D2 – What is this thing called 'design'? Dispelling the myths and conjuring new understanding

Outright success in the exploitation and commercialisation of project outcomes from the first Call are yet to be determined, although the AAL JP has funded 5 collaborative research and development Calls since 2008. Despite this much learning and adaptation has taken place during this period and as the global economic, political, social and technological climates change, the AAL JP and its participants need to keep abreast and alert if European businesses and economies are to remain viable and competitive. Simply put, to survive in challenging economic conditions and stay ahead of overseas competition, EU businesses must add value – designing innovative products and services that will unlock new markets and deliver what consumers locally, regionally, nationally and internationally need and/or desire.

Design is increasingly being used beyond this traditional remit as a strategic tool which enhances performance and unlocks innovation. Research has begun to examine this interdisciplinary role of design, and future work must aim to understand its full impact on business performance.

This session aims to generate debate and discussion among participants on two levels. Speakers will dispel the myths and address poor or out-dated understanding around design. Participants will gain a refreshing insight into how design has developed, diversified and responded in meeting the needs of economies, societies and innovation. The terminology and how the design knowledge base has expanded and is now an integral part of international social and economic strategies for business growth and development as well as improvement in the quality of life of their citizens. The presentations will be followed by an interactive discussion with the audience.

Session D3 – Design and creativity driving innovation in AAL

Design has been defined as the process that links creativity and innovation. It does this by shaping ideas to become practical and attractive propositions for users or customers; but what is creativity? How can it be fostered, developed or unleashed?

The aim of this session is to explore a knowledge base that has a proven track record in many other business sectors, including management and education. This knowledge base has facilitated diverse other market areas in the successful conceptualisation, development (including consumer-led approaches and proto-typing) and exploitation of their products, services and systems. The application of its methodologies and perspectives to technological, business and social innovation has not received due attention within the AAL JP itself.

Therefore in the spirit of learning and changing to reflect the contexts in which innovation is taking place in the field of ambient assisted living, this session will provide participants with an opportunity to experience how to unlock their own creativity and those of their project teams. It demonstrates how with the right tools, innovation and AAL products and services can make the transition from poor uptake to exciting innovations that people really want.

Session D4 – Robotics

Robots have been fascinating objects for a long time. Often “humanoids” are the first things people might think of. However, recent research has also learnt that other types of in house rolling objects could play a significant role in supporting the older adult and his/her carer. Sometimes, surprisingly positive reactions have been recorded when testing them with older adults. Of course, many things first have to be improved before a robot will really become a companion. In this session the results of a large number of on-going European projects as well as the plans of just starting projects will be discussed.

Session D5 – Winners of the 4th Young Researchers' Workshop: Research on Innovative Solutions for Elderly

The young researchers` and PhD. Workshop - taking place in course of the AAL Forum 2012 for the fourth time - is a chance for junior researchers in the field of AAL to present and discuss their work interdisciplinary. The workshop will be assisted by experts from the area. This year again, we invited creative and dedicated young researchers from various disciplines (geriatrics, engineering, architecture, informatics, psychology, sociology, nursing sciences, economics, etc.) who investigate technical solutions for elderly.

During the full-day workshop ahead of the AAL Forum, the three best ideas will be selected. The reward for the winners will be the chance to present their work in front of a bigger audience during the AAL Forum. The workshop includes 4 different tracks such as "Virtual Reality and Telemedicine", "Social Computing", "Assistive Technologies for the Elderly" and "Communication Technologies " The topics will be introduced shortly by the chairing experts, followed by the three winners who get to present their work and ideas.

Session D6 - AAL's role in creating age-friendly environments

AGE Platform Europe has committed under the European Innovation Partnership on Active and Healthy Ageing (EIP-AHA) to set up and moderate an EU virtual forum on Age-friendly environments (AFE) to link stakeholders (public authorities, NGOs, service providers, industry, researchers) interested in the promotion of AFE at local, regional, national and EU level.

AGE and its partners call on the European Commission to launch an EU Covenant on Demographic Change that will seek to create the political framework to bring together local and regional authorities across the EU who want to find smart and innovative solutions to support active and healthy ageing and develop age-friendly environments. Creating an age-friendly EU by 2020 is the symbolic claim of a coalition of European organisations led by AGE for the European Year 2012.

In today's context of severe budget constraint, innovative and cost-efficient responses to demographic change are needed more than ever in order to deliver tangible results for citizens of all ages across the EU. This session will discuss the role of AAL technologies and design-for-all for the creation of age-friendly environments. It will seek to identify actions already taken and needed at all levels and in different areas to foster the autonomy, inclusion and active participation of all generations in society. It will be the opportunity to discuss plans of action and mobilize other actors to get engaged, aiming at a scale-up of existing solutions so that they do not remain isolated but they are linked with others. Attention will also be given to the role of user involvement in the creation of age-friendly environments.

TRACK D NOTES

SESSION D3: CREATIVITY WORKSHOP – DESIGN AND CREATIVITY DRIVING INNOVATION IN AAL

Bianca Silianoff, Ellen Baumm

Chair: Jackie Marshall Cyrus
Speaker: John Ceserani

Main message & key points

The workshop focused on integrating creativity, innovation, project management and leadership for high performance and sustainable new ways of working. The processes of creativity and innovation were introduced and practised by different tasks. The speaker introduced himself as an animal (giraffe) for example and invited the audience to do the same with their neighbours.

Creativity was defined as making connections to get ideas and innovation was defined as developing concepts from ideas that have potential for value. Further, innovation was defined as being about getting ideas, which do not have to be meaningful in the first state, but become serious after selection and developing solutions.

Most companies are using the operational cycle, which stands for routine, rules and enhancing safety. Yet, for innovation and creativity the innovation cycle is important. The innovation cycle is about experimenting, developing solutions, speculating and constructive reviewing. The importance of the working atmosphere was pronounced.

The process of an idea becoming an action was also introduced. The problem solving process was introduced by an example practised by the audience. People were supposed to think of an actual problem and share it in small groups. Using the creative strategy people were asked to solve the problem. The workshop was performed with an integrative character. People were asked to interact, to bring in ideas and to fulfil various tasks. The audience was interested and responded vividly.

Conclusions

Everybody has the potential to be creative. People have to let themselves have silly and non-sense thoughts and also allow themselves to play with these thoughts. The growth of thoughts was compared to the creation of a snowball. Imagination is important for achievement. Information and creativity need to be balanced to get solutions.

TRACK D PAPERS

ROBOT-ERA PROJECT: FROM THE END-USER'S PERSPECTIVE TO ROBOTICS. PRELIMINARY FINDINGS

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Abstract

The Robot-Era project is a 4-years Large Scale Integrated Project funded in the FP7-ICT-2011.5.4 (ICT for Ageing and Wellbeing), started January 1st, 2012. The objective of the project is to develop and implement the general feasibility, scientific/technical effectiveness and social/legal plausibility and acceptability by end-users of a plurality of complete advanced robotic services, integrated in intelligent environments, which will actively cooperate with older people in real conditions to provide favourable independent living. In particular, an indoor robot, a condominium robot and an outdoor robot will be developed, together with an AmI infrastructure, fully integrated in domestic and urban context. The aim of the paper is to present the methodology used for the first phase of work of the project, aimed at exploring the needs of the target to be matched with the technological requirements of the Robot-Era platform. Even if the studies in the field are rapidly growing, the definition of a detailed methodology to combine the collection of information on the older population characteristics/needs and the technological requirements to achieve is still lacking. The small dimension of the samples, the difficulty in comparing quantitative data already available in the literature and qualitative ones on the specific artefact to develop, the changing needs of the older population, the diffusion of the technology in the younger older people respect to the oldest ones, represent just some examples of the issues to be approached and solved by a solid methodological paradigm.

1. Introduction

Nowadays the society sustains elderly people to age well by means of medical cures, socio-medical services, and other social activities but these requests of support and assistance are expected to become so high that it is becoming also difficult to manage and sustain. The role of robotics has gained an essential importance for supporting the

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ageing-in-place, clearly preferred by the older population and the health care cost of the society.
The extent of involving the end-users since the conceptual stage clearly belongs to User-Centred Design philosophy that offers a complete background of methods and strategies to catch the target perspective and improve the design and the development of any technological artefact. Different stages of users involvement require different methods for capturing useful information for the development of assistive devices: usability tests, questionnaire surveys and tasks analysis were found as the most used tools for all the stages of a technology lifecycle (conceptual, design, testing and deployment stage) (Sarwar Shah & Robinson, 2006), while qualitative methods as focus groups were found as the most useful for a product concept evaluation (McQuerrie and McIntyre, 1986) and the interface design process (Nielsen, 1997). Finally, a crucial methodological role is played by the use of scenarios as a starting point for acting in design workshops, introducing critical and typical situations to be analyzed (Caroll et al., 1991), provoking new ideas (Bødker et al., 1993), and, at the same time, evaluating prototypes at the end of the development. The involvement of the end-users in the Robot-Era project allowed the opportunity of using different techniques among the most appropriate ones for each operational objective to address.
In particular, during the work of WP2 "User- and town- centred design of Robot-Era services", the preliminary feedback from the primary, secondary and tertiary end-users was collected, with the aim of refining the initial scenarios and services. Three phase can be identified, that can constituted the conceptual and the design stages of the lifecycle:

a) Needs analysis and initial scenarios refinement,
b) Services analysis and new scenarios development,
c) New scenarios evaluation and Usability/Acceptability requirements analysis.

2. Methods

First step: Needs analysis and initial scenarios refinement.
For refining elderly needs and scenarios proposed in the Robot-Era project, it has been decided to conduct focus groups in three sites: Italy, Germany and Sweden. Four focus groups were conducted in Italy, involving 32 elderly, while two focus groups were conducted in Germany, with 13 elderly and one in Sweden with 4 older people. The scenarios that were described inside the proposal and that needed to be refined were: carrying objects, monitoring the environment, supporting health management, enhancing relationships with relatives and friends, reminding tasks and events, reducing domestic risks of accident, surveillance, bringing objects, welcome to visitors, service communication to flat owner, assistance while walking outside, social local service information and maps, home shopping service, waste collection service, home postal service. The focus groups started from the presentation of the project objectives and then the researchers have shown some videos of similar assistive robots operating in indoor and outdoor environment, in order to give a concrete idea of the potential use of the robots. At the beginning, the opinion of the participants was requested for all the activities that can be supported by the platforms, divided into the

main needs domains: (1) personal care and household activities, (2) well-being and overall health, (3) freedom to go wherever desired, (4) participation in desired activities, (5) family relationships and emotional well-being. In addition to the opportunity of verifying the actual relevance of the offered support, also an introduction to the end-user perspective on the platform and their acceptance behaviour has been evaluated. For the analysis of the attitude towards the platform, the Assistive Technology Device Predisposition Assessment (ATDPA) form of the Matching Person and Technology (MPT) model was used, in particular the section D of the Consumer Form.

Second step: Services analysis and new scenarios development.
The aim of the second step of the analysis was to provide a first structure of services and functions that should be realised within the Robot-Era project. Thus, in order to shed light on the structure of services / functions to be realised, particular two kinds of investigations were carried out:

- a creative workshop with care institutions, professional care staff and inhabitants of a professional care facility in Germany, involving 6 seniors and 5 professionals;
- two focus groups with 12 stakeholders and 12 caregivers in Italy.

For the creative workshop activities, the methods Brainwriting, Simplified Scoring and Contextual Inquiry have been used to combine an evaluation of already existing ideas for robotic services with a creative part to find new solutions particularly important for care facilities.
The aim of the Italian focus group with carers was to analyze the functions and services of the platform to be implemented, in order to give adequate support to the care giving activity, while the involvement of the stakeholders allowed a better understanding of the Robot-Era platform opportunities, in terms of diffusion in the local/national areas and services. For this purpose, the same videos shown to the older people were presented to the carers and stakeholders, after the project presentation.The discussion was divided into different areas, such as (1) general impression on the robotics and on the Robot-Era platform; (2) ideal target of the platform; (3) technology acceptance and barriers to the use; (4) closing questions: suggestions and remarks.

Third step: New scenarios evaluation and Usability/Acceptability requirements.
After the scenarios and services refinement, it was decided to require for a re-evaluation of the Robot-Era concept from the end-users and then to proceed with the analysis of the first usability and acceptability requirements of the platform. In particular, new services and scenarios were presented to the participants: drug and shopping delivery, indoor escort at night, surveillance, laundry support, food delivery, cleaning, communication (video call) with friends, family, caregivers, service providers, reminding (of events or taking drugs), garbage collection, outdoor walking support, objects transportation and manipulation. The study on the design was focused on the analysis of the affordance, safety, aesthetics, emotional acceptance, usefulness and dependability of preliminary robotic components, used for generating reactions and opinions from the end-users and driving the initial development. It was decided to

conduct group interviews with older people, in Italy and Germany. In particular, four group interviews were conducted in Italy with 40 older people and two in Germany, involving 42 older people. A structured questionnaire was presented, composed of different sections:

- Section on General Information, containing single and multiple answers questions;
- Section A Scenarios, containing detailed questions on each scenario, evaluated on a Likert scale from 1- not agree at all to 5 – completely agree, to be answered after the presentation of videos.
- Section B Requirements, containing both single answer questions and questions to be evaluated on a Likert scale from 1- not agree at all to 5 – completely agree, to be answered after the presentation of photos of the robotic components.
- Section C Usability, containing multiple answer questions and questions to be evaluated on a Liker scale from 1- not agree at all to 5 – completely agree to be answered after the presentation of photos of sensors and interfaces.
- Section D Acceptance contains questions to be evaluated on a Liker scale from 1- not agree at all to 5 – completely agree.
- Section E Demand and cost information contains single and multiple answer questions as well as questions to be evaluated on a Likert scale from 1- not agree at all to 5 – completely agree.

3. Results

First step: Needs analysis and initial scenarios refinement.
The main aim was to enrich the initial functions with the suggestions coming directly from the older people on the basis of their needs, in order to start a technical reflection on how to improve the platform functionalities. In all the events of interaction with the older people, it was always reported that a new technology should be a medium for connecting and supporting the relationships within older people, family and carers, and not a substitute of their presence.

On the robots, the indoor one was found very interesting in Italy and Germany, for what concerns a) safety, covering activities as surveillance and emergency warnings; b) household works, slightly controversial for the Sweden participants that have underlined the need of more complex activities to be supported, such as defreezing the fridge; c) health management, for reminding medicine to take, bringing objects/pills if the user is sick in bed and sending message to the family in case of need. The outdoor robot was felt as important in enhancing the feeling of security while walking outside, most of all if it can alert the users of obstacles in the path. In addition to the outdoor mobility, the majority of the suggestions were upon physical requirements of the platform for supporting risky or heavy movements: the mechanical arm capacity has to be extensive for taking objects over the furniture and the robot should be able to move inside the home during the night.

The highest requested characteristic of the platform is the flexibility: the platform has to be adaptable to the changing needs of the older population, so the opportunity of having different modules to change or add would be taken into consideration, stressing the opportunity of reaching a high level of customization of the platform, directly in the context of use with the specific user. The opportunity of having fun with the robots was stressed by the younger elderly: reading a book, playing games or giving up-to-date information at local level are interesting for the older people, mostly if they have a higher level of education and they are engaged in leisure activities. The improvement of the quality of life, the prolonged independence at home, the feeling of security are all issues of attitude, strictly connected with the performance of the platform: the participants of each country showed an overall high predisposition towards the robots, excluding the older elderly group. Of course this topic needs further assessment, but it could be said that fear of being not able to use the robots or stigmatization are low barriers, even if having some skills with technological devices was reported as highly recommended for a good use of the platform, especially for the Italian participants.

Second step: Services analysis and new scenarios. Even though the predefined target group did not include care service providers, this group turned out to be also very important. Care services may be among the first adopters of robots and thus could influence the market acceptance positively. On the services/stakeholder side suggestions were mainly focused on secondary care tasks, which consume a lot of time or are physical demanding, but at the same time do not allow direct interaction with the elderly. Thus, care staff and management is interested in management of patient data, support of prevention and rehabilitation activities, automated waste management, surveillance and food supply. The robot could also support care staff by contacting and organizing appointments with physicians by video call and tele-anamnesis in case of accidents or dramatic change of vital data. In general this was one of the most important statements in relation with having time for more intensive personal contacts to patients. Even if more personal contact is desired, the robot should be able to support the internal social life by organizing social events between the patients, f.e. playing games together.

Third step: New scenarios evaluation and Usability/Acceptability requirements.
The data have confirmed the relevance of the new planned scenarios, providing a description of the activities to be implemented on the basis of the older people wishes and preferences and giving a first definition of technical requirements to be satisfied on the usability and acceptance issues. In general, it could be said that a high willingness to use the robot in case of need was detected, for transporting/manipulating objects at home (82%), for cleaning (80%), for garbage collection (75%), for surveillance (73%), for outdoor walking support, indoor escort at night and reminding events, tasks (72%), for laundry support (70%), for communicating with important persons (68%), for food delivery (67%) and for shopping/drug delivery (62%). The scenarios that received more attention from the participants were Indoor escort at night, Surveillance, Communication with relevant persons, Outdoor walking support and Reminding. Regarding the physical requirements of the different robots (domestic, outdoor/condominium), it could be said that the desirable robot should be similar to a person (as dimensions) and they have to

look like an electronic appliances. A technical look/appearance of the robots and a normal (human) body size seem to be more acceptable from a German perspective, while the Italian sample preferred a human appearance for the robots, in addition to human body size.
Interestingly, the results suggested that particular attention should be given to the impact on the home environment for the indoor robot, taking into account the small dimensions of the older people apartment, especially in the Mediterranean area. Finally, all the presented sensors were considered appropriate and not too intrusive.
Regarding the interfaces, the participants reported to clearly prefer a menu with a bigger size of the images and icons and easy to understand, meaning not grouping the functionalities into a restrict number of domains that can be difficult to get. Also, they have preferred the speech command/vocal reply for interacting with the robots that should have a female voice. On the acceptance dimensions, the perceived adaptability, the positive attitude towards the platform, the perceived ease of use and enjoyment have received more attention from the participants. The only scale that has received a lower score was anxiety, meaning that the participants have perceived as not intimidating the proposed technology. Finally, among the factors that can mostly influence the decision of purchasing a robot, the cost resulted not so important if compared to the state of the own health and the ease of use of the platform, even if the opportunity of being economically supported by the insurance scheme/welfare system provision can play an important role in the purchase.

4. Discussion

The results that have been reported represent just some of the issues discussed with the technical partners that constituted the core of matching the technical ideas with the needs of the users, with the aim of developing a technological solution with a high agreement from the potential users, in terms of acceptance, relevance, and easiness to use. Of course, the combined analysis of user profile, technology acceptance antecedents and technical requirements will support a fruitful exploitation of the Robot-Era platform in devoted market segments, to be individualized during the next phases of the project.

On the methodological side, the collection of useful information was allowed not in the creation of scenarios per sè, but in their constantly evaluation and refinement: one of the most recurrent bias using the scenarios is that they are often represented by stories the rarely cover the entire user interface and tasks to support and, moreover, their concreteness can represent a hindrance for the design of novel technology, characterised by high flexibility and open-ended tasks. For this reasons, more mature scenarios, enriched with user interface elements, for example, should be re-presented after the first feedback from the users, for a more detailed evaluation. Another crucial point to be addressed is to understand when the users needs analysis should be stopped, most of all during the development of a novel technology (Lingaard et al., 2005). In this case, the use of creative techniques and focus groups for the services refinement have strongly supported the generation of new ideas, on one side, and the undiscovering of met and unmet needs, on the other one. After the testing in realistic condition foreseen for the next phase of the project, a re-evaluation of the acceptability and usability requirements of the platform will be conducted, assuring an additional adjustment in line with the user profile, before testing the Robot-Era platform in real condition of use.

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DESIGN, DEVELOPMENT AND EXPERIMENTATION OF ASTRO ROBOT COMPANION FOR AGEING WELL AND AMBIENT ASSISTED LIVING APPLICATIONS

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Abstract

This paper focuses on the design, development and experimentation of a robotic assistive platform integrated in smart environments, able to provide basic services of daily life. The design and implementation of ASTRO robot was sustained by a multidisciplinary team in which technology developers, designers and end-user representatives collaborated using a user-centred design approach. The key point of this work is to demonstrate the general feasibility and scientific/technical effectiveness of a mobile robotic platform integrated in a smart environment and conceived to provide useful services to humans and in particular to elderly people in domestic environments.

1. Introduction

European population projections have recently underlined that the number of over-65 elderly people in the world will quickly increase in the coming years. Nowadays the society sustains elderly people to age well by means of medical cures, socio-medical services, and other social activities but these requests of support and assistance are so high that it is becoming difficult to manage and sustain.

The idea of using robotic systems for assisting and monitoring people has been strongly supported and shared by many research groups. Most of them have investigated the figure of robot for human assistance and studied all aspects related to the service provision, communication and safety interaction. Some examples of these projects are MOBISERV[3], a project conceived to enhance the independent living of elderly people and provide health care assistance and support in their daily social

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[3] The MOBISERV Project (An Integrated Intelligent Home Environment for the Provision of Health, Nutrition and Mobility Services to the Elderly) - http://www.mobiserv.eu/index.php?lang=en

activities, KSERA[4], a project oriented to develop a domestic robot able to follow patients through the house, SRS[5], a project focused on the development of a semi-autonomous robotic platform, FLORENCE[6], a project conceived to improve the well-being of elderly people as well as improve the efficiency in care through Ambient Assisted Living (AAL) services and COMPANIONABLE[7], a project focused on the integration of companion robots into smart home environments for care support to older persons (with Mild Cognitive Impairment) living alone at home and to their care-givers.

In this context, the this work was conceived to design, implement and test a system (the ASTROMOBILE System), composed of the ASTRO Robot and a Wireless Sensor Network with environmental and wearable sensors, that was able to significantly enhance the quality and the acceptability of current robotic services to a new level of service and performance by:

- designing the ASTRO's appearance and functionalities by means of a substantial analysis of users' requirements and attitude to robotic technology to improve acceptability and usability;
- improving the ASTRO's behaviour by means of a smart sensor network able to share information with the robot (Ubiquitous Robotics);
- developing an advanced human robot interface based on natural language and able to enhance the usability and interaction of elderly users with the ASTRO robot

2. Methods

The robot ASTRO was built in three phases by an (inter/multi)disciplinary team, based on technology developers, elderly care organizations and designers: (1) the initial end-user requirements' analysis to address criteria of acceptability and usability from the beginning of the design, (2) the physical and software architectural integration of the entire ASTROMOBILE system and (3) the final experimental evaluation in the Peccioli living laboratory with elderly people.

At the beginning of the Experiment, the ASTRO appearance and functionalities were studied and designed with the User Centred Design approach and involving engineers, an expert designer and a group of eleven elderly volunteers in order to identify a concept responding to usability and acceptability criteria. A well structured program of interviews, focus groups and workshops were organized to point out end-users' needs, considering life styles, habits, needs, quality of life, pathologies, cognitive and/or

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[4] The KSERA Project (Knowledgeable SErvice Robots for Aging) - http://ksera.ieis.tue.nl/

[5] The SRS Project(Shadow Robotic System for Independent Living) - http://srs-project.eu/

[6] The Florence Project (Multi Purpose Mobile Robot for Ambient Assisted Living) - http://www.florence-project.eu

[7] The CompanionAble Project (Integrated Cognitive Assistive &Domotic Companion Robotic Systems for Ability & Security) - http://www.companionable.net/

motor deficits, and the robot's appearance, considering the properties of affordance, safety, aesthetics, friendliness and usefulness. Based on these findings, the ASTRO robot was conceived with a well defined appearance (figure 1) and with appropriate functional capabilities (Table 1).

Figure 1. ASTRO Robot concept sketch and final version

Table 1. Main functionalities of ASTRO Robot and experimental scenarios

	Experimental Scenarios
User needs ASTRO to carry out some daily activities	1. User calls ASTRO because he/she needs a physical help to stand up from the sofa or the bed.
	2. User calls ASTRO because he/she needs one of objects set on the ASTRO's pocket (water, TV remote controller, etc.).
	3. User calls ASTRO to call a friend or a caregiver if he/she feels bad (Skype from bed);
	4. User calls ASTRO because he/she needs to access to entertainment tools (music, pictures, videos, internet, etc.);
ASTRO autonomously helps user in appropriate situations	5. ASTRO moves to user for reminding him/her to take drugs or appointments;
	6. ASTRO moves to user because there is a critical alert in the house (i.e. the door is open, the user feels bad, falls, etc.);

Caregiver remotely uses ASTRO to assist the user	7. Caregiver is outside the home and contact remotely ASTRO asking it to move to the user and activate audio and webcam to assess and support the user (Tele-operated mode).

The development of ASTRO was conceived to be integrated in an Ambient Intelligent infrastructure based on a wireless sensor network, able to monitor and localize the end-user, the robot and objects. ASTRO was equipped with multimodal interfaces, (speech recognition, vocal synthesis, touch screen with simplified graphical interface, coloured LEDs and smart phone) developed to simplify and make natural and intuitive the interaction with end-users. The system framework was implemented with modular components, in communication through the D-Bus system. The modularity of the D-Bus allowed implementing seven modules as showed in Figure 2.

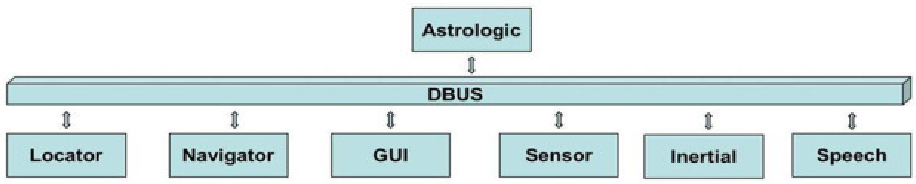

Figure 2. The modules on the D-Bus that composed the ASTROMOBILE system

Thanks to this shared information between the ASTRO Robot and the Wireless Sensor Networks and the effectiveness of the ASTROMOBILE system, that was able to exploit sensing, acting and interacting abilities with respectively the wireless sensor networks, the robot and the advanced user-robot interfaces, the capabilities of the entire system to provide high quality services to elderly users were particularly improved.

For example the ZigBee Localization Network was used to improve the indoor localization capabilities by measuring the RSSI signal between the mobile nodes, i.e. the robot and the end-user, and the anchor nodes in the environment and estimating their respective positions; this allowed a sort of awareness, thanks to which the robot was aware of the position of the end-user to reach in the workspace, improving the quality of services.

3. Results

During the evaluation phase, 16 elderly people 65+ (including the 11 elderly of the design phase) were involved to use ASTRO in the previous described scenario, realistically arranged in the Peccioli living lab (Figure 3), and were asked to complete a questionnaire with multiple-choice and open questions. Results of this investigation highlighted that:

- elderly had a positive view about all the functions in terms of usability;
- elderly felt the robot easy to use and were satisfied about how the tasks were performed;
- most of seniors considered ASTRO aesthetically cute, friendly and safe;
- 75% of them thought that this kind of assistance could be integrated into their lifestyle and, at the questions “Would you like to buy this robot for assistance?”, only two persons excluded this possibility.

On the whole, senior volunteers opinions about ASTROMOBILE system was positive because the system worked well during the scenarios and the interaction between robot and user was enough easy. In addition elderly subjects suggested also some improvements for making the ASTROMOBILE system better. Finally, elderly participants were satisfied with ASTROMOBILE and considered it acceptable as far as most of them thought that in case of necessity in their daily life, they would buy or rent ASTROMOBILE system

Figure 3. Experimental sessions in the Peccioli Living Lab with elderly

4. Discussion/conclusions

In conclusion this work demonstrated that robotic technology for AAL applications is nowadays promising and feasible. The real and concrete involvement of elderly with a user-centred design approach allowed facing developmental aspects that made ASTRO very near to a pre-market solution. Elderly were trained to use ASTRO and this gave the possibility to better understand how to implement facilitated interfaces and to spread the culture of considering the companion robot similar to a household appliance. ASTRO was developed with an interoperable integration of mature technological and standardized solutions already available on the market, such as the mobile robotic platform (Metralabs, Germany), Wireless Sensor Network (ST Microelettronics, Italy), Software Interface (Simon Listens, Austria), robot and environment OS (Win7 and Ubuntu) and other minor components.

ROBOTIC UBIQUITOUS COGNITIVE NETWORK

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Abstract

Robotic ecologies are becoming increasingly popular, due to their potentials of building networks of heterogeneous robotic devices pervasively embedded in everyday environments. These features are particularly appreciated in Ambient Assisted Living, where acting capabilities of robotic ecologies are used to achieve independent living of their users. One main issue in robotic ecologies is how to make them self-adaptive, in order to reduce the complexity of their pre-programming, installation and configuration, which still require a deeply involved human intervention. The EU FP7 project RUBICON develops self-sustaining learning solutions, with the objective of creating cheaper, adaptive and efficient coordination of robotic ecologies. This paper introduces the objectives of RUBICON and presents its approach and methodology.

1. Introduction

Robotic ecologies are networks of heterogeneous robotic devices pervasively embedded in everyday environments, where they cooperate to perform complex tasks such as helping elderly users to live independently in their homes as part of Ambient Assisted Living (AAL) solutions. In AAL applications, the devices of a robotic ecology may vary from embedded sensors and actuators to larger robots capable of sophisticated interaction with the user. Building intelligent environments out of multiple robotic devices extends the scope of the applications that can be built, reduces their complexity, and enhances the individual values of the devices involved by enabling new services that cannot be performed by any device by itself. Consider for instance the case of an automatic vacuum cleaner that avoids cleaning when any of the inhabitants are at home, based on the input from sensors used by the home alarm system. While their potential makes robotic ecologies increasingly popular, one fundamental problem is how to make them self-adaptive, so as to reduce the amount of preparation, pre-programming and human supervision that they require in real world applications. Current robotic ecologies solutions strictly rely on models of the

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environment and of its associated dynamics. In particular, in AAL applications they require pre-defined models of both the activities of the user they try to assist and the services that should be carried out to assist them. Crucially, they lack the ability to proactively adapt to evolving situations and to subtle changes in the user's habits and preferences. As a result, these limitations make such systems difficult to deploy in real world applications, as they must be tailored to the specific environments, hardware configurations, applications and users, and constantly be updated to suit changes in both the environments and in the applications where they are deployed. As such, they can soon become unmanageably complex and expensive. The EU FP7 project RUBICON (Robotic UBIquitous COgnitive Network) builds on existing solutions to develop the concept of self-sustaining learning for robotic ecologies. Specifically, RUBICON investigates how all the participants in a robotic ecology can cooperate in using their past experience to improve their performance, by autonomously and proactively adjusting their behaviour and perception capabilities in response to a changing environment and user's needs.

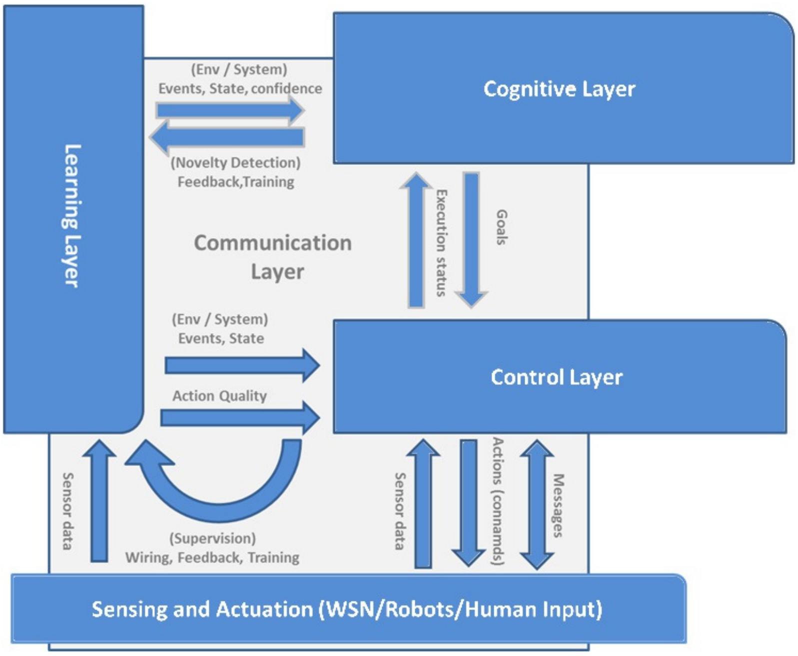

Figure 1. An overview of the RUBICON architecture

RUBICON will deliver learning solutions yielding cheaper, more adaptive and more efficient configuration and coordination of robotic ecologies, supporting open, dynamic, heterogeneous and computationally-constrained systems, as well as a wide range of services and end user applications. Its approach builds upon a unique combination of methods from cognitive robotics, agent control systems, wireless sensor networks and machine learning.

2. The RUBICON Approach

RUBICON comprises three main layers, namely Learning, Cognitive and Control layer, that are built over the Communication layer. The latter layer provides support to general purpose, unicast communications between robots, sensors, actuators and host PCs, and it provides the abstraction of synaptic channels that are used to build neural networks distributed over all components of the RUBICON ecology. This layer is built over the PEIS middleware [8] to exploit the features of self-configuration and high-level collaboration in robotic ecologies through subscription based connections and a tuplespace communication abstraction. An overview of its architecture is shown in Figure 1. With this architecture, RUBICON develops goal-oriented robotic ecologies with a tightly coupled, self-sustaining learning interaction among all of their participants. An example of RUBICON ecology is shown in Figure 2, where each participant to the ecology contributes to collaborative learning with the other participants by interacting through remote synapses, which mimic synapses linking neurons in biological nervous systems. In the following sections we illustrate the main design principles of the three main layers of RUBICON: Learning, Control, and Cognitive.

Learning Layer – The role of the Learning Layer (LL) is to:

- recognize and detect relevant sensed information by providing predictions which depend on the temporal history of the input signals (e.g. to predict user's future location, or the probability of success of performing an action in a given situation);
- analyze and process sensed information to extract refined goal-significant information (e.g. information fusion and event recognition);
- efficiently propagate and deliver such information to the control and cognitive layers in order to support single-node or multi-node (cooperative) control strategies and high-level reasoning implemented in the control and cognitive layers;

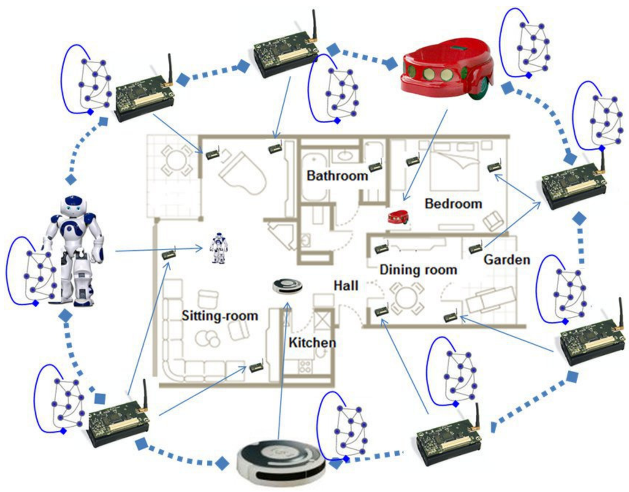

Figure 2. A RUBICON Robotic Ecology

To achieve these capabilities, the LL builds a Learning Network (LN) overlaid on top of the robotic ecology. The LN is a flexible environmental memory that serves as a task driven model of the environment and that can readily be shared by new nodes connecting to RUBICON. This allows a straightforward sharing of the learned experience. The memory formation process in the LN is driven by the task-specific supervised learning based on feedback information provided by the high-level reasoning implemented by the Control and Cognitive Layer. The design of the LN makes use of Recurrent Neural Networks (RNN), and specifically of Reservoir Computing (RC) models [1], due to their modular, networked structure which naturally adapts to the distributed nature of the RUBICON ecology. The RC models offer an interesting trade-off between computational efficiency and the ability to deal with dynamic systems and noisy sensed data. RC uses a network of randomly interconnected neurons, the reservoir, that serves to capture the dynamics of the input signals and whose parameters are not impacted by the learning process (hence the computational advantage and their suitability to computationally constrained environments). Each node of the LN thus hosts a RC network composed by a variable number of artificial neurons. In turn, the neurons are connected by remote synapses (implemented by means of communication channels) with neurons residing on other nodes, thus creating a distributed, artificial recurrent neural network. With this approach, each neuron in the local learning model may be considered as a node of a distributed reservoir; the instantaneous state of such reservoir thus incorporates the combined knowledge attained by each sensor node, while reflecting the dynamics of the overall RUBICON. Preliminary studies of RC used in combination with sensors for localization applications aimed at forecasting users movements can be found in [2].

Control Layer – The nodes participating in a RUBICON system need to perform several steps in a coordinated and goal oriented fashion to achieve necessary and meaningful tasks. A robotic ecology is capable of using alternative means to

accomplish its goals when multiple courses of actions/configurations are available. For instance, a robot may decide to localize itself with its on-board sensors, or to use more accurate location information from an environmental camera. However, while having multiple options is a potential source of robustness and efficiency, the combinatorial growth of possible execution traces makes difficult to scale to complex ecologies. Adapting within tractable time frames to dynamically changing goals and environmental conditions is rendered even more challenging when these conditions fall outside those envisioned by the systems designer.
The Control Layer (CL) is designed to tackle these issues by:

- providing introspection capabilities, in order to describe the capabilities of each component in the robotic ecology and to judge if a node is able to achieve a given goal;
- formulating, executing and monitoring both action and configuration plans to satisfy the system-wide goals and the necessary collaborations set for each node;
- adapting plans building and selection strategies to the computational and physical environment, by exploiting the underlying learning support to estimate the benefit and costs associated to each plan.

To these ends, the CL is framed as a multi-agent system where each node in the ecology is controlled by an autonomous agent with timeline-based planning [3], and plan monitoring and execution capabilities [4]. Timeline-based planners lend themselves to bridging the gap between task planning and execution monitoring by retaining rich temporal information and leveraging constraint-based reasoning algorithms to propagate temporal, resource and causal relations. The domain description used by the planner contains a high-level specification of the behavior of the environment and the capabilities of each component in the system. Specifically, the domain is a collection of crisp rules, called synchronizations, each establishing flexible temporal relations between actuation (e.g. plans that provide contextualized assistance to the user) and sensor readings. Also, the CL leverages temporal reasoning capabilities to infer non-trivial contextual information from sensor readings, which, in turn, is used to refine the contextualized plans.

Cognitive Layer – While the LN provides learning functionalities to fuse and enhance existing perception abilities and to predict and classify events and human activities, each of these learning tasks must be precisely pre-defined, in terms of the data sources to be provided in input to each learning module as well as the training examples needed for training their outputs. For instance, performing activity recognition tasks requires an accurate predefined activity model encoding dependencies that a human expert has identified between sensed data, as well as ground truth information collected during recorded training sessions.

Furthermore, while the CL can synthesize and coordinate the execution of strategies to achieve goals set for the RUBICON ecology, the only way to autonomously generate these goals would be to add further synchronizations to link activity recognition to service rules. For instance, the human designer may describe how the RUBICON ecology should fetch a drink every time the user is resting on the sofa after work, or that the blinds should be closed in a sunny day after the user has been observed watering a plant.

The Cognitive Layer (COG) is essential to close and animate the loop in the RUBICON architecture by orchestrating the LL and the CL to drive the self-sustaining capabilities of the RUBICON ecology without strictly relying on human originated models. Specifically, the COG addresses these issues by:

- building up of knowledge and understanding of the RUBICON ecology based on reasoning over the events learnt by the LL;
- actively maximizing the opportunities to gather further knowledge on the environment and on the user;
- implementing a novelty detection process, whereby events of particular interest and unknown event patterns are identified and utilized as motivational drivers for setting goals for the CL.

To these ends, the COG is built over Self-Organizing Fuzzy Neural Network (SOFNN) [5][6] - hybrid systems where fuzzy techniques are used to create or enhance neural networks and that can be used to learn membership functions and create fuzzy rules that may be easily interpreted. Our aim is to create SOFNNs that reflect the knowledge obtained by the RUBICON ecology and autonomously map it to goals to be achieved by the CL in order to satisfy generic application requirements (e.g. user's safety) while also driving active exploration to gather new knowledge.
The particular appeal of SOFFN is their ability for structural growth through the addition and the pruning of neurons. By linking such a structural adaptation to novelty detection and habituation mechanisms [7], the RUBICON's consortium creates a self-sustaining learning architecture that builds over hand-coded neural fuzzy rules, and that is able to leverage past experiences to autonomously adapt these rules to the particular context where the RUBICON ecology is installed.

Figure 3. Plan and pictures from the HomeLab, TECNALIA, Zamudio - Bizkaia (Spain).

***RUBICON Test-Bed* –** While RUBICON seeks to create integrated and application-agnostic capabilities for self-sustaining, learning robotic ecologies, it is vital to review their performance and assess their potential when applied to the real world. To this end, RUBICON uses the Tecnalia's HomeLab (shown in Fig. 3) - a smart home laboratory designed to act as a test facility to understand the habits and behaviors of individuals in order to assist them in their daily living and also alert relevant stakeholders of potentially dangerous or anomalous behaviour and/or situations. The facility is a fully functional apartment of over 40 square meters equipped with automated doors and blinds, and also with gas/water/smoke/movement detectors, contact sensors to detect the opening and closing of windows, doors and drawers, and pressure sensor pads in beds and chairs. It also includes microphones and existing sound analysis components used to detect and classify sounds (door bells, doors opening/closing, phones...) based on deterministic and probabilistic techniques. In addition, the test-bed is being extended with mobile robots and with wireless sensor networks (WSN) nodes, each comprising a computational unit with radio and sensors.

3. Conclusions

This paper illustrates the concept of self-sustaining, learning robotic ecologies that builds over learning, control and cognitive techniques. While the techniques illustrated in this paper have been tested in isolation, we believe that their integration along the lines discussed in this paper promises to solve many of the problems that still obstruct the implementation and diffusion of smart robotic environments outside research laboratories. Ongoing work within the RUBICON project is to refine and implement RUBICON's high-level architecture and exercise it in realistic settings.

Acknowledgments

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COGNITIVE-CARE ROBOT FOR ELDERLY ASSISTANCE: PRELIMINARY RESULTS OF TESTS WITH USERS IN THEIR HOMES

Gábor Fazekas[1], András Tóth[2], Pierre Rumeau[3], Katalin Zsiga[4], Tamás Pilissy[5], Vincent Dupourque[6]

Summary

This paper presents the preliminary results of the field tests with a home-care robot providing cognitive help to the elderly living alone in their own home. Subjects received the robot for a three-month-long period. Usage frequency of certain functions and satisfaction of the users were evaluated. Information inquiry services and entertainment functions were most frequently used. Hungarian speech recognition and navigation of the robot have to be improved so as to make these functions working more reliably.

1. Introduction

Growing number of old lonesome people require the development of assistive technologies to help them to live longer and safer in their own home. The DOMEO-project of the Ambient Assisted Living Joint Programme of the European Union and its member states aims to develop and to test in real milieu a companion robot, named Kompaï, that gives cognitive help to the elderly. Kompaï is in full compliance with the forthcoming standard ISO DIS 13482 Robots and robotic devices - Safety requirements for non-industrial robots - Non-medical personal care robot. Functions provided by the robot are: emergency help button, navigation in the apartment including obstacle detection and avoidance, automatic docking to its charger, carrying small objects, speech recognition and synthesis, emergency signal, video or audio-call via Skype, weather forecast, entertainment (web-browser, games), agenda, managing a shopping list, possibility of full remote controlling for the caregiver, monitoring blood pressure and body weight. Users can communicate with the robot by voice commands or by using the touch screen and the simplified graphical user interface of the robot.

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Figure 1. Elderly user communicating with the Kompaï robot

2. Methods

Ethics approvals to field tests were obtained from the relevant Hungarian authorities. Since the Kompaï robot was classified as a non-medical assistive device, ethics approval procedure has excluded the track with medical devices that are always used in medical context.

Field tests of the robot are on-going under real conditions since September of 2011. Users' recruitment campaign included several robot demonstrations to selected audience in the National Institute of Medical Rehabilitation and in two elderly care centres of Budapest. Inclusion criteria were established towards the users and also their homes. As for the users, they were older than 70, lived alone, were able to move indoors without assistance and to communicate with the robot by voice and touch. Their homes also met some requirements to ensure safe and obstacle-free movement of the robot. Therefore the apartments were single storied, with open doors and enough space for moving. Loose cables and rugs as well as high doorsteps were handled properly during robot installation.

Robots are deployed at users' homes for circa a three-month-long period. This presentation summarizes the experiences of the field tests of the first 4 users (3 women, 1 man; mean age 81.25 years). Two of them had never used a computer. Testing period with the first user was longer because of initial technical difficulties with the robot. In comparison, the robot worked so reliably at the third user that he wanted to negotiate an extension of the test. The other two users did not appreciate so much the functionalities of the robot, so they used it only for 67 and 69 days, respectively. The two robots were at users' homes altogether for 365 days, but data was only collected during just 287 days (due to technical problems with the data logging capabilities and other maintenance/update operations).

Despite the differences between the duration of the field tests, the numbers of use sessions were very similar (between 124 and 140).

3. Results

The most often selected Kompaï services were: agenda, entertainment functions (primarily web browsing) and information inquiry services (time and date, weather forecast) but the movement of the robot and e-mail services were also popular for some users (**Fout! Verwijzingsbron niet gevonden.**). The least used services were shopping list and e-mail, although the latter was used quite regularly by the second subject (more than six times per day on average). The weather forecast, the web browser, the agenda and the remote control functions proved to be working most reliably. Since most of the technical problems occurred with the navigation and the speech recognition, control by voice and related functions as well as navigation in apartment proved to be the least reliable. The emergency alarm service was not evoked during the testing period but worked always perfectly during demonstration in the user's training period.

Table 1. Usage statistics of the four participants

	Participants				
	1	2	3	4	Avg.
Date and time (per day)	1.79	1.91	0.57	6.57	2.71
Weather (per day)	2.29	1.48	1.68	8.16	3.40
Agenda (per day)	0.83	2.57	3.18	5.88	3.11
Shopping list (per day)	1.12	0.40	0.21	1.31	0.76
Email (per day)	0.57	6.33	0.90	1.02	2.20
Skype (per day)	NA	0.84	1.73	0.33	0.97
Entertainment (per day)	2.14	3.36	2.55	4.76	3.20
Navigation (per day)	0.36	2.42	3.43	0.35	1.64
Number of days used	*58*	*67*	*111*	*51*	*71.75*
Number of sessions	*124*	*131*	*134*	*140*	*132.25*

Each user turned to the robot with some fear at the beginning, but during the usage the acceptance of the device increased greatly. It should be mentioned that one of our users who had never used a computer earlier, asked his son to buy at least a computer for him after the termination of his test period.

Based on the subjective evaluation it can be claimed that users considered navigation of the robot, email and Skype as most useful services, while shopping list, remote control and carrying of small objects as least useful ones.

Touch screen was used by the first user more frequently than by others which can be explained by the weaknesses of the speech recognition engine at that time. Usage behaviour of the second and third users was more balanced since they used both the touch screen and the speech recognition almost equally. In contrast, the fourth subject preferred unambiguously the speech recognition.

4. Conclusions

Cognitive-care assistive robots can provide services for the elderly in several ways. Certain functions of the tested robot, like speech recognition, self-localization of the robot must be improved upon according to the experiences of the field tests. The authors expect after overcoming the present weaknesses, such robots can become a useful companion of the target users. By the end of the field test period 10 users will be completing their trials giving us the chance for a much broader insight into cognitive-care robot use in home.

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ACCOMPANY - ACCEPTABLE ROBOTICS COMPANIONS FOR AGEING YEARS

Gert Jan Gelderblom[1], Ben Kröse[2]

Abstract

We describe the context, the objectives and the structure of the FP7 project ACCOMPANY that started October 2012. The project focuses on a robot companion that monitors the elder user in a home environment and assist with household chores. We report on the work that is carried out on the requirements analysis and on the sensory systems involved.

1. Context

A major challenge concerning the development of service robots for the elderly is to enhance existing state of the art technologies and interfaces in order to facilitate independent living at home. In October 2011 the ACCOMPANY has started under FP7 objective (ICT-2011.5.4) ICT for Ageing and Wellbeing. The ACCOMPANY system will represent a novel technological solution to facilitate independent living at home for elderly users. The state of the art service robot platform, Care-O-bot® 3 serves as a basis os a system that will provide services to elderly users in a motivating and socially acceptable manner, to facilitate independent living.

The ACCOMPANY consortium is coordinated by the The University of Hertfordshire, United Kingdom and has the following partners: HogeschoolZuyd, The Netherlands; Fraunhofer, Germany; University of Amsterdam, The Netherlands; University of Siena, Italy; Maintien en Autonomie à Domicile des Personnes Agées, France and University of Birmingham, United Kingdom.

2. Objectives

The ACCOMPANY project & system will

- Develop a companion robot as part of an intelligent home environment which will assist elderly people to maintain their independence within their home environment
- Assess user requirements and user acceptance of the robot

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- Provide physical, cognitive and social assistance in everyday home tasks, and contribute to the re-ablement of the user
- Deliver services to the user through socially interactive, acceptable and empathic interaction
- Establish a co-learner relationship, where robot and user provide mutual assistance

3. Project

The project multidisciplinary research activities include issues such as acceptability, safety, reliability, efficiency, robustness, usability and ethical considerations.
The state of the art service robot platform will be integrated with the ambient intelligence in the domestic environment by combining sensor data and by building a cognitive architecture for integration.

Figure 1. The Care-O-bot doing a fetch and carry task

The use of three test sites in three different European countries (UK, the Netherlands and France) will ensure an extensive testing and evaluation process while addressing cultural differences in both elderly care and the attitudes of users towards the use of service robots in eldercare.

4. Foreseen outcomes

The ACCOMPANY project has identified an important 'niche' in the eldercare market, where we believe socially intelligent service robots and ambient sensor systems can make a difference and will be beneficial to users & healthcare providers as well as industry.

New knowledge will be created in terms of user requirements and scenarios suitable for using services robots in elderly, and substantial technological advancements will result in intensive scientific dissemination.

The target project outcomes will help to realize our underlying vision, that service robots in the context of an intelligent home environment, if firmly integrated in a user-centred and application-oriented agenda, has its place in the care of elderly and other user groups, by being able to increase their independence, sense of being in control of their daily lives, and quality of life.

5. Progress in user requirements and scenarios

The specification of the aims of the study is taken up in the project through the involvement of representatives of the target group. This concerns primary users; elderly users seeking to maintain their independence at home, and secondary users; their informal care givers and formal care givers. Through regular group meetings in three countries (UK, Netherlands and France) needs assessment is detailed, after conversion of the needs in system functionality system design is iteratively evaluated by the groups. As a vehicle for this development scenarios are developed explaining the user needs the system want to to address and the way in which the support is provided by the system to answer these needs.

The needs assessment initiated by a literature review and detailed by focus group discussion resulted in a preferred set of activities for which support by a robot system is regarded as most useful. These activities are ADL activities supporting Selfcare (nutrition and personal hygiene), Mobility (in and around the home, including transfers) and Social inclusion (preventing social isolation). Out of these activities a first basic “getting me something to drink” scenario was developed to elaborate on the various objectives in which the project seeks advancement.

6. Sensory systems

User’s activities can be detected by the sensors on the robot, and by analysing the activation and deactivation of sensors in the Robot House.

Sensors on robot. The Care-O-bot is equipped with three laser range finders, a pair of stereo cameras and a depth sensor. To improve the current approach for object detection on the Care-O-bot platform, which solely bases on stereo vision, we aspire to develop a new data fusion system that incorporates the data of the depth sensor as well. The objective is to combine both modalities to create highly accurate 3-D point clouds with associated color information and to mitigate the deficiencies and measurement errors of each single sensor.
The data of the laser and depth sensor on the robot are also fused with the data from the overhead cameras (as described below) to give a more robust estimate of the locations and poses of the users.

Sensors in home. The University of Hertfordshire (UH) Robot House will be used as a test environment where participants will be invited to perform various activities related to carrying out household chores. This will facilitate collection of environmental data which will then be used to aid the development of the activity monitoring system being developed for this work package.

Two different types of commercially available sensor systems, GEO System and ZigBee Sensor Network, are currently installed in the Robot House. The initial setup provides more than 50 sensors embedded in the Dining Area, Living Room, Kitchen, Bedroom and Bathroom of the Robot House to support detection of user's activities relevant to household chores. GEO System is a real-time electrical device energy monitoring system. It is used in the Robot House to detect the activation and de-activation of electrical appliances by the user, such as opening the refrigerator, boiling water in the kettle, detecting the doorbell in the case of visitors at the door etc. The ZigBee Sensor Network is a standards-based (Xbee GatewayX4) low-power wireless sensor system. It is used in the Robot House to detect users' activities that cannot be detected by the GEO System, such as opening and closing of drawers and doors, occupied chairs and sofa seat-places, open water taps in the kitchen sink and bathroom etc. The three main sensors type currently installed are Reed Contact Sensors, Pressure Mat Sensors and Temperature Sensors. Figure 2 gives an overview of the most important sensor locations. Apart from the simple sensors we also mount a number of overhead fish-eye lens cameras to estimate the activities of the users. A model-based probabilistic framework is used to infer the positions and poses of the users.

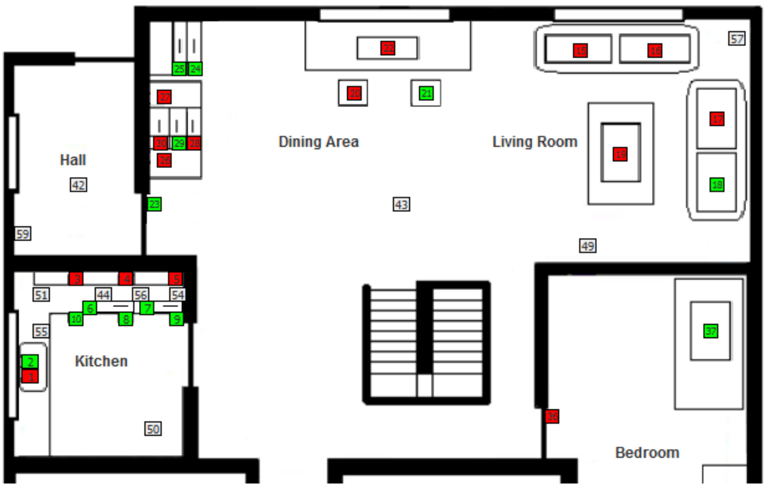

Figure 2. Overview of most important sensor locations

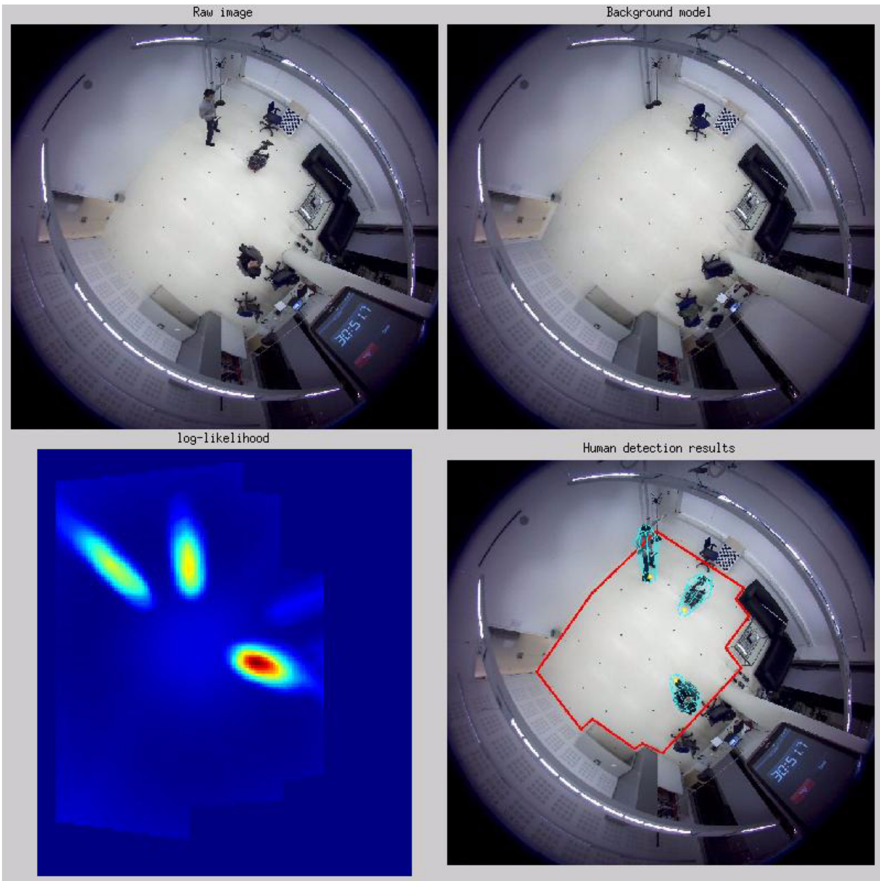

Figure 3. Inferring the position of the users and the robot from camera images.

7. User studies

By the end of each project year a prototype of the developed functionalities will become available for evaluation. After establishment of basic system functioning and safety, both general subjects and representatives of the target group will be involved in formative evaluations. These evaluations will test the realised functionality to be able to assess the suitability for the intended support in terms of usability, ethical aspects and the more detailed objectives of the projects regarding physical support, co-learning and reablement and empathic interaction. Initially in the first prototype the actually integrated system functionality will be limited and this will increase in the sub sequential prototypes.

MOBISERV – A NEW KIND OF COACH IN THE JOURNEY TO INDEPENDENT LIVING – HEALTH, NUTRITION AND WELL-BEING SERVICES TO OLDER ADULTS

H. v.d. Heuvel[1], C. Huijnen[1], P. Caleb-Solly[2], D. Ellender[2]

1. Purpose

The goal of the MOBISERV project [1] is to support independent living by means of a personal and proactive companion robot integrated with smart garments and a smart home environment in order to improve quality of life for an older person and take away several burdens from his or her informal carer. MOBISERV monitors your physical activity and health indicators through wearable smart fabrics, monitors your nutrition habits by smart home sensors, and offers a secure portal for informal carers to setup, fine-tune and use the system. The system and services provides older adults with: 1) general and social suggestions and reminders; 2) nutrition assistance and dehydration prevention by eating and drinking encouragements; 3) a personal health coach encouraging physical activity and exercises; 4) games for cognitive stimulation; 5) video communication to friends, family and a call centre; and 6) fall detection and follow-up.

2. Methods

The design of the developed concepts, system and services is based on an in-depth user requirements phase, including a mixed methods approach combining literature reviews, observations, interviews, focus groups, questionnaires, cultural probe studies and workshops with potential end-users (*N* = 121) and formal and informal carers (*N* = 102). This research has been performed in the UK and The Netherlands, and based on the results, a total of seven personas were developed to support an understanding of the perspectives of the end-users. Based on these personas, many scenarios were designed. A selected set of scenarios and functionalities has been further designed, translated into system requirements, developed and evaluated with end-users and informal carers in several iterative user-centred design cycles, by means of video prototypes, focus groups, semi-structured interviews, and extensive user trials with the

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actual working system prototypes in test homes ($N = 28$), in care homes ($N = 20$), and in people's own homes ($N = 5$).

3. Results

The studies provided rich knowledge about the context of use and potential barriers, constraints, and criteria for acceptability [2]. Older adults are receptive to service robots whenever the robot does not interfere with their daily routine and if they can customize the robot's character and appearance. Participants reported that they want to be in control of defining the robots' behaviour. Important challenges for acceptance are the robot's voice, the level of system-initiative, and the level of social situation awareness. Based on the results of these initial evaluation studies, the system has been enhanced and again evaluated with end users in a fully functional smart home environment. During these sessions, users experienced the system for several hours. A researcher was present to observe during these interactions, and to initiate a dialogue on how users perceive their experience, the usability of the system, and the usefulness of the services. User indicated that personalisation is important, referring to the robot's voice, its name, and the content of its services, in order to show that it knows the user, is attentive, has intelligence, and cares for this person. Also, much more autonomous behaviour is expected – the fact that the robot physically comes to the user, takes lots of initiatives to activate and motivate the user, and keeps an eye on him or her are the key selling points. Based on this, we might develop certain 'characters' for the robot, from which a user can choose its preferred personality and behaviour. In terms of usability, many small issues were discovered in the dialogues, in the graphical user interface, and in the overall interaction flows. In terms of integration in the overall delivery of care to a person and offering truly useful real-world services, tools need to be developed for informal carers to use MOBISERV in an unobtrusive way, and to personalise and instruct the system exactly the way they wish.

4. Future Work

MOBISERV will be further improved to accommodate the users' needs. A second iterative design cycle has started in which the system will be redesigned, improved, and again evaluated in a real-life settings, now over longer periods of time. At both pilot sites (UK and The Netherlands [3]) target users will spend several days in either their own home or a smart home equipped with the MOBISERV system. Again, human-robot interaction will be evaluated in situ to gather knowledge about how a robot like MOBISERV and its services can be effectively integrated into the users' specific context and there ecosystem of care, considering introduction, training, age-related differences, their health and experience with technology, and how care recipients and their informal carers experience a social companion robot over longer periods of time.

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FLORENCE – A MULTIPURPOSE ROBOT PLATFORM TO SUPPORT ELDERLY AT HOME

Dietwig Lowet[1], Melvin Isken[2], Frank van Heesch[3], Nils Volkening[4], Leire Martinez[5]

Abstract

The goal of the Florence project is to investigate how current robotic technology can be used to support elderly people to live longer independently at home, by improving the quality of care, supporting family and care providers and reducing the cost of elderly care. To this end we have developed a low-cost, mobile, screen-based robot. This robot provides a platform that support AAL applications in the areas of social connectedness, safety and coaching. In this paper we describe the Florence robot, the result of the user tests and explain in detail the role of a mobile Florence-like robot can play in elderly care and why a robot is a suitable platform for this.

1. Introduction – the Florence approach

In the early design phase of the project, we identified four main requirements on which the design of the Florence robot is based. The first one is that the robot should be low-cost (around $1000) and be based on current state of the art technology. This prevents using advanced humanoid robots and brings us to a robot hardware design with a mobile base on wheels and a touch screen interface on top with a height of around 1.5 meter. Figure provides a schematic picture of the Florence robot hardware and a picture of our first prototype.

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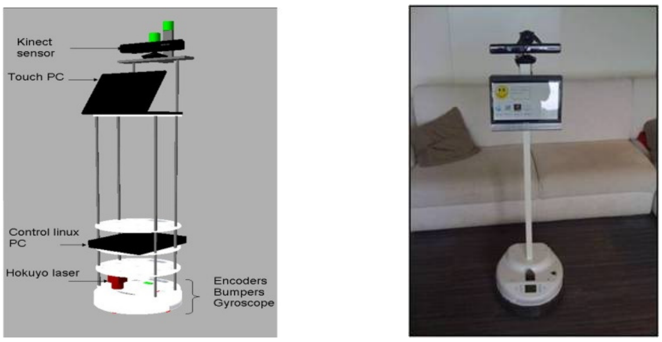

Figure 1. The Florence robot, based on the Turtlebot platform

Secondly, this type of robot is suitable to support elderly in three important application areas: robotic telepresence, monitoring and coaching[6]. In the second part of this paper (Section 0), we explain the benefits of these applications for elderly and why a Florence like robot is, in our view, the best solution for these applications. In these areas, we have developed 6 AAL applications, as proof of concept:

1. Keeping in touch: communication via robotic telepresence,
2. Fall handling: fall detection and robotic telepresence to assist the elderly,
3. Lifestyle improvement: providing coaching advise for taking more physical activity,
4. Home interface: the robot as easy metaphor to interact with the smart home,
5. Agenda reminder: providing a gentle way of reminding people of medications and appointments etc.
6. Monitoring: monitoring vital signs data and storing it for later data mining.

Third, user acceptance is very important. Therefore, the robot should also be suitable for fun and lifestyle services e.g. listening to music, or controlling your home. In addition, the project has followed a highly user-centered design process in the project, in which we tested the Florence system with users at three points in time: Wizard of Oz testing at the start of the project, a first real user test in controlled home environments halve way through the project (Section 0) and final user tests at the end of the project inside real homes of elderly people.

Fourth, we view a Florence-like robot as a multi-functional device comparable to a PC or a smart phone, for which later multiple applications can be developed based on user preferences, care provider services. Therefore, we follow a platform approach to enable easy development of applications by (3rd party) developers.

[6] We also identified "companionship" but decided not to explore this concept in this project.

2. The Florence robot

The Florence robot has a mobile base with wheels and a touch screen on top for user interaction. The robot can sense its environment with a 2D laser scanner, bumper sensors, a gyroscope, a wide-angle camera, and a 3D depth camera[7]. The robot contains two computing nodes; a Linux laptop at the bottom that handles all typical robot related functions such as navigation and a windows Touch PC at the top that handles all human-robot interaction. The Florence robot prototype has a cost-price of around $2000 (which is close to our target of $1000). The main goal of the Florence robot platform [2] is to provide common functionality to AAL application developers, to provide a consistent behavior across applications, and to shield them from dealing with low-level robot technologies and interaction modalities by providing high-level API interfaces, e.g. "goToKitchen", "goToUser", "remindUser" etc.

The User Interaction Subsystem provides a consistent user interaction experience across applications and shields applications from the complexities of the different UI modalities, like gesture and speech interaction. The GUI part of applications is implemented in HTML5. The application logic of the AAL applications can also be implemented in HTM5/JavaScript, if performance is not an issue. . The applications logic can also be implemented in native code, for performance reasons. The HTML5 applications can interact with the components of the Florence platform via the websockets [4]. The Interaction Manager is developed around the Ravenclaw dialogue-management system [5]. To interact with the user, an application provides a "dialogue-tree" to the Interaction Manager. In its simplest form, a "dialogue tree" is just a combination of one "output" (e.g. *"Did you already take your medication?"*) and a list of possible "inputs" (e.g. *"yes"* or *"no"*). The interaction with the user is done via speech, an animated face, and text on the touch screen, as shown in Figure 2.

[7] Based on the Microsoft Kinect.

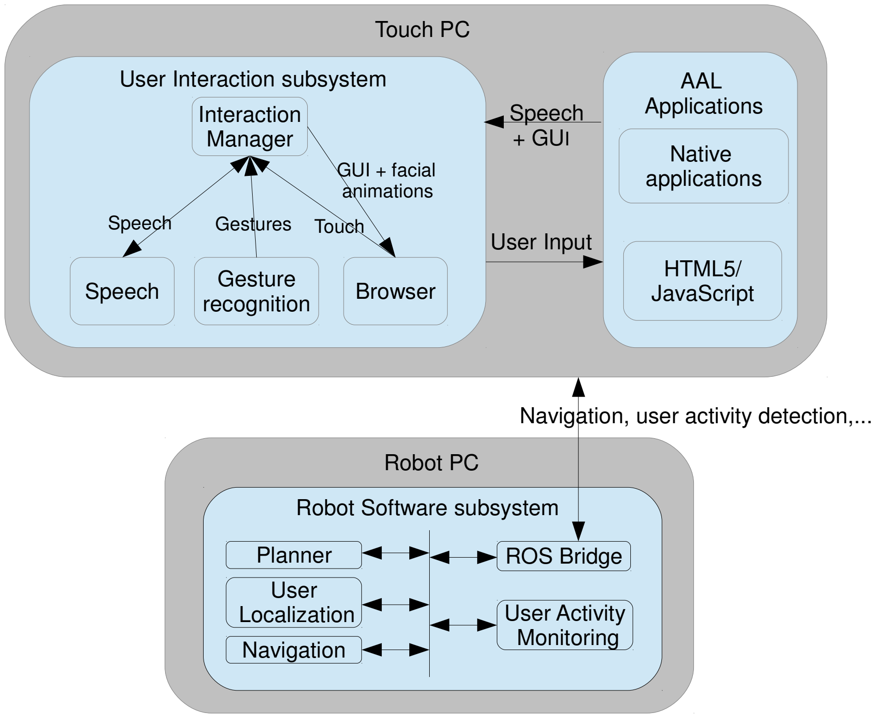

Figure 2. The Florence software overview

The Robot Software Subsystem is based on the Robotic Operating System [3] and provides a high-level interface towards low-level robot functionality for navigating the robot around the house, to determine the location of the user and to monitor the user activities. It contains also a planner that schedules the applications based on user preferences and application requirements. In Florence, the communications between software components is socket-based enabling easy development and deployment.

3. User tests results

A first version of the Florence robot and the six proof of concept applications have been tested with users in the controlled home lab environments at Philips (Eindhoven) and OFFIS (Oldenburg) in the beginning of 2012. A total of 17 elder participated in both tests. The elderly were all living alone and independently at home. For the applications based on robotic telepresence, the elderly was accompanied by a close family member (a son or daughter). In addition to participating in the robotic telepresence applications, the close family members would also observe the other application tests with their father or mother and provide their feedback. Four care professionals also tested and evaluated the Florence robot and applications. In total, 38 users were involved in the user tests.. The elderly tested the Florence system under the guidance of a user experience researcher, while a second researcher took notes. A third researcher interviewed the close acquaintance while both observed the user tests with the elderly. For the “keeping in touch”, the close family member remotely controlled the robot and communicated via audio and video with the elderly.

Though we tested six different AAL applications with the elderly and their family members, they only saw a difference between “robotic telepresence” on the one hand and “providing advice” on the other. One of the main findings we learned was that both elderly and family member highly valued robotic telepresence, but, surprisingly, not so much for social connectedness but for remote assistance. The elderly liked the idea that someone could immediately be present (virtually at least) and assist them. However, almost all elderly expressed their fear that robot telepresence technology might reduce the number of real visits. The children see robotic telepresence as an easy and comfortable way to daily check whether their elderly parent is doing alright, and to always be able to assist their elderly parents in case of everyday problems and emergencies.

With respect to the applications that provide reminders and advice to the elderly, elderly who were still very healthy and did not yet need help, are very proud of the fact that they can still do all things independently and would not like a robot to “command” them. Elderly who already needed care for themselves or had cared for someone else were in general positive about the functionality and applications they tested.

4. The role of a Florence robot in elderly care

In this second part of the paper, we will explain in more detail the role that a Florence robot can play in supporting elderly people at home, based on our experience in building the Florence system and the user tests. The first thing to note is that a Florence (-like) robot does not target one or two user needs or AAL applications, but that a Florence robot provides three key *“application building blocks”* for AAL services: (1) 24/07 remote assistance, (2) Unobtrusive monitoring, and (3) Coaching. These building blocks can be used to build various AAL services, such as medication management, emergency handling, exercise coach etc. We further explain this concept of these “building blocks” by means of
Figure 2. On the far left are the basic, state of the art technologies that are widely available and that are used as within the Florence system. The second rectangle on the left depicts the Florence platform proper, developed in the Florence project, containing a number of software components that can be reused by AAL application services. Together, they provide the three “Florence AAL building blocks” that can be used by AAL service developers, depicted in the grey rectangle second from right. On the far right in Figure 2, the list of elderly needs and services that care providers deliver to elderly is depicted. These services can benefit greatly from the Florence AAL building blocks.

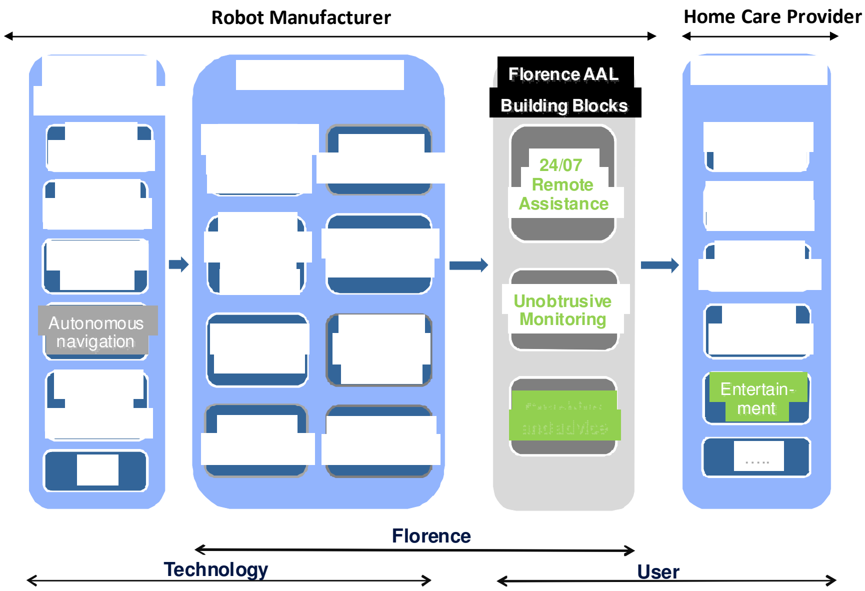

Figure 2. The Florence Platform provides three "AAL service building blocks" using state of the art technologies depicted on the far left to be used in AAL services that address the needs of elderly at home, depicted on the far right.

We no explain in detail what these Florence building blocks provide to AAL services and why a mobile, screen-based robot is best suited for providing these functionalities.

4.1 24/07 remote assistance

Robotic telepresence enables close family members and professional care providers to remotely assist and support the elderly at his/her home at every moment during the day and night. Assistance can be provided in many different situations ranging from emergency situations, e.g. a fall, to assistance in medicine intake, to providing assistance with every day electronic and other complex devices, e.g. a microwave, or with health problems e.g. headache or stomach pain. Robotic telepresence also enables close relatives to frequently and easily check whether their parent is doing well: is he/she dressed, is the home is tidy and cleaned up. A Florence-like mobile robot offers three essential benefits for 24/07 remote assistance that other embodiments cannot provide. First, a mobile robot enables to provide assistance at the place needed, for example, if the elderly has fallen in the kitchen, or has a problem with a device in the living room. This is in contrast to video call solutions based on a fixed device like a PC or television, which can only be used for communication and not for remote assistance. Note that even with a mobile phone it is very awkward for an elderly to point the camera constantly at the place needed. Secondly, the remote person can remotely control the device. This is important, since, in many situations the elderly is not capable to operate a device like a tablet (PC) or mobile phone and the elderly is even less likely capable of pointing the camera in the right direction at all times, especially in case of an emergency. This remote control also allows the remote person to check, by moving around, whether everything is OK. Lastly, a robot, due to its mobility and physical embodiment provides a much stronger feeling of presence for both the elderly as well as the remote person, compared to traditional audio/video chat.

4.2 Unobtrusive monitoring with high-bandwidth sensors

A mobile robot equipped with high-bandwidth sensors, like cameras and a 3D depth sensors, is able to monitor activities and vital signs[8] of persons continuously and unobtrusively. These high-bandwidth sensors of the robot can also be used to detect patterns of daily life of the elderly like cooking, sleeping, eating, having diner, watching TV, reading, having a visitor. Accurate activity detection is important for many AAL applications and helps to improve the user interaction, for example, to select the suitable time slots for medication reminders (at the moment of diner and not at exactly 12:00). A robot can also be used to gather subjective data from the elderly by asking the user how he/she is feeling[9]. A Florence-like mobile robot provides three essential benefits that cannot together be provided by other solutions. The first two benefits are strongly interrelated: using high-bandwidth sensors for getting sufficient information and privacy. High-bandwidth sensors such as a camera, microphone or 3D depth sensors have the potential to cause privacy problems. The detailed information these sensors can provide, are needed for understanding the user context. Also, users are aware of the privacy threat that cameras and microphones yield and often do not like the general idea of having one's home equipped with microphones and cameras in every room to monitor them. A mobile robot provides a good compromise: people expect a robot to have and use an onboard camera, microphones and depth sensors to sense its environment and their use is justified though the robot's behavior. Moreover, privacy can be guaranteed at any moment simply by sending the robot away. A third benefit of a mobile robot for unobtrusive monitoring is that a robot removes the need for rewiring the home to allow smart sensors to monitor its inhabitants.

4.3 Easy and social interaction for coaching

A third building block for AAL applications that is provided by the Florence platform is referred to as "coaching". We use the term "coaching" here in a broad sense: it encompasses everything related to the robot providing feedback and advice to the elderly. Examples of coaching are medication reminders, agenda reminders, advice to do some physical activity, or to eat healthier or to prevent dehydration, etc. The robot can also warn and advise the user, about the state of the home, e.g. a window that is left open while it is raining or a door that is not closed/locked Also for coaching a robot provides tree essential benefits that together cannot be provided by other solutions. Firstly, a social actor like a robot can provide easy and natural interaction

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[8] As an example, Philips has developed software that can measure the heart beat and breathing rate of a person based on computer vision by looking at the face and chest of the person

[9] This is important in general health monitoring and currently now efficient solution exists. When elderly visit their doctor, they often are not able to provide their health overview of the last couple of weeks and a doctor must get this information indirectly e.g. by asking family, nurses etc.

via speech and gestures which is particularly suited for those not comfortable with complex devices. Secondly, a robot is unique in that **it can take initiative** to provide the coaching information at the right time needed in an unobtrusive and user-friendly way (based on the activity recognition that a robot can perform with its high-bandwidth sensors). This can be expected to raise user acceptance a lot. Thirdly, previous research has shown that coaching from a social actor device provide better adherence than e.g. just showing text messages on a screen.

5. Summary

Using the robot as a coaching agent requires a lot of autonomy: autonomous navigation, good speech recognition. Though these technologies are working in a lab environment, there is still a lot of work needed to bring them into the homes of people. Unobtrusive monitoring with video cameras and 3D depth cameras to detect vital signs data is already possible to some extent; however detecting user activities and patterns is still a challenge which we are currently working on. Robotic telepresence seems to be the first viable robotic solution to support elderly at home: It is both technical feasible with current technology at low cost and addresses important user needs by providing 24/07 remote assistance. However, also for robotic telepresence, a number of technical issues should still be addressed with respect to improving video (wide-angle, high resolution, high dynamic range) and audio quality. We are currently addressing these issues in the second version of the Florence robot. This updated version will be tested at the end of this year with elderly people in their own home, in collaboration with the "Carintreggeland" care provider [6] in the Netherlands.

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[4] Websockets, http://tools.ietf.org/html/rfc6455

[5] http://www.cs.cmu.edu/~dbohus/ravenclaw-olympus/research.html

[6] http://www.carintreggeland.nl/

TRACK E RATIONALE: ON-GOING PROJECTS

A wide variety of research projects has just delivered results or is working on it. From the large number of contributions from the call for abstracts a selection has been made and grouped in special sessions with topics such as: AAL middleware, AAL Solutions, cognitive impairment, mobility, serious gaming, social interaction, tele-monitoring and design with people.

Track E consists of the following twelve sessions:

Session E1 – AAL middleware

In the past years a lot of AAL Middleware solutions have been developed. It is obviously essential to abandon monolithic proprietary concepts for complete, comprehensive solutions in favour of few established middleware approaches that allow open AAL systems to evolve over time. Such middleware solutions will be the heart of flexible AAL platforms that allow future AAL solutions providing assistance and complementing the health and care systems to expand modularly and be customizable to individual needs, lifestyle and health progression. The benefit will be twofold: on one hand, the market will be open to the enterprises of different sizes to realize their ideas for new products and services that can be added easily to broad ranges of existing settings, and on the other hand, end users will be able to pick desired products and services over time according to their changing preferences and needs and whenever they can afford. However, the emergence of such flexible and customizable systems will depend on interface definitions ensuring ad-hoc interoperability at the semantic and process levels and recognized international standards or industry agreements.

The session will present the work of three most relevant projects for this specific topic by brief presentations and 3 short presentations. The remaining 15 minutes are reserved for discussion about the next steps towards consensus building and standardisation.

Session E2 – AAL solutions to support care, diagnostics and prevention

The motivation for this session is the potential for significant economic and social impact from the introduction of innovative AAL solutions. While this potential has been recognized for some time, breakthroughs in terms of widespread availability and deployment of solutions have yet to be achieved. The AAL Joint Programme has funded activities in this area for some years, and some of these are now at a stage in their development where direct hands-on involvement of development companies is the best way to make sure that this work produces results that are effective and applicable in real industrial settings.

Each presentation should provide information about on-going activities and discuss the form and content of possible market potentials. Additionally it should be shown how companies in practical experimentation with new technologies can be involved and how this work can influence to match their needs.

Session E3 – Ethics of data mining and automatic decision making

Activities of data mining and automatic decision making are central to AAL and provide a minefield of ethical issues. New types of analysis and solutions must be developed. The key problem is that whenever we use information, combine it with other information, or use it to make a decision, we must take the information out of its original context. Making information useful and relevant in a different context is always a creative process of "re-framing", which is one of the strengths of human intelligence. We are all aware that the process of "re-framing" can be misused.

The problem is that transfer of information is never a mere repetition of words and bits of information. Whenever we transfer information the information gets some new meaning. To find out whether this re-framing was reliable, more is needed than the mere control whether the original words and bits of information have been correctly copied and transferred. The criterion is not identicalness but reliability. As long as re-telling and re-combining existing information is done by human beings, people can go beyond the mere words and argue, discuss and assess whether the transfer of information happened in a reliable or unreliable way. When information is transferred and combined by intelligent machines, it is easy to do data-mining and combine information from a large variety of contexts. How can machines be sure that the information used is not "taken out of context", and has constructed a picture of the situation which does not do justice to the people involved. The situation requires even more caution when machines use the combined information as the basis for strong conclusions and decisions about a person.

The session will explore what this all means for the context of AAL. How can we identify those issues of (un) reliable information transfer? Is it possible to develop AAL systems that appropriately address these issues? Four introductions will launch the discussion. A panel discussion will address what all this can mean for the participants.

Session E4 – AAL solutions for persons suffering from cognitive impairment

This session is focussed on ICT-based solutions for older adults with cognitive impairments/dementia and their (informal) carers. Different aspects of design and use of ICT solutions by people with cognitive impairments will be presented, as well as results of trials, business case and market chances of the AAL solutions.

Session E5 – Fall prevention

This session deals with the fall prevention problematic. Rationale an contents of this session:

- Attempt to prevent rather to detect a fall or distress event risk for dependent alone persons living in their home (even if fall detection is still important)
- Address the different prevention strategies currently developed through advanced research projects
- Try to exploit the potential noticeable change/variation within a care receiver's profile in his/her daily habits and/or health, nutritional, social exercise status.
- Afford more freedom and flexibility to the care receiver and his/her relatives (family, care givers) by bringing him a better safety feeling and a positive mental
- Use common apparatus from the house through multimodality and/or smart home environments

The session will present first a tutorial on fall prevention and the work of four most relevant projects for this specific topic by brief presentations (15 or 10 min each). The remaining 15 minutes are reserved for discussion.

Session E6 – Mobility and supportive AAL solutions

This session focuses on ICT-based solutions for older adults which will help them to sustain their optimal level of activity and mobility for as long as possible, as well as enhance their individual sense of confidence, autonomy, competence, security and safety. Results of user surveys, requirements analyses and project experiences will be presented, including results of trials, business cases and market chances.

Session E7 – Serious gaming for health

Serious games have been recognized and are employed in various domains - from military to education - and have found increasing interest from the health domain, particularly in learning and rehabilitation. In this session, researchers from a wide range of disciplines will present the state-of-the-art on serious gaming research, development and philosophy.

The session will tap into motion sensing technologies for exer-gaming, the design of a learning game for elderly Europeans, tele-rehabilitation, ICT for physical exercise for people with Parkinson’s disease, and serious games to co-create happiness. After the presentations we hope for a lively discussion on the findings, philosophies, and the future of games for healthcare.

Session E8 – Social interaction

In this session the focus is on projects promoting and enabling social interaction of older adults by ICT. In short presentations some (almost) finalised AAL projects will present how senior end users appreciate the AAL solution they developed and how they estimate their chances for the market.

Session E9 – Tele-monitoring and integrated care

It is overall well accepted that modern society has to challenge the enormous increases of persons with chronic conditions. Older adults with typical diseases such as diabetes, chronic heart failure and COPD themselves will need to monitor the status of their health, not only to prevent exacerbation of the disease(s), but also to help alleviate the cost pressure. Although debates on the evaluation methodologies of medical and economic effects are still going on, it is obvious that tele-monitoring of vital signs and self-care management are beneficial for patient and society. This session will report more experiences with technical platforms.

Potentially, ICT can play a key role in supporting integrated services and realizing the expected benefits. In practice however, real-life examples of integrated (e-)care service are slow in emerging due to the fact that social and health care are very much entrenched in their own ‘silos’, which in turn is reflected in the design and functionality of tele-care/telehealth solutions. This session will also show how in 2 different projects the integrated services support the effective management of chronic diseases, and address issues which affect independence.

Session E10 – AAL: connecting people to people

The degree to which one feels connected to society has implications for a person, the community and the wider social notions of normality. A lack of connectedness results in experiencing varying levels of exclusion from society. If the chances of being able to ‘fit in’ or a ‘part of the whole’ are reduced because society, family circumstances, technology and/or its design, prevent engagement, this can then lead to feeling incomplete and excluded.

Research has shown how objects, technology and services that are designed to allow older adults to be independent and ‘fit in’, can at the same time, exclude and stigmatise them from society because they are perceived as being objects of frailty and difference.

This session will present projects that are about fostering social interaction for older adults at risk of exclusion or already experiencing it. They will challenge some of the assumptions about technology and its role in preventing exclusion.

Session E11 – Designing with people

Many things need to change within the AAL Community before we can unlock and create a vibrant and commercially viable market geared to meeting the needs of our ageing populations. One of the first hurdles we need to scale is the way we perceive, think, talk to and engage with adults older than ourselves. More often than not we speak at older adults, thinking we understand their lives, feelings, motivations and needs. We rarely ascribe wishes and aspirations to them. What we understand are our lives not theirs.

This session will explore some of the engagement methods used within projects to overcome the issues highlighted above. Speakers will give an overview of their experiences, methods and actual contact with people brought greater insight and understanding into how we can actually develop and commercial life enhancing technologies.

Session E12 - Large-scale rollouts as instrument for achieving impact

AAL has not achieved market breakthrough despite clear socio-economic needs, socio-political support, and a growing population of potential customers with revenues over € 3000 billion. Stakeholders in the AAL community, for example the EIP-AHA on the side of European policy and the Lecce Declaration on the supply side, have tried to analyse this situation and to find about the challenges and ways out. One of the conclusions from these activities has been about “scaling-up and generating critical mass” as “key for successful implementation”, where “critical mass” refers to any of end users, suppliers, products and services.

Certainly, large-scale rollouts are an important instrument for involving or generating critical masses and achieving impact. They can end up with impressive showcases involving a critical mass of end users in their real life, establish de facto standards, and result in an initial portfolio of products and services that stimulate the market. Therefore, concrete steps towards the realization of such large-scale rollouts are being taken in the context of the 3millionlives programme in the UK and the Objective 3.2 of the call 6 of CIP ICT PSP “Towards open and personalised solutions for active and independent living”.

In this session, the above two programmes as well as the activities from Denmark, Netherlands and the Basque Country will give short introductions to challenges on the way of large-scale rollouts in order to stimulate open discussions on the kind of products and services for independent living that have a chance to be accepted by the end users, experiences with end users.

TRACK E NOTES

SESSION E8: ICT SOLUTIONS FOR ENABLING SOCIAL INTERACTION

Sebastiaan Peek, Annica Kristoffersson, Iulian Covlescu

Chair: Sofia Moreno, Spain

Summary of the session

Loneliness and social isolation severely impact the wellbeing of people in general and the quality of life of older adults in particular. The introduction of ICT has revolutionized the way that young people understand social relationships. What about other generations? In this session, we had the chance to get a closer view of some initiatives that try to promote social relationships of senior adults through the use of ICT.

Frequently, R&D projects present interesting approaches. However, few of them actually benefit society, and few of them are able to reach the market. This is the result of difficulties in finding a valuable business model, a low position in expenditure priorities and the fragmentation and isolation of different types of solutions. This why the chair of the session insisted that the speakers included their market approach strategy in their presentations, and she proposed a game to provide feedback to the project teams. She distributed some candies, as imaginary money, between the older adults attending the session and she asked them to distribute the money between the projects, hereby answering two questions:

- How much would I pay for this product/service?
- How much would I invest from my saving in this company?

At the end of the session the project speakers collected the candies. There were noticeable differences between the amount of candies each speaker received. Loneliness is a major risk that everybody sees. However, in order to help people through ICT solutions, one must first get to the older adults and secondly make them use the solutions. Without a solid business case most of the projects will remain just great ideas. At this stage, most projects lacked a business model. Presenters acknowledged the need for a market approach strategy.

Fostering social participation through social presence

Speaker: Katja Neureiter et al, Salzburg, Austria

The main goal of the project is to support social presence of older adults who are restricted in mobility by means of a device which enables communication and interaction over distance. The device features two screens: the top screen is used to display the upper body and head of the communication partner, the lower screen is a touchscreen that displays the hands and table of the communication partner. The device is designed for three modes of communication:

- Meet: one-to-one high-quality audio and video contact with family, friends and caregivers;
- Club: communication and interaction between groups of people, providing meaningful social activities;
- Classroom: communication in the direction to simulate the feeling of being useful (e.g. voluntary activities).

The device was evaluated in eight workshops with potential end-users in Spain, Sweden and the Netherlands. (N=48, average age was 71). End-users experienced more social presence than in other communication systems. Participating in activities through the system was appreciated and considered useful, although interaction with the caregiver was difficult in some aspects. Further steps are: user studies in the lab, heuristic evaluations and field studies with potential end-users.

Fostering social interaction with user-centred smart TVs – results from the FoSIBLE project

Speaker: Mario Drobics et al, Vienna, Austria

The main goals of the project are to foster social interaction and to enable simplified access to new media. For this purpose, a Smart-TV is developed. The Smart TV is combined with gesture recognition to overcome limitations of controlling the system with a remote control, tablet or speech recognition.

Examples of scenarios for the system would be: awareness of others (leaving messages, getting notified when friends are online”), sharing things together, gaming and enabling physical activity. Benefits of just gesture recognition are that it is intuitive and that no additional devices are needed. Drawbacks are that users have to remember the gestures and that some gestures might be hard to carry out or exhausting. A field trial of the project will be conducted in about 30 households in Germany and France. Also, a study of usability and acceptance of a remote control, tablet control and gesture control will be carried out later this year.

Natural communication device for assisted living – NACODEAL

Speaker: R. Saracchini

NACODEAL´s main objective is to generate a portable device in which an Augmented Reality module will be integrated. Friendly guides will be created so its users will be capable of performing their daily activities and access online services which are relevant for them. NACODEAL will have its own social network technology that will contain the network of friends and family of the older adult. In contrast to other projects, the end users will be able to access to their social network through their adapted mobile device. The idea is to facilitate the use of NACODEAL by creating a comfortable device in terms of use which provides them what they need, so that way they will feel uncomfortable if they go out without the device.

Technology should not be imposed on older adults. We should make technology useful for them so that they require it. In the final part of the presentation, ideas of future social interaction with the social network database are presented. The ideas focus on the use of a small portable (PICO) projector, a portable camera and a portable CPU (e.g. a smartphone). With this combination of devices, it is possible to display information from the social network on a number of surfaces (e.g. walls).

A Wikipedia skin for senior citizens

Speaker: Florian Franchiger Bern, Switzerland

The importance of senior citizens is underrated. Seniors are not enough considered in the Web Content Accessibility Guidelines (WCAG) 2.0. The existing skins for Wikipedia leave room for improvement. Within the project presented, two skins have been created and tested; a full version of Wikipedia with different colours of links clicked and unclicked and a tempered version with reduced content.

Within the project TAO, two skins have been created and tested; a full version of Wikipedia with different colours of links clicked and unclicked and a tempered version with reduced content but room for improvement still exists.

V2me – Virtual coach reaches out to me

Speaker: Andreas Braun

When we become older, we become lonelier. Loneliness is a health risk. The project creates a friendship enrichment course through virtual coaching. The virtual coach is an expert that can teach, motivate and coach the older adults and the content can be edited via a content editor by a caregiver or by a researcher.

Through a user-centred design and iterative pilot tests in different countries, a virtual coach has been created. During the pilot testing, older adults have preferred a black interface with white text. This coach will be subject to eight weeks of effective assessment with users.

The system is adaptable to the user. The user can choose to buy only an application for a tablet or the full service. The business plan also includes gaining money via providing “extra services” and maintenance.

Join-in preventing loneliness in the elderly through social networking

Speaker: José López Bolos

The main idea of the Join-in project is to develop games that will prevent loneliness. Thus the Join-in platform should offer to the end-user: games, information, a discussion room, being build based on the serious games concept. The games developed based on this concept that involve physical exercise are called exer-games. The requirement for the main platform to work is Internet access. For exer-games to function there is need of a full platform that contains a Kinect system and specially designed controllers. The controllers were specially developed for the exer-games of the project. Software requirement is the compatibility with HTML5. The security requirements are satisfied through the use of the ELGG standard.

Based on the trials conducted so far in the project, they have observed that a Facebook type of platform is not easily accepted by older adults, and so a different design must be used. From the perspective of game designing, they observed that men like more competitive games than women.

A clear business model was not presented, only a general idea of how the system will work. The platform can be sold as a software product if the end-user has a computer and internet connection. Profits are being made only on the service and software maintenance. The costs for this option is yet unknown. For the exer-games and the entire platform that includes the Kinect and the controllers, 700 euro was the price range approximated.

Effective approaches to develop information and communication technologies attractive and useful for elderly people

Speaker: Javier Gómez

The main message of the presentation was that AAL projects need a clear methodology. Thus a three –layered methodological framework that tries to combine qualitative and quantitative methods was proposed. The project called ELISA was carried out based on the framework developed and proposed. Usability tests on users were used to create a proper design.

The findings from the test were that the tablet should have soft margins, a butterfly shape and an interface with 3 columns. The 3 columns are presented on the same screen and depict the following categories: Interest, friends and activities.

A clear business model was not presented, only a general idea of how the system will work. An approximation of the entire platform was 400 euro based on the cost of the tablet on which the application runs. The profits would be made from the services provided in the Activity column of the application, and from the data services that can be sold to the client.

Strengthening social networks by combining physical and virtual meetings

Speaker: Hein de Graaf

The presentation was in a different format than the previous ones, no slides being presented. The main message was that besides the virtual meetings, there is the need of physical meetings too. The speaker argued that there should be ways of getting people together in a physical way and to those get-togethers to present the available ICT solutions for virtual meetings. A virtual 3D-enviroment should be only “a place to go”, not the purpose of a project per se. Focusing on the “baby-boomers”, the generation born after the Second World War, that are soon to become eligible for pension, a new type of old adults will appear. These people are open to technology, but also crave for direct social contact. Thus, the focus would be to make them meet physically first by fun experiences. The new older adults should be seen as strong people that want to socialize, not weak people that need ICT or aid. This social project is not an AAL project but received funding from the CIP program.

AWARE-AGEING workforce towards an active retirement

Speaker: Clara Bollain

The idea behind the project is to develop a social network and a knowledge management for retired persons. There is a need for a support in the transition from being an employee to being retired. The users that are targeted are older workers, retired people, but also companies and associations. The platform is a web service called SEN+ and the user has free access to it. So far it was developed in four languages: English, German, Spanish and Italian.

The design has five tabs that depict the major activities of the platform: My social network, My knowledge, Improve environment, Recommendation and Lean and Teach. The people can create their own lessons and teach via the web-platform. In June, the user-pilot started in Germany and Spain. The project has entered the last year of financing from AAL.

The business model is thought of as being a platform for the retired people than can be beneficiary for companies. Thus the companies are the ones paying for the product and the users have free access to it. For an easier transition, the user can log in on the platform before retiring, being then used with the system once they actually retire. A price for the companies was not presented.

TRACK E PAPERS

HOST INNOVATIVE SERVICES TO PROMOTE SOLIDARITY, TECHNOLOGICAL AND SOCIAL INCLUSION OF ELDERLY PEOPLE

A. Doñate-Martínez[1], J. Garcés[2], F. Ródenas[3], F. Abry[4], X. Deloche[5]

Abstract

The first results show us a real interest of end users and local partners for the project, several expectations and needs which we can include in 4 main subjects: Social link, communication and sharing - Organization and memory – Health - Food and cooking. In this sense, the project Smart technologies for self-service to seniors in social housing – HOST – is currently working in a solution to provide easy-to-use technologies and services in social housing flats to allow a better quality of communication and a better access to package services from the elders; by experimenting a European model of "connected flats" for elder people. In the modern digital society, people can access an increasing number of products, services, contents and information mainly on-demand, via the Internet. The complex skills needed to benefit from the current technological framework tend to exclude an increasing number of elderly people as they do not have enough IT knowledge and education to use the proposed technologies.

1. Introduction

In the modern digital society, people can access an increasing number of products, services, contents and information mainly on-demand, via the Internet. The complex skills needed to benefit from the current technological framework tend to exclude an increasing number of elderly people as they do not have enough IT knowledge and education to use the proposed technologies. This situation implies a real need for elders, population that meant around 85 million in 2008 (aged ≥ 65) in the European Union, as this constraint can dull that elders make the most of technological opportunities to help them in their everyday life, and favour a critical and unacceptable digital exclusion.

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In this sense, the project Smart technologies for self-service to seniors in social housing – HOST – is currently working in a solution to provide easy-to-use technologies and services in social housing flats to allow a better quality of communication and a better access to package services from the elders; by experimenting a European model of "connected flats" for elder people. These technologies imply specific equipments enabling easier relations with family, service providers and housing operators, through enriched supports (images, text, voice, documents).

So, HOST technologies are characterized by the following innovative services :

- TV -based ICT devices (a box) allowing oral, textual and visual connections between the elderly and their "circle of relation-relatives".
- A specific added screen could fit both with an exit scenario or a second channel of access if the TV set does not fit all the necessary requirements (regarding users' usages).
- Touchpad and different interfaces (handset and navigation scenarios) will be experimented jointly on an open IP technology to ensure a friendly and easy to use environment.

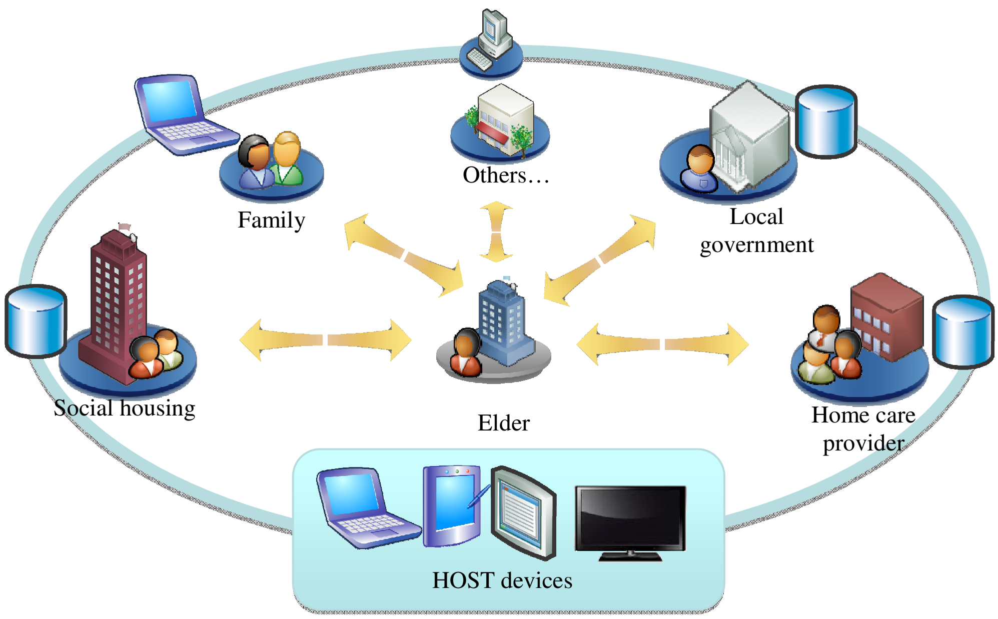


Figure 1. Connection of elder with other actors through HOST devices

2. Methods

For the design of HOST services end-users are involved in different steps, as the followings: analysis of their needs, presentation and installation of the equipment, experimentation process, meeting with technical referents, assessment and dissemination. The co-design process has been realized in France, Italy and United Kingdom within several experimental sites.

In France the first step of experimentation – the co-design process – toock place in two neighbourhoods from Lyon with 15 participants. The "everyday life workshops" allowed to expresse 30 needs to design the service package according to these main categories: organization/memory, communication/sharing, food and cooking, and health and medicines. The device available is a Tablet PC. In Italy there are five experimental sites (Borgaro, Orbassano, Cesena, Lizzanello, Rome) with 20 participants in total. The devices available are: interactive TV, Tablet PC and Smartphone. And the services provided consists in: medical and home care, companionship, home assistance, entertainment. In United Kingdom the co-design is being developed in Newark (Nottingham) with, currently, 18 participants. The technology employed is a plain ordinary TV that offers the following service package: TV, calendar application, message application, health and wellbeing and other services.

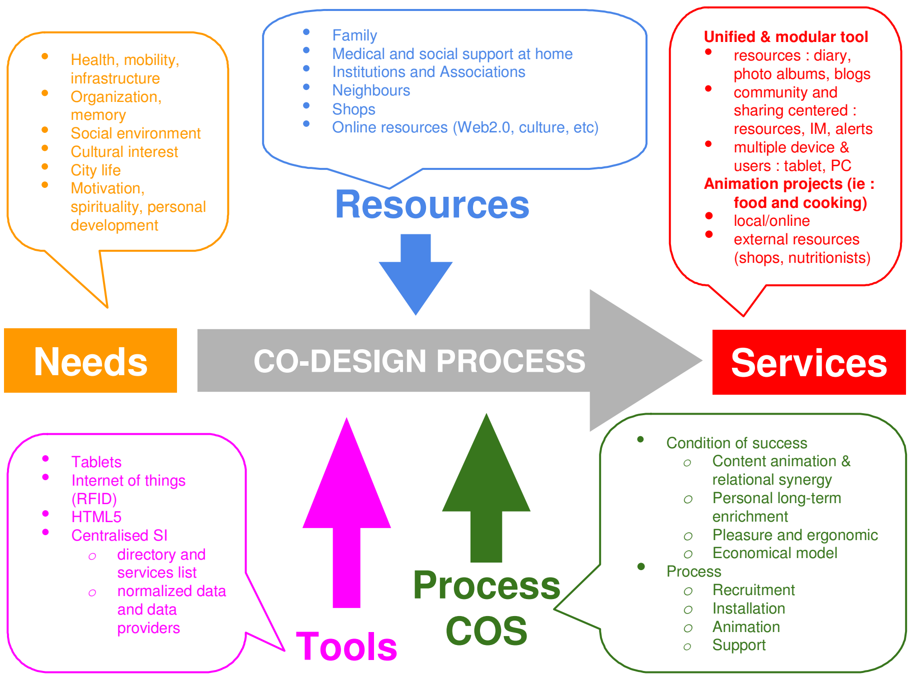


Figure 2. Co-Design process

3. Results

Since the official launch of the project, on May 2011, a substantial progress has been developed by the consortium. The main advances achieved are the followings:

- Definition of users’ requirements and needs.
- Establishment and design of guiding rules and principles about ethics, privacy and security issues.
- Establishment of an Internal Ethical Committee with participants from each experimenting country and coordinated by Polibienestar Research Institute (Spain); as well as an External Ethical Committee in each experimenting country too.
- Preparation and implementation of co-design trials in each country.
- Establishment of the basis regarding to the evaluation process, including tools, key moments, variables/indicators, etc.
- Development of different dissemination means: HOST website (www.host-aal.eu), leaflet and poster.
- Achievement of several dissemination activities, as publications and participation in scientific events.
- Availability of several tools to facilitate the management of the project as the collaborative exchange platform for the partners.

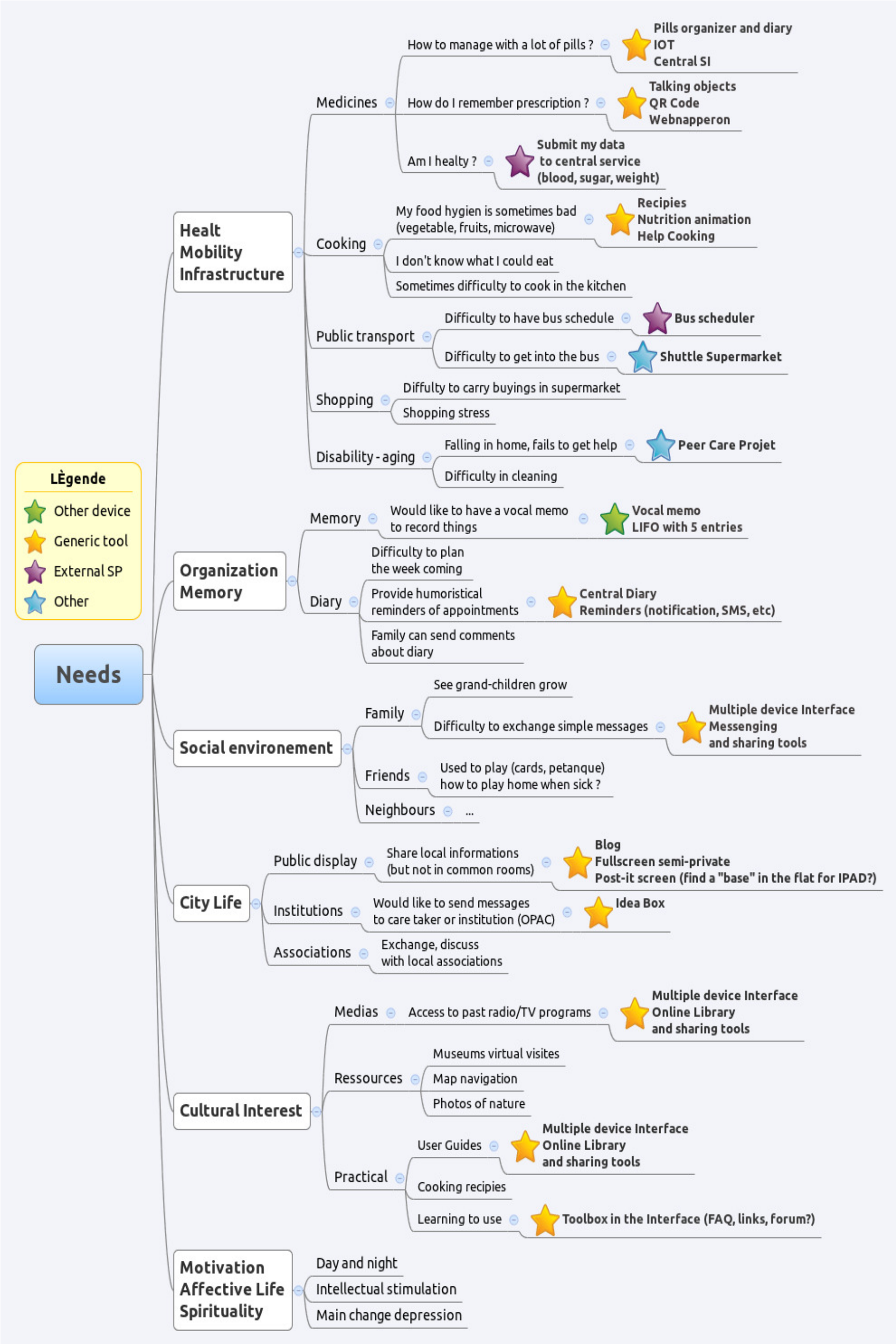


Figure 3. Elderly needs and requirements

4. Discussion/conclusions

With the establishment of new technologies and services from HOST project addressed specifically to the elderly at their homes provides monitoring through their "circle of relation-relatives", as well as implying support for their caregivers by avoiding negative repercussions related to informal care and facilitates communication with their family, service providers and housing operators.

The HOST project has the potential to help elderly people to access innovative devices and contents, under the responsibility of social housing landlords. The challenge to equip individual flats and collective residences and to allow the elderly to get an adequate level of self-service represents a huge market potential. So, the expected results and impacts of the HOST service for the elderly after their establishment will be:

- To bring more comfort of living.
- To reinforce social inclusion (with friends, family, administrations, social operators…)
- To allow a longer stay in their houses.

Another innovation of HOST project is based on social housing as a main issue for allowing elders to develop new usages based on digital technologies and access new services, which perspective has not yet been much explored even on national level, and not at all at the European level. So, it represents a huge market to equip individual flats and collective residences, and to allow elders to get the adequate level of self-service. Thanks to social landlords are familiar with working as a network, it constitutes a real opportunity to launch quickly an assistant ambient living device on the market with a limited margin of error and at a European level.

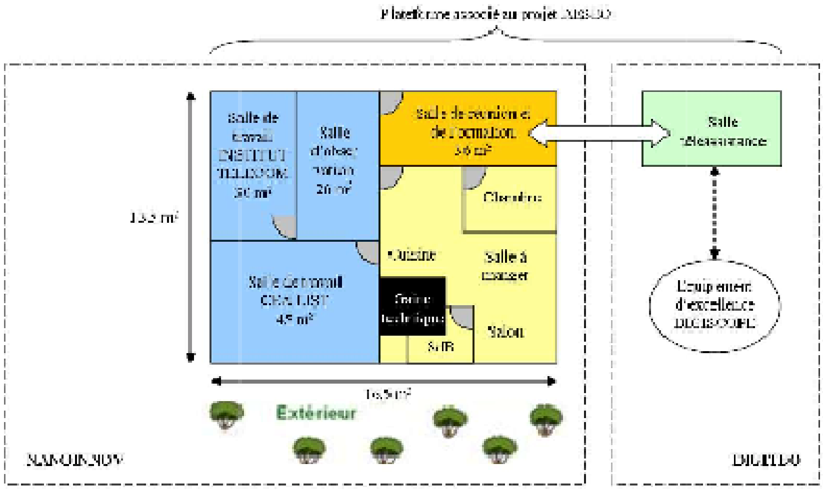
Consortium partners:

- OPAC du Rhône
- Polibienestar Research Institute – University of Valencia
- FINABITA
- Nottingham Community Housing Association – NCHA
- ADAMA
- Bio Result
- Triple Play
- ERASME
- National Research Council Construction Technologies Institute – CNR-ITC
- Université Joseph Fournier Grenoble

MOBILE MII – MOBILE WITH MANY INTELLIGENCE INSIDE

B. Dorizzi[1], P. Sayd[2], J. Boudy[1], J.L. Baldinger[1], M. El Yacoubi[1], L. Lucat[2]

The goal of the MobileMii platform is to create a platform for world-class ICT research in ambient intelligence for the comfort and security in the place of life. Activities will build on research topics of the CEA-LIST and the Institut Mines-Telecom. Research will focus on major prospects of ambient intelligence at home and at work such as telecare, the activity monitoring (or surveillance) at the place of life, or smart assistance for work tasks. Specifically, it is to create a platform localized in buildings of NANO-INNOV and DIGITEO on the "Plateau de Saclay" in the South of Paris. This platform features hundred square meters including development zones, a showroom, and a realistic space for metrology equipment designed in laboratories.



MobilMii also addresses a user-driven research whose objective is a short-term return on research investment. MobilMii will demonstrate the industrial relevance, performance of developments, with the idea to influence developments to meet specific needs, to develop resulting technologies developed, thus reducing time to market.

This platform will promote exchanges with institutions and the regional community of national and international ambient intelligence community (scientific, industrial users).

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It will give opportunities for demonstrations in a realistic context and provide support equipment for future research projects.

A major challenge of the platform is to develop innovative devices and services. The innovative nature will be generated thanks to the multidisciplinary technical teams, from CEA and Institut Mines-Telecom, acting together on a same place. This will be an opportunity to simultaneously develop services based on several technologies (communications, sensors, HMIs, reasoning, ...).

To this aim the Mobile Mii encompasses the following research topics:

- Multimodal Telemonitoring: Developed for nearly ten years by the team INTERMEDIA, it is the remote monitoring of vital and actimetric parameters of healthy elderly or dependent care receivers at home to detect potential situations of distress such as falls or cardiovascular events leading to a fall or not. This will be performed via video analysis, actimetric analysis, supervision and management of alerts by heterogeneous data fusion,
- Monitoring activity on the place of life: personal safety and security, monitoring, measurement of the activity, indoors and outdoors location
- The reasoning, learning, context management systems and decision support
- Recognition and identification of the silhouette, gait, face

The implementation of this platform needs the following steps:

- install actimetric vital sensors, cameras, microphones (to detect abnormal sounds), computers in the apartment of Nano-innov
- managing databases resources (biometric, vital signs, videos databases)
- manipulate the context management tools and adapt existing context ontology
- participate in large-scale data acquisition campaigns taking place on the platform and manage access and storage of the new resources, by taking into account constraints of data security to maintain privacy.
- manage software versions of identity recognition, data fusion, developed before and after implementation in the platform.
- prepare and maintain demonstrations to showcase the work of researchers involved in the MobilMii platform
- develop pre-industrial prototype from these technologies in partnership with interested SME or Industry.

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HOMEBRAIN: A CASE STUDY

Jan Havlík[1], Lenka Lhotská[1], Marie Přibová[2], Petr Panýrek[3]

Abstract

A new project Home Brain – a TV computer – has been started in the Czech Republic. The paper deals with the pilot study of user's experiences. The group of users were used the new system for the evaluating period and after that they have told their meaning about the system during moderated discussion. They specified the most frequently used functions and the advantages of the system in their meaning. The paper introduces the results and overall summary of the study.

Keywords: smart home, HomeBrain, TV computer

1. Introduction

Currently there is an increasing demand for smart solutions for the elderly and impaired persons. The optimal solutions allow the elderly live at their natural environment – at home – instead of institutionalized care. [1]

A new project – Home Brain – has been started in the Czech Republic. Home Brain – the home TV computer - is the unique system put into practice in the end of 2011. The system is the product of more than five years of research and development and offers new possibilities of using assistive technologies in daily life. [2-3]

2. Realization

The system is designed as a small device like set-top-box connected to a standard TV set. The control of Home Brain is solved using a double-sided remote controller adapted to the elderly. It fulfils several main functions, namely gate to the internet, multimedia services, senior monitoring, health state monitoring, social networking, remote control of home devices, intelligent security system etc. Additionally, it can be connected to telebanking, e-services (including e-government), and other electronic services.

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There has not been proposed any system similar to HomeBrain in the Czech Republic yet. The system allows networking of the elderly (or handicapped persons) in the social sense without need to use sophisticated devices with complicated control.

3. Results

During the pilot study the Home Brain has been tested by 5 users, 4 women and 1 man, from 66 to 78 years old. The user experiences have been investigated by a moderated discussion. As a main advantage of the system the users highlighted the simplicity and the intuitiveness of system control. The respondents had no manuals, they learned only by using the system. They agree that the most important issue is to not be afraid of using the Home Brain. As the most frequently used functions they sign watching TV, using a TV archive (instead video-recorder), listening to radio, Skype calling, instant messaging, using the photo archive, managing details about their home (payments, important decisions, dates of medical visits etc.) and evidence of health status. [4]

The respondents have been also asked for arguments for potential new users. As crucial arguments they mention the simplicity of the use, the comfortableness, the enhancement of communication possibilities and the cheap opportunity to gain information.

4. Conclusion

The overall summary of the study has been done as an evaluation of benefits. The function benefits have been evaluated low, it means the system does not provide new possibilities, but only the integration and new comfort in comparison to formerly used devices. On the other hand the psychological and self-expressive benefits have been evaluated high. The system provides easy possibilities of communication with the family and friends, the users are pleased with watching pictures of their family etc. They are proud using a modern device.

Acknowledgement

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EVALUATION OF AAL MIDDLEWARE PLATFORMS

Myriam Lipprandt[1], Alexander Marinc[2], Tim Dutz[2], Guido Moritz[3], Marco Eichelberg[1], Reiner Wichert[2], Andreas Hein[1]

Abstract

In this paper we present preliminary results of an evaluation of existing AAL middleware platforms with regards to their suitability for "real life" AAL system development. The process of identifying the most important platforms already showed that the term "AAL middleware" is vague and has overlap with different domains like ambient intelligence (AmI) frameworks and home automation. The final list contained 54 platforms from research projects, industry and various open source projects. After applying three very basic rule-out criteria, only 10 platforms were left. This result, after years of funding, is certainly an alarming sign. Nevertheless there is hope that the second phase of deeper evaluation of the 10 remaining platforms, which is ongoing, will identify at least one platform suitable for the purpose of real-life AAL applications.

1. Introduction

Over the last years, many national and European AAL projects have not only developed assistive systems with the aim of providing improved autonomy for users at home, but also many "middleware platforms", i. e. reusable software infrastructure frameworks for the development of assistive systems. For the developer of a new AAL product the question arises which of these platforms might be a suitable, future-proof basis for system development. AAL middleware platforms comprise a wide range of technologies, architecture paradigms and domain-specific devices from home automation, consumer market and medicine. These components operate in a heterogeneous and distributed environment, where a middleware platform can be seen as the bonding between components. Such platforms should allow implementers to easily develop new AAL applications. Our goal is to evaluate the existing AAL middleware platforms with regard to their suitability for future usage and to evaluate their usability for system developers. Furthermore, the evaluation should indicate short and long term expectations for the sustainability and the usability for system

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developers. Both are significant, because many of the evaluated platforms have been developed in academia and are not proven to be usable in future productive environment.

2. Methods

At first we identified existing platforms fitting in the categories “AAL”, “Ambient Intelligence” (AmI), “Framework” and “Home Automation”. During this process, we noted that the boundaries of the AAL domain are not sharply defined. AmI platforms do not really differ from AAL platforms, only the services and the use cases make the difference. Our initial list contained 54 platforms from research projects, industry and various open-source projects. It is important to notice that boundaries of the different categories and domains often cannot be sharply defined. For example, it is hard to identify a specific feature as simple comfort function for everyone or required for daily living of elderly, because comfort functions may turn into AAL functions with increasing age or declining physical health and cognitive abilities. Thus, services and features may overlap. The difference is often only the use case.

Our evaluation of these 54 platforms is performed in an iterative, multi-level approach. The first step was to define mandatory criteria that were used to exclude all platforms not meeting them from deeper examination. 1.) Platforms that showed no “sign of life” (e. g. software update) for 2 ½ years, 2.) Platforms that were simply not available for download or purchase and 3.) Platforms that did not provide the ability to adapt the software to multiple AAL scenarios were excluded. In a second step, the usefulness of the remaining platforms for future AAL systems is tested using deeper evaluation criteria. However, this is an ongoing project that is beyond the scope of this paper.

3. Results

We aimed to include all significant platforms into our survey and so we had to extend our list several times over the course of our initial assessment. It quickly became apparent that limiting our considerations to platforms that were specifically labelled “AAL” would not reflect the actual market situation, though, and that there are indeed many other frameworks available that are capable of providing the required functionalities. From a technical standpoint, the differences between a platform that is supposed to provide the basis for “AAL applications” and a software framework that generally supports the implementation of home automation systems are indeed often marginal. If one considers, for example, the means to support network communication or the management of contextual information, it is obvious that these functionalities are not only required for AAL related applications. Consequently, one of our core findings was that a significant amount of software frameworks can be considered to support the development of AAL applications, even if these frameworks were not explicitly developed for the AAL domain. This holds especially true for a large number of frameworks that originate from the home automation domain. The industry has spawned a reasonable number of these and albeit many of them are commercial products that must be paid for and which are, therefore, not within our primary focus, we decided that for the sake of completeness, we should nevertheless include the more widespread ones into our survey.

We thus ended up with a total of 54 frameworks and platforms, divided among four different categories. The first category is made up of those platforms that have been specifically designed to support the development of AAL applications. All of these so-called AAL platforms originate from EU and national funded research projects. The second category comprises all middleware platforms that also come from scientific projects, but that do not belong to the first category (i. e., that are not specifically labelled "AAL"). The third group consists of the aforementioned industry provided solutions. Lastly, the fourth category is a selection of frameworks that can significantly support the development of AAL applications, but that do not fall into any of the other three categories. An exemplary member of this fourth category would be the OSGi framework.

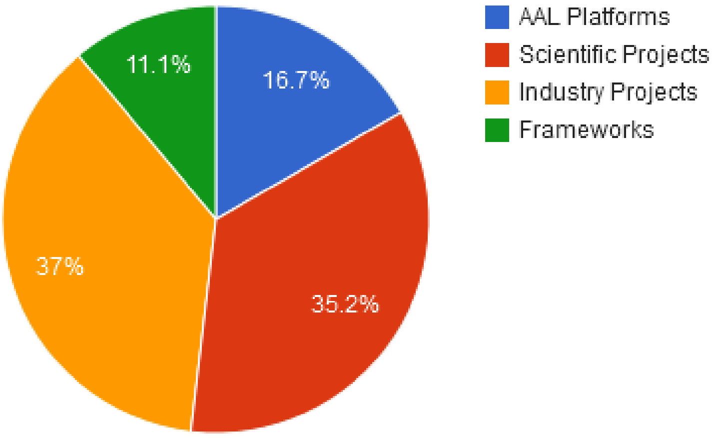

Figure 1. List of the AAL Middleware Platforms

In the following sections some details are provided for each of these groups. It should be noted, however, that despite careful research there is no guarantee that all relevant software frameworks were identified, and obviously in this paper we cannot provide detailed information about each of the platforms identified. Consequently, we will only provide a general introduction to each of the four categories and then cover the ten platforms that we have selected for deeper examination (for reasons to be pointed out below). Readers interested in the full list of platforms are encouraged to contact the authors for further information.

Category 1 - AAL Platforms

We have identified a total of nine platforms that have been specifically developed to support the implementation of AAL applications. The majority of these, which includes the platforms AMIGO, MonAmi, M-POWER, OASIS, PERSONA, and SOPRANO, stem from like-named European research projects that had already been finished by the time of our survey (summer of 2012). The three currently ongoing research projects dedicated to the development of AAL platforms are the projects openAAL, Netcarity and universAAL. Generally speaking, it must be said that we found the situation in this category to be highly unsatisfactory. For most of the platforms we had difficulties with simply acquiring detailed information, let alone retrieving source code or even executable software packages. If available at all, most project homepages also lacked recent updates which again hinted at a general disregard of the projects' results. Of the three ongoing projects, the universAAL project was the only one showing significant work activity. The openAAL platform, which is still supported by a German research institute, is itself based upon the universAAL platform. And although the Netcarity project claims to provide a platform of its own, we have not been able to get access to it as the project website provides no information whatsoever as to how this could be done.

Category 2 - Scientific Projects

This category is by far the largest of the four, as it includes a total of 21 projects (and the list could have been extended even further). Considering the focus of most of these projects, it is obvious that the question of how to achieve interoperability between heterogeneous devices is primarily of interest to the scientific community (in contrast to the closed-source platforms provided by the industry of which many focus on connecting and controlling only a specific group of devices, see below). However, many of these scientifically motivated projects, such as GENESYS, MisterHouse, OXYGEN, RUNES or SOCRADES, did not require detailed investigation from our side, as they had obviously been abandoned by their respective communities. As a rule of thumb, we excluded all projects from our considerations that had no activity within the last two years. On the other hand, some of the projects that do enjoy an active developer community revealed at further investigation that they do not have the appropriate scope for supporting AAL systems. Among these is the project IST-MUSIC, which focuses on the connectivity of mobile devices.

Fortunately we also found a set of very promising approaches in this category that are kept up-to-date by an active community of developers and users. Among these projects are the HYDRA middleware, which results from a European research project. Although the project has officially ended in late 2010, the project page is still maintained and the platform is being updated. Other examples include MundoCore, which is developed by the Technical University of Darmstadt, openHAB, which comes from a private development project, and openURC, which is an implementation of the according ISO standard (ISO/IEC 24752). Another interesting project is the OSAmI project, which does not focus on providing an all-in-one middleware platform but rather provides a set of distinctive solutions for the AmI area, all of which are based upon the OSGi framework.

Category 3 - Industry Projects

As already mentioned, most projects from this category deliver solutions that are tailored for use in very specific settings. A prominent example is the "RWE SmartHome", which is entirely based upon proprietary "Homematic" components and has a black-box approach that negates the possibility of extending or modifying the software. The same holds true for most of the other solutions, many of them offered by upstart companies that intend to benefit from the growing market for home automation systems. ReCon, RocketHome, Cestron, Mediola and myGEKKO are a few examples from this group. However, a few other projects stand out from the rest. Among these is the only open-source project that falls in this category which goes by the name of OpenRemote. Another manufacturer of home automation systems for assistance, safety and comfort is Gira which has managed to achieve an elevated status within this market sector. Another notable product is the IP-Symcon platform, which is capable of communicating with almost every established bus system for home automation. Indeed, in terms of *syntactic* interoperability, the IP-Symcon platform appeared to us as the most promising candidate of the entire list, a status that probably comes in part from the fact that the company has specialized in providing only a software platform, and does not offer an integrated solution for home automation that includes specific hardware components (different to most of the other vendors on the list).

Category 4 - Frameworks

We have assembled a variety of tools, standards and projects under the fourth category. Naturally, a "platform" should provide more support for the development of applications than only the functionalities that already come with sophisticated programming languages such as Java. However, we would like to point out that even a plain programming language can already provide a lot of support for the development of distributed applications. For example, the combination of the Java Remote Method Invocation Framework (RMI) and the Java Message Service (JMS) may not explicitly support the development of AAL applications, but will still provide a good communication infrastructure for such applications anyway. The same holds true for combining R-OSGi with the UPnP-standard. We should also mention the established ROS software (short for Robot Operating System), which provides a lot of functionalities that programmers will find useful when trying to implement AAL applications. Two more projects that fall into this category are Google's highly anticipated android@home project and the overdue Apache River Project.

4. Selected platforms

The application of three simple criteria significantly reduced the original number of 54 platforms to a subset of ten relevant ones. First, we decided to omit all projects that did not see activity within the last 2 ½ years, as they seem to be no longer supported by a community of developers. Secondly, we excluded all those platforms that were simply not available. Whenever a project did not offer the means to acquire software or at least buildable source-code, we dropped it from the list. Note that this did not lead to the exclusion of software that has to be purchased. The third criterion ruled out all those platforms that did not provide the means for adapting or extending the software to individual needs, e. g., by providing an API. As stated above, we ended up with a total of ten projects that managed to satisfy all of our criteria and which will thus be evaluated in more detail. These are:

- AAL Platforms: universAAL [1], and openAAL [2]

- Scientific Projects: HYDRA [3], MundoCore [4], openHAB [5], openURC [6], and OSAmI [7]
- Industry Projects: IP-Symcon [8], mBS Smart Home SDK [9], and OpenRemote [10]
- Frameworks: none

One might argue that ending up with a subset of ten out of originally 54 is already a disappointing result in itself. Furthermore, we feel the obligation to point out that the fact that a subset of the platforms managed to satisfy our criteria does not give any information about the quality of the platforms themselves, i. e., in how far they can support developers in the process of setting up AAL systems. But on the other hand, we would like to state that this is indeed another interesting finding of our survey: although there is obviously a demand for middleware platforms in the home automation/AAL segment, many of the projects that tried to provide platforms have either unintentionally failed or did intentionally limit themselves to the provision of solutions that can only satisfy a small group of potential users (the latter holds especially true for many of the commercial products).

5. Discussion & conclusion

We need to discuss why so much money has been invested into the field of AAL middleware platforms without an outcome that is even remotely in proportion to this funding. Out of 54 platforms, over 80% are ruled out. Only 10 platforms remaining after applying the simple "filter" of downloadable sources and software support. This is not what we had expected. Is it because the research projects aims at the functionalities of AAL applications and not on the implementation of AAL middleware platforms? Is the implementation of such a platform out of scope, so that every research institute builds its own platform in a "quick & dirty" manner? This could give an answer why there are so many non-active platforms and no sustainable maintenance was provided after the end of projects.

Another notion can be the process of inventing and establishing an innovation like AAL into a market. The bridge from research to a product is often a challenge and needs also to be pushed from the industrial side and maybe from the political side. AAL touches many domains (e. g. health care system and home automation industry), legal aspects and economic criteria, what leads to another point: Who is interested in an AAL middleware platform that can incorporate devices and services from different vendors? A black-box approach with proprietary software is a common business model among companies. The idea of AAL middleware platform is the opposite of a black-box. Companies have to open their philosophy from locking developers into a domain controlled system to an approach of interoperability with different vendors.
A third question is: How many AAL middleware platforms do we actually need? Many IT related markets have undergone a period of market adjustment and are now dominated by one or a few system families, which is just perfectly well. Perhaps the AAL market will also need just one or a few "major" AAL middleware platforms that meet the needs, no matter if it comes out of a list from 54 platforms.

The second phase of deeper evaluation of the 10 remaining platforms is currently in progress. For the time being it is an open question which of the remaining platforms will have the ability to fulfil the needs of flexible systems that can be adapted to many AAL applications. The authors hope there will be at least one platform suitable for the purpose of real-life AAL applications.

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EVALUATION OF AAL PLATFORM AND SERVICES: THE UNIVERSAAL CASE

DarioSalvi[1], Juan Bautista Montalvá Colomer[1], Maria Teresa Arredondo[1], StåleWalderhaug[2]

The universAAL project has an ambitious goal: creating the reference design and development platform for the Ambient Assisted Living. This means that not only universAAL will have to produce innovation in the field, but it will also have to convince all the domain stakeholders of the high quality of its outcomes, including manufacturers, industry, service providers, authorities, caregivers etc. The project is producing many complex and diverse artefacts including architectural descriptions, development tools and libraries and a set of example services for elderly. The final users of these artefacts are very assorted: elderly and disabled people, doctors, nurses, relatives, as well as software programmers, hardware manufacturers, system integrators. In such a complex scenario, an evaluation framework is necessary for ensuring that the “right things” are evaluated with the “right people” and the “right methods”.

1. Introduction

One of the problems related to the adoption of Ambient Assisted Living (AAL) in real settings is related to the maturity of the prototypes developed in the many AAL research projects. Currently, AAL is pushed mainly by technology, meaning that it is not always well designed for its final users, and does not always cover real needs [1]. The adoption of AAL technology depends on how the core stakeholders perceive the technology’s utility in terms of usefulness, robustness, ease of use, etc. In order to convince stakeholders, including manufacturers, industry, service providers, authorities and health organization, it is necessary evaluate such quality criteria in a coherent and rigorous way.

Many EU projects in the AAL field have struggled to assess and prove the quality of their outcomes, but have not been able to start a proper market yet. In order to convince markets, quality control is essential and should include also organisational and political aspects. Evidence should be acquired about the advantages of AAL so that decisions makers can address the correct investments. Evaluating AAL systems is a daunting task. A typical AAL system is based on several, complex and diverse artefacts, e.g. flexible and modular architectures, distributed systems, integrated sensors and actuators, innovative user interfaces, algorithms for reasoning and

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semantic extraction, development platforms and tools. Also the final users of these artefacts are very diverse: elderly, disabled people, health care professionals, friends and relatives, as well as software and hardware designers, programmers, integrators, and deployers. Evaluating all these artefacts with all their potential users can be extremely costly and time-consuming, or even impossible. The need arises to have a formal, solid-based framework that allows to prioritise what should be evaluated, with whom and how and in the correct way. Our work is focussed on generating such an evaluation framework within the universAAL project. universAAL[3] is a EU cofounded project with an ambitious aim: creating the reference design and development platform for the Ambient Assisted Living. This means that not only universAAL will have to produce innovation in the field, but it will also have to convince all the stakeholders of the high quality of its outcomes.

In order to assure this quality, universAAL dedicated effort for an entire workpackage for verification and validation, giving ita role of strategic importance. In the following we describe the ongoing work and some preliminary results, with a special focus on the way design and application of the evaluation framework.

2. Methods

Conducting a rigorous quality evaluation is a daunting task that must use good practice evaluation techniques and international standards. The main aim of an evaluation is to find some *evidence* of the quality of a product. Our framework is based on two pillars: a framework for creating theories in software engineering [2], and the standard ISO 25000 [3]. We utilize this theory framework to formalise the main objectives of our evaluation, what we call *Research Questions*(RQs).

The RQ is formulated to address whether a certain *quality characteristic* of a *given artefact* satisfies *a need of a particular user*. The artefact identifies the "what" to evaluate, the user the "whom with" and the quality characteristic and the need the "how" (e.g. "Does the usability of the service satisfy the need of simple interaction of elderly users?").

The selection of the needs, actors, artefacts and quality characteristic, follows a strict process. Regarding the artefacts, we have created a taxonomy of all the outcomes of the project, including software, tools and technical documentation. The taxonomy provides a simple way for the evaluator to sketch the variety of artefacts produced in a complex project as universAAL. For modelling the users and their needs, we analyse a consistent set of relevant documents (scientific papers, reports, etc.) and we create a model of "actors" and needs. While analysing these documents, every time a *quote* is found that relates to particular actor's need or artefact's quality characteristic, we assign a weight, depending on the relevance of the source. Eventually, by summing up all weights, it is then possible to prioritize which actors' needs we want to cover and which artefacts' quality characteristics are more requested. By linking actors' needs

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[3] www.universaal.org

and artefacts' quality characteristics we create the Research Questions as depicted in figure 1.

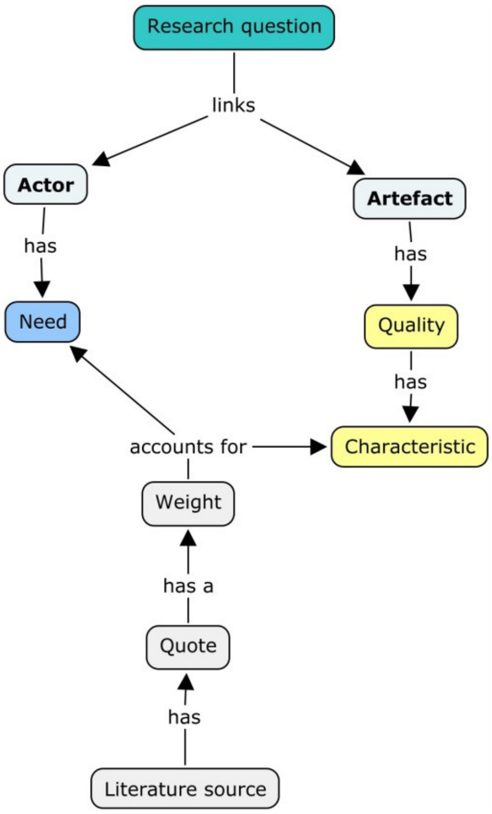

Figure 1. Research Questions model

The choice of the quality model for the artefacts and how these quality characteristics are actually measured, is not straightforward. For this purpose, we adopted the standard ISO 25000, SQuaRE (Software Product Quality Requeriments and Evaluation). SQuaRE distinguishes among *internal* quality characteristics, which are related to the code and do not rely on the execution of the software (e.g. code documentation), *external* quality characteristics, which are related to the running software, in relationship to the environment where they run on, other users that operate it (e.g. resource utilization, usability) and quality *in use*, which is related to when the system is used in its final context (e.g. productivity, satisfaction).

In universAAL we adopted the standard quality model and we extended it in order to include technical specifications like the definition of use cases or the architectural decomposition, which have a major relevance in the project.

The standard has been adopted also in the way it structures evaluations into steps. Specifically:

1. Establish Evaluation Requirements
The evaluation requirements are identified as Research Questions as mentioned before

2. Specify the Evaluation
In this step the specific artefact, quality characteristics, users and needs are selected for an assessment.

3. Design the Evaluation
Specific metrics and tools are selected for the assessment and a plan is created considering both theoretical and practical aspects.

4. Measure characteristics
Quality characteristics are measured with their final users. In the case of internal quality characteristics users are often not required and the assessment can be conducted automatically.

5. Compare with criteria
Measured values of quality characteristics are compared to target values

6. Assess results
The results of the evaluation are discussed and recommendations about what and how to improve are provided.

In order to ensure the relevance and the good quality of the evaluations themselves, we included a so-called *meta-evaluation* methodology. This consists in assessing the correctness of the evaluations, e.g. if problems occurred, if the right methods and the right users were chosen, the statistical relevance of the study. Therefore a further step must be added to the previous list:

7. Meta evaluation.
The objectives of the evaluation are compared with its actual execution and the RQs are revisited.

3. Results

We have used this framework for evaluating the universAAL outcomes that have been produced since now. Each evaluation required the elaboration of a proper strategy and proper assessment tools. Following, we enlist the main artefacts that have been evaluated and a summary of the adopted methodology for each one of them, a deeper discussion is not possible hereby, for details we invite to read the project's deliverables publicly available at its website[4].

[4] http://www.universaal.org/es/about/deliverables

- Reference use cases[5] and scenarios[6] have been evaluated with respect mainly to how understandable they are, how well they represent the AAL domain and how they have actually been taken into account in the implementation of universAAL. The adopted assessment techniques span from focus groups with external experts to online questionnaires in order to reach acceptable levels of insights and statistical relevance.
- The Reference architecture has been evaluated with a scenario-based methodology [4] which consist of iteratively assessing how use cases were well fit into the architectural description.
- Development platform and tools, under the internal quality perspective, have been evaluated with a set of selected automatic software metrics [5], [6]. The metrics have been executed within the continuous integration environment consisting of a Hudson[7] server with a set of installed plugins. Characteristics like test coverage, potential bugs and code style have been evaluated.
  Under the external quality perspective, a set of focus groups has been run with both developers of the project who were using the tools for building services and external developers who came in contact with the project.
- Example AAL services have been analysed only conceptually with relevant experts in the field where the services are thought to operate (e.g. health, security).

4. Discussion/conclusions

universAAL project is not over yet and there are still many artefacts that have to be evaluated while others need further assessments. For instance, services have been evaluated only for their design and not their actual implementation as they are still under development. The experience we gathered since now about our evaluation framework, although preliminary, is generally positive. The framework is providing a useful guideline for structuring and prioritizing evaluations in such a complex domain as AAL. Nonetheless the framework is still in a young stage and continuously evolving while we update our models and refine the assessment techniques.

Acknowledgements

We would like to thank the whole universAAL consortium for its contribution in this work. Parts of this work was funded by the EU 7th Framework Programme, Grant agreement no. 247950.

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ARCHITECTURAL CHALLENGES IN CONSTRUCTING AN AAL SYSTEM; LILY APPROACH

Serge Smidtas[8], Vadym Kramar[9], Markku Ojala[10]

1. Introduction

We provide an overview of the architectural design issues involved in the LILY project and describe how three different approaches can be brought together. We will also discuss some standardization issues. In a given work, the architectural challenges involved in developing AAL systems are observed from the viewpoint of the LILY project. The idea of the work is to share practices and initiate a discussion in search of a highly interoperable system with a reduced number of limitations.

The Lily project came from three very distinct approaches, focused on original services that are delivered to *elders* and care-takers. The services have been already delivered for years. These services have been *independently* developed, each bringing added value for *elders*.

- Pandora (Siperia Systems, siperiasystems.com) is a service system that manages all professional help services for elders' homes, including billing, planning, organizing.
- UbiHomeServer[11] (Oulu University of Applied sciences, oamk.fi) is a reusable modular architecture allowing delivery of a variety of services through an original user interface designed for TV, mobile, and touch-screen devices.
- VisAge (Camera-Contact, camera-contact.com) is a group of services broadcasted to elders' touchscreen terminal.

[8] VisAge Camera-Contact
[9] Oulu University of Applied Sciences
[10] Siperia Systems Ltd
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Figure 1. Main view of the UbiHomeServer GUI

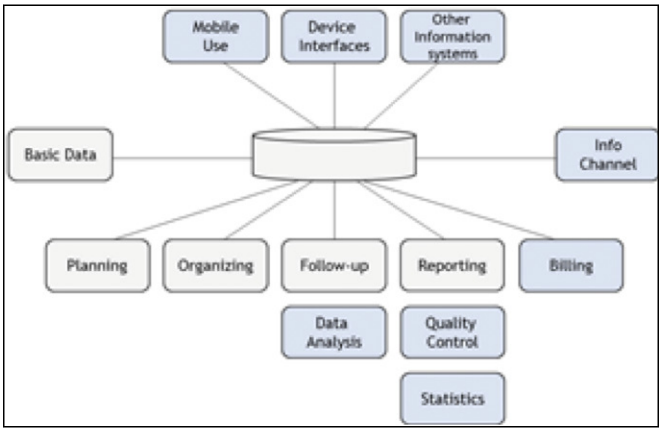

Figure 2. Managed data of Pandora

Figure 3. Sample view of the VisAge system

2. The LILY project

In the LILY project the Ubiquitous Home Environment (UHE) is considered. The UHE is a user-centric set of systems that serve users in domestic environment and expanding its services to public and professional environments. An essential part of the UHE is a serving engine. Serving engine may be implemented in a form of a dedicated in-house server, or built on a base of a modular framework that may be distributed among few computing devices. The serving engine achieves interoperability with the UHE infrastructure through a variety of generic and dedicated modules. The serving engine should expose a number of GUIs to a variety of end-user or terminal devices.

In the following, a focus is on the architecture required to manage services delivered to the end-users through UHE, but not on the added value of those services for the elders.

All middleware have shared properties, such as the following:

- Interoperability with execution environment (that may be hidden behind well-defined APIs)
- Data repository (that may be located in the cloud)
- Front-end user interfaces (that may be web-based)

Examples of integrated services in the three systems:

- Reminders of appointments with professionals
- National news page adapted to elders
- Preventive Health program

universAAL[12] platform allows Web Services to dialog with its Service Bus. The APIs of that part of universAAL platform are still to be mature, and some limitations can be predicted – such as limitations of the Service Bus itself. The other two buses of universAAL platform – that, for example, allow services to interact between themselves, are not accessible to remote services. Also, a service is not allowed to adapt itself to the habits of an elder analysed by a distinct service embedded in the platform.

One aim of the Lily project is to tackle the interoperability of services for elders that are already functioning and to study the extent to which different parts of the systems can be exchanged and made interoperable.

[12] http://universaal.org/

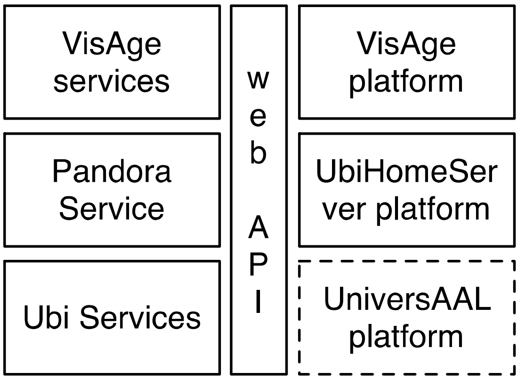

Figure 4. A common shared API between services and platforms

Description of interaction of remote services in the VisAge system.

In the VisAge system, we adapt broadcasted content using unintentionally given information, gathered from the elders. Elders tend not to be motivated or to have the capacity to click on 'like' buttons, and to configure and maintain computers, so we need to understand their interests without counting on their interaction.

For that purpose, we use a camera to monitor activity of elders when content is shown on the screen. The algorithm that detects movements and the face detection that uses Haar classifiers together annotate the log of recorded events. The impact of the content shown is measured by the correlation between the event window, with the movement and face detection timing-diagram. The goal is to determine which content attracted the elder closer to the screen, or made him interact with the screen, and to determine which content was boring and led the elder to leave.

This information is then consolidated and integrated with intentionally given information. The first kind of intentionally given information comes from the social network of the elder, such as helpers, subscribers of the e-service, or family. The second kind of intentionally given information comes from the elder himself by touching the screen anywhere and specific buttons, such as 'like' buttons.

The computed score of interest is then used to choose at the right time which service is the best to display on the full screen.

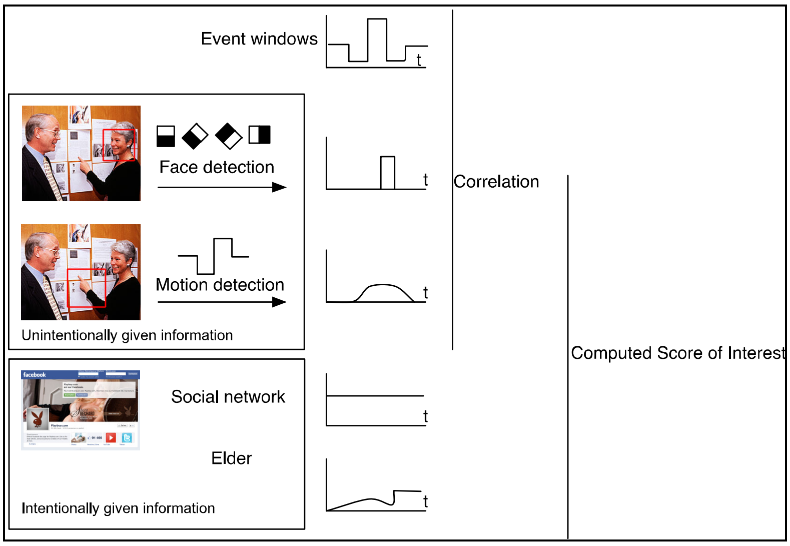

Figure 5. VisAge service interaction

Architectural description of VisAge System

The VisAge system relies on a framework to broadcast e-services through the elder's terminals. The elder's terminal is composed of a touch screen that is always on. The screen displays content from e-services. E-services can be hosted anywhere on the Internet. For example, distant e-services can show local weather or deal with fall prevention, serious game for health, social interaction, telemonitoring, or connecting people to other people. Registering a new e-service that an elder would be allowed to subscribe to, or be subscribed to by an helper, requires OAuth and webservice WSDL function access. Examples of functions accessible through the webservice are as follows:

- setUserWall allows an e-service to write on the 'wall' of the elder and share information with other e-services.
- getUserLastActivity returns the last e-services broadcasted.
- getUsersSeeingMe returns the social network persons accessing a user's information.
- getActimetry returns the activity diagram of an elder so that, for example, a service can interrupt itself if the user goes away.
- setServicePriority sets the priority of the e-service itself. A service with a (normalised) high priority at a given time will have more probability to be displayed on the screen. For example, for an e-service showing an RSS-feed, if fresh news arrives, the service can increase its priority.

Lastly, a distinct JavaScript API provides some required common functionalities, such as adapting Web content to touchscreen interfaces and virtual keyboards.

3. Conclusion

We have seen that services adapted to elders require original service interaction, far more intrusive than many existing systems could accomplish, accessing the whole user history and activity.

It is very important to have a broader look at the AAL solutions and consider community aspects at any stages of projects. Service platforms or serving engines are in scopes of many AAL projects. User groups are often well defined, namely end-users and developers. But the rest of the community - service providers and content suppliers are not less important. Excluding them from a scope of research and development work may cause a failure of the entire ecosystem regardless of how well it is engineered. It is sometimes forgotten that engineering solutions are not for engineers, and for them - to become real world solutions - attractive monetization schemas are required in addition to end-user satisfaction. Those schemas are possible under a condition of low-effort low-cost opportunity for business entities to enter the ecosystem. Thus technology match and standardization has to be considered at a variety of levels ranging from basic technologies till business processes allowing a seamless inclusion of stakeholders into the ecosystem.

Acknowledgment

The 2012-2015 Lily project is partly funded by the Ambient Assisted Living European Association and the national funding agencies Tekes and ANR.

VIDEO MONITORING FOR ACTIVITIES OF DAILY LIVING RECOGNITION

Konstantinos Avgerinakis[1], Alexia Briassouli[1],
Ioannis Kompatsiaris[1]

Abstract

A novel algorithm for helping patients with dementia, based on computer vision and machine learning technologies, is presented. Static and wearable cameras are used in order to record the activities that an elder performs throughout day. The goal of this task is to recognize daily activities of the patients with dementia in order to develop behavioural profile and be able to track the progress of their condition and detect potential deteriorations

1. Introduction

The worldwide increase in life expectancy (Figure 1) entails age-related health issues, multiplying healthcare costs every year, among which dementia is prominent, with a new case every four seconds. Although currently more common in high-income countries (Figure 2), dementia is expected to increase significantly in developing countries, which are projected (http://www.alz.co.uk/research/statistics) to account for 71% of cases by 2050 (Figure 3). Technologies that monitor activities of daily living (ADL) can allow a person with dementia to remain independent, reducing the burden on family/friends and decreasing healthcare costs. They also offer an increased sense of safety, since emergencies can be detected and appropriate feedback will be provided to assist the person with dementia in daily life and cognition issues.

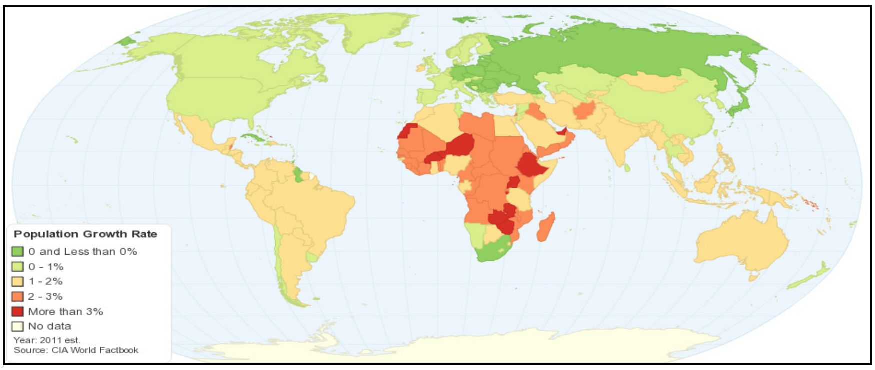

Figure 1. Worldwide population growth rate.

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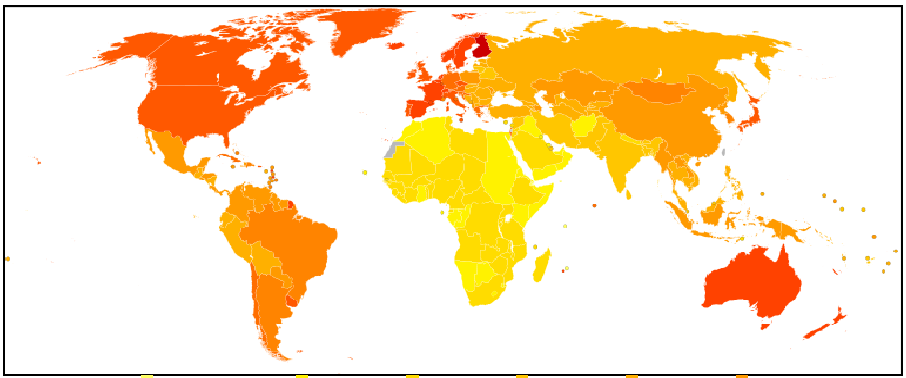

no data , less than 100 , 100-120 , 120-140 , 140-160 , 160-180 , 180-200
200-220 , 220-240 , 240-260 , 260-280 , 280-300 , more than 300

Figure 2. Alzheimer's and other dementia diseases per 100.000 inhabitants in 2002.

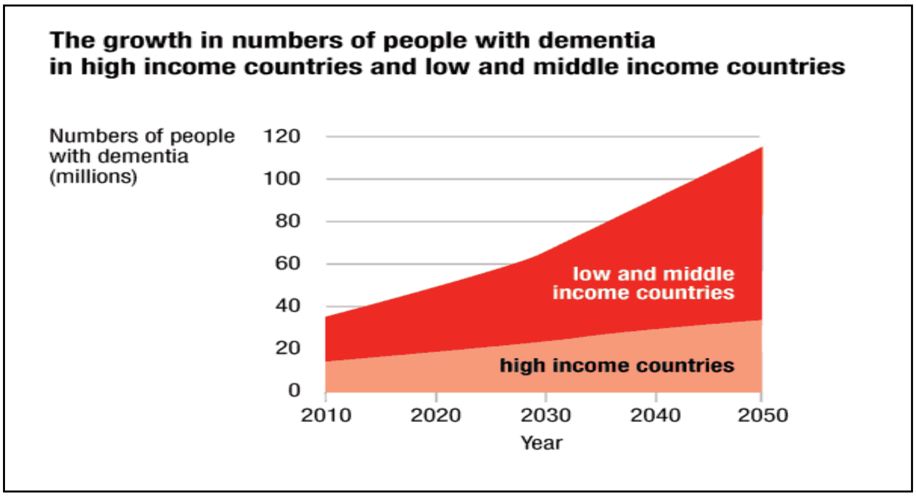

Figure 3. Increase in cases of dementia in high, middle and low income countries.

We propose a solution for remote monitoring that provides alarms when unusual events occur or the person cannot carry out usual daily activities. Recognition of activities of daily living has taken place in [1],[2],[3]. Our innovation lies in the fact that we successfully combine machine learning techniques (SVMs) with computer vision algorithms for extracting appearance/motion features and optimized trajectories via statistical signal change detection, to recognize daily activities. More specifically, the innovations that we introduce are:

1. A new statistical model, based on kurtosis metric, for separating static from moving pixels, so that we can reduce the computational cost of the action representation procedure.
2. A novel statistical model, based on CUSUM, for selecting optimal and meaningful lengths for the construction of each action trajectory vector.

3. The use of a hierarchical k-means tree, based on which a vocabulary tree could be built and will be used for defining the set of actions that performed in videos. Additionally, we propose the use of an inverted index file which will be used to describe fast and discriminatively the actions that occur in each video.

Early systems for real-time video monitoring are already in the market, increasing the independence of people with dementia and reducing related healthcare costs. People can continue to live in their homes unassisted, nursing homes can be decongested, friends and relatives can resume work. The cost of such a system is lower than providing help in the person's home and will further decrease as technologies improve. The independence it offers will also increase as the accuracy of the monitoring and resulting feedback improve.

2. Methods

The concept is based on unobtrusive monitoring of a person with dementia, the only requirement being to place cameras at home. The caretaker can continuously monitor them in real time and is automatically notified of abnormalities. Furthermore, monthly reports from the automatic video monitoring are provided to doctorsand an assessment-diagnosis can be compiled depicting the progression of each patient's condition.

Motion statistics and appearance features in conjunction with fast machine learning techniques are combined to deal with realistic scenarios. We extract dense trajectories for foreground subjects and appearance and motion descriptors represent actions after statistical change detection-based temporal segmentation. A vocabulary based on these features is used to cluster actions and train an SVM. This database of actions can be stored and used for testing new sequences in real-time.

2.1 Trajectory estimation from dense optical flow

For separating static from moving pixels, motion estimations (optical flow) are analysed statistically using Kurtosis metric. When there is no real motion, non-zero motion values are induced by noise, corresponding to hypothesis H0, and are therefore assumed to follow a Gaussian distribution, while real motion introduce deviations from Gaussianity (hypothesis H1)

$$H_0 \ : \ u_k^0(r) = z_k(r)$$

$$H_1 \ : \ u_k^1(r) = u_k(r) + z_k(r)$$

Where $u_k(r)$, $z_k(r)$ denotes true and noisy motion values respectively. The kurtosis G2 of Gaussian data is equal to zero and is used to detect whether motion is caused by noise or by changes in optical flow. The unbiased estimator of for kurtosis G2 is given by:

$$G_2[y] = \frac{3}{W(W-1)} \sum_{i=1}^{W} (u_i(r)^4) - \frac{W+2}{W(W-1)} (\sum_{i=1}^{W} (u_i(r)^2)^2$$

Where W is a manual chosen temporal window from which motion values are obtained. Kurtosis values are significantly higher in regions of pixels whose motion changes.

2.2 Sequential change detection on trajectories for temporal segmentation

Sequential change detection, namely Cumulative Sum (CUSUM) method is applied to HOF descriptors, so that we can obtain optimal trajectories. HOFs of the first w0 frames H_0 = f{h1,h2, …,hw0} are considered to follow an initial distribution f0, approximated as a multi-variate Gaussian, with mean and covariance matrix respectively given by:

$$\mu_0 = \sum_{i=1}^{W_0} h_i, C_0(i,j) = E[(h_i - \mu_0)^T (h_i - \mu_0)] = \frac{1}{W_0} \sum_{i=1}^{W_0} (h_i - \mu_0)^T (h_i - \mu_0)$$

And is compared at each frame k, with the "current", estimated from the w_0 frames before, and including, the current one, i.e. frames k-w0+1 to k. Corresponding pdfs are given by:

$$f_{pdf=0,1}(h_i) = \frac{1}{(2\pi)^{N/2} |C_{pdf=0,1}|^{1/2}} \exp(-\frac{1}{2}(h_i - \mu_{pdf=0,1})^T C^{-1}_{pdf=0,1}(h_i - \mu_{pdf=0,1}))$$

Where pdf=0,k=1 denote the initial and current pdf correspondingly. $\mu_1 = \frac{1}{W_0} \sum_{i=k-W_0+1}^{k} h_i$ and $C_1(i, j) = 0$ for $i \neq j$, $C1(i, i) = E[(hi-\mu_1)^T(hi-\mu_1)] = (\sigma_{i,1})^2$. In order to determine whether a change in motion occurs, the log-likelihood ratio can be used as a test statistic Tk, to be incorporated into the CUSUM test, so we have: $T_k = \log(\frac{f_1(h_k)}{f_0(h_k)})$. The CUSUM test is given by the iterative form: Sk = max(0,Sk-1+Tk), S0 = 0. For Gaussian data under each hypothesis H0 and H1, the test statistic, i.e. the log-likelihood ratio, becomes:

$$Tk = \frac{1}{2}\ln(\frac{|C_0|}{|C_1|}) + \frac{1}{2}((h_k - \mu_0)^T C_0^{-1}(h_k - \mu_0)) - (h_k - \mu_1)^T C_0^{-1}(h_k - \mu_1)$$

with diagonal covariance given by: $Ci = diag[(\sigma_{i,1})^2,(\sigma_{i,2})^2,...,(\sigma_{i,N})^2]$,i = {0, 1}, where $(\sigma_{i,k})^2=E[(hi-\mu_1)^T(hi-\mu_1)]$, k=[1,2,…,N]. The inverse of each diagonal matrix is given by: $C_i^{-1}= diag[1/(\sigma_{i,1})^2 , 1/(\sigma_{i,2})^2,..., 1/(\sigma_{i,N})^2]$, and the determinant of each diagonal matrix is given by $|C_i| = \prod_{j=1}^{N} \sigma^2_{i,j}$, i={0,1}. By plugging in Tk equation into S_k at each frame, we get a value for the test statistic which significantly increases when there is a change in our data. This leads to the temporal segmentation of the extracted trajectories based on actual changes in motion, rather than their segmentation using a manually selected constant threshold.

3. Results

Evaluation uses a standard benchmark dataset[2] (Figure. 4) and results are analysed on Table 1 and Figure 5. We can observe the boost that hierarchical k-means introduce to the recognition system as the size of the vocabulary words increases. Furthermore, HOGHOF action representation seems to perform quite well when the vocabulary is large and the trajectories length have been set manually while on the other hand HOGHOF with optimal trajectories (ChDetHOF) perform better when the vocabularies are smaller (Figure 5). Activities that were confused were either too similar to each other, such as answering phone with dialling phone, or were induced by small motions, like use silverware and peel banana (Table 1). Detected activities and patterns can be fed back to the caretaker and combined with other monitoring devices to draw conclusions on the person's condition.

The most important issue is interference in the user's personal life and privacy: Users are volunteers fully informed of the monitoring. The Charter of Fundamental Rights of the EU [4] will be respected and data will be stored and transmitted complying with the provisions of EU Directive 95/46/EC [5]. Private locations and faces are not recorded to ensure ethical regulations of individual countries are respected.

2http://www.cs.rochester.edu/~rmessing/uradl/

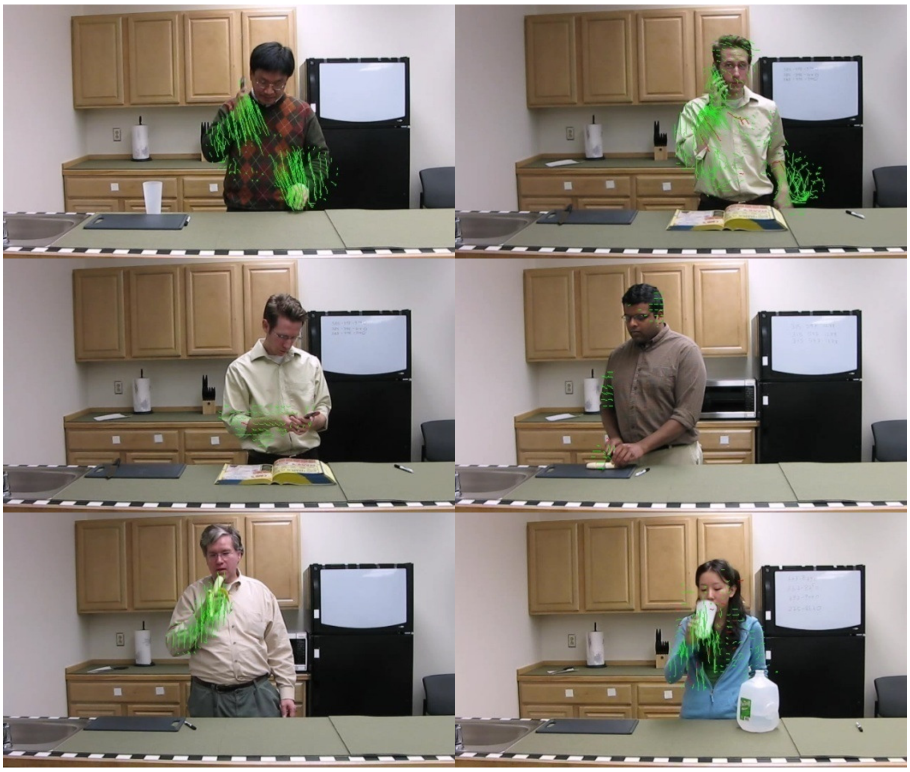

Figure 4. From top to bottom and left to right we have the activities: answer phone1, answer phone2, dial phone, chop banana, eat banana, drink water.

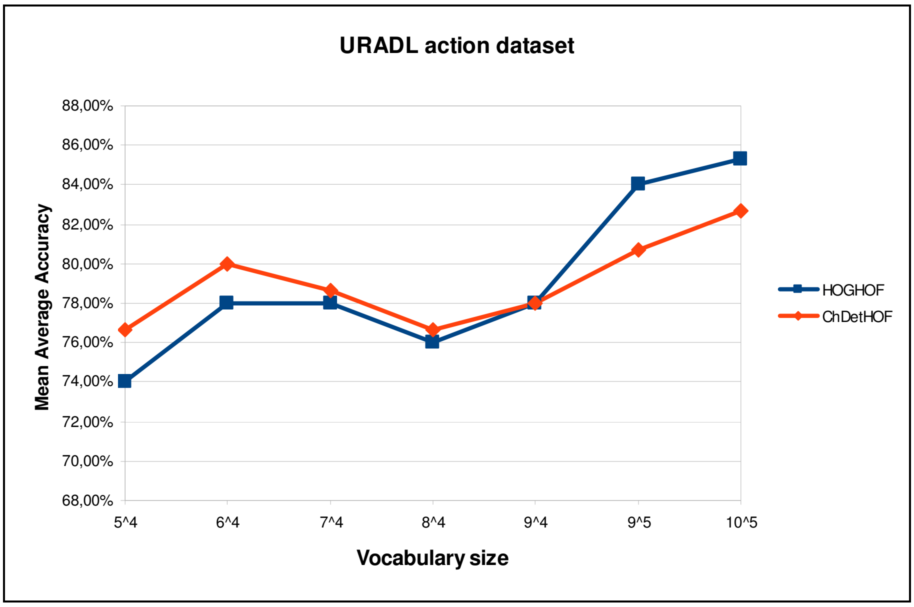

Figure 5. Action recognition results for each trajectory implementation when using different vocabulary sizes.

Table 1. Best recognition rates for 10 activities: AP(Answer Phone), CB(Chop Banana), DP(Dial Phone), DW(Drink Water), EB(Eat Banana), ES(Eat Snack), LiP(Lookup in Phonebook), PB(Peel Banana), US(Use Silverware), WoW(Write on Whiteboard).

			HOGHOF ChDetHOF							
	AP	CB	DP	DW	EB	ES	LiP	PB	US	WoW
AP	**0,67**	0	0,27	0	0,07	0	0	0	0	0
CB	0	**0,93**	0	0	0	0	0	0,07	0	0
DP	0,27	0	**0,73**	0	0	0	0	0	0	0
DW	0	0	0	**1**	0	0	0	0	0	0
EB	0	0	0,07	0	**0,8**	0,13	0	0	0	0
ES	0	0	0	0	0	**1**	0	0	0	0
LiP	0	0	0	0	0	0	**1**	0	0	0
PB	0	0,07	0	0,07	0	0,13	0	**0,73**	0	0
US	0	0	0	0,13	0	0	0	0,2	**0,67**	0
WoW	0	0	0	0	0	0	0	0	0	**1**

overall accuracy :	**0,853**

Acknowledgement

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http://www.cs.rochester.edu/~rmessing/uradl/

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[4] http://www.europarl.europa.eu/charter/pdf/text_en.pdf

[5] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31995L0046:en:HTML

IMPLEMENTATION AND DETECTION OF ADL-PARALLELISM BASED ON SMART METER

J. Clement[1], J. Ploennigs[1,2], K. Kabitzsch[1]

Abstract

People living alone are afraid of having accidents at home that no one recognizes. Technical innovations for assistance, such as activity and ADL detection, should be inexpensive, easy to install, not body-worn and, unobtrusive. Smart Meters provide such a way, as their installation is promoted in Europe and the US per edict. ADL detection improves the identification of dangerous situations and notification of relatives and care givers. It will increase the feeling of security of the family and the elderly, who can stay self-determined. A novel impulse approach is introduced that determines parallel ADLs by modeling the behavior of the human forgetting curve. The approach increases the ADLs that are relevance for an appliance on every use of it.

1. Introduction

The demographical change all over the world creates new needs and challenges for technical innovations. Older people have a strong desire do stay self-determined in their own well-known homes. Unfortunately, they suffer from normal age-related, physical degeneration and are exposed to a higher fall risk and diseases that reduce their abilities in everyday life. Even if they are not directly affected, elderly and relatives are often burdened by the fear that such things may happen if the elderly is alone and nobody detects it. Technical inventions can help these people and support the home care and increase their quality of life.

2. Approach

Common approaches require to equip the flats or the persons with multiple, dedicated sensors. This makes the solutions very cost intensive and many elderly are not able to pay for them. Many systems also add a stigmatization problem, as the sensors indicate and remind the people and others of problems. This paper focuses on a low cost approach to monitor human behavior in single households by the usage of smart meters. Smart meters are getting common and their installation are promoted in the US and Europe by laws [1]. Smart meters enable the simple monitoring of a building's energy consumption down to individual devices. This can be used to detect *Activities of Daily Living (ADL)*. ADLs are common activities a human is performing in his

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home, for example: nutrition, grooming, or using the toilet [2]. Monitoring these ADLs can help elderly to stay longer in their homes and care givers to provide individual services.
A novel impulse approach is introduced that determines parallel ADLs by modeling the behavior of the human *forgetting curve.* This also improves the detection of critical situations, long period analyses to detect slowly upcoming diseases, seasonal depending and more. In result, ADL monitoring is more accurate, such that relatives and care givers can better rely on the information and system to save costs.

3. Monitoring system

The ADL detection is currently developed in the AUTAGEF-Project [3]. Its goal is to develope a cheap and not body-worn monitoring system for single households to detect health critical situations and to support relatives and care givers. Central to this approach are smart meters. Their data is logged and analyzed by a so-called Smartbox. The box can be installed next to the smart meters that are commonly hidden in a compartment in the apartment [4]. This way the devices are not noticeable by the occupant or visitors. The Smartbox supports the connection of various interfaces from standardized network protocols to serial interfaces. This allows the interoperable integration of different devices such as sensors, actuators and smart meters. This all-in-one solution addresses particular elderly with a low budget.

In our approach the apartment will only be equiped with smart meters for electricity, water and heating. Other sensors could be added, but are not mandatory. Raw data from the smart meters is only temporarily stored on the Smartbox during modeling process. Data reuse for other applications, e.g. energy management and billing, is only possible with aggregated, anonymized data and restricted to what the user permits. On the one hand, this permits business models to refinance the system by energy savings [4]. On the other hand it addresses the big ethic thread of the misuse of data. In dialog with lawyers, we created an anonym system with no unlimited storage where only in danger preselected information is sent to helpers. The system is unobtrusive and thus causes no stigmatization.
The approach is developed in close contact with end users that are periodically invited for discussions, surveys and tests. Therefore, demonstrators are installed in a show room and in a detached house of a senior, who permanently evaluates the daily use.

4. Impulse ADL detection

The impulse approach consists of three phases. Within the *initialization phase* home appliances and their relationships to possible ADLs are defined. Subsequently the behavior model including the impulse approach is learned in the *training phase*. This model will be compared to current smart meter data to find abnormalities in the *application phase*.

4.1 Initialization phase

During the *initialization phase* general information are gathered about the apartment's layout and available home appliances that are relevant for ADL-detection. Appliances can be categorized as static or mobile. Static appliances can be assigned to a certain room whereas mobile appliances can be used in any room. Some appliances work permanently without any user activities. These activities have to be defined and filtered. Figure 1 displays a three room apartment with the assignment of home appliances. For each appliance a consumption profile is trained that is used by the smart meter for identifying the appliances. Figure 2 shows some examples. Obviously some consumption characteristics are identical for different appliances such as the lights in different rooms. A differentiation is not directly possible, but can be done by analyzing the temporal and spatial correlation of events.

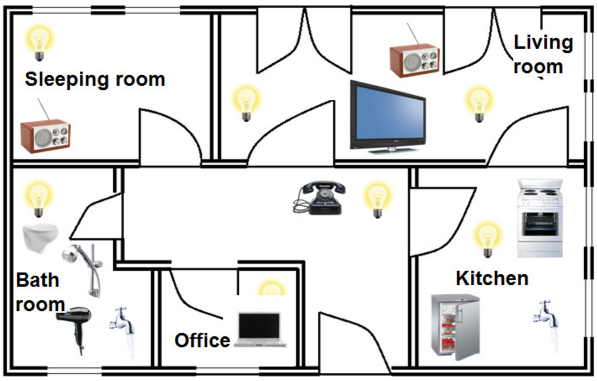

Figure 1. Assignment of home appliances to apartment rooms.

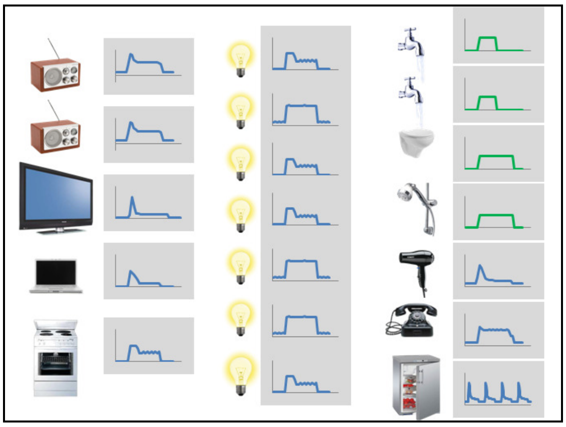

Figure 2. Assignment of smart meter consumption to home appliances.

The paper focuses on basic ADLs like eating, sleeping, hygienic, sanitation, cooking, household or media. Each ADL can be defined by its typical set of *actions* that differ in their temporal order. Actions are related to the usage of home appliances where one appliance can be assigned to different actions. The temporal order is crucial to identification of the currently executed ADL and not all previously assigned appliances have to occur in an ADL. It gets event more challenging considering the parallelism of actions and ADLs. For example, the ADL *cooking* is addressed by several appliances such as: oven, water boiler, fridge, tap, mixer and the kitchen light, where the ADL *household* (cleaning the kitchen) refers to the tap, fridge, vacuum cleaner and kitchen light. An event stream like: *kitchen light – fridge – tap* refers to both ADLs and an event stream: *kitchen light – fridge – radio – tap* refers in addition to the ADL *media*. The challenge is now to identify the right ADLs that are executed.

Therefore, a *general relevance weight* is assigned to appliances. It describes how commonly the appliances is used for the ADL and will be individualized during training. Figure 3 shows a screenshot of the data collection interface.

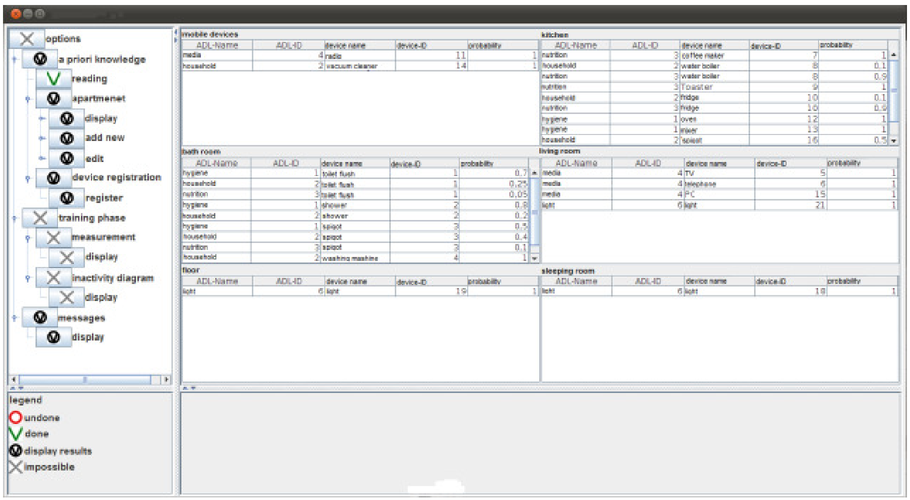

Figure 3. Software screenshot that displays rooms with assigned appliances and its probabilities.

4.2 Training phase

Based on the information gathered in the *initialization phase* a behavior model is created in the *training phase*. As described in [5] a Semi-Markov-Model (SMM) is trained and the general relevance weight $G_a(e, a_i)$, which describes how commonly an appliance $e \in E$ is used for the ADL $a_i \in A$, is computed. Figure 4 displays the resulting SMM for one day. States are defined by concurrent active appliances which are assigned to rooms (colored background) and to ADLs (colored underlines).

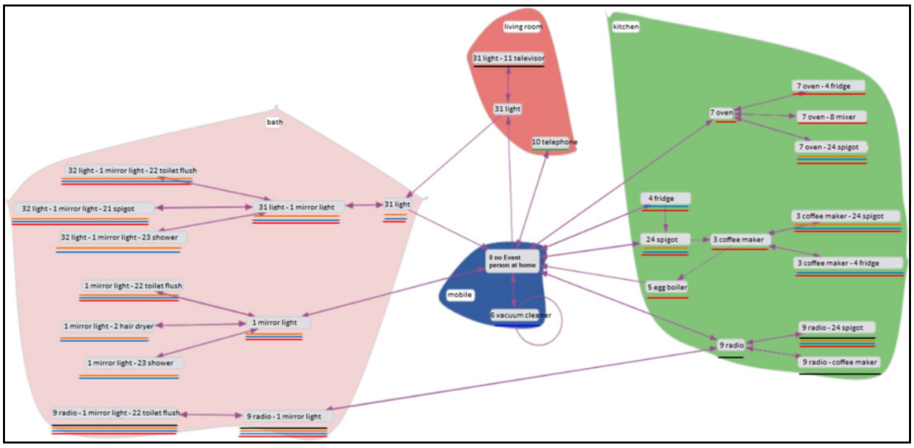

Figure 4. Semi-Markov-Model: states are assigned to rooms which are highlighted by different colors. States are also assigned to ADLs marked by colored underlines: orange: sanitation, blue: household; red: nutrition; black: media; green: telephone; white: shopping.

The SMM approach combines concurrent appliances in a single state. This allows to model parallel executed actions [5] and overcomes the common assumption of sequential actions in modeling ADLs [6]. But, it has limitations in identifying parallel ADLs, caused by the Markov property of independent states and the temporal classification of the SMM.

The impulse approach eliminates that by analyzing the temporal correlation of events. Succeeding events assigned to the same ADL will be emphasized while longer time intervals have less impact. The impulse curve $I_{a_i}(t)$ of an ADL a_i bases on a modified version of the human forgetting curve [7] using the exponential decline function:

$$I_{a_i}(t) = \sum_{e \in E} \begin{cases} G_a(e, a_i)\left(0.2 + 0.8e^{-d(t-t_{on})}\right), & active \\ G_a(e, a_i) b_{on} * e^{-d(t-t_{off})}, & inactive \end{cases} \quad (1)$$

with the general relevance weight G_a (e.g. Tab. 1), the decline factor d , the last impulse value from active state b_{on} and the last event times t_{on} and t_{off} of the appliance activation and deactivation.

On activation of an appliance, an impulse is created in the assigned ADLs. The impulse declines exponentially to 20% as long as the appliance is on. If an appliance is deactivated the value decreases further.
Figure 5 displays the impulse curve from a single apartment over one day for five ADLs: *sanitation, household, nutrition, media* and *sleep.*
Figure 6 shows the impulse response for a single appliance (toilet) switched on twice within a short period. Thus, the second impulse raises higher than the first one. The

appliance is assigned to three ADLs (red: sanitation, blue: household, green: nutrition). In this case G_a (Tab. 1) has a major impact as the appliance is mainly assigned to *sanitation.* Figure 7 shows a more complex sequence of activity. The corresponding SMM-part is shown in Figure 8. First the *radio* in the kitchen was switched on followed by the *mirror light* and the *toilet flush* in the bathroom. After the usage of the *toilet flush* the *mirror light* was switched off and the *radio* remains. The yellow curve in Figure 7 belongs to the *media* ADL and raises at 10:37 am when the radio is turned on. Over time it falls into the background due to the exponential decline. During that time the appliances mainly assigned to the *sanitation* ADL (toilet flush, mirror light) are used within a short period, such that the red impulse reaches its climax at 10:41 am and exceeds the *media* ADL. At 10:45 am all appliances are switched off and the *media* ADL is again the dominating impulse as it was the last one deactivated. The graph reveals that the *sanitation* ADL was executed in parallel to the *media* ADL. This process is obvious by visual analysis, but needs to be automatically evaluated. Therefore, the area of each ADL's impulse per minute is summarized. The results are listed in Table 2 and plotted in Figure 9. Going down the rows in Table 2 reveals that first the *media* ADL, then the *sanitation* ADL, and last the *media* ARL were dominant. The aggregation over all active appliances shows that the *media* ADL was the mainly executed ADL.

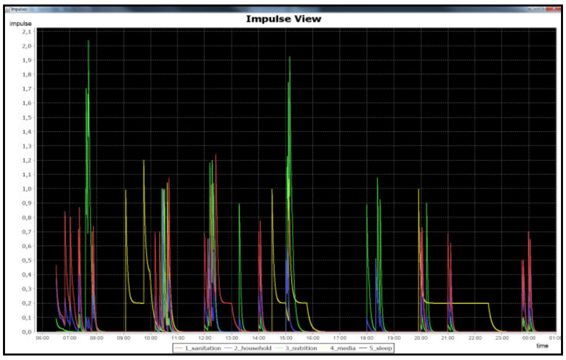

Figure 5. The ADL significance level of one day.

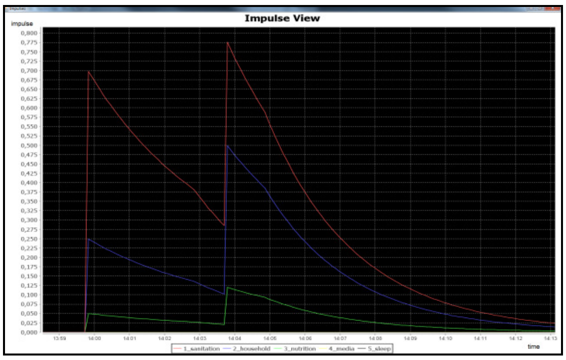

Figure 6. Zoomed part of Figure 5 displaying one active appliance assigned to three ADLs.

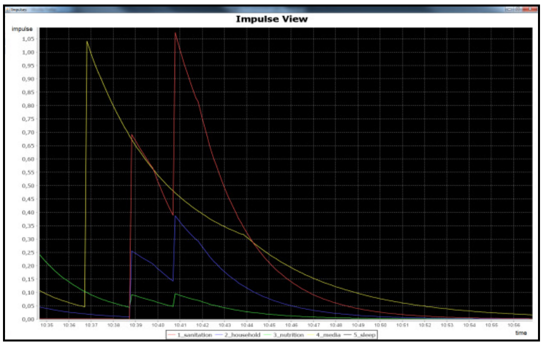

Figure 7. Zoomed part of Figure 5 displaying the corresponding impulse to Figure 8.

Table 1. Weighted allocation of appliances from the structure shown in Fig. 8 to the corresponding ADLs.

Appliance	ADL	Weight G_1
radio	media	1.0
	sanitation, household, nutrition	0.0
mirror light	sanitation	0.6
	household	0.2
	nutrition	0.2
	media	0.0
toilet	sanitation	0.70
	household	0.25
	nutrition	0.05
	media	0.0

Table 2. Area calculation for the significance of each ADL with the maximum of each line highlighted.

time [h:min]	*sanitation*	*household*	*nutrition*	*media*
10:36	*42*	*1210*	*6405*	*11752*
10:37	*31*	*906*	*4796*	*56493*
10:38	*6202*	*2767*	*3397*	*42902*
10:39	*37831*	*13896*	*4760*	*37378*
10:40	*36171*	*13160*	*3879*	*30190*
10:41	*49923*	*17978*	*4363*	*23867*
10:42	*40225*	*14470*	*3474*	*23870*
10:43	*23558*	*8480*	*2036*	*18980*
10:44	*16912*	*6088*	*1462*	*17389*
10:45	*10202*	*3672*	*882*	*12713*
10:46	*6796*	*2444*	*587*	*10157*
10:47	*4476*	*1611*	*387*	*8036*
10:48	*3190*	*1148*	*276*	*6925*
10:49	*1930*	*695*	*167*	*5070*
sum	*237491*	*88525*	*36869*	*305722*

Figure 8. Zoomed part of the SMM in Figure 6 representing a structure of human habit.

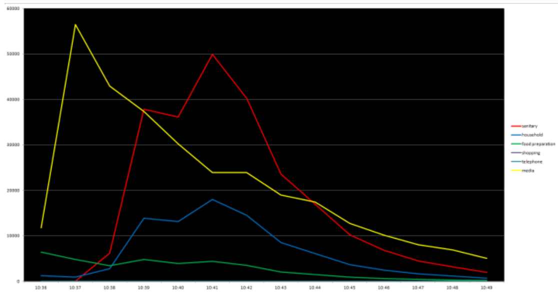

Figure 9. Display of the impulse area from Table 2 of the Figure 9.

The main benefit of the approach is that the currently active appliances strongly support their ADLs while previous stimuli remain in effect, but with a lower significance. This allows to detect ADL that are interrupting other ADLs.

5. Conclusion

This paper demonstrates how smart meter data can be used as an affordable and practical data source for human activity recognition and behavior modeling without the need of highly integrated sensors. The paper introduced the impulse approach which analyzes the temporal correlations of the appliance events using a model that adopts the human memory. The ADL significance is analyzed separately such that parallelism and temporary effects of interleaving ADLs are easily detectable, which are two important aspects of human habits. Particularly, the daily routine of elderly is very stable and therefore qualified for monitoring and modeling. The models allow doctors and care givers to understand people's diurnal rhythm. It improves inactivity detection and changes in ADLs indicate the development of diseases such as Alzheimer's.

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INTEGRATING TECHNOLOGY IN LONG TERM CARE – SHARING INSIGHTS

J.C. van Dijkhuizen

1. Introduction

In this paper we summarize the lessons learned in supporting development and implementation of solutions that integrate technology in the primary processes of health care organisations in long term care. We focus on the key success factors.

Vilans is the Dutch knowledge centre for long term care. Vilans and its founding fathers have been working on development and implementation of technology in the primary processes of health care organisation for many years. Furthermore, Vilans shares and disseminates applicable knowledge to health care professionals in long term care. Vilans works in the field of care for the elderly, people with mental and physical limitations and people with a chronic disease.

This paper is based on cross-project and cross-sector observations of dozens of projects related to technology in care. These are empirical conclusions and opinions even, instead of the results of extensive and fundamental research. Nevertheless, we are proud of what we have seen and learned and are grateful and glad with the opportunity to share these insights at the 2012 AAL Forum. We have seen, in other sectors and in health care as well, that great inventions do not always lead to extensive use and/or a great customer experience.

In this paper we present observations that help anyone who is passionate about implementing technology in long term care. Primary target groups are health care executives and change managers, and secondary target groups could and should probably be formed by interested suppliers of technology.

2. Be very keen on the client objectives

We all know that means are getting scarce in health care. Both budget and skilled staff are insufficient to meet the increasing health care demand in long term care. One could argue – and some people do - that this lack of means will force labour saving technology to be used in long term care and that lack of skilled staff is the critical success factor for the integration of technology in long term care.

We do believe that this is not the way to go. It is not necessary and it is not wise to argue and act like this. Although development has been supply driven in recent years, there are plenty of experiences and applications in long term care that show that people do get used to technology based health care. For example, video communication in home care does not only reduce professional visits, it increases the number of client-professional contacts. It lowers the contact threshold which, even when communication is not needed, benefits clients in their perceived safety.

We have seen both expected and unexpected client benefits in experiments. That is what experiments are all about. Nevertheless, implementing technology in health care on a large scale should address client benefits in advance. Go talk to your clients; find out what is worrying or annoying. Client objectives are not what you think your clients want or do not want; it is about what they value themselves. Be more precise instead of targeting at improving quality of life. We distinguish health, autonomy, safety, reducing loneliness, comfort, participation and fun as possible client objectives.

3. No one likes a stigma

People with diabetes are subject to daily routines of checking and injecting themselves. Although life can be acceptable, this is a burden. Lots of people with diabetes are not interested in checking blood values as lots of people do not check their body weight every day. You do not want to tell your alarm system that there are no burglars in your house.

Hence, we need to find ways to make self management interesting, by literally rewarding good results, by offering benchmark information or by integrating medical and general monitoring systems. Do expand the target group of a service, e.g. you do not have to be an oblivious widower to appreciate a meal you like delivered at your home at a time of your convenience. You do not need a limitation to enjoy comfortable home automation. You do not have to be a diabetic to manage a healthy life style yourself.

4. This innovation may be new, innovation is not

It is not innovative to innovate. Lessons can be learned from the past and from research as well. It is important to realise that when new technologies are developed, the start is often about processing old services in a new, cheaper way. The first car was a coach without the horses; the first web pages were online copies of existing paper brochures.

Once new technologies are available and introduced people find new interesting services. If we can talk to our clients by video communication which is easy with minor initial expenses, why wouldn’t we talk to our clients on demand? But then again, if we implement this solution, is it really necessary that one of our professionals contacts the client, maybe a relative of a neighbour can be used as well.
New technologies often allow paradigms to shift.

5. Be very keen on strategy, objectives of the innovation

We have stated that a very specific view on client objectives is essential to implement an innovation in your organisation. The same applies obviously to the organisational objectives. In these days increasing efficiency is an obvious goal, but we recommend you to really think this over and be very explicit about your strategy and vision on implementing technology in long term care. As we have seen, new technologies allow services to be organized in other ways. Implementing e-health implies implementing patient centred care and implies the introduction of self management. Introducing domotica into long term intramural health care asks for another attitude from professionals, it also allows some clients to live independently again. Hence, think beyond doing the same as you used to do. Make up your mind: are you an early adopter or part of the early majority?

6. Distinguish service and channel

We see that the introduction of new technology is new to health care organisations. Health care organisations are used to a single distribution channel service delivery. Often technology changes the way the service is delivered, but it does not change the service itself. It is important to distinguish between those situations. Furthermore, health care organisations develop towards multi channel service delivery, with a need for cross channel collaboration and extensive attention for customer relationship management.

7. Do not discuss the Christmas menu with the turkey

Everybody wants to innovate, nobody wants to change. It is strange, but true. Innovations need a set up with people that are really keen to try the innovation. In your start up phase you would like to work with the *innovators* among your clients and professionals (using Rogers' *Diffusion of innovations*).

If the innovation is radical and if this is possible, then create an experiment separated from the regular business line that will change because of this innovation. Once the innovation has a proven added value, find your early adopters within your organisation. Dare to lead and be very clear about your decision to innovate, accept that some professionals will back out because of it. Do not spend too much effort on the *laggards*.

8. Low hanging fruit, the organisational and social business case

In Dutch a saying encourages people to first pick the low hanging fruit. It means focus on the biggest steps that easily lead to progress; 80% result with 20% effort. It also

implies to keep on thinking and prioritising after each step. After eating the first three apples, hunger might be over and focus on thirst might be the wise thing to do.
In the Netherlands, health care and well being is financed with the major laws. One law was meant to cover uninsurable special and mostly long term health care costs (AWBZ), one law was meant to cover well being and social inclusion (Wmo). On the other hand, people are not divided into parts because of these laws. Hence, innovations that invest in well being (e.g. reduce loneliness) might reduce the costs of long term care. However, because of the three laws (ZvW, Wmo, AWBZ) and three financial systems, the benefits of this innovation can be found in one system whereas the investments of this innovation are located in another system.
The 'low hanging fruit' is in business cases that are straightforward. An organisation invests a bit and within current finance regulations these investments pay off because of the benefits of this innovation for this organisation.
As far as innovations in long term care are concerned, a social business case is often made which calculates the benefits for society. These are the most complex and from the view point of society probably often the ignored and possibly very interesting business cases.

9. Embed within regular client processes

Make a plan with a client or client relatives about the provided services in a health care plan. Be specific on results to obtain, about technology that is used, about the benefits, the consequences, the risks and the risk management measures. We see that in the care for the elderly, the disabled and people with a chronic disease, organisations are applying this process, this instrument; then again, we see a lot of possibilities for improvement. Make these plans patient orientated instead of disease orientated (general practitioner). Take care of a fluent collaboration between night and day care professionals.

Do not set up a specific technology risk management system. Risk management should be about all risks, including the risks of using technology. This might be the opportunity to improve all your risk management.

10. A house needs a fundament

For a lot of health care organisations it is quite new to use technology in their health care services. It is new to the health care professional in 'the front office'; it is new to supporting staff in the back office as well. We recommend health care organisations to develop a vision on both health care and the information architecture of the organisation. Try to define the roadmap. We see that size of the organisation matters, although even IT-departments of bigger organisations have to get used to delivering services that are really essential for the health care process. Consider working with care specialists in your IT-department and consider working with IT-specialists in your care department.

11. Consumer electronics

No travel agency has given away personal computers, yet booking trips on the internet has grown to the default way to do it. We see that the use of hardware that is interesting for clients besides the health care application helps acceptance and helps the business case. Although health care is subject to more regulation than regular retail services (privacy, reliability) we see that this is the way to go. It will also help to reduce the stigma related to some services.

12. To sum it up

Go out there to understand the clients' needs and problems; dare to lead, clients do not ask for solutions they do not know. Integrate 1) your innovations within consumer electronics as much as possible; the use of technology in the (renewed) strategy and vision of the organisation, such as self management, patient centred care; 3) within regular client processes such as the health care plan, risk management; 4) your innovation within the (renewed) information architecture of your organisation. Separate 1) changing the delivery of old services and introducing new services; 2) experiments with radical innovation from the regular business line in both front office and back office; 3) your actions for clients and professionals that are happy with your innovation (innovators, early adopters) and those that are not (laggards).

ICT EMBEDDED TEXTILE SOLUTIONS FOR MUSCULOSKELETAL MONITORING, IMPROVEMENT AND WELLBEING AT HOME (ICTEX4FIT)

Kostas Giokas[1], Sandra Vilaplana[2], Jorge Gonzalez[3], Maitte Ferrando[4], Barbara Branchini[5], Jose Luis Alfonso[6]

The term 'musculoskeletal problems' is a non-diagnostic approach, which includes all pain conditions in the musculoskeletal system. Musculoskeletal conditions comprise of over 150 diseases and syndromes, which are usually progressive and associated with disability pain, seriously affecting autonomy and quality of life. They can broadly be categorized as joint diseases, physical disability, spinal disorders, and conditions resulting from trauma. Musculoskeletal pain is the complaint most frequently reported in health interview surveys. Typically around 50% of the population report musculoskeletal pain at one or more sites for at least one week in the last month. It rises with age; around 60% of women aged over 75 living in the community report some physical limitations.

To reduce the enormous impact on the quality of life of individuals and socioeconomic impact on society related to musculoskeletal conditions, people at all ages should be encouraged to follow a healthy lifestyle and to avoid the specific risks related to musculoskeletal health.

ICTex4FIT aims at providing a tool to increase user's physical condition while preventing from chronic and acute musculoskeletal conditions and related disability. It will collect relevant information concerning physical condition, musculoskeletal symptoms prevention and related parameters. It assesses behavioural/lifestyle indicators (activity, movement patterns, exercising adherence, etc.) in order to provide an updated monitoring of the patients. It also detects potential musculoskeletal risks (injuries, falls, symptoms worsening, and chronicity, among others) through intelligent processes able to generate alarms to support professionals' decisions in order to prevent/reduce future musculoskeletal complications. Furthermore it will support daily-life activities of the elderly while reducing musculoskeletal risks (pattern activity corrective instructions, exercises and diet recommendations, reminder for preventive medication, among others). Finally it will improve the recovery from musculoskeletal conditions (if they finally occur) by supporting their management.

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ICTex4FIT will offer an innovative product to its end-users. The ICTex4FIT product will beable to collect relevant info concerning musculoskeletal symptoms & related parameters. This information will be made available to the physicians for further evaluation and investigation. Therefore they will be able to assess the behavioural/life style indicators (activity, movement patterns, exercising adherence, etc.) in order to provide an updated follow up of the patients. This way the physician will build the user's Activity Profile. ICTex4FIT will support daily life activities of the elderly by improving musculoskeletal conditions management (medication reminder, activity, exercises & diet recommendations, etc.) via a central information hub. Through the activity profile the ICTex4FIT platform will provide musculoskeletal management adaptation to elderly person. The physician will be able to use the ICTex4FIT system/platform to help prevent acute musculoskeletal symptoms by limiting the elderly activities (injuries, falls, etc.) and using intelligent processes. In this context alarms will be generated, directly to the physician to prevent critical situations and to support his/her decisions making. The physician will help the end user to improve the recovery from acute musculoskeletal conditions (if they finally occur) supporting their management, by designing the appropriate regimes within the ICTex4FIT platform

As mentioned above the main objective of the ICTEX4OLD project is to develop an innovative solution to enhance the ease of DAL of older persons at their home by integrating ICT technologies into the home based environment. A methodological approach has been designed for the ICTEX4OLD project. The approach emphasizes the challenges underlying the transfer of research results into innovative and commercially successful products and services:

1. **Integrated market-oriented approach for wellbeing services and business models.** Currently there are no similar products available in the market. The development of many ICT solutions runs the risk of neither being adequately transferred into "real world" applications (nor into commercial exploitation). One of the most important reasons is the lack of understanding of market mechanisms of 'technological world'. To overcome the obstacles concerning dissemination and exploitation, the ICTEX4OLD project follows an integrated, market-oriented research approach that also addresses economic challenges. The ICTEX4OLD project's main emphasis will be on challenges regarding the transfer of research results into innovative and commercially successful products and services.
2. **User-centred design**. Technologists, in general, have little understanding of the needs and priorities of users. In the field of elderly care, researchers are prone to generalising experiences within their social environment, which often leads to misinterpretation of users' needs. On the other hand, users – in this case elderly people, their relatives and caregivers– are not aware of what is 'technologically possible'. Therefore, it is very important to bring both groups together at a very early stage of development in order to create application scenarios and solution concepts that meet users' needs in an optimal way. Within the ICTEX4OLD project, this will be achieved by a user-centred design process, emphasising early end-user inclusion.

3. **Evaluation-driven development**. In order to enable effective dissemination and exploitation of project outcomes, an evaluation-driven development approach is envisaged for the development of ICTEX4OLD systems, processes and use cases. This reflects the strong need for early end-user involvement. Evaluation-driven development will ensure early identification and solution of user acceptance problems and innovation barriers, thus facilitating the exploitation of project results.
4. **Progress beyond the State of the Art and contribution to the knowledge in the field**. ICTEX4OLD is not just a research project – it involves applied research and it is an innovation project focusing on the improvement of the transfer of basic research results and the latest technologies into widely adopted, "real-world" systems and services:
   a. ***Monitoring Technologies and Sensors:*** Telemonitoring is a current alternative method to monitor people with chronic diseases. It ensures timely transmission of clinical and physiological data and helps provide prompt medical intervention before deteriorations occur (Jaana et al., 2009). Home telemonitoring has the potential to improve health results and reduce health systems' cost (Kun, 2001) (Giorgino et al., 2004), so it is currently arousing much interest. Nowadays there is a huge variety of mature monitoring technologies allowing for effective patient monitoring. Among the different sensors available are use the established 'test strips' for glucose, 't-shirt' approaches with an already working ECG/pulse monitor with blue tooth module, which needs to be upgraded to the BLE 4.o/Continua chip set., microphone sensors serving as miniature digital stethoscopes, monitor transpiration via humidity sensor (Sensirion), etc. All the information coming from the sensors will be integrated into an Electronic Health Record (EHR) system in charge of merging health information from travellers and triggering alarms in case of emergency.
   b. ***Human Machine Interaction andUsability*****:** The notion of 'usability' is highly important since it determines the way a certain system or platform should be designed. The ISO 9241: 1998 standard defines usability as '*the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction*'. Innovative ICT platforms do not take into account user-acceptance of elderly and their needs and priorities. In order to motivate and enable elderly people to use modern ICT systems, it is of prime importance to know the key problems inherent in these systems. ICTEX4OLD aims at encouraging elderly to live independently for longer. Since ICTEX4OLD users are elderly, platforms used to monitor and assist them must be easy to use. More than 50% of problems related to usability reported by elderly people could be solved by improving the design or providing training (Fisk et al. 2004 as cited in Gamberini et al., 2006). Current developments in Natural Language Processing allow for the creation of intelligent human-machine interfaces able to interact with people in a more natural way by adapting themselves to the users' needs and allowing to interact by voice or tactile devices (Carletta et al. 1996)

(Allen et al. 2001) (Alcácer et al. 2005) (Allen at al., 2007). Multimodal are computer systems endowed with multiple communication capabilities for interaction and able to interpret and convey information from various sensory channels. The weaknesses of one sensor modality are offset by the strengths of another (Holzinger et al., 2008).

c. ***Automatic Decision Making.*** There are situations where systems need to support decision making under complex preference policies that take into account different factors. In general, these policies have a dynamic nature and are influenced by the particular state of the environment. The decision process needs to be able to synthesize together different aspects of a preference policy and to adapt to new input from the current environment. Argumentation (see e.g. Bench-Capon and Dunne, 2007) is very well suited for modelling the decision making capability of (autonomous) systems in such dynamic and adaptive environments. Argumentation can be abstractly defined as the formal interaction of different conflicting arguments for and against some conclusion due to different reasons and provides the appropriate semantics for resolving such conflicts. The nature of the "conclusion" can be anything, ranging from a proposition to believe, to a goal to try to achieve, to a value to try to promote. Thus, argumentation is very well suited for implementing decision making mechanisms for multi-expert teams where different conflicting points of view expressed by the different experts have to be taken into account and where a compromise is necessary in order to make a collective coherent decision. Argumentation has been used successfully in the last years in different situations, e.g. for deliberating over the needs of a user with a combination of impairments in an AAL application (Moraitis and Spanoudakis, 2007) or for ambient assisted living systems (see Marcais et al., 2011).

d. **Electronic Patient Record**. The architecture will be developed using the Service Oriented Architecture (SOA)paradigm used to integrate multiple distinct systems from several domains into an integrated architecture. Its main advantage consists on simplifying data interoperability by standardizing the software interpretation. Focus will be on integration of noisy data into the electronic health record and using this data for the clinical management based on robust and reliable algorithms. To this end, ICTEX4OLD will use SOA to integrate the multiple disparate clinical systems/medical information systems from which different patient data isrequired to deliver an integrated view of the patient. SOA will be implemented by considering medical systems as web services and use XML, Web Services Description Language (WSDL), Simple Object Access Protocol (SOAP), and Universal Description, Discovery, and Integration (UDDI) in conjunction with HL7/openEHR messaging and the data transfer protocols

CARE@HOME: AN INTEGRATED APPROACH TO CARE AND SOCIAL INCLUSION OF ELDERLY

Alina Huldtgren[1], Siska Fitrianie[1], Hani Alers[1], Nick Guldemond[1]

Abstract

Ageing of society makes a paradigm shift in western care systems necessary. To be sustainable, new care systems have to be implemented to integrate medical and social aspects involving formal and informal caregivers. The use of technology becomes indispensible in this setting to facilitate self-management and cost-effective service delivery. Care@Home takes an innovative approach to the design of a service delivery platform that aims at supporting the elderly people's wellbeing and independence in their homes. With participatory and value sensitive design we ensure that the needs, concerns and values of the elderly but also of all other stakeholders are accounted for.

1. Introduction

The world's population is ageing rapidly. This is a major societal challenge worldwide, but especially in Europe where already one in five persons is aged over 60[2]. At the same time the working population is shrinking. The projections show a growing imbalance between the number of elderly citizens in need of care and the actual supply of formal care services. At the same time the prevalence of age and lifestyle related impairments and medical conditions are rising due to a combination of ageing and the effects of a sedentary lifestyle [1,2]. This trend not only results in a rise of healthcare costs, but also creates an enormous pressure on the resources in society [6]. It is clear that we can no longer expect that formal caregivers and professional institutions will provide the services for the support of our elderly. Therefore, implementation of services for elderly which integrate medical and social aspects is imperative as well as the use of technology to facilitate self-management and informal care as well as cost-effective service delivery. Key in this service design is to support the elderly in living independently in their own homes, but at the same time facilitating the provision of informal and formal care when needed and ensuring social inclusion.

Recent AAL projects have resulted in some promising ICT-based service solutions ensuring wellbeing and independence of older people in their homes. However, we found that the widespread introduction and acceptance of these systems could be improved. This is mainly due to (1) a lack of accessibility (high costs and efforts in installing systems) (2) psychological and technological barriers for elderly and (3) a

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lack of a holistic approach to system design which takes into account all stakeholders, services etc. To achieve better acceptance, an inclusive and integrated approach to AAL design for the elderly is needed that is cost-efficient and requires little adaptation in the home of the elderly. The term inclusive refers to a design which is suitable for a large amount of users with different degrees/types of impairment and at varying stages of technological literacy. An integrated platform is one which is designed to integrate personal services for the elderly (reminders, emergency detection, care, games), and the social network which includes formal/informal caregivers and community members.

The **CARE@HOME** project (www.careathome-project.eu) exemplifies this approach and aims at quality of life, improved accessibility and social inclusion. CARE@HOME is about enabling empowerment, wellness and social care in the home of elderly through interactive multimedia.

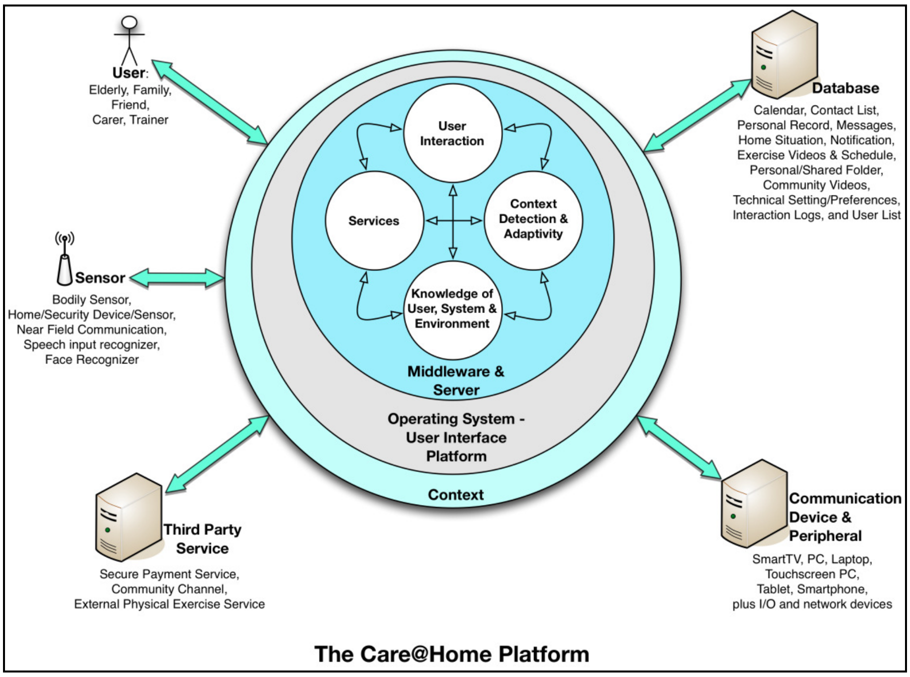

Figure 1. Overview

The elderly will interact with a smartTV which acts as a user-centred hub providing reciprocal communication for elderly, family, and caregivers and services for household, emergency detection, physical activity, community information and entertainment. Given the familiarity of interacting with a TV interface, the elderly are encouraged to use the provided services with an eventual goal of attaining a ‘self-serve’ society.

CARE@HOME is innovative in several respects. (1) It enables care services at home without the costs of retrofitting existing dwellings. (2) It provides an open platform (Fig 1) offering context-based services and adaptive user interaction that facilitates an independent lifestyle and the assurance of timely access to caregivers. (3) Technology (e.g. sensors and communication) is integrated in community-driven products, which are highly personalized and easy-to-use. The accessible platform opens up a market for continuous development of new services by various companies to be offered to the elderly without the need to install new hardware or software.

2. Methods

The design concept of CARE@HOME is focused on human-centred design for understanding the user in context. By employing Value Sensitive Design [4] and Participatory Design [5], we tackle usability, user experience, and ethical issues systematically through early user involvement and iterative integration of research and development.

"Value sensitive design is a theoretically grounded approach to the design of technology that accounts for human values in a principled and comprehensive manner throughout the design process." [4]. To that end, it provides an integrated and iterative three-part methodology consisting of conceptual, empirical, and technical investigations to incorporate knowledge of the ethical impact of a technology into the design. Furthermore, VSD introduces the notion of direct and indirect stakeholders, which expands user-centeredness to considering all people affected by a technology. This distinction helps to understand the perspectives of the elderly, formal and informal caregivers as well as all other people or institutions affected by the development of ICT-services for the elderly. For each group of stakeholders, harms and benefits are identified, and satisfying value trade-offs are aimed for.

In such a multi-stakeholder setting, it is not feasible to leave the decision making to the service designers or researchers alone. Involving participants, in particular future users, in the design of technology and its introduction to the daily practice of people has a long-standing tradition in the Scandinavian Participatory Design (PD) [2]. PD has a strong focus on empowerment of people who are confronted with the introduction of new technology in their workplace/life. Due to its historical scope PD has led to methods that engage in envisioning futures involving changes in the social, technological and political environment in which they are situated. Such a holistic approach to the design and introduction of technology is indispensible within the care domain. We expect that acceptance of the new technologies will increase through the engagement with stakeholders throughout the decision making (e.g. what type of services are useful) and design processes (i.e. the interface and interaction design).

3. Results

We are currently engaged in a number of research activities to collect knowledge regarding elderly-system-interaction mainly focusing on smartTV interaction. In this section, we describe some preliminary results and our ongoing activities.

In our recent design of a service for group awareness and communication between elderly and informal caregivers we conducted a qualitative, interview-based Wizard-of-Oz study with older adults. HTML mock-ups were used to gather feedback on early design concepts. In this research, we found that our participants viewed technology as complex to use and tended to resist adopting the technology, simply because the term smartTV is not familiar for them. However, after we referred it as a TV with a regular remote control, all participants were able to actually interact with the developed services at ease. This finding supports our choice of the communication platform. Another important finding was that elderly's preferences on the use of colours, font sizes, display layout, and privacy concerns differed (e.g. a number of participants were not willing to share information, while an equal number preferred to share more information). This indicates that personalization is an important aspect in providing services that are tailored for each user's needs.

Applying our inclusive and participatory approach, we are currently conducting the following activities: (1) the study of cognitive and physical impairments of elderly and their effects on user-system interaction; (2) the design and testing of several user interfaces for smartTVs and tablet computers with elderly people; (3) an investigation of value-related concerns of the elderly; (4) an ethnographic study of the formal caregivers work.

Further research is planned to expand the focus of design activities to other stakeholders, e.g. informal caregivers such as family members, friends and neighbours. Ongoing user engagement in the form of interviews and focus groups to tackle value issues as well as prototyping and user evaluation is planned.

4. Discussion/conclusions

The approach that we are taking with the Care@Home project differs significantly from the current engineering paradigm in many other technology driven projects. Our approach combines participatory and value sensitive design methods to ensure active participation of all stakeholders in decision making and design of new ICT-services that integrate care and social aspects. Thereby, it aims to develop human-centred services and to increase the acceptance of such ICT-service solutions which will lead to a sustainable care system, social inclusion and reduced healthcare costs in the long-term.

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BEHAVIORAL ANALYSIS BASED ON ENVIRONMENTAL, LOW-COST SENSORS

Agostino Losardo, Ferdinando Grossi, Guido Matrella, Ilaria De Munari, Paolo Ciampolini[3]

1. Introduction

Within the Ambient Assisted Living paradigm, awareness of user's behavior enables adaptivity, monitoring and wellness assessment. Exploitation of technologies, however, needs to be tempered by AAL-peculiar constraints: reduced invasiveness, impact on lifestyle, right to privacy, etc. This prevents AAL systems from adopting too intensive ambient technologization and draws instead the attention to the need of effectively inferring behaviors from available data, possibly privileging indirect approaches, not involving user's consciousness and attention.

In this abstract, we describe experiments carried out in real environments aimed at extracting wellness-related information from raw data involved in low-level home automation functions.

2. Results

Within the context of a regional-funded program, we deployed several instances of the CARDEA AAL system [1] at sheltered elderly houses. Several gigabytes of data, gathered through the years, are being explored, looking for expressive behavior traces: although the CARDEA framework includes wearable sensors (for physical activity monitoring and fall detection), we purposely looked at less expressive devices, such as passive-infrared detectors commonly exploited for automatic lighting and intrusion detection.

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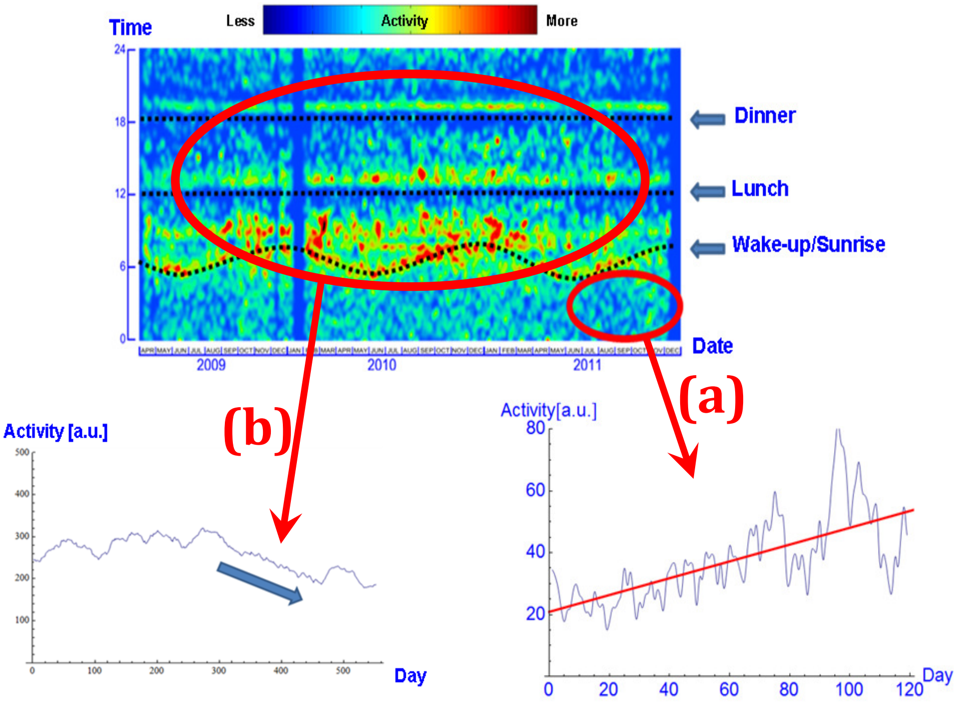

Figure 1. color map of sensor activity: highlights of sudden increase of nocturnal activity (right, a) and of slow decline of diurnal activity (left,b)

Through suitable data processing, we were able to validate the basic concept: "poor" data include indeed marked evidence of wellness-related behavior. For instance, changes in wake-sleep rhythms or hypokinetic trends (connected to aging or diseases) can be clearly extracted from the analysis.

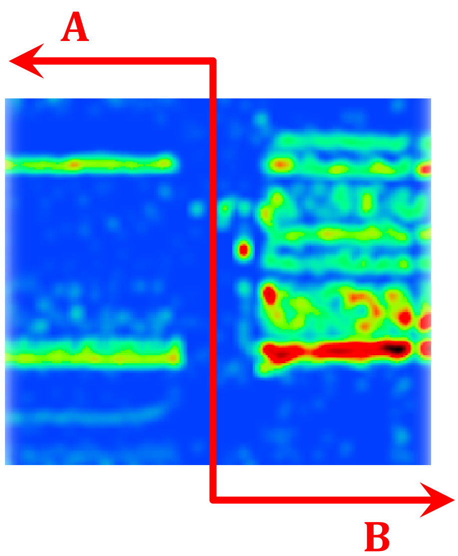

Figure 2. different activity "signatures"

In Figure 1, a time-map of activity coming from a single (passive infrared) sensor is shown: data comes from a flat in a sheltered elderly residence. A 92-years old lady lives alone in the flat. First of all, we may notice that clear marks of daily living activities are quite evident in the density plot: since meals are served in a common area of the residence, the corresponding absence from the flat results in horizontal darker "stripes". Similarly, a periodic behavior is exhibited by the wake-up activity, strongly correlated with sunrise time. This validates the approach, showing that series of raw data actually embed behavioral information. Long-time observation allows for working out average activity profiles, which may serve as a reference for spotting meaningful changes related to health or wellness. Data, however, exhibit a wide variance, which make simple, absolute threshold-based comparisonquite unreliable. Also, a profile (and consequently thresholds) strongly depends on individual behaviors, as expectable: Figure 2 shows a density plot relative to a timeframe in which a tenant shift occurred. The figures highlight deeply different activity patterns (despite similar ages and health status of Persons A and B): this indicates that working out "universal" thresholds is hardly feasible, and that possibly long training phase is needed to tune individual thresholds. Hence, stationary matching against absolute "safe" ranges (as customarily done for physiological parameters) is unpractical; meaningful information can be extracted instead from dynamic trends, based on relative changes. In Figure 1, two examples are shown: region "a" includes events occurring during nighttime. Marked changes in density can be appreciated at a glance: Fig. 1a shows a time plot of "integrated" activity in the [0 ÷ 6 AM] interval, and make quantitatively more evident the trend. Nocturnal activity almost doubles within a month, this being likely relevant to caregiver attention. A slower, yet definite, trend is instead extracted by analyzing diurnal activity on a longer timeframe (region "b" in Figure 1, and plot 1b): again, regardless of the actual absolute activity level, relative changes show a marked, prolonged activity decrease (about a 30% decrease over a 5 months period). Such a decline is correlated to health status worsening, which, after a short time, made hospitalization necessary.

A second example is shown in Figure 3, which refers to a different person (84-years old, female) living in another flat. The density plot makes somehow evident a decrease in the overall daily activity, which is made more explicit by the time plot in Figure 3b (total activity, integrated over the whole day). In this case, a slower, yet steady, decline is observed (-20%, over a 10 month period), hardly perceivable by the caregiver by means of day-by-day observation. At the end of the period, a fall occurred, again resulting in the need for a care facility.

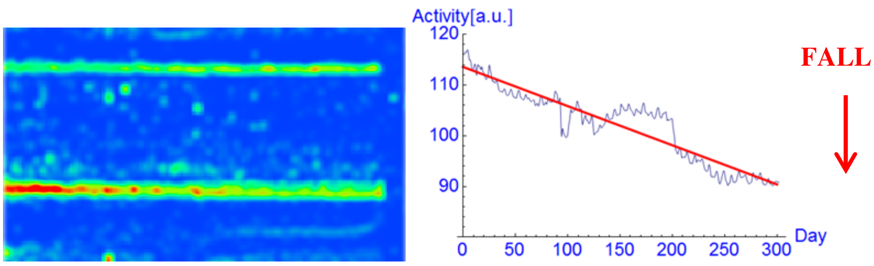

Figure 3. slower activity decline

3. Conclusions

Even if the above consideration comes from in retrospect analysis of collected data, potentials of trend analysis in a predictive environment are suggested: the AAL system is given much more insight capabilities which, in turn, can provide feedback for system adaptivity, and provide formal and informal caregivers with helpful information.

Innovation hence comes from the exploitation of reuse of information primarily aimed at different purposes, so that such a feature comes at almost no additional (hardware) costand can be regarded as a high added-value option for AAL systems, likely increasing market appeal and fostering evolution from home automation to wellness management.

Of course, the basic concept can be extended and enriched either by observing multiple sensors at a time, or by involving in the dynamic analysis more expressive information, such as those coming from wearable sensors (at the expense of increased invasiveness, though).

End-users (elderly) do not need to intentionally and consciously interact with system, so they just need to be duly informed. Caregivers were involved in planning of sensors deployment of monitoring actions, as well as in the validation phase, in which system-inferred behavior were checked against their logbook. The indirect monitoring approach also mitigates privacy concerns: moreover, actual inferred behavior is not necessarily disclosed to the caregiver, who can be just informed of meaningful changes over time.

The proposed approach thus aims at improving AAL systems perceptiveness, without increasing the technology burden and costs, providing caregivers with objective tools for wellness monitoring, capable of revealing meaningful information, often likely to be unnoticed otherwise.

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AN AMBIENT TECHNOLOGY FOR REST/ACTIVITY FRAGMENTATION IN OLDER ADULTS

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Andrea O'Brien[1], Brian O'Mullane[1]

The Great Northern Haven (GNH) consists of 16 purpose-built smart homes focussed towards supporting AAL for older adults. Over 2200 sensors and actuators are fitted throughout the development, and approximately 100 sensors in each home measures electricity usage, motion levels, water usage, brightness levels, light switch usage and contact sensors. To date, we have collected over two years of data from a number of older adults using the embedded sensors and models are being built to detect patterns in activities of daily living and health. GNH is a unique development in that it is not a test bed for research. These are real peoples' homes and as such, the data collected is extremely rich.

Sleep is a fundamental physiological process with important restorative functions. Sleep problems have been shown to be detrimental to human health. In humans, short (seven hours or less) and long (nine hours or more) durations of sleep have been shown to be significant predictors of death in prospective population studies. Sleep disturbances may be indicative of poor health and functional deficits, especially in older adults. Total sleep time is reduced in the elderly and this is not due to a reduced need for sleep, but in a diminished ability to sleep. Sleep complaints are commonly reported by over 50% of those aged 65 and older. These complaints include getting less sleep, frequent awakenings, waking up too early, excessive daytime sleepiness, and napping during the day. Additionally, high incidences of balance, ambulatory and visual difficulties (after controlling for medication use) have been reported in older adults with sleep problems. Artificially imposed sleep fragmentation has been associated with impaired alertness, attention, changes in mood, and loneliness. Additionally, altered sleep/arousal profiles have been found in people with sleep disorders, neurological diseases and in older adults.

Recently, the increased fragmentation in the temporal dynamics of behavioural states (specifically sleep and arousal) have been associated with age and with lower levels of cognitive performance in older adults using wrist actigraphy. However, this technology requires the adherence and active participation of the user in wearing the sensor. Although this approach may be automated, quantifiable and objective, its use is not appropriate for neither cognitively impaired older adults nor long-term data collection. Fragmentation of these behavioural states can be quantified using ambient motion detectors placed in the homes of older adults. The analysis of longitudinal data

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will elucidate whether changes in the temporal dynamics of motion/non-motion (serving as a proxy to activity/rest), collected unobtrusively, may be used for the detection of a deteriorating health status in older adults.

In this work, we are extracting metrics which quantify the fragmentation of rest/activity from the activity data in the GNH smart home data set. This work examines the longitudinal variations in these metrics both within and across multiple subjects. This presentation will describe the changes in these metrics over extended periods of time, and will relate these metrics to measures of sleep quality, loneliness, cognition, physical functioning and quality of life.

TALK AND (V)ASSIST – ACHIEVING INDEPENDENCE WITH NATURAL SPEECH INTERACTION

Bernhard Wöckl[1], Irene Stepniczka[1], Markus Garschall[1], Gianni Pelosi[2], Eva Reithner[3], Gerard Chollet[4], Thierry Simonnet[5], Hugues Sansen[6], Olivier Voltz[7], Horst Foidl[8], Grégory Legouverneur[9], Samy Elbaz[10], Ernst Kruijff[1], Manfred Tscheligi[1]

Abstract

The goal of the vAssist project is to provide specific multilingual natural speech controlled home care and communication services for two target groups of older persons: seniors suffering from chronic diseases and/or (fine-) motor skills restrictions. The main objective is the development of simplified and adapted interface variants for tele-medical and -communication applications applying multilingual natural speech interaction (and supportive graphical user interfaces where necessary). vAssist aims at enhancing the perceived quality of healthcare services enabling a reduction in the costs related to their production and delivery by achieving channel independence in the supply of services so that existing hardware in the home of senior users can be used (e.g. PCs, TVs, mobile phones, tablet PCs). Further, a User-Centered Market-Oriented Design approach (UCMOD) is followed involving end users in all phases of the development process considering market-oriented aspects from the initial phase of the project. This assures that the iteratively developed services and business models are adapted to the requirements and needs of the users. From an interface point of view vAssist leverages approaches to connect to universal interfaces for the delivery of AAL services and provides user-specific natural speech

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controlled interfaces in order to address a broad audience. However, the aim of vAssist is not to develop another platform for service and interface integration, but to provide specific modules in order to enhance existing services with speech intelligence. Existing platforms and initiatives (e.g. universal [18]) are considered in the exploitation strategy and technical design of the project. Overall, vAssist services are expected to be ready for the market 2-3 years after the completion of the project, as the solution bases on existing services and such that are currently already in use in senior homes, enhanced with natural speech interaction, so that service developments do not have to start from scratch.

1. Introduction

Currently,87 million persons in the EU-27 are aged 65+ [1]. With increasing age also the prevalence of physical and cognitive problems increases resulting in a high demand for supportive services. These facts not only support the claim for advanced services but also for interaction paradigms that enable the compensation of age-related restrictions. In direct relation, the vAssist [8] project focuses on supporting seniors suffering from fine-motor problems and/or chronic diseases by applying multilingual natural speech interaction for the usage of home care and communication services. European statistics on diseases that lead to motor problems show that currently 1.2 million seniors suffer from Parkinson`s [6] and 630.000 from multiple sclerosis [7].

The main innovation of vAssist is expected in the reduction of costs by achieving channel independence in the delivery of vAssist services so that existing hardware in the homes of senior persons can be used. Moreover, an intelligent module enabling the interpretation of user requests by distinguishing between commands, information requests and inputs will be integrated following a triplet model. Research studies will mainly concentrate on speech behaviors to adjust the speech technology to the natural speech interaction flow of older adults. From a business perspective speech interactionshows a high potential, since previous studies indicate high acceptance rates among older persons [2][3]. Further, speech interaction not only addresses motor restricted seniors but also those with little or no computer literacy since no new form of interaction has to be learned.

2. Methods

In vAssist a User-Centered Market-Oriented Design process (UCMOD) is applied considering user, technical and economic constraints in a sound methodological setup. The project is currently in the requirements specification phase. For the collection of a broad range of user data and perspectives from primary (seniors) and secondary users (informal caregivers: family members; formal caregivers: medical experts) a mix of quantitative and qualitative methods was applied. During focus groups the future vAssist system was demonstrated using a Wizard of Oz (WoZ) approach [19] and room for first experiences with an existing natural language system was given followed by guided discussions on hardware, interaction and business related aspects. Further, standardized questionnaires were applied to get a full picture of user requirements from the perspective of different target user groups. With this setup a broad range of user needs and wishes related to the future vAssist system could be covered that will be balanced in the ongoing system specification phase.

To achieve a high standardization level, vAssist takes profit from related AAL initiatives [18] by striving for an active technical exchange. Further, standard protocols are used to achieve channel independence for getting access to services via different devices seniors' currently use in their daily life. Web services take the role of a standard means of interoperability between applications that run on a variety of platforms and/or frameworks deploying a cloud computing model.

3. Results

First results from vAssist requirements studies highlight that future senior user's claim for static and mobile hardware solutions that present information by voice, text, graphics and videos. Further, smooth and pleasant voices, pro-active error solving strategies and high security standards related to personal data, as well as active feedback on battery status are requested. Moreover, findings from discussions with primary, secondary and tertiary users indicate a strong need for future vAssist service packages that are open to individualization offering low, mid and high cost models that differ in the number of included services and/or hardware (if needed). The evaluation of cost models and technical developments will continue during iterative lab studies and final field trials focusing on usability, accessibility, user experience and technology acceptance.

Within vAssist, ethical issues are extensively considered from different perspectives applying project internal control mechanisms including national legislations [14][15][16][17], general human rights [10], data protection regulations [11], ethical frameworks [9][12][13] and guidelines for Ambient technologies [4][5]. Further, an external ethical committee approves all studies with active user involvement. During the field trial phase, users will be able to use and evaluate the developed vAssist services over a longer period in their private living environments. As an exit strategy, the vAssist consortium plans to provide at least basic communication and tele-medical services even after the field trial phase to the participants. In any case if the users wish to use the services after the field trials the consortium commits to leave the deployed technical, hardware and software infrastructure that was installed in the users homes. However, after the project phase the vAssist services will need to change from pilot to commercial services that match the business model developed within the project. In the case that the multilingual natural speech controlled services are not ready for the market at the end of the project and demand a further iteration it is planned to provide basic communication and tele-medical services to the users even without the support of speech control.

4. Discussion

To sum up, the vAssist project strives for enhancing the quality of life of senior European citizens by focusing the development process on different points of views concentrating on the balance of user needs, business aspects, technical issues and ethical correctness. Current activities for bringing the vAssist solution to the market mainly focus on convincing organizations that provide care services to senior persons to take the vAssist services up in their current service portfolio. Moreover, first feedback from senior persons highlight that a major precondition can be seen in the robustness and reliability of the technology as well as the usability of the interaction and individualization of services packages dealing as major acceptance and market potential factors. The applied UCMOD setup faces these challenges by iterating technical developments during several evaluation phases to assure that in the end of the project user wishes, business criteria and technical developments are well balanced and in line with the requirements of primary, secondary and tertiary users.

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CASE STUDY ON THE USE OF (USER) DATA IN THE HOME ENVIRONMENT

Ilse Bierhoff[11], Claire Huijnen[1]

Abstract/Summary

Ethics in the context of AAL means more than arranging informed consent. The model developed within Netcarity[12] and CompanionAble[13] identifies ethical risks, ethical principles and various levels where risks can occur when installing smart home technology and services into homes. It has proven to be a useful tool to facilitate discussion and to make ethical considerations part of the user-centred design process. The work carried out shows that small alterations really can make a significant difference. Several alterations were made to the design of the user interface and the workflow of the services based upon the results from the ethical focus groups. Furthermore, it also became clear that the safety and other benefits of the system can outweigh the possible feeling of intrusion and loss of privacy. A major issue is still how to overcome the fact that halfway through the design process the system isn't running flawlessly and discussions with users tend to focus on the flaws in the system instead of ethical issues.

1. Introduction

When implementing AAL services into homes, turning them into smart and aware homes, on the one hand offers benefits for the inhabitant. A smart home can provide an environment that is constantly monitored to ensure the inhabitant is safe, can alert carers should the inhabitant be in difficulties, or can improve the communication with a network of people. On the other hand installing smart home technology and services into a home environment can be seen as receiving a new (invisible) guest, a particular kind of stranger. With the rise of ambient intelligence a new dimension is added, the technology fades into the background and the user is placed in the centre. Even though the technology is invisible, it can have a huge impact on the lives of people. Possibly especially because the technology is invisible, it can have a huge impact.

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[12] NETCARITY (A Networked Multisensor System for elderly people: health care, safety and security in home environment) was an Integrated project supported by the European Community under the Sixth Framework Programme (IST–2006–045508).

[13] CompanionAble (Integrated Cognitive Assistive & Domotic Companion Robotic Systems for Ability & Security) was an Integrated project supported by the European Community under the Seventh Framework Programme (FP7-216487); www.companionable.net

The fact that installing smart home technology and services is a very complex task is clearly stated by Weiser, who in 1991 wrote that *"Neither an explication of the principles of ubiquitous computing nor a list of the technologies involved really gives a sense of what it would be like to live in a world full of invisible widgets"*[6].

2. Methods

Ambient assistive technologies offer many possibilities and opportunities for various markets and people. Marzano and Aarts [5] mention a number of characteristics that are inherent to ambient technologies:

1) **Embedding**; the technology will become invisible and imbedded in the environment in such a manner that people will not see this in the physical environment and can interact with it in a natural way;
2) **Context awareness**; the technology can identify and recognize people and match certain characteristics of people to the settings of an environment;
3) **Personalization**; all the preferences and needs of a person are being collected and stored in a user profile. The service or technology can then be adapted on the basis of this profile in such a manner that the service will be completely matched to the needs and preferences of a dedicated person.
4) **Adaptation**; the technology will react and adjust automatically in changing circumstances and environments, while paying attention to the persons in that environment.
5) **Anticipation**; the technology will be able to anticipate to (changing) environmental factors and prevent undesirable situations.

The invisibility, interconnection and the automatic behaviour of technologies have the potential to be beneficial to the end user and to offer great usability. At the same time they might cause a number of challenges for the individual or the society as a whole. So, when developing AAL systems we should not only focus on the potential benefits, but we should also be sensitive to the potential barriers and challenges. In order to identify these challenges the starting point was a study performed by the SWAMI project [7]. The SWAMI project aimed to identify and analyse the social, economic, legal, technological and ethical issues related to identity, privacy and security in the forecasted but not yet deployed Ambient Intelligence (AmI) environment. Based upon this work and a literature study the following 6 groups or risks are identified:

1. **Privacy**: it is important to be aware of the implications of AmI for private life and personal data and to take adequate social, technical, economic and legal measures to protect privacy. Different facets of privacy invasion, such as identity theft, 'little brother' phenomenon, data laundering, disclosure of personal data, surveillance, risks from personalized profiling, and victimization when user profiles are incorrectly treated or protected. In relation to surveillance the boundaries between public and private spaces need to be clearly defined.

2. **Identity**: the different components of identity, i.e. information related to legal identity, identification, authentication and preferences, play important roles in determining the feasibility of the AmI environment. The scenarios expose and detail the consequences when identity-based data are misused, erroneously used or incompletely processed. Identity-theft is also part of this risk.
3. **Control**: this is one of the main issues in the dark scenarios and stems from the different factors, for instance, when there is a lack of trust on the part of the citizen/consumer in the AmI infrastructure and its components. It can also emerge when the complexity level of AmI devices or services is too high and consequently does not enable users to get what they want. Strategies should be defined in order to compensate for the complexity, to weaken this feeling of loss of control and to avoid feeling of dependence on the technology.
4. **Security**: this is a key challenge for successful AmI implementation. The scenarios depict security issues in different contexts: security imposed for telework, biometrics used for authentication or identification, human factors and security, malicious attacks, security audits, back-up security measures, security risks, access control, the illusion of security and viruses. The possible impacts that arise when there is a lack of security or unsuitable security measures are also underlined. When security is assured, malicious attacks can be prevented.
5. **Trust**: the notion of trust has technical aspects as well as social, cultural and legal aspects. In the scenarios, trust is raised in different connections: trust and confidence, lack of trust (from loss of control, unwillingness to provide some data, contextual misunderstandings) and honesty.
6. **Digital divide**: AmI technology has the potential (because of its foreseen user friendliness and intuitive aspects) to bridge some aspects of the current digital divide, but this same technology could also widen other aspects with regard to unequal access and use. Exclusion is an effect that you wish to prevent.

In order to be able to make a model on ethical decision making, it is important to know the basic principles of ethics. In different sources of literature the four principles of Beauchamp and Childress [1] are presented as one of the most widely used framework that offers a broad consideration of ethics issues generally, not just for use in a clinical setting. In short these four principles are:

1. **Respect for autonomy:** respecting the decision-making capacities of autonomous persons; enabling individuals to make reasoned informed choices. Autonomy has been understood to include both freedom of action and freedom of choice.
2. **Beneficence:** this considers the balancing of benefits of treatment against the risks and costs; the healthcare professional should act in a way that benefits the patient
3. **Non maleficence:** avoiding the causation of harm; the healthcare professional should not harm the patient. All treatment involves some harm, even if minimal, but the harm should not be disproportionate to the benefits of treatment.

4. **Justice:** distributing benefits, risks and costs fairly; the notion that patients in similar positions should be treated in a similar manner.

Kitchener [3] added an additional fifth principle to this list: **fidelity**. Fidelity is considered to be "faithfulness, promise keeping, loyalty". We consider fidelity to be of importance in a context of AAL. Mainly because in the traditional care settings, most of the contact between care giver and care recipient took place in face to face settings, however, this relationship might change/alter due to the mediated communications that take place as well.

Ethical issues or risks can occur on different levels, for example on a society level, but also for individual different ethical considerations might be seen. Ethical questions can be posed to and considered by multiple stakeholders; e.g. the technology developers, the end users, the informal and professional caregivers or other people who might use it or be affected by it.

Based upon this background an ethical model is developed. The model identifies ethical risks, ethical principles and various levels where risks can occur when installing smart home technology and services into homes for the purpose of offering Ambient Assisted Living. The model is displayed in figure 1.

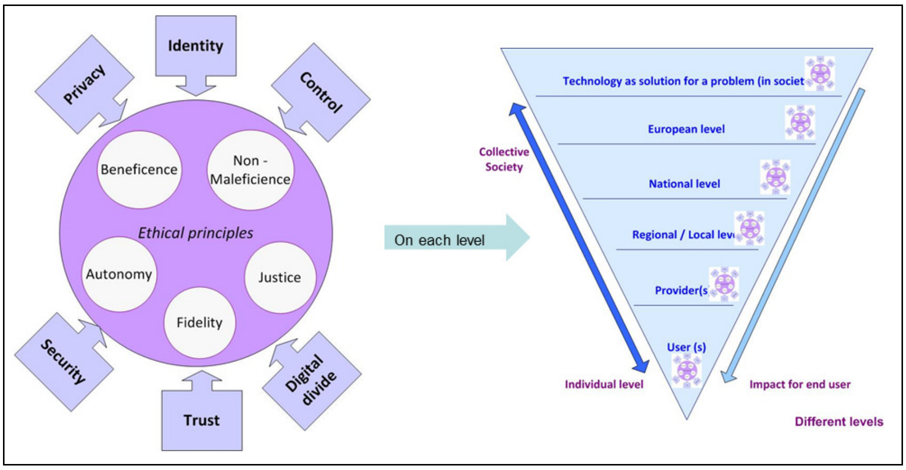

Figure 1. Ethical model

3. Results

The model has been applied as part of the user centred design process in two EU research projects Netcarity and CompanionAble. Netcarity is a project that investigated, tested and implemented technology and services in home environments to enhance the well-being, independence, safety and health of older persons. The purpose of Netcarity is to offer support in daily life by offering easy accessible services that serve as a first introduction to service provision on a distance. The services can be accessed by a touch screen that shows an overview of available services. The touch screen is envisioned to be the “window to the world” that allows them to take part in modern society and to provide assistance when needed.

One of the offered services is ‘Contact with family and friends’ and is targeted at communication. The Netcarity interface is used to enable video communication between users, their peers, family and friends. The Netcarity solution is open source (SIP based) and therefore allowing non Netcarity users to also use this service. It allows the older persons to initiate/receive video-calls only to/from those contacts that are registered for them within the Netcarity system.

Questions in relation to this service: ”Can the callee give permission per contact moment? Is it possible to indicate ‘not now’?”, “Are the possibilities with respect to presence/absence clear for the caller and callee?” Per contact moment a client can accept or decline the call. In addition to that the user interface is equipped with the option to indicate an availability status to other users. At the moment there are three possibilities: Not available, at home but currently not actively using the interface, and available for contact (see figure 2). An additional feature is that a person can change their own personal identity. This can be used when multiple persons are living in a household to indicate who is operating the Netcarity system, or for example to indicate different moods.

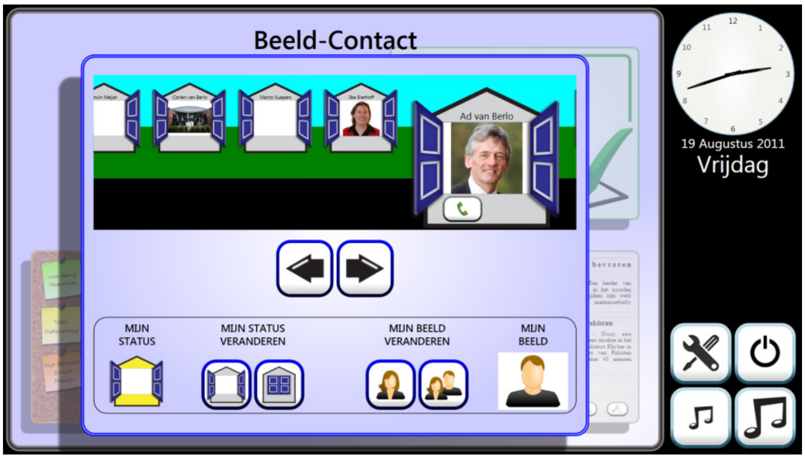

Figure 2. Video contact service, possibility to change identity

The Good morning service is targeted at welfare. There is daily video-contact between the older person and an employee of the service centre (SC) to ensure that the participant is well and to address any immediate needs for assistance. It is essential that the SC employee shows interest in the daily life of the older person. The focus isn’t necessarily on care but on things that occupy a person, care can be part of that. The basic periodicity (every day during a given time period) of the good morning service can be configured for each older person, based on his/her needs.

Questions in relation to this service: “Do we need a protocol for the use of the camera? If so, what elements should it contain?”, “What is the purpose of the service and with what goal is the camera used and applied?” Yes, a protocol is needed and should contain how to end a conversation in a respectful manner and under what conditions. The camera is used to improve and stimulate social contact and conversation, not to judge whether the health condition is good or bad. If a client does not look good, the nurse is notified by the service desk personnel. When the situation is severe, it might be possible to keep the connection open until the nurse arrives. It is made possible for the older persons to decide before making the call but also during the call to activate or deactivate the own camera. Two buttons are integrated in the design: With image (met beeld) or without image (zonder beeld). The design is presented in figure 3.

Figure 3. Good morning service, option to use with or without own image

CompanionAble is an Integrated Collaborative Research project within the 7th Framework Programme focussed on Research Technology Development and Innovation (RTDI) to support Ambient Assisted Living (AAL); in particular to push forward the frontiers of research in integrating assistive robotics within smart house environments.

The CompanionAble project is not an e-health project but an e-inclusion project. Therefore the main goal is to support people with memory impairments in their functional capacities in daily activities, for compensation and rehabilitation and preventing a worsening condition in the future. Moreover, the aim is to optimize the quality of daily living. Consequently, medical or monitoring support for memory training or drug reminders, as well as other functionalities, are designed in this perspective.

In relation of using the robot in the home environments the following question was asked “What are the side effects on the informal carer’s attitude?” In the final trails of CompanionAble, every person with MCI or dementia was accompanied by his or her informal carer, in most cases their partner. We have done several in-depth interviews with these partners, before, during and after the 2-day trials. All partners concluded these sessions with a very positive feeling, some even while asking when this system will be available in the near future. Some informal carers entered the sessions with a sceptic or fearful feeling, but all these feelings were quickly gone when they saw the robot and what it can do. Many stated without asking that this robot and underlying system could really become a ‘right hand’ of them as carers. One woman stated that taking care for your husband who is suffering from early dementia is very hard, and sometimes frustrating. She said that because you have to deal with the related problems all the time, it becomes very hard to see the person you love apart from his or her disease and all the frustrations, bringing negative feelings into the relationship. Then she continued saying that this robotic system could take over some of the annoying and constantly recurring tasks, such as over and over reminding him/her about certain things. If this can be done, she said, it would not only help her husband, but also help her in spending more quality time with her husband instead of ‘care time’, and help them together in keeping a happier relationship.

Figure 4. CompanionAble user and robot during a trial

In relation to active daytime management the following question was asked: “Will people’s motivation and autonomy be diminished when the robot reminds them of appointments?” No, this specific target group of people – persons with MCI, regardless of age – stated that these reminders are one of the most important things the system offers to them and one of the main things they miss in their daily life, when their partner of informal carer is not present. For example the robot asking a question like “there is something important you have to do today at this time: do you know what it is?” before giving the actual reminder is welcomed by several users. This should indeed be a feature of the system, triggering the mind of the user every now and then. In fact, the autonomy is expected to increase because people become more empowered and less dependent of their partners and other people. During the field trials people actually asked to remind them more, and indicated that this active engagement makes them more motivated to actually become active and do something [2].

4. Discussion/conclusions

The developed model is used to start the discussion on the ethical aspects of the Netcarity and CompanionAble system. It has proven to be a useful tool to facilitate the discussion and to make ethical considerations part of the user centred design process.
A number of other important additional aspects have also been identified:

- **Accessibility**; the interfaces have to be designed in a manner that these are easy to use and accessible for the targeted end users. This means keeping in mind their functional (in)capabilities.
- **Economics**; accessibility also includes an economical / financial component, in the sense that the systems should be affordable for many people (this related to the principle of justice). This is including the costs for reimbursement, maintenance and services distribution (so that all people have the possibility to use it).
- **Utility**; with regard to the actual needs and wishes in daily activities needs to be taken into account. Do people really get (only) what they need? Accessed utility might be different for different people and subject to change over time.
- **Side effects**; effects of the system on the relationship with proxy carers and professionals need to be considered. Try to describe what you (or others) still need to do to bring your results into a successful product or service on the market. What can be concluded from the work done so far?

Initial experiences have been gained on how to incorporate ethical considerations in the user centred design process but additional research is needed. Major issue is how to overcome the fact that halfway through the design process the system isn't running flawless. The use of Wizard of Oz techniques could be investigated.

The work carried out shows that small alterations really can make a difference. Several alterations were made to the design of the user interface and the workflow of the services based upon the results from the ethical focus groups. Furthermore it also became clear that the safety and other benefits of the system can outweigh the possible feeling of intrusion, for instance related to video analysis equipment, person location equipment, or remote control of the robot.

It is important to realize that the ethical considerations can also be manually applied when the technology fails. In this way it is possible to follow the ethical guidelines even when the technology is not ready yet.

Acknowledgement

The authors acknowledge the input and role of the Netcarity and CompanionAble consortium and would also like to thank the many people who volunteered in the various stages of user research.

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MYLIFE – A CASE STUDY OF THE ETHICS OF USER INVOLVEMENT IN FIELD TRIALS ACROSS EUROPE

Nada Savitch[1], Rachael Dutton[2], Deborah Brooks[3], Antony Walker[4]

Abstract

Because the Mylife system is based on user controlit was natural and important that field trials of the Mylife system and listening to the views of people with memory problems were an integral and major part of the project. We argue that ***not*** *to involve end users in the development of technology is unethical. Adapted methods are described that are inclusive of people with cognitive problems as full participants in product testing trials.*

1. Introduction

Mylife is a system designed to enable people with memory problems to remain orientated in time and in control of their appointments and social lives for as long as possible. The design concept of the Mylife system is based on user control. Although the appointments are entered remotely by a carer, friend or relative, the person using Mylife is in control of what information they are looking at and when. This is achieved by a technological and design solution that transfers the information and displays it using a simple to use interface on a touchscreen tablet pc permanently installed in the person's home.

Because of this emphasis on user control, it was natural and important that field trials of the Mylife system and listening to the views of people with memory problems were an integral and major part of the project.

We would argue that **not** to involve end users in the development of technology is unethical. From the simplest systems to complicated automatic decision making systems, it is the people who are the most important component of any system.

People with memory problems or dementia are particularly prone to the assumptions of technologist and designers that they know best. These users are nearly always

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presented with ‘solutions’ which have been developed completely separately from the reality of the lives of the people they hope to benefit.

Projects which do not involve potential users risk delivering technology which people cannot understand, with the result that they do not use it.

There is often a reluctance on the part of researchers to engage directly with people with dementia. This may be partly caused by the fear of the condition and the stigma associated with dementia. Researchers (and ethics committees) often do not realise that people with dementia can be involved in research. Researchers are therefore often uncertain about how to go about engaging with users who have memory problems. In addition, manufacturers and designers producing new products may have concerns about the amount of time and cost involved in setting up a consultation process.

This case study aims to give some indication of how field trial methods can be adapted to ensure that end users with memory problems are engaged with the testing process and have their voices heard.

2. Methods

Working with people with memory problems that may be due to, or develop into, dementia demands an inclusive and ethical approach to field trials.
In the UK the appropriate ethics committee advised that product testing such as used in this project would not need full ethics approval. In Norway and Germany the advice was different. However, ethical involvement of users was central to the project.

The methodology developed as part of the Mylife project aimed to be as inclusive of people with memory problems as possible. The methods we used in field trials seek to address some common issues associated with involving end users with memory problems:

- People with memory problems may find it hard to express their views – due to other symptoms of early dementia such as language difficulties, but also because they are often not used to being consulted.
- People with memory problems may have problems remembering what the trial was about and/or specific issues they have encountered with the system being tested.
- People with cognitive problems often lack confidence and may assume that it is they who are being tested rather than the system.
- The voice of family carers and professionals are often heard above those of people with cognitive problems.

A variety of methods were used that enabled people with memory problems to express their views in ways that suited them. Many people with cognitive issues have problems filling in long questionnaires and forms that are used routinely by researchers. Where possible interviews were used with people with memory problems, where questionnaires were thought appropriate for carers. We also used observational techniques using video and audio recording where appropriate.

Methods used for other groups were adapted for people with memory problems.For example, the think aloud technique requires people to say out loud everything that they are thinking and trying to do, so that their thought processes are externalised. Classic think aloud protocols involve participants thinking aloud as they are performing a set of specified tasks. Users are asked to say whatever they are looking at, thinking, doing, and feeling, as they go about their task. This enables observers to see first-hand the process of task completion. Observers at such a test are asked to objectively take notes of everything that users say, without attempting to interpret their actions and words.

A variation of the think aloud protocol is more appropriate for participants with dementia. The modified think aloud protocol for people with dementia described by Savitch and Zaphiris (2005) involves more intervention and the participant is encouraged to see himself as a collaborator in the evaluation and not an experimental subject. This method is appropriate for use with people with dementia because it enables the participant to be part of the research process and to concentrate on the strengths of the individual rather than highlight their impairments. This co-operative evaluation method enables the researchers to ask questions and clarify points with the participants during the tasks. This was felt to be especially useful when working with people with language and memory problems.
More quantitative methods would inhibit the participants and contribute to feelings of failure [1].

This adapted protocol allows the researcher to:

- Answer questions from the participant
- Explain the screen display when appropriate
- Carry out tasks and sub-tasks for the participant where necessary
- Explain to the participant where they have ‘gone wrong’ if appropriate.

Under the adapted Think Aloud protocol we are using, hints and tips can be given. Time should be allowed for the participant to try to carry out the task themselves.However, the participants should not feel that they are being tested and the researcher should try to ensure that they are not distressed by the experience.

Using adapted methods like the adapted. Think Aloud protocol ensure that consent can be continually reconfirmed during the trials rather than just at the beginning. The protocol assumes that the researcher is continually checking that the participant is not distressed or uninterested in the process.

As with any intervention that is trialled, an exit strategy was a vital part of the ethical considerations. Some users may become reliant on the system. Exit strategies varied slightly in each country. Attempts will be made to ensure that the system still operates after the trials have finished. It is also important to keep participants informed about the progress of product development and how this will affect them.

3. Results and analysis of data

Results of field trials will be presented elsewhere at this forum.

The views of people with memory problems were central to the project and weighted equally with those of their family carers and professionals. Each questionnaire presented to the carer was replicated by an interview with the person with memory problems or dementia themselves. Equal weight was given when analysing data to both types of user.

Qualitative analysis of rich data from audio and video recordings of people using the system allowed non-verbal and other data to be included. This is vital to ensure that people who have difficulty expressing themselves verbally are still included in the results.

4. Conclusions

This case study has shown that with some thought and application on behalf of designers and researchers, people with memory problems and those with a diagnosis of dementia can and should be involved in testing new technological advances that are designed to help them live better lives.

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IT-REHAB – INTEGRAL TELEREHABILITATION SYSTEM

Helena Fernández-López[1], Daniel González-Jiménez[1,2], Francisco J. González-Castaño[1,2], Luis A. Rocha[3], José A. Afonso[3]

Abstract

The main functionalities of the physical rehabilitation module of IT-REHAB are briefly described in this paper. IT-REHAB is a telerehabilitation system under development for patients with physical or cognitive rehabilitation needs. It supports wireless biomechanical and physiological data collection and includes advanced functionalities based on a custom-designed Medium Access (MAC) protocol for improved bandwidth utilization and an immersive user interface that incorporates virtual reality elements for a motivating experience. Moreover, it includes affective computing technologies for pain intensity estimation, wearables for easy sensor devices setting up, and real-time communication between patients and therapists.

Keywords - telerehabilitation; eHealth; assistive technology.

1. Introduction

Degenerative joint diseases are among the most common diseases in elderly patients, affecting mainly those joints subjected to weight bearing as knees and hips. Osteoarthritis is the leading cause of intervention. Specifically, knee arthroplasties are among the most common orthopedic surgical procedures in Spain [1]. Actually, in recent years, around 50,000 primary and revision hip and knee arthroplasties were annually performed by the Spanish National Health System [2].

Patients submitted to orthopaedic surgeries frequently need a large number of physiotherapy sessions. Providing for these needs leads to significant psychological and financial burden on the patients, their families and the health care system.

IT-REHAB is a telerehabilitation system which is being developed to support patients with physical and cognitive rehabilitation needs. This paper describes the main

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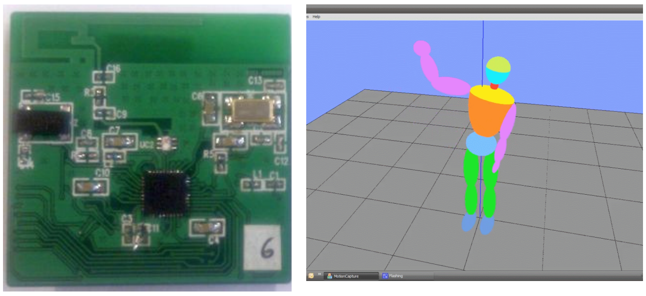
functionalities of the physical rehabilitation module of IT-REHAB, which allows patients to conduct physiotherapy exercises under remote supervision of their therapists. While a patient exercises, the system continuously measures the extension of the movement of the monitored body structures. Moreover, it will be able to monitor physiological parameters and to estimate pain sensation through video image analysis.

2. The IT-REHAB system

IT-REHAB includes physical and cognitive rehabilitation modules. The physical rehabilitation module is based on the motion capture system developed by Afonso el al. [3]. This system is based on kinetic sensors that capture the 3D orientation of any segment of the body and transmit it, in real-time, to a base station. The system achieves accuracy better than 2.5°. Figure 1 shows (a) a wireless orientation capture board and (b) the prototype user interface developed for testing purposes. The cognitive rehabilitation module will follow the development of the physical rehabilitation module.



(a) **(b)**

Figure 1. Orientation capture board (a) and prototype user interface (b).

Besides supporting remote rehabilitation, the system allows therapists to supervise the performance of several patients on joint physiotherapy sessions. The possibility of patient interaction may prove stimulating for those recovering from interventions and also for chronic patients, such as those with chronic pulmonary obstructive disease (CPOD). However, as orientation capture devices generate a large amount of wireless traffic, it is necessary to guarantee minimum bandwidth requirements to assure that data packets are not lost.

The IEEE 802.15.4 protocol, a widespread wireless communication standard for low-rate, low-power consumption Wireless Personal Area Networks (LR-WPANs), already provides a reservation-based data transfer scheme named Guaranteed Time Slot (GTS). However, the GTS scheme presents some drawbacks, such as inefficient bandwidth utilization and support to a maximum of only seven sensor devices.

The eLPRT (enhanced Low Power Real Time) protocol [4] implemented on the orientation capture boards provides a new reservation-based MAC (Medium Access Control) protocol that introduces several performance enhancing features in comparison to the GTS scheme. Namely, it includes various mechanisms designed to enhance data transmission reliability against channel errors, improve bandwidth utilization and increase the number of supported sensor devices. In the current implementation, up to forty nine sensor devices can simultaneously operate.

The patient interface under development will include virtual reality elements, which provides an immersive, interactive and motivating experience to patients. Moreover, the system will allow therapists to select exercises and control practice intensity and feedback to create personalized treatments. It is expected that these advanced features will positively contribute to improve user compliance and treatment results, as the outcomes from the research conducted by Merians et al. [5] suggest.

Additional features to be implemented include physiological data monitoring, such as heart rate and oxygen saturation (SpO_2), and a novel mechanism to estimate pain intensity from facial expressions obtained from video images captured during therapy sessions [6, 7, 8]. This last feature is being developed by the Multimodal Information Area of Gradiant, which has relevant knowledge in human sensing, face analysis and affective computing [9, 10, 11].

IT-REHAB will additionally include wearable pieces that will allow easy motion capture devices setting up. Finally, it will support data transfer and storage for adequate patient follow up and evaluation.

3. Related work

Most projects [12, 13] and recently launched systems, such as [14], aim solely at the home environment and require individual positioning of several orientation capture devices. IT-REHAB overcomes these limitations by providing an environment where multiple patients can be supervised in joint rehabilitation sessions. Moreover, the use of wearable pieces will contribute to facilitate positioning motion capture devices on body segments. In addition, IT-REHAB will enable estimating pain intensity based on video analysis and real-time monitoring of some physiological parameters.

4. Conclusion and future work

IT-REHAB will lead to convenient care of patients who need rehabilitation for long periods. It includes innovative technologies and advanced functionalities that open new possibilities for patients, therapists and health care systems in general.

Future work includes the development of the patient interface and the algorithms for pain intensity estimation as well as the assessment of the acceptance and the performance of the system in real scenarios. Related projects include the development of a system to enable COPD patients exercise at home. It uses the Kinect, from Microsoft, or a similar user interface for image capture, and includes a software module that evaluates the similarity of a patient gesture with a gesture template.

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AMBIENT LIGHT GUIDING SYSTEM FOR THE MOBILITY SUPPORT OF ELDERLY PEOPLE

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Abstract

Within this project we will develop and implement an intelligent light wayguidance system, which should attenuate age-related mobility impairments caused by reduced spatio-temporal orientation, worry about getting lost, and fear of falling. This guiding light will consist of up to date lighting technologies, innovative intelligent control algorithms, smart mobility monitoring systems, and a distributed information system for mobility parameters. Together with end-users and all stakeholders we will examine how these components can be combined with inter-personal care services.

1. Objectives

The aim of this project is to develop, tentatively implement and empirically evaluate an intelligent lighting assistance for maintaining and improving indoor and outdoor mobility of older people at different stages of ageing process and to prepare it for market launch. Generally, light is used to meet visual needs of human, e.g. highlighting risks of falling, is applied for temporal orientation throughout the day, e.g. emphasizing day-night rhythm, for spatial navigation during activities of daily living, e.g. illumination of a defined location areas, and is used as remembering as well as information signal, e.g. light spots and light signals [1]. Light therefore has great potential for attenuation of age-related mobility impairments caused by reduced spatio-temporal orientation, worry about getting lost, and fear of falling [3,8]. This project makes use of light in this sense by implementing a light wayguidance system in private homes of older people that performs a time- and motion-controlled change of intensity and colour temperature of room lightings [4]. We will use existing lightings in these rooms and supplement them with additional lighting equipment and electrical installation technologies. After modification light characteristics of lamps can be changed according to the personal daily routine and preferences of residents. This modification of all light parameters will be performed on a regular basis.

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Furthermore, mobility parameters of residents (such as movements in and outside the home) will be continuously monitored and the results of analysing these data will be used to change the programming of light variations (e.g. circadian lighting variations, orientation lights, light quality coding of rooms, salient illuminating intended goals). For this kind of intelligent light adaption we will use elaborated genetic algorithms, which abstractly resemble evolution in nature and are often used to find good search solutions within huge data spaces as we will derive from mobility monitoring and multiple light control [5]. A genetic algorithm is a stochastic search in which a successor situation is generated by combining properties of two preceding situations. In our case a situation is defined by multifactorial state of room lighting in older person's home. Each state is rated by the evaluation or fitness function, which is in our case the nature and scope of mobility of older person. According to this evaluation two states are selected for reproducing new states applying analogical crossover and mutation procedures. This adjustment of light programming will be done automatically by our system on a regular basis, nevertheless, residents can manually readjust their lights at any time.

The degree of mobility is an important indicator of health, furthermore, mobility aims to overcome the effect of spatial and temporal distances on human activities [2,7]. As the ability of individual temporal and spatial orientation of elderly people will be influenced by our new intelligent light wayguidance system, called Guiding Light, primary and secondary end-users might consider it important to know positive as well as negative variations of personal mobility. This knowledge might be very important as it will strengthen self-control and self-determination, setting up appropriate expectations, improving compliance, and supporting participation among seniors. For secondary end-users this knowledge is decisive for choosing adequate home health/care/social services. For this reason we will integrate relevant parameters (e.g. senior's general motility, dynamics of body movement, and distances in indoor as well as outdoor locomotion) into a distributed information system as the basis for decisions about preventive provisions. This will give residents at any time insight into some aspects of their health status, which can be shared with persons of trust (e.g. family members, health/care/social services).

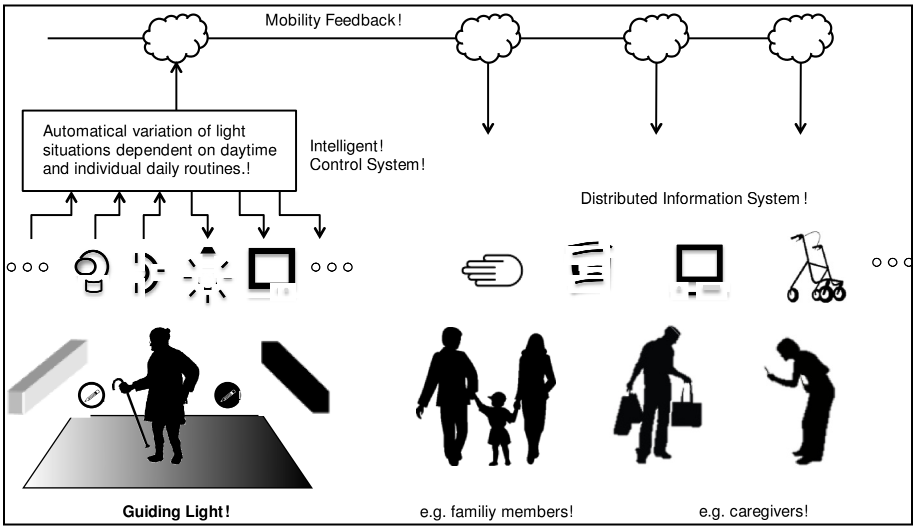

Figure 1. Basic components of Guiding Light service model.

2. User centred design process

When developing the user interfaces of Guiding Light, we will apply principles of participatory design and iterative design, which means that the end-users will be involved at all stages of development [6]. Besides, we apply a design-for-all approach that will greatly enhance the potential for commercial exploitation because it extends the group of potential beneficiaries to include anyone desiring a more usable and joyful experience with AAL home automation. This applies to computer interfaces as well as the home environment. Outcome of the project is an intelligent light wayguidance system consisting a variable set of flexible modules that work together with other heterogeneous home automation systems, information and communication systems as seamlessly as possible. Guiding Light will support spatio-temporal orientation of older people and thus sustain their mobility as long as possible.

Our end-user segments are located along various continua rather than in “locked” categories. Primary end-users, actually using Guiding Light, are older people in post-retirement age but at different stages of individual ageing process reaching from healthy elderly up to multi-morbid elderly. Configuration of our solution packages (e.g. modules of home automation and information system) is different for those needing (professional) care (on a regular basis) - because having problems with mobility and spatio-temporal orientation e.g. due to dementia - and those older people who need no care. Solution packages can always be reconfigured according to individual needs. Nevertheless, we will focus single person households since they are more vulnerable to age related diseases and (stand-alone) emergency cases. End-user communication will be different for experienced front-runners and digitally challenged people but system will be easy to use in the same way for both user segments since we will follow a design-for-all approach in user interface design. Technological solution of home automation (wireless/field bus system) can be different for those end users who move their flat, e.g. into a new service oriented single apartment, and those who stay at home either entirely reconstructed or adapt only relevant room installations. Secondary end-users, directly being in contact with a primary end-user that uses Guiding Light, are family members, staff from health/care/social services, and/or staff of retirement houses as well as residential care homes.

3. Business plan

Our direct customers, to whom we will sell Guiding Light, are from customer segments along the value chain of estate industry that deal with housings for older persons. This includes planning organizations (e.g. communities/municipalities, architects, home adaptors, electrical planning engineers), creating companies (e.g. real estate/project developer, building industry/trade, general contractor), and management organizations (e.g. housing cooperatives, property companies, operators/carriers of retirement homes, social services, outpatient care services, physician, facility manager, building services engineers, telecommunication companies). Additionally/eventually we will sell Guiding Light to family members of older persons (possibly suffering from dementia illness). Direct consumers will probably reach financial support from health/care insurances, property/public/private funds, building societies, estate agents, or other private persons (e.g. family members) etc. This financial support is, however, not absolutely necessary, since with Guiding Light consumers will either receive economic relief or better profit as well as satisfied end users.

We are promising the following value proposition for customers and end users: Basically, we want to provide for our end users, older persons possibly suffering from dementia, support in mobility and in orientation at home as well as outside of their homes with Guiding Light. We expect positive impact on health and spatial awareness/orientation through lighting and training, optimization and support of activation at morning and relaxing at evening, and through intelligent feedback and guidance based on acquired individual data. Guiding Light will not only enhance older person's quality of life but also standard of living/working for all related persons (e.g. family members, health/care/social services) by means of saving time/money, optimizing services/support, and last but not least peace of mind concerning health and wellbeing of older persons entrusted to their care. Additionally, as an innovative living and residential form as well as sustainable health/care service Guiding Light will be a unique selling proposition for our customers (e.g. forward-looking living concept of housing cooperatives, modern care services of operators/carriers of retirement homes, innovative social services). From the technical side of view our solution will be unique because we are offering up-to-date building automation with modularity and scalability of AAL components (only needed modules have to be bought = pay for use). Easy installation into existing flats and houses help to keep costs and efforts for residents low. Finally, simplest interfaces and a mostly automated and ambient working system will avoid feelings of obtrusion and allow elderly and non-technology-affiliated people to use the system without problems.

Our customer relationship is mainly limited to planning organizations, creating companies, and management organizations (see customers segments). These direct customers need to know us as AAL solution developer with innovative products of high quality that provide valuable benefits for their own customers (residents) and let them earn money with that. If customer is aware of Guiding Light, he has to use it and sell it in combination with his products (e.g. buildings, flats, health/care services) as innovative and promising opportunities for customers with the proper needs. This means that on the one hand our customer has to use our expertise to create attractive bundles for his customers and on the other hand there should be an effort to advertise those AAL-solutions to the market. Our direct customer segments has to be the sender for the AAL-product, resp. Guiding Light. In return the customer can expect a know-how transfer regarding our solution, second level support, ongoing progress in development, maintenance etc. Our relationship to the end-user segments (primary and secondary) will be limited, because our direct customers will get in touch with them and will establish a customer relationship there and also provide first level support. Although within Guiding Light we can provide upselling possibilities directly for e.g. additional modules or devices.

We plan to generate revenues through Guiding Light by means of several activities along the value chain of estate industry. This includes consulting/planning activities to setup bigger projects (project based revenues). Since our main platform can work as a distribution network where other developers of AAL modules can distribute and sell their applications within our framework/environment and we as a platform provider can earn e.g. 30% of the revenue. Furthermore, we will generate revenues through implementing front-end hardware and software components (revenues from installation) and through initial profit margin for the hardware/sensors/equipment installed into the flat/houses. Our current business model deals with monthly service fees from the end consumer for used modules based on micropayment (e.g. 9,50 EUR per module, month and account/person). Our long term intention is to bring Guiding Light to a mass market and to earn money based on micro payment. This requires the use or definition of standards to make installation, configuration and later extension of the product as easy as possible without the need of additional support from the outside.

4. State of the project

We have started project on May 1, 2012. On current status of project we have consolidated the scientific findings about the importance of light stimuli for older person's wayfinding and the implementation of research findings in AAL - including our own results - considering user acceptance and related issues together with selected stakeholders. We have focussed implications of medical (resp. geriatric) and psychological (resp. gerontological) aspects in aging process on spatial and temporal orientation, daily structure, and mobility of the elderly. Furthermore, we have analysed relevant home automation technologies (sensors, actuators and building management systems), latest lighting technology and the impact of light on spatial and temporal orientation, relevant software systems, protocols, and data interfaces intended to use for Guiding Light. We have also validated technological integration against a variety of real use scenarios together with selected representatives from target groups.

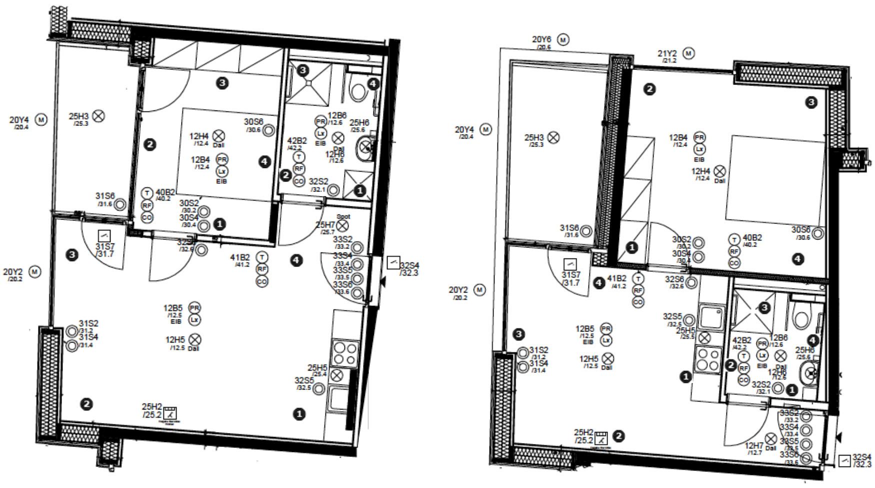

Figure 2. Layout plan of two test households for elderly persons.

We have already acquired 2 of 20 private households with older persons (72+) who will participate in the field test of our project. So far we have planned barrier-free arrangements, relevant equipment, and electrical installation of these two apartments. This includes actors (e.g. controllable lighting, shadowing, switches), sensors (e.g. motion, light and air quality), intercommunications (e.g. emergency call, ethernet, internet), and user interfaces (e.g. touch screens). Additionally, we could start developing software architecture for building automation and information system of Guiding Light.

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MYGUARDIAN: A PERVASIVE GUARDIAN FOR OLDER PEOPLE WITH MILD COGNITIVE IMPAIRMENTS

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Abstract

Many elderly people with a mild cognitive impairment experience barriers towards moving around in outdoor environments. Many barriers are caused by worries: "How can I be sure to find my way?", "What happens when I get lost?", "What if I suddenly fall ill or need help?". Similar questions are posed by the caregivers: "Where is he/she now?", "Does he/she need help?", "Can I be sure he/she is going to get back home?", "Is it safe to let him/her go outside alone?". MyGuardian aims to facilitate safe and secure mobility of seniors with mild cognitive impairments while preserving their autonomy and dignity, and thereby enable seniors to increase their mobility (while increasing their self-confidence) and consequently to take part in the self-serve society. By removing the barriers towards autonomous mobility, MyGuardian ultimately improves physical health, wellbeing, and social life of seniors. At the same time, MyGuardian improves wellbeing and efficiency of voluntary caregivers (e.g., family and friends) by ensuring their peace of mind and keeping them informed when the senior is experiencing confusion states and risk situations when out and about, and improves efficiency of professional caregivers by providing them with up-to-date information and by supporting coordination of their care efforts. Third, MyGuardian enables new business models for professional caregivers by enabling them to assist voluntary caregivers and to step in when needed.

Keywords: Orientation, mobility, mild cognitive impairments, dementia, safety.

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1. Introduction

The European MyGuardian project (2012-2105) [1] launched in the Ambient Assisted Living program aims to facilitate **safe and secure mobility of seniors with mild cognitive impairments** while preserving their autonomy and dignity, and thereby enable seniors to increase their mobility (while increasing their self-confidence) and consequently to take part in the self-serve society. By removing the barriers towards autonomous mobility, MyGuardian ultimately improves physical health, wellbeing, and social life of seniors. At the same time, MyGuardian **improves wellbeing and efficiency of voluntary caregivers** (e.g., family and friends) by ensuring their peace of mind and keeping them informed when the senior is experiencing confusion states and risk situations when out and about, and improves efficiency of professional caregivers by providing them with up-to-date information and by supporting coordination of their care efforts. In Figure 1 a explanation of MyGuardian concept.

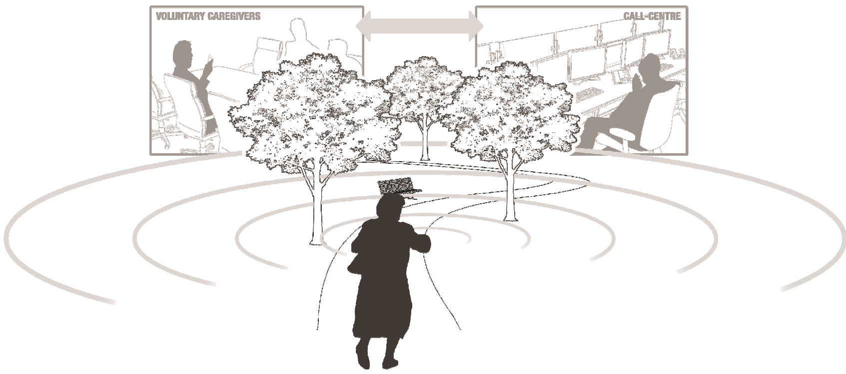

Figure 1. By removing the barriers towards autonomous mobility, MyGuardian ultimately improves physical health, wellbeing, and social life of seniors with mild cognitive disorders.

MyGuardian will positively affect the quality of life of seniors with mild cognitive impairments and their caregivers at different levels: it will allow them to **maintain autonomy and mobility**, which is a crucial issue for enabling independent and healthy living, as it is proven than mobility and active lifestyle contributes to slowing down the development of the cognitive impairment; it will also guarantee **on demand assistance**, which is essential for keeping peace of mind when safe moving around safely, especially in an unknown environment; it will also enable independent living by allowing seniors to maintain a high degree of independence and autonomy while assuring that assistance can be provided, if required; it will **help seniors to participate into digital self-service society**, while keeping their caregivers informed and calm about the context and state, the senior is.

MyGuardian will be developed and evaluated with target end-users in Spain, France and The Netherlands. End-user organizations in these three countries will be involved.

In addition, SMEs in the consortium will leverage their customer networks in further countries. Each end-user organization will provide access to approximately **30-50 seniors** with mild cognitive impairments together with their voluntary caregivers and possibly also professional caregivers (e.g., their social nurses). The service fits both the aging, self-serve society trends, and the trend of wide availability of mobile computing and ubiquitous communication technologies.

2. Methodology

The contribution of end-users will play a crucial role along all the phases of MyGuardian project: from the service definition, to its development, implementation and exploitation. For this reason it is important to underline that the perspective of the end-users will be constantly analyzed and studied during the whole process. We will describe the perspective of end-users at three levels: by analyzing the effective involvement of primary end-users (elderly with mild cognitive impairments and his/her caregivers) during all the project stages; by summarizing the role the secondary end-users (elderly care organizations) will play along the project; the involvement of tertiary end-users (public or private institutions) in the project will be pointed out.

The end-users involvement along all the stages of MyGuardian project will be guaranteed by the presence of **three elderly care organization in MyGuardian consortium, "CETIEX" (Spain) and CAR (The Nederland), AGIM (France): the needs, the expectations and feedbacks of 150 elderly users (30-50 per a trial site) will be gathered and analyzed during all the stages of the project.**

Primary end-user that is, elderly with mild cognitive impairments, will be able to test and validate the pilot application in all its functionalities, thus verifying the capability of MyGuardian service in helping them in their mobility concerns during their daily life activities, making them feel safe and re-assured. Thanks to the planning of frequent face-to-face meetings between end-users and corresponding project members (i.e., CETIEX with HIB, CAR with ConnectedCare, and AGIM with Vigisense), elderly people and their caregivers will be able to express their opinions and provide contributions in order to improve the MyGuardian software and adapt it to their real expectations and needs.

During the phase of MyGuardian project development, secondary users will also provide to the other project partners the perspective of the end-users in order to be able to validate the project progress by means of their feedback. End-users perspective will be considered during the business model analysis as well, since it will provide input about user behavior and attitude, purchasing processes, regulatory and other decision-making aspects. The involvement of tertiary users (institutions and private or public organisations which are not themselves directly benefiting from using the service, but contribute in organizing, paying or enabling the service) will be guaranteed as well thanks to the planning of dissemination activities.

MyGuardian test environments are **realistic user's environments**, where MyGuardian will be tested in their daily activities and **not limited to a control environment** in order to demonstrate the success criteria of the proposal. The outcome of the tests will be monitored and investigated, **both in situ and based on surveys and interviews with the end-users**. To improve our view regarding the user acceptance the investigation of test scenarios **involving volunteers** (especially voluntary caregivers) **from the "outside world"** is also planned.

3. Service

The main features to be achieved in MyGuardian service are:

- **Enable easy-to-use & rich communication between the mobile senior and the caregivers**

MyGuardian removes barriers towards mobility, and at the same time increases peace-of-mind for seniors and caregivers by providing easy-to-use & rich communication. In non-emergency situations, communication between senior and caregiver can reassure both caregivers and the senior. Since explicit synchronous communication (e.g., by telephone) is often experienced as too intrusive, MyGuardian will provide additional communication modes. Asynchronous messages ("I'm feeling fine", "I'm home") can be a valuable source of information for caregivers, and seniors often want to share information. Moreover, explicit communication can be enriched using implicit tags, e.g. by tagging messaging with contextual information on senior state, including location (precise, or rough and ambiguous, as required) and senior's psychological state (i.e., feeling lost or confused). This will improve awareness of the actual care needs and increase peace of mind of caregiver(s) and senior itself.

- **Remote tracking & assistance**

The MyGuardian system consists of a minimally intrusive device (consisting of a smartphone and possibly a bracelet) carried by the seniors with mild cognitive impairment, as well as a web service that can be accessed by their caregivers (using a mobile phone or desktop PC), and it will **enable the caregivers**, within pre-agreed and preset privacy and ethics parameters, **to "virtually guard"** the senior, by getting in touch with a roaming senior (i.e., 'nudging' him/her) anytime, as well as, if explicitly requested, to monitor the whereabouts of the senior (at the given precision level). The system will also **monitor senior physiological state and behavior** in order to detect if senior shows signs of being lost or confused, or if he/she is exposed to any particular behavioral risk. In these cases, the system will provide an **appropriate, personalized intervention, escalating depending on the assessed criticality of the situation**, the senior is in. Therefore, the intervention will be provided in the form of a feedback to senior himself ("Are you ok?"), an automatic assistance request to his caregiver(s) or, a direct contact with a call-centre.

- **Enable coordination between caregivers**

Seniors with mild cognitive impairments are generally supported by a group of caregivers, both voluntary caregivers (including family members, neighbors, friends)

and professional caregivers. A key challenge of the MyGuardian project is, on one hand, to calm them down by providing relevant real-time information about the senior state, and, on the other hand, if the need arises, to improve awareness within the group of caregivers, and enable them smooth distribution and delegation of care tasks.
These features will be provided through the architecture depicted in Figure 2.

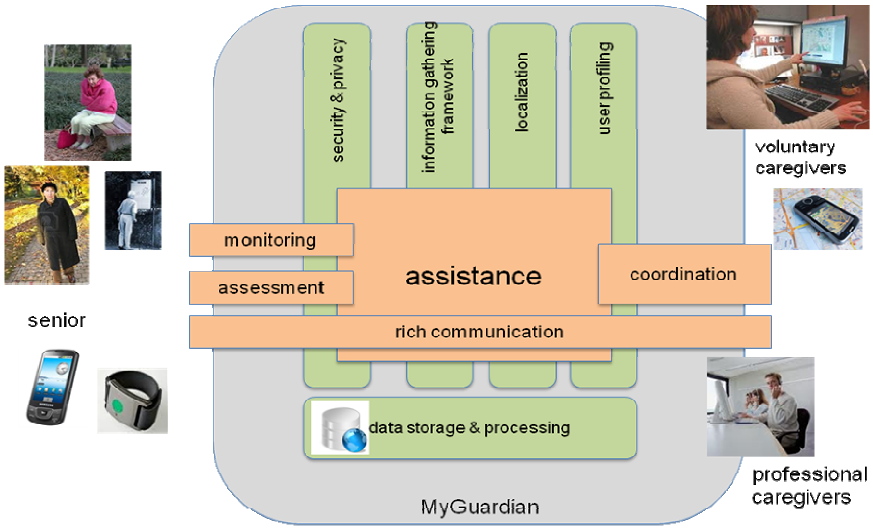

Figure 2. Overview of MyGuardian System Architecture

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USER EVALUATION OF THE ROSETTA ASSISTIVE TECHNOLOGY SYSTEM FOR PEOPLE WITH DEMENTIA

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1. Introduction

Worldwide it is estimated that in 2050, the number of people with dementia will have risen to 115 million people. Persons with dementia experience memory and other cognitive problems, which seriously impact their daily functioning. Care resources to support them will be insufficient in the future and therefore alternative solutions, such as assistive technologies are needed. In the European Rosetta project three separate ICT systems are improved and integrated with the objective to create one integrated, modular, system, the Rosetta system, that helps community-dwelling people with severe memory problems and people with a dementia syndrome in different stages of the disease to retain their autonomy and quality of life, postpone institutional care, and that supports the informal and professional carers.

The aim of the project is to develop the Rosetta system and evaluate it on a) usefulness, user-friendliness, and impact in daily life of persons with dementia and carers; b) ethical issues regarding design and trial, and c) technical issues.

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2. The Rosetta system

The Rosetta system integrates three systems: the Elderly Day Navigator (EDN), the Early Detection System (EDS), and the Unattended Autonomous Surveillance/Advanced Awareness and Prevention System (UAS-AAPS) (see figures 1,2 and 3). EDN supports persons in daily functioning in the areas of memory, social contact, daily activities and safety, EDS monitors daily behaviour over a long period of time and timely detects changes in patterns of functioning, and UAS-AAPS automatically detects emergency situations (like falls or wandering) and generates alarms to carers. The technology consists of a touch screen computer, a mobile device, sensors, actuators and cameras, integrated into a system where the real-time analysis of the situation is performed in the house and the information/messages are provided in a cloud-based environment outside the home. The separate parts of the ROSETTA system are not completely new, but are built upon previously developed systems. The major innovation consists of integrating them in such a way, that it meets the needs of persons with mild cognitive impairments and dementia in different stages of the disease. In the earlier to mild stages of dementia mainly EDN and EDS will be used and in the more severe stages of dementia mainly EDS and UAS-AAPS. The system is based on a collection of open international standards. The most important ones are: Java, OSGi, SIP, SSL, MySQL, Wi-Fi, Bluetooth and Internet related standards as XML and HTTP.

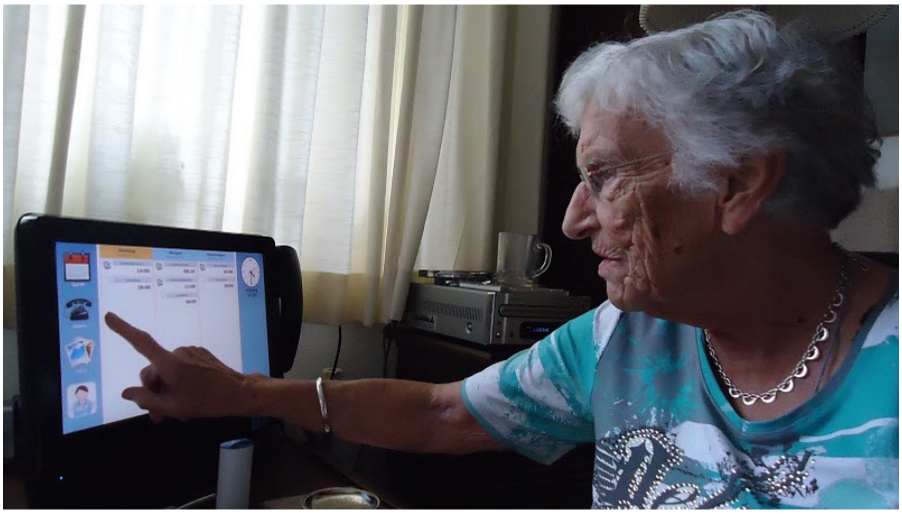

Figure 1. The Elderly Day Navigator touch screen

Figure 2. EDS web portal for carers with assessments of behaviour patterns of a specific client

Figure 3. Smart AAPS camera in the corner of the living room

3. Methods

During the development of the Rosetta system, iterative workshops were organized with persons with dementia, their carers and experts to assess needs, wishes and functional requirements. The prototype was tested in the lab, in a demonstration house in the Netherlands and finally in a controlled field trial with persons with severe memory problems or dementia in the Netherlands, Germany and Belgium. They used (parts of) the system for up to 5,5 months in their homes. Data were collected by means of pre-test and post-test interviews and standard questionnaires, observations, in between interviews, diaries and logging. Besides, at the end of the trial in the Netherlands, informal carers participated in a focus group session. Professional carers from the three participating countries received an online survey on usefulness and user friendliness of the Rosetta system and on work satisfaction.

4. Results

Recruiting participants along with their informal carers for the trials proved a challenge. Doubts about participation were common at the start among persons with dementia and their carers. This was related to questions regarding the technical performance of the system, acceptance of the system by persons with dementia, or privacy issues. Most of these doubts disappeared during the trials.

42 Persons participated in the controlled field trial, post-test data were available for 28 persons. Despite some problems with system performance mainly in the beginning of the trial, participants positively valued the usefulness of the system. They were, however, less satisfied with the user friendliness. There were no statistically significant effects on outcome measures in this explorative trial, but participants indicated that the Rosetta system helped structuring the daily activities, improved feelings of safety and security, diminished burden of carers and enabled people to stay longer in their own home.

Privacy issues did not seem to be a major concern within the Rosetta-trials. Most participants and informal carers felt they could be themselves with the sensors and cameras in the house and that privacy was warranted, although some participants did seem to somewhat adapt their 'normal' behaviour. Furthermore, some participants expressed they did not feel free to quit before the end of the trial. After the trial period, people were offered to keep the system in their home, and five participants in the Netherlands accepted this offer.

Persons with dementia, informal carers and professional carers see potential in implementing the Rosetta system on a larger scale in the future, provided that some improvements will be made. These concern for instance the sensitivity of the touch screen, elaboration of the agenda function, extension of the fall detection functionality to include additional type of falls, and improvements regarding the technical performance of some of the functionalities.

5. Discussion & conclusions

The project succeeded in the user participatory development of an integrated, multimodular, Rosetta system. Both in the opinion of people with dementia and their carers the Rosetta system has the potential to assist people with mild to severe cognitive problems in their daily functioning, thus helping them to retain their autonomy in daily life and to postpone admission to a residential care facility. However, before bringing the system on the market, several improvements have to be made regarding the user friendliness and usefulness of the system and the introduction of the system in the homes of people with dementia.
Implementation of the improved Rosetta system may (costs-)effectively support the growing number of community dwelling persons with dementia during the early and more advanced stages of the disease.

CONFIDENCE – A MOBILITY SAFEGUARDING ASSISTANCE SERVICE WITH COMMUNITY FUNCTIONALITY FOR PEOPLE WITH DEMENTIA

Cornelia Schneider[1], Viktoria Willner[1]

Abstract

This work deals with a mobility safeguarding assistance service for people suffering from mild to moderate dementia called CONFIDENCE. For this people assisted living at home should be made possible in order to prolong their active participation in social life and in order to alleviate the strain on public care services. Also families who are burdened with providing care either directly or via cost-intensive public or private care organisations should be supported by the service. CONFIDENCE offers the combination of service innovation with state of the art mobile communications technology and location based computing, within the legal frameworks of the participating organisations: the idea is to offer real-time assistance via mobile phone and geo-tracking technology when people suffering from dementia suddenly lose orientation and feel insecure. End user trials will be conducted in three countries which have differing requirements due to the organisational culture of their social service systems.

1. Introduction

With increasing life expectancy dementia is a rising problem. In 2006, it was estimated that 7.3 million Europeans between 30 and 95+ were suffering from dementia. And the number of persons affected is expected to double by 2040[1]. The most common types are Alzheimer's disease (60 %) and vascular dementia (16 %). Dementia affects the elderlies' capability for autonomous ability indoors as well as outdoors. At the first stage of dementia, people suffer from moderate but progressively increasing memory loss, difficulties with time-space relationships, and disorientation even in places they are familiar with. They often feel unsure in their daily routine. As a result of the increasing sense of disorientation people get fearful and consequently they gradually lose their independence and mobility. Common routes and tasks such as shopping, housekeeping or simply taking a walk become a daily challenge.These limitations not only pose problems for those concerned they can also become very challenging for their families. Here the CONFIDENCE approach for a mobility safeguarding assistance service with community functionality for people with dementia comes into play. CONFIDENCEaims at providing mobility and safeguarding assistance services forpeople suffering from mild to moderate forms of dementia. It intends to develop a novel community-enabled mobility safeguarding assistance service that combines

[1] Ferri, C. P. et al. (2005).Global prevalence of dementia: a Delphi consensus study. Lancet, 366, 2112–2117.

"assistive technologies" with "personal help". To this purpose a community consisting of family members, staff of home care agencies and/or trusted volunteers will be built up. They will use advanced ICT to work together in supporting patients with mild to moderate dementia.The mobile CONFIDENCE service is a "virtual companion" providing different levels of assistance that can be adapted, depending on the situational needs of the patient and the degree of orientation loss. It will offer a **virtual voice service** (requesting assistance from care persons, who can locate the person in need on an electronic map and give them instructions on where to go), a **virtual video service** (client can actually see the care person, thus creating a sense of confidence and security), a **location tracking service** (provided the previous consent of the client, the person can be tracked on an electronic map during all his/her moves), a **mobile community service** (allowing care persons organise care and to be mobile themselves while giving instructions to persons who have lost orientation), and finally, a supporting service called **training/preparation @home** (serves as a platform for training and stimulating the other CONFIDENCE services - it should assist the elderly e.g. when planning a trip).

2. Methods

CONFIDENCE is implemented according to the human-centred design standard for interactive systems (ISO standard 1307). Two development cycles (iterations) of CONFIDENCE are organized around lead users by involving them in all phases of the development process starting with (1) requirements analysis, followed by (2) system design, (3) implementation and (4) field trials. The first iteration already aims at running parts of the system in a field trial and the second iteration aims at the refinement of the implementation including the feedback of the first iteration. The field trials will take place in three different countries (Austria, Switzerland and Romania) from each countrythree persons with dementia, one professional from the respective home care agency, one volunteer and one family member (14 persons in total) were selected as lead users.Now we are at the first stage of CONFIDENCE were three lead user workshops onein each country took place to define personas, scenarios and the functionality of the different services.

3. First results

Due to the fact that CONFIDENCE has just started only first results concerning the lead user workshops can be presented now.

According to the lead user workshops in Austria, Switzerland and Romania the main functionality for each CONFIDENCE service has been identified. Furthermore for each country a corresponding persona (with country specific habits) has been defined. Based on the identified functionality suitable scenarios have been created.

Consecutively the identified functions of the CONFIDENCE services will be briefly described:

Training/Preparation @Home
This service will consist of a component called “Information and Reminders” where different types of information can be retrieved and reminders can be scheduled. Furthermore a component for “Preparing a trip” will be implemented so that the elderly and/or family members will be able to plan and prepare for a trip.

Mobile community service
According to the lead user workshops this service will focus on two main aspects “Assistance in the coordination of care” (e.g. care planning, integrating the existing network of the elderly in the care process etc.) and “Assistance forpeoplewith dementia” (e.g. possibility to enter appointments and reminders for the elderly).

Virtual voice service
This service will focus on two main aspects “Request help at home” and “Request help when having problems on the way”.

Virtual video service
This service will be an extension of the virtual voice service. It will support voice interaction at home and on the way with the opportunity to see the local conditions.

Virtual tracking service
The agreement of the care recipient provided the service will consists of following components:

- Support in way finding
- Support in case of deviations from planned routes
- Support in case of deviations from daily/everyday trips
- Generic detection of anomalies

4. Next steps

Both personas and scenarios will be validated within a second lead user workshop in each country within the next few weeks. After the workshops functionality, personas and scenarios will be finalized. In parallel work package “system requirements” will start. The business partners will begin to analyse the market opportunities and barriers for CONFIDENCE in each participating country.

MYLIFE - MULTIMEDIA TECHNOLOGY FOR PEOPLE WITH MCI: THE TRIAL RESULTS

Dr. Eva Schulze[1], Anja Wilbrandt[2]

1. Introduction

Dementia is increasing steadily – scientists expect, that there will be appr. 12 Mio. people affected all over Europe in 2030 and even 19 Mio. in 2050. Right now there are already 10 Mio. struggling with dementia. The costs for nursing these people will expand dramatically because the traditional family concept (several generations living together/the younger ones taking care for the older ones) is disappearing.

Mylife is a technical assistant, which was developed to support people with memory problems or mild cognitive impairment (MCI) in daily life. The Mylife program runs on any android based touch-screen-technology, such as smartphones or tablet PCs. It displays day, date, time and appointments at a glance. It also includes an acoustical and optical reminder to forthcoming events. By having a look at the calendar one can check previous or upcoming events. In addition Mylife offers the opportunity to look at photographs or send a contact message to familiar persons.

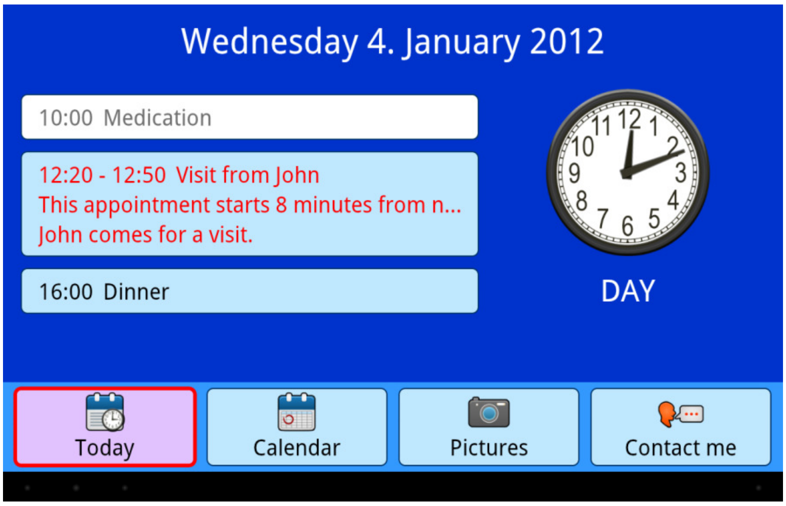

Figure 1. Today

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Figure 2. Reminder

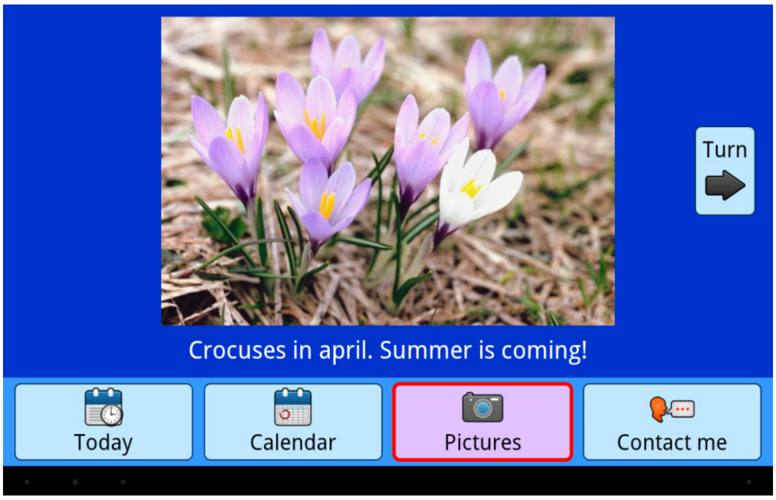


Figure 3. Photos

The aim is to give a reliable daily routine, to increase independence and wellbeing as well as to reduce stress. Caregivers (relatives or professionals) can adjust Mylife to the user's changing needs, wishes and abilities as they select internet-based services from any PC. By doing this they can add appointments or photographs, customize the background color or the features that are shown in the menue etc. The internet-based solution also allows a location-independent support or contact, e.g. by some relatives that live far away.

2. Methods

After developing a prototype, the system was tested internationally in focus groups to make the design and the features most suitable to the possible end-user's needs, before starting the field trials.

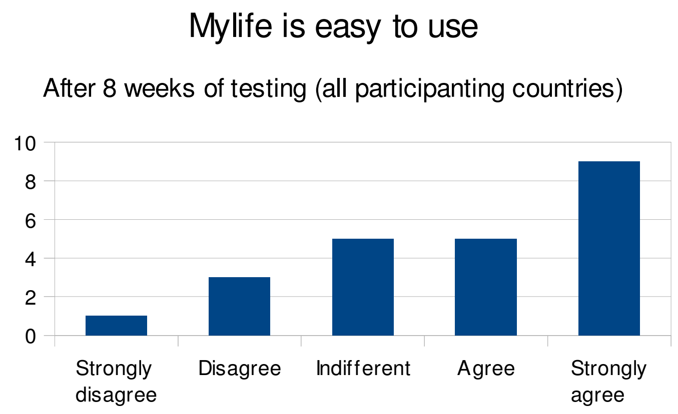
For these field trials the research team decided to form pairs: One person – the one with the memory problems – uses Mylife (user) and the other one adjusts it to the user's wishes and abilities (helper). This helper could be a person who is close to the user, e.g. a relative, spouse or (professional) caregiver.

The first part of the field trials in Germany, Norway and Great Britain lasted until July 2012, 36 pairs of people with memory problems and their helpers took part. They were asked to use Mylife for eight weeks at home, while their assessment of the device, problems to handle it and well-being was recorded regularly by observations, interviews and questionnaires.
The aim was first of all to find out whether people with mild cognitive impairment are able to handle this technology and if this kind of assistance can be helpful for them. The other central question was whether relatives and professionals are accepting this technology and are prepared to work with it.

A basic principle of these evaluation method was to include the target group at an early stage of the system's development to ensure, that the outcome meets the user's needs.

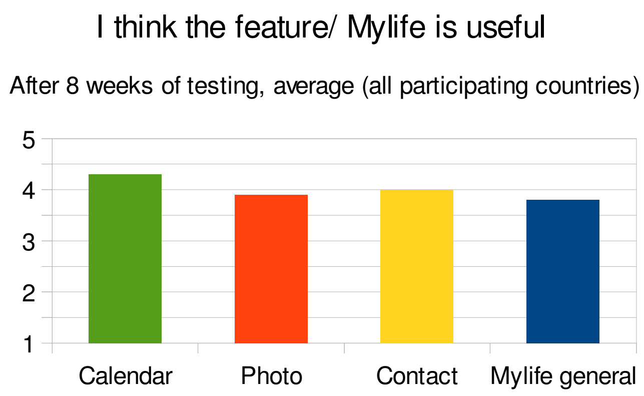
3. Results

Handling and Usability
Because the target group has little experience using modern technology the device has to have a simple design to be operated without difficulty. The results of the first trial show, that the system is easy to handle, even if one's not experienced in using computer technology. It is clearly designed, the buttons are in most instances big enough, the symbols are self-explanatory and the navigation through the features is easy and intuitive. Nearly none of the participants had problems to handle Mylife. The helper also agreed, that Mylife is easy to use for people with memory problems (see following graph).



Usefulness
The features, that were already implemented for the first trial were accepted by the participants very well. Especially the Today page showing day, date, time and appointments at a glance was assessed to be very useful as it gives orientation to the users about what is going on every day and makes them independent from asking others about possible events. This screen view plus the reminder were found to be the most helpful feature as it reduces the fear of forgetting important events.
The photo feature was found to be entertaining, the users enjoyed looking at photographs from their past, the family, places they went to, animals or landscapes. The users liked the opportunity to add captions to the pictures, so they got assistance in remembering things, persons or places.

As shown in the following graph all the features – as well as Mylife in general – were found to be useful (assessment of the caregivers).



1 = Totally disagree, 2 = Disagree, 3 = Indifferent, 4 = Agree, 5 = Totally agree

4. Ethical aspects

The overall idea when starting this project was increasing quality of life, independence and autonomy for people with mild cognitive impairment. Mylife was not made to replace social contact. It was self-evident that ethical principles, such as privacy, autonomy and dignity, have to stay intact.

5. Conclusion

After the first trial the Mylife system has been revised, according to the scientific results and suggestions made by the participants. One of the main wishes was to implement some music. It now includes also radio, weather forecast and newspapers. An international second trial with the revised system will follow in October.

It is planned to work on the system even longer to implement a simple opportunity to add information by the user on his/her own. This gives the user the chance to act more independently and autonomously.

Regarding the positive results from the evaluation and the fact, that there is no comparable technical assistance for people with MCI – at least in the German speaking countries –, it is intended that Mylife comes into the market the upcoming year.

AGEING IN BALANCE - WORKING TOWARDS LESS FALLS AMONG OLDER ADULTS

Milla Immonen[1], Patrik Eklund[2],
Heidi Similä[1], Tuula Petäkoski-Hult[1]

Abstract/Summary

The aim of this presentation is to present a novel idea of a system for assessing the fall risk probability and fall risk factors of a person, and a fall prevention system founded on the knowledge of the fall risk factors. The system will be used by individuals and the professionals (psychological, physiological, environmental, social, and health factors).This novel system for evaluating a personal fall risk will be developed in AAL - Ageing in Balance (AiB) -project. The fall prevention technology for personal use motivates older adults to maintain better physical, cognitiveand mental condition and points out beneficial environmental modifications. The system emphasizes the role of the patients in preventing their own falls.It also integrates evidence based guidelines into daily clinical practise of health care professionals and provides tools for fall risk evaluation and decision support.The AiB system is reduces care costs and to improves the person's wellbeing.For example in Finland 7000 person will have hip fracture per year and it costs 140 M€ during the first year after falling.

1. Introduction

Falls result in high costs for care and rehabilitation. Causes of fall accidents are well studied, but a solution for early fall prevention is missing. The prevention should be introduced during active years of life to make it part of everyday life. The system will be used by individuals and professionals (psychological, physiological, environmental, social, and health factors).This novel system for evaluating a personal fall risk will be developed in *AAL - Ageing in Balance* (AiB) -project. Willingness to pay –approach will be studied also in the project to find out if people are willing to pay, and how much, of new health monitoring possibilities.

It is easy to agree upon risk factors being part of balance, dizziness, posture and gait, with drugs and cognitive impairment adding to that list of conglomerates of risk factors. Various medical and psychological factors need to be added, incontinence cannot be neglected, and environmental factors are by many seen as the most important ones.

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For screening and assessment purposes, all of these are frequently seen as risk factors per se. However, they are not explicit risk factors. They are names for bundles of risk factors, where some factors are more specific, and others are more general. AiB will provide a risk factor framework also and eventually to be based on a formal ontology and typing system, which, on the one hand, enables fall risk modelling, and, on the other hand, facilitates the development of the AiB support system for risk assessment. Further, a more strict and ontological view on characteristics may also shed some light upon understanding the structure on cohort studies

2. Methods

The AiB System has been designed with end user involvement. In the beginning of the project, the end-users (older adults and care personnel) are evaluating the designed use scenarios. The usability is also evaluated by the end-users and adjustments to the system will be made accordingly.

The system functions as follows: the users, their relativesand different specialists will fill in the web assessment forms form their perspective and sensor-based tests will be performed. These tests include physiologicaltests with sensors (e.g. balance or muscle tone), mind & memory tests or games.After collecting all the needed information, the system calculates the individual fall risk, highlights the critical factors and produces suggestions for health, remedial and environmental actions.

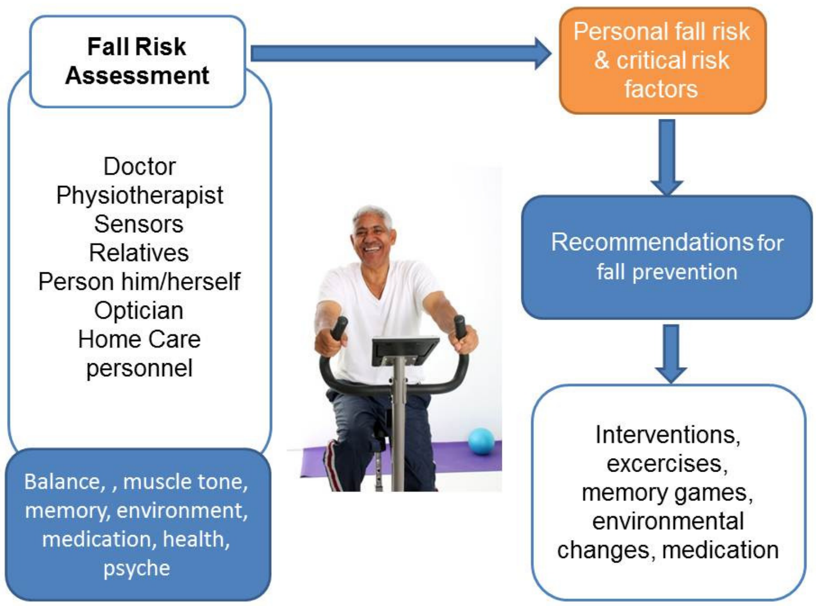

Figure 8. Fall prevention process

There are several assessment methods for evaluating the fall risk;Joseph Sheldon's classical paper[3] from 1960 is often seen as a starting point for systematic considerations of fall risk factors. Thereafter there are several milestone contributions and here we mention just a few of them. Mary Tinetti [4,5,6], e.g. with her co-authors Franklin Williams and Raymond Mayewski, provided new insight for interventions, and Joanna Downton's [7] overview was state-of-the-art at that time. Stephen Lord [8], with his co-authors Catherine Sherrington, HyltonMenz and Jacqueline Close, has provided significant contributions.The Australians and ACSQHC [9,10] has had a large impact, also within many European countries, e.g as seen by the Finnish THL [11] and IKINÄ [12] for fall prevention, and Pajala's report [13], frequently referring to the Queensland and Australian approach.Rubentein's and Josephson's overview [14] is also very useful for AiB's approach to presenting fall risk factors.

Individual countries have differing recommendations for the fall risk evaluation. The system will be designed so that it is adjustable to fit the practices of the end-user organisation. Recommendations and interventions will be used for reducing the fall risk. After finding out the risk factors, the system recommends what kind of actions would be needed for lowering the fall risk.Similar Chronic Care Model (CCM) [15], our model suggests that functional and clinical outcomes are the results of productive interactions between 1) the informed, activated patients and 2) the prepared, proactive practise team of health care professionals.

Motivational tools for physiological, psychological and cognitive activation will be developed without omitting the environmental adjustments at home. The persuasive tools are designed to support maintaining or improving the muscle strength, guide balance training, review and monitor pharmacological treatments, provide psychological and cognitive exercises, to name but a few. These persuasive tools will 1) to recognise their personal needs and objectives, 2) to set goals and 3) to follow their progress with regards to their goals.The fall risk of the older person is regularly being assessed to verify the effectiveness of the interventions.

The project also gathers information about the effectiveness in fall prevention of using the gym equipment regularly compared to a group, which is not going to gym. The data of the gym visits and exercise is also collected by using a smart card, provided by HURLabs.

3. Discussion and future steps

Ageing in Balance is in its first phase, defining the fall risk assessment model and specifying the technologies for fall risk assessment and fall prevention. During the following steps the objective is to motivate about 20 elderly persons to work within the project and participate as active members of established AiB club. The aim is to proceed together and develop the product and servicesbased on the opinions and experiences of elderly people and care givers. The technologies are specified together with the project consortium and the needs and wishes from real end users are taken seriously as they are involved from the beginning until the end of the project.

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USER REQUIREMENTS FOR AN AMBIENT EVENT DETECTOR: A MULTI-CULTURAL SURVEY WITHIN THE AAL-JP-PROJECT *FEARLESS*[1]

Stefan Ortlieb[2], Gaby Streffing[2], Claus-Christian Carbon[2]

Abstract

In this paper we report thekey findings of a multi-cultural user requirement analysis which was conducted within the fearless-project prior to technical specification. On the basis of our findings we outline a model for technological impact assessment, which will guide our actions in the forthcoming stages of the user-centered design process.

1. Introduction

The AAL-JP-project *fearless*is dedicated to fall and fire detection as well as inactivity monitoring in the private homes of solitarily living elderly. In a user-centered design process an autonomously operating ambient event detector is beingdevelopedto enhance mobility and social participation of elderly people by reducing their most prevalent fears.

What do elderly people actually fear? User-involvement starts with a profoundunderstanding of user needs. Thus, a multi-cultural user needs analysis was conducted prior to technical specification. Quantitative and qualitative survey data was collected from potential primary users (elderly people aged 60+) as well as their relatives and other trusted persons in Austria, Spain (Catalonia), Germany and Italy. Based on this survey data we sought for answers to the following questions:

- What do elderly people fear?
- What do their relatives fear?
- Where do the most severe falls occur?
- Are there any apparent intercultural differences in terms of fears?
- Which functions should an innovative ambient event detector provide?
- How much money are users willing to spend on an ambient event detector?
- How much are users willing to spend on services related to an ambient event detector?

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2. Methods

Qualitative and quantitative research methods were applied to identifythe most important needs of elderly and their relatives: 259 potential primary users(aged between 60 and 101) and 215 relatives from Austria, Germany, Spain (Catalonia), and Italyparticipated in our survey. They either filled in a standardized questionnaire or took part in a standardized face-to-face interview. Primary users answered questions about resources and deficits oftheir current home environment, previous falls and fears related to a broad variety of critical incidents (e.g. falling, fire, housebreaking).Their relatives answered these questions from a third-person perspective.[1]

3. Results

What are the most prevalent fears?Across all cultures two incidents were perceived as most troubling by primary users and relatives alike: suffering a stroke and falling in the absence of others. In the private home of elderly users' five "hot spots" for severe falls could be identified: garden, living-room, stairs, bathroom and transition areas. Apart from these commonalities, users from Italy and Spain (Catalonia) were particularly worried about housebreaking while solitarily living elderly from Austria and Germany frequently reported fear of social isolation.[1]

What are the most preferred functions?Two basic functions for an ambient event detector could be identified: Detection of falls and fires. In this respect a considerable number of users from Austria, Spain (Catalonia) and Italy were agreed. In addition primary and secondary users from Spain (Catalonia) and Italy would also appreciate an integrated burglar alarm. In the German sample fire detection was clearly favored only by primary users.[1]

	Austria		Spain (Catalonia)		Germany		Italy	
	Elderly	Relatives	Elderly	Relatives	Elderly	Relatives	Elderly	Relatives
Fall detection	X	X	X	X	(x)	(x)	X	XX
Fire detection	X	X	XX	X	X	(x)		X
Burglar alarm			XX	X	(x)		X	X
Gas detection			X	X			X	X
Inactivity monitoring			X	X	(x)	(x)		
Flooding			X	X				
Monitoring of daily routines			X	X				
Light triggered by motion	X				(x)			

(x) = functions appreciated by at least 30% (only applied to German samples)

X = functions appreciated by at least 50%

XX = functions appreciated by at least 70%

Figure 1. Preferred functions for an ambient event detector

What would be an appropriate pricing? Across all cultures we found that relatives are willing to spend more money in the hardware of an ambient event detector than primary users. We found that the hardware should be less than 200€ and monthly expenses for services related to the event detector should not exceed 50€.

4. Technological Impact Assessment Model (TIAMo)

A model for technological impact assessment was derived from the results of our user needs analysis. It translates primary user needs into a set of seven systemrequirements and points out appropriate indicators for outcome evaluation. Moreover, it highlights the interdepend-ency of these factors: The system requirements can be arranged hierarchically like elements of a prefabricate house. Let us start by looking at its foundations:

- **Affordability.**Of course, the projected ambient event detector and the services related to ithave to be affordable for elderly withlimited financial resources. According to our survey data the ambient event detector should be less than 200€ and monthly expenses for services related to it should not exceed 50€.

- **Social networks.** In order to reduce fears effectively, the *fearless*-system has to be considerate of its users' social needs. Design and image of the event detector must not allude to age-related deficits (e.g. frailty). Otherwise the event detector is likely to intensify social withdrawal among elderly users: They might limit social activities in their home environment to avoid stigmatization – if they accept the system in the first place. What are the implications for the *fearless*-system? The detector should either blend into the furnishing of the home or mimic other widely-used devices (e.g. smoke detector).[3]
- **Fall and fire detection.**The results of our user requirement analysis clearly indicatea need for fall and fire detection among primary users and relatives from different cultures. Thus, the *fearless*-system has to detect falls and fires reliably in order to meet user expectations.
- **Adaptability.** Besides fall and fire detection a considerable number of potential primary and secondary users from Spain (Catalonia) and Italy also favor an integrated burglar alarm function. Diversity among potential userscalls for adaptability: The *fearless*-system should be adaptable to individual needs by allowing forupgrades (e.g. a burglar alarm) anda straightforward integration into existingprivate homes.

An intact social network, reliable fall and fire detection, and adaptability are the pillars which support the three pivotal factors for outcome assessment:

- **Internal control beliefs.** Maintenance of internal control beliefs is a prerequisite for well-being and fear resolution.[2] Elderly withan internal housing-related control belief are convinced that they can exert control over their home environment.By introducing a novel technology to their private home this belief must not be undermined. Hence, the *fearless*-system should provide a user interface which makes relevant information visible or audible (e.g. status of the system) and allows for active control.
- **Falls efficacy.** Fear of falling is defined as "a lasting concern about falling that can lead an individual to avoid activities that he/she remains capable of performing".[3] We prefer the complementary concept:*Falls efficacy*. Itrefers to an "older person's confidence in performing a series of everyday tasks without falling".[4]
- **Mobility.**Ideally the mere presence of the ambient event detector will disinhibit physical activity among primary users by increasing their falls efficacy. Here the virtuous circle closes asmobility is a prerequisite for social participation and hence for the maintenance of social networks.

[3] These design aspects are of great importance especially for primary users suffering from dementias: In their home environment every device or piece of furniture which appears unfamiliar to them will cause discomfort.

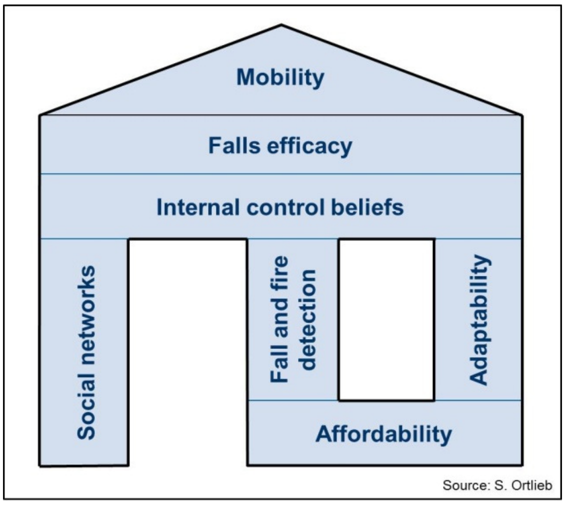

Figure 2. Technological Impact Assessment Model

5. Conclusions

The TIAMo is still a work in progress. So far it is centered on the needs of primary users. However, our model has to reflect at least one more stakeholder perspective in order to establish a truly “balanced scorecard”: the needs and expectations of telecare providers. Finally, theTIAMo shallprovide a common understanding of system requirements among the project partnersandguide our actions in the forthcoming stages of the user-centered design process and outcome evaluation.

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IMPACT OF END-USER INTEGRATION WITHIN THE FEARLESS[1] PROJECT

Rainer Planinc[2], Martin Kampel[2], Michael Brandstötter[3]

Abstract

Elderly often refuse the use of technical systems due to various reasons. The commitment and acceptance of the elderly for using a technology decides whether this AAL technology is successful or not. Hence, the end-users (primary and secondary) need to be integrated into the project already from the very beginning to ensure that the technology serve real end-users needs and wishes. This paper presents an example of anend-user integration strategy within the fearless project.

1. Introduction

Falls and their consequences (e.g. lying on the floor for hours) are a great risk for elderly [1] and getting help quickly after a fall reduces the risk of death [2]. Hence an automatic fall detection system based on computer vision is developed within the *fearless*(Fear Elimination As Resolution for Loosing Elderly's Substantial Sorrows) project. Due to the use of computer vision, privacy aspects need to be addressed, but limitations of other sensor types can be overcome [3]. In order to do this, depth sensors are used [4], thus making the identification of elderly impossible. To ensure that the system is developed in line with the demands of the end-user, the integration of end-user is essential. Hence, the non-technical focus of the *fearless* project is the integration of end-users throughout the whole project. The acceptance of elderly using AAL solutions depends on the needs and benefits provided by this solution. To be able to provide real benefits, the demands and wishes of elderly, their relatives as well as care-taker organizations need to be taken into account.

2. Methods

Feedback of the end-users is seen as the key feature for a successful AAL project. Hence, end-users from Austria, Germany, Spain and Italy are integrated to ensure a high diversity and to reflect different cultural attitudes.

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[1] This work is supported by the European Union under grant AAL 2010-3-020.
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The end-user involvement within the project can be divided into two stages:

1. at the beginning of the project, an end-user requirement analysis is conducted. Based on this analysis, the technical specification of the *fearless* system is developed.
2. Field pilots are conducted concurrently to the system development to achieve a high degree of consent between end-users and system developers.

The end-user requirement analysis is used to identify the fears of elderly as well as the desired functions an assistive device should offer. Due to different cultural attitudes, results show that the end-users' fears depend on the country and culture they live in. But two fears are identified to be in common in all countries: the fear of falling and the fear of fire[5]. Since all already available products for automatic fall detection need a device to be worn by the elderly, the aim of the *fearless* project is to automatically detect a wide range of risks with a single sensor unit, enhancing mobility and enabling elderly to take active part in the self-serve society by reducing their fears - without wearing any device. Hence an automatic risk detection system on the basis of the user requirements analysis' outcome is developed within the project. This approach uses recently emerged sensor technology (depth sensors) in the field of computer vision and offers the advantage that different risks can be detected automatically without big installation efforts (plug&play). To ensure the consideration of privacy aspects, no image data is either stored or transmitted.

The field pilots are separated in two phases: phase Astarts with a limited number of users (one per country) in order to test the feasibility of the system and all interfaces. After the completion of phase A, phase B of the filed pilots with a higher number of end-user (>30) is conducted. During the field pilots, technical as well as psychological issues are assessed. Hence, the technical system is tested (e.g. reliability, interfaces,…) but also the influence of the system on the user (e.g. reduction of fears, mobility enhancement) is examined.

Furthermore, the interoperability is taken into consideration via the use of a telematics platform. This platform ensures a seamingless integration of the *fearless* system in already existing call center structures by providing standardized interfaces on the one hand and can be used together with electronic health records using the HL7 standard on the other hand.

Figure 1 illustrates the structure of the field pilots: primary end-users from Austria, Germany, Spain and Italy are involved. The alarms are sent to the telematics platform and are forwarded to appropriate call-centers (e.g. of the same country) and/or relatives, depending on the user preferences.

Figure 1. Design of the *fearless* field pilots

To be able to provide a realistic business case, suppliers (i.e. network of electricians and electric shops) are integrated in this project. Usually elderly will contact their known and trusted electrician around the corner to get information. However, these are mainly small family businesses which do not have the resources and skills to provide these services. The project *fearless* is incorporating this aspect and involves an international network of electricians via one of its partner.

3. Results

During the pilot phase, the system will be tested including all relevant end-users: primary end-users provide feedback for the system and their fears are monitored since a reduction of fears is expected. Secondary end-users (caregiver) are integrated during the pilot phase since they provide the call center and take proper actions if a risk is detected. This enables caregiver to test the integration of such a system already at an early stage.

In order to respect the elderly's privacy, only depth images - not allowing the identification of people - are used. An example of this depth image is shown in
Figure 2. But since these depth images still contain more information as needed for verification if a person lies on the floor or not, an even more abstract illustration depicted in Figure 3 is used for the call center agent to verify if a person is lying on the floor or if the person was already able to get up on their own again. This abstract illustration only shows the major body orientation and the height with respect to the ground floor.

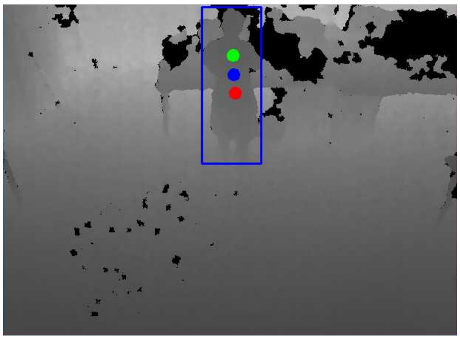

Figure 2. Depth image

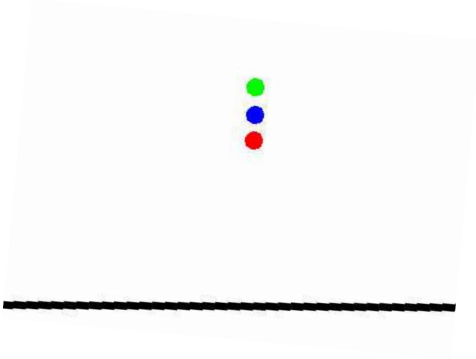

Figure 3. Abstract illustration

4. Conclusion

The integration of end-users is crucial for being successful, since the acceptance and commitment of all relevant end-users is needed. Hence, the integration has to take place throughout the whole project duration. Furthermore, ethical aspects need to be considered and the privacy of the elderly needs to be respected at any time, especially when developing a computer vision based approach.

Acknowledgement

The authors want to thank the whole fearless project team, since an overview onsuch a project can only be given if techniques and ideas of many researchers involved are used.

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ISTOPPFALLS – A NEW ICT-BASED APPROACH FOR PERSONALIZED FALL RISK PREDICTION &PREVENTION AT HOME

Dr. Rainer Wieching[1]

1. Introduction

A demographic transformation is underway with a significant rise in the proportion of people aged 65 and older expected over the coming decades [1]. It is therefore crucial to invest in research aimed at dealing with health challenges of an ageing population. Falls represent a major age-related health challenge facing our society, with about one third of older community-living people falling at least once a year [2]. Falls in older people can markedly change one's health trajectory, have debilitating and isolating consequences and can trigger a downward spiral of disability which can lead to institutionalization and premature death. Falls and fractures account for over half of all injury-related health care costs and have a major impact not only on older people, but also their carers, health services and the community [3]. This impact will grow substantially in the near future due to the increased proportion of older people in the population. The prevention of falls and mobility-related disability among older people is an urgent public health challenge in Europe and internationally.

Despite robust evidence and availability of best-practice clinical guidelines to support interventions for preventing falls in older people, implementation of preventive measures remains low, mainly due to the accompanied high cost in both time and resources of the recommended individualized approach [2]. Novel methods for delivery of quality healthcare are required to increase effectiveness of management while containing costs and using scarce human resources to maximum effect. Technology-based solutions have potential to reduce costs while maintaining individualized high quality healthcare [4]. Fall prediction and prevention is a field of research where technology can be used to facilitate healthy ageing, well-being and independent living, but similar paradigms could potentially be used in other areas of geriatric medicine [5].

The primary aim of the *iStoppFalls* project and its consortium partners is to develop and evaluate innovative home-based technologies to assist in preventing falls, and thus to improve quality of life of older adults living at home. *iStoppFalls* will develop unobtrusive technological solutions for continuous monitoring and prevention of fall risk factors that are required to coach people in tailored individualized prevention programs, including exercise and education. The emphasis is not on laboratory research but on active implementation of successful fall prevention strategies in people's own home.

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2. Methods

A coordinated, active and multidisciplinary team is central to this project to face challenges related to the development of these technology-based solutions. *iStoppFalls* involves representatives of world-leading technology and research experts from both university and industry partners in Europe and Australia. The program will strengthen collaboration between research and technology which will contribute to European excellence and competitiveness and will produce new insights.

The Senior Mobility Monitor (SMM) as a component of the iStoppFalls system will unobtrusively and continuously monitor mobility in daily life. It will evaluate quantitative information on frequency, duration and type of mobility activities and qualitative information on balance function and muscle power.

On the other hand, the Kinect based fall preventive exercise training game (Exergame) of iStoppFalls will facilitate real preventive exercise training at home (3 times a week), whereby data is acquired by unobtrusive sensing together with biomechanical modeling and optional heart rate data assessment.

The iStoppFalls knowledge based system for fall prediction & prevention correlates these two types of mobility analysis information (SMM & Exergame), and in turn provides sufficient data to perform a trend analysis of these entities, thus evidencing valid fall prediction and sustainable fall prevention in terms of tailored home based exercises for community dwelling older adults.

The interactive TV component and the whole iStoppFalls system will be based on user-centered design and living-lab approaches, and thus provides advanced HCI methods adjusted to the capabilities of the elderly users (usability, accessibility and user experience design).

3. Results

3.1 Semi-standardized end-user interviews

First results were obtained during the initial requirements analysis we performed in the iStoppFalls project.By means of 22 end-user interviews in Germany, Spain and Australia we gained a deeper insight into the attitudes and practices of older adults (male and female aged 65-85 years) related to mobility, health, falls, exergaming, activity monitoring, media use and privacy and security aspects.All important outcomes from all interviews of all countries were grouped for frail (n=8), active (n=5) and normal (n=9) older adults participating the interviews.
<u>General Information:</u> All participants live independently at home and are able to do most ADL activities, even the frail older adults. All active and normal older adults were well socially embedded, only the frail ones lived a bit isolated at home. Nevertheless, the frail older adults meet their family members on a regular basis.

Health and Mobility: Consequently, the so-called active older adults were active most of the days during the week, like exercising in a gym or regularly walks outside. Most of the normal users take medications every day but try to be active during the week (walking, etc.). Most of the frail older adults already had surgeries and take medications regularly. Most of them feel unsteady and old, and try to be active from time to time.
Falls: Except of one, none of the active users have ever suffered any fall in their adulthood and have no fear of falling. Even most of the normal elderlies did never experience a fall, but most of them feel that they have a greater risk of falling. Not all of the frail elderlies have already experienced a fall, but some of them several times. All user groups were interested in information/education on falls.
Media Use: All participants are watching TV regularly. Interestingly, most of the active users were already familiar with using new media like computers, smartphones, etc. Even the normal elderlies have mobile phones and use computers from time to time. But most of the frail older adults do not like modern technology and new media.
Exergames and Activity Monitoring: Neither the active nor the normal and frail older adults have any experiences in using exergames, but some of the active participants know this technology from their grandchildren. Active participants would like to play cognitive games together with the physical exercises. Most users would favor gymnastics, virtual walks, and user-friendly exercise games as contents, especially music and dancing would engage older people to move and stay active. Most of the frail participants were interested in the SMM and associated activity monitoring.
Privacy and Security: Independent from grouping, all participants did not refuse to provide information about their health condition for the iStoppFalls computer system. They do not see any problem if the information given is used for medical purposes.
Other Aspects: All users think that the planned iStoppFalls system is very useful and that it can improve the quality of life of elderly people as well as prevent falls in the future. Neither prominent gender nor country-related effects could be demonstrated.

3.2 User experience workshops

Furthermore, we performed 3 workshops with 9 older adults of the same age range, whereby we played a commercially available, controller-free, full-body-motion based exergames by using Xbox/Kinect with gesture and voice control. Despite this game (Your Shape – Fitness Evolved 2012) was designed for a considerably younger audience, the feed-back and game experiences of the older adults were in general positive. Nevertheless we identified some important aspects which should be highlighted in order to design exergames for older adults at home:
Take handicaps into consideration: A female participant with hip problems stated that for her it would be important that exercises should be offered that she could do seated. Such, or similar handicaps apply to many older people, and thus, for the design of the exergame this means that it is necessary to provide alternative possibilities of being able to do the exercises seated or standing with a chair as support.
Demonstrating the correct body position: The participants from the workshops regarded it as very important, that the correct posture is first demonstrated and then done by the user himself. For this, the participants would like to see a real person

showing how the movements are done correctly, preferably in a short video clip. The person should wear tight-fitting clothes, so that the exercise is recognizable in detail.
Give exact feedback on how to correct a wrong posture/position: The results showed that it is always necessary to correct wrong postures or movements of the users and to explain, how exactly the exercise is done correctly and what effects such wrong posture/movements mayimply. In order to fulfil the aim of the overall application, i.e. to prevent older people from falling, it is especially important that they train correct postures and movements.
Do not demand for unnecessary and/or dangerous movements: The workshop showed that most of the participants had age related problems with their hips, back, knees and joints. This needs to be kept in mind when designing the exergame, and thus fast and expressive movements should not be demanded.
Appropriate size of buttons and timing of feed-back: Many participants had difficulties keeping their hands firmly on the sometimes rather small buttons. They slid off before the action could be performed, so that they again had to move their hand onto the button. Therefore, the buttons of the gesture control need to be large enough, so that the seniors do not have difficulties keeping their hand there for a certain period of time.
Clear labelling of loading processes: All user often had the problem that they couldn't clearly identify what was happening on the screen – if it was a part of the demo, where only instructions are given or if the last turn in a game was being repeated, or if the game was just loading or if their own gesture or voice directions were required. This means it is necessary to make sure that in the design of exergames for older adults, it is possible to clearly distinguish between what is happening on screen and to know when an input is expected from the user. These notifications though, need to be understandable for older people.
No unnecessary functions and visual stimulation: In the workshops it became apparent that older adults did not want fancy accessories or unnecessary extra functions.
Give precise and simple instructions: All participants of the workshops did not have any prior experience with gesture or voice control. It is important that their inexperience is taken into consideration, to be able to give them an understandable and concise instruction manual. It is necessary to always give the older users hints and instructions on what to do or to explain what is happening. This leads to the important conclusion that in an appropriate exergame application for older adults there is a general need for notifications and to give as much feedback as possible.

4. Discussion

The recent work of Gerling et al. [6] was the first attempt to define design guidelines for elderly oriented exergames with MS-Kinect. These guidelines are a mixture of high-level usability rules like "simple setup routines" (Guideline 7) and high-level game experience user rules like "Dynamic Game Difficulty" (Guideline 4). However, although these guidelines allow a better understanding of elderly player's needs when using MS-Kinect, they keep on a very rough and vague stance as they were based on restricted lab investgations only, and were not settled in the daily life practices of community dwelling older adults living independently at home. If we aim to reach this growing part of our society by ICT-based exergames to implement an active and healthy lifestyle which prevents a vicious cycle of inactivity and isolation, we found that such guidelines clearly need a social dimension reflecting relevant attitudes and practices of the end users in focus.

5. Conclusion

Further research in terms of living labs and randomized clinical trials is needed to answer all these important questions by a broader qualitative and quantitative evidence.

Consequentely, the first iStoppFalls prototype will be evaluated and further enhanced based on the results of an initial pilot trial and a living lab with 45 participants in Germany and Australia by the end of 2012. The final, re-designed iStoppFalls demonstrator will be evidenced by a randomized clinical trial with 360 participants which will be implemented in Germany (90), Finland (45), Spain (45), and Australia (180) in 2013.

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ASSISTANCE FOR SAFE MOBILITY: THE ASSAM PROJECT

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Abstract

To compensate for declining physical and cognitive capabilities, such as unstable balance, declining vision, or slight dementia, modular navigation assistants for various mobility platforms, such as walkers, wheelchairs or tricycles, shall provide sustained everyday mobility and autonomy with seamless transition from indoor to outdoor environments.

1. Introduction

The project *Assistants for Safe Mobility*, ASSAM, AAL-2011-4-062,www.assam-project.eu,is funded under the AAL Joint Programme by the European commission and the national funding organisations Bundesministerium für Bildung und Forschung BMBF (DE), Ministerio de Industria, Turismo y Comercio (ES), and the Ministry of VWS (NL), with the partner organisations represented by the authors. Here we report on prior work and our plans for the next 3 years; cf. [HYPERLINK \l "KriAALKong2012" 1].

The ASSAM project aims to compensate for declining physical and cognitive capabilities of elderly persons by user-centred development of modular navigation assistants for various mobility platforms, such as walker, wheelchair, and tricycle (cf.

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Figure), providing sustained everyday mobility and autonomy with seamless transition from indoors to outdoors in environments such as residential complexes or the neighbourhood quarter.The assistance systems shall provide

- *Physical assistance* for declining walking capabilities, encouraging physical exercise;
- *Safety assistance* by obstacle avoidance;
- *Cognitive assistance* for declining visual and mental capabilities bynavigational aid;
- *Securityassistance*by a care centre connection in case of emergency situations.

Three end-user organisations (in Germany, Spain, TheNetherlands) will ensure user-centred development including *every-dayusability* assessment cycles in field trials. Central *ethical* issues are to *onlyassist when necessary*, permitting the user toact independently, and individual user adaptation. During field trials, candidates can withdraw at any time.

Figure 1. Smart wheelchair, smart walker prototype, and smart tricycle design

2. Platforms and Variants of Assistants

The modularity of the approach allows several variants in configuring hardware platforms (walker, wheelchair, and tricycle, cf. Figure 1.), additional devices (a smartphone or tablet PC for interaction, GPS, laser range sensors, etc.) and navigational software for individualised use, cf. Figure 2. The *Navigation Aid* and *Driving Aid* extend non-electric platforms, while the *Navigation Assistant*is based on platforms with electric wheels.

Navigation Aid shallprovide basic outdoor navigation abilities, like a car navigation system, but tailored to the mobility platforms. Apart from a modern smartphone or tablet PC, only two so-called *OdoWheel*(patent pending)devices will be needed, attached to two front or back wheels. Its odometry (self-movement) and inertial measurement data are fused with GPS localisation outdoors, and OSM map information, to increase overall localization accuracyfor safetyand security. Maps will be annotated with specific accessibility properties.

Using additional laser range sensors, the *Driving Aid* will enhance safety by recognising and warning for steps and obstacles. The sensors also enable indoor positioning and navigation.

Whereas these assistants only signal directions and give warnings, the *Navigation Assistant*is based on platforms with electric wheels. It shall proactively correct the driving direction to avoid obstacles by controlling the drive, steering and braking accordingly. It allows automated driving (without manual steering) to a specified target location in a charted indoor environment. From the bed or sofa, the user can remotely direct it to a parking position, or demand its return, cf. Figure6.

Navigation Aid	***Navigation + Driving Aid***	***Navigation Assistant***
outdoors	indoors, outdoors	indoors, outdoors
Self-Navigation in OSM Maps	Self-Navigation + Self-Driving, Obstacle Warning	Auto-Navigation, Obstacle Avoidance
SmartPhone, GPS, OdoWheel	Laser Scanner, Embedded Computer	Laser Scanner, Embedded Computer, Electric Wheels
Navigation Directions	Navigation + Warning Directions	Autonomous Steering | Patronising

Figure 2. Variants of assistants for mobility platforms

3. Physical Mobility Assistance

For *physical mobility assistance*, the smart motorised platforms brake when descending a slope, aid going up, and provide safety on inclined surfaces to avoid toppling over.

Based on more than 15 years of experience in building smart assistive systems for electric wheelchairs [2,3,4,5] (Figure 3. and Figure 4. show the 3rd generation prototype of *Rolland* based on the outdoor Champ from Meyra; Figure 1. shows the 4th generation on the basis of Xeno by Otto Bock), the *iWalker* demonstrator was developed in the EU-project SHARE-it[6], similarly equipped with a laser range sensorand motorised rear wheels. We envisage a new attractive, “universal” lightweight frame design for the walker with optional attachments for a seat, shopping basket, even small child carrier or golf bag. The walker brakes safely when going down, and assists the pushing effort on slopes going up; handlebars sense the grip, an inertial measurement unit (IMU) senses the inclination and 3D acceleration. While the pushing force is controlled to remain always constant, a medical prescription may specify a slight force to push against for controlled training exercises; imbalances in the arm or leg forces can be compensated to adapt to the user’s needs.

This experience, and the associated software assistants, shall be transferred to the similar development of a *smart tricycle*. The tricycle platform, possibly with two wheels in front rather than the back, is obviously more stable than a bicycle or motorised pedelec. It is envisaged for users, who get tired easily, have difficulty in walking, would enjoy using a bicycle but feel unsafe, or should do supervised physical activity. The idea is to assist, but not to patronise, the driving.

4. Navigation Assistance

The *Navigation Aid*willuseOpenStreetMap (OSM) data. The OSM standard already allows the annotation of outdoor path properties such as the accessibility of a sloped curb, ramps, obstructions, or the availability of toilets nearby. The completeness of available annotations for all platform and user requirements shall be checked, and extensions to the standard proposed (particularly for indoor environments), as necessary. *ASSAM safetylevels* of accessibility with constraints required for variants of the mobility assistants will be defined, allowing “ASSAM-ready” certification for specific environments. A challenge is the seamless transition from indoor to outdoor environments.

5. Safety Assistance

With a local map provided by a laser scanner, the *Driving Aid*will guide around obstacles by giving warning directions by an arrow or language commands, cf. Figure5. As part of the *Navigation Assistant*, the *Driving Assistant* for the wheelchair corrects the driving direction proactively to avoid obstacles; for the walker it indicates the driving direction by slightly breaking the appropriate wheel; the user is guided around obstacles.

Figure 3 and Figure 4 show the present solution of a 2D safety region. The challenge is 3D recognition of obstructions at various heights, such as crossbars, changing pavement heights, holes, or down-going stairs, cf. Figure 4. As local obstacles such as stairs or ramps can be detected (to avoid toppling over), safety and self-localisation for security will be considerably increased.

Figure 3. Safety region

Figure 4. Problem zones

Figure 5. Warning direction for obstacle avoidance

Figure 6. Remote Control interface

6. Assistance for Declining Vision orMental Faculties

Elderly persons with declining vision are less likely to learn the usage of standard aids for the blind; these, or persons with declining mental faculties (mild dementia or loss of short-term memory), will find excellent *cognitive assistance*, in particular with a natural language interface: the mobility assistants will guide back home; localisation/positioning allows orientation in unfamiliar surroundings, and gives the secure feeling of never getting lost.

7. Security Assistancein Emergencies

When having difficulties with the technical support,when dealing with a map (due to stress or cognitive overload), or in case of slight dementia, some users will require additional*security assistance* by interacting with a real person. In emergency situations, an alarm raised by the user or the system automatically shall connect to a call centre. A caregiver will assess the situation by an on-board camera when permitted (possibly using remote control, cf. Figure 6, and provide online navigation assistance. As*positionand direction* of the platform areknown,a first question like "do you see the city hall in front of you?" will establish contact and provide assurance.

8. Environment Control, User Interaction

For the walker, the vision of a *personal service* or *companion robot* becomes more realistic, when interaction with an intelligent environment is added. This is demonstrated inthe Bremen Ambient Assisted Living Lab, BAALL.de, a 60m^2 apartment fully equipped for trial living of two seniors: sliding doors are opened, light is switched on, the kitchenette/cupboards/microwave is moved to an appropriate height; a higher service such as "reading an bed" adjusts the bed to a comfortable reading position, dims the lights, closes the doors, etc. Uttering an intention such as "I want to eat a pizza" triggers proactive actions in the environment, affecting doors, lights, kitchenette, fridge and corresponding routes, cf. Figure 7. In the ASSAM project, such additional software services ("apps") shall be tested with the new mobility assistants, and extended experimentally to other building and outdoor environment control, such as remote door and lift controls in a larger building complex, or activation of traffic lights at street crossings.

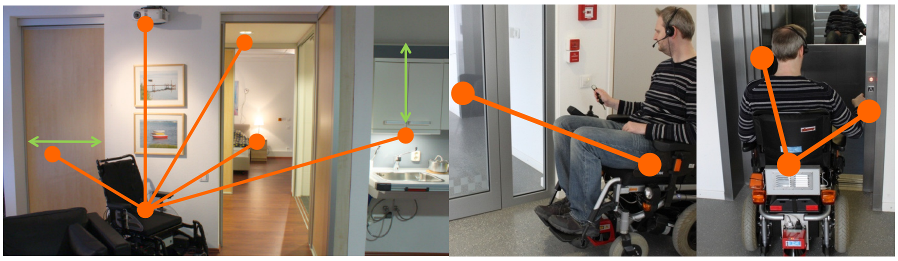

Figure 7. Seamless environment control: in BAALL, at outer door, at lift

In general, interaction of the user with the mobility assistants and the intelligent environment shall be multi-modal, adapted to the individual user's needs. One generic mode is by pointing to symbols for services or visualised route graphs on the touch screen of a smartphone or tablet computer. However, visual faculties decline; the number of options and symbols may become hard to manage. Thus an important alternative is spoken dialogue. Although the general case of *natural language interaction* (initiation of clarification dialogues, understanding of dialects, adaptation to individual language deficiencies, etc.) is a research issue, interaction in well-designed restricted dialogues is fairly well developed. It will be implemented for goal-oriented navigation.

9. Conclusion

For market introduction, the cost of *safety* laser scanners has so far been prohibitive; withrecently available affordable sensors the development of industry prototypes is within reach. An even larger market is openedfor existing *non-electric* vehicles with an add-on navigation component based on OdoWheel. We expect mobility assistants to be leased, rented out for share, or provided free of charge at supermarkets, hotels, airports, touristic areas, etc. This encourages a business model to provide *certified maps* that are safe to navigate in, increasing personal autonomy. The *Open Street Map standard* will be extended indoors and by annotations for specific requirements, e.g. platforms negotiating a curved ramp, or for users with declining vision.For multi-modal interaction of the user with the mobility assistants and an intelligent environment, the ISO*Universal Remote Console standard*, URC, shall be used, an open scalable platform for *interoperability* and personalised user interfaces; cf. also the openurc.org consortium of companies.

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AAL PROJECT: ASSISTANT AIDING SUSTAINABLE INDEPENDENT SENIOR TRAVELLERS TO NAVIGATE IN TOWNS

Stefan Carmien[1]

1. Introduction

The theme of the AAL program call 4 is "ICT based Solutions for Advancement of Older Persons' Mobility".The call aims at development of ICT-based solutions which will help older persons to sustain their optimal level of mobility for as long as possible, as well as enhance their individual sense of confidence, autonomy, competence, security and safety. For seniors, maintaining their independence and supporting participation in the world often requires use of public transportation especially if they lose the ability to drive, due to aging. ASSISTANT project will aid them in using public transportation anywhere (rural/urban) and provide a simple yet effective safety line[2] for them. ASSISTANT provides an on-line means of planning a trip, guidance on transfers when making multi-step journeys, an alert which tells the user when it is time to leave the vehicle, and assistance with getting from the vehicle to the final destination. Essentially, the project will offer seamless support for the entire length of a journey, across different means of public transport and in both rural and urban environments. Perhaps the single most effective aspect of the ASSISTANT system is to remind the user when to exit the bus/metro or change direction, a very critical yet to-date unsupported real-time feedback element in travelling which allows the user to enjoy the time of the journey without constantly checking the progress of the vehicle.

The ASSISTANT idea is innovative in a sense that it is **simple, safe and usable**and can be deeply adapted to the older individual's life according to his/her needs and preferences. ASSISTANT builds its technology on two most well known interfaces for older people, PC and mobile phone.The main target group of ASSISTANT project is **mobile older people**[3]particularly travelling to novel places or beginning to use (again) public transportation after loosing ability to drive themselves.

The system will be **developed together with primary end-users** involvement and iteratively evaluated in three countries with three public transport systems in **Vienna,**

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[2] Literally a rope that a caver or diver can follow that leads them from a dangerous or lost situation to a safe one, typically back to where they started

[3] Who are not suffering from any other disease significantly more than Age Associated Memory Impairment (AAMI) and normal physiological changes of aging.This group varies from 65-90 ages are the primary user group of this system. Additionally, thanks to multi modal in and output possibilities of ASSISTANT, the system is thought to be fully accessible and can also be easily extended to other user groups (see other user segments). Additionally ASSISTANT may be of use to travelers new to an area, young people, and persons with cognitive disabilities.

San Sebastian and Paris. Both the concepts and the low fi prototypes will be re-designed after each feedback circle until the product achieves to fulfil the defined goals from end-user perspective.

Another key to ASSISTANT's simple success is the use of **well-tested and robust technologies** combined with customizable user interfaces and consideration of unexpected events and their consequences. As the components of ASSISTANT technology already exist and is commercially used technology, the novel and effective plan is to combine existing technology with a people centred perspective and by using standards developed in this area (see standards), in order to align these technologies to human needs for mobility and usage of public transportation and technology in general.

2. Methods

ASSISTANT is simple yet innovative system supporting public transportation usage of older travellers by supporting them with user centred visualisation of a set of information about local public transportation. The information is shown through a smartphone and an application running on a PC supports route design. With help of ASSISTANT users can create their own routes, get pervasive feedback to stay in the route and get help in case of they are lost. ASSISTANT can be of use even on well-known routes: the haptic-mode reminder of arrival at the desired destination or transfer point can allow the senior to read or relax without constantly checking the progress of the vehicle.

ASSISTANT's main innovation lies in its being simple and robust its 'design for failure'.The system will also have the capacity for detection and correction of any errors the user makes on a journey, and will be customized according to the precise needs and preferences of each user. Where location data are absent, the positioning of both the user and public transport vehicles will be estimated using a prediction function. Table 2 gives an overview of the project's novelty. ASSISTANT will use location, system state, and user interaction behaviour as a basis for an AI based error detection. Where location data are absent or unreliable, the positioning of both the user and public transport vehicles will be estimated using a prediction function. Once an error type[4] has been detected the user model will determine the appropriate mediation strategy.

[4] ASSISTANT will only detect the presence and possibly the type of error, it will not be attempting deduce plans or intentions of the user or why the environment caused an error state.

Table 1. ASSISTANT's novelty

ASSISTANT	In contrast to
Personalization and customization possibility for accessibility needs, preferences, and error recovery	One-size-fits-all; this becomes especially difficult in error recovery
Designed for failure – accommodating human error as well as failure of system components	Making naive assumption that real world use is **MORE** reliable than lab use
Elder interface based on HCI research and using participatory design approach	Naive design, not research based and more specifically not **asking** seniors what they want
Route planning metadata includes accessibility of bus/metro stations	Without accessibly data the system may be difficult or even dangerous to use
Provide help for the last 500 meters from end of bus/train/metro trip to final goal	End of travel support at the final station - before the journey goal is reached. It's difficult to figure out how to navigate that last block

The project's end-product will be a purchasable application which is supported by a maintenance service, sold by the application producer, providing maps and up to date timetable information. Because ASSISTANT's components will consist of existing tried and tested technology, this end-product will be ready to market shortly after the end of the project.

SUPPORTING OLDER ADULTS' INDOOR AND OUTDOOR WAY FINDING: GETTING TO KNOW THE USERS IN TERMS OF TRAVELING AND NAVIGATION

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Abstract.

Supporting older adults in way finding, both outdoor and indoor is the goal of the Entrance project, which seeks to develop a home platform to be used for trip planning and navigation, as well as a mobile navigation aid. In order to identify the users' requirements regarding traveling and navigation, several studies were conducted (e.g., end user interviews, workshops, and a survey). We found out that the participants of the studies appreciated getting to know new cultures and extending their horizon, therefore they primarily conducted culture trips. Although the participants were open to use technical support for navigation, they also indicated a lack of trust in the available devices. Furthermore, they reported orientation or navigation problems e.g., in unknown cities or underground car parks, which seem to be caused by inappropriate signage or too few information points. The results suggest that the development of the navigation aid should make use of already applied navigation and orientation strategies in order to support recognition rather than recall.

1. Introduction

Older adults are less likely to use digital services, such as purchasing e-tickets and booking vacation packages. Compared to younger adults, they usually have less experience with interactive technologies, do not always see the benefit of using them,

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do not trust them or find them insufficiently adapted to their needs. Other problems often encountered by older adults are difficulties in way finding both outdoors and in large indoor environments.

The Entrance project seeks to find possibilities for older adults to address these issues by the development of 1) a platform usable for both trip planning and indoor/outdoor navigation, tailored to older persons' needs and helping them to maintain and develop their cognitive capacities; 2) an adaptive interface for users with different proficiency levels of Internet use; 3) a multimodal mobile navigation interface and an innovative system for indoor positioning combining global and relative positioning technologies.

At the beginning of the Entrance project we identified older adults' needs, wishes and preferences in terms of traveling and navigation within a requirements analysis. We conducted workshops, interviews, as well as an online and offline survey with older adults. We aimed at identifying traveling interests, strategies and routines of the target group. We were also interested in what kinds of technologies the participants used when traveling and wanted to figure out respective problems and barriers. Furthermore, we tried to identify strategies when navigating indoor and outdoor. We finally assessed problems that might occur, and situations in which navigation help might be required.

In this paper we will illustrate the results of the requirements analysis regarding traveling and navigation and present the implications, which need to be considered in the development of navigation aids for older adults.

2. Related Work

Older adults' travel behaviour is influenced by a variety of factors, such as education, income or gender [9]. Traveling might increase the quality of life by creating new interest, or preventing one's life from becoming boring [11]. Older adults conduct long-distance journeys primarily for pleasure purposes (e.g., vacations, sightseeing excursions, for rest and relaxation, visiting friends and family or outdoor recreation), personal or family reasons (e.g., shopping trips, medical visits, providing rides for others), as well as business reasons [9]. The main transportation mean is the car, followed by the airplane and bus [3]. However, older adults might face physical restrictions with increasing age, like visual or auditory impairments [6],[15]. Furthermore, older adults' cognitive capabilities need to be considered, e.g., by providing a simple operation of navigation aids [1].

A number of studies have documented an age-related decline in human abilities to orient and navigate outdoors and indoors (e.g., [9],[13] or[14]). These studies consistently report that older adults take longer to reach a target location and make more errors than younger people. Compared to young adults, older adults seem to require more time to form a cognitive map of the environment [8]. Older adults encounter more difficulty than younger adults in learning and remembering routes in novel environments (e.g., [4], [6] or [12]). The same is valid for landmark selection and recognition, integration of body-centred information and forming association between landmarks and body turns [6]. As a result, many older adults develop coping strategies for avoiding unfamiliar routes and places[6]. Furthermore, some older adults may restrict their daily activities or show resistance to moving in new environments[6].

3. Requirements Analysis Methods

In order to find answers to our research questions (*RQ1: How do end users plan/organize/conduct their travels?* and *RQ2: How do end users navigate indoor and outdoor?*), we conducted interviews, workshops, as well as an online and offline survey:

End User Interviews. Overall, 9 participants were interviewed on their traveling and navigation behaviour, five in Austria and four in France. The interviewees were between 64 and 72 years old, and all participants were already retired. We conducted episodic interviews, which included semantic and episodic questions [5]. Semantic questions focus on gathering knowledge on certain topics (e.g., “What kind of technologies do you use for navigation?”). Episodic (narrative) questions aim at stimulating the interviewee to narrate on a certain topic (e.g., “Can you remember a situation where you used technologies during the journey? What did the situation look like?”).

Workshops. Two workshops with a total of 13 participants were conducted in Austria (n=6) and France (n=7). The participants were between 54 and 71 years old, and all of them were already retired. In a workshop, a group of participants discusses issues, based on a semi-structured guide, which was developed by the researchers participating in the project. This qualitative approach aims at gathering perceptions, needs, problems, beliefs, etc. from a target audience and enables to gain deeper insights into a topic. Therefore, workshops are not used to gather representative data but to explore relevant issues and tendencies.

Survey. Based on the findings of the end user interviews and the workshops we developed an online[2] and an offline (paper-based) questionnaire to reach a larger number of older adults in Austria and France. A total of 116 fully answered questionnaires were used for the analysis, including 82 offline and 34 online versions. The participants were between 50 and 83 years old, and 94,8% indicated to already have retired.

The interviews and workshops were analysed qualitatively by categorizing and summarizing the statements (following a grounded theory approach [2]). The data gathered in the survey was analysed quantitatively using SPSS 20.0[3].

[2] http://limesurvey.com

[3] http://www-01.ibm.com/software/analytics/spss/products/statistics/

4. Results

In the following, the most relevant results for our two research questions will be presented.

4.1 How do end users plan/organize/conduct their travels? (RQ1)

In the interviews we identified a **variety of different travels** the participants were interested in, like culture trips, city trips, senior travels or adventure trips (e.g., camping, taking a cruise or traveling as a backpacker). The main **motivations** were to get away, to gather new experiences (e.g., getting to know new cultures) and to extend one's personal horizon. Only a few **routines** were identified when travelling, i.e. going to the same place or the same hotel, using the same traveling guide or using the mobile phone in order to be in contact with family and friends at home. When **organizing the travels**, the participants relied on a travel agency, a Senior Club they are traveling with, or planed their journey on their own, by reading books, watching movies beforehand and looking up information in a traveling guide or on the Internet. According to this, only few **technologies** were used for organizing travels: the TV, sometimes the computer (Internet) as well as the (mobile) phone for calling for example the travel agency. The interviewees also rarely used technologies during journeys, e.g., the mobile phone in order to be in contact with family and friends or to activate the alarm clock, and audio guides when visiting museums. **Events during the journey** (e.g., buying a ticket) are either organized on-site, like buying a ticket at the office or at a ticket machine, or in advance, when buying a ticket on the Internet or reserving one.

In the survey, similar results were found. The majority of the participants indicated to be interested in culture trips (74,5%), 35,3% in wellness trips and 25,5% in combined travels. Furthermore, the participants primarily stated to book via a local travel agency, followed by booking on the Internet and by telephone.

4.2 How do end users navigate indoor and outdoor? (RQ2)

The interviews revealed a variety of different **strategies when navigating outdoor**. The participants indicated to use different tools, e.g., maps, navigation systems, signs, the Internet or smart phones. The mentioned strategies varied according to the transportation mode, e.g., going by car requires different strategies than walking. Furthermore, the place where one has to navigate (e.g., in the countryside, in a city) seemed to be decisive for the navigation strategy. Besides, the participants indicated to look for landmarks or ask other people in order to find the right way. Being in an unknown city or at the underground car park were mentioned as being problematic when orientating oneself or navigating.

The majority of participants in the workshops were open to using **technical devices** for support (e.g., navigation systems or online maps). However, an important finding was that they lacked trust in the device and the suggested routes. Furthermore, the participants stated that they often asked others (e.g., passers-by) for help in orientation or navigation, and referred to signage on-site (both indoor and outdoor). Nevertheless, navigation was associated with many **problems**, such as inappropriate signs, too few information points, or no available person to ask. While navigation for older adults is often focusing on impairments and restrictions (e.g., [1], [15]), the participants in the workshops did not refer to visual, hearing or physical restrictions in navigation.

The survey provided further details on the older adults' navigation behaviour both indoor and outdoor. When **going by car**, almost three quarters (71,2%) indicated to usually use a street map, 44,2% indicated to use a navigation system, 31,7% to use print-outs of maps they had looked up before on the Internet, 15,4% said that they ask other people and 13,5% stated to navigate by means of landmarks. When **walking** the participants indicated to use maps (59,6%), but also to ask other people for help (54,8%) or to navigate by means of landmarks (38,5%). In **familiar outdoor environments**, the participants indicated to pay attention to landmarks, to use street maps, or to ask other people, while in **unfamiliar outdoor environments** they primarily indicated to use street maps, a navigation system or ask other people.

For **navigating indoor**, the participants stated to usually use information boards (85,5%) as well as to pay attention to signs (70,0%), to ask other people (46,4%) and to watch for reference points (30,0%). While the participants indicated to primarily use information boards and pay attention to signs in both familiar and unfamiliar indoor environments, they rather referred to reference points in familiar environments, and to asking people in unfamiliar environments.

5. Implications

On basis of the requirements described above, we derived several implications. Paying attention to those implications will help meeting the older adults' needs and thereby enhance the development of navigation aids for older adults in our project.

- As culture trips seem to be very important for the end users, **integrate information** on sights and cultural heritage in digital navigation aids, both for trip planning on the home platform and on the mobile navigation aid on-site. Furthermore, allow individual access of favoured information.
- Use **landmarks** (outdoor) and **reference points** (indoor), and provide recognizable details, if they are not unique in the environment in order to support recognition rather than recall.
- **Describe the target in advance** in order to help the older adults in recognizing it.
- Consider that printed street maps are still commonly used when going by car, while technologies are rather complementing than replacing them. Thus, the navigation support should **comply with traditional maps** as far as possible.
- As asking other people is a common navigation strategy, the system should **integrate help functions**, e.g., with the symbol of information counters or offices.

- Consider that the navigation strategies vary between familiar and unfamiliar **outdoor environments**. When navigating in familiar outdoor environments older adults might pay attention to landmarks and use street maps, whereas in unfamiliar outdoor environments especially the use of street maps is the most common strategy. Thus, allow adapting the system to familiarity, and only display the information needed in the specific situation to support flexibility and efficiency in use.
- Consider that information boards and signs are the main navigation aids used when navigating in familiar and unfamiliar **indoor environments**. By using the same signs in the digital navigation aids, which are in the physical indoor environment, the end users' recognition will be supported. Furthermore, providing information, which is usually displayed on information boards, will enhance easy and quick orientation.

6. Conclusion

Our expectations regarding the user involvement in the requirements analysis were partially met. For example, the engagement of the older adults during the workshops was amazing, as well as the participants' thorough knowledge and enthusiasm. Conducting the interviews was very informative, but also very time consuming, due to the participants' talkativeness. We were surprised by the initially negative attitudes towards modern technologies, what made the recruitment quite difficult. However, we noticed that as soon as the older adults realized that they can actively influence the future, they became very active and open-minded. For us it was important to understand the problems, which older adults have regarding technology usage. Besides the identification of problems, many ideas for digital navigation support came up, like taking a picture from the car in the car park with the mobile phone to be supported in finding it again later.

Supporting older adults in indoor and outdoor way finding is challenging, but according to the results of our requirements analysis it seems to be worth designing for this special user group. The participants in our studies reported various problems in navigation, and regarding technical support they indicated distrust in the offered solutions. However, adhering to already familiar strategies, e.g., using the same elements, which the older adults are used to from the real world (like signage, street maps or information boards) seems to be promising. Furthermore, it will be beneficial to use landmarks or reference points for indicating the way. On basis of the users' requirements the system is currently being developed. Through an iterative design, i.e. the prototypes are evaluated throughout the development (beginning with the design, and ending with the final prototype), it will be ensured that the older adults' needs will integrated in the design of the final solution on the best possible way.

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INDAGO: A PEEK AT A MOBILE AMBIENT INTELLIGENT FUTURE

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Abstract

The elderly part of the population might often depend on support and care. Assistance is not only needed in the home-care context, but also as a sustainable mobility support. Being mobile is a fundamental prerequisite to participate in social life and amenities [1]. The inDAgo project [2] aims to fulfill the premise of a mobility assistant that takes care about their owners during their journeys. The concept relies not only on IT Infrastructure but also on service providers and helper networks (see figure 1).

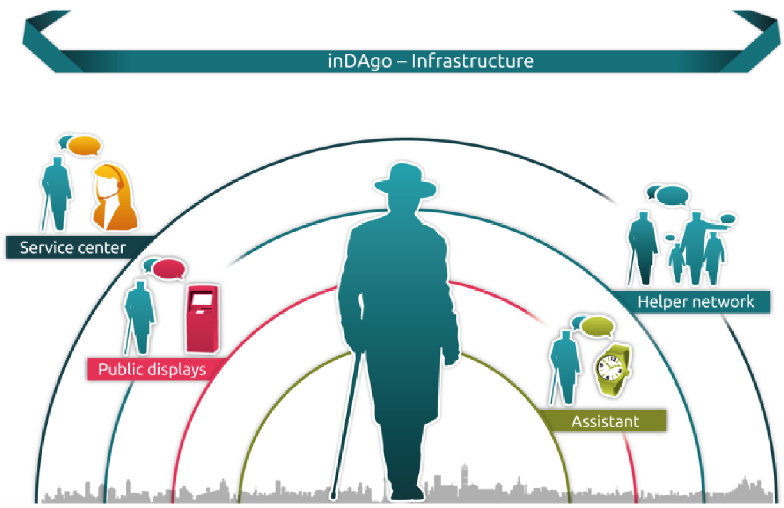

Figure 1. The inDAgo Architecture

1. Methods

A positive user experience of the system will depend on the quality of the service. The underlying information must be valid, trusted and accurate. The data needed will be gathered through various online resources. The maps are based on the information provided by the open-street-map project [3]. This data will be enriched by relevant

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terrain information e.g. acclivities. Additionally, the real-time information about traffic networks and weather conditions will be included. The routing algorithms take the person's mobility and preference profile into account when computing an optimized route.`

Gathering this information and calculating an optimal route is part of the geo-information research in this project. Making this information accessible for the users is part of the user experience [4] research which is the focus in this paper. As with all user-centred design approaches [5], the project started with an elaborated analysis phase.

We conducted interviews with n_e=6 domain experts (à 60min). We asked about the work with elderly and persons with reduced mobile capabilities. Information about the context, their mental models and how they perceive the problem space of mobility for elderly gave us insight in their daily routine and their perceived problems.

We included the end users in our research: four focus groups with a total of n_f=28 participants (19 female, 5 male) were conducted. In the aftermath we extracted the main arguments and put the statements in a questionnaire where the participants could rate them according to a five point Likert scale. Those results backed the observations from the focus groups. Based on results from our contextual analysis we created some persona (see figure 2) and visualized three main usage scenarios as storyboards (see figure 3).

Figure 2. Rosemarie Herzig - one of the inDAgo Persona

The scenarios covered the tasks of consulting a doctor, meeting with friends (ad hoc) and visiting the city for leisure and cultural reasons. The scenarios follow the guidelines of the scenario based design approach from Rosson [6]. The scenarios and storyboards were presented to our focus group participants who verified them.

Figure 3. Persona and Scenario Toolbox

2. Results

During the focus groups, on-site visits and interviews it became clear that not one member of our target group owned a smartphone. At this point we assumed a smartphone or tablet app as the way to go. Our research showed that there were numerous aspects that prevent a smartphone solution:

- poor display quality (sunlight, size, no twenty-twenty vision)
- lack of usability
- technical anxiety
- burdensome learning ("why should I learn those things, I'll be dead in five years"(sick))

Smartphones or tablets have (had) the benefit of always available display space. In an urban environment with a dense display infrastructure of public accessible displays (e.g. ticket machine, ATM, …) this advantage vanishes. Using the infrastructure of the city will be a major point as can be seen in various research results [7]. In this setting three aspects pose a challenge:

1. The cross-linking of diverse services like bank terminals with the AAL infrastructure of the inDAgo middle-ware.
2. Providing a user interface that can be used intuitively no matter what the hardware provides (e.g. screen size, touch, hardware keys, gestures, audio ...).
3. Offering a device with minimal interaction possibilities and a high acceptance factor to serve as an assistant.

The cross linking will be met with the application of the UniversAAL framework [8]. The user interfaces for diverse public displays can be written as so called UI-handlers in the UniversAAL framework.

Thinking about a device which would function as a 'little helper' when no (display) infrastructure is at hand lead to the concept of wearables and ubiquitous computing. Those wearables, gadgets, jewellery or everyday objects like a bunch of key could interact with the user in different modalities. E.g. a talking hat that connects to a hearing device or shoes which give hints by vibrating or colour changes (see figure 4 for some ideas).

Figure 4. Some early ideas and hardware demonstrators

Another 'helper' aspect of the inDAgo system is the usage of a social network. In this network people can offer their help to others who are currently stuck. If – for example – a wheelchair driver is deadlocked with no reasonable chance of freeing himself, he might signal his situation to the inDAgo helper network. If a member of the network is near, he or she will be informed about the situation. As a fall back there will be a 24/7 helpdesk implemented. Options about the implementation of a social (online) community around inDAgo are currently discussed.

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WAYFIS: PERSONALIZED WAY FINDING SERVICE FOR SENIORS

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Abstract

WayFiS project aims at improving the capability of seniors to plan and execute mobility activities by solving the problems elderly people cope with when trying to move in unknown outdoor environments. WayFiS is the first route planning service for elderly people that considers both the pedestrian and public transportation mobility issues and that it is based on the existence of a wide range of personalization features, building up user profiles, and that include the health state of the person and his common behaviors and needs. The target group of the project constitutes the elderly people older than 70 years old and not familiar with ICT and with technologies in general, usually living alone and suffering from health limitations due to aging. The resulting WayFiS services will be tested at target groups in Spain, Hungary and possibly Switzerland. In this paper, the objectives of the project will be highlighted and the current state of research activities will be presented.

Keywords: Personalized Navigation Service, Geo-localization, Route planning for elderly, Way finding, User Profiles.

1. Introduction

The European WayFiS project (2011-2103) [1] launched in the Ambient Assisted Living program aims at improving the capability of seniors to plan, manage and execute mobility activities at their own discretion by solving the problems elderly people cope with when trying to move in unknown indoor and outdoor environments, thus enabling them to take part in the self-serve society. The problems that are approached are mainly related to the access to information, sight problems, walking and/or motor abilities, cognitive abilities, associated health limitations, scarce availability of proper information regarding transport adaptations, stations/stops accessibilities, and so on. The target group of the project constitutes the elderly people older than 70 years old and not familiar with ICT and with technologies in general, usually living alone and suffering from health limitations due to aging. The resulting

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WayFiS services will be tested at target groups in Spain, Hungary and possibly Switzerland. A key factor of WayFiS is the end users involvement in all the phases of the project from the project definition to the final user acceptances tests, trying in this way to cover and adapt the WayFiS service to their needs.

The innovation of WayFiS is the development of a personalized way finding service for elderly people, considering both public transport and paths by foot, and focused on the objective of making the elderly feel healthy, well and safe and that takes into account their specific limitations and healthy habits, with the challenge of aggregating a huge amount of information from different sources and including them into one mobile service with an intuitive interface (e.g., voice-touch-write). The WayFiS is the first route planning service for elderly people that considers both the pedestrian and public transportation mobility issues and that is based on a wide range of personalization features, building up user profiles that include the health state of the person and his common behaviors and needs. WayFiS also includes localization and positioning features for both indoor and outdoor environments that will guide the elderly along complex paths.

The process of way finding will have to consider a variety of objectives regarding the totality of the journey such as the following: finding the route that is adjusted to seniors' mobility limitations; matching nutrition needs and disease's restrictions; avoiding inaccessible routes; finding necessary facilities along the route.

In order to accomplish these goals the following set of information has to be available: presence or lack of stairs / elevators; availability of public transportations that are enabled for disabled persons ('low' buses vs. 'high -step' buses); availability of proper food sources such as markets, restaurants (according to the need of allergy-free or diet-compliant foods; pharmacies that provide certain medications - in case they are needed urgently; availability of toilets, hospitals or police stations.

Hence, WayFiS will affect the quality of life of elderly people at different levels: it will allow them to maintain mobility, which is a crucial issue for enabling independent and healthy living; it will also guarantee orientation, which is essential for safe moving around in an unknown environment; it will also enable independent living by allowing elderly people to maintain a high degree of independence and autonomy; it will help elderly people to participate into digital self-service society.

2. Methodology

WayFiS concept is designed from and to the users. The User requirements phase has had the objective of collecting the requirements from the end-users defining the main characteristics of the services, usability requirements, and main functionalities. In this task user assessment methods have been applied, which include general surveys, focus groups and personal semi-structured interviews in which both quantitative and qualitative approaches will be taken into account. The results were feed directly into subsequent work packages to ensure the strong user-centered focus of the project. In addition, the task has examined what conditions influence the acceptance of the technology and therefore are necessary preconditions for technology adoption.

Figure 1. WayFiS Focus Group in Extremadura

The results of this task reflected some significant real needs of potential users. These requirements range from health related needs like the necessity of a health monitoring system, need of the functionality of reminder to take medicines, the availability of pharmacies or hospitals. Moreover, some interesting requirements have been expressed by the end-users, which were not initially foreseen, that are related to the safety of the elderly such as for example the notification of easy paths along the way or the presence of alert systems for relatives in case of need.

Other interesting suggestions come from the needs the end users have expressed concerning their social life such as the availability of Points of Interest depending on user's profile such as seniors centers. As far as the transportation related needs are concerned, end users expressed the necessity of some functionality for finding nearby public transportation stops and of easy to use route planner. In parallel to this task, it also took place the implementation of an Ethical and Social Impact Study covering the main directives and recommendations that should be considered in a project involving senior end users; as well as exit strategies and inform consent consideration to protect user's data and privacy. After the development phase, WayFiS project will develop a pilot to be tested by end-users in Spain and in Hungary (thanks to the presence of end users organizations that are partners of the project): in this way, a wide test bed covering different ages, interests, needs and cultures is provided. Namely, based on measurements-based performance evaluation methods will be employed at least in two stages, i.e., first after the first prototype generation, and then with the second prototype including the first feedback obtained in the user's acceptance tests.

The pilots implementation will consider the uses cases defined in the project, as these use cases implies senior making trips, two stages have been considered: one first stage with a monitor following the elderly on their trip in order to understand their problems or doubts with the service, a second stage for the elderly travelling independently where the tracking will be done based in the mobile service's logs.

3. Service

The service developed with WayFiS project will be constituted by a mobile interactive end-user application, delivered as a service, for elderly people that has been thought to be used with minimum intrusiveness for them and maximum benefit. The service will be available as a twofold facility: a web based pre-planning application and a mobile application. WayFiS as web-based application will allow end users to test the service and to perform the definition of the user profiles together with a pre-planning of the desired journey. This facility will be provided as web-based application and not as standalone software in order to discharge the final user from installing the program on his computer. WayFiS service will then be available as smart phone application in order to allow the user to be able to view in real time his current location and the path to be followed in his portable device and also to hear the directions by a voice describing the journey. In Figure 2 the WayFiS Pilot scheme is provided.

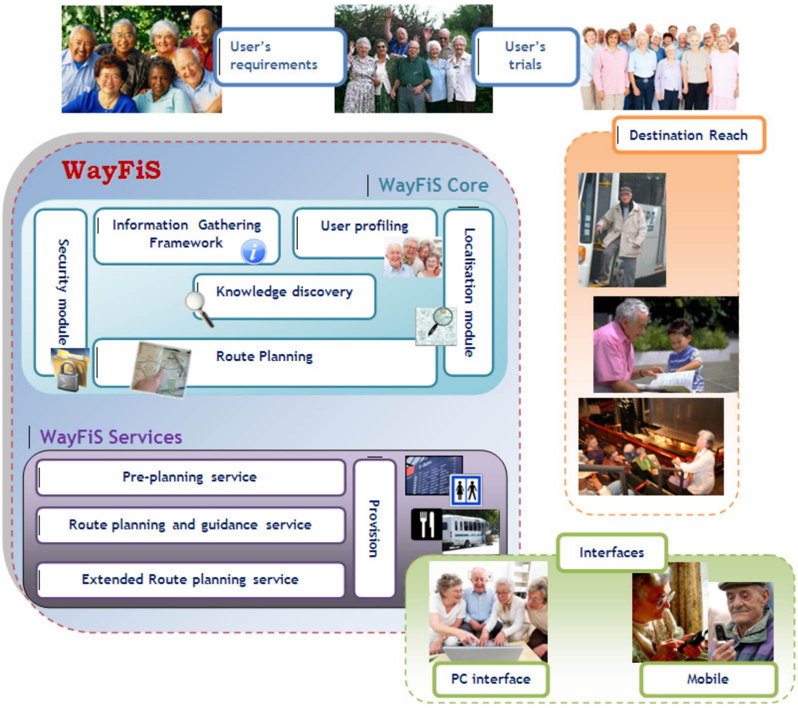

Figure 2. WayFiS Pilot scheme

WayFiS core technologies are the following: a Knowledge discovery module and Information gathering Framework for processing and integrating the huge amount of heterogeneous information from multiple sources, including traffic information, travel time prediction, stations/stops accessibilities, surrounding characterization; a User profiling module for building up profiles characterizations; a Localization and Positioning module with the use of outdoor technologies like GPS or triangulation of network-signal based localization and indoors technologies like navigation supported by stationary bacons from Wi-Fi, Bluetooth or RFID technologies, or combination of those; Route planning module including context aware technologies and route optimization; a Privacy and Data Security module for personal data protection. Thanks to these technologies, the following services are provided to the elderly: web-based pre-planning service; route planning and guidance service.

The interface is designed for elderly; this implies that problems like vision, technology understanding, hand use, and etc… have been taken in account. The interface follows a general design rule for all the common elements such as how to scroll the view, used colours and fonts, the symbols and figure used, pollution of interface elements (i.e. buttons, text inputs, and etc…), the size of the elements, and the use of specific hardware buttons present on the mobile device.

Acknowledgements

WayFiS is a project funded under the Ambient Assisted Living Joint Programme (AAL JP) on the third call AAL-2010-3, with the collaboration of the European Commission, Ministerio de Industria Energía y Turismo of Spain (MINETUR), Federal Office for Professional Education and Technology (OPET) in Switzerland and National Office for Research and Technology of Hungary (NIH).

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IWALKACTIVE – THE ACTIVE WALKER FOR ACTIVE PEOPLE

Andreas Rumsch[1], Rolf Kistler[1], Alexander Klapproth[1]

Figure 1. Active Walker for active people

Active living is a way of life that integrates physical activity into daily routines. This is particularly important for older people, as regular exercise can increase both mobility and the potential for independent living. However, a large proportion of the age group 60-85 suffers from various kinds of physical disability that prevents them from living as actively as they would like to. Rollators and walkers have become very common mobility aids, as a means for walking support. In Sweden and Germany ~4% of the population uses a rollator.

One of the main problems with existing rollators and walkers is that they are heavily stigmatized. People in actual need of walking support often hesitate or refuse to use these walking aids, since they are seen as only for "old", "sick" or "handicapped" people. Further, physical challenges arise outdoors, when the user needs to overcome physical obstacles or uneven ground with curbs, gravel, snow etc. Can a rollator become as accepted as a pair of Nordic Walking sticks today?

The aim of iWalkActiveis to offer walking impaired people a highly innovative, attractive, open walker platform that greatly improves the user's mobility in an enjoyable, motivating way, while at the same time enabling physical activities that are either impossible, or very difficult to perform with a traditional rollator.

Figure 2. Active Walker

Technically and conceptually, the idea goes beyond that of a conventional walking aid. iWalkActive creates an active walker for active people. It takes an innovative walker frame – the Veloped - extends it with an efficient, powerful e-drive and combines it with the possibilities of state of the art ICT technology acting

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as a mobile device dock connected to valuable assistance services.

The most important resource for the whole Consortium is the users involved in the project. They build the basis for solutions which will be used and truly accepted in the future. The different user groups active in different stages of iWalkActive, an SME directly working with their customers and the focus groups organised by the iHomeLab, provide a solid basis to achieve the project goals.

iWalkActive is focusing on active adult people between 55 and 75 years who live independently and love to spend their time outdoors. The project will involve several user groups. The different user groups have been selected to cover the whole range of possible iWalkActive users. They were characterised in terms of their activity and mobility as well as the environment in which they live.

The active walker will be thoroughly tested by four different user groups in three European Countries (AT , CH, SE) in both urban areas and the outdoors and could hit the market within 2 years after the project ends. The aim is to bring benefit to both end users and society, in the form of improved health and higher quality of life of the individual, together with long-term reductions in healthcare and socio-economic costs. The figure below presents the 4 groups which will be directly involved in iWalkActive.

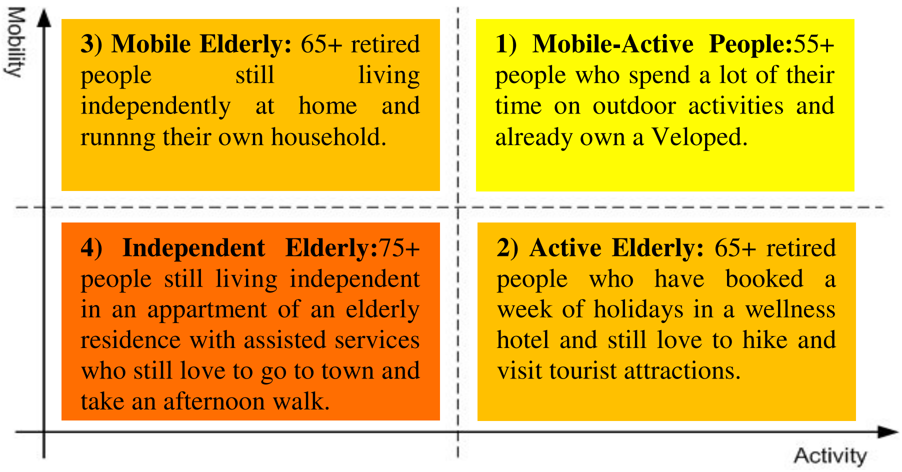

Figure 3. User groups

The iWalkActive activity platform offers outdoor as well as indoor navigation and orientation services and the assisting features of an all-terrain capable walker with a supportive e-drive. Community services such as the recording and rating of walking routes and an open interface for new walking-tailored Apps down-loadable over an AppStore based on the UniversAAL uStore, enable the users to enjoy improved mobility, greater access to the outdoors and better possibilities to stay physically active. An ICT supported walker is a novelty and does not exist on the market today. Also the focus on active elderly walking outdoors is new. Specifically, taking the state of the art, the iWalkActive consortium has identified the following technological novelties and innovation potential of the integrated, unique iWalkActive mobility solution:

- A **barrier-free navigation and orientation system** that is **especially tailored to the needs of walker users** and works seamlessly for outdoor and for indoor use. A walking path (e.g. to the next toilet) will never lead to obstacles such as stairs that cannot be mastered.
- Innovative **context-aware algorithms taking data from walker sensors** (current location, path, velocity, steepness, terrain, height, etc.) which allow the walker system to react in real-time to suit the user's needs or let the system and externals (in alignment with the security policies) localise, monitor and track the walker in order to intervene in an emergency. Also an individual adaptation of the routes and the trips to the physical health and current condition of the user becomes possible thus supporting him optimally (suggesting routes/pauses ad-hoc).
- Innovative community concepts which allow taking the walker as an input device to learn, record and store new routes in a commonly accessible directory and let them rate.
- An innovative **SmartDevice-to-Walker interface** converting the walker to a dock to easily connect the high-tech ICT device to the mechanical frame and interact with it (and its additional sensing capabilities and the e-drive control mechanism).
- A novel, **intention-based, assistive e-drive** option (including an electrical braking system) that ideally supports the user while walking unobtrusively just heading in the direction and with the force he needs it in his current context. For this special application it is necessary to develop a higher-level control system which is integrating different sensor data and a conventional motor controller applying different modes and context-sensitive algorithms.
- A novel **mechanical walker design which overcomes physical obstacles**, i.e. curbs, thresholds and potholes, and uneven ground like cobbles, gravel, grass, sand and snow.
- An open **walker AppStore platform based on the uStore of universAAL** providing an **open walker API** for any other services provider who want to be included into the extensible walker ecosystem (e.g. emergency call system or vital signal monitoring based on heart rate and skin resistance sensors in the handles, walker as self-propelled dust cleaner, …).

Figure 4. Outdoor walking

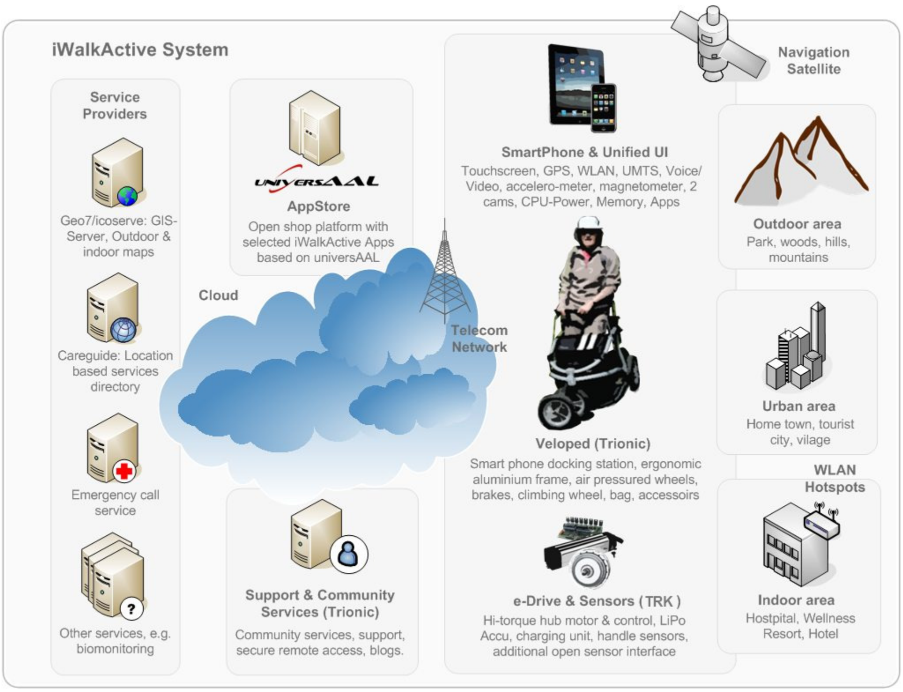

Figure 5. iWalkActive System Overview

Figure 5 gives an overview of the iWalkActive System including all communication nodes and their distribution. It also indicates how the ICT hard- and software framework will be build up around the walker in order to allow for a seamless integration of the different services under the hood of a unified user interface running on the smart phone.

Instead of marketing, sales and distribution towards traditional mobility retailers, the active walker will be marketed, sold and rented out in the places where physical activities take place. The services and products will physically be placed at tourist resorts, sport hotels, hiking clubs & Nordic Walking facilities. In addition, the iWalkActive will be marketed towards the end user on the Internet.

MOBILESAGE – SITUATED ADAPTIVE GUIDANCE FOR THE MOBILE ELDERLY

Ivar Solheim[1], Ileana Turcu[2], Victor Sanchez Martin[3], Marit Rosenvinge[4], Helge Klitzing[5], Lavinia Curescu[6], Valentin Alonso Gracia[7], Luke Chen[8]

Abstract

Today's society is flooded with a plethora of new techno-devices which although easy to use for the newer generations are unfamiliar and can pose severe difficulties to the elderly. This is why senior citizens exhibit anxiety towards the uptake of new ICT based solutions, such as for example automated ticketing machines. The idea behind the AAL-project MobileSage (2011-2014) is to provide elderly people with context-sensitive, personalized and location-sensitive tools which allow them to carry out and solve everyday tasks and problems in the self-serve society when and where they occur, "just-in-time". Modern elderly live longer, are healthier, more active, mobile, independent and more demanding customers than ever before. They will increasingly look for useful, user friendly and personalized ICT services that add value to their active and mobile life and that can help them to stay active despite various impairments. Here MobileSage provides a timely approach and solution. Two innovative services are provided for the advancements of older people's independence and mobility in the daily life, including in particular transportation and travel. The means is instantiated by a personal agent on the smartphone, which provides a help-on-demand service. This service offers relevant, accessible, and usable content upon request, in the form of multimodal and personalized instruction and guidance, enabling people to help themselves. The main target group of the MobileSage service is elderly persons with or without disabilities (motor, perception, cognition), MobileSage also enables and promotes the users' own generation of such help providing accessible and usable content. Users in the three participating countries—Norway, Romania, and Spain—have been involved in all stages of the innovation process. This includes comprehensive studies of user needs, definitions of requirements, and evaluation of solutions. There are partners in all three countries dedicated to user involvement and running the pilot study with users.

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1. MobileSage overview

MobileSage aims to provide elderly people – the primary end users – with a personalized context-sensitive tool which provides assistance for carrying out and solving everyday tasks and problems in the self-serve society whenever and wherever they occur, just in time, or, on demand As such, the system acts like a conciliator of knowledge.

MobileSage consists basically of two services, which are the main two deliverables of the project. They are called Help-on-Demand (HoD) Service and Content Management (CM) Service, see Illustration 1 which shows the overall architecture and the major building blocks.. The HoD Service offers relevant, accessible, and usable help content upon request, in the form of multimodal and personalized instruction and guidance, with the goal to enable primary end users to help themselves.

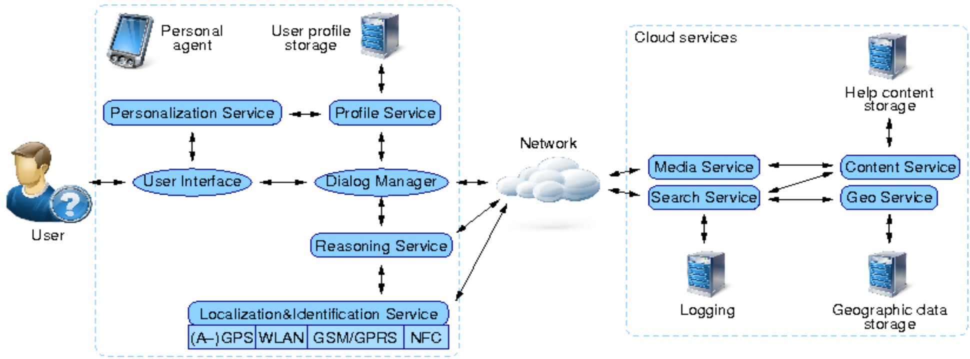

Figure 1. System architecture for Help on Demand Service (left) and Content Management (right) with the network in between

The content itself is fetched from the CM Service. There are no limitations regarding what kind of content can be conciliated, including manuals, usage instructions, and travel descriptions. It is anticipated that mainly secondary users will upload content to the CM Service as they are likely to have a direct interest in helping the primary users. However, it is expected that also tertiary users provide content. For instance, a manufacturer may provide manuals for their ticket machines, or the railway operator that runs these machines might do so. Even a municipality might be interested in producing such help content as a special service for their citizens. Of course, there is nothing preventing primary users to produce and make help content available themselves as well as through the CM Service.

1. Help-on-Demand Service

The Help-on-Demand (HoD) Service is a thick-client application, a personal agent, running on a smartphone. Its main building blocks are built up in a service oriented manner. The user interacts with the Dialog Manager through the User Interface. The

Dialog Manager utilizes the functionality provided by the Profile Service, which takes care of the user's profile. Besides the user's personal preferences also the use pattern is stored there. The user's behaviour and actions in the User Interface are logged and analysed by the Personalization Service which is responsible for adjusting the user profile accordingly.

Besides utilizing services provided as cloud services, the Dialog Manager is further in contact with the Reasoning Service with the task to make an educated guess of the user context. In order to do so, the Reasoning Service itself makes use of network services such as Media Service, Search Service, Content Service, etc. The most important factor for determining the user context is the current location. The Reasoning Service therefore gets help from the Localization Service which has the responsibility to determine the user's location with highest possible accuracy, based on technologies like A-GPS, WLAN, GSM/GPRS, and NFC, and triangulation methods.

2. Content Management (CM) Service

The Content Management (CM) Service is organized as a cloud service and runs on a web server. The implementation of the CM Service is sketched in Illustration 2. A user who wants to produce multimodal content uses a User Agent like a browser to gain access to the service. The user interacts with the service's Dialog Manager, which in turn controls the User Interface. The main logic for handling the multimodal content lies in the Content Manager, which has a modular design to be able to add additional modalities in a simple way. MobileSage will include the modules Video, Audio/Speech, and Subtitles. The fabricated content is finally stored by the Content Service.

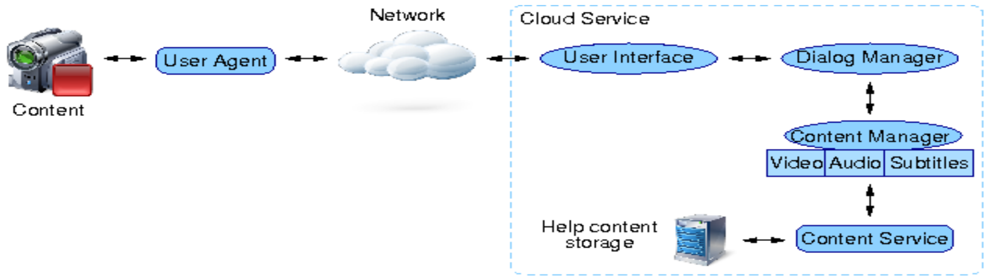

Figure 2: Architecture of Content Management Service

3. Personalization

MobileSage is an adaptable service, meaning that the service adapts to each individual user by means of a personal profile containing various personal parameters as illustrated in Figure 3. Besides parameters reflecting the users' abilities and preferences, the profile also contains parameters which let the system adjust its behaviour and user interface as it learns from the interaction with the end-user. System parameters can be changed, like the speed of timed media, the duration of media playbacks, etc., such that the service not only is able to assimilate itself with each individual user and her/his needs, but is also able to follow transitions of one individual user's physical and mental state over time.

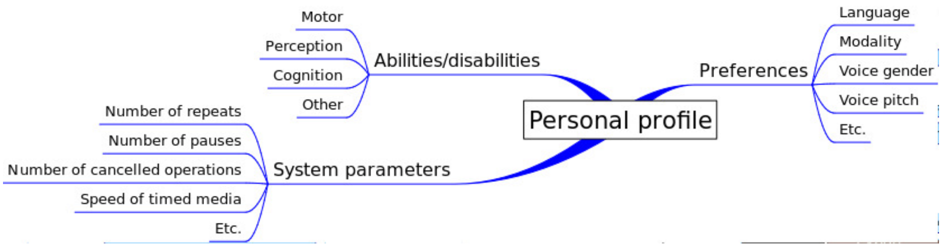

Figure 3: Overview of personal-profile structure

4. Iterative development process

The development process in MobileSage follows an iterative approach, with several development iterations for the services. One iteration consists of the steps specification work, risk analysis, development and integration, and evaluation. The development is user centric, meaning that users from the target group are involved at each evaluation step, and that the development starts with an analysis of the user needs. The idea is that the user requirements, which are a direct consequence of the user needs analysis, are "translated" to system requirements, and that the specification of those is refined in each development iteration based on the results from the last user evaluation.

5. Pilots with users in three countries

All surveys and evaluations involving primary end-users will take place in three European countries, Norway, Romania and Spain. Between 36-45 primary end-users will be involved in pilots in the three countries. In all countries project partners are selected to be dedicated to work on national pilots. In each country: 12-15 seniors +65, mixed gender, urban environments, both without and possible half of them with disabilities (visual and motoric in particular) in order ensure that MobileSage interface and accessibility comply with demands for universal design /design for all. In order to make sure that end-users are not simply put in the role of passive objects of research but are active participants, they will be kept informed of outcomes, and all relevant interfaces, features and documents will be translated into the three languages.

AAL-MOBILITY AND DESIGN ETHICS: DESIGNING WITH SENIOR TRAVEL WORKERS AND TRAVELLERS

Ozge Subasi[1], Marilla Valente[2], Eva Reithner[3]

Abstract

This paper gives a short overview of co-design communications, processes and design ethics from STIMULATE Project[4](AAL-JP Call3). It contributes to AAL- mobility and well-being in tourism economy contexts. Design ethics and ethical communications are introduced as co-design requirements for applied design projects.

1. Introduction

Social activities and mobility are important aspects of quality of life (QoL) for aging population [3]. Travel support is one of the areas for enhancing QoL, as older people travel more than any other age group, registering round 260 million trips a year and that active seniors are one of four key customer segments predicted to have a substantial effect on the airline industry during the upcoming 15 years [[4]]. If designed well, travel support services and products for seniors have a huge market potential, namely aging community (+65), as aging society has wealth and an important consumer power [[1],[2]].

Members of aging population are not the easiest for collaborating and co-designing, neither are they homogenous. One reason for non-collaboration is the not-well-defined ethical design principles; another one is the lack of appropriate design communications for the specific community. We shortly introduce our design ethics and an example communication for sharing and co-designing in the AAL area, to contribute to a better value sensitive approach [[5]].

2. Methods & Principles

In our design process, we try to fill this gap by applying following principles:

- <u>*participative design/sustainable exploitation*</u>: Older travellers are co-designer of our system. Local communities (travel and tour organisers, senior travel

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[4] Stimulate (E2 Mobility Services for Elderly People) is an Ambient Assisted Living Project funded by European Union under AAL-JP Call 3 (website: http://www.stimulate-aal.eu).

groups and end user organisations) are active contributors to decisions, which results in a sustainable exploitation plan that includes multiple views from different stakeholders.

- *consumer insights*, emphasis to non-functional: fine-tuning of the consumer perspectives and thinking about giving-back to people for their efforts (e.g. non-functional benefits of such systems).
- *volunteerism & locality as motivator*: Offering the local information and volunteer involvement as active motivators for usage by older people
- *design ethics guidelines:* Design ethics guidelines, that are understandable to all partners and embedded to all processes.
- *ethical communications:* Communication techniques, that are created for communicating design and technology decisions to end-users in an understandable way, where an end-user can easily comment to decision and to its ground.

2.1 Design ethics

The STIMULATE Project follows an ability based [[6]] participatory approach (rather than a problem oriented model). It actively involves older people and further stakeholders in the design process. The project collaborate more than 30 older co-designers (age between 55-92) in multiple continuous studies. Below (Figure 1) is an example communication, between end-user organisations, older people and technology developers, so that both parties comment on design decisions easily. The communication is used for supporting end-users reflecting back to designs from technical partners.

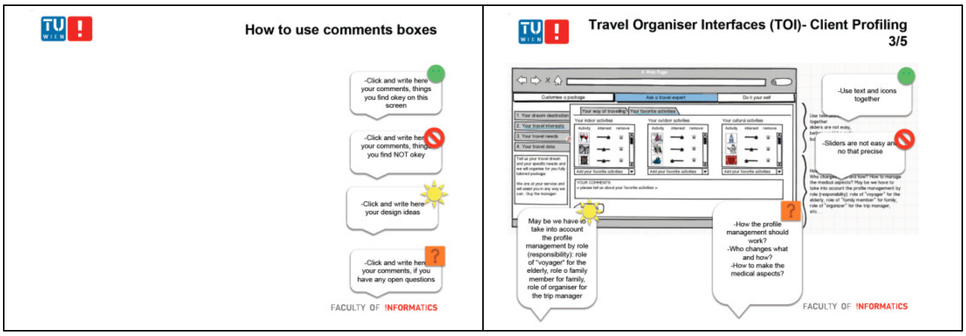

Figure 1: Example communication board between users, experts and technology designers

Additional to ethical considerations in the project, we defined our "ethical design principles" by following "respectful design" principles [[7]]. Different from conduct for ethics for research, we have used the matrix for ethics risk and benefits. This means we consider not only informed consent, exit strategy but also (as summarized from [[7]]):

- Physical benefits and risks
- Financial benefits and risks

- Psychological benefits and risks
- Social benefits and risks
- Spiritual benefits and risks
- Environmental benefits and risks

Our communication materials (as in Figure 1) are informed by these ethical principles.

3. Discussion/Conclusions

During the first year of the project, the abstract wishes and needs from heterogeneous groups of seniors has been collected and systematically converted to design decisions by using introduced communications. Those decisions were made available to stakeholders and older participants of the project by using easy-to-understand language following design ethics principles. Our future aim is to keep the simplicity during technical development. We also aim to keep our development decisions transparent to the target group. In conclusion, by following a respectful design strategy in fine details, we further aim to build sustainable relations with our people, which is a must criterion for the success of such products in AAL area.

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STIMULATE: BUILDING SUSTAINABLE E^2 MOBILITY SERVICES FOR ELDERLY PERSONS

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Summary

This paper contributes to AAL-well-being in the context of mobility and tourism for seniors. The main issues of the STIMULATE project are presented hereunder.

1. Introduction

Current information and communication technologies allow development of new *ad hoc* services tailored to the specific profile of the customers, especially in the travelling field. However, access to them is subject to a reasonable acceptance of the underlying technologies. The "STIMULATE" project aims at bridging that gap by facilitating the mobility and the independent travelling capabilities of senior people aged mostly from 55 through using fully adapted Information and Communication Technologies (ICT). In particular, "easy to use" and "à la carte" assisted travel planning will be provided to seniors via appropriate terminals, as well as itinerary optimization and local assistance via smart phones when "on the move".

2. Objectives

The objectives are to set up an online platform of thematic travels for the elderly persons. This platform will allow:

- elderly people to select the best travel itinerary based on their needs and capabilities;
- tour operators to propose relevant thematic travel for elderly people and optimized services.

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Then when travelling, the platform will offer assistance to elderly people to facilitate their travel and make it better.

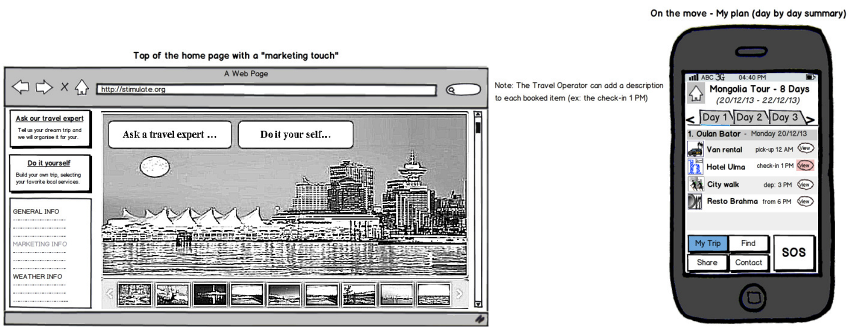
3. Methods

3.1 Regarding Innovation and Technology

Advanced user communication technologies will be used for interactions, namely adapted graphical representations and navigation using common place terminals (PC, smart phones and tablets). Advanced knowledge based on GIS technologies will be used for processing and personalizing seniors' "travel and shopping requests", optimizing transport itineraries, providing travel assistance, securing health care support, and enacting the overall execution of the planned travel and shopping.

To achieve the STIMULATE platform goals; the plan is to adopt a qualitative approach in the following technological aspects:

- Accessibility and usability: they are key factors for the elderly to adopt the solution. They are often lacking in the current IT offer (complex use of software or web sites not being accessible). The proposition is to adopt a holistic approach of accessibility addressing as many disabilities or reduced capabilities as possible at the same time. On the usability aspect, the idea is to use a value-centred design methodology.
- Simplicity: STIMULATE will use an innovative combination of well-known devices such as smart phones and tablet, and natural interaction such as voice and audio effects. The combination of such devices and voice control will offer the elderly the opportunity to interact easily with well-known media and will also provide accessible alternative solutions to elderly with disabilities (e.g. hearing, reduced speech or visual capabilities).



3.2 Regarding Business Market

The business models for the STIMULATE project are built upon the traditional and direct approaches that older people already use to plan their travels, but they enable them to have access to more information through the aggregation of data through a service provider. Beyond the purely technical aspects, the business model, built upon the creation of a central STIMULATE service provider, is crucial to ensuring that the unique needs of the elderly are addressed. The service provider aggregates not only like-interested elderly travellers, but also provides access to information from multiple potential tour operators and myriad travel content details about places of interest and the like. Beyond this, the service provider will act as a central point of contact for information of particular importance to the elderly users while travelling, based upon interaction through a mobile device, including referrals for emergency services, local health services, and the like.

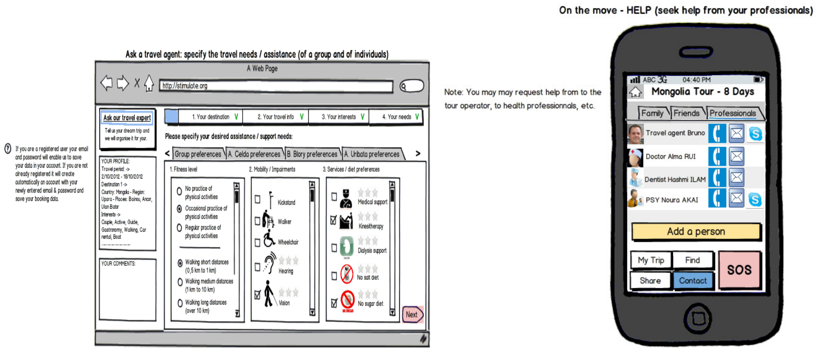
In this service provider model, it is expected that the end-users will pay for the services in some direct form, and tour operators or other travel industry participants will pay fees associated with advertising in the network, and directly connected with travel services that are purchased by the end-users as a commission. As a part of the exploitation planning of the STIMULATE project, the options for working with existing service providers to implement this approach will be explored, along with the potential for a new service provider to be created as a direct outcome of the project including members of the existing consortium, depending upon their strategic interests and business objectives.

3.3 Regarding End-users

To reach that goal, STIMULATE is using a user-centred co-design methodology enabling seniors to specify their assistance needs, to extensively plan a trip, to optimize the transport means and itineraries, to secure advice, to be provided with personal assistance while on the move, as well as to secure local shopping recommendations and assistance.

STIMULATE Project has an interdisciplinary strategy on how to involve end users in all stages of the project. The project involves users and stakeholders from different countries during the whole process. Moreover social scientists from different social disciplines like gerontology, social support, sociology and ethics together with designers plan and update how to conduit the applied research with an optimization of end user contributions from different countries and groups by using well-established research methodologies from social disciplines.

The strategies for co-designing with users, communication mechanisms for gathered data is led by Vienna University of Technology based on on-going scientific discussions. End-user groups like e-Seniors, DMMR, AFC in France and EURAG in Austria ensure the project is well aligned with older users' needs. Moreover other partners collaborate with users and other user segment groups as they systematically build a knowledge transfer from a large set of gathered data on needs to a more systematical approach with ontologies. As a part of the end-user involvement strategy, user groups have been defined, selected and recruited according to a well-defined profile. This plan considers: sampling requirements, ethical regulations and several strengths of different user and stakeholder groups which are located in different cities.



3.4 Regarding Ethics

Ethics in the field of ambient assisted living is what the involved stakeholders 'should' do as the right thing, for the good to the users and for those who may be collaterally affected as well as for the common good generally. Ethics is essential for all the stakeholders at all levels of action.

With several fields covered by the project and its assumed further applications, STIMULATE covers a large field of specialties which may sometimes conflict from an ethical point of view, and likely reduce its social and personal validity, if an ethical harmonization is not respected. Different phases of the project may affect the potential users, mainly persons over 55: preliminary studies, definition of functionalities and design of physical device (including graphical user interfaces), trial design and management (including panel of target users), general conclusions on the device, its applications. These can be crossed by several ethical domains, namely: social, biologic and medical ethics, as well as engineering and marketing ethics, some of which clearly defined by standing rules and regulations.

Concluding on this analytical review, the social value and "personal" value of the project is a more comprehensive ethical result. Such criteria as users' satisfaction, user's mobility and cognitive abilities improvement as well as the acquisition of new practices (culture, social, etc.) are essential for determining device marketability and level of innovation.

3.5 Regarding the breakthrough of STIMULATE project

The STIMULATE project relies on innovative multi-objectives optimization algorithms: based on end-users profiles taking into account several characteristic such as physical disabilities, end-user preferences, available accommodations, transport means and activities profiles, the platform will draft a list of well-matched travels during the planning phase. The algorithm is based on a process of simultaneously optimizing one or more conflicting objectives (such as the price, the compliance to his profile, and so on.) subjected to certain constraints. Parts of the constraints are fixed by the healthcare professionals, which can be related to itineraries, activities, user assistance needs and local available transport services. While on the move, the platform could propose to the end-users in real-time alternated activities and transport means regarding to new constraints such as closed activities or unexpected traffic events such as traffic jam. Such proposed services by the platform are possible through innovative and efficient algorithms and appropriate use of ontology models for the profiling. In addition to tackled scientific challenges the STIMULATE project uses open technologies such as web services for assuring the less dependencies between each core services.

4. Discussion

The STIMULATE project is willing to go further on and adapt its ICT to seniors' everyday life mobility. It should allow elderly people to be more independent in the self-served society.

WHAT REMAINS?

Alessia Cadamuro[1]

1. Use co-design tools as services that remain

What remains? is a design research project that is part of a larger investigation into how game elements can be used as motivational triggers to stimulate Alzheimer patients physically and socially. *What remains* uses co-design tools and turns these during the engagement with participants in the project into a service that remains and persists after the designers leave.

2. Co-design & empathic design

Mattelmaki and Sleeswijk Visser [7] state that "co-design activities typically aim at searching new potential directions and producing design ideas and solutions." Since co-design is generally a collaboration between designers and a small representation of the people who will use the designed product or service in the future, it is fundamental to use an empathic approach. "Empathic design starts with a need to understand user experiences in the early phases of the design process" [2]. However, establishing a group to a co-design with is an activity that takes a long time and requires good preparation, because it is extremely important to find the correct way to enter into people's lives without upsetting them or causing disruptions.

3. Engaging the homeless – the ethical problem of co-design

Starting and ending a co-design project is a delicate matter that involves ethical issues, especially when working with people who are vulnerable such as homeless people, or older people with Alzheimer. In an effort to address and overcome these ethical issues, I have started to work with participants in such research in a particular way. *Fictitious Address* is a co-design project and a service system for homeless people. The system helps homeless people to get back crucial documents they have lost, such as an ID card, to get a physical address and to get registered for social services. In order to understand the problems and priorities of homelessness it was important first to design the right conditions for the creation of a group of homeless people to work with on the project. Only after that, it became possible to enter the group as a designer. This step always requires much attention, respect and gentleness. Once the group existed, we shaped our co-design experience together through different sharing activities. Empathy was one of the most important elements that we tried to stimulate with these activities. Over time, the co-design group became a small community that eventually took over

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the whole *Fictitious Address* service. At this moment I, the designer, could step out of the group again. The method that was applied focused on respecting the human relations that developed during the joint activities. More precisely, it strengthened the confidence of the group and made them see that they eventually did not need the assistance of a designer anymore to continue to meet, and to keep using the product service system they helped to co-design. By then, they had experienced and were confident they could generate solutions to their problems themselves. The creation of a small independent community is crucial in achieving this stage.

A similar approach facilitated my detachment from the group of homeless people. During the separation phase, it was very important to find a way to maintain communication with the people that I had been involved with. This resulted in a continuing connection through mainly letters, emails and direct visits every few months. This allowed me also to observe the continuing success of the project, without my direct involvement.

4. Engaging Alzheimer patients – readdressing co-design ethics

At the moment, I am involved in a second project with Alzheimer patients, to further explore and extend the approach I took in *Fictitious Address.* Alzheimer disease is the most common form of dementia. There is no cure for it, it worsens as it progresses, and eventually leads to death. In this project I work with Careyn, a social enterprise dedicated to the health and welfare of older people. Through long observation sessions including conversations with a psychologist working at Careyn, it became clear how older people with Alzheimer spend their days at the centre. The Careyn environment is designed to be very stimulating and staff routines are friendly and comfortable. This is a fundamental quality in successful care for Alzheimer patients. According to Kyttä [3], “Environmental psychology suggests how a pleasurable living environment is composed of physical, social and emotional environmental offerings or affordances divided into community feeling, aesthetics, safety, recreation, activities and needs of different resident groups”. However, during my visits to Careyn, I also noticed some similarities with observations in care centres by Kälviäinen [1]: “[On the one hand] care homes filled with devices, messy information boards, differing styles of furniture and stimulation material are fussy and associated with disrespect. Assistive devices stimulate experiences of disability stigma, cleaning items communicate about constant cleaning and an unclean environment, and children’s materials imply childish residents. On the other hand too bare environments with cold colours and lighting, public space items and settings present a displeasing, boring and even scary atmosphere redolent of healthcare institutions.”

5. A lack of interactions

Most striking during all my observations was however that the patients did not have any interaction together. Even though they share some spaces on a daily basis, they are completely confined to their own world, detached from the environment in which they live and from the world outside the care home. In order to understand and explore opportunities to create social stimulation between older people with Alzheimer I used co-design as a research method. Through co-design “designers (or design researchers) can facilitate the initiation of collaborative processes as well as participating to the process as contributors” Mattelmaki, [7]. Older people with Alzheimer and caretakers at Careyn are involved as the experts that will guide me to understand what Alzheimer disease is. They are the experts of their own life experiences, because every day, sometimes during many years, they have had to deal with their problems and think about possible solutions. I knew from the previous co-design projects *Fictitious Address* that it is necessary to engage participants with and through empathy if I wanted to create a collaborative group with them. According to a psychologist and caretakers at Careyn, “elderly with Alzheimer are a very delicate group because of their disease. For them it is easy to become restless, aggressive or passive and lost.” In order to become familiar with them I started to spend long periods inside care homes, especially during lunchtime. Lunchtime in the care homes is the moment where the patients gather together to share the same table and food, but during the observations it was clear that they did not have any interaction, communication or conversation together. Yet, eating and speaking together, about the weather, their families, and many other simple topics presented me an intense and good starting point for feeling accepted by patients and caretakers, allowing me to start our collaboration in a positive manner.

6. Future co-design experiments

In order to overcome communication problems between elderly with Alzheimer I designed two group experiments, to be proposed during lunch and dinner at the care home. The aim of these experiments is to stimulate social interaction within a safe and well-known environment by using food and the concept of sharing. Two playful co-design interventions aim to use lunch as a moment to trigger dialogues and more generally communication between people sitting at the same table. In this part of the project, as a designer, it is very important to be accepted as part of the whole group because the co-design experiments are only possible via my direct participation to these activities. The first experiment comprises feeding each other using long wooden sticks. Each stick is too long for a person to use it her or himself. The experiment proposes to use it for feeding another person through an engaging interaction. In the second and subsequent experiment each participant has two plates in front of her or himself, one empty and one containing just one of the ingredients of the entire lunch. Each person is asked to place a portion of food on the empty plate and then pass the plate to the person at her or his right. This is then repeated until, step by step, all of the plates have all the ingredients and arrive again at the initial owner of the plate, full of food. Both experiments will last for a few weeks with the same people, with the main aim to consolidate the group.

7. Conclusions

The objective of this approach to co-design is to find ways to slowly enter a sensitive environment with vulnerable people, through creating friendships with the participants and proposing an involvement into activities that stimulate the creation of a collaborative group. This initial part is necessary especially to stimulate mutual trust and complicity between designers and participants.

The end of the co-design experience can be a traumatic event for a co-design group because of the intense relations built during the collaboration. In particular if a co-design group is created with vulnerable people, a lot of new emotions and feelings are involved. Co-design events such as the ones described here typically generate a weekly routine that may create a feeling of safety between the participants. If this safe environment suddenly disappears, this may create problems for some of the participants.

The co-design experience that is created in the projects described here are designed to persist. This principle is the starting point for designing services in the *What Remains* project. Using game elements, these services aim to provide life benefits to older people with Alzheimer. The co-design process still has to go through a number of iterations to find out what interactions and game elements will work best to create a service that can remain after the designer leaves.

Acknowledgements

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EREHAB: UBIQUITOUS MULTIDEVICE PERSONALISED TELEREHABILITATION PLATFORM

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Abstract

This paper presents the eRehab project, an innovative tele-rehabilitation solution development project. Its cloud-based architecture enables anytime, anywhere and multi-device rehabilitation therapy execution. Furthermore, it is based on the Universal Remote Console (URC) technologies and serious game technology, to achieve the maximum degree of user satisfaction. The flexibility provided in terms of location, client device, interaction means and content is understood as the path to maximize patients' acceptance and adherence rate.

Keywords: tele-rehabilitation, Universal Remote Console (URC), personalisation, inertial sensors.

1. Introduction

The life expectancy of citizens in modern societies is increasing rapidly. Such trend has a direct impact in the sustainability of healthcare systems in terms of public healthcare policies and budgets [1]. Rehabilitation services' users are mainly seniors. The solution presented in this paper tackles the needs detected in the healthcare rehabilitation process. In this sense, firstly, there is an overload of the rehabilitation resources and personnel in the first phases at the hospital due to the need of individual attention. In this stage, rehabilitation is still a process regarded as strongly linked to facilities available at hospital or medical centres. As a consequence, the time required for the rehabilitation sessions is largely exceeded by the travelling time, and thus, daily activities are severely disrupted and additional costs for travelling need to be added. Finally, the adherence to home rehabilitation therapies have shown to be low.

[1] Vicomtech-IK4, Spain
[2] BioDonostia, Spain
[3] Baleuko, Spain
[4] STT, Spain
[5] Bilbomática, Spain
[6] Vilau, Spain
[7] Teccon, Spain
[8] Ikusi, Spain

eRehab aims to answer to these needs by developing an ICT solution that helps elderly people maintaining a healthy and active lifestyle, while minimising side effects and improving healthcare systems' sustainability. The eRehab platform aims to reinforce the rehabilitation process in its whole duration, in order to obtain a better and faster recovery of patients. Likewise, the project targets to increase the motivation of the patients during the rehabilitation and a reinforcement of the adherence through digital entertainment technologies. Finally, the project aims to provide the therapists with a tool to assess the patients' evolution, both real-time and offline. The solution will support the monitoring through different commercial wireless and low cost devices like Microsoft Kinect, Nintendo Wiimote or inertial sensors.

2. Ubiquitous multi-device personalised tele-rehabilitation platform

eRehab expands the rehabilitation localisations, starting from hospital, moving home and giving the chance to continue outdoors or on travel. Apart from the localisation choice, the eRehab solution is implemented in three different client devices (PC, Smartphone and TV). Regarding the choice of client device, the inclusion of URC technologies [2], enables the easy personalisation of user interface (UI) and maximizes available interaction capabilities. Specific joint rehabilitation therapies (elbow, shoulder ...) require precise joint angles measurement: eRehab platform supports inertial sensors, providing a resolution beyond the limits imposed by other hardware, such as Microsoft Kinect. Concerning the implementation of the platform, the project commits to open standards with the aim of maximising the interoperability with other systems. Specifically, the project is using the ISO 24752 standard [2] and the WSDL [4] specification. eRehab platform's system architecture is depicted in Figure 1. The architecture is composed by three layers: the user layer, the cloud layer and the hospital layer. The cloud layer is composed by the UI resource and audio-visual content repositories, the hospital information system (HIS) and the rehabilitation services. Additionally, the Skype videoconferencing service is being integrated.

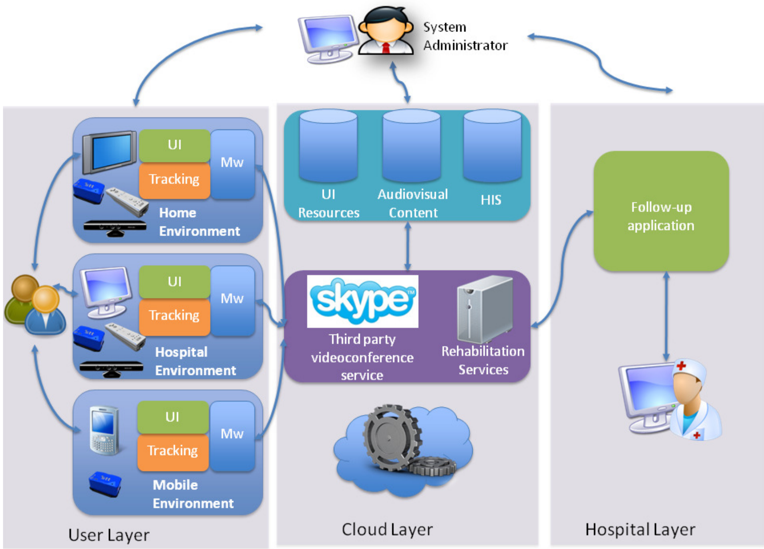

Figure 1: eRehab platform's system architecture

The UI resource repository is based on the resource server concept introduced by the URC technology [2,5] and follows the implementation guidelines provided by the URC Consortium in [6,7]. This approach will enable the provision of incremental support for new users with different needs and preferences, and to upgrade parts of the UI or the complete UI, depending on the evolution of user or maintenance tasks. The audio-visual content repository has been designed to support different modalities, in order to respond to all user needs. Furthermore, the most ambitious scenario is targeting the provision of an audio-visual content merging the prescribed exercise with the user's feedback depiction on the screen. The rehabilitation services are being defined following the WSDL [4] specification, making sure that the implementation is independent from the HIS system implementation in each hospital.

The user layer follows the same approach for the three different deployment environments. Each client is composed of a URC-based middleware, a tracking solution and a user interface. The URC-based middleware solution allows for the user interface personalisation and easy upgrading. Also, the URC-based middleware enables for the definition of a common interface specification for the different tracking systems, enabling the seamless exchange of the tracking systems. The hospital layer is composed of a follow-up application, which allows the rehabilitators to prescribe a rehabilitation therapy to the patient and to revise the tracking results from the patient's therapy execution.

Additionally, the SkypeKit product is being integrated with the UIs developed. Thus, a patient-doctor online videoconference will be provided for each considered scenario.
Finally, Figure 2, shows the initial audio-visual concept developed in tight collaboration with the Donostia Hospital rehabilitators through the Biodonostia

HealthResearch Institute[9]. Virtual rehabilitator's look has been specifically designed, so that older adults find her both familiar and convincing enough to follow her instructions.

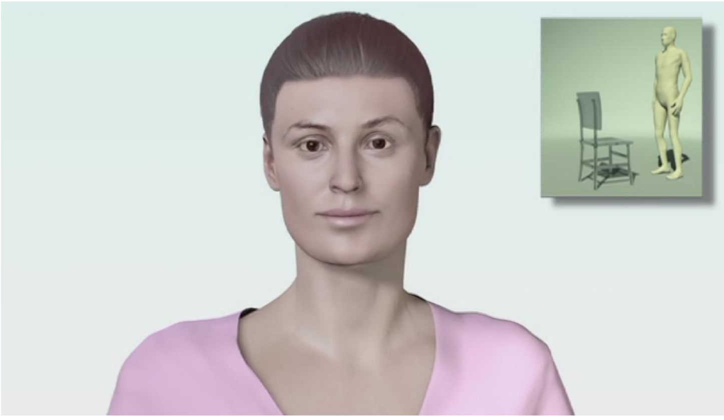

Figure 2: Virtual physiotherapist providing rehabilitation instructions

3. User involvement and ethics

The design of the audio-visual content has been carried out in tight collaboration with the Biodonostia rehabilitation staff. The developed audio-visual concept together with mock-up user interfaces will be tested at Donostia Hospital (Spain) in September by rehabilitation personnel and patients this autumn.

Specific questionnaires have been developed to gather both rehabilitators' and patients' voice regarding the designed audio-visual content paradigm and look, the inertial sensor's tracking system (the tracking system used in the first prototype) and the online communication system. The system will be updated on the basis of the results. In addition, the project is carrying out an ethics supervision task, which supervises the ethical issues and provides the corresponding ethical committee with the needed documentation for the user tests.

4. Conclusions

The eRehab project provides the maximum flexibility regarding the customisation of the client application in terms of user interface, content and tracking system, as well as the location for the rehabilitation and the client device from which is used. Still, the project is in development phase and needs to implement final client bundles that will attain the users' acceptance and adherence to the therapy.

In this sense, with the objective to achieve users' acceptance, a first round of user tests with patients with knee prosthesis will start soon. The acceptance by the end users of the user interfaces and the content deployed over several client devices is key for the large scale implantation of the system and for its extension to other health services.

Acknowledgments

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ACTIVA: DEVELOPMENT OF AN ACTIVE THERAPY SYSTEM BASED ON PHYSICAL EXERCISE WHICH HELPS TO ENHANCE MUSCLE STRENGTH IN PEOPLE WITH PARKINSON'S DISEASE THROUGH LEISURE AND NEW INFORMATION AND COMMUNICATION TECHNOLOGIES

Laura Carrasco[1]

This is a project funded by the Ministry of Industry of Spain through the FORWARD PLAN for the 2009 session.

1. Participants

The promoters are the Parkinson Association of Madrid (APM) and the Technological Institute of the toy (AIJU). Parkinson Association of Madrid (APM) is a Non-Profit Organization that has been supporting people with Parkinson's disease and their families since 1994. Nowadays APM is the biggest association of people with Parkinson's disease in Spain. It has 1.600 members and its aim is fundamentally to offer patients and their relatives care, information, guidance, and services such as physiotherapeutic rehabilitation, speech therapy rehabilitation and music therapy.

All these services are offered at the rehabilitation centre managed by the APM where more than 20,000 therapeutic sessions are carried annually by 38 professionals specialized in Parkinson's disease. The APM also supports research with the goal of eradicating this disease and improving the quality of life of those affected. The Technological Institute for Toys (AIJU), is a Non-Profit Association formed by experts in therapeutic and intergenerational leisure games. Its Department of Pedagogy Product Market is made up of doctors and graduates in Education, Pedagogy and Psychology. The Engineering Department is specialized in the application of new technologies in the field of play and toys, and has experience in the use of graphics and virtual reality technologies and Augmented Reality. Both departments stand at the centre of the two types of experts required for the development of this project.

In addition, the technical staff at AIJU will be joined by Arctic Telemedicine specialized in ICT for the health care sector and Brainstorm Multimedia which specializes in three-dimensional environments supported by Advanced Technology Display and Interaction, thus establishing a multidisciplinary team to ensure the successful development of the project.

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2. Introduction

The main aim of ACTIVA is to establish the basis for the development of an interactive game of high recreational and therapeutic value. It will be based on the combination of exercise with advanced visualization and communication to promote socialization, entertainment and improvement of motor and muscle skills in people with Parkinson's. Moreover, it will offer new entertainment options while improving functional and social skills. Wii-motes Nintendo Wii will be used to support interaction in the games that will be developed. In addition, interactive games will be integrated into an information system that will enable Parkinson therapists to manage the rehabilitation of its users. Therapists will, on the one hand, be able to select the games set for each user and the levels of difficulty and, on the other hand, have access to the scores achieved by their patients, thus picking up useful information on the progress and performance of each user in their rehabilitation through these games.

Based on the evidence of the positive influence of leisure activity on satisfaction and quality of life, the development and implementation of an interactive game that will allow for the scientific exploration of how the combination of game, exercise and ITC can be used as a leisure tool for the prevention and rehabilitation of the negative effects linked to Parkinson’s disease (shaking, stiffness, slow movements, etc) is under consideration. Bearing in mind the conclusions obtained in several investigations about games, new technologies and more specifically about the Wii pad, it seems clear that the combination of both elements would allow for the simultaneous and innovative intervention into the aspects considered essential~~s~~ in the social integration and health care of those affected by this pathology.

The methodological program designed by ACTIVA is based on the priority of involving potential users as well as Parkinson experts in all the stages of the project. The design of the investigation, based on the methodological triangulation, combines qualitative and quantitative techniques of collection and analysis of information that will be used simultaneously depending on the specific aims of each stage. ACTIVA will receive experts in development of recreational products of high therapeutic value, specialists in virtual reality and ICT, experts in Parkinson and final users for the creation of the first game prototype. This prototype will be based on the most advanced technologies of the Information and the Communication for the improvement of the physical and functional capacities of those affected by Parkinson's disease. The prototype will be introduced in five centres specialising in the treatment of Parkinson’s disease, so that it can be evaluated and validated in the different pre-established modalities of use: individual game, collective game and online game played between centres. In order to be able to attain a comfortable and motivating use of the Wii remote control as well as of the visualization and interaction interfaces, the collaboration of an interdisciplinary group will be necessary. This group will, on the one hand, study the requirements and preferences of the group of patients observed and, on the other hand, determine the possibilities that advanced information technologies offer for therapeutic intervention and for the enjoyment of leisure time and the recreational activities in question. Therefore, this complementary and multidisciplinary workgroup will guarantee the results of the project.

3. Specific aims

The specific scientific aims of the ACTIVA project are:

- To obtain a knowledge base regarding the use of ICT as a tool for dealing with different types of users as well as to know the difficulties found in its use and application.
- To validate the hypothesis of the proposed technological configuration.
- To determine the thematic preferences of greatest interest to the group.
- To collect the information required to decide upon the content of the recreational activity most suited to the entertainment and treatment needs determined by the experts at Parkinson's disease as well as to the enjoyment of leisure time of those affected by this type of illness.
- To describe the methodology of the game, bearing in mind the configuration of this recreational proposal.
- To develop the contents in accordance with the established designs, identifying, with the input of the specialists, the areas of intervention and physical priority variables that must be registered by ACTIVA.
- To establish an "Advice Group" formed by users and therapists, who will oversee the design of the proposed game and will give feed-back of high added value.
- To transfer the requirements of the users and the evaluation of the interfaces of visualization and interaction to an ICT-based game that will integrate the contents and the most suitable technology and will facilitate the use of this type of game for the target audience.
- To develop the functionalities designed in the software application of the ICT-based game.
- To carry out a first internal validation of the prototype with regard to the fulfilment of the specifications gathered in the functional analysis of the recreational application and the requirements and needs of the group.
- To introduce the prototype developed at the Parkinson's Association of Madrid.
- To train users and experts of the collaborating Centre in the use of the recreational application developed and the recreational dynamic (rules, user profiles, etc.)
- To check the acceptance of the Wii and the games based on ICT by the specific group of persons with Parkinson's and to evaluate the impact of the implementation of the recreational offer designed on the perception of the users and experts.
- To develop a demonstrator that allows to carry out demonstrations of the ACTIVA system to potential clients at fairs and personalized presentations.

All this will be portable to ensure the possibility of carrying out relevant demonstrations to the most important care centres for Parkinson's worldwide.

- To create a service for the introduction of the technology and the development of 3D therapeutic applications adapted to the needs of every type of patient and care centre.

The ACTIVA project will develop a low-cost and efficient therapeutic system, which will allow for maximum use, and a visualization and interaction system that will offer users the possibility of generating 3D contents easily, broadening the range of therapeutic possibilities.

4. Methods

The ACTIVA project foresees the following methodological program.

4.1 Module 1 - Analysis of Needs and Requirements in the use of ICT

This first module aims to compile, through a combination of different methods, any information that provides insight into the design requirements facilitating access to the use of ICT in the group of persons affected by Parkinson's, emphasizing, in particular, its recreational format. This information is to be obtained by in-depth analysis of previous experiences and the direct consultation of the intended users and experts in the field of Parkinson's. This is the only way it will be possible to ensure from the outset the creation of a game of high therapeutic value which genuinely caters to the preferences and treatment needs of this group.

First of all, and as a knowledge base, it will be necessary to develop a review of secondary sources for the study of those specific characteristics of the persons affected by Parkinson's disease that determine, both in terms of the pre-existing limits and potential, the playful use of ICT. As we have seen in this report, there have been numerous studies linking new technologies to treatment through leisure activities. It is essential to use this information as a starting point to plan appropriately the subsequent stages of this research.

Secondly, it will be necessary to test the hypothesis relating to the basic technological configuration proposed, in order to be able to discern if it is really suited to its proposed use by the group of people with Parkinson's disease.

4.2 Module 2 - Design of the contents of the proposed recreational activity

The information obtained in the previous module will provide useful guidelines for the development of ICT-based games of high therapeutic value which respect the preferences and motivations of people with Parkinson's disease. Considering that the technology will to a large extent determine the contents, the information of the first module of the project will make it possible to select those contents which will be both highly motivational and compatible with the technical requirements established.

For the design of the contents of the proposed recreational activity it will be necessary to study the thematic preferences of the group, since the experience of the research team indicates that getting these right can significantly alter the success of the game. Based on the results obtained, the next step will be to develop the contents which most closely match the preferences and treatment needs of the group of persons with Parkinson's. At a later stage a comprehensive design and a functional analysis of the integrated recreational activity (technology, contents, methodology of game, etc.) will be carried out.

4.3 Module 3 - Design and functional analysis of the integrated recreational offer

With the technology and the most suitable contents in place the next phase will proceed to design and develop the functional analysis of the integrated recreational activity. This functional analysis will describe perfectly the proposal of the game (levels of difficulty, dynamics of the game, number of players, objective, etc.), the technology to use and the contents included in the proposed game. This functional analysis will be the reference document necessary for the programming of the software application of the proposed games and for the integration of the hardware (Wii) which will give rise to the prototype of the recreational application.

4.4 Module 4 - Development of the integrated prototype of the proposed recreational activity

In this phase, based on the results obtained in the previous phases, the prototype of the proposed recreational activity will be developed, integrating hardware (Wii), software and contents. Moreover, the contents of the game will be prepared and configured, so that an initial version of the game will exist and tests can subsequently be performed on this version.

4.5 Module 5 - Implantation and validation of the prototype

The developed prototype will be tested at the Parkinson's Association of Madrid which is one of the participants in this project. For the testing of the prototype there will be organized games sessions that will be supervised by the staff of the Parkinson's Association of Madrid. There will be teams collecting information, allowing staff at the centre to record the behaviours, attitudes and worries of the users before, during and after the games sessions. These tests will make it possible to check, on the one hand, that games based on new technologies are accepted by the group of persons affected by Parkinson's disease and, one the other hand, to evaluate by means of qualitative methods how the recreational activity is received both on the part of the users and on the part of the experts at the Parkinson's Association. A sample of between 100 and 150 persons is needed.

4.6 Module 6 - Development of the pre-commercial prototype

The developed prototype will be refined by the feedback generated and documented in the tests carried out in the previous module. As a result, a pre-commercial product will be obtained integrating all the functional elements of the prototype.

5. Results

At this moment in time the project has reached module 5 of development, when the AAL Forum 2012 takes place it will have reached module 6. The project will not be concluded until December 2012.

SUITABILITY ANALYSIS OF COMMERCIAL OPEN-SOURCE DRIVEN MOTION SENSOR DEVICES APPLIED TO EXERGAMES FOR THE ELDERLY

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Abstract

In this paper we go through the process of selecting and testing the most suitable commercial sensor device to be used by the elderly while playing exercise games. We explain why we have chosen the Kinect as the best device for this purpose. This paper also details SANDRA: a tool we developed to handle the user's movements and determine which device suits better our needs and gives a short description of a game using the tool.

Keywords: elderly, exergame, Kinect, motion recognition, rehabilitation, remote controller, senior, Wiimote.

1. Introduction

Seniors are encouraged to exercise in order to keep healthy and fit [1]. However, exercising is usually considered boring for those who have to do it alone, and the elderly tend to get more and more isolated in our society nowadays [2]. A good way to solve that problem is to present the exercises as social games, that is: using gamification to make it funny and the social component to motivate the users not to drop out [3]. Our first aim is to assess different low-cost motion sensor devices. They have to be able to input the motion data of the elderly into PC-based exergames. We have been searching for affordable devices which can be used off-the-shelf for immediate use. Our final aim is to test a demo exergame which is part of the Join-In project. In this PC-run game, the elderly have to virtually meet and exercise at the same time.

Before developing the game, we had to choose a device to input the motion data of the users into the game so that they see their physical activity reflected in the game. Nowadays, there are several devices and techniques which can be used to motion capture users actions. The most accurate ones are used in the cinema industry. We have to rule that option out because of its high price cost for our purpose. However, the latest generation of motion sensor controllers for video game consoles are affordable enough and provide a fair amount of motion data.

1.1 Candidates Considered: the Wii Controllers and the Kinect

Among all the possible inexpensive sensor devices available in the market, we have decided to test Wii controllers and the Kinect as our main motion sensor gadgets. The Nintendo Wii controllers were the first released wireless battery-fed controllers which introduced accelerometers and gyros. The hacker community have worked for years to reverse-engineer it. As a result, several open-source libraries are available to manage the motion data which the Wii controllers provide. Among these, we use wiiuse, which can handle the WiiMote (including the Wii Motion Plus) retrieving accelerations along the X, Y and Z axes, angular momentums to calculate its orientation and the button-related events of pressing and release them. Other not-so-important features for our motion capture purpose such as the LED lighting and vibration control are also available. The Nunchuk is also supported by the Wii library and provides another accelerometer and button reader. Although the Wii Balance Board does not really belong to the Wii hand set, we have included it as a suitable complement. We use the Wiiboard-simple library which can get the weight applied on the four different areas of the board.

Figure 1: WiiMote, Nunchuk, and Wii Balance Board

The Microsoft Kinect introduced a new concept of motion sensor device to the market. Its full-body-tracking hands-free philosophy made us considered it an excellent candidate to compete against the Wii controllers. Microsoft released a SDK to develop applications for the Kinect on Windows but we have chosen a multi-platform because we did not want to depend upon any operative system. This will help to keep the cost down of a possible deployment in the future. We chose OpenNI as a core library to deal with the data which it can give: the X, Y and Z positions of a user's joints. Currently OpenNI only supports 15 joints (head, neck, shoulders, torso, hips, knees, feet, ankles and hands) out of the 20 available.

Figure 2: Microsoft Kinect

2. Elderly Tests

Two groups of seniors were offered to try both Wii and Kinect as an introduction to the concept of exergaming. They tested the Wii Balance Board with the games Slalom and Table tilt as well as a running game using the Wii Mote. They also played the slalom game of the Kinect Sports Season Two, and a couple of games from Kinect Adventures. Those who tried both had no strong opinion on which sensors they preferred. However, we were present throughout these tests and we could see how they reacted to the games and their motion capture system. The Kinect slalom game, which was very challenging, requested the players to jump and move energetically. The elderly performed those potentially hazardous movements without worrying about the possibility to fall and break a bone. They also got so eager on the Wii Balance Board that one person tipped. We cannot allow such risks when they are going to play alone at home. For the Kinect, we noticed that they had difficulties with the option selection system. It consisted in placing your hand at a certain place for some seconds. It was not intuitive and it was difficult for them to hold their arm for that amount of time. They also needed some time to realise that the human-like figure which was on the screen was mimicking their movements and it was representing them in the game. Nevertheless, they managed to understand the user detection constraints of the Kinect very well.

2.1 Comparison between the Wii controllers and the Kinect

In order to assess the devices, we show a comparison table which includes both the technical and the elderly-specific aspects to consider.

Device	**Kinect**	**Wiimote + Motion Plus + Nunchuk**	**Wiiboard**
Price	$150	$59.98 (more than one may be required for specific purposes)	$99.99
Maintenance in game	No in-game maintenance	The Wiimote has to be calibrated after some minutes of play	No in-game maintenance
Connection	USB port	Wireless-Bluetooth	Wireless-Bluetooth
Sensors	Microphone array, RGB camera, depth sensor	Wiimote: accelerometer, IR camera, 10 buttons Wii Motion Plus: 1 gyroscope Nunchuck: accelerometer, analogue joystick, 2 buttons	4 weight sensor detectors
Output features	1 3-colour led, tilt motor	4 1-colour led, vibrator, speaker	1 1-colour led

Elderly usage problems	Selecting options is not so intuitive as if it had real buttons. Specifically for the selection system the Microsoft games has: it is difficult to have their hand still until the option is selected and they select other options unwittingly because they hold the hand in a wrong position while they look for the right option.	The buttons are too small and too confusing for the elderly. They had trouble distinguishing what is what and how they are used.	Its heavy, they may fall off it
Used in a wheel-chair	Yes	Yes	No
Library used	OpenNI (modified version)	Wiigee +wiigee-plugin-Wiimote (modified versions)	Wiiboard-simple
Library constraints	It fails detecting users. Only 15 joints are available. The microphone is not supported	Sound not supported	It has to be connected with the red synchronization button that is in the battery socket
Involved limbs	All the body	Arms (potentially legs if the Wiimote is attached it to them)	Legs only

2.2 Our Demo - Description

As a consequence of all the divergences of the devices, we developed SANDRA to unify the sensor handling under a single system. It is a multiplatform application which wraps the functionality of several sensor devices. It uses OpenNI as the underlying library to manage the Kinect device, the wiigee library for the Wii controller handset and Wiiboard-simple for the Wii Balance Board. Using this Java library we send the data of the sensors to the game server throughout websockets. Once there, they are processed. The processing stage depends upon the level the users are playing, so it will need different kind of data. SANDRA can provide and stop different services on-demand. This increases the performance by reducing both the computer CPU usage and the communication traffic between the users' PC and the external server. The demo we developed is a browser-based game with four clearly differentiated levels: the lobby, the warm-up, the 'reach' exergame and the score page. The user's movements are monitored by the Kinect at all times.

2.3 The Exercises

In the lobby, the users connect and start the necessary devices to play. After having connected and synchronized, they are led to a new screen where they see an explanatory video with the instructions to play. Each user is associated to a team of four people. Those four people will always play together. We wanted to make it in this way because the elderly prefer to play with people they know. While they are watching a video demonstration of how the game is played, they can also see which of their team member is on-line. When they are ready to start the game, they show they are ready by doing a specific pose. Once all the users are ready, they go to the warm-up scene where the users' avatars meet virtually and they salute each other with hugs or waves. After a while a key will appear, and they can walk over to the key and grab it. As soon as one of the players has taken the key, all players will be led to the next scene.

In this scene the users' avatars are in a room where they have to grab objects above their heads with their hands meaning they have to stretch their arms towards the ceiling. After having reached the object, the avatars automatically move to the next object and the process repeats a given amount of times within a timeframe. After having reached all the objects, they are led to the next exercise. After the game is finished, they all "meet" in the lobby again.

2.4 The Score Page

In this page the users see their own score and the team score. The score is calculated depending on how they performed in the exergames. The page does not show the other team member's score but rather a total team score depending on participation. During the "Reach" level there is a random prize that is won by one of the users. It is completely randomised and hidden in one of the objects they have to reach for but the player who finds this prize receives a higher score tally. The user who was lucky enough to find it is displayed on this screen by name. In this way, we add a gaming element: will I be lucky this time? This adds motivation to the users who, in general, perform the exercises slower than the other users. It gives them the capabilities to be on an equal score as a fitter peer and also introduces a social aspect and promotes user interaction to find out who has found the prize.

3. Challenges and Solutions

The main constraints imposed to the demo are set by the underlying libraries which SANDRA uses. OpenNI is still under development. Consequently it has some bugs. The most important problems are failures detecting users and access violations which lead into crashes of the Java virtual machine. If any of those errors arise, SANDRA has to be restarted. Future versions of OpenNI should solve these issues. Due to resource constrains we had to go for the 1:1 movement that the Kinect features instead of animations. This solution provides a higher feeling of realism in the game because the avatar mimics exactly what the player does. Nevertheless, we thought that animations are better suited as the elderly may tremble or do some embarrassing movements that should not be shown to the other players.

We think that other devices such as the Wii controllers are potentially useful. However, they need to be adapted to the senior citizens or be used in a different way (as part of other systems). Due to the fact that they cannot be used off-the-shelf, we think they have to be ruled out for the elderly exergaming field. In addition, if we want to develop a browser-based game with an animated avatar (1:1 limbs movement or not), the Wii controllers cannot provide the necessary data to move the avatar's body parts. If a future release of Three.js or any other WebGL library efficiently implements animations, the Wii controllers would get closer to the Kinect in terms of suitability.

5. Conclusions and Future Work

After the tests we performed and the experience we got from the development of SANDRA, we realise that the Kinect on its own can provide the motion detection capabilities that the elderly-oriented exergames need. Although it has some flaws, they are related to the current available open-source drivers and not to the device itself. So, we theorise that it will be a neat solution to motion capture the elderly movements and inputting them in social exergames in a near future. For future releases of our demo we are going to introduce a chat voice system in the lobby and in the score page so that the elderly can share their thoughts and socialise more. We will also improve the performance of the internal logic of the remote game server so that the game processing will be distributed among the PC users.

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FONDNESS: USING SERIOUS GAMES TO CO-CREATE HAPPINESS

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Abstract

Using ICT-solutions to address health and lifestyle problems of elderly people raises profound conceptual issues. I intend to investigate the main psychological, ethical and philosophical dimensions of a concrete case – the 'FONDNESS' serious game currently in development by researchers from NHTV University (Academy for Digital Entertainment, supported by Academy for Leisure // AAL-Joint Programme – 5th call). 'FONDNESS' is planned to be a serious game in the 'Tamagotchi'-tradition, intended to stimulate elderly people in executing their daily tasks, and in general maintain an active and healthy lifestyle. Information gathered via the user's active interaction with the game throughout the day will be available in a data cloud accessible to the user's formal and informal caregivers.

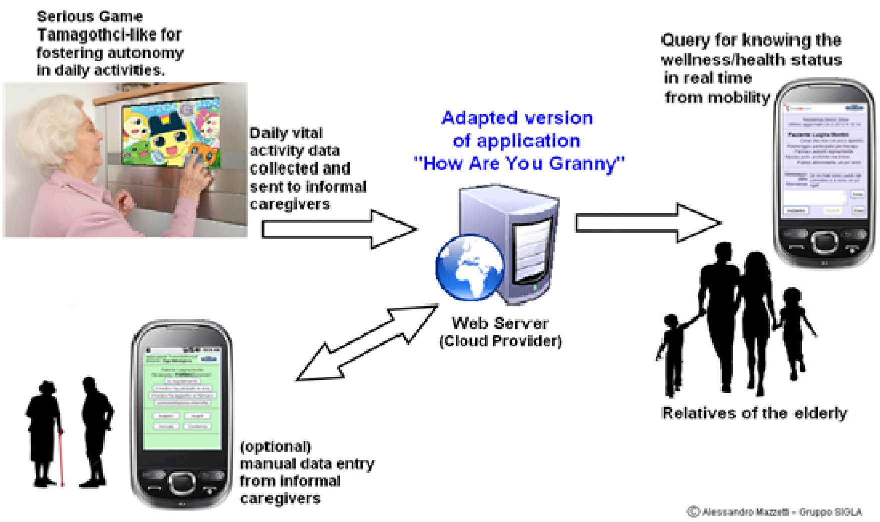

Figure 1. Schematic overview of the 'HowRUGranny' core system that is being adapted for the 'Fondness'-project.

The psychologically salient context for the end user, despite the 'serious' healthcare purposes to which the FONDNESS-game will be employed, is the context of *leisure time*. Leisure is about freedom, creativity, using the imagination, exploring and pushing boundaries... but also about relaxation, regeneration and self-reflection – brief

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moments of fun, life-changing experiences, and everything in between. The main connection between leisure and healthcare, then, is that both aim to improve the quality of life. The 'active ingredient' of leisure that we utilize in the 'FONDNESS' research and development project is the stimulation of optimistic participation via the co-creation of meaningful experiences.

A core aspect of **leisure** is the (relative) freedom it offers to look for inspiring ideas and experiences, to be creative or to stimulate creativity, and/or to look for spiritual fulfilment. Because expressing creativity and exploring inspiring activities can result in meaningful experiences, leisure activities can help constitute someone's intended/desired personal identity: when you wish to be or appear to others as a healthy, vital person, the free space in leisure to make choices you really want to make (as opposed to the tasks you have to carry out at work or in a role as caregiver) are likely to be choices that express that ideal – you will go play sports rather than sit on the couch, eating junk food. That is, in leisure time people can exploit the aforementioned freedom to construct particularly salient parts of a personal narrative [2].

Understood this way, there is – or at least, can be – a strong drive in leisure to improve personal and communal well-being. Interestingly, this generates a recurrent loop: the search for things we want to do in leisure – i.e. pursuing positive experiences – can inspire a self-stimulation effect. The causal chain here is that positive emotion stimulates creativity, which facilitates co-creation, which can stimulate positive emotions. There is ample empirical evidence for the beneficial effect of positive emotions on overall - and long-term – wellbeing (e.g. Gable & Haidt [6]). Now, a general state of wellbeing, reflected in a positive mood, is claimed to enhance creative ideation [4]. In the social arena, a positive inclination ameliorated with creative ability – call it a benign inventiveness – can assist in smoothing out any social stress that might emerge. One could even claim that leisure tools (i.e. meaningful experiences by way of art, events and other creative interactive encounters) can facilitate meaning-directed attunement processes, stimulating shared responsibility and the co-creation of values in a social / collaborative / interactive network.

These are the kinds of experiences that FONDNESS would be intended to stimulate. These meaningful experiences, for the end user, serve to promote a satisfactory degree of wellbeing, and should occur at two levels: both within the game (i.e. the kinds of activities that cohere into a meaningful and effectively beneficent whole) and regarding the context within which the game is to be used (using the game is not the end goal, but a means to stimulate health and wellbeing, which means the use of the game is to be embedded in a broader experiential, social and *ethical* network).

Which kinds of co-creation (recall that this is a core component of the leisure experience) will result in the most efficient and appropriate device/application depends on the objectives of the FONDNESS game. After all, 'stimulating autonomy' is a complex notion with several different possible meanings. Unpacking this notion, we might arrive at one or more of the following purposes of the FONDNESS game:

- Data gathering (for the benefit of informal caregivers)
- Substituting for face-to-face contact
- Enhancing face-to-face contact
- Providing fun activities (stimulating imagination)
- Stimulating cognitive activity (maintaining a specific level and/or retarding degeneration)
- Stimulating cognitive development (improving abilities)

If a specific choice is made, this will raise other questions. To develop an adoption strategy for the end users (primarily the elderly themselves, but obviously also healthcare professionals and informal caregivers), we need scripts inside *and outside* the game to optimize the support network for the serious game users. These scripts will need to meet certain criteria, or be subject to specific constraints, some of which I will explore below based on concepts, insights and theories from (the philosophy of) psychology (embodied embedded cognition), philosophical anthropology (especially concerning human-computer-interaction). The core question to be addressed is: which psychological and social dynamics govern the co-creation of a meaningful experiences for the end users when this co-creation is mediated by technological tools?

One of the current paradigms from the **philosophy of psychology** is 'embodied/embedded cognition' [10]. 'Embodied cognition' can involve claims such as those made by Damasio [3]: processes involved in realizing basic bodily awareness, proprioception and emotional responses are also constitutive of the processes that realise cognition, crucially including off-line cognitive processing. The main idea underlying 'embedded cognition' is that an agent is to be understood in relation to his environment. One way to flesh out this idea is by referring to J.J. Gibson's [7] 'affordances', where the properties of (some relevant part of) the environment and the capabilities of the agent conspire to define a range of possibilities for action.

One consequence of the ideas from the 'embodied/embedded cognition'-paradigm is that the meaningfulness of interaction between people rests, to a large extent, upon the implicit detection of behavioural cues. Behavioural, vocal and symbolic expressions (e.g. language) are meaningful in part because they evolved as an inescapable (i.e. automatically occurring) mutual involvedness of conspecifics (e.g. mother and child). Support for this notion, at least for its ontogenetic aspect, can be found in Stern [8], when he speaks of affect attunement. For instance, the way in which an infant and its mother are able to share affective states depends, to a large extent, on mirrored behavioural structures. In the case of FONDNESS and many other forms of mediated interaction (i.e. social interaction via, in these cases, *digital* media), the point to take note of is that most of what makes 'normal' face-to-face interaction meaningful is absent, or at the very least *different*. The spectrum of stimuli to react to in the case of a tablet-based interface with a domotics system is rather different than the range of input that is available when an elderly client interacts in person with a caregiver. What does this mean when we expect a FONDNESS-like system to perform care-related tasks?

In **philosophical anthropology**, there is a long tradition of commentary on the influence of technology on the behaviour and psychological constitution of technology-users. Naturally, the rise to prominence of computers, the Internet and related ICT-devices and –applications has evoked analyses and predictions of how our minds and lives have changed/will change (e.g. De Mul [5], Van Leeuwen [9]), not all of them positive.

One discussion that is relevant to the FONDNESS project (and similar initiatives) concerns the **psychological** effects of playing computer games (e.g. Yee [11]). Some of the usual positive effects, in most cases measured in younger people (improved hand-eye-coordination, spatial insight and visual attention) would all be relevant skills to train in elderly people with decreasing aptitude in such areas; however, the most significant desired benefits of FONDNESS concern other kinds of skills and attitudes, namely self-valuation, life satisfaction and self-care. Leisure, in the analysis above, can play a role in realizing such wellbeing effects. However, the stimulating power of leisure activities depends on either a deep, meaning-infused connection to an activity, or the dynamic creation of novelty, of new stimuli. In normal, social interaction, both of these factors are combined to create meaningful co-creation: novelty in social interaction (co-creation) is likely because people are not static input-output-generators, but react differently from instance to instance due to different moods and experiences, and/or the development of their own personality over time. Meaningful input in social interaction is likely because this is what we evolved to look for in selecting interaction partners: we spend time willingly with the people who make us happy.

When part of the work done by those personal encounters (e.g. stimulating someone to take care of him-/herself, helping someone improve his/her quality of life) needs to be done by or via devices or applications on such devices, this suggests certain standards that these devices need to meet. One of them has to do with keeping things interesting. Desensitization effects are well-known in psychology: a new stimulus will cause strong responses for a limited time, after which the novelty wears off and the sensation intensity subsides – these effects have correlates at the neural level. Novelty effects are part and parcel of didactical programmes (you need to keep students involved and on their toes with new approaches and ideas in a coherent and cumulative educational structure). Along similar lines, FONDNESS will need to appeal to the imagination and interests of its intended users and sustain this across longer timespans, after the initial novelty effect has worn off. The challenge here might be greater than in the case of commercial computer games or even educational programmes, the challenge not limited to a matter of mere novelty, because it is likely that a significant portion of the target audience is not used to the kind of interface that, for instance, tablet computers offer, and/or is not necessarily intrinsically interested in the kinds of games/activities that such devices make possible.

Depending on what employing a FONDNESS-style game is intended to achieve – is it merely about keeping an eye on someone, or is there an objective of development (cognitive or otherwise)? – there will need to be a cache of staggered modules, at the very least in the form of a training programme to foster familiarity with alien interaction styles, and preferably with additional content to, over time, expanding possibilities to retain interest and any stimulating/inspiring power that the device/application might have.

And even if the device/application is successful from a design perspective, some proportion of the intended users will continue to prefer other solutions. Apart from budgetary considerations (one of the reasons to look for more efficient care solutions), it then becomes an **ethical** question whether people should be denied the kind of care they prefer, the kind of care that could even be claimed to be superior (because of the significance of personal, face-to-face interaction, especially in the case of people who might feel - or actually be - more vulnerable). The salient aspect of this ethical issue involves security: a caregiver that is physically present is much more versatile in a crisis situation than a tablet computer. One defence available to the FONDNESS project in this case is the idea that the device/application is meant in part to enhance personal contact time through its use: it does not replace personal contact; it merely makes it more efficient. If informal caregivers already know the most recent medical data via their access to the data cloud, the actual 'face time' with the client can be spent on activities that might be more 'meaningful' to the client's wellbeing. However, this would still mean that the actual wellbeing effect is realized in more or less normal social situations, rather than via the use of the device.

Even if we disregard this point, there is at least one major additional ethical matter: privacy. Will the client agree to the sharing of personal information about his medical situation, and/or his activities throughout the day? For any of this to be effective, and possibly the privacy argument to be dealt with, what is needed is a specific attitude to providing care. Experience-based co-design of solutions in a care context [1] is an approach that would align quite well with the leisure aspect of the FONDNESS project. The idea is to use insights from the design world to generate the optimal procedure, finding the best attunement of performance (functionality), engineering (safety) and the aesthetics of the experience (usability). This procedure of using co-creation as a development tool and as a way to guide and monitor implementation could, conceivably, result in different versions of the application in different contexts or for different users: customizability in tailor-made solutions are also important.

Summarizing this very brief exploration, we can see that FONDNESS will need to stimulate the co-creation of meaningful experiences. It is unlikely its use will replace face-to-face contact, but it may enhance it. The game will either need to appeal to deeply seated interests in the client, or evolve along with his aptitude in using the system. To avoid any of the associated ethical pitfalls, experience-based co-design of tailor-made solutions should be the main paradigm for both development and implementation.

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PLAY FOR LIFE: THE LEAGE GAME

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Abstract

In this paper, the alpha co-design sessions of the Learning Games for Elderly Europeans (LEAGE) game are presented and discussed. These sessions were performed in The Netherlands, Spain and Greece. Valuable insights were gathered from the participating seniors on the usability and playability of the game. The gathered knowledge will be used for the design of the LEAGE Beta version, which will be evaluated at a later stage in the project.

1. Introduction

People are never too old to learn and play. Yet, seniors are largely ignored in the design of educational material and games. We combined learning and game play in the design of an innovative digital learning game for European (EU) seniors: LEAGE. A framework for serious game design was used; pimi[1], which emphasizes player-centred and iterative design, the involvement of a multidisciplinary team and full integration of play and learning. The design of the LEAGE game is based on: 1) existing literature on senior gamers[2-4], 2) a player centred needs analysis by means of focus groups in three EU countries[5] (Spain, Greece, and The Netherlands), and 3) co-design sessions (see Figure 1.).

From the focus groups and low-fi co-design sessions several educational and stimulation goals were identified and a preliminary storyboard was developed which comprised of a road trip through Europe where players have to play mini-games that focus on seniors' learning goals, e.g., gather knowledge about culture, travel, foreign languages. In addition, relevant ingredients for seniors engaging in digital learning games were included[2-4], among others, fun, co-located co-play, cognitive and physical stimulation, avoiding childish appearance, and contribution to escaping from daily life routine.

Seniors were positive about the initial storyboard and were provided with three different interface designs during the co-design sessions; a museum theme, a colourful theme, and school theme. Overall, seniors preferred the museum theme combined with a simplified colourful theme. Furthermore, an avatar guide that is responsible for the narration in the game was perceived as childish and not representative for the senior

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[4] 50+ Hellas

population. The results from the first sessions formed the basis of the Alpha version of LEAGE, which was evaluated and described in the following sections.

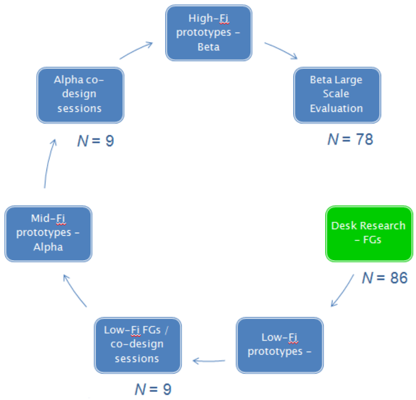

Figure 1. Iterative user-centred design cycle of the LEAGE project. This paper describes the Alpha co-design sessions.

2. Methods

2.1 Participants

Seven seniors (M_{age} = 68.4; 5 female) participated in the session with the Alpha version of the LEAGE game. More than half of the participants had experience with computers and three with digital gaming.

2.2 Procedure

The participants performed a series of predefined tasks (e.g., play level, change name etc.), although semi structured and open for free play. It was most importantly to gather an understanding about the usability and player experience before the whole game was programmed. At an Alpha stage it is still relatively easy to alter the interface and game play using the comments and POBAs of the participants.

3. Results

A small set of results are presented out of an extended list of usability and playability issues. Several seniors reported that the game provided limited feedback on game tasks and actions, for example; when you create a new player then there is no feedback that you did. Furthermore, there was a lack of consistency in the presentation of certain elements in the game, for example, sometimes the avatar is shown including the name, and sometimes not. Interestingly, the senior participants that used a remote to operate the LEAGE game pressed the buttons for more than 1 second on the remote. The button (1) represented ‘Next’ in the game menus and mini games, pressing (1) resulted in going through the whole game in 10-20 seconds (see Figure 2 for an overview of participants playing LEAGE by means of the remote control during the Alpha sessions).

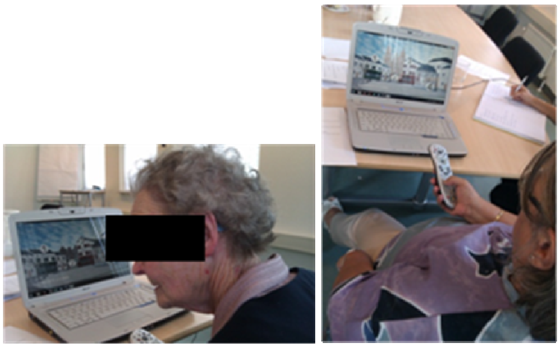

Figure 2. Overview of the Alpha sessions where participant were playing LEAGE by means of the remote control.

Unexpectedly, the senior participants appreciated the images of the 'avatars' that represent themselves, while these were cartoon like and usually much younger in age. The participants chose younger versions of themselves, when they were young. The avatar of the women in The Netherlands was perceived as somewhat non-Dutch in respect to the clothing and hair colour (see Figure 1 for the image of the avatar in The Netherlands in the Alpha version of the game).

Figure 3. Image of the avatar in the Netherlands in the Alpha version

In addition, a sunburn image of a person showed too much skin according to the senior participants and they suggested to just show an arm. (see Figure 4 for the sunburn image in the Alpha version of the game).

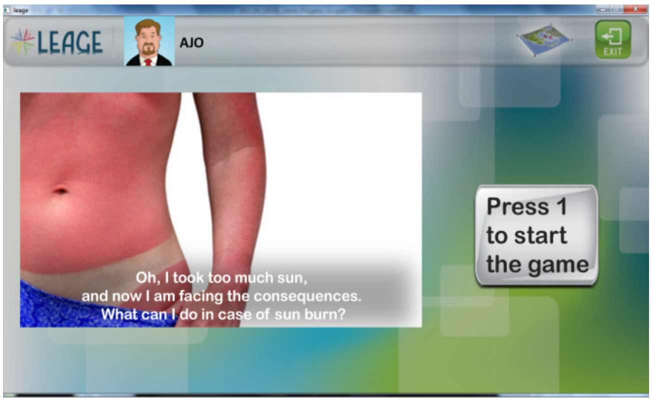

Figure 4. Image of a person who is sunburned in the Alpha version

4. Discussion & Conclusion

This paper described the Alpha sessions – usability and playability of the LEAGE game: game UI, game levels, and storyboard. These were evaluated and the knowledge will be used to enhance LEAGE and perform additional user testing during the final user studies, with a focus on usability, playability, game experience, educational goals, attitude toward technology and actual transfer of knowledge. In conclusion, the Alpha tests provided us with a number of valuable and in-depth results. The results are used to enhance the game to its full potential and ultimately to launch LEAGE to market.

Acknowledgements

We gratefully acknowledge financial support from the European Commission's Lifelong Learning Program (project nº 510663-LLP-1-2010-1-GR-GRUNDTVIG-GMP). In particular, the work reported here has been supported by the LEAGE (LEArning Games for older Europeans) project: http://leage.exodussa.com

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AWARE PROJECT – AGEING WORKFORCE TOWARDS AN ACTIVE RETIREMENT

Alberto Ferreras[1], Alfonso Oltra, Rakel Poveda, Jurij Wakula[2], Roger Domínguez[3], Emanuela Capelli[4], Paula Fayos[5], Carlos Martínez[6]

Summary

The AWARE project, inside the AAL European Program, wants to include mature people in the active world through the usage of ICT tools, recovering their important contribute in a "shared economy of knowledge", and also to contribute to improve their quality of life. To do this we have developed the Senior Experience Network (SEN+).

1. Introduction

Ageing workforce is an important issue arisen during last years: the optimisation of their experience, the gap between older and younger workers and the preparation for retirement are some of the biggest challenges to companies and public entities. Similarly, retirement poses a major problem as, without the daily routine and social contact of the workplace, many people find themselves feeling alone and disengaged from their usual social circle. Current ICTs offers a wide range of opportunities for social inclusion, for getting in contact with other people and for levelling social disparities. However, difficulties observed in access and in use of such technologies represent the continuation of pre-existing social differences.

To remove these difficulties the AWARE project aims at developing an effective solution at the European level for social inclusion of the elderly retired people and at preparing the older workers for transition to retirement. This objective will be achieved by providing skills in the use of ICTs for social participation and an ICT-based tool that can enable social interaction of both groups in order to promote an active aging and to fight against consequences that could arise after retirement, such as depression, loneliness and isolation. Therefore, the primary objective of the AWARE project is to develop a Social Network hosted on a web platform to provide innovative services to both the older workers and retired elderly people, and to contribute to social inclusion, to contribute to EU policies towards the aging society and to support companies' in the management of the needs of the ageing workforce.

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2. Methods and initial results

The main result of this project will be the Senior Experience Network (SEN+). To develop SEN+ a comprehensive work plan has been followed, including the definition of needs and requirements, the definition of the specifications, the development of the different modules, the toolbox development and the integration of the modules into a common platform, and the pilot implementation, validation and improvements.

The project is now under the pilot tests stage. Several groups of users and companies in Spain and Germany are using the SEN+ prototype in real conditions and reporting their experiences to improve the final version. The project is expected to be finished on July 2013.

The SEN+ platform is a specific Social Network with three modules integrated:

- **IMPROVE MY ENVIRONMENT**: This is a database of ergonomic recommendations to adapt workplace and home environments. Users can search recommendations by selecting different features related to the type of environment, the functional activities and the type of recommendation. Open searches can also be performed.
- **MY KNOWLEDGE**: This module permits workers to maintain an active role after retirement by allowing share of expertise and experience, get in contact with other workers and retired elderly people. This will help people to stay active after retirement and will allow the company to maintain and acquire knowledge and expertise although a worker has retired. In 'my knowledge' users can create different pages that can include text, documents, images, videos, links, etc. These pages can be shared with others in an easy way.
- **LEARN AND TEACH**: This module includes a trainer tool for the platform and other courses about ICT skills. Here the users may also create and manage their own courses.

The Social Network is the area for contacting with friends, experts and groups. The users can take advantage of the Social Network to communicate with others, search and find friends, join groups, communicate with individuals and groups using messages, forums, chat, search for experts, etc.

The platform and its interfaces have been designed basing on accessibility and usability requirements of the final users. It has been developed using open-source software and the system is modular in design to maximize flexibility and extensibility.

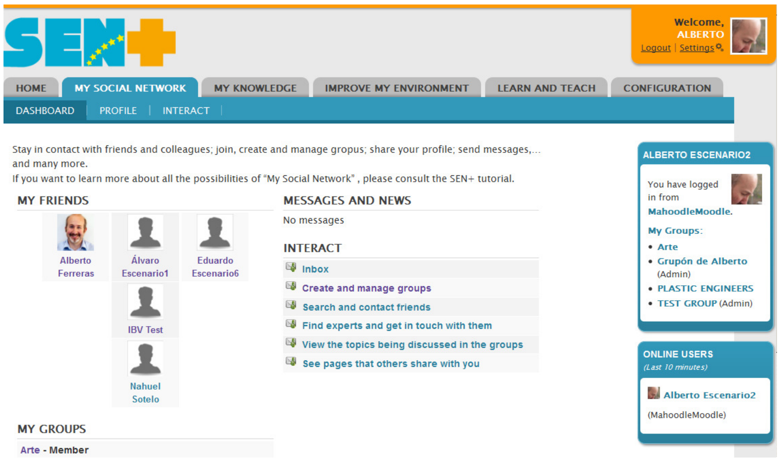

Figure 1: Screen capture of the SEN+ prototype

Final users (elderly workers, retirees, companies and municipalities) have participated during the conception and design process (detection of needs and requirements) and they are currently involved into the pilot testing.

2.1 Exploitation of the results

The final idea of the project is to offer users a set of e-services through the SEN+ platform in order to give easy and effective tools to older workers and retirees. The portal will be very useful for companies in order that they can retain the knowledge and the experience of their workers. This idea can also be used in other environments as municipalities and associations. To do this the SEN+ platform will provide different options, some for free other on payment basis, to allow private spaces designed for users and companies. This system will create a synergy between these users and the portal administration and this will contribute to implement new contents inside SEN+, ensuring the project development also for the future.

3. Conclusions

The AWARE project aims at developing solution for social inclusion of retired people and at preparing older workers for transition to retirement. This objective will be achieved by providing an online platform (SEN+) that can enable social interaction of both groups in order to promote an active aging. Companies have also a good chance with this tool to keep and manage the knowledge and experience of their workers.

The platform (SEN+) has been developed accordingly to the needs, demands and capabilities of the users and it is now in the pilot testing that will ensure that it is usable and useful for them.

FOSTERING SOCIAL INTERACTION WITH SMART TVS: RESULTS FROM THE FOSIBLE PROJECT

Mario Drobics[1], Steffen Budweg[2], Sandra Schering[2]

1. Introduction

Smart TVs offer a great platform for integrating new services, especially for older adults who use the TV set in a regular manner. Various studies have shown that television is an important medium for elderly and have demonstrated a growing demand for TV-based entertainment and interaction. According to the findings of statista 2012[3] the average viewing time per day of German citizens in older ages is 178 minutes while people in the ages of 14 to 29 are watching only 111 minutes per day.

When developing new services for Smart TVs, using traditional remote controls as input devices has several challenges. Although traditional remote controls are perfectly suitable for basic interaction like changing TV channels, they have strong limitations when more complex interactions are necessary and especially entering text can be difficult and frustrating. Furthermore, especially older adults have special needs (e.g. regarding memorization abilities, coordination, and vision) or habits which restrain their ability to use more complex applications on such platforms and thus, increase the digital divide.

It is therefore necessary follow the specific requirements and needs of elderlies when developing new interaction services for Smart-TVs for older users. Thus, in the following we first present the FoSIBLE project and then describe how we therein try to resolve these demands during the development of the Social TV platform. After this, the results of several studies that have been already conducted will be described.

1.1 Smart TV Interaction methods

Within the AAL-JP project FoSIBLE, a Social TV community platform for elderly people is being developed that aims at providing social support among peers, friends and family. To reach this goal, a novel combination of input methods and various possibilities to stay in touch with others have been realized. The central element of the platform is a Smart-TV system which is used to display messages, images and videos. It also provides the user with the possibility to chat with other users while watching

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TV, to recommend TV shows, to post articles in social communities and to start external games.

Multi-modal input approaches for controlling the Smart-TV system are used to offer the user an appropriate input method depending on her individual abilities, preferences and needs for a given task (Figure 1). As the traditional remote control had strong limitations when entering text or performing complex actions, alternative user interaction methods based on both Gestures and Tablet interfaces have been developed within the project while Smart Furniture is used for additional input and control sensors.

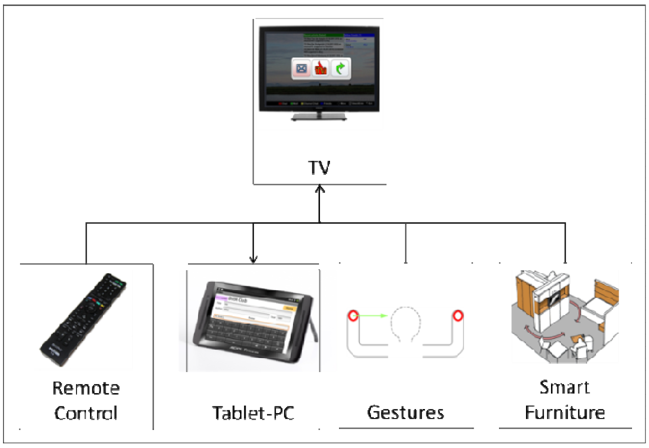

Figure 1: System Overview

Gestures can be used to navigate through the menu system of the TV and to switch channels [2]. This is intended to support the user when the remote control is not in reach (for example when the user wants to play a video game). Secondly, a Tablet-PC has been integrated to allow the users not only to navigate through the menus and enter text more easily, but also to provide an additional display. This is especially important for older adults who might have a limited field of vision or other visual impairments.

While our project is reaching towards its end, commercial solutions are appearing on the market. However, many manufacturer solutions lack the focus on older adults and thus do not respect their special needs. Therefore, there is the need that solutions specifically targeted at this audience make use of the proposed user interaction methods. As a part of the dissemination activities of the FoSIBLE project, these components will therefore be distributed separately of the main application, too.

2. Validation & Empirical results

The whole application was developed in close cooperation with end-users in Germany, France and Austria. The design of the gesture interface was of particular interest and has been investigated in a dedicated study where different types of interaction devices have been compared. Furthermore, real-life field tests in Living Labs as well as lab studies in Smart Home environments have been conducted and provide results regarding innovative concepts Social TVs as well as fundamental concepts to foster social interaction for elderly and families including social presence and awareness.

Multi-modal input approaches for the interaction with the Social TV platform seem to be promising from a usability perspective. We will therefore compare the three interaction devices remote control, tablet and gesture recognition in order to find out their particular advantages and strengths but also their limitations. In this way an optimal use of the devices in our platform is ensured.

Gestures where chosen as an alternative to physical remote controls as they introduce some additional physical activity for the users. To find out what kind of freehand gesture interaction is best for older adults and conducted a user study in which different possibilities to control a corresponding TV menu where compared in a user study with 24 older adults [1]. Each of the interaction types was analysed regarding task completion time, error rate, usability and acceptance. Results showed that directly transferring tracked hand movements to control a cursor on a TV achieved the best performance and was preferred by the users. In general, the participating older adults showed a very positive attitude towards gesture-based interactions

Also in the scope of the FoSIBLE project, the concept of “activity communities” that allows elderly to share their activities and games virtually has been explorer. Through the integration of physical games and the associated functions of an activity community, interactivity and social interaction can be increased [5].

Playful interaction concepts that foster social interaction between elderly and families such as the developed application *Gameinsam* [3] are also gaining relevance. The re-integration of elderly people in family life as well as the support of connectedness are important goals of the application. It allows the users to watch a TV program and sharing their guesses about the broadcast, e.g. answering questions in a quiz show. In this way, all participating users can work on a joint high score. Furthermore, we did research in one field of application by analyzing and classifying Serious Games for elderly [4]. To foster social interaction and connectedness between elderly and their family members, the concepts of social presence and awareness play an important role. In order to analyse how social presence and awareness can be evoked and increased when using Smart TVs, our empirical study explored the different forms of visualizations of remote TV recipients such as videos, photos and buddy lists. Furthermore we also identified that the TV genre is an important variable that should be taken into account when developing applications for Social TV [6].

3. Outlook

Later this year, a dedicated user study will be conducted to compare the three different input methods (remote-control, Tablet, gestures) regarding performance and acceptance. In addition to this, the integrated FoSIBLE Social TV community system will be deployed in multiple home environments throughout France and Germany later this year, delivering more results from the real-life usage and more insights about the end-user acceptance and usability for novel multi-modal interaction techniques for Smart and Social TV systems. In addition to this, in a user-centred Smart Home Lab environment study, usability aspects and design issues of the whole platform will be evaluated. Because multi-modal input approaches for the interaction with the Social TV platform seem to be promising from a usability perspective, we therefore will compare the three interaction devices remote control, tablet and gesture recognition in order to find out their particular advantages and strengths but also their limitations. In this way an optimal use of the devices in our platform can be ensured.

To foster social interaction and connectedness among peers, family and friends through Social TV applications, game technologies and as well social presence and awareness support seem to be promising. Nevertheless, it is necessary to consider usability aspect regarding the whole system in order to enable elder people an intuitive navigation through the system. For this, the use of different input approaches is relevant for a needs-oriented interaction with the system wherefore a specific examination of different input devices is relevant.

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VAYAV FOR SOCIAL INCLUSION THROUGH VIRTUAL WORLDS

Hein de Graaf[1]

1. Introduction

VayaV is the name of a set of projects in which the technology of social networking through internet will be used by people who really need that, but hate or fear computers. We are showing people gathering in physical meetings locally the possibilities and challenges of a 3D virtual environment based on open source. So this is a combination of physical and virtual meetings aiming at fun and gain and knowledge for the target group. We call it the **VayaV Metaverse**, combining open online social media, distributed knowledge creation and data from real environments. In this way we will create new forms of social innovation together with the participants, strengthening personal social networks. Especially of (elderly) people who are slip sliding into exclusion and loneliness.

VayaV is organized by a Dutch Cooperative of the same name (VayaV Cooperative UA) lead by Hein de Graaf who is a social psychologist. He worked until his retirement in 2012 for the Dutch Association of Municipalities to assist them in fighting (feelings of) loneliness, exclusion, apathy of their citizens. The Dutch municipalities all agreed that the main social problems facing their citizens are exclusion, feeling lonely, passivity, and lack of friends and an adequate personal social network. In the latest figures, more than a third of the people who were interviewed (a cross section of the whole Dutch population) said: I am often lonely and I am suffering because of it. With their consent, a virtual environment (VayaV Metaverse) is being developed in such a way that people who do not like computers and know nothing about digital social networks can meet and have fun and form a community of friends and acquaintances. In this case, there is more to the VayaV approach than playing a game in which someone has set the rules and goals for you. It is more like everyday life where people set their own goals and rules, according to their own values and norms.

Social networks are for meeting friends, making new friends, some of them are providers of services and advice or experts on issues relevant to you. We need them, especially when you get older and lose friends and the ability to make new ones. Since 2003 the world has seen the astonishing quick rise of virtual social networks. Millions of users joined them, but only a small percentage of those are senior citizens. Roughly speaking the analyses tell us that the relatively successful areas where the senior citizens are active are the ones that are closest to their 'lifestyle', their everyday

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experiences: email (reminding us of writing letters), search engines (looking up facts). But the 3D environment to meet people almost as in the physical world, has been ignored until now.
This is a feature Facebook and such cannot deliver: the possibility to meet in groups and interact in groups. The goals of VayaV are:

- Meet pressing social needs that are not met adequately now: inclusion, participation, co-production of products needed when physically, psychologically or socially challenged.
- Multidisciplinary approach: in the Dutch VayaV Cooperative we (will) have user groups representatives, local policy makers, professional and voluntary service providers, ICT experts, social psychologist, sociologist and marketing/ business partners working together. We will also invite partners from other EC countries as soon as possible, especially from universities, municipalities and SME's. Unfortunately, we have failed to convince the evaluators at AAL to give us a chance, despite submitting a proposal three years in a row.
- Big Data about what really goes on in the world relevant to our goals are best collected through communities of people with strong ties: i.e. the VayaV communities. The same goes for extended or collective awareness. Those communities have strong ties because they share fun and pleasure in the first place. Gain and knowledge, awareness and collecting big data are possible to achieve only when the communities are up and running. By combining physical and virtual meetings in a 3D environment VayaV is offering the possibilities of meeting a lot of people to choose from and maintaining the strong ties with the few who you consider to be your best friends.

This paper is based on a 5 year participating research project of Hein de Graaf as a social psychologist in Second Life. He focussed on the psychological (bordering on sociological and anthropological) aspects of 'living' in a virtual 'world' such as Second Life. The research tried to find out the opportunities and threats of those aspects regarding the possibilities of strengthening the personal network and quality of life. The concrete outcome of the research were real life projects under the name VayaV and a scientific publication called 'Social Inclusion through Virtual Worlds, published by IGI-Global. It can be found here (chapter 17): http://www.igi-global.com/book/serious-games-virtual-worlds-education/72157

This essay describes the theoretical foundation of the use of virtual worlds (3D environments) to strengthen the personal social network of people who are challenged in that area, especially the elderly. The concrete outcome of the research is translated into real life projects under the name VayaV. VayaV is described in the essay as a case study for avatar based communication as an instrument for socializing and community building. Important issues arising from my 5 year study are discussed:

- Identity: how do I want people to perceive me?
- Confusion and trust: anonymity and role playing
- Community: social networking in communities. Who can I depend on in times of need?)

- Friendship and intimacy: weak ties and disappointments
- Gender: women and men in the virtual world
- Playing and well-being
- Compensation: for physical and ‘personality’ challenges

VayaV is at the moment using the virtual environment of Second life and the Second Life viewer for testing and demonstration purposes only. We have built virtual simulations (‘sims’) in Second Life as demo for the VayaV groups called Nederland, Noordzee and Vrijstaat and also started a Dutch social community mainly consisting of older persons in the sim Nederland, called Doggersbank burgers. Both are available for on line visitors through downloading a Second Life Viewer and starting a new avatar through de website of Second Life (www.secondlife.com). There are videos on YouTube available showing the Virtueel Kerkrade simulation and a midwinter gathering on Doggersbank in Nederland on Second Life:

- http://www.youtube.com/watch?v=ZNxIfvKHsSg and
- http://www.youtube.com/watch?v=nExXbU10ag0

Instead of using Second Life for our own ‘worlds’ we will encourage the VayaV participants to design and help us building virtual meeting places in our own ‘Open Sim’ platform. In this VayaV Metaverse simulated 3D environments will be shaped and built based on the look and feel of the local municipalities the elderly are living in. In the virtual world, there is a place for video, for photo realism, for verbal or written representation of oneself and instrumented avatars. We can look at virtual worlds as being able to reach and communicate with one another by new means that are not so different from the old trusted ones. Much of this is dependent on individual preferences. Some people like audio, some like text, some like ‘real’ faces, other respond to cartoon creativity. All these are available in the 3D world we will develop. In the VayaV Metaverse we will provide to each user a view and interaction that makes them feel comfortable, but not at the expense of others comfort. In the localized VayaV projects older persons are meeting in the ‘real world ‘together with enthusiastic (elderly) virtual world users and computer hobbyists and professional service providers, with the aim of getting acquainted with the possibility of meeting also in the virtual world. A large percentage of the elderly are interested in this combination of virtual and real.

In setting up the local physical VayaV groups we will also involve local community leaders and others who represent diverse interests in the community such as community service organizations and the local authorities. They will provide input into the process of assessing changes in the social environment of the end-users that may occur as a result of the VayaV communities activities and experience. Also the effects of the VayaV communities will be evaluated in the context of the target group attitudes. Is a ‘fear of change’ bias inherent in their attitudes towards this new form of communities? How can this potential fear of change be overcome? Information about these attitudes and perceptions will also be gathered from community leaders because their attitudes are important and may give insight into the overall attitudes of our target group if community leaders are perceptive and sensitive to community concerns and interests.

At the moment VayaV is tested in 3 Dutch municipalities in the Provence of Limburg, partly within the DISCOVER project co-funded by the EC, CIP-ICT-PSP-5 Objective 3.2 Digital competences and social inclusion, aiming at improving the digital skills of (informal) carers. The Provence of Limburg also is providing funds for this project that is called: Leuk voor Elkaar, starting June 2013.

2. Conclusion

So, VayaV is using innovative ICT solutions (like virtual meetings in a 3D environment specially build based on users specs and expectations) paired with old fashion physical meetings and (not so) old fashion ICT applications that are already widely used (but often not by them) to support elderly people to strengthen their social networks and fight exclusion. A short description can also be found here*:* (http://ec.europa.eu/research/innovation-union/pdf/active-healthy-ageing/20120403_vayav.pdf).

A USER-CENTERED DESIGN APPROACH TO THE DEVELOPMENT OF A WEB PORTAL: THE NOBITS EXPERIENCE

Timea Jámbor[1], Peter Seprenyi[2], Luca Morganti[3], Andrea Gaggioli[4], Silvio Bonfiglio[5]

1. Aim of the project

The Nostalgia Bits (NoBits) project aims at fostering social interaction between the elderly and the community through capturing their memories, personal, family and local history embodied by letters, newspapers, postcards, photos and other documents. A web-based platform has been developed where tangible artefacts of an elderly person's life experience can be uploaded and become a significant resource for other generations, and a means for connecting the elderly users with members of own generation.

2. Improving the quality of life of the elderly

Nostalgia Bits will have a direct, positive impact on the quality of life of elderly people by offering them a medium to transmit their memories into an enjoyable activity. It will connect them to their peers, who share and can relate to their life experiences. Additionally using NoBits will help to link them to the younger members of their families, strengthen the relationship with their grandchildren. Through this, they will be acting as a valuable resource for young people interested in learning about different periods in history. Through the contacts they make with young people seeking information, they will initiate meaningful and enjoyable intergenerational communication. Elderly people can then benefit from the knowledge that their activities and personal history are providing valuable insight for others which will confer on them a sense of the significance of their lives - past and present.

The pursuit will not only engage them cognitively, it will motivate them to advance their computer skills and significantly broaden their social spheres. Using NoBits will allow elderly users to combat feelings of isolation, and low self-esteem; by connecting them with family; lost friends (and their families) and peers. It will also allow them to contribute to their community by tapping the enormous wealth of knowledge and experience they hold within themselves.

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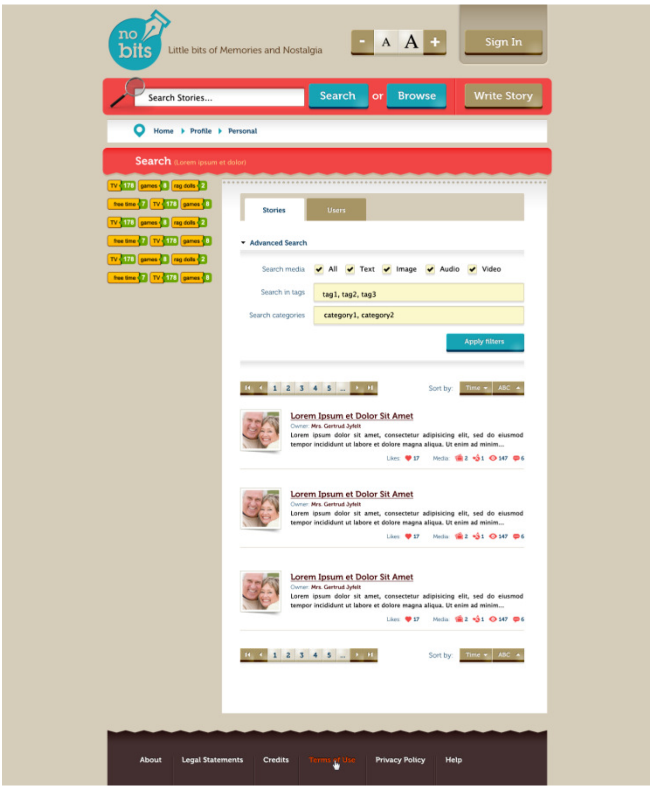
3. Understanding users

Deep understanding of the opinions of the potential users of the NoBits portal is essential to guide key decisions concerning its design and rollout. Therefore a range of user need analysis and market research was conducted with the elderly (primary users) and children (secondary users) and experts related to the topic. The following methodologies were used: interviews with experts, in-depth interviews and qualitative focus group discussions with the elderly, focus group with children and desk research.

Following a User Centred Design approach, the users had the role of technical partners inspiring the main functionalities of the platform. The information gathered have been carefully implemented in the website: the key need and wish of the elderly to collect and share their memories with others is innovated through the use of Internet as a medium to do it. The idea of sharing memories as a social activity on the Web guided the whole process: the architecture of the platform serve both the functional objectives as well as the wish to make the usage of it an enjoyable activity - with a respect to the possible limited computer literacy of the primary user group.



The main guidelines

Intuitive and easy-to-use portal and function design
Easier access and control of the portal results in higher participation. Easy and logical search function, e.g., based on place, period; guided reading, e.g., marking articles which has been read, connecting different memories of the same characteristics. Another important principle is the linear progression of tasks, less options. The less options, the easier to make a decision.

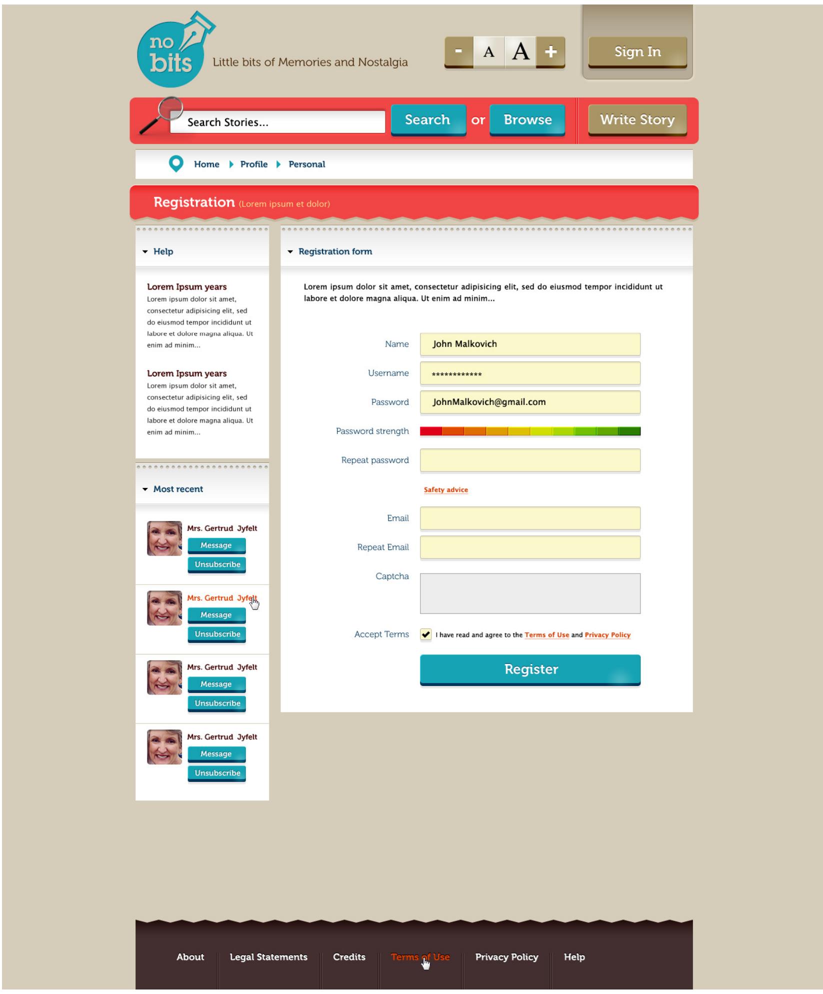
Design
Looking carefully also to W3C standards, the main challenges elderly face is driven by their possible decline in vision, motor-skill diminishment and cognitive decline. Internet design is not in line with their experiences of technology from their earlier lives, our investigation highlighted the following priorities for the NoBits website:

- larger / adjustable font size (no condensed font type)
- simple search function
- simple error messages
- no moving interface elements
- use of strong contrasts
- no small images, icons
- text based communication

Concerns regarding privacy
The elderly expressed their fears about security settings, claiming that security settings and privacy protection should be easy and clearly understandable. A simple and easy to use privacy system has been created: users can decide whether they want social functions on their memories or not.

Access through other devices
As the elderly are often more familiar with other communication devices than the computer (e.g., TV, mobile phone), they offer an opportunity for the elderly to access NoBits in an easier, more familiar way, which might not even require a computer. Other ambient devices like the digital pen can be a way of making the access easier for the elderly.

The above solutions have been implemented so far to incorporate the user needs and requirements expressed.



4. Understanding how the project fulfils its aims and users' need

Further field trials, usability study and an online research are planned to check with both user groups how they perceive the functionality and design of the portal, how it fulfils their needs and expectations. The online research has the objective to gather further information for the final segmentation of the primary users. This will allow developing a support plan for the launch of the NoBits platform. It will also answer questions on the financial aspects of the business model.

The usability study will focus on assessing in a quantitative way the usability, likeability of the platform. The field trials aim to evaluate the user acceptability and effectiveness of the NoBits, the approach, the service platform and the individual technologies incorporated within it. The methodology for the trials is articulated in two key phases: formative evaluation and summative evaluation.

The specific objective of the formative evaluation is to finalise the adequacy of the technical solutions, by means of identification and subsequent remediation of bottlenecks. The formative evaluation will involve usability experts and small groups of users. The expected output of formative evaluation is a set usability guidelines for improving the NoBits platform and tools. Results of all the usability evaluations will be included in a report to be fed back to developers. In contrast to formative evaluation, the goal of summative evaluation is to judge the worth of NoBits approach, at the end of usability testing. For that reason, summative evaluation will have participants use NoBits service platform and tools without the obtrusive presence of the researcher or artificial usage conditions. The evaluation will provide a broad overview of user wishes and/or concerns with the use of a social reminiscing system. Furthermore, the summative trial results will inform the external stakeholders about the costs/benefits of the NoBits technology and applications relative to competing social reminiscence systems.

V2ME – VIRTUAL COACH REACHES OUT TO ME

Kerstin Klauß[1], Andreas Braun[2],Peter Klein[1], Reiner Wichert[2]

Abstract

An aging population is facing various challenges such as the loss of independence in many aspects of daily life and the strongly connected risk of loneliness. V2me aims at providing a flexible assistive solution that prevents loneliness. This is achieved by combining a virtual coaching system and computing devices that provide a multitude of social networking and communication functions to the users. In order to satisfy the key-factor of ‚user-acceptance', we choose an iterative development process according to the DIN EN ISO 9241-210 (user-centred design process, short: UCD). This paper will give a short overview of the phases along UCD.

1. Introduction

Loneliness can have an important effect on health and well-being. At the same time the risk factors for social isolation and feeling of loneliness increase in old age. Given the number of about 115 million persons in the European Union above 65 years of age in 2012 there is already a numerous and still increasing group of persons that potentially benefits from an AAL solution that prevents or reduces loneliness with the help of modern ICT. Nevertheless many older persons are not yet having access to technologies like Skype, E-Mail or similar. This is often due to a lag of skills with ICT intertwined with a deep distrust and even anxiety [1]. To overcome this barrier V2me establishes a virtual coach which thereby acts as a mediator between the user, the computing devices and a social network of all system users that aims at supporting social contacts and shared events. Thereby positive user experience in the interaction with modern ICT is expected to increase; whereas fear and distrust at the same time are reduced. Furthermore the Virtual Coach is expected to be a factor in preventing loneliness by itself, creating a para-social relationship between system and user. A key element is the adaptation of a cognitive-behavioural group intervention program from the Free University of Amsterdam to modular virtual coach lessons on the V2me system. The program aims at supporting the elderly users to work on their skills in maintaining existing contacts, finding new contacts and creating meaningful relationships.

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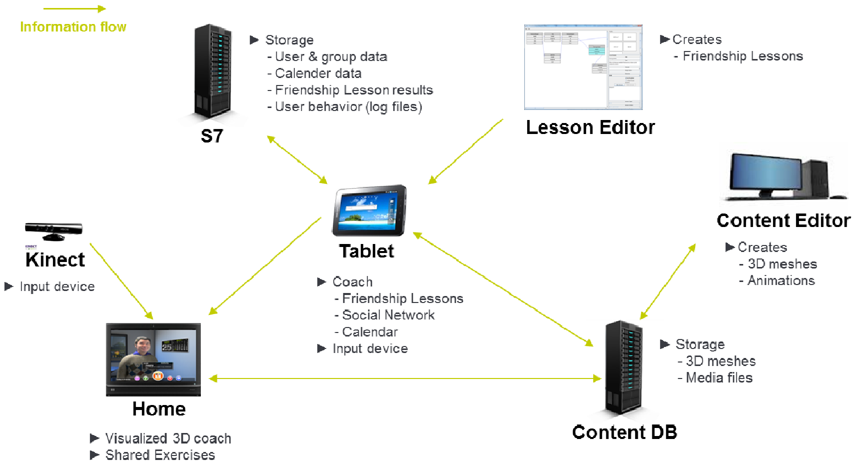

Figure 1. V2me system components

The interaction paradigms for our approach focus on ease-of-learning. Gestural interaction, based on natural movements is such an easy-to-learn method for controlling interactive systems. Initial studies have shown that they are a facilitating factor regarding the usage of ICT in older adults. Therefore we have chosen a combination of small-form-factor tablet device and large-screen PC to realize our system. The tablet acts as main input device, combining portability and low-weight whereas the visual representation of the virtual coach will be displayed on large screen. A high user acceptance of the system is expected to play an important role to overcome the widespread distrust towards modern ICT among the target group. In order to satisfy this key-factor of ‚user-acceptance‘, we worked along a user-centred design process (UCD). The UCD is an iterative development process along for main phases: 1) Analysis, 2) Design, 3) Prototyping, 4) Testing [2].

2. Methods

As previously mentioned V2me is following the UCD process described in the previous section. In the analysis phase, requirements can be derived based on the information from and about the target group. In its early phases V2me conducted workshops and interviews with potential users as well as a state-of-the-art analysis. Based on these results we have derived requirements for the V2me system. In the design phase, these requirements are implemented in a screen and interaction design. V2me therefore used wireframes for the visualization and communication of the interaction design which could be easily adapted in the iterative development process. Based on these concepts and the underlying requirements the V2me visual design style was being developed. As the UCD is focused on user involvement the prototyping phase aims at making the interaction and visual design concepts come alive. We iteratively created prototypes already based on Android technology but still restricted to the scenarios planned to be tested. Finally in the testing phase, the current status of the system is evaluated with end users. V2me conducted one-on-one sessions and workshops in various usability studies in three countries (Finland, Netherlands and Germany) with potential users of the above 65 years old target group. The feedback of the users was valuable for the further development and optimization of the system. Hand in hand with the UCD we integrated the scenario-based design approach by Rosson and Carroll which is using scenarios and personas to translate requirements in concrete stories with typical users [3]. This enables us to focus on the user and helps to bridge misunderstandings caused by different terminology in a multidisciplinary team. These scenarios are continuously extended throughout the whole development process, getting more and more detailed. At the end of the project a validation effectiveness study will follow to test the whole system which will be installed at the participant's homes.

3. Results

The mainly qualitative results from both one-on-one sessions and the workshop were evaluated and analysed in terms of ease-of-use, usefulness and user acceptance of the prototype. All in all, there is a wide difference between reported and observed ease-of-use. Whereas participants reported that they handled the system "reasonably well" in one-on-one sessions (in a scale from 1 'well' to 5 'poorly'), it was observed that constant support by technical staff was required. Some usability issues were identified which lead to requirements for further optimization of the system. In general the design and appearance of the UI was experienced positively by the participants but also weaknesses were found concerning the simplicity and self-descriptiveness of the interaction. Since the participants were quickly able to use the system the learnability of the system was found good. The functionality of finding friends through shared interest groups is in line with the finding that people create new contacts through hobbies and this supports proceeding with expanding the prototype with related functionalities.

4. Conclusions

V2me was one of the first projects examining tablet use by older adults, starting the process in 2010 with the newly released class of 7-inch tablets. However, development work in this field is vivid at the moment. At this stage, the prototype was not perceived to decrease loneliness but based on the study the idea had potential to do so when it will be ready. The present contribution shows that technology usability for the older users is, despite the technological advancements, still an issue. Technology use in old age is affected by the previous experience in technology, as well as physiological limitations (such as poorer motoric skills and lower skin conductivity). Experience with touch screen devices is generally low, since they are in an age class that has been introduced with the modern communication technology only in later life. Therefore, compared with the younger people who have practically grown up with the technology and have good motoric skills, they are in a remarkably different position. Therefore it is important to focus on creating a clear and simple UI instead of using complex features that might jeopardize the simplicity and intuitiveness of the system. Another option is to augment the system with additional modalities, such as speech and gesture.

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A WIKIPEDIA SKIN FOR SENIOR CITIZENS

Florian Frauchiger[1], Eduard Klein[1], Anton Bolfing[2], Markus Riesch[2]

Summary

The project's [1] goals are to ease access to the many opportunities offered by online communities for elderly people. The project aims to profit from the growing number of senior citizens who contribute to online communities. Besides the development of effective methods of motivating senior citizens to participate, the project also concentrates on the adaptation of user interfaces for senior citizens – specifically for the Wikipedia community. Although the specific needs of elderly users cannot only be determined by a minimum age, we selected a user focus group aged from 60 upwards.
Based on literature research on web design guidelines for elderly people [2], requirements for improving the Wikipedia platform have been identified and a prototype skin has been conceptualized and developed [3]. Although the German version of the Wikipedia has been studied, the results can be assumed to also be valid for the international version, since both are based on the MediaWiki [4] platform, and in practice look very similar.

1. Senior Citizens and Elderly Users

Seniors, silver agers, golden agers, third agers – many expressions exist for people in their 50ies or 60ies and above. In this document we use the broadly accepted terms "senior citizen" and "elderly users" and refer to people over 60 years. The number of senior citizens is growing rapidly, especially in developed countries. However, they feel often excluded from new developments in information technology. Of these developments specifically the internet has turned to an important medium, which is used daily by many people, companies and government agencies. Numerous services are provided electronically and some are even supplied only over the internet. It has become an important part of our lives. Therefore, it is nothing but reasonable to let senior citizens benefit from all the advantages of the internet. For some of them, it might not even be just a gimmick, but a really useful tool to accomplish everyday tasks: e.g. shopping (and delivery), or preventing loneliness by creating contacts with other people with similar interests etc. But it's not just a one-sided advantage; it's a win-win-situation. Senior citizens often have valuable experience and knowledge, which they can share with others in different online communities, blogs or encyclopaedias. It makes the web more interesting and attractive. Furthermore, with their increased proportion of the population, senior citizens are becoming a large market segment and therefore attractive to companies. Shopping made easy and

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convenient is particularly appreciated by seniors [5]. And, because of the increasing presence and relevance of the internet, the number of disabled people or senior citizens with age-related handicaps who want to use it, is expected to increase too.

2. Requirements for Elderly Users

In Europe alone, over 45 million people live with some kind of disability. In addition, the ageing population means there are a growing number of people with age-related handicaps. Although senior citizens and people with disabilities should not be considered as the same target group, in many cases there are similarities, for example visual impairment or coordination problems. Poor eye-sight is a frequent problem amongst elderly users and makes it necessary to use large fonts and strong colour contrasts.

Moreover, cognitive abilities such as concentration or the willingness to get involved in new technologies and activities decrease with age, which constrains user navigation and orientation. This makes it necessary to provide well-structured pages with highly visible links that are marked with meaningful descriptions and well placed on the website. These are just a few requirements which can be met to provide a website usable for seniors. Many of these prerequisites are already covered by the W3C`s accessibility guidelines “WCAG 2.0” [6]. However, senior citizens have more needs than mentioned in these guidelines. As a starting point for the identification of requirements for elderly users, the results of a recent study [7] have been used. In that study, Wikipedia has been assessed on the WCAG 2.0 criteria, and recommendations for optimization have been published [8]. In this current study, the set of requirements for elderly users (9 categories, 45 criteria) have been compared to the WCAG 2.0 criteria (4 categories, 12 guidelines, 71 sub-guidelines), and the respective requirements have been mapped accordingly whenever appropriate.

The result of this detailed mapping is, that almost half of the above mentioned criteria (17 out of the 45) correspond to one of the WCAG 2.0 criterion. Our conclusion is that the recommendations for the improvement developed in our accessibility study will also improve website navigation for elderly users. For the remaining criteria from the set of requirements for elderly users, recommendations for improvement have been derived from expert interviews and validated by people with extensive experience in this domain [9]. Examples of requirements include “provide location of the current page”, “differentiation between visited and unvisited links”, whereas examples of recommendations are “highlight the current UI element (e.g. link, input area)”, “emphasize links when touched”, “avoid blank white background colour”.

3. A Prototype Skin for Elderly Users

The prototype developed in the context of this project was implemented by means of CSS. The capabilities of CSS are limited however. With a more powerful language such as JavaScript, more recommendations could be implemented in the future. Some recommendations are out of the remit of this study since specific communities' "buy-in" is necessary to improve website design. Consider for example, the recommendation "use alternative representation when integrating images". As a registered user at Wikipedia it is possible to choose some predefined skins. Furthermore these skins can be adapted or a personal skin can be created. In the context of this project, a skin was chosen which matches the given requirements the most. Two versions of a prototype have been developed as extensions of a predefined skin.

In the "full" version, almost all requirements have been integrated. Its purpose is to show what can be achieved with CSS taking into the requirements; however, the skin looks somewhat different from the standard Wikipedia skin. For example the colours of visited and unvisited links are red and green, which doesn't comply with the normal colour concept of Wikipedia or anywhere else on the internet. Furthermore there is a small symbol in front of every link. Or another exaggerated requirement is the box around links, which appears when placing the cursor over it. Figure 1 shows a screenshot of the "full" version of the prototype.

In the "tempered" version, several requirements have been reduced and adjusted. With this version of the skin the page still looks very neat and simple, but specifically the requirements which involve the appearance of links, have been adjusted. Now the skin still is optimized for elderly users, but the design matches the existing default skin more closely.

Figure 1. Screenshot of the "full" version of the prototype

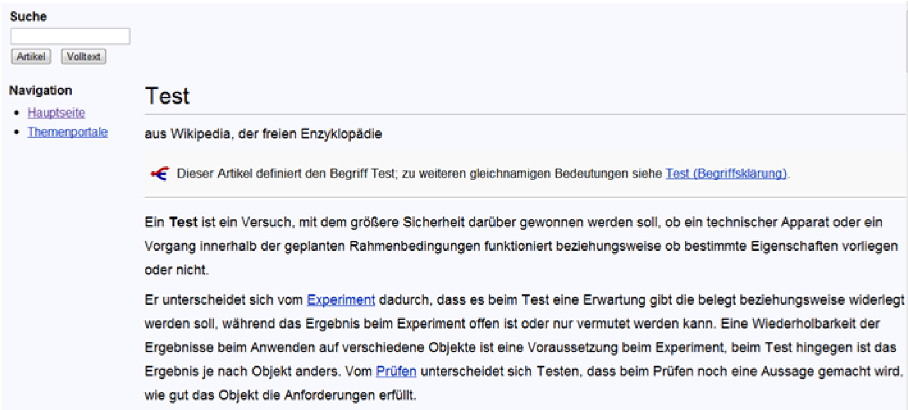

Figure 2. Screenshot of the "tempered" version of the prototype

4. Accessibility – General Situation

There are studies which check websites for accessibility, for example the "Swiss Accessibility Study 2011" [10]. This survey, performed for the third time, evaluated 100 websites of public interest. Among these sites were websites for the federal government, universities and public service providers. The results of the study are mixed. Progress has been made at the governmental and cantonal level in terms of improving accessibility. However other sites (cities, online shops, communities etc.) there is a lot of room for improvement.

Unfortunately, studies with accurate numbers and statistics about the state of accessibility of websites are few and far between. One reason is certainly that good analysis, i.e. to make a meaningful and correct statement about the accessibility of a website, requires extensive and time-consuming work that cannot easily be done for a broad range of websites all over the internet.

In recent years, many groups, committees, and organizations have been formed or founded which campaign for accessibility in the internet (e.g. project BIENE [11], the second version of the "Barrierefreie-Informationstechnik-Verordnung" [12], Accessibility Standard P028 – Guidelines of the Government for accessible services in the Internet [13], and more). In some countries laws have even been passed concerning this matter. But nonetheless, there are still many websites which pay little or no attention to accessibility issues. [14][15]

Some of the more serious problems result from the innovations of Web 2.0, especially Ajax. With Ajax, only parts of a website are reloaded. Programs reading pages out loud for blind people (screen readers), but also programs translating texts into braille, have their problems with this concept. A well-known example, the Google suggestion list (given when entering a search term) is displayed with the use of Ajax and cannot be read by the programs mentioned above.

4.1 Accessibility and Usability - Wikipedia

In comparison with other websites, Wikipedia is a rather accessible and useable site. Many requirements are fulfilled by using valid - meaning W3C-compliant - HTML code and the use of CSS throughout. Wikipedia has also been nominated for an award at the “BIENE”-competition several times. At this contest, the most accessible web services are honoured [16]. Despite these nominations Wikipedia has yet to win an award due to deficiencies which still pervade. [17][18]

4.2 Usability Initiative

The Usability Initiative - a project at Wikipedia initiated in 2008 – aims to improve the usability of Wikipedia. One of the outputs of the Usability Initiative is the current skin named “Vector”, which has been set as the standard skin since June 2010. It is used by all anonymous users and users who are logged in, but who have not chosen any other skin.

Furthermore, the MediaWiki project “Athena” focuses on the development of a new skin optimized for use with mobile devices (smart-phones, tablets etc.) [19]. User interfaces that are optimized to run on multiple different devices are generally, by their very nature, more accessible than user interfaces specifically designed for any single applications.

5. Project Context

The described work is a part of the research project „Third Age Online“, which is headed by BUAS (University of Applied Sciences at Bern). The goal of this project is to motivate elderly people to get involved with, and contribute to online communities. With this in mind, in cooperation with the foundation “Access for All”, a campaign group for general internet accessibility, the accessibility of the internet for senior citizens was analysed. On the basis of this analysis, requirements were defined, compared with the requirements of WCAG 2.0, and partially applied to a prototype for a new skin of Wikipedia.

Upcoming topics in the project context are research on assistive tools for authors of wikis and online communities, and taking measures to form a sustainable “Wikipedia Accessibility Task Force” based on an internet platform, the purpose of which is to bring together the “accessibility community” spread all over the world and to concentrate their efforts. The platform is intended to coordinate actions and inform the interested audience on accomplished, on-going and planned activities.

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JOIN-IN: PREVENTING LONELINESS IN THE ELDERLY THROUGH SOCIAL NETWORKING

José López Bolós[1], Claudia Hildebrand, Hans Demski,

1. Introduction

Loneliness and social isolation in the elderly are major problems in elderly care. In many European countries[2]more than half of the people over the age of 75 live alone and 12% of older people feel trapped in their own homes[3]. Research has shown that being alone in old age will often lead to social deprivation, low self-esteem or physical inability and also that there is a strong correlation between social isolation and poor health[4,5]. Join-In aims at counteracting loneliness in the elderly by providing a methodology and technologies for elderly persons to participate in social activities and to make them part of society. By offering useful activities that encourage communication we aim to help the elderly to meet and exchange with others.

2. Methodology

Join-In tackles a problem that clearly affects a large amount of the population. During the last decade social networks have shown themselves as powerful tools for connecting people and for providing emotional support from/to family and friends. The Join-In Social Network for the elderly will encourage and facilitate socialising. It allows communication by TV / PC. Communicative multiplayer video gaming, exergames and group exercising are considered key activities for attracting senior citizens to the network and for making the network attractive. Games and exergames for the target group can so far not be found on the market. Within the project we are developing a number of games – all based on user requirements, cut to the special needs of the target group and designed in close co-operation with the users:

- A memory card game – to be playable in single and multi-player mode, which will, besides training the memory, foster communication because people will be able to use their own photos.
- A walking game – adaptable to the speeds of the single users. The players can discover a virtual environment while exercising and socialising with their friends in the social network.

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- A biking game – where people cycle along routes they know and can talk about their surroundings to co-players while training.
- An exercise game set in the frame of an “antique hunt” which offers well devised exercises training different parts of the body.

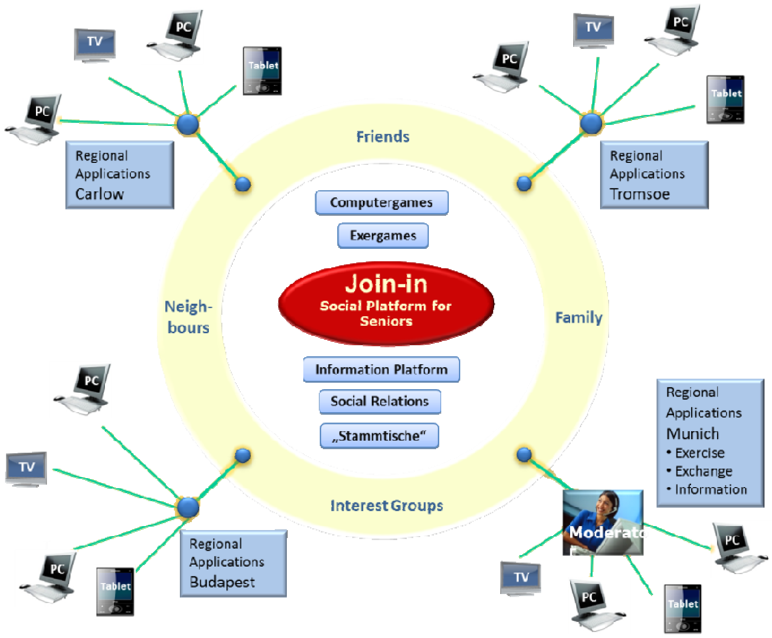
On top of that physiotherapists are designing exercises for the elderly that can be played in a group moderated by a life person, or which the user can play on its own. All this will help the elderly and motivate them to stay fit; and it will also reduce treatment by supporting prevention. Additionally, our solution will be low-cost, thus seniors of different economic backgrounds can afford them.

Active participation is vital if the individual is to profit from the Join-In developments, yet motivation in the elderly is a challenge. Therefore, we are developing a methodology for elderly persons to participate in the social activities and the social networking.

Users were involved from the start of the project. Research questions, like:
- What activities and games are “favourites” with the elderly?
- Which anxieties might hamper the acceptance of the social platform and user acceptability towards the technologies to be used?
- Which are the day-to-day activities of the users and what are their attitudes towards exercising?

It helped developing products that are integrating the needs of the target groups as much as possible. Additionally, we got feedback from board gaming and exergaming sessions where different games were tested and issues as e.g. controllers and avatars were discussed. To obtain answers we created different sets of target user groups in Germany, Hungary, Ireland and Norway. Field tests are scheduled to be performed in all of these countries. Lifestyle, attitude to life, health and the social network of the target groups are being put in relation to the questions and will contribute to the methodology.

When working with users, ethical questions are very important. We, therefore, always emphasized the voluntarism of participation in the user sessions and in participating in the different activities, and in answering questionnaires, etc. All questionnaires are made anonymous; the questions asked are beforehand checked by the Ethical Committee of the Diakonie München-Moosach. From the results of our research with the tests groups, we saw that data protection and privacy are major issues with the elderly; that’s why for the envisaged pilots the respective data protection and ethical officers were involved.



3. Results - The Social Network

The Join-In project is a web-browser platform. This platform consists of different services asked for by the user. The one that wraps all of them together is the Join-In Social Network, which we designed based on the needs we obtained from our target groups. It can be accessed from any computing device that supports a modern web-browser, allowing the users to connect through a broad offer of devices.

The social network follows the standardized Open Social API and uses the open source framework ELGG, a framework designed as a base for social networks which allows customization thanks to modules that increase its functionality. This expanded functionality has been one of our two main objectives in the development. We aimed to offer our end users a way to socialize with their contacts though different channels: text (mails, comments, blogging and tweet-like-messages, instant chatting), video & audio conference, file sharing (text, pictures, etc…).

Our second main objective was to allow the users to access the socialising tools by the easiest and most comfortable way we could create based on the "user opinions/needs" we had researched. Some results were quite obvious, like appropriately sized buttons, colour contrast, etc.… Covering the diverse needs of each individual implied that the user should be able to customize to a certain degree the layout while not making the process too complicated. Additionally, we thought that the platform should allow the introduction of some type of special users (moderators or supervisors), with more privileges and duties, to help the users who are less technologically capable.

For increasing the interconnectivity of the different applications, a new API, the Join-In Connector API, has been implemented, allowing the developers to introduce and request information of the social network. This API is useful for the games, because thanks to it, users can play together with their friends, pass the scores achieved by the users to the social network so they can check their progress later, share them or even comment them. One of the most interesting services the Join-In Social Network offers are the games, exergames and exercises developed specifically for the target group. Doing things together with others, who are sharing the same interests, will be a motivational and enjoyable way to the senior users for exercising their brain and physical skills, while having access to the social tools described before.

Based on a list of technical requirements for the games set up and ranked by the user groups some candidate games were considered against the user requirements and technical requirements. Following from this, it was agreed that prototypes of an attention game, and a multiplayer memory card game would be developed initially. As the users preferred the memory card game, this was developed further and a first version is available. The (exer)games are programmed in the web standard HTML5, embracing the newest web technology, since this offers really interesting features for multimedia projects. In a final commercial release of the Join-In games, it is expected that the user will be able to choose between a variety of cognitive control training games (and exergames) via a single platform.

User analysis showed that the senior users cannot use or don’t like to use a mouse as a pointer device to control the computer and that also controllers like WiiMote were found difficult to use by some of the users. We therefore designed a controller structure adequate to hands with grasping problems (common problem in elderly) that can also be used for a TV. Thanks to the controller sensors (accelerometer and gyroscope) it can be used in different applications reducing the need for other controllers. All this together makes Join-In an appropriate service designed to be fun and to help our elderly to socialise..

4. Conclusions and Outlook

The Join-In Project is still in the development phase. The network and applications are presently being finalised, pilot testing is scheduled to start in February 2013 in Germany, Norway, Hungary and Ireland. We aim to make the applications available from the end of the pilot studies till market introduction in some of the pilot sites and to integrate the Join-In applications in some of the regular local activities.

As Join-In aims for developments that will be going to the market in the medium term we have started market analysis and narrowing down the product definition. Many online communities and social network already exist. Seniors represent the fastest growing demographic group over the web for social networks. The social networking preferences of the elderly are based on clear benefits; the focus is on the content and the quality of the content, building groups around interests (e.g. religious issues, sports, cooking). Join-In offers an easily accessible social network for seniors with communicative interests that can be shared and will be fun doing them together. We expect that the regular use of the network will lead to a decrease of isolation and an increase of motivation, allowing the users to improve or maintain their health through mental and physical exercises, specially designed for them.

FOSTERING SOCIAL PARTICIPATION THROUGH SOCIAL PRESENCE

Katja Neureiter[1], Christiane Moser[1], Manfred Tscheligi[1], Achilleas P. Achilleos[2], Christos Mettouris[2], George A. Papadopoulos[2], Robbert Smit[3]

Abstract

The Connected Vitality Network project seeks to enable communication and interaction over distance for older adults, who are restricted in mobility and tend to suffer from social isolation or loneliness. A tele-presence system is developed consisting of two screens that are arranged to each other at an angle of 135 degrees. Through this special arrangement, older adults should experience their communication partner almost life-sized, which should provoke social presence during a remote conversation. Our workshops with potential end users aimed at investigating first impressions on participants' social presence and if they experienced closeness within a conversation. It was investigated to what extent the developed formats (ideas for activities) are suitable to meet older adults' needs in terms of being active together with others (e.g., family members, friends or care givers). Moreover, the participants' likes, dislikes and possible improvements were assessed. The most important evaluation insights and the technical implementation are presented in this paper.

1. Introduction

Modern information and communication technologies (ICTs) are nowadays an integral part in our everyday life and offer possibilities to get in contact with communities, family and friends. Due to age-related physical restrictions older adults are often not that mobile anymore and therefore tend to suffer from social exclusion or the feeling of loneliness [2]. Thus, ICTs are especially promising for them. Within the Connected Vitality Network a tele-presence system is developed that aims at providing a possibility for older adults to be active together with others. Through the special arrangement of two screens the communication partner appears almost life-sized. It is intended to provoke social presence, the feeling of "being together" within a remote communication. We would like to outline, that it is particularly important for us to integrate potential end users iteratively within the whole development process in order to actually meet the target group's needs.

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So far, older adults' requirements regarding communication over distance, meaningful social activities and needs in terms of care were assessed in the project by means of workshops, a survey, and several interviews with experts in order to investigate what kind of formats the system should provide. Based on these insights, ideas for activities the telepresence system could offer and first design sketches were developed that address three different formats the system could provide: 1) the possibility to call somebody 2) the possibility to be active together with others (e.g., playing games) and 3) the possibility to hold or participate in a course together with others. In order to evaluate these ideas on the basis of a prototype, the four end user organizations in the project performed workshops with potential end users in order to get first impressions on participants' social presence (i.e. whether they experience closeness within a conversation) and to find out to what extent the different formats were considered as valuable and useful social activities from the end users' perspective. In the following we give a brief overview on the concept of social presence, the feeling of being together when communicating over distance. Afterwards, the technical implementation is briefly outlined and we give insights into the different formats that have been developed. Finally, the first user evaluation and the most important insights with respect to three central research questions are described.

2. Related Work

First approaches regarding a conceptualization of social presence originate from the work of Short et al. [6], who define social presence as the *"degree of salience of the other person in a mediated communication and the consequent salience of their interpersonal interactions."* They point out the medium's qualities in order to experience social presence within a mediated communication. Newer approaches especially consider the individual's perception of a medium in a mediated communication. Biocca and Harms [1], for example, define social presence as the *"sense of being with another person in a mediated environment"* or as *"the moment-to-moment awareness of co-presence of a mediated body and the sense of accessibility of the other being's psychological, emotional, and intentional states."* Thus, two components play an important role: interactivity and immediacy. Interactivity is considered as engagement and is illustrated by the activities a user performs and the feedback s/he receives. It might be comparable to what Biocca and Harms [1] define as mutual understanding or psychological involvement. It is influences by a temporal component: immediacy (e.g., the communication partner reacts straightway). Immediacy influences the interactivity, which might in turn have a positive impact on social presence [7]. In the following section we are going to describe the different formats and activities the system provides and will outline central issues regarding the technical implementation. Moreover, it will be described how the tele-presence system aims to provide social presence.

3. Technical Implementation

The CVN system is developed as a hybrid communication model called "YoooM", which combines the client-server model with the peer-to-peer model. In particular, the combination of the models was critical in order to support the key characteristics of quality, reliability, scalability and performance requirements. Technical tests revealed that the peer-to-peer model provides higher scalability and better performance for one-to-one communication, while the client-server model offers reliability in multiparty communication. Moreover, the extended peer-to-peer WebRTC and client-server BigBlueButton (BBB) projects offer high-quality audio and video codecs. These requirements are fundamental for ensuring the feeling of social presence that is provided by the CVN formats: Club, Meet and Classroom (see Figure 1-3). All communication formats of the YoooM system are implemented as individual modules. All modules adhere to a crucial objective: to provide technical capabilities that support enhanced physical experience and social interaction. As already mentioned in the beginning, it is important to support social presence within the remote communication. In order to reach this goal, the following technical preconditions are considered: (1) enrich media-based communication by auditory and visual cues, (2) mimic face-to-face communication and (3) provide realistic animation of human behaviour, i.e. body language. These conditions were defined based on user-oriented research performed by [3][4], which involved interviews of older adults and family members, as well as feedback from experts and care providers regarding meaningful social activities for older adults.

Figure 1.

Figure 2.

Figure 3.

Foremost, user requirements drove the definition towards the ***Meet Format*** (see Figure 1) that supports the following: (1) one-to-one, high-quality audio and video call, (2) opportunities to be in contact with caregivers, family and friends and (3) mimicking real-life face-to-face interactions. These are satisfied by the implementation of a one-to-one, high-quality audio and video module by extending the web-based WebRTC project. The implementation of the C++ module is based on the peer-to-peer model and the VP8 codec [5] of WebRTC to enable high-quality audio and video communication. In particular, the implementation benefits from the positioning of the high resolution displays, the high-quality digital microphone and the two high-quality digital cameras of the YoooM device manufactured in this project (see Figure 1-3).

Furthermore, the ***Club Format*** (see Figure 2) supports the following: (1) communication between groups of people familiar to each other, (2) possibilities to participate in a club, (3) occupying older adults in meaningful social activities and (4) mimicking real-life face-to-face interactions. It is implemented as a C++ module that hosts two WebBrowser controls of the MSDN library. This allowed running the multiparty communication implemented as an H.264 [8] Flash-based application (extending the BBB project), while running a Flash-based application serving gaming activities or browser sharing amongst users. Figure 2 shows a screenshot of the multi-party communication between three users while playing the Ludo game using the touchscreen. The Club Format enables social presence via its communication capabilities and promotes social gaming activities that encourage physical activity, promote older adults well-being and improve their health.

The ***Classroom Format*** (see Figure 3) supports: (1) communication activities that promote communication and interaction with others and stimulate also the feeling of being useful and (2) voluntary activities which basically involve teaching others (e.g. older adults, grandchildren). The main communication activity in the Classroom Format involves a one-to-many video call that is able to effectively support teaching activities such as painting, storytelling or knitting. As illustrated in Figure 3, the many-to-many audio and video call is taking advantage of both screens to showcase the lead participant (e.g., older adult or care provider) in higher resolution at the centre of the YoooM device, while other participants (e.g., older adults or family members) are displayed in lower resolution at the corners of the lower screen. Any of the participants may take the centre high resolution position, if needed during the session. The user interface is arranged in this way to provide the capability to the lead participant to clearly teach other participants. This format supports social presence via the audio and video call capabilities, which are manifested to encourage activities promoting communication, interaction and learning together with others, while at the same stimulating older adults' feeling of being useful.

4. Evaluation

In the following the study setup, the central research questions and the main findings are presented for the first user study evaluating the three formats.

4.1 Study setup of the workshops/Central idea/implementation

The central goal of the workshops was to evaluate the aforementioned formats and to identify to what extent they are suitable to meet older adults' needs in terms of being active together with other people (e.g., family members, friends or care givers). Through this approach we intended to specify the requirements towards the YoooM with respect to the activities by identifying improvements, likes, dislikes as well as problems that might occur. Overall, eight workshops were conducted, two in Sweden, two in Spain and four in the Netherlands. 48 older adults took part in the study, aged between 56 and 83 years (average age 71 years). 93,8% were already retired and one quarter (27%) had restrictions in mobility. Within the workshops participants could only try out the Meet format, i.e. performing a call. All other activities had not been implemented, thus simply the ideas were presented to the participants using a Flash prototype on the YoooM.

4.2 Central Research Questions

In order to identify the target group's needs regarding social presence and meaningful social activities three central research questions were defined: RQ1) Did participants experience social presence during the interaction with the Meet Format? RQ2) To what extent are the program formats suitable to interact over distance? RQ3) To what extent are the formats suitable to perform meaningful social activities?

4.3 Central Insights

In the following, insights with respect the central research questions are outlined. Thereby, we will focus on the most important findings we identified by means of the workshops that were performed.

RQ1)When interacting the first time via the YoooM device, by trying out the Meet format, most participants of the workshops expressed their positive attitude towards the device, were impressed, surprised and enjoyed the "lifelikeness" when interacting with another person. Most of the participants stated that they felt very close to the communication partner and that the conversation seemed to them very realistic. The statement of one participant illustrates this quite well: *"I have conducted a few video conferences and you don't get that real feeling of human contact and presence."* Another person stated that s/he felt so close that s/he wanted to shake hands. Most of them appreciated that they could see the facial expressions and body language, which are an important component in face-to-face communication. We can therefore conclude that participants experienced social presence when interacting via the YoooM device.

RQ2. In general, all three formats were considered as useful to interact with other older adults, friends or family members. Nevertheless, participants did not like all activities that were presented. The sense of being present and the experience of being close to and active together with the people one loves were pointed out. The idea of being in contact with the care giver via the device was considered as partly useful. Some participants pointed out that it depends on one's needs whether one could be remotely supported in terms of care, because not all activities could be performed remotely (e.g., household activities).

RQ3. This question intended to identify to what extent the formats and activities are experienced as meaningful and to what extent they are suitable to make older adults feeling useful and being satisfied. Regarding the Club Format participants pointed out that they appreciated the idea of being active together with others (e.g., family members or friends), which was considered as an important social activity within former workshops. Whereas the participants liked the idea of playing PingPong or showing one's pictures from a journey they once made, the game Sudoku doesn't seem to be appropriate to perform meaningful social activities as it was considered as a game one usually plays alone and participants could not imagine playing this game together with others.

Regarding the Classroom format it has to be pointed out that the activity reading books was considered as an important social activity. Most of the participants pointed out that they appreciated the idea of being active with others, for example, their grandchildren. The second activity, which was evaluated within the workshops was teaching painting, also seems to be valuable to perform meaningful social activities. Some participants pointed out that they felt to be useful when teaching others and that they were motivated to learn new things or to train their motor skills. The Meet format was especially evaluated from a care perspective. As already mentioned, the results revealed that participants considered the Meet format as partly useful to receive remote support from a care giver, a nurse or doctor, for example one could quickly get in contact with a doctor, who could see if it was necessary to send the ambulance. Therefore, especially safety issues could be addressed. Nevertheless, it has to be considered that the workshops revealed that participants could not imagine that the format could replace personal contact (especially if one actually needs support regarding the activities of daily living).

5. Conclusion and Next Steps

Summing up, the workshops with potential end users of the YoooM system revealed that the formats and activities the system provides are valuable in order to be in contact with family member and friends to perform meaningful social activities and to be supported in terms of care. Participants of the workshops especially appreciated the "lifelikeness" they experienced within the conversation using the Meet Format and got a real feeling of human contact and social presence. Until now, all formats have been implemented and two heuristic evaluations have been performed in order increase the usability of the system. User studies in the lab with potential end users have also been performed to explore to what extent participants are satisfied with the activities that are provided, what they like and dislike and how they would improve the different activities the YoooM system provides. In a next step the system is going to be evaluated by means of field tests, where potential end users will receive one YoooM device at their home for a period of approximately one month.

Acknowledgements

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SENIORCHANNEL AN INTERACTIVE DIGITAL TELEVISION CHANNEL FOR PROMOTING ENTERTAIMENT AND SOCIAL INTERACTION AMONGST ELDERLY PEOPLE.

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Abstract

SeniorChannel is a project funded under call 2 of Ambient Assisted Living Program AAL, whose objective is the development of an Interactive Internet Protocol Television Channel (SeniorChannel) that will not only provide elderly people with a method of interacting but also with a unique means of access to the range of diverse activities in their community including the opportunity to share knowledge and experience, the ability to participate in topical debates, entertainment services, work-shops and discussion groups regardless of their geographical location. Also will be developed and implemented a low cost, easy-to-use, integrated TV studio and production centre that will enable community driven broadcasting

1. Introduction

SeniorChannel is a project funded under call 2 of Ambient Assisted Living Program AAL which it is on its final year, and whose objective is the development of an Interactive Internet Protocol Television. The vision in project SeniorChannel is based on the assumption that the quality of life for elderly people in our communities will be improved if advanced network technologies can be used to facilitate engagement and interaction amongst them, both directly and indirectly. As people get older, their roles in life and the community change. They retire from professional life and relinquish the responsibility that comes with parenthood; this can lead to disengagement as they feel their involvement in society is less valued compared to when they were younger and more active.

The goal in project SeniorChannel is to integrate innovative technologies and high added value content in order to provide elderly people with an opportunity to interact

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and share their knowledge, opinions and aspirations with the wider community and derive enjoyment from the experience. Furthermore, SeniorChannel will give elderly care professionals an innovative approach to developing and managing the specific social needs of the elderly in the wider community.

To achieve this goal, SeniorChannel is developing an Interactive Internet Protocol Television Channel that will not only provide elderly people with a method of interacting but also with a unique means of access to the range of diverse activities in their community including the opportunity to share knowledge and experience, the ability to participate in topical debates, entertainment services and discussion groups regardless of their geographical location. The unique approach adopted by the SeniorChannel consortium has been to develop and implement a low cost, easy-to-use, integrated TV studio and production centre that will enable community driven broadcasting and from which seniors can produce their own programs. SeniorChannel will also provide new business opportunities through direct access to a growing segment in the market. The SeniorChannel technology will facilitate interaction between elderly people themselves, as well as others for whom the elderly person's well-being is of particular interest, such as, care supervisors and the family of the elderly person. This will be of particular use in situations where elderly people are geographically dispersed.

2. Methods

The technology developed in this project consist in an integrated TV studio and production centre, installed at the Users Centres and a Set Top Box specially adapted for this project installed in the elderly person's home. For both developments the user's requirements collected from the users and care supervisor of the Users Centres has been an essential point of reference.

Historically the TV has been a passive media; SeniorChannel integrates robust and reliable interfacing technologies that facilitate the interaction of elderly people with outside world through the TV. Simply using a Set Top Box and a TV remote control device, specifically selected for the project, the elderly people will be able to access at home to a wide range of interactive services. The operative work carried out in the SeniorChannel project started with a User Consultation about their interests regarding contents and their requirements for the system functionality. To achieve this, the SeniorChannel consortium designed protocols and tools for the user consultation, conducted the consultation with potential users in a Day Centre for elderly people in Alicante and obtained crucial requirements that leaded the development of technical development of the project.

Taking into account the requirements established, the technical partners of SeniorChannel project defined the architecture based on Web Services as:

- A virtual studio to produce TV programs to pre-recorded or broadcasted in live (installed in the user's centre).
- STB/Media Centre at user's home to access on-line TV or on-demand content.

- Video Server to process the video streaming of the store on-demand content and live programs.
- Interaction Server to manage and process the interactions of the users providing the results of the interactions.

As soon as the architecture was defined for the project, the project partners started to develop the technology to integrate it according the defined architecture. One of the main technological milestones was to develop a low cost TV studio to produce the TV programs using VR techniques. The result was a TV studio including a video camera, lighting system, two graphic stations (one for processing and one for output), the real time 3D graphics software, sound system and Chroma key for less than 6.000€ . With this low cost studio the elderly people are able to produce their own programs that can be broadcasted in live programs or pre-recorded for on-demand television.

Figure 1: SeniorChannel TV Studio

The STB and Media Centre was also designed and develop in order to meet the requirements and constrains of users and the other technological requirements of the overall system.

Figure 2: SeniorChannel Set Top Box

Other important development was the user interface. This software was designed and developed according to the requirements and usability recommendations generated by the partners' experts in this field. This has been a key development in the project because this interface is the connection between the user and the contents and programs generated in the SeniorChannel.

Figure 3: STB User Interface

Although it is not in contact with the users, there are some important developments that make possible the broadcast of the contents to the users and the interaction with them (selection of TV programs on demand, answer questions during the programs visualization, rating of quality, etc...). For making possible to broadcast the pre-recorded and live programs to the users, it has been necessary to set up a video server.

For making possible the interaction of user with the contents during the visualization of the TV programs, a web service based interaction server has been set up in a very well defined communication environment. In parallel to the technical development, a set of 6 TV type programs were agreed with the users to be developed in the project as a base to validate the Interactive TV Channel from the technology, usability and content aspects. The six types of programs selected for production during the project were:

- Personal Histories - Pre-recorded (on demand)
- Documentary of the Centre (on demand)
- Cooking Program (on demand)
- News Review (on demand)
- Quiz Show (on live)
- Debates (on live)

With the system integrated, a group of 15 senior of the elderly centre, supported by an expert, prepared the on demand TV programs. There were talents, directors, operators, redactors, etc. The on live programs will be produced from September to December 2012.

Figure 4: Personal Histories Program

3. Results

The first evaluation tests were done during the beginning of July 2012 in Alicante, following the tools and method designed by the experts of the University of Padova which include informed consents to be signed by the users prior to any data collection. For the testing of the Virtual Studio and in order to avoid decontextualization, users had to produce a program with a screenplay describing the steps to be recorded and an actor was available. To give the users a sense of how the program should look like, a video was shown at the beginning so they can have an idea of the content while they were producing it.

In the case of the Set Top Box tests, users from their homes where allow to watch 2 programs per day during a total period of 3 days. During the visualization of the programs, the users could rate them from 1 to 5 to show their like or dislike; and at the end of each program a set of questions where display to assess the usability, the satisfaction and the social implications of SeniorChannel. Also, a set of tools where use before and immediately after the trial to collect more information. Since the Set Top Box trials imply entering the users' homes to install the equipment and to uninstall it and to avoid causing more troubles to the seniors, a preliminary meeting was arranged to explain and define the schedule that was going to be followed. In addition, the interviews and questionnaires before and after the test were planned to be done inside the same visit for other activities such training and uninstall, reducing in this way the number of visits to the minimum.

The results from this evaluation test are being analysed and will be available soon. More tests are planned for the following months to be able to refine the system and get a maximum satisfaction of the users.

4. Conclusions

The SeniorChannel consortium is still working to get the best results out of the project and to bring them into a successful product to the market. However, from the experience of the work done so far some points can be improved. During the years that the project has being developed, the technology has change rapidly. In particular, the Set Top Box solutions have been replaced by Smart TVs and desktop applications that allow users to watch content without the need of additional equipment. This type of applications represents the future but they still need to be adapted to senior users with their particular conditions and needs. Inside the SeniorChannel project extra efforts are being dedicated to port the developments done in the Set Top Box to desktop applications for standard computers.

The current situation of crisis makes the commercialization of the products like SeniorChannel even more difficult, entertainment is the first spending that governments and families reduce when there are not enough funds. SeniorChannel was conceived from the beginning as a low cost solution and this give us some advantages, but innovative approaches need to be used to guarantee the successful in the current market.

NATURAL COMMUNICATION DEVICE FOR ASSISTED LIVING – NACODEAL

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1. Motivation

The facilities offered by modern technology are many, however, elderly people is often unable to enjoy them fully. This phenomenon is due to factors such as lack of familiarity, the large amount of information available, coupled with natural problems that come with the advanced ages like senility and memory loss. The NACODEAL project aims to offer better autonomy and life quality during their daily activities, taking advantage of state-of-art technology.

2. Innovation

Nacodeal proposes two new accesses to information technology oriented to elder. First and the most innovative one is the application of augmented reality to provide new services and aid. This functionality has a great potential to improve the social activities in a more natural way. Secondly it develops an adapted interface designed specifically for this sector of the population which can easily use the features that are more useful and necessary, through a mobile device, but to which usually they cannot easily access. This access problem is due to the type of interaction of these devices which is not designed properly to the thinking of the older person.

2.1 Augmented Reality

Projects like SixthSense and Omnitouch demonstrated the advantages of Augmented Reality and pico-projectors to deliver a flexible interface using simple hardware. These solutions, however, do not try to solve the specific issues that create the gap between elder users and modern devices.

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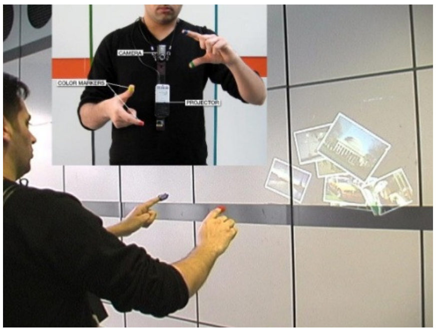

Figure 1. Image of the SixthSenth project

Inspired by the potential of Augmented Reality interfaces, the NACODEAL project aims to deliver a guidance service who will actuate like a digital assistant to aid elderly people with daily tasks. This digital "caretaker" will track the user localization within his residence, and detect the context associated (tasks, memos, contacts, hazards, etc.), exhibiting information through video and audio according with the person's habits.

Figure 2. First test of information and video projection

2.2 Special designed Elder User Interface

It will provide too friendly interface between social networks and establish contact with persons of his/her social circle through an standard device like a Tablet. After thoughtful research performed in France and Italy, involving experts in the field, interviewing caretakers and volunteers, it was possible to determine aspects like the needed features, appearance, usability and positive and negative impacts in the user life that the device may bring to their life.

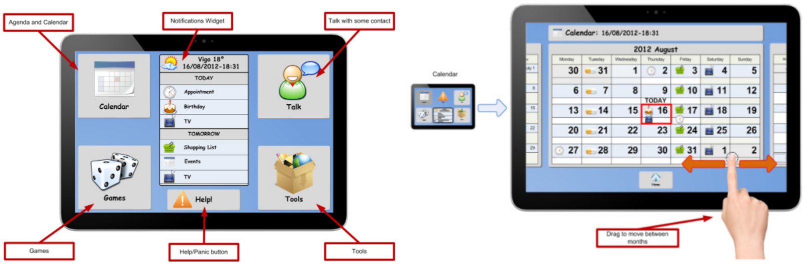

Figure 3. Some images of the devices interface on the development stages

2.3 Social interaction

Social interaction is one of the main targets of the Nacodeal project something that will be highlighted on the different services that will be provide on the first version and that will be foreseen as future developments. The project will create among others a closed social network that will ensure privacy, to be customized by each user; in this social network the seniors will be able to meet their family and friends. The purpose of this application is to avoid the loneliness and abandoned feelings of the elder.

The device will facilitate the user's contact with the people around them, enabling the knowledge of their status, messages sending or seeing photos ... Within this social network your doctor may also be included, so new appointments with him could be closed and afterwards they will appear in your calendar application, and also on the notifications application so the users will not forget it. NACODEAL difference with other projects of social interaction is the mechanism provided in this case for the interaction which is a mobile device. This enables the user to see this device as "all in one" helpful at all times, you can call, view your calendar, photos ... and stay in touch with your network of family and friends anywhere. The device could be used at home, in nursing homes or even on the street so that he will never feel alone. The novel augmented reality system with camera and pico-projector will allow, in the future, a more natural interaction with their social network.

The aim of the project is to facilitate older people's approach to the new technologies, by providing tools that will be useful in any situation so that they demand their service without becoming dependant of the device, the same way as younger people will not leave their homes nowadays without carrying their mobile..

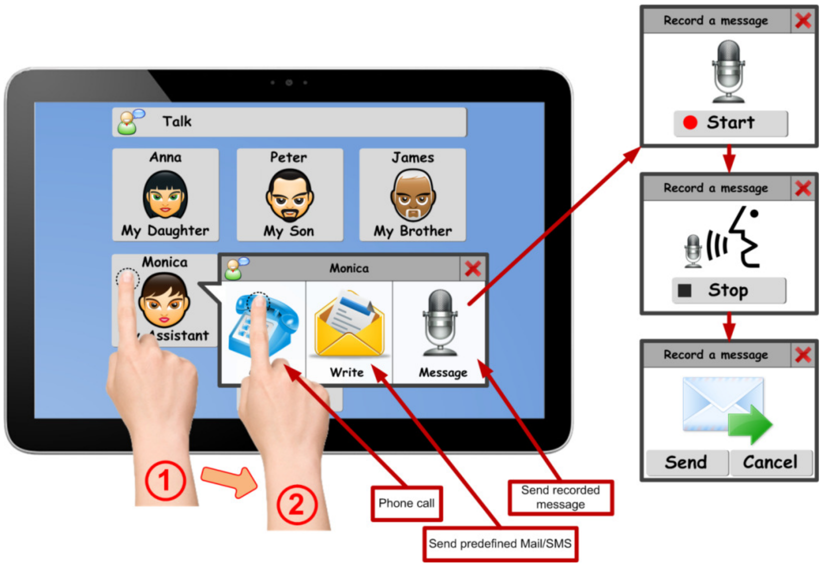

Figure 4. First design of the application to contact with friends and family

2.4 Future

The project opens two major pathways for the integration of older people in the information society. The first one with the use of the tablet / smartphone, that will be prepare for them to be used. This device can open a new market of applications and utilities for seniors while feeling comfortable with the new way of interacting they will demand new services and applications. Furthermore, in the near future, the "new elderly" will be more accustomed to technology and its use will be more natural.
Augmented reality allows a large number of social applications. This first project will provide the base functionalities along with the first and most important applications of the system. But on the same concept and operational ways are planned many other services, such as:

- Interactive games to exercise memory, mobility.
- Recognition by the device of family or friends. The device may display images associated with that person to remember kinship and memories.
- Access to calls and video calls anywhere seeing the other person, making it more friendly to use.
- Use as an input interface to control the Smartphone

2.5 Implementation

The rationale behind the NACODEAL arose from the consortium of 5 partners: Instituto Tecnológico de Castilla y León ITCL, IBERNEX Ingeniería, Imaxdi Real Innovation S.L (Spain), COOSS Marche Onlus (Italy), and E-Seniors (France). The development of the NACODEAL will be carried out by its responsible institutions during 30 months, along 4 distinct stages: Dissemination and scenario definition, the development of the prototype device (augmented reality, communication and hardware modules), user validation and introduction of the finished product into the European market. The consortium will follow international standards to ensure the high quality of its deliverables. Namely, the framework described in ISO 12207 will be used in order to carry out from the initial concept to the end product. Since the device will process sensitive data from the user, the security risk analysis will be performed according the ISO 14508 guidelines. The quality of the services provided will be assured by best practice approaches provided by the ITCL framework.

3. Ethics

In order to comply with standard ethics parameters in EU, the participation of an user will be always voluntary, without any restrictions of race, religion, gender or physical disabilities. It will be provided the clear explanation of the nature of the test, purpose, duration, characteristics and monitoring. The volunteer is free to cease his/her participation at any moment, without any consequences. In this case, an exit plan will be followed to determine the dependency potential of the device and any effects that its removal may have in the well-being of the participant.

EXTENDING THE INDEPENDENCE OF GEOGRAPHICALLY AND SOCIALLY ISOLATED INDIVIDUALS WITH CHRONIC CONDITIONS THROUGH TECHNOLOGY-BASED SOLUTIONS FOR REMOTE INTEGRATED CARE: THE REMOTE PROJECT CASE STUDY

Evangelos Bekiaris[1], Alexandros Mourouzis[2,3], Maria Panou[1], Nikolaos Maglaveras[2,3]

Abstract

REMOTE is an AAL project that focused on enhancing the elder's personal space with audio-visual, sensor and motoric monitoring abilities for keeping track of vital signs, activity, behaviour and chronic conditions as a means to detect health risks and critical situations and for providing, both proactively and reactively, effective and efficient remote support. This paper presents the project concepts, the approach and principles endorsed, and the achieved results.

Keywords: Chronic conditions, Tele-healthcare, Ambient Assisted Living.

1. Introduction

The burden of future care for older European citizens is described as a major time aggravated thread to societies. Today, over 100 millions of people in Europe, or 40% of the population in Europe above the age of 15, live with a chronic condition[4]. Given that this figure is increasing year by year and that chronic diseases are currently the leading cause of mortality in the world, representing 60% of all deaths, significantly challenging demands are placed on our health care systems, such as:

- long lasting and costly interactions with the health care systems;
- on-going[5] *monitoring and treatment adjustments*; and
- range of services by primary, community and care professionals per patient case with high risk gaps in care handovers.

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[4] European Chronic Disease Alliance; WHO Europe

[5] On-going monitoring is needed for determining triggers or negative factors of conditions.

Numerous recent studies have brought forward that the management of chronic diseases is difficult within today's care systems, which are designed to provide acute and episodic care across disparate health facilities. A clear difficulty is that the social determinants of chronic disease are so broad that prevention becomes a challenge that requires cross-sector and multi-level collaboration beyond the conventional boundaries of the health system. To this end, a paradigm shift is required for more effective chronic care delivery in the near future. The success of the envisioned chronic care innovation is mainly subject to prompt and collective mindset changes, both on the part of the clinician and the patient. However, several R&D efforts worldwide have proved that the use of state-of-the-art Ambient-Assisted Living (AAL) technology, such as bio-sensors, smartphones, home automation, web services and social networking, has the potential to drive and speed-up improvements in chronic care. To speed up the transition, *REMOTE*[6] ("Remote health and social care for independent living of isolated elderly with chronic conditions"), an AAL project (Grant Agreement no. AAL-2008-1-147), was proposed and accepted for funding further to AAL Call 1. REMOTE implements a novel approach, which aims at addressing emerging deficiencies in current tele-healthcare R&D and summarizes the basic elements for improving care in health systems at the community, organization, practice and patient levels.

2. The Concept in brief

REMOTE aims at defining and establishing a multidisciplinary and integrated approach to R&D of ICT for addressing, in real life contexts, identified needs of frail elderly, especially of citizens at risk due to geographic and social isolation in combination with chronic conditions , such as hypertension, arthritis, asthma, stroke, Alzheimer's disease, and Parkinson's disease, and the coexistence of lifestyle risk factors, such as obesity, blood pressure, smoking, alcohol abuse, poor eating / drinking habits, stress, and low levels of physical activity. The project introduces an innovative, ontology-driven, open reference architecture and platform to enable interoperability, seamless connectivity and content sharing among different applications and services. REMOTE addresses real needs of citizens at risk due to geographic and social isolation in combination with specific chronic conditions and the coexistence of lifestyle risk factors, such as obesity, blood pressure, poor eating/drinking habits, stress, etc. The patient is equipped with off-the-shelf medical devices which are managed by mainstream computing units, such as a laptop or a smartphone and that can record vital signs measurements (see Figure 1).

The recorded data is transmitted to the medical centre and can be accessed online by groups of authorized medical professionals (see Figure 2). Appropriate alerts are triggered if health status deterioration is detected and are sent to the medical centre and corresponding medical professionals and informal caregivers. Patients can have remote access through their mobile phone or PC, to various integrated services related to independent living and support that offer personalized guidance on nutrition,

[6] Project website: http://www.remote-project.eu/

physical or mental exercise, socialization and scheduled activities, as well as for control of their home devices.

Figure 1. Innovation in vital data monitoring

Figure 2. Innovation in personalised tele-monitoring

3. Innovation

The state-of-the-art of REMOTE encompasses an enormous domain of related applications and services for the elderly, architectures, ontologies and standards for their inter-connection, integration, etc. We will focus here on discussing REMOTE's breakthrough against major limitations of other approaches. First of all, most efforts so far have a focus restricted on health-related issues, failing to see the person as a whole entity of a dynamic and complex nature with, often, multiple conditions and social and psychological aspects playing a major role in individual well-being and quality of life. For elderly, these aspects are even more important because of natural decrease of abilities and skills and the progressive limitation of social life. This implies the need for integrated, scalable and adaptive care solutions for all stages of life, acute care, chronic care, preventive services, rehabilitation services and end of life care. REMOTE, recognizing isolation -both geographical and social- as a common multiplying risk factor, aims at overcoming these limitations by both changing the focus of the research, and by adopting an approach whereby ICT and AmI-based applications and services are part of holistic strategy to health care and management as well as to subjective well-being of the elderly. Regarding REMOTE's progress beyond the state-of-the-art in integration of technologies and products, the following areas are notable:

- Open reference architectures and ontologies
- Intelligent agents and AmI framework
- Wearables, sensors and health/activity monitoring
- Independent living applications
- Social support applications
- In-home and domotic sensors and localisation systems
- User interfaces and adaptive systems
- Tele-healthcare products and services

4. Methodological Approach

The main goal of REMOTE is to contribute to interoperability and standards in the field as a means for unblocking the potential of currently available technology and for leveraging health and social services across Europe. This is achieved by introducing an innovative, ontology-driven, open reference architecture and platform that now enables interoperability, seamless connectivity and sharing of content among different applications, sensors and services in chronic care (see Figure 3).

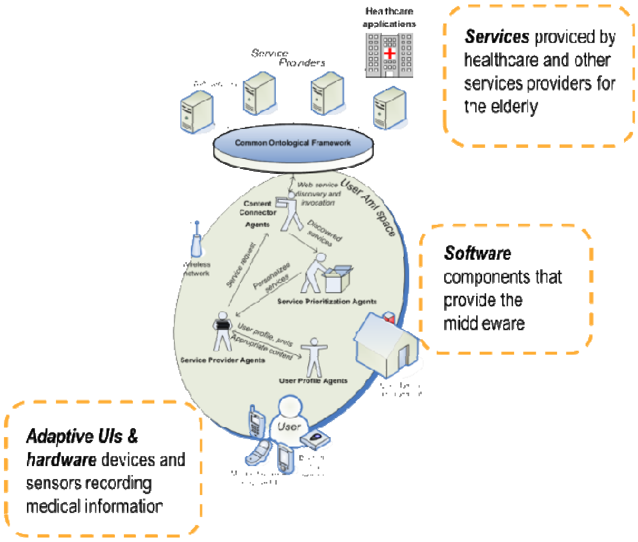

Figure 3. The REMOTE's open reference architecture for achieving interoperability and integration

In designing the REMOTE work plan particular attention was paid to the involvement of users, both patients and professionals, in all of the phases of the project: concept building, design and validation. First, the project started with a thorough and multi-level study of user aspects, needs and requirements based. This study included a user survey (126 patients, 73 professionals, 54 family members from eight EU countries) and several direct interviews (19 patients, 11 professionals, and 10 family members from 6 EU countries). All the gathered feedback was used for the definition of user requirements and 41 detailed use cases.

The end-users of REMOTE involve individuals with various chronic conditions, diverse (dis)abilities, various backgrounds and technical skills, and questionable ease in using new IT devices, platforms and services. Aware of this challenge, designers and developers in REMOTE followed a UCD approach involving representative users in the design process, and proposed a novel method of producing device-independent user interfaces for all, thus achieving significant accessibility, usability, and aesthetics quality levels.

5. Results

REMOTE was validated with all types of target users, and in all European social, economic, legal and preference related environments, through its Pilots in 6 countries with relatively high percentages[7] of population aged 65+ years.

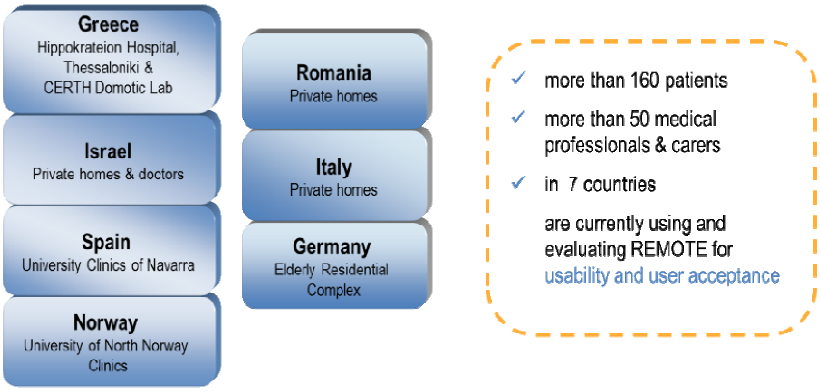

Figure 4. System validation and use case verification in REMOTE

REMOTE defined a thorough ethics code for the conduct of research within project. First, the key ethical and legal issues were identified and studied. Thereupon, a relevant project policy towards examining these issues was carefully designed, launched, and continuously monitored throughout the lifecycle of the project. Relevant international and European conventions (e.g., the Helsinki Declaration), as well also all national legislations, were fully integrated in the course of the project.
Overall, the REMOTE model being patient-centric embodies a holistic approach towards addressing key requirements including:

- the shifting from hospital-based acute care towards long-term condition management in home settings;
- new mechanisms promoting the reshaping of the relationship between patients and their care providers and ensuring more productive interactions between them;
- new tools supporting and enabling easier, multi-level collaboration among cross-sector and multidisciplinary care teams;
- new tools supporting clinical decision making for an individual patient;
- integrated approaches towards *self-care*[8],*self-management*[9], and *tele-medicine*[10];

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[7] e.g., Germany 18%, Greece 17.9%, Spain 16.9% in contrast to rates such as 11.1%, 11.9%, and 13.8% in Ireland, Cyprus, and The Netherlands respectively – Source: Eurostat, 2006. Data navigation tree, population and social conditions, People by age classes

[8] Guided behaviour and lifestyles for people at risk of ill health focused on reducing the risk of disease onset or progression.

- tools supporting the enhancement of the autonomy, independence and quality of life of individuals living with chronic conditions;
- the provision of more effective and holistic care coordination and case management around the needs of the patient;
- better tools to support policy and management decisions at the population health level.

6. Conclusions

Telemedicine works: For instance, disease management through tele-monitoring of heart conditions reduces mortality rates by an estimated 20%. It has also demonstrated the influence on attitudes and behaviour of patients resulting in better clinical outcomes[11]. New technologies and integrated systems such as REMOTE are the answer to overcome those challenges experienced by patients with chronic conditions, such as Heart Failure, Hypertension, Parkinson disease, Diabetes, Arthritis and any combination thereof.

REMOTE system is a unique business opportunity, as it offers not only profitable financial opportunity but also helps the elderly, the chronically ill and the remotely located. Together it gives the most promising, appreciated and rewarding businesses. The market is clearly there, and it is huge, with endless opportunities. REMOTE comprehensive and multi-cultural approaches assure multiple and promising market opportunities. A promising market opportunity is foreseen, as 1.4bn smartphone holders are expected to use m-health systems in five years' time. Elderly people at large, especially individuals with chronic conditions and/or in risk of exclusion, will benefit from REMOTE in terms of an increased level of self-management capacity. The feeling of security and command that aged people 'on the edge' in the European countryside will receive, will strengthen their confidence in leading an independent life at home and delaying, if not fully avoiding, institutionalization. Without being highly intrusive, REMOTE enables continuous health monitoring services, thus allowing health care personnel at hospitals and care institutions to seamlessly supervise, follow-up, treat, and monitor elderly people in their own homes or within elderly homes. Older people will be able to live longer on their own, while in an emergency help can be called for immediately. The REMOTE open Reference Architecture will enable sharing of data and interoperability between various services, thus enabling "*integrated care processes for the ageing population*".

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[9] Guided activities focused on minimizing the impact of chronic disease on a patient's health and life.

[10] Provision clinical health care at a distance.

[11] Systematic Review of Home Telemonitoring for Chronic Diseases: The Evidence Base: J Am Med Inform Assoc. l 14, 269—277 (2007)

Figure 5. Applied to over 7 different countries, languages, medical health systems, different mentality, geographical and climates, and more

INTERNET OF THINGS AND CLOUD COMPUTING AS KEY TECHNOLOGIES FOR HEALTH SERVICES PROVISIONING: THE VIRTUAL CLOUD CARER PROJECT

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Abstract

The demographic and social changes are causing a gradual increase of the population in situation of dependency. Current estimates claims there are 1.300.000 dependent persons in Spain and the public spending in 2010 was 5.500 million Euros for care of 650.000 dependents [1]. Although the budget has increased year by year since 2007, it is also true that the current global economic crisis requires a rationalization of social and economic resources more when the public health system has not yet reached the maximum number of dependents entitled to care. At the other hand, in the last decades there exists an undeniable increase in chronic diseases. Recent data of the European Union reveals the main chronic pathologies are the following ones: diabetes; according to International Diabetes Federation (IDF), the global cost of the diabetes in Europe was approximately of €68.300 million in 2007 and will grow until €80.900 millions in 2025. According to countries, depending on the prevalence and the level of available treatments, the cost in diabetes will be in a rank of 2.5 - 15% of the total of sanitary expenses. The cardiovascular diseases, including all the diseases of the circulatory system, demanded a total cost in Europe in 2006 of €109,000 million (10% of the total of the sanitary cost; in Spain 7%). The indirect costs include €41,000 million loss of productivity and €42,000 million of the cost of the informal cares. All it makes a total of €192.000 millions in 2006. Respiratory diseases. EPOC. The set of the main respiratory diseases (EPOC, asthma, cancer of lung, pneumonia and tuberculosis), is responsible for 20% of all the deaths and generates a cost of €84,000 million in Europe. The EPOC affects in Europe 44 million people, with a prevalence of the 5-10% of population greater than 40 years [2].

1. The Virtual Cloud Career project

The “Virtual cloud carer” (VCC 2011-2013) R&D project will try, from the dominion of the information and communications technologies, initiate an approach to the field of the innovation in the integral care to the elder people with chronic diseases, being understood here by integral care, the provision of medical assistance and social

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support necessary to take care in an ideally correct form to elder people according to their health state. The main objective is to design and build a tele-monitoring and tele-control platform for dependent people and their caregivers in home and outside.

A main part of this platform will be a sensing subsystem according to pathologies and/or dependencies, with the possibility of defining thresholds and alarms, by means of connected biomedical and physical sensors to a computer within the dependent's home that measure the different health signs and send this information to cloud for their analysis or visualization for caregivers. In the cloud part VCC will develop a management platform which main purpose is to distribute the stored information taking in account the user profile, also in this part it is mandatory to define the logic process for alarms and warning generation based in measurements from remote sensors and then communicate dangerous situation to caregivers or medical personnel.

1.1 Technological Oriented Objectives

The main technological objective in the frame of VCC is the design and implementation of a tele-monitoring and tele-control platform for dependent people and their caregivers, in home and outside, the main characteristic of the platform will be an easy and intuitive use, independently of the underlying technology in which it is sustained. A main part of this platform will be a sensing subsystem according to pathologies and/or dependencies, with the possibility of defining thresholds and alarms, by means of connected biomedical and physical sensors to a computer inside or outside the dependent's home that measure the different health signs and send this information to cloud for their analysis or visualization for caregivers.

When the person is outside those sensors will be integrated inside an intelligent mobile device connected to Internet by 3G and implementing M2M (machine to machine) communication protocols. Another technological service provided by the platform will be a system for manage physical activity using video streaming and 3D recognition in order to observe the good completion of exercises, this service will be specially recommended for physiotherapeutic rehabilitation.

The project also consider the development of an adaptive communication interface between user and computer, facilitating the understanding of Internet and new technologies to people with a low-tech profile, while encouraging its use by providing a simple and friendly human machine interface. In the cloud part will be necessary to develop a management platform which main purpose is to distribute the stored information taking into account the user profile, also in this part it is mandatory to define the logic process for alarms and warning generation based in measurements from remote sensors and then communicate dangerous situation to caregivers or medical personnel.

1.2 Social Oriented Objectives

In this case, the main social objective lie on the attempt to bridge the gap that prevents the elderly and people with chronic diseases to have a minimal quality of life, permitting people to do daily activities knowing their health status in all moments.

Also, we are trying to include the elderly to Internet society, developing simple mechanisms for interaction between technical elements (computer, or special input devices in place of keyboard) and people, like for example, an accessible Web browser to improve usability through the use of alternative hardware to keyboard or voice commands.

1.3 Health Oriented Objectives

Similarly, the "Virtual Cloud Carer" project will provide a range of health-oriented goals that help the elderly to keep active through physical training exercises and, otherwise, assist medical staff in the task of monitoring the treatment for these people from homes. For the case of physical training our idea is to use existing motion tracking technologies based on low cost hardware equipment as for example Microsoft Kinect. This will prevent premature degeneration and improves the senior's mood with functional diversity by increasing the feeling of being useful to society around them.

1.4 Technology Platform's Architecture

Among the initial services of the platform, there are technical difficulties related to the application area. For example, the development of an accessible Web browser must be multimodal and interoperable in order to take into account the needs of all members of the group, which greatly complicates the solution due the diversity of users. At the other hand, the design of a mobile device for collect bio-sensor information must take in account the diversity of technologies and different communication protocols (USB, IEE, I2C, etc.). Is then necessary to develop a proprietary API that deals with this issue and permits send the data from mobile device to Internet.

Another important technical difficulty is to develop a system for 3D recognition for evaluate the rehabilitation exercises without intervention of medical personnel, in this case it is necessary to include information about how well is done the exercises, also the use of common computer applications through the use of voice commands will permit the elderly to connect to the Internet for entertainment and searching for information about their health status. The ability to speak will be performed by TTS module (Text to Speech), which will be able to interpret instructions to carry out a phrase, change computer's volume, etc. This module will be capable of aloud the name of the icon over which the user is, or alert user of events or errors via voice messages. For this subsystem the idea is to implements a graphical user interface (GUI) having a similar behaviour to the Windows desktop, but with some innovative characteristics that allow meets the specific 65+ user requirements (size of icons, colours, etc.) including likewise key aspects of advanced user interfaces. An important part of this subsystem will be also an adaptable and voice commanded Web browser. Figure 1 depicts a high level architecture of the Virtual Cloud Carer components. The creation of a subsystem for gesture recognition and movement detection will be created having in mind the necessity for assist and improve the physical recovery process of patients with movement disabilities caused by neurological, orthopaedic or rheumatoid problems, this subsystem will be based on interactive applications and games that monitor the patient's movement and engage them in performing the exercises recommended for recovery. This is something that many researchers have recently tried to achieve using different devices and sensors for patients' movements detection, like the Wiimote, but in our case we want to use the Microsoft Kinect, which tracks the human motion without requiring any devices attached to the body.

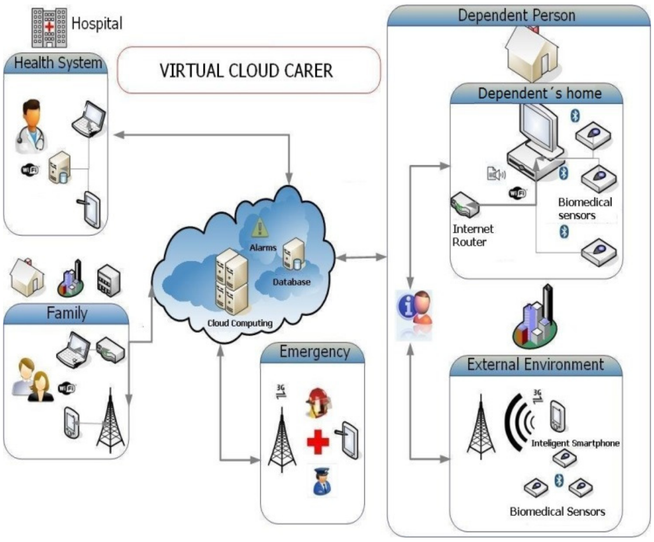

Figure 1. High Level Architecture of Virtual Cloud Carer

About the mobile device our approach is to develop this part around a microcontroller suitable for collecting information from sensors, GPS, accelerometers, etc. The device must be capable of transmit data to the Internet through a 3G connection via an integrated modem and send/receive data via Bluetooth to/from sensors. In the cloud part there will be available a TCP/IP socket with capabilities for receive and transmit basic information using a special and dedicated protocol.

Acknowledgments

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MAKING INTEGRATED ECARE A REALITY: THE INDEPENDENT EXPERIENCE IN HULL

Mark Gretton[1], Mike Burton[2]

Abstract

The process of integration of health and social care in the UK over the last 50 years has been largely unsuccessful with various policy initiatives attempting to integrate health and social care succeeding only in establishing rigid health and social care 'silos' that fail to meet the needs of individuals. In the UK, in Hull, we have attempted to tackle this in our pilot for the INDEPENDENT project by utilising services that are currently available in health and social care and joining them up with tele-monitoring technology. An unanticipated early benefit has been people treating health monitoring as a social activity.

1. Introduction and policy background

The history of the integration of health and social care in the United Kingdom of Great Britain and Northern Ireland over the past 50 years has not been a glorious one. Within a few years of the formation of the National Health Service (NHS) in the UK in 1948, policy initiatives were being formulated to attempt to integrate health care - the work of the NHS – with social care, which in Britain means local government that is spread across 426 local authorities in England, Wales, Scotland and Northern Ireland. The issue of integrating a national health service with so many social care providers is just one of the many problems that have stymied the development of an integrated system of caring. Since the 1960s, 50 years of policy initiatives have attempted to better integrate the National Health Service and local government. Unfortunately, the results of these initiatives and the experiences of patients and service users have been often unsatisfactory, sometimes disastrous. In short, many people have cared about integration, but we have seen very little integration of care. Why has this been the case?

The failings of health and social care integration have recently been summarised by Gerald Wistow, in a recent paper considering the (largely) failed attempts at integrating health and social care in the UK. The author finding two overriding reasons for failure. Firstly, systems were built around skills of providers rather than the needs of users; secondly, these systems were designed for separation, not integration (Wistow 2012)[3]. In short, service providers, perhaps understandably, looked first at

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[2] Hull City Council

[3] Wistow G (2012) Still a fine mess? Local Government and the NHS 1962-2012, Journal of Integrated Care, 20, (2) pps 102-114

their resources and then built their services around them, perhaps a result of costs of health in particular far outstripping what had been envisaged when the NHS was being planned. This led to the development and then buttressing of what have become known as 'Silos of care,' organisations operating independently of each other, each one self-contained and managed, and each one attempting to provide a 'one size fits all' solution for diverse individuals with multi-various needs. To this analysis, we can add that in recent years information communication technology (ICT) developments that many hoped would be a positive force for integrating care have been conceived and developed on the same model. Thus we have seen technology providers present a solution to care providers and individual patients that has been more about what the provider had developed, rather than what the individual needed; so-called 'technology push' solutions to health and social have compounded the problems of silos, rather than solving them.

Wistow doesn't advocate the demolition of the 'hardened silos' that are in place, nor does he recommend a formalised bridging between these structures. Instead, he suggests an approach utilising the current available systems, but weaved together with the needs of users at the centre. This fits well with a 'Google maps' approach to integrating care proposed recently by Michael Rigby. Rigby explains that when Google maps plans a journey, it doesn't create anything. It looks at what routes are available – car, rail, pedestrian – and joins them as efficiently as it is able. If one mode of transport suits one person more than another, then the journey planner can indicates this and Google maps will focus where it can on the preferred form of transport. This approach lends itself well when used to integrate care: look at what is available, join it up and, critically, only create a solution at this point if there is still a deficit (Rigby 2011)[4]

2. Methods

Hull City Council, the principal social care provider to the city of Kingston-Upon-Hull, a medium-sized city in the North of England with a population of around 200,000 people and suffering from high levels of social and health deprivation across the board formed a Hull pilot site for the INDEPENDENT project along with the University of Hull, which has for the past 10 years been providing a tele-monitoring service to the city of Hull, initially focussing on people with heart failure, now being broadened to other long-term conditions. (For more details on the INDEPENDENT project philosophy and methodology, see "Beyond Silos - Better and more efficient care though ICT-enabled integration of social care and healthcare services" by Sonja Müller, Ingo Meyer & Lutz Kubitschkein this publication).

Focus groups of elderly people in Hull conducted before and during the INDEPENDENT project have indicated that their issues around integration centred upon local gaps they perceived between health and social care, specifically their

[4] Rigby MJ (2011) ICT in integrated care: from concept to practice "Beyond Silos: The Why and How of ICT in Integrated Care Service Provision" conference, 23rd November

inability to manage elements of their health as they would wish, due to lack of access, and a feeling of isolation due to mobility restriction. As part of the work of the Hull pilot site of the INDEPENDENT project we have sited Tunstall 'MyClinic' multi-user device (MuDs) in common-access rooms in sheltered accommodation residences owned and managed by Pickering and Ferens Homes, a social landlord with a long tradition in the city of Hull. Residents can access the MuD using bar-coded cards to protect their privacy (should they wish this) and monitor their blood pressure, weight and pulse oximetry. In addition, the MuDs are enhanced to allow messaging between the elderly residents and monitoring nurses via ICP Triage Manager (ICPTM). The MuDs also have a limited internet functionality, allowing access to a directory of local services hosted by Hull City Council including bus routes, weather forecasts, rolling news services and healthy eating advice. The health monitoring is carried out by nurses who provide the Hull Telemonitoring Service run by the University of Hull and can provide support to the INDEPENDENT users via the MuD, over the phone, or by contacting their long-term condition nurses or doctors. Using the 'Google Maps' philosophy of care, most of these services were in place, but needed joining up for individuals to use them. The only elements that needed adding in were the MuDs and ICPTM.

3. Results

Early informal qualitative evaluation has been positive, with around 50 people across three sheltered homes using the systems on a regular basis to monitor their health and access health and social care advice. Excitingly, there has been an additional unanticipated benefit that may increase uptake of the system and impact favourably on the marketability and the chance of 'life after project' of this particular development.

Figure 1. Two friends helping each other manage their health.

A number of residents go in groups or pairs to record their blood pressure, pulse and weight and are also helping some of their friends for whom the system is a slight physical challenge, due to issues such as visual impairment and loss of local function due to stroke. We have seen these people encouraging each other to use the system and discussing their respective results in an almost competitive way, good-naturedly teasing one-another over blood pressure results and weigh gain and loss. One group arranges a specific time each week for this, late on a Friday morning, after which they go out together for lunch. This 'Lunch Club' element opens up the intriguing possibility that monitoring health in this way can reduce social isolation not just by encouraging older people to use ICT solutions themselves, but also by making health monitoring a social activity in itself. This may add not just health benefits, but also increase the social value of the system by providing enjoyment to people in later life.

4. Discussion

This unexpected early benefit raises a number of questions too. Are elderly people (at least in the UK) less concerned about privacy issues than younger people? Much of the planning and execution of the pilot was concerned with ensuring people's needs for privacy were maintained, whereas it appears that for our cohort this was less important than having a friend or friends to accompany them. If this 'social use' of monitoring is a finding that continues, should it be further facilitated by making sure that the room where the MuD is sited is always large enough for several people to be in it at the time, rather than just a 'booth' approach for one person as was utilised at one of the residential homes? And crucially, will these perceived benefits be maintained over a period of time and add sufficient value that these systems are seen to provide benefits that are worth paying for beyond the life of the project?

Figure 2. Some of the members of the "Friday lunch club"

These are questions that we hope to answer following the evaluation of the INDEPENDENT project in Hull. But at the moment we are hopeful that we have joined up existing health and social services in a way that helps elderly users, enhanced them only when there was nothing currently available to do what people needed to be done, and in the process provided an environment where people can take control of their health and decide how they add value to their lives. And all with a little help from their friends!

ICT SUPPORTED DIABETES PREVENTION AND SELF-CARE MANAGEMENT – EXPERIENCES FROM THE EMOTIONAAL PROJECT IN FINLAND

Virpi Kuvaja-Köllner[1], Marina Steffansson[5], Aija Kettunen[5]

1. Introduction

Elderly people, as do all of us, prefer independent living. This independency might be threatened due to consequences of chronic diseases such as type 2 diabetes mellitus (T2DM). There are studies about possibilities of Information and Communication Technology (ICT) in diabetes prevention and self-care management but the role of electronic feedback and end-users' experience is limited. There is also a lack of studies which have collected end-users' experiences from both clients' and health care professionals' sides. This information is needed to develop usable ICT-supported services for diabetes prevention and self-care management. Another point of view is that there will in the future lack of health care professionals in all countries and new innovations to do prevention, treatment and care are needed.

In this project we have developed and studied the combination of a web-based portal (Raitti.fi) and a cell phone in the prevention and self-care management of chronic diseases. According to the earlier studies, the early detection of risks and early support for high risk individuals can delay the onset of type 2 diabetes. The ICT enables quick feedback from health care professionals, supports self-care management and it can decrease the problems caused by long distances in rural areas. The aim of this study was to explore the benefits and usability of the developed ICT supported concept in diabetes prevention and self-care management in the rural area in the Finnish primary health care system. ICT changes the use of resources and that is why the costs and benefits of this ICT based model were taken under review.

This combined research and development project hopefully gave us a better possibility to increase the knowledge about ICT's possibilities in T2DM prevention and self-care management in the primary health care context. This information could be useful in the future when there are more and more elderly people with chronic diseases and the lack of health care professionals is an issue in all areas, not just in rural areas. The generation who is retiring now is already familiar with ICT solutions, so it is just a matter of time and innovative markets as to who is the quickest one offering new solutions and taking over the markets.

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2. Methods

The work in this project consisted of research and development parts. The first phase of the project developed and offered health care corners with a computer and health measurement devices in tree villages. Twice a month the nurse offered face-to-face visits. A village assistant of the project helped and supported people with the computer and other technology devices. Her role became very important due to problems with information technology connections in rural areas. She had the knowledge to try different solutions in different areas. The project also borrowed a computer and devices for home use. The questionnaire surveys (in 2010 N=291 and in 2012 N=241) for people over 64 years old living in the project villages and other areas outside of city areas gave us information about computer technology use and telecommunication connections, interest in health promotion and the location and accessibility of services.

The second phase of the project developed a more intensive ICT based diabetes prevention and self-care management concept which was piloted. The participants (N=15) of the pilot used a web-based portal or a cell phone combined with the portal. The computer group measured their health values with their own devices and saved their information onto the Raitti.fi portal. The mobile phone group used the Insmat BBM-820 Medical Senior Phone and devices which were developed to dock direct into the phone. These devices were the H300C Blood glucose monitor (eB-G) and the H100C automatic wrist type blood pressure meter (FT-B12W-V). Both groups got feedback in 1-3 days from the nurse working in a health centre.

The end-users, the pilot participants and the nurse were interviewed about the usability and benefits of this used system. This feedback was given further to the web-portal developers and they could make almost all the suggested improvements. The end-users' interviews gave us a deeper understanding about the usability and benefits of ICT in view of diabetes prevention and self-care management. Due to the limited duration of the pilot (3 and 5 months) and the limited number of participants of the pilot, it was known that the health outcomes results cannot be generalized. However, to support our findings, the literature review was used to find out the earlier evidence of the effectiveness of ICT, fast feedback in the prevention and self-care management of type 2 diabetes. The calculation of different kinds of resource use was also based on the interviews and on the recommendations according to Finnish Current Care Guidelines.

3. Results

The share of daily/weekly computer users increased in the age group 77 years and older from 7.7 percent to 12.4 percent. The share of non-computer users decreased during the last two years in the pilot villages. The internet connections improved during this project. The health corner solely with a computer and health devices does not persuade citizens to do measurements, whereas the attendance of the nurse attracted more visitors. However, most of the people prefer to use a computer and do self-measurements at home. The health monitoring pilots' participants were satisfied with these offered ICT solutions. They felt that this system motivates them better than the traditional system and supports more self-care management. Although the duration of the pilot was short, the health outcomes improved slightly during this intervention. The average weight reduction was 2.3 kg/person and also in blood pressure, blood sugar, waist circumstance and body max index, a reduction was shown in group level results. The comments of the nurse were also promising. The time resource needed from the nurse for this process is minimal, only 1-5 min/patient/check**.** The Finnish Current Care Guidelines suggest that type 2 diabetes patients should have face-to-face meetings with a nurse 3-4 times/year. If two of these face-to-face visits are replaced with these weekly ICT contacts, then it would mean an approximately 30 minutes' time save per patient. The costs of care would be less and the outcomes of care better. In this pilot the calculation was based on weekly contacts. If the nurse gave feedback every second week, this system would enable prevention and care for more people than in the traditional system and this would be more cost-effective. The ICT devices and the portal which were used in this pilot still need some development. The end-users' feedback was valuable in the development process.

The ethical issues were discussed and taken into account during the whole intervention. The participants were recruited mainly via newspaper announcements and articles. Only a few volunteered via recommendations of health care professionals or via our own contacts. All the participants were voluntary and they got information about the intervention before they started and all of them were free to drop out. The results which are published are collected and analysed so that no individual can be recognized, only the comments of the nurse could be recognized but she gave us a permission to use her feedback. We will not publish individual health outcome results. The health outcome results are on the group level and their sensitivity is means, maximums and minimums. The feedback and comments from individual participants are not identifiable.

The other point of view is that the use of ICT solutions decreases the face-to-face contacts between people. Avoiding travelling and face-to-face visits between the nurse and persons who are still in working life was in most of the cases perceived as positive due to e.g. enabling better time management. However, in the situation where the visits by health care professionals are the key social contacts for the older person, this decrease in office meetings might be a negative thing. In these cases the discussion should be directed as to who should be the instance or person who could ensure that those older people who are lonely could have social contacts also outside the health care sector.

4. Discussion/conclusions

In this research and development project the focus has been on the ICT system, the midpoint of which is the Raitti.fi web portal. The portal is the link for the information change and feedback which happens between the patient and the nurse. The results show that ICT based self-care management with electronic feedback from the nurse is well-suited to the purpose of preventing and treating chronic diseases such as type 2 diabetes, overweight and hypertension, especially in rural areas with long distances. This study also brought out some additional information which was not expected. This additional information was that this concept is well-suited for many other purposes which are reported here next. This system is very good in a context where the situation needs follow-up due to medication start or change. If the person for example manages to do lifestyle changes but the health values do not get any better than it might be a case where medication in needed. This ICT based system enabled intensive follow-up and feedback which can support decision making in these kinds of situations. This pilot also proved that the relationship between the patient and health care professional can be very intensive and close and that is why this system could help people with mental health problems. In some cases short daily contacts might override the weekly face-to-face visits by a health care professional.

The further step which is needed is that this system should be tested with a larger number of people and hopefully also in different countries. Especially this system is suitable in those countries where organizations are open-minded in regard of the working process and innovations. Chronic disease prevention and self-care management work could be done more and more by nurses, also in other countries than in Finland. The major issue here might be the power of reimbursement systems and the power of sickness funds in countries such as Germany. As long as the contacts and feedbacks which are done via ICT are unable of invoicing there will be barriers in the implementation of these ICT based systems in those systems and countries. The potential of ICT is possible to bring out the best in those situations where the costs of health care are allocated and the services are produced by the same organizations; then there will be strong incentives to use the scarce resources in the best way.

MOBILE MONITORING OF VITAL PARAMETERS: WORLD TENDENCIES AND CURRENT STATE OF IMPLEMENTATION OF MHEALTH PROJECTS WORLDWIDE AND IN RUSSIA

Oleg Medvedev[1], Maxim Yatskovskiy[1], Sergey Sedykh[2], Sergey Balandin[3]

The unprecedented spread of mobile technologies as well as advancements in their innovative application to address health priorities has evolved into a new field of eHealth, known as mHealth. According to the International Telecommunication Union there are now close to 5 billion mobile phone subscriptions in the world, with over 85% of the world's population now covered by a commercial wireless signal (1). Mobile patient monitoring requires diagnostic sensor technology, which is not yet available at the low costs that would make it accessible in developing countries. Since health data are transmitted via the telecommunication network, patients are required to have access to a mobile phone and/or wireless device, to which diagnostic sensors can easily connect (2). In regions where mobile patient monitoring initiatives have been implemented, delays in care may be resolved. The literature primarily reported patient monitoring studies for elderly individuals in high-income countries throughout the European and South-East Asia Regions (3). Caregivers are increasingly able to monitor the real-time status of vital signs of patients remotely, using a mobile phone, PDA, and/or computer. There are 14 million of people 70+ in Russia. Many of them are in need of constant monitoring of physical condition, care and psychological support. Now these people are taken care of by their younger relatives, but the relatives often have no time to be around and feel guilty. So, caregivers are interested in a tool for constant remote health monitoring of their elderly relatives. 20% or 2,76 million elderly people in Russia need constant care. According to our our analysis of the market about 250 000 caregivers can afford to buy the gadget ($200) and pay a monthly fee for the service ($20).

There are three main approaches for monitoring physiological parameters from the patient's home. First- includes monitor (sensor) of blood pressure, ECG or some other vital parameter and information transmitted from the monitor to the cellular phone of the patient via BlueTooth radio channel. Medical information from the mobile phone then transmitted to the care provider's Server or PC via Internet using SMS or GPRS. The advantage of using mobile phone for the health monitoring is in providing more freedom to the patient to move from one place to another. He/she could be monitored being anywhere -at home, at the country house or on abroad. The main problem for developers of the monitoring systems is based on the fact, that there are several

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operating systems for smartphone competing with each other on the world market. Among them Windows Phone 7, iOS, Symbian, MeeGo, Android, RIM Blackberry, WebOS, Linux. Market shares for different OS are not stable but fluctuating in time. The latest data from Gartner shows that Android share 43% of the market, Symbian – 22%, iOS-18% and RIM-12%. The existence of different operating systems on the market create big difficulties for the developers of software for m-health services because it is necessary to have programmers who have an experience with these OS. We try to overcome this problem through establishing cooperation with the groups of programmers from different Universities. This cooperation is organized under the umbrella of FRUCT (Finnish-Russian Universities Cooperation) [www.fruct.org]. Groups of programmers with experience in different operating systems for smartphones represent Universities of Petrozavodsk, Yaroslavl, St. Petersburg, Nizhny Novgorod, Moscow and Helsinki.

The second approach is based on the use of desktop gateways providing several types of wired (RS232, USB) and wireless (WiFi, Bluetooth, Ant+, ZigBee , NFC and others) channels for receiving information from wearable monitors. The advantage of such approach is in easy set-up of the system with monitors, manufactured by the different vendors. On the other hand the limiting factor of such system is monitoring of the health condition of the patient while at home. The mobility of such systems is very limited. The third approach is based on the usage of so-called "imbedded" monitors, i.e. containing GSM radio module for sending data to the server of the call-centre without use of a regular smartphones. In our project we used the first and the third approaches for monitoring vital parameters. We have developed the project for implementation of such system for the monitoring patients with cardio-vascular and endocrinological (mostly diabetes) diseases.

Figure 1. The typical architecture of the personalized patient monitoring

The architecture of such system includes the following elements (Figure. 1):

- set of measuring sensor devices and smartphone;
- software for the smartphone for receiving data from the monitor, to perform preliminary analysis and sending results to the server/
- software for the server part of the system, which collects and analyses the information received and providing access to these data;
- working places for physicians, providing care to the patient being monitored;
- module of interaction with the regional information systems of the Ministry of Public Health.

System is able to receive data of the personal monitoring of physiological and biochemical parameters like ECG, blood pressure (BP), glucose level in the blood. We used monitors manufactured by the AND Medical, Japan (BP monitors), Alive Technologies, Australia (ECG monitor with 3D movement sensor), BodyTel, Germany (Glucometer) and by Russian Altonica Company (ECG monitor). The primary purpose of the system is to monitor the health condition of the patients and to send alarm signal in case of appearance of life threatening abnormalities to the Emergency services. The system will help to provide high quality care to patients at home that will unload the hospitals . The system will be tested till the end of 2012 and in case of getting positive results could be recommended for implementation in the Russian Federation.

Figure 2. Okkolo is a bracelet controlling user's health condition. It will inform a caregiver automatically and immediately on user's health change: pulse rate, temperature, falls

Additional system, that is under development now, will use wrist watches with the number of sensors (heart rate, 3D accelerometer, temperature) and GSM radio with speakerphone to connect the patient to the call centre (Fig. 2). Russia is still a beginner in the area of patient monitoring. First important steps forward were made in the year 2011, when Ministry of Public Health and Social Development of Russia have approved the Concept of Informatization of the HealthCare (4). "Systems of the remote health monitoring of the different groups of patients" were mentioned officially and their role was determined in the state controlled health care. In the next couple of years we expect the results of the first pilot projects in Russia supported both by the Ministry of Public Health and by Private Business.

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BEYOND SILOS - BETTER AND MORE EFFICIENT CARE THROUGH ICT-ENABLED INTEGRATION OF SOCIAL CARE AND HEALTHCARE SERVICES

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Abstract

The potential benefits ICT-supported integrated care can bring are increasingly recognised in many countries in Europe. Disadvantages of closed silo service provision have been widely recognised at the policy level and steps taken to introduce for example cooperative structures, including third sector and citizens groups, and shared budgets. In practice however, real-life examples of integrated eCare service are slow in emerging. The paper presents a successful approach to service implementation of integrated eCare services and describes evaluation results from four pilots of integrated eCare services in Europe.

1. Introduction

Possible needs of older people are as diverse as the target group itself and there is often a demand for both social care and healthcare services, particularly when it comes to people with chronic conditions. Further to this a better alignment of formal and informal care services across the boundaries of social care and health care promises improved outcomes for patients, better service quality and increased efficiency of service delivery. Potentially this can be to the benefit of all: beginning with older people in need of care and their family and friends, and including care professionals, service provider organisations, payers and other governance bodies.

However, although single examples emerge, ICT-supported integrated social and health care is still very much at a concept stage and there remains much to be learned how it can be made a reality. One of the main reasons for this can be seen in the challenges arising in ICT implementation when it comes to creating workable service processes and viable business models. What seems to be required in order to reach the market and to make integrated eCare a reality is an approach to service implementation that takes these challenges into account and addresses them in a way that creates positive outcomes for all stakeholders involved. We have developed such an approach that we have so far applied to two European projects, INDEPENDENT and CommonWell. Both projects focus on better joining-up of formal social/healthcare services & strengthening participation of the "third sector" and conduct pilots of ICT-supported integrated care services in 9 sites across Europe. Through innovative usage

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of ICT, current "silos" in service delivery are broken up to allow for cooperation across relevant care sectors and participation of family members.

2. Methods

A dedicated programme of service process innovation complemented by adaptation of technology is pursued in order to develop an integrated digital support infrastructure that is interoperable and open thus facilitating the inclusion of new services or new partners:

- Using existing technology to provide as many older people as possible with digital access to support services they need
- Augmenting and opening sectorial care platforms to enable coordinated cross-sector support
- Adopting a clearly demand-driven inclusive approach and avoiding technology 'push'.

Potential end user groups are involved at several stages prior to the pilot phase:

Requirements elicitation: The service development process starts with the identification of key demands in relation to provision of integrated social care and healthcare services at the pilot sites involved. The demands are explored in focus groups and individual interviews with potential end users of the envisaged service.

User case and service process model development, including technical feasibility checks. Based on the requirements identified in the focus groups, use cases (i.e. textual descriptions of the services to be developed, presented in a user-centred, story-like format) are drawn up in two iterative steps. In parallel, service process models (i.e. formal descriptions of the services, presented in a flow chart format) are developed and also checked for their technical feasibility.

Prototype (mock-up) development: The second versions of the use cases and the service process models are used to develop a first prototype (in the form of a mock-up) to be used in a first test with potential end-users of the service. The methodology used for prototype v.1 tests requires each of the participating pilot sites to build a prototype that is pertinent to the scenarios that map to the agreed use cases, and also that can be easily presented to the target groups (typically clinicians and service providers) so that the technology partners can be assured that the direction of proposed development is broadly correct in advance of serious development efforts.

Prototype testing with end users: On the basis of the mock-ups, a first round of tests with end-users is conducted and their feedback on the adapted processes and the prototypes is sought. The methodology for this prototype v.2 testing consists of conducting individual interviews with all users who will use the system. Methods involve task execution and thinking aloud, a detailed walk-through and the completion of a questionnaire. The objective is to find out about the system's functionality, usability and design aspects, intuitiveness and interaction between the user and the system.

Service specification (in two iterative steps): After these tests, the use cases and service process models are finalised and feed into service specification. A first version of the new services is implemented in a testing environment and a second round of professional end-user tests is carried out. Test outcomes help to finalise the service specifications that are subsequently used to develop the architecture and feed into the pilot implementation and testing in the framework of the pilots.

Wider deployment of the services is supported by a dedicated programme of socio-economic service evaluation and a business case modelling approach building on cost-benefit analysis covering the service development and implementation activities as well as the pilots and modelling the further deployment of services. Evaluation of telecare/telehealth and/or integrated care interventions is best served by multi-perspective and multi-method approaches, and such an approach was applied in INDEPENDENT and CommonWell. The evaluation approach of the 12-months pilots involves multi-stakeholder perspectives and data gathering, including end-users, service provider and organisational perspectives. Triangulation is used to cross-reference data from the different sources in order to maximise the reliability and robustness of the conclusions drawn from the evaluations. The designs employed in each pilot site are as robust as possible within the constraints of the realities of the 'interventions' and available resources in each case. Core evaluation dimensions addressed are client/carer level impact, service staff impact, organisational impact, technology, integration, implementation process and a global assessment.

A *business case modelling* approach is used to support the creation of viable business models. Business case modelling is in this context understood as an analytic process following different stages in the deployment cycle of a service, from requirements analysis to service implementation. The main purpose is to inform the deployment cycle as far as requirements from the business side are concerned and to ensure that these requirements are met to the greatest possible extent. This includes the analysis of service costs and benefits to different actors, the consideration of financing means and the re-modelling of the service concept to ensure economic viability. In methodological regard the approach is built around a cost-benefit analysis (CBA) that was chosen over alternative approaches because it allows adopting a multi-stakeholder perspective, i.e. costs and benefits can be analysed separately for different actors. This is of particular advantage in the fragmented environment met with in integrated care service provision, where many different actors are involved, whose costs and benefits need to be balanced individually to achieve a viable and sustainable service model.

3. Results

The evaluation of the CommonWell pilots showed that integrated eCare service can bring about tangible benefits to all involved. Foremost, there are positive impacts on older people, including those with chronic conditions, and their relations with caring responsibility. But also social and health care professionals as well as service providers can benefit from integrated services.

3.1 Impacts on service users

In CommonWell service users were asked what they thought of the service they had received and how they felt it had benefited them. Overall, service users were very happy with the CommonWell integrated eCare services they received. They identified a number of benefits as being especially important to them:

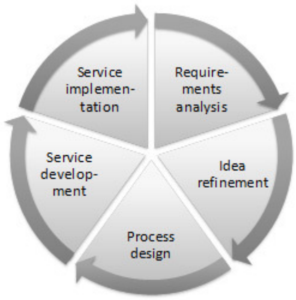
- A sense of reassurance
- A sense of security and safety
- Feeling looked after
- Having someone at the other end of the phone who can help
- Reduced stress
- Increased confidence in managing their condition
- Better support in critical situations

3.2 Impacts on care professionals

CommonWell has evaluated the impacts of integrated eCare services on health and social care professionals. Staff were positive about how CommonWell services had affected their ability to do their job. The main benefits they identified were amongst others improvements in management and planning of the care process, improvements in understanding of complex processes such as admission and discharge planning, increased speed and efficiency and better targeting of interventions. Furthermore, an increase of job satisfaction was observed at all CommonWell pilot sites. The CommonWell introduction has led to more efficient service delivery. Several processes and tasks were simplified and automated. The care professionals taking part were better informed about their clients, with the result that health changes and critical situations were detected at an early stage.

4. Discussion/conclusions

Results from the evaluation of the pilots reveal that there is not one single model of integrated eCare. In CommonWell for example, all services piloted were implemented in the framework of established processes and systems of care delivery, service administration and management, many of which were not supported by means of ICT. As described above, the project used an iterative process of service design and implementation that built on existing processes and technology infrastructures, and also ensured acceptance and support by staff members and end-users as much as possible. This approach was built to address the peculiarities of the eCare domain in terms of framework conditions, stakeholders involved, funding and reimbursement and other factors as they existed at the time of pilot implementation. The approach is conceived as a cycle rather than a linear series of steps, emphasizing that development is a continuous rather than a finite activity and also that it is iterative and relying on information going back and forth between the different phases. In a similar way, the phases are also not finite within the cycle but ongoing or rather recurring with varying intensity and overlapping to various degrees. The deployment cycle is graphically depicted in the figure below.



This approach allowed the persons in charge of CommonWell at each site to reflect upon how care was being delivered up to the project start, to identify problems or barriers that either already existed in the old services or that might emerge when integration would be attempted. On the basis of this reflection, ways could then be found to overcome these problems. A key role in this was played by an intensive exchange between all stakeholders involved, particularly those responsible for the technology on the one hand and the care professionals on the other hand. That the social and health carers who would eventually have to work with CommonWell played a strong role in the design of the service processes proofed very valuable later on in the implementation and piloting of the services.

This way, CommonWell has revealed practice-proven examples of the benefits that can be achieved through ICT-enabled integration, developed and deployed under the existing framework conditions set by social care and healthcare systems in different European countries. Further pilots on ICT-supported integrated care are currently conducted within the framework of INDEPENDENT.

From a point-of-view of policy makers it seems to us that, on the one hand, there would be value in better understanding how successful socio-technical integration of eCare within day-to day care practice can be achieved on a wider scale, with a view to learning from examples of successfully deployed integrated eCare solutions other than CommonWell or INDEPENDENT particularly in terms of:

- how they are aligned to the underlying social and health care processes,
- how this alignment was achieved at the time the service was set up,
- what concrete steps and measures were used, and
- what the costs and benefits of socio-technical integration were from the perspective of all stakeholders involved in the value chain.

On the other hand it would seem beneficial to promote existing examples of successful socio-technical integration as well as the overall approach among policy makers, service providers and IT manufacturers.

In more concrete terms we think that, service providers and the IT industry could benefit from synthesised guidance on what socio-technical innovation can mean in practice and how such a concept might best be applied in the development and implementation of integrated eCare services. Such synthesised guidance would need to be effectively communicated to the stakeholders, e.g. through an online forum. Ideally stakeholders would be involved in such a forum from a very early stage on to allow them to formulate their needs and to define what they can contribute. Also adequate levels of resources should be foreseen for the operation of the forum over a longer period of time. The latter is deemed necessary particularly with a view to achieving sustainability, since past experience has shown that the continued operation of such a forum without adequate resource backing is unlikely to succeed.

There might also be value in creating incentives that promote socio-technical integration of eCare through the inclusion of respective requirements in relevant EU project funding schemes such as the CIP and AAL programme.

CAREBOX: A COMPLETE TV-BASED SOLUTION FOR REMOTE PATIENT MONITORING AND CARE

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Abstract

Influent voices from different areas like government and insurance companies already realized the savings that could be done with remote health monitoring and assistance systems. The TV is still the technology that older adults feel more comfortable with, and therefore we present CareBox, a new prototype that perfectly integrates with TV viewing experience and uses this almost ubiquitous mean to provide some features that they really feel the need in their daily lives: health agenda, medication intake and vital sign measurement scheduling and alerts, vital sign monitoring, videoconference with doctors and other features that may be also useful for doctors like support for medical questionnaires and health videos.

1. Introduction

Isolation (either physical or social) has been a social weapon that is inevitably lowering the results of any care service. Shortening the distance between the patient and the care takers definitely improves these results. Remote patient monitoring systems have been around for many years and are seen as a solution to reduce the costs for health care, which are still rising due to the increasing of life expectancy [1], but only few had been effectively working in the real world. One of the biggest barriers in a wide adoption of this kind of technologies is that they usually are too proprietary and lack interoperability. Assuming that older people is its main target, overcoming the technological barrier they reveal when asked to use unusual devices is one of the main challenges the scientific community is facing. *CareBox* was thought-out and designed with all these issues in mind. It aims at using standard technology to provide a full-featured and easy-to-use TV-based remote patient monitoring service, focusing on using interoperability standards to allow its adoption by many stakeholders. It is a result that came out from the eCAALYX European research project funded by the European Commission under the AAL Joint Programme Initiative.

2. System Design

Providing a modular architecture to *CareBox* means not only there was the care to decouple the presentation layer from the logical layer, but also to decouple the communications layer from the logical layer. Also, there was the focus on using free, open and standardized technologies and protocols to promote the use of the system in

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every use case. *CareBox* was developed to be running on a Nvidia ION-based Mini-PC (
Figure1), using a modified version of the OpenELEC distribution, which targets at providing a complete XBMC media centre with minimum software requirements, complemented by a Firefox web browser for generic use. Having complete control over the Linux operating system allows us to provide support for several hardware components, namely peripherals used in the system: dongles for vital-sign sensors, webcams, remote controls, etc. Most of the implementation was done using the scripting and skinning capabilities that XBMC media center provides to develop plugins using the Python programming language. The set-top box is one of the patient's portals to the system. It was completely designed to fit any environment and use any electronic medical record system and not be limited to eCAALYX's requirements. This will certainly lead to the development and integration of new and innovative features.

Figure 1. CareBox

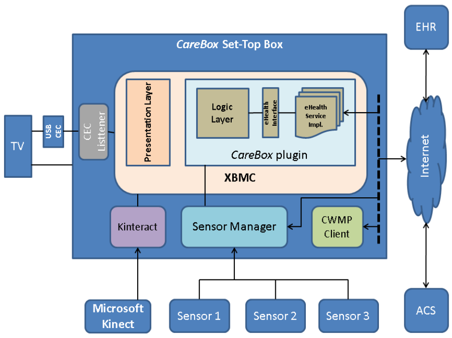

Figure 2. CareBox architecture

CareBox strongly focus on interoperability. The modular design regarding the communications layer allows the system to support different protocols and communication schemas and technologies, being quite easy to switch from one module to another and to implement new ones.

Currently, and since the system was developed under the support of the eCAALYX [2] project, only the implementation for the protocol used by the care server developed in the project is available, as well as an early, but quite usable, implementation for the eHealthCom [3] server. Nevertheless, implementations for subsets of the ASTM-CCR and HL7-CCD specifications are underway. These implementations will explore all the possibilities of using the standards for every feature available. In case that is not possible, extensions to the standards will be used.

The management of the system can be done remotely since *CareBox* provides an expandable CWMP (TR-069) client that allows not only remote configuration but also remote firmware upgrade through the use of an Auto-Configuration Server (ACS).
Bluetooth technology is used to communicate with the supported vital sign sensors.

3. Technical Details

3.1 General Considerations

CareBox firmware image features a small footprint (slightly more than 120 MB, plus 100 MB if compiled with support for Microsoft Kinect) and a quite short cold boot time (nearly 20-30 seconds on a USB pen), although it supports a standby mode. The system was properly set up in order to include several libraries and frameworks needed for some *CareBox* features. It can use either Ethernet or Wi-Fi to access the Internet and comes with an RF remote control that allows a simple operation of the set-top box. This remote is also programmable so that it can also control the TV set through InfraRed.

3.2 Multi-User Support

CareBox was also designed to have multi-user support. Depending on the protocol and caretaker server, the configuration can hold data for more than one user, to be used in scenarios where *CareBox* is shared by multiple users in the same location. Two login mechanisms are available: one is having a simple user selection interface, without any authentication method. This is the simpler to deploy, although it may raise privacy issues. The second mechanism came to address these issues and uses a fingerprint sensor connected to the STB (via USB) (
Figure1). Right after validating a fingerprint, the user is automatically logged in and may be logged out manually or by idle timeout.

3.3 User Interface

Regarding the graphical user interface, a lot of care was taken in this matter. It must be emphasized that the system was primarily designed to be used by elderly people, as it was a main requirement of the eCAALYX project, and the current minimalist design is based on the work made by [4] and [5]. The output of this work came from some tests made with real people using low-fidelity prototypes and mock-ups.

Figure 3. Reminders Interface (Google TV)

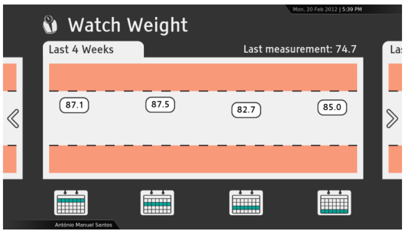

Figure 4. Weight graphics

3.4 Agenda and Reminders

In order to help the patients in their schedules, a useful medical agenda was developed to ease the tracking of their medication, vital sign measurements and appointments. To raise the usefulness of the system, a reminders system was developed and uses the TV to warn the patient for upcoming events (Figure 3). It uses time frames based on patient's daily routine: Wake-up time, Breakfast, Lunch, Dinner and Bed time. This information, alongside last intake time, allows for a quite effective reminders system, alerting the patient for medication at the right time. *CareBox* holds medication information based on common parameters used in standards like ASTM-CCR or HL7. Specifically, medication frequency is based on what SNOMED CT defines.

3.5 Vital Sign Monitoring

Another main feature of *CareBox* is the ability to read vital sign measurements from some sensors and provide the patient with graphics that represent the evolution of some measured vital signs. The patient can select from within different time frames for each vital sign. All the measurements are grouped in time blocks and all the measurements taken within that time block are processed in order to have a mean value that will be shown on the graphic (Figure 4). While this is straightforward regarding weight, things are a bit trickier in what it takes to blood pressure, since there's no explicit separation of systolic and diastolic graphics. In this case, the mean arterial pressure calculation (*MAP*) is used, based on the values of the diastolic pressure (*DP*) and systolic pressure (*SP*) (1).

$$MAP \cong \frac{2}{3}(DP) + \frac{1}{3(SP)} \qquad (1)$$

CareBox also supports vital sign thresholds per patient, represented as red areas at the top and at the bottom of the graphics.

3.6 Questionnaires

Medical questionnaires are a useful tool for the doctors to retrieve medical data from the patients. Functional Impairment (Barthel Index) or Geriatric Depression Scale questionnaires are common examples in the context of treatments of elderly people with chronic conditions. Although most of them are designed in order to have questions of dichotomous nature, the system supports any number of questions with any number of possible answers.

3.7 Health Videos

Another topic that isn't being vastly explored by this kind of systems is the possibility of using them also for pedagogic purposes. Allowing the patient to watch videos related to their condition, or just providing generic health-related videos (daily exercises, how to use a sensor, etc.) is of utmost importance. Therefore, and exploring the fact of having the system developed on top of a media center framework, *CareBox* easily provides this feature, supporting almost every video and audio format (Figure 5).

3.8 Videoconference and Emergency Call

A patient will feel much more safe and confident if he knows that he can establish a visual communication with his doctor (or even with his own family) in a quite easy way, anywhere, anytime. As for the doctor, he will certainly be pleased to be able to video-call

Figure 5. Health Video playing

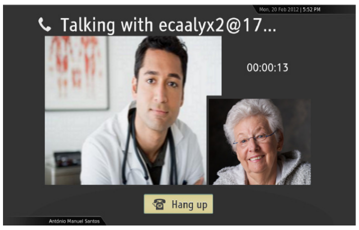

Figure 69. A running video call

his patients anywhere, using common technology like, for instance, his own smartphone. Therefore, *CareBox* provides an integrated SIP VoIP client that can be used to start or receive audio/video calls with/from doctors, as long as the needed configuration parameters are provided (Figure 6). *CareBox* is provided with a webcam (it includes the microphone) but it should support any webcam compliant with the UVC specification and supported by the Video4Linux 2 drivers. *CareBox* also offers an Emergency Call service, which basically uses the VoIP client to make an audio call to a pre-defined contact.

3.9 TV Integration

CareBox is provided as a set-top box that simply connects to an available input on the TV. Although it supports analog connection through VGA output (it provides an adapter for SCART/S-Video connection), *CareBox* also provides a digital HDMI output (for both video and audio) and explores some unused capabilities of this type of connection. The HDMI-CEC standard allows a device to be able to control others through an HDMI connection. *CareBox* partially supports the HDMI-CEC standard through the use of an USB-CEC adapter, allowing the patient to be notified of a medication reminder or of a new call from the doctor while watching his favorite TV shows. He can even control the *CareBox* with the TV remote control.

3.10 Google TV Port

With the recent developments on Google TV, a clear window of opportunity has opened in what it takes to developing applications for the TV. The video overlaying ability is clearly an added value in this system, allowing notifications on top of the TV image. Therefore, *CareBox* also has a port for Google TV, which can be later distributed as an application through Google Play. This port is almost fully functional, when compared with the current features of the standalone version, only missing the support for taking measurements and a VoIP client due to limitations on the support to USB peripherals, including webcams.

3.11 Microsoft Kinect support

Foreseeing the need to promote body activity, *CareBox* has provided the support for Microsoft Kinect through the integration of the OpenNI/NITE middleware stack and the development of a natural interaction driver, Kinteract [6], that detects some common hand movements (directions, wave, push, backward, etc.) and maps them into pre-configured standard keyboard events, which are then sent into the Linux user level input subsystem (*uinput*).

4. Results

The eCAALYX project comprised two phases of field trials with 10 patients. In the first phase, a limited set of features was tested, focusing the tests more on usability and stability. The results were not as positive as expected [7], mainly due to confusing navigation and a defective remote control. Nevertheless, the patients were able to work with the STB after minor training and no major issues were detected. The second phase of the trials took place in March and April 2012, and already included a larger set of features, except again for the Videoconference/Emergency Call. The patients immediately noticed an increase on the usability and the overall results were much more positive. The set of considerations and recommendations include: the remote control should be more tailored for this scenario, with only the necessary buttons; shorter loading times (this was due to severe connection issues to the Caretaker Server); immediate visualization of the measurement value on the TV after using a sensor (not an issue anymore since the STB can now act as sensor gateway); learning curve still too steep. Massive field trials, with 80-100 patients, will be taken in different countries in the already running CAALYX-MV [8] project. Also, Fraunhofer Portugal AICOS has recently made another round of internal tests with ten older adults in order to validate the implementation of the user interface and collect feedback in order to improve it. The results of the tests [9] showed that the overall user interface layout is now appropriate, although some interesting findings and recommendations were provided and are already implemented.

5. Conclusions and Future Work

CareBox tries to gather all import features into a single product that can be easily distributed and managed. Currently, and despite still being under heavy development, there are already some foreseen features being implemented like expanding the support to medical information standards (HL7 and ASTM-CCR) and extending the support to sensors using technologies like ANT+, Zigbee or Z-Wave. A first version for Raspberry Pi is also almost finished, which will dramatically lower the cost of the solution. New features are also in the pipeline: promote user mobility with movement games using Kinect, support for the visualization of more vital signs, including physical activity data, and adding new services like, for instance, home automation using recent standards like OpenURC. Last but not least, the development of a simplified interface for smartphones could also be of major importance, allowing the user to interact with the system (for instance, acknowledging medication reminders, making/receiving calls, etc.).

Acknowledgements

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INTELLIGENT RECOMMENDATION SERVICE FOR APPROPRIATE NUTRITIONAL AND PHYSICAL BEHAVIOR OF ELDERLY

Lucas Paletta[1], Walter Scheitz[2], Bernd Maierhofer[3], Gerald Fritz[1], Andreas Behmel[2], Susanne Maunz[2], Patrick Luley[1]

Abstract

Ageing affects nutrition as well as lifestyle: adequate nutrition becomes increasingly difficult with increasing age, whereas physical activity usually decreases. Nutrition and lifestyle, however, are important determinants of health and outcome in the elderly. Appropriate nutritional behavior of the elderly requires prevention of malnutrition, dietetic treatment of age typical insufficiencies, obesity and ensuring the quality of life with enduring vitality. In this work we present how a motivational component is added to a standardized prototype for nutrition and activity monitoring. The component is implemented in terms of an intelligent recommendation service that is capable to respond in real time to inappropriate choices of food or activities. Within the Austrian AAL research project DIAFIT, we focus on the proper positioning of recommendations in order to optimize recipes according to individual food preferences. DIAFIT includes the mounting of an intelligent multisensory user interface within the elderly kitchen, together with the functionality of an intelligent nutrition assistant that operates through recommendations in feedback to food and recipes choices and on the basis of a current nutritional status.

1. Introduction

Ageing affects nutrition as well as lifestyle: adequate nutrition becomes increasingly difficult with increasing age, whereas physical activity usually decreases. Nutrition and lifestyle, however, are important determinants of health and outcome in the elderly. Appropriate nutritional behavior of the elderly requires prevention of malnutrition, dietetic treatment of age typical insufficiencies, obesity and ensuring the quality of life with enduring vitality. Only a continuous monitoring of nutritional and physical behavior enables to prevent from dietetic deficits such as metabolic diseases that would arise from long-term malpractice. Furthermore, autonomous ageing within the old adults' home crucially depends on the capability to prepare food and engage into daily activities independently or supported by informal carers. Until now, technical solutions have focused on providing detailed nutritional planning and guidance without the

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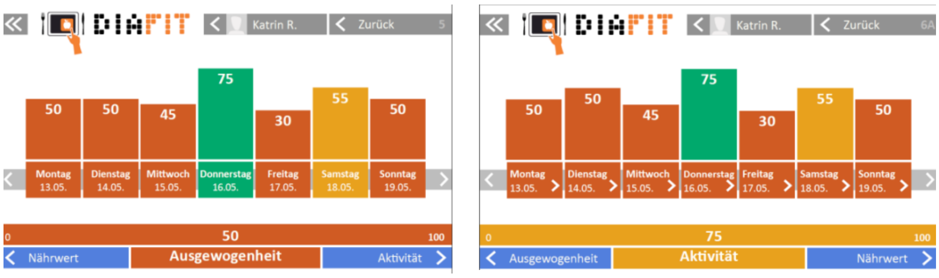
flexibility to adjust to personal preferences and availability of food. End users have been rejecting standard type dietary guides for decades because they prefer to use their own instead of unknown recipes, they prefer to vary food preparation instead of strictly obeying to static menu plans. From extensive usability studies we conclude that the consideration of individual habits and the capability to flexibly react to any nutritional situation are crucial factors for any service that would propose alternatives to daily malpractice.

Within the national project DIAFIT, we focus on the proper positioning of recommendations in order to optimize recipes according to individual food preferences. DIAFIT includes the mounting of an intelligent multisensory user interface within the elderly kitchen, together with the functionality of an intelligent nutrition assistant that operates through recommendations in feedback to food and recipes choices and on the basis of a current nutritional status. The intelligence of the system component will decide - in coordination with the individual dietary habits and the short-, medium- and long-term nutritional status - on time, type and scaling of food and recipes in terms of recommendations for the regulation of a healthy diet. To support the usability of the user terminal, it includes a personal cookbook for the storage and retrieval of own and region typical recipes.

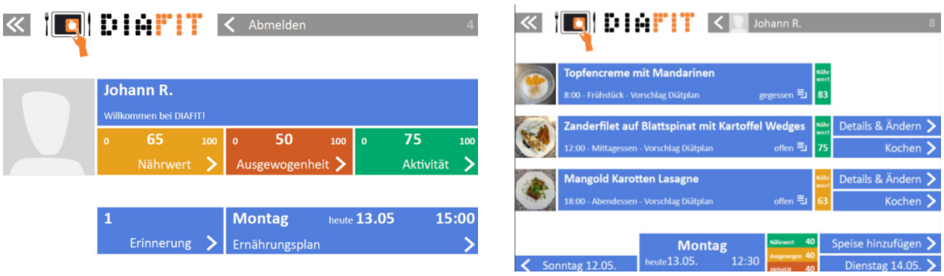
(a) **(b)**

Figure 1. The DIAFIT terminal is considered (a) to support the elderly where the nutrition is prepared, i.e., within the kitchen. (b) The first DIAFIT prototype is produced with interactive screen, camera and corresponding (rectangular) area of interest to recognize food.



(a) **(b)**

Figure 2. User interface with traffic light based, intuitive reflection of the nutritional and activity based status of the elderly in the context of a single, most recent time interval of one week. (a) The nutritional status in the context of nutritional equilibrium; the bars reflect qualitative and qualitative (number between 0 and 100) evaluation of the current status. (b) Activities are as well reflected with respect to traffic light oriented color design.



(a) **(b)**

Figure 3. (a) Recommendations for the overall evaluation of the nutritional and physical user status and (b) evaluation of individual recipes in the context of nutritional benefit to the end user.

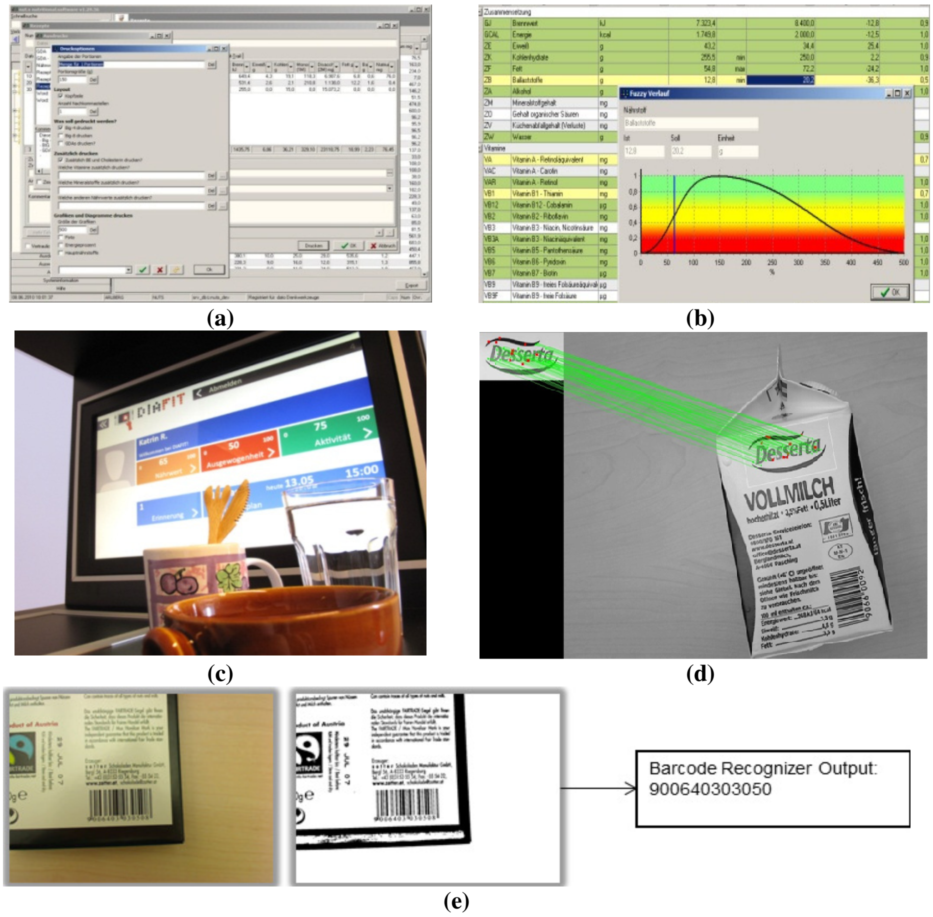


Figure 4. AI based recommender engine and multisensory interaction functionalities supporting the intuitiveness of the human computer interface. (a) Interface of the Austrian company dato reflecting the complexity of the nutrition status interface (more than 125 nutrition facts per food item). (b) Nutrition limits are not checked with crisp values but instead by using AI, i.e., Fuzzy Logic for a more smooth and natural interpretation of nutritional behavior. (c) DIAFIT prototype with central information interface. (d) brand based recognition of food package for a better usability of nutrition monitoring. (e) Barcode reader and resulting correct classification of barcode oriented food classification.

2. Innovation

The key innovation of the DIAFIT prototype lies in the cooperative approach including (i) an Artificial Intelligence based approach to define meaningful nutrition conditions for elderly and in (ii) the appropriation of the corrective recommender through a traffic light color oriented, consistently designed interface. The multisensory interface assists in preparing a convincingly natural interface.

3. Methods

The R&D prototype of the multisensory data input system enables a user-friendly aggregation of food nutrition data, using image based object recognition and barcode recognition. The weight of the food is estimated by an all-over synchronized digital scale. Food recognition by means of computer vision methods today represents an active area of research and thus an intuitive service application for dietary monitoring. For example, in order to understand well nutritional content as well as calories estimation, it appears appropriate to view food recognition in the frame of visual object recognition where the object has to be presented dominantly within the image or the object content has been segmented for further classification before. [2] presented a“wearable system” for the monitoring of calories on the basis of color, texture, geometry and shape features that were combined for a successful image analysis using a neural network. [3] presented a system for the recognition of fast food, being based on simple computational models for color recognition and a priori knowledge on the classification of segmented data (bread, ham). [4] addressed „soft labels“ to individual pixels and generated multi-dimensional histogram features who describe simple relationships that are successfully classified by Support Vector Machine networks. Using this method, the authors were able to classify 61 food categories each with 7 sub-categories.

Our methodology uses SURF features [5] with k-nearest neighbor classification for food recognition. The method then compares features with those stored within a food feature representation database. At the same time, the image is scanned for barcode patterns (Figure 4e). Currently, the food recognition is appearance based and enables to recognize 40 food categories and practically any barcode. Required is a 2 MPixel web camera, currently we operate with a 6% error rate, however, the system only reacts to highly confident (more than 95% confidence estimate) visual patterns and the user is presented only meaningful output of the intuitive food interface.

The recommender system is applied in order to optimize the proposed recipes in the direction of individual as well as for generically appropriate nutrition behavior. The R&D prototype of the multisensory input component enables a very motivating assistance function, in connection with the recommender system. New recipes can be collected in a very intuitive way, and the recommender functionality can directly feedback with a proposal for an alternative food input.

4. Conclusion

DIAFIT recognizes the need to motivate old adults to engage themselves in occupations, physical daily activities that guarantee well-being. DIAFIT’s mission to improve the quality of life translates into R&D that aims to motivate and monitor physical, mental and social well-being, and that contributes to reducing the societal burden of disease. Ultimately, older adults will take profound advantage of making well-informed choices, consume nutritious foods and live healthier lives. The described multisensory interface and intelligent recommendation service enables a very intuitive editing of recipes and a natural monitoring of the nutritional status, in particular in the frame of the recommender system. Next steps are made towards enlargening the food database to N > 1.000 and in the integration of nutrition and activity based status for a personalized recommendation system.

Acknowledgments

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SERVANDO PLATFORM: AN OPEN ARCHITECTURE FOR THE COMPREHENSIVE FOLLOW-UP OF PATIENTS AT HOME

T. Teijeiro[1], A. Piñeiro, P. Félix, J. Presedo

In recent years, the sustainable resource management of public health systems in modern welfare states is threatened by a number of factors. These are, amongst others, the ongoing population aging, the ensuing increased prevalence of chronic conditions, the care activity oriented to the punctual treatment of the acute phase of the disease, and the recent economic crisis, opening a debate about the need for a new health care management model with the essential objective of improving the quality of life. Integral and preventive care, along with the assisted self-management of the chronic disease should be the main features of this new model, in which health care must distribute and show a seamless continuity across a set of different care scenarios. Information and Communications Technology (ICT), through notions like telemedicine, telecare or telehealth, has the potential to provide low-cost solutions for this new health care model, in order to move some of the medical care out of the clinical setting.

We find an extensive scientific bibliography showing a wide variety of application proposals and even some specialized scientific journals covering a wide spectrum of related topics. These are moving the emphasis from a technology-centered perspective to the real impact on health quality, cost-effectiveness and access to health care. Nevertheless, a certain sort of sprawl is perceived, as there has been a heterogeneous proliferation of ad-hoc initiatives, technologies and systems, most of the times focusing on a single disease or pathology, and it is being recognized as one of the major factors hindering the widespread adoption of telehealth [2].

The SERVANDO platform [3] develops a set of configurable medical services at home through the definition and implementation of follow-up protocols, that is, an adaption of the notion of clinical practice guidelines to the scope of home supervision. We propose a mechanism for generating a follow-up agenda from a follow-up protocol, and for a scheduled execution of the medical actions described in that agenda, providing flexibility to the patient to avoid drastic changes in their lifestyles. The agenda and the scheduler that manages it are integrated in a distributed architecture that develops its functionality through an extensible set of services.

Figure 1 shows the architecture designed to support the protocolized home supervision. At hardware level SERVANDO is distributed into two kinds of systems: (1) a central information system, located at the medical center, which coordinates the home supervision of the patients, manages communications, stores the information

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relative to each patient, and permits the visualization of the generated alarms during the supervision and the corresponding physiological parameters; and (2) a mobile follow-up device used by the patient at home, connected via Internet with the information system, and responsible for the execution of the corresponding follow-up protocol through the implementation of its follow-up agenda. As follow-up devices we have used smartphones, due to their ubiquitous nature and considerable computing capabilities they have reached in recent years, but it would be possible to use any device with Internet connection and computing capabilities, like tablet PCs, notebooks, etc. Following we shall outline the architecture components that make possible the supervision of the patient.

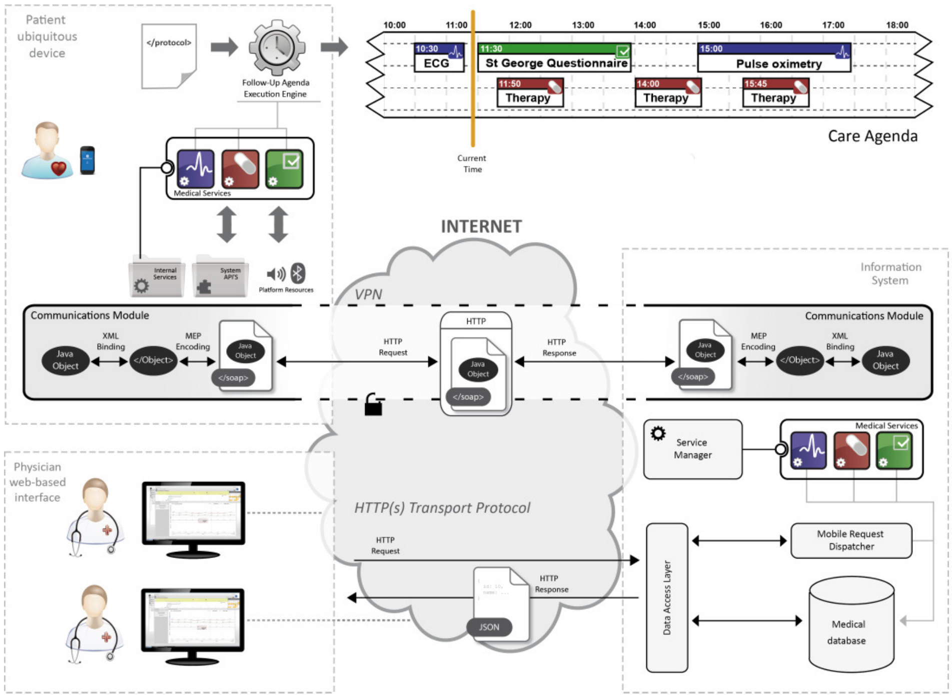

Figure 1. SERVANDO Architecture

1. Follow-up agenda execution engine

This component is responsible for the following tasks:

- Obtain a representation of the follow-up agenda for the patient under supervision from the follow-up protocol designed at the medical center, that is, the ordered temporal sequence of medical actions that should be performed. A time representation based on the STP formalism [1] has been developed, which allows the medical staff to define a temporal interval for the achievement of each medical action in a formal and flexible way.

- Schedule the execution of medical actions and manage the conflicts that can appear if different medical actions simultaneously request the same resource.
- Invoke the medical service responsible for providing the execution logic of each medical action for starting and finishing their different instances.

2. Medical services

Medical services constitute the extensibility model of SERVANDO. They are distributed software entities responsible for providing the execution logic of the medical actions that form the follow-up agenda. These entities can be dynamically added or removed from the platform, which enables SERVANDO to be adapted to different supervision scenarios. An example of a medical service is the monitoring service, responsible for obtaining and processing physiological signals from the patient. The designed architecture proposes an inversion of control model, according to which the platform manages the main execution flow (including starting and stopping the platform, network and system state control, etc.), while it delegates all tasks related to the execution of medical actions to medical services. At the moment, the following medical services were developed to be executed within SERVANDO:

- *Monitoring Service*: Its function is to manage the dialog between the platform and a set of sensors responsible for the acquisition of biosignals, which will be processed in order to find relevant events in the course of the patient's disease. This service provides actions related to the instant measurement of physiological parameters like blood pressure, height, temperature or peak expiratory flow; and continuous signal monitoring and processing, currently supporting ECG and pulse oximetry signals, featuring intelligent processing algorithms to identify relevant events such as ischemia episodes, arrhythmias, or apnea episodes, among others.
- *Questionnaire Service*: This service has been designed for the presentation and processing of questionnaires that will be filled out as forms via the mobile device screen. Some interesting general purpose questionnaires are quality of life tests, such as the Medical Outcomes Study Short Form-36 (SF36) test or, in the context of COPD patients supervision, the St George Respiratory Questionnaire (SGRQ). This service also allows the patient to record and communicate symptoms during the application of the protocol.
- *Therapy Service*: Is the responsible for the management of the therapy prescribed to the patient, through simple notifications of drugs and doses, with visual information to make easier the proper identification of the specific drugs and other helpful information presented in a suitable form to patients with visual difficulties.

3. Communications module

This component has been designed to support any communication scenario that may appear in the context of remote supervision, including continuous transmission of physiological signals, instant communication of symptoms, periodical transmissions or on-demand communications. In our approach, we have opted to offer a flexible mechanism of message exchange in which each service will be able to send or receive any kind of message that adheres to an object-oriented design. Transmissions can be performed according to a set of provided message exchange patterns (MEP), including synchronous and asynchronous send, or send/receive. Mobile devices can also act as servers, attending remote requests and therefore supporting bidirectional communications between patients and physicians.

Since the information handled by SERVANDO has a particularly sensitive nature, data security and privacy are key aspects of the architecture. For this reason, all data transmissions are encrypted using standard technologies, by implementing a Virtual Private Network (VPN) between the mobile devices and the central information systems, and using the HTTPs protocol to show information to the physicians. In addition, all data stored in SERVANDO is anonymized, so the patient is identified in all communications by the serial number of the monitoring unit that is being used. This serial number is associated with the electronic health record at the information system that is based at the health care authority facility, this being the only system capable of resolving such relationship. By this way, if the information system is on a secure network, security is guaranteed.

4. Web visualization tool

At the hospital endpoint, the medical staff will be able to check in real time or off-line any information it considers relevant for the follow-up process. Through a event oriented Web-based solution, the physician will receive regular summaries and alerts at different temporal granularity levels of what happened at home, allowing the modification or amending of the subsequent programmed actions. Besides summaries and alerts, this solution also allows to consult all the information acquired by the system, and includes a full-featured signal viewer which allow measurements at low level on the ECG or pulse oximetry signals.

SERVANDO provides solutions for multiple supervision scenarios and types of patients: from the monitoring of chronic patients to the simple inculcation of healthy lifestyle habits to sedentary or overweight people. With the aim of creating an open and leading telehealth platform, the full source code and the project documentation has been made available to the community as an Android-based open-source project (http://proxectos.citius.usc.es/servando).

To validate the viability and capabilities of SERVANDO, we deployed it in a real supervised scenario of 18 COPD patients enrolled in a home supervision program. As a result, we found that after one year there were significant improvements in Saint George's Respiratory Questionnaire (SGRQ) and Short Form 36 (SF36) dimensions

[4]. At the moment, SERVANDO is being used in a pilot study with heart failure patients, in collaboration with the cardiology service of the University Hospital Complex of Santiago de Compostela, who also participated in the design of the platform.

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LONELINESS AND ITS IMPACT - CONSIDERATIONS FOR THE DESIGN OF ENABLING TECHNOLOGIES

Praminda Caleb-Solly[1]

1. Introduction

This talk explores some psychological aspects of loneliness and social isolation factors, relating these to older adults' personal experiences and perspectives. The aim is to consider what implications these issues could have on co-design and participatory studies, and how the impact of solutions and interventions could be enhanced by clear characterisation of the target groups and individuals within them. The objective is to enable more efficient sharing of effective strategies to address these target user group needs and to develop a mutual understanding of the deployment conditions of any assistive and enabling technologies in these contexts.

De Jong Gierveld and Tilburg et al. [4] note that "*loneliness concerns the subjective evaluation of the situation individuals are involved in, characterized either by a number of relationships with friends and colleagues which is smaller than is considered desirable (social loneliness), as well as situations where the intimacy in confidant relationships one wishes for has not been realized (emotional loneliness).*"

This definition includes a number of key points that should be considered. The first is the differentiation made between social loneliness and emotional loneliness. These two components were defined by Weiss [9], where emotional loneliness was seen to be absence of an intimate relationship (partner, best friend) and was characterised by intense feelings of emptiness, abandonment and forlornness and social loneliness on the other hand was an absence of a broader, engaging social network (siblings, cousins, friends and neighbours), which can occur when people move to a place where they are newcomers, such as a residential home, or a seaside town for retirement.

2. Understanding loneliness from an older person's perspective

Loneliness can be a very frightening state for a person to be in, particularly if they are vulnerable due to physical frailty. Being frightened is known to have a deep biological impact and effect.

The feelings of loneliness can be even more overwhelming due the various age related changes that are experienced. These include poor vision and hearing, having lung disease that causes breathlessness or arthritis that is accompanied by chronic pain.

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Having to endure these physical stresses on an everyday basis without having someone to share the burden of tasks further affects the feelings of vulnerability. Additionally, old age brings with it an increasing number of losses; these can include the loss of social status from a previously active role in the community or society, loss of financial income, as well as the loss of a spouse, siblings and friends.

From an evolutionary perspective, the brain considers this state of physical vulnerability and loss of a known supportive network as one that needs additional vigilance. As a result, in order to protect oneself in this vulnerable state, hyper vigilance can result in mistrust of other people as well as exaggerated anxiety of imagined external aggression. Compounded with possible memory loss or early dementia, this can result in the person further isolating themselves by resisting new associations or not leaving the house.

While emotional loneliness and social isolation are closely bound, they are not necessarily mutually inclusive, as stated by Cornwell and Waite [3], loneliness has to be differentiated from social isolation, which denotes the objective characterisation of a situation and refers to the absence of relationships with other people. So a person might have a reasonable social network, however still be emotionally lonely, resulting in all the physical and psychological damage that this can result in. Additionally, as noted by Cacioppo [1], loneliness is sometimes confused with depression and poor social support.

Investigating social isolation requires the identification of the objective characteristics of functioning of communities, such as help in neighbourhoods, and the size, composition and functioning of someone's network of personal relationships (van Tilburg,1998). While social isolation can be measured, the experience of emotional loneliness is seen to be subjective, and lies on a subjective continuum, which is dependant on a range of personality characteristics, as well as personal and cultural expectations and norms.

3. Vulnerability factors for loneliness in later life

Identifying and tackling possible factors at an early stage can help to ameliorate some of the negative aspects of loneliness. Also an early and pre-emptive intervention can also reduce costs and impact further down the line.

As stated by Cacioppo [1], the interplay of three complex factors underlines the effects of loneliness. These include the level of vulnerability that a person has to social disconnection, their ability to self-regulate their emotions that are caused by feeling isolated and their representations and expectation of others. In their survey of older adults in Britain, Victor et al. [8] investigated the prevalence of, and risk factors for, loneliness in later life. They proposed three loneliness pathways that were, the continuation of a long-established attribute, late-onset of loneliness and decreasing loneliness. Based on observing these pathways they noted that any interventions and policies must reflect the "variability of loneliness" as responses that were not sensitive to these differences may be inappropriate and ineffective. Victor et al. [8] cite the following factors which present an increased risk of loneliness in later life: Marital status (bereavement), increases in time alone over the previous decade, elevated mental morbidity, poor current health (sight, hearing, chronic illness, fall in the previous year) and poorer health in old age than expected. Gieveld et al. [4] define an alternative set, with some overlaps which includes, socio-economic status, health, social roles, social standards which include living alone or co-habiting, differences between urban and rural areas and neighbours, as well as national and ethnic differences, whereby different cultures might express loneliness differently.

The implications of these multiple factors are that we have to be careful about generalisation of approaches and interventions. So for example, social media based solutions will not address everyone's needs and people should not be coerced or put under peer pressure to use such services.

4. Challenges for developing technological interventions

The challenges that need to be taken into account when considering viable and effective solutions can be grouped into three categories.

The first category relates to the older person's physiological and psychological characteristics. Progression of age-related disabilities can cause communication barriers, such as deterioration of vision, hearing and speech. A loss of purpose can result in a feeling of hopelessness and low self-worth. There is a need for meaningful and purposeful interaction, and not just interaction for the sake of it. A key aspect to consider in designing enabling technologies is physical frailty. Touch screen, gesture recognition, even voice recognition systems assume a certain level of physical ability. Some older people don't like to admit to loss of hearing and this could be the problem in a voice-based interactive system. Also these losses are gradual and there are no resources in the health-care system to do frequent enough assessments. We have found that even short period of interactions with a speech-based interaction system can be quite tiring, as the technology still requires clear enunciation, articulation, a certain level of alertness to detect changes on the screen. Also these days as we seek to empower people to take charge of their own health, respond to information that they have never had before, it is giving them quite a responsibility and we need to be careful about the ethical aspects of perhaps redefining family relationships, roles and responsibilities, particularly where age has had an impact on health.

The second category is the cultural and social context within which the technology needs to function. A number of gerontologist and studies report a stigma attached to admitting loneliness that implies that there can be a reluctance to accept the interventions. As stated earlier, the perspectives and definitions of loneliness vary, as does the degree to which it is experienced. This can impact on differences in what is needed or wanted by the different stakeholders in the scenario. It should also be noted that social inclusion might not necessarily result in the development of meaningful relationships, however one-to-one befriending schemes could [2].

The third category is the organisational and economic infrastructures that often act as a barrier to implementation of solutions. There is a skills gap that is rapidly growing for the setup, support and maintenance of assistive technology that requires a certain level of professional training. Related to this is the issue of assessing individual needs in relation to matching these with appropriate technology. The lack of understanding of the potential and limitations of solutions can result in a mismatch of interventions in relation to specific needs. There are also issues related to the availability and accessibility of physical places where people could be brought to meet-up. The physical space is not just above the available area, but also the aesthetics of the environment that would be conducive to socialisation and focussed, purposeful interaction. For example places for playing Boules or knitting. There are also barriers with conducting longitudinal studies to evaluate the efficacy of interventions over a long period of time, which are both logistic and methodological which need to be addressed. This means that deployment of effective solutions often cannot gain adequate economic backing to gain traction. This is compounded by the difficulty recruiting the relevant participants for evaluation studies, as it is common that people who are feeling vulnerable, frail, depressed and lonely are not the ones who want to put themselves forward to be part of a trial. Instead it is common for those involved in evaluation studies to be a self-selecting group of curious and engaged individuals to a large extent. This is a cause for a bit of concern as commonly, these are not the people who need the most help; these are not the ones that are truly experiencing social isolation and emotional loneliness.

So researchers working on designing and developing enabling technologies need to address how to recruit more “authentic” participants and also consider what the impact of commonly used co-design and participatory design methods would have on this group of users. In developing systems for connecting people to people it is important to understand more about the underlying causes, the background to the issues, so that intervention addresses the causes and not just the symptoms.

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GOLDUI: ADAPTIVE EMBEDDED HUMAN INTERFACES DESIGNED FOR OLDER PEOPLE

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Abstract

The concept of GoldUI is focused on empowering the older individual, enabling them to access online "self serve" services and therefore to benefit from the convenience and economy of the digital world by using the familiar home technologies of domestic radio, TV and telephone augmented by an easy-to-use mobile Smartphone interface when away from home. By using content adaptation and personalization techniques GoldUI will provide an older person with access to an extendable range of online services such as local library, social networking, home delivery shopping and banking through modalities that are relevant to the individuals' abilities and needs. The resulting GoldUI application will be tested at target groups in Spain. In this paper, the objectives of the project will be highlighted and the current state of research activities will be presented.

1. Introduction

The European GoldUI project (2011-2103) [1] launched in the Ambient Assisted Living program aims at improving the independence and participation of older people, for whom technology can present some problems and difficulties particular to the elderly. In order to foster independence and participation, GoldUI adopts an end-user perspective to develop and test technological solutions in the home environment and other related activities of daily living. GoldUI will allow the elderly to access a wide range of cloud-based services through multiple devices and communication channels: traditional telephone, Smartphone or tablet, IP-TV and home radio. The services offered by GoldUI will cover various user needs in daily life according to the user's limitations and personal preferences:

- Local news.
- Music playback.
- Weather forecast.
- Reminder of personal events and appointments.

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- Social life: keeping in touch with relatives and friends.

The service will be designed to complement other methods of information access such as ‘traditional’ web browsing, use of specialised mobile phone applications, etc. It will provide a tailored, clear interface that will encourage older people to make greater use of online services. It will also leverage well-established online services (such as Facebook to foster the relation with family and friends, Twitter for messaging to SMS for relatives and carers, etc.) rather than reinventing the wheel, to enable the project to focus its effort on customisation and tailoring of access for the older user.

The innovation of GoldUI is the development and maintenance of a cloud-based secure user profile, which is intended to be maintained by a trusted relative or carer. The service will be designed to complement other methods of information access such as “traditional” web browsing, use of specialized mobile phone applications, etc. It will provide a tailored, clear interface that will encourage older people to make greater use of online services; it will also leverage well-established online services.

The MVP methodology (Minimum Viable Product) strategy will be used for fast and quantitative market testing of GoldUI service: it is an iterative process of idea generation, prototyping, presentation, data collection, analysis and learning. The process is iterated until a desirable product-market fit is obtained, or until the product is considered to be non-viable. The MVP will be used to rapidly prototype and deploy a basic service as early as possible in the project in order to learn from end user experience at all stages of the project.

2. Methodology

GoldUI concept is designed from and to the users. The User requirements phase has the objective of collecting the requirements from the end-users defining the main characteristics of the services, usability requirements, and main functionalities. The end users’ involvement will be guaranteed thanks to the Human Centred Design (HCD) approach that will be adopted during the project. As a general methodology we will use People Led Innovation (PLI),developed by the FeSalud, in order to allow the potential customers or/and users to lead the innovation process and, as such, to guarantee the success of that product or service from both the social and business point of view. The end users themselves define their own needs at the beginning of the project, but also participate in the generation of practical solutions to these problems with other interested agents, warranting their technological and social efficiency. During the process of user involvement, four specific issues will be tackled:

- Usability and accessibility of interfaces, devices and services
- Technology acceptance
- Customisation and adaptation: older people are not a homogeneous group regarding physical, psychological or social aspects. It has to be noticed that even different sub-groups of elderly people should be considered (are the needs of people of +55, +65, +75 similar or different?). To allow people with

different characteristics and skills to interact with the service, the technical solutions developed will be fully customisable and adaptable to different groups of users.
- Social effectiveness

Users will be involved in all phases of the project in order to put them at the centre of the innovation process and to encourage them to play an active and collaborative role in the development of technical solutions. Due to this, the research and design process will be organised as a set of iteration cycles intended to understand users' needs and preferences, develop design solutions, and conduct different types of evaluations (of ideas, of concepts, of prototypes) in cooperation with users.

At the user's requirements phase that has been carried on so far, users' impressions were positive; they were just concerned by the possible maintenance cost of the product.
Carers and users interviewed agreed on the fact that this solution is more focused on people ages 50 to 65 years because this range of population is more familiar with ICTs (personal use – through family members such as son or daughter). They think that people without ICT knowledge will not be the target market for the GoldUI solution. The project consortium will work in order to improve the design of the service to be more easy to use for seniors not familiar with ICT technologies.

The GoldUI developed solution will be tested in real-life user environments in pilots carried out in different settings in the region of Andalucía in Spain. In order to carry out these tests, a number of different living labs have been selected in which the partners in the consortium participate actively. These living labs offer the perfect innovation environments needed to define and validate new products and services providing essential feedback to the development process. Pilot trials will be organised in two different ways in order to gather a maximum number of final—users and carers (expected more than 40 users) as well as obtain a complete evaluation of the GoldUI solution:

- Pilot trial at home
- Pilot trial at Lab

Pilot trial at home will be organised as follows:
- One training session for final-users and carers in order to explain to them the functionalities of devices using the GoldUI solution. In this case, we are talking about Smartphone and digital radio. During this session, the objective for the users will be to create their GoldUI profiles and understand the different functionalities of the devices as well as to get to know the services delivered by the GoldUI solution.
- Once participants have understood the different functionalities of the devices and of the GoldUI solution, final-users and carers will take the devices home in order to test them over approximately one week. After having tested the GoldUI solution at home, users will be asked to attend a feedback session and fill in several questionnaires in order to get their impressions and suggestions.

Pilot trial at lab will be organised as follows: Two pilot trials will be organised in the lab. The procedure followed will be really similar to the first one. The unique difference in this case is that users and carers will test directly the GoldUI solution after the training session. The following criteria will be studied in the pilot trial:

- Loneliness
- User[4] feedback
- User value
- Usability and accessibility
- Usage of the solution
- Market perspectives

3. Service

GoldUI will use an intelligent adaptive user interface to dynamically repurpose content from traditional web sites to be accessible in a clear, reliable format suited to digital home radio receivers, WebTV, STBs and mobile devices. Although a key focus of this project will be on the use of digital radios and STBs, the architecture will be designed to be adaptable to multiple devices. The GoldUI service will consist of a set of cloud-based components which primarily interface with the end-user and their trusted carer via streamed WebTV and internet radio technologies. In order to suit varying user sensory needs/preferences and provide alternative access channels to the available content, GoldUI will also implement telephone voice services and mobile applications for Smartphones and tablets.

The components of GoldUI service are: **Web Service Gateway**, run-time component that provides the following features: service mapping, transformation, access, and validation of Web service requests; **Multimodal Interface** provides the human-computer interaction: the most common interface combines a visual modality (e.g. a display, keyboard, and mouse) with a voice modality (speech recognition for input, speech synthesis and recorded audio for output); other modalities include pen-based input or haptic input/output; **User profile** has to be created, maintained and updated in order to deliver specific content to the end-users based on their demographic profiles and preferences, local setting, etc.; A **Content Adaptation framework** is needed in order to allow a personalized content retrieval from multimedia services; A mechanism to provide **Security and Access Control** is also needed to allow only the authorized devices and services to access to the other components of the system; **Device Profiles** have to be stored on GoldUI service in order to be able to map all the personal media by which the user connects and interacts with the service: these profiles will include information on the protocol used, type of service to be delivered to the device, etc...; **Real time messaging services** will have to be integrated in order to allow in and outbound voice and SMS messaging services to connect with end-users relatives or carers.

[4] The use of the word "users" refers to final users as well as carers, family, etc.

The interface is designed for elderly; this implies that problems like vision, technology understanding, hand use, and etc. have been taken in account. The interface follows a general design rule for all the common elements such as how to scroll the view, used colors and fonts, the symbols and figure used, pollution of interface elements (i.e. buttons, text inputs, and etc.), the size of the elements, and the use of specific hardware buttons present on the different devices.

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AALUIS PROVIDES FREEDOM OF CHOICE

Ch. Mayer[1], M. Morandell[2], M. Gira[1], M. Groot[3], J Bobeth[4], S. Schmehl[3], F. Lettmann[5,] J. Pemmer[6]

Abstract

Many services for older adults lack of accessibility, adoptability and usability of the user interface concerning arising special needs and preferences [1]. Based on the outcomes of the first stage of user involvement, by means of questionnaires and cultural probes, these needs are addressed in the course of the project. This will be achieved by developing a middleware layer to facilitate the connection of different AAL services to user interfaces, with diverse input and output modalities on various devices. AALuis will enable users of AAL systems to use more services interacting in their preferred way and thus providing freedom of choice. The standardized, open layer can be integrated into already existing AAL middlewares, such as the universAAL platform. It enables the transformation of a task centric [2] service description to concrete user interfaces for different devices. This transformation process will be context sensitive. It exploits various information models, ranging from the availability of I/O devices and their I/O modalities to user's capabilities and preferences

1. Introduction

The user interface (UI) is the most important feature of interaction between users and (AAL) services. It is considered critical to the success or failure of an ICT product or service [3]. Different success criteria have to be met in particular in the field of Assistive Technology. Beside the WCAG principles (perceivable, operable, understandable and robust) [4], other criteria are joy of use, likeability, usability, non-stigmatization, motivational and personal adoptability. In the course of ageing abilities, preferences and special needs of people change. This influences the set of services that can bring a benefit to the single user. Specific needs concerning the interaction with such a system emerge and change over time. To comply with these continuously changing needs of elderly users, the flexibility of user interfaces is of high importance. To create a homogeneous experience for heterogeneous services even though user interfaces are adoptable and changeable is a complex task.

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Furthermore a standardized way of integration of innovative user interfaces is important to ensure a European wide exploitability and versatility. Thus the focus has to be on these aspects as a step forward to innovative user interfaces and the easy integration thereof in existing and open middleware systems.[6]

2. User Requirements

The requirements phase of the project AALuis confirmed that choice is perceived as being too limited for older adults in practice, when talking about services and their user interfaces. Practical solutions, to adapt service experiences to changing needs and wishes are needed [5] for a real freedom of choice. In the two targeted user groups (younger elderlies [60-70 years], who are more oriented towards lifestyle services, and older elderlies [75-85 years], who are more oriented towards care and assistance services) it could be shown that the acceptance of different input/output devices and modalities for interaction depends strongly on the technology affinity of the user and is restricted for older elderlies [5]. The intention of AALuis is to support the continuum from “comfort” to “extended assistance” (compare to Figure 1. AAL continuum targeted by AALuis). AALuis’ approach is based not only on services, but mainly on facilitating the adaptation of user interfaces due to changes in capabilities and preferences of the user.

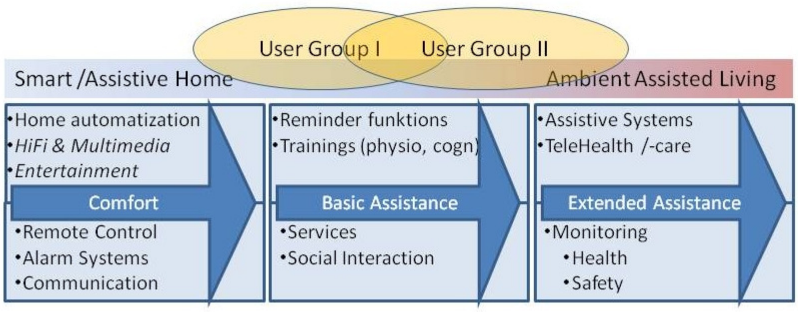

Figure 1. AAL continuum targeted by AALuis

3. Technical Approach

AALuis’ user interface layer is developed as an extension for OSGi-based AAL middleware solutions (e.g. HOMER or universAAL). The layer allows services to be extended with rich user interfaces utilizing different types of devices and modalities. AAL services can either be connected via Web Service (SOAP) or deployed as OSGi bundle. In both cases a service needs to provide: A task model (based on CTT), a service binding description and a content file. AALuis takes these XML based service artefacts, and creates user interactions based on dynamically adapted user interfaces for different devices.

At the centre the Dialog Manager (DM) acts as the central delegation point for the interaction between user and service. During the user interaction DM interprets and executes the task model. User intent is acquired by collecting the users' actions on I/O devices. Available I/O devices are discovered via UPnP. To enable context sensitive user interaction User, Device, Environment and Task context information models are exploited. Depending on the context at hand appropriate user interfaces artefacts are created by a User Interface Transformation Manager: The basic idea is the transformation of abstract user interfaces descriptions to usable concrete user interfaces for specific I/O devices. The abstract user interface description is derived from the service artefacts. A chain of transformation steps constructs artefacts that can be rendered in the targeted modality. In the first stage of the project these artefacts (UI fragments) are HTML5 encoded, and provided over HTTP. This is shown in Figure 2. AALuis User Interface Transformation Workflow.

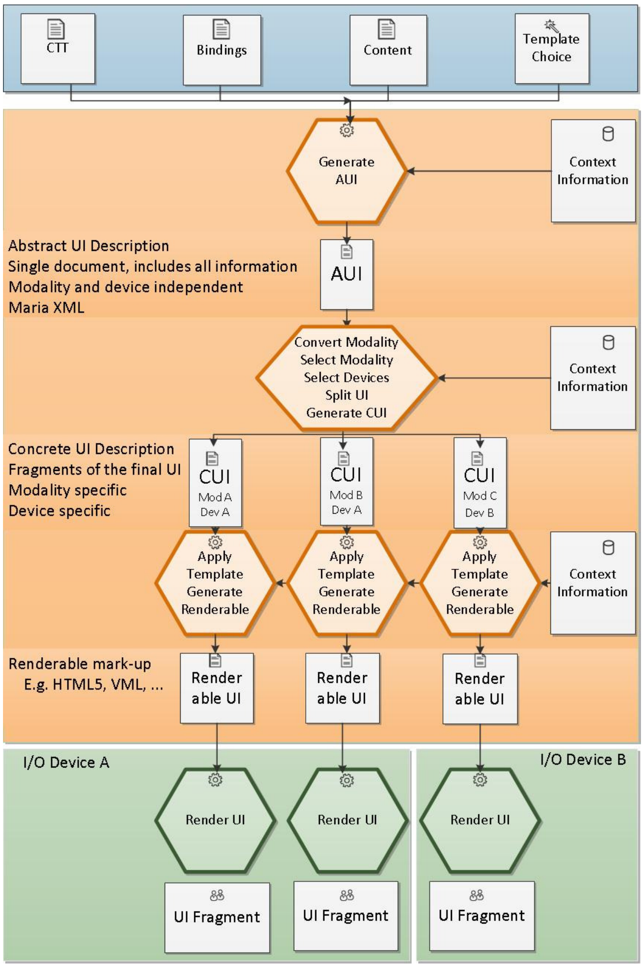

Figure 2. AALuis User Interface Transformation Workflow

3.1 UI Generation & Transformation

The User interface transformation consists of the following components: [9]

3.2 UI Transformation Manager

The UI Transformation Manager's responsibility centres on the generation of user interface artefacts, on which all interactions between the system and user are based. The UI Transformation Manager follows a simple request/response protocol. Initiated by the Dialog Manager a user interface request causes a task and context specific response. The request is composed of task information and additional information necessary for the generation process. The response consists of the user interface artefacts to be hosted by the AALuis Layer which are eventually rendered by I/O devices. The UI Transformation Manager component internally applies a transformation workflow to attain its goal. The transformation steps are handled by the components described below.

3.3 AUI Transformer

The Abstract User Interface (AUI) Transformer handles the first step of the UI transformation. Based on the provided service artefacts (i.e. the User Interface Request, CTT, binding, and content documents) an abstract XML based UI description is created. This description is the basis for further transformation.

3.4 CUI Transformer

The Concrete User Interface (CUI) Transformer handles the second step of the UI transformation. Based on the inputs concrete UI descriptions are created. The inputs are the AUI description and the input from the consumed services: I/O Target Selector, I/O Converter and Context Providers.

3.5 Renderable Transformer

The Renderable Transformer handles the last step of the transformation process. The result is one or many artefacts that are part of the UI Response.

3.6 Template Store

The template store makes templates accessible for the transformation process. In the first prototype the templates will be static. In the second iteration it is planned to let service developers put additional templates into the store. These templates can be device, modality and service/task specific – or any combination thereof.

3.7 I/O Target Selector

The I/O Target Selector selects one or more targets for the current interaction. The targets are the I/O channels, bound to specific I/O devices, used as basis of the user interaction. The list of I/O targets is created by applying an I/O channel selection strategy on the available context information, and available devices and their modalities.

3.8 I/O Converter

An I/O Converter transforms one I/O channel modality into another if necessary (as demanded by the current context) and possible. This means a text input can be, for example transformed into an audio and video avatar message.

4. Outlook

This approach will be evaluated in two evaluation cycles with older adults and formal/informal caregivers. Newly created AAL services and innovative user interfaces will be integrated into a prototype. The services under development are based on the requirement findings, and are formulated by user organizations involved in the project.
The first evaluation will be organized as lab trials at the half time of the project. Results will be the major input for the second development lifecycle. At the end of the project field trials will demonstrate the usability of the AALuis approach.

Market introduction of the products is prepared by cultural probing, capitalizing on partner SME networks and building on AAL to business modelling [7]. The innovation offers chances for several stakeholders: It provides on the one hand freedom of choice to assisted persons and their beloved ones and on the other hand AAL companies can benefit from new age-friendly services, which are well connected and increase their robustness to market changes and thus improves chances of business success [8].

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FACTORS INFLUENCING TECHNOLOGY ACCEPTANCE BY COMMUNITY DWELLING OLDER ADULTS: PRELIMINARY RESULTS OF A SYSTEMATIC LITERATURE REVIEW

S.T.M. Peek[1], E.J.M. Wouters[2], J. van Hoof[2], K.G. Luijkx[3], H.J.M. Vrijhoef[4]

1. Introduction

In the last decade much effort has been put in the development of technology to support active and healthy ageing at home. At the same time, questions have been raised on the readiness of community dwelling older adults to accept and use these technologies [1-3]. In order to improve the implementation of ambient assisted living technology it is crucial to understand which factors influence technology acceptance. For this purpose, a systematic literature review was conducted, the first of its kind to target this specific issue: acceptance of technology by older adults who are living independently. In this extended abstract preliminary results are presented and discussed.

2. Methods

Seven major scientific databases (including MEDLINE, Scopus and CINAHL) were searched using a combination of 150 different keywords (including synonyms) such as “living independently”, “ageing in place”, “assistive technology“, “ehealth”, ”utilization” and “adoption”. This led to 4,692 search results. After the removal of duplicate results, a total of 2841 unique articles were identified. These articles were assessed to see if they matched formulated inclusion and exclusion criteria (Figure 1). The most important inclusion criteria were: articles had to be peer-reviewed, describing community dwelling older adults who were at least 60 years old, and aimed at investigating factors that influence the acceptance or use of electronic technology developed to support ageing in place. Using these criteria initially 15 articles were included. Three researchers read these articles and extracted factors influencing acceptance by means of a data extraction form. In addition, references of the articles were checked for other articles eligible for this review (snowball method). This led to the inclusion of one extra article [19], bringing the total number of articles included in this review to 16.

[1] Fontys University of Applied Sciences & Tilburg University
[2] Fontys University of Applied Sciences
[3] Tilburg University
[4] National University of Singapore

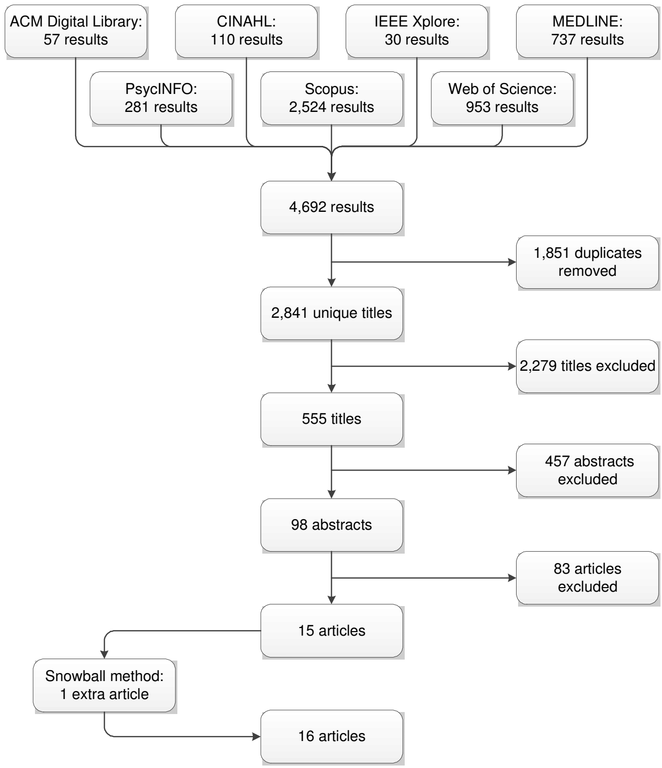

Figure 1. Flow diagram of the article selection process

3. Results

Results show that the majority of the reviewed articles were based on qualitative research methods (interviews, focus groups); 12 articles used this type of method (see Table 1). Three articles were based on a combination of qualitative and quantitative research methods (surveys, analysis of log files) and one article was based on quantitative methods alone. Articles described acceptance of different types of technology, and more than half of the articles described combinations of types of technology. Technology that provides safety and security (e.g. ,monitoring technology and personal alarms) was the most prominent type of technology, followed by technology to promote health (e.g., health monitoring) and technology to provide interaction (e.g., video telephony). Technology that supports older adults in their Activities of Daily Living (ADL, e.g., electronic memory aids) was less prominently included. Results also show that the majority of the articles (11) solely describe acceptance of technology at the pre-implementation stage: technology was shown or explained to older adults and they were asked whether they would be willing to use it sometime in the future. Evaluation of acceptance at the post-implementation stage (3 articles) or a combination of evaluation at the pre- and post-implementation stage (2 articles) was far less common.

Table 1. Characteristics of the 16 reviewed articles

	Method			**Technology type**				**Implementation stage**	
Article	Qualitative	Quantitative	N	ADL	Health	Safety / Security	Interaction	Pre	Post
[4]	X		65		X	X	X	X	
[5]	X		18			X	X	X	X
[6]	X	X	333		X	X		X	
[7]	X		32		X	X	X	X	
[8]	X		13		X	X		X	
[9]	X		14			X		X	
[10]	X		14			X		X	
[11]	X		35			X	X	X	X
[12]	X		9			X	X	X	
[13]	X		15 [5]	X	X	X	X	X	
[14]	X		23 [6]		X	X		X	
[15]	X	X	100	X				X	
[16]	X		7			X			X
[17]	X	X	14				X		X
[18]	X		11			X		X	
[19]		X	1406			X			X

In summary: the major part of the articles contain qualitative data of technology acceptance at the pre-implementation stage. Therefore, the focus in this extended abstract lies on these articles [4-15, 18]. Seven types of factors influencing pre-implementation acceptance were identified: benefits expected of the use of technology (e.g., feeling safe/secure, enabling independent living and benefits for significant others); concerns regarding the use of technology (e.g., cost, obtrusiveness, privacy implications); the need for use of technology (e.g., perceived personal need, preference for living independently); presence of alternatives to technology (e.g., satisfaction with current technology or assistance of caregivers); facilitators for the use of technology (e.g., technical support); personal characteristics of the older adult (e.g., perception of personal health, fit with cognitive impairments), and the social environment of the older adult (e.g., perception of use by others, influence of professional caregivers). Analysis of quantitative and post-implementation data is currently in progress. While reviewing all 16 articles it was observed that only one article [8] referred to established technology acceptance models [20-21]

4. Discussion

It is clear that technology acceptance of community dwelling older adults is influenced by a multitude of factors. These factors should play a paramount role in the design and

[5] A second group of 15 older adults that did not meet our inclusion criteria was excluded from the review.

[6] A second group of 16 family members and friends was excluded from the review.

implementation of new technologies. Our research provides insight into key pre-implementation acceptance factors. Additionally health professionals need to be aware of the identified factors and their influence on acceptance in the post-implementation phase. Knowledge of these factors provides opportunities for matching communication and promotion of technology as well as adequate support of end-users. At the moment only a small number of studies focus on post-implementation acceptance. Future research in this field should fill this gap. Also, longitudinal research is necessary to be able to compare pre-implementation factors to post-implementation factors. For instance: do pre-implementation concerns (such as cost, privacy implications) evolve into actual barriers of technology use in the post-implementation stage? Furthermore, more quantitative research is required to test whether factors described in qualitative research apply to larger groups of community dwelling older adults. In this pursuit established models of technology acceptance [20-21] cannot be ignored. A full manuscript of this systematic literature review is currently in preparation.

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OWELA (OPEN WEB LAB) AS A TOOL IN THE SOMEDALL PROJECT

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Abstract

During the SoMedAll project elderly people have an important role as a source of information both in Italy and Finland. Their opinions are gathered in the beginning of the project as well as during the evaluation phase. At first their opinions and stories were gathered and discussed to create different kind of scenarios for the use of social media based services. Because it was important to collect data from people with different lifestyles and living conditions three different methods was used. Methods were Owela (Open Web Lab), interviews and social media club group meeting. This article describes mainly the method Owela. Based on the experiences received it is important to collect data using different kind of methods. It was also noticed that in Italy elderly people are not so familiar with new technology than elderly people in Italy. This is a challenge in these kinds of projects, but is not an obstacle to achieve good results. As end users elderly people have had a key role during the planning and pre-testing phases. They will have an active role in the evaluation of the "Old Foxes" service platform and service page evaluation in the PC and IPTV environment.

1. Introduction

The elderly inhabitants are globally in very different positions in relation to the new technology. In western and industrialized countries they have more possibilities to use personal computers and televisions than people living in developing countries. This diversity can be seen also in Europe. In spite of this situation there is a need to develop new kind of possibilities to produce and offer services for elderly people, especially in those countries where the number of senior citizens is growing fast. Based on the Eurostat statistics Italy and Finland are the fastest ageing countries in Europe and among EU-members. In Italy the population is about 60 million and the share of people over than 65 years is more than 10 %. When analysing this number a little bit closer it can be seen that the share of people over 80 years is over 5.6 %. So in Italy there is more people over 65 than Finland have inhabitants, approximately 5.4 million. Finland is coming grey even faster than Italy. For example in the year 2000 the share of people over 65 was 15.0 %. During the year 2030 it will be 26.3 %. This means that every fourth person is over 65 years old. In Slovenia the number of population is two (2) million. The share of people over the age 65 is estimated to be 20.6 %. Based on

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[2] Miina Sillanpää Foundation, Finland
[3] Aldia Cooperativa Sociale, Italy

mentioned figures and numbers there will huge questions to answer in those countries and of course the other European countries will follow Italy, Finland and Slovenia. This means also new possibilities for business life. It can be stated that social media based services will have remarkable possibilities to offer alternatives for elderly people to achieve services they need in their daily living. Elderly people have huge amounts of valuable knowledge, experience and memories that they are willing to share. Social media is an ideal means for elderly people to enrich their social life and share their knowledge. But unfamiliar technology and lack of computer skills prevent them using it. New identified social media services need to be focused on ageing people taking account usability issues. The objective of the SoMedAll project is to develop a platform for offering social media services for elderly people with a variety of easy-to-use user interfaces. By configuring the platform service providers can create web sites that enable content creation, communication and social media for elderly people. The platform includes open interfaces for adding new tools and features to the services.

2. Methods

The aim of the SoMedAll project has been to ensure that the users' roles are remarkable from the beginning to the end. This is one reason why Owela was chosen to be one tool to collect information among elderly people in Finland and in Italy. VTT's Owela is a participatory web laboratory for developing and evaluating digital media concepts and services. It is an online space for open innovation with users, customers, developers and other stakeholders. In SoMedAll it is used as a tool for distributed design to collect needs, ideas, comments and different kind of feedback from elderly people in different phases of the project and as part of user-centred design process (Figure 1).

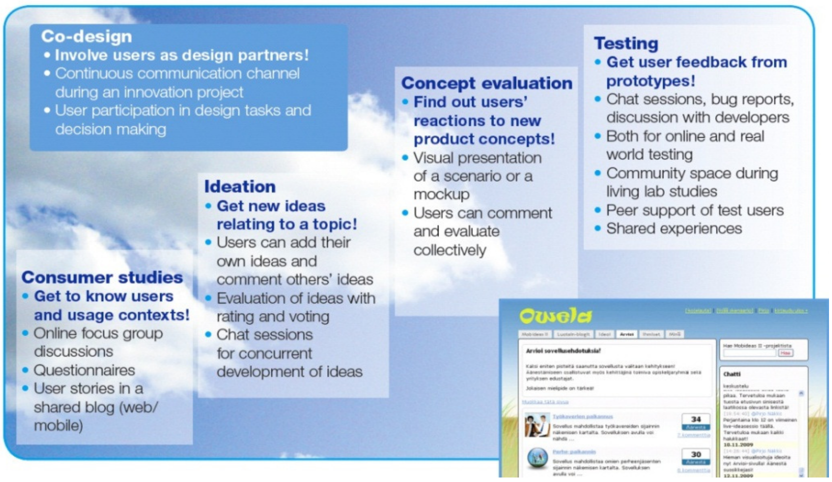

Figure 1. Use of Owela in different phases of the innovation process.

3. Results

In the beginning of the project Owela was used to collect information and to discuss what kind of social media based services and activities could be wanted and needed by ageing people. Owela was translated for Italian users, but in the first phase it was not used with elderly people. Instead of that there was used interview method for data collection. Owela was used for questionnaire, discussions and ideations with elderly people. Both Finnish and Italian sites were set up in Owela. During the first stage of the project Owela users were able to create their own ideas and to participate in nine different predefined discussion themes which were: Maintaining health and well-being, Services for senior citizens, Learning new things, Getting new experiences, Collecting and sharing memories, Sharing a hobby, Retiring, Peer support and Maintaining social relationships (Figure 2).

Figure 2. "Vanhat Ketut" (Old Foxes) discussion and ideation forum in Owela for elderly people and other stakeholders.

Based on the results of the previous phase user groups, their characteristics and needs were analysed. Three different user groups of elderly people were formed based on "mental and physical age", living conditions, need of care, health conditions and disabilities: No Go, Slow Go and Go Go. GoGo group is defined as elderly people that are capable of autonomously manage their living and need only a limited and episodic support. SlowGo is defined as non-completely autonomous elderly people, who are capable of partially manage their living, but need a recurring external support. No-Go group includes elderly people that are not capable to take care of their daily activities at their own homes. They need personal assistance to manage at their own home or at a service home. The user stories describing the service functionality for each group were written and feedback was gathered through Owela. In addition to free comments Owela users were asked to give scores about how believable and interesting the stories was, how willing they would be to take the planned system in use and the ethical acceptability. For getting users to participate in Finnish Owela site advertisement in Facebook, Google and other web sites and organisations relating to elderly people were used. There were totally 108 registered users who also logged in "Old Foxes" discussion area. The age of registered users varied from 28 years old to 83 years old. 52 % of Owela users were between 55 and 65 years old, 28% between 65-70 years old and 8 % over 70 years old. 11 % of Owela users were under 55 year old. 49 % of users were women and 51 % men. It was important to reach people from different age groups. It is important to notice that almost all participants had some experience in computers and new technology. 38 users, 18 man and 20 women actively participated on Owela discussions (researchers are not included in these numbers). This is 35 % from all Owela users that were logged in Owela. The age between these active participants varied from 56 to 80 years old. In addition two participants were under 50 years old. Totally 733 comments were added during discussion period. 666 comments were created by end users and 67 comments were added by researchers. 261 comments were received for the predefined discussion themes. 41 new ideas or discussion topics were added and totally 431 comments were added to these subjects. Six different topics and 41 comments were added by users for the memory sharing. The amount of the comments by one single user varied from 1 to 145. 15 users had over ten comments and 8 users had only one comment. The average was 18 comments by a user. Five active users created 50 % of all the comments and 17 users created 90 % of the comments.

The development of the SoMedAll service was decided to target to Slow-Go and Go-Go users. The purpose is to support mental and physical wellbeing and capacity and provide means for rehabilitation with help of social media. The mock-ups of "Old Foxes" site were developed and Owela has been used to assess and evaluate the suggested "Old Foxes" site. Based on collected opinions and comments the site is developed further. During the final testing and evaluation phases Owela will be used as one tool to collect feedback from end users. Traditional interviews are also used because it is important to collect also Slow Go users' opinions for development work. During the design process many user requirements and guidelines were analysed and used. The results described above are concentrated in Finnish results because Owela site was not activated in Italy during the first step of the project. The results of the second phase are not yet available.

4. Discussion/conclusions

Based on the experiences achieved during the SoMedAll project's processes it can be stated that Owela is a useful tool to share information and to support discussions among older people. It can be also motivating. As an example of the motivation was that after the first Owela discussions some active Finnish participants opened their own closed Facebook site for the group “Vanhat Ketut” (Old Foxes). They were eager to continue their discussion further and the eldest member is over 80 years “young”. Conversations and partnership with end users has been helpful to solve ethical questions if any has showed up. End users have emphasised that they are eager to use social media based services if they are beneficial and create some extra value for their daily living and supports living in their own homes or departments.

So far the results show that social media based services will grow and elderly people will be active users of these services. Important is that services are available and easy to reach. Also the usability issues are crucial when planning new services and new technology for elderly people. Adaptability of services is important factor because users have different living conditions and different kind of needs. Adaptability is important also if the abilities of the users will decrease and there is a need to have new services to support daily living.

AN APPROACH FOR DEFINING AN INTERACTION CONCEPT FOR AAL APPLICATIONS

Markus Wiedeler[1], Manfred Wojciechowski[1]

Abstract

We have developed an approach for defining an interaction concept for AAL applications that makes sure, that such an application is accepted by the end user. This approach defines five different aspects of an interaction concept and describes how to coordinate the different roles in the development process to define and validate these concepts. A description of our approach and its application and the results from different projects are described.

1. Introduction

The acceptance of an AAL application by the end user is strongly dependent on the user interface and its underlying interaction concept. Especially elderly with small technical expertise can be overchallenged by the complexity of the usage of such an application. There are many discussions on this aspect, e.g. [1]. The Fraunhofer Institute for Software and Systems Engineering has developed an initial approach for defining an interaction concept for AAL applications and applied it in different projects. In the following we will shortly describe our approach and the results that we have experienced in some of those projects.

2. Approach

The end user's acceptance for assisting technologies supporting daily life or working situations beside others depends on the appropriateness of the interaction concept that is being used. From our experience there are many aspects that have to be considered in choosing the right interaction modality for the end user, especially in designing AAL solutions for the elderly. Targeting elderly as the end user puts special challenge on the interaction concept of an AAL solution. In our approach we distinguish the following interaction concept aspects:

- Selection of the end device
- Definition of the appropriate functionality
- Provision of suitable navigation and selection mechanism for content and functionality
- Specification of basic design guidelines

[1] Fraunhofer Institute for Software and Systems Engineering

- Creation and suitable visualization of the content
- Defining situations / contexts / process steps for different functions

The variety of possible end devices for end user interaction is increasing. For example we can use the regular PC and provide AAL services via the internet using the installed web browser. We can also use the regular TV of the end user as a point for user interaction with the help of a settop-box. Currently smartphones and tablets are becoming popular. Possible future alternatives are augmented reality glasses, a mobile point of information like the Giraff [3] or a hearing surrounding. In the selection process we consider different aspects. One of the aspects is the usage situation, e.g. has the end user his hands free for using the device. Another aspect is the technology background of the user. Finally we consider the possible constraints of the end user, e.g. physical disabilities.

The definition of the appropriate functionality in the AAL domain is a careful balance between the benefit for the user and the costs, e.g. of the needed hardware or the quantity of functionality that from an engineer's point of view we want to provide for the end user. The functionality has to be defined together with the domain experts, e.g. care givers or the end users themselves.

The way how to provide the defined functionality and content to the user is also another aspect that we include in our approach. It must be intuitive and very quick to get access. The available mechanisms may be limited by the selected end devices, e.g. using a remote control on the TV. Speech recognition, gesture control, personalization or context awareness can be used to enhance the interaction concept at this point. At this point the special experience of the user has to be considered. Some people expect to choose with a fingertip others wants to wipe through the selection.

As in regular software applications the definition of the basic design guidelines for the user interface is an important part of an interaction concept. This includes the usage of colors, font types and sizes, and images. Here we have to take into account the variety of possible impairments of elderly users into the configuration options of the application.

AAL applications may provide content from an expert domain, e.g. health care. It is important to provide content in a way that is understandable by and attractive to the end user. For example a tutorial on wearing a hip protector can be provided by a video. To get an direct choice the possibilities of functions are selected by the situation of the person. So we defines situation from different parameters, like time, location, sensor information, process steps or so on. With the situation typical functionalities are connected. So the user gets an good overview about the common services. All services can be used but weren't offered on the short way of use.

These six aspects of an interaction concept have to be carefully designed in order to meet the expectations of the end users. In our approach we strive for the involvement of the end user and the domain expert in different stages and as early as possible in the application development process. The following figure gives an overview on our approach on the involvement of different roles in the development process of AAL applications.

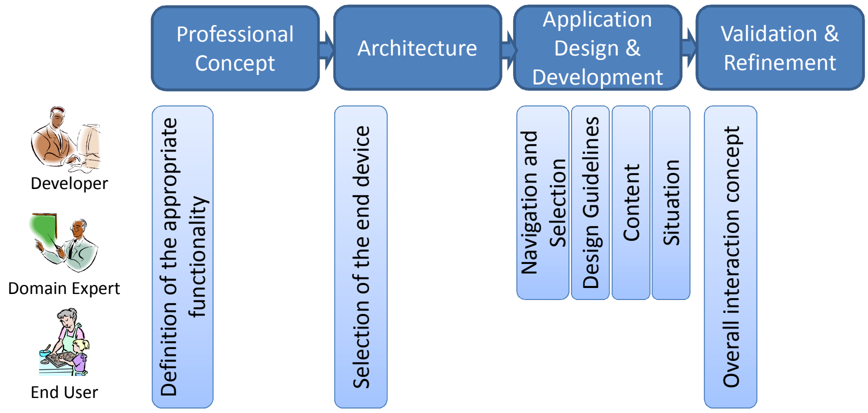

Figure 1. Involvement of the roles in different phases

3. Results

We have applied the approach in a couple of AAL projects. The "Daily Care Journal" [2] is one of these projects. Its aim is to support the coordination between professional and informal care networks and the documentation of activities of daily life by the informal care. The domain expert is a professional care provider, which is part of the project team. End users include the professional care givers, the informal care and the elderly care takers. Together with the domain expert we have defined an initial set of functionality of our application. This includes the management of a care taker's care network, the coordination of appointments, and the self-documentation of care actions and problems by the care taker or his informal care givers. The self-documentations included different aspects of the activities of daily life, e.g. eating and drinking, hygienics or pain. In the next phase we had to decide on the appropriate end device. We have developed a prototype, which already showed to planned functionality, for three different end devices, which we have preselected. These devices included a web-browser, a settop-box with a TV and a tablet-PC. Together with the professional care giver we organized a workshop, where 27 seniors aged from 65 to 88 attended. We asked the participants to try out the prototypes of their choice and give us feedback using a questionnaire. At this early stage the participants gave positive feedback on the usefulness and benefit of the functionality, and also suggestions regarding desired content. More than 63% confirmed that they could think of using that application for themselves. About 61% of the attendees already had some experience with computers. Nethertheless only 48% tried out the browser-based prototype on a laptop. About 50% of the participants tried out the settop-box and more than 70% used the demonstrator on the tablet-PC. Even participants with computer experience rated the interaction concept of the prototype based on tablet-PC best. Based on these results we decided to provide a browser-based application for the informal care givers and a tablet-PC based application for the care takers. Experiences from the workshop gave us input for the definition of the navigation and selection mechanism and the design guidelines. Using the tablet-PC we restricted the possible interaction modalities to be as simple as possible. We only used the point-and-click-paradigm and abstained from wiping or the usage of context menus. Functionalities are offered by clickable buttons, which included simple icons to visualize what the user can expect. The size of the buttons and the font was defined bigger than the standard for usual apps. Navigation to the desired functionality is designed to achieve quick access with only a small number of interaction steps. One part of the concept is the usage of context-awareness in order to automatically select and offer the functionalities that might be of relevance, e.g. a drinking protocol when being in a drinking situation. In the following figures some screenshots of the tablet-PC application are shown, which give an idea on the design.

Figure 2. Screenshots of the tablet-PC application

After having finished the development of the applications we started the validation and refinement phase in July this year. 10 pilot participants were selected to evaluate the solution. None of the participants refused to place the sensors in their home environment to use the context-aware functionality. The application has been built in a client-server-architecture, with using 3G mobile connection for the server communication. Here we experienced that problems with loosing connection or slow response were initially perceived by the participants as being their fault. We had to reimplement the communication part with giving clear feedback to the user what is happening and how to solve a problem. Before using the application the end user has to authenticate himself by typing his user name and a passphrase. Our initial implementation of the passphrase input field with showing a '*' for each letter was perceived negatively by the user. Because of finger deformation, trembling or other physical problems it was very hard to input the correct passphrase without visual feedback. As a result we had to show the passphrase in the input field in clear text. The overall design was perceived very positively. In October we will start a pilot with additional 30 participants in order to evaluate the professional concept of building and supporting care networks. We applied our approach also in other AAL projects. With "RISUS" we help professional care givers to plan and document their care activities using a tablet-PC. Here we experienced that depending on the age of the care givers the wiping-paradigm was only partly accepted. Therefore we had to provide an alternative, which is based on point-and-click. "SMILEY" provides a platform for services in a smart home environment. As part of the navigation and selection concept icons representing functions that are frequently used, are placed in a prominent position on the screen. Another concept is the implementation of a situation-aware recommender system.

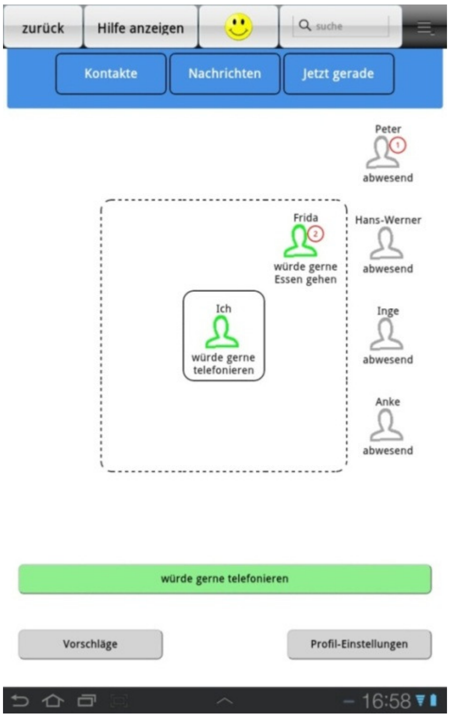

Figure 3. Screenshots of the SMILEY-App

4. Discussion/conclusions

The approach having an early involvement of the domain expert and the end user in the different phases of the AAL application development has helped us to build well accepted interaction concepts. We will further refine our approach in a systematic way that will include decision support for the interaction concept based on end user and technology based evaluation criteria.

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PARTICIPATORY DESIGN FOR PEOPLE'S HEALTH

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Abstract

The increasing availability of new technologies in the computer science world, the growing complexity of working environments and the tendency of work dematerialization requires the application of a multidisciplinary approach in which: social sciences and human factors from one side and ICT disciplines from the other are combined together to understand and realize IT solutions enabling the cooperation in highly knowledge content works, as e-welfare services.

1. Introduction

In order to create a sustainable e-welfare design we are convinced it is important to combine different ad-hoc research methods, like CSCW (Computer Supported Cooperative Work [13],[16],[22]), cognitive ergonomics [21], visual semiotic and economy. In particular, an understanding and refining of user's experience is possible with theoretical and methodological adjustments and compositions of existing approaches. The results are design activities that maintain a better and closer contact with the end-users. This approach has been successfully applied in the MOPAL (Mobile Palm for Assisted Living) project [1] for the integration of socio-assistive processes with mobile technologies in the Province of Trento, Italy. The focus of this work is on showing that along all the design phases of an artifact the designer should rely on multi-disciplinary knowledge and expertise (e.g., human-computer interaction, sociology, ICT domain)and, even more important, she should devise and design artifacts capable to sustain people in their working and daily lifeThe goal is to ensure these artifacts are coherent with user-oriented requirements and working practices. We show it is fundamental to study the interactions amongst people involved in the healthcare and welfare services[10]along with the technical objects they use to achieve this goal.

2. The methodology: A transition towards ever-growing services

The "traditional" delivery approach for IT solutions offerspartial response to the increasing complexity of the e-welfare services, in relation to analysis, design and development of technology. In fact, as we experienced in the MOPAL project, the

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focus is definitely more on service provisioning. As shown in Figure 1, the role of the IT-company is rapidly changing: from supplier to service provider. The general idea of selling licenses and maintenance is getting obsolete. As IT specialists we have to face with ever-growing services and we have to manage a continuous relationships and communication with users and stakeholders [8],[9],[11],[12]. Of course, the delivery of software is still the main goal, but humans become a key factor to properly "build" (cfr. [19],[25]) and deploy services. In other words, the software applications are resources, rather than the final outcome of the process.

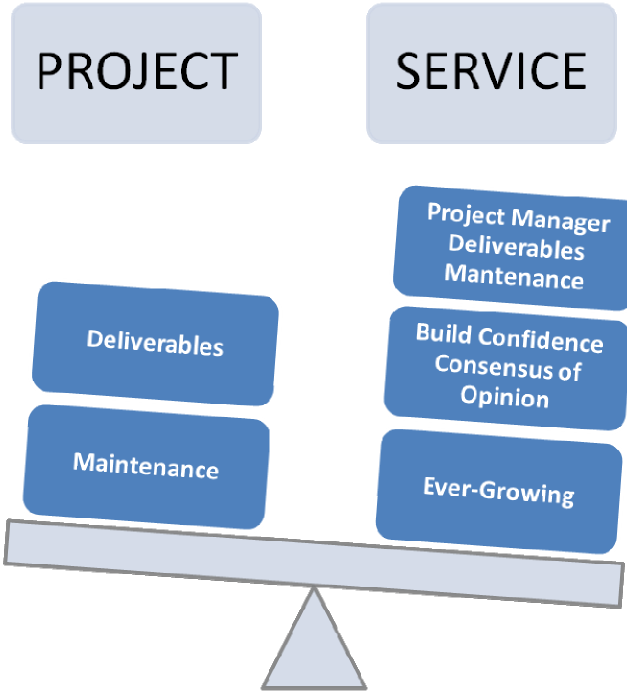

Figure 1. A new vision: from project and delivery to ever growing services.

The current roles involved in the service construction and provisioning process are shown in Figure 2. On one hand, those roles have very different backgrounds [26] and, even though they should work closely in the same provisioning chain, often in the same organization, their expectations, working skills and languages can be so different and their relationships are quite difficult, particularly when they have to communicate requirements and objectives [24],[27],[28].On the other hand, contracts and agreements subsist amongst users, providers and the governance and they have to be carefully considered, concerning the evaluation of service sustainability.

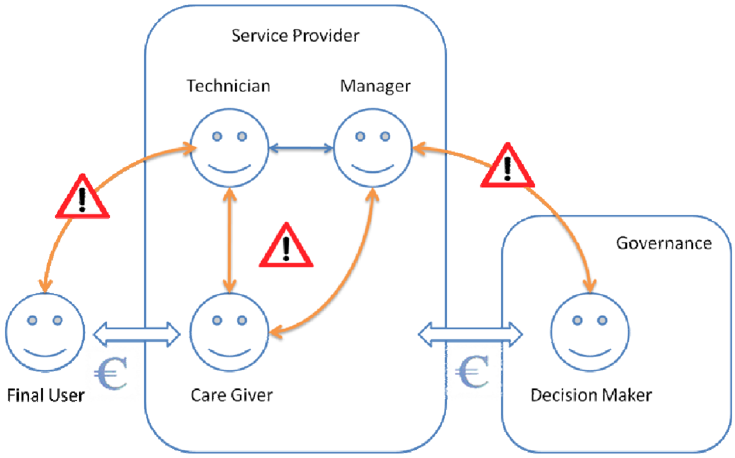

Figure 2. Contracts vs. communication requirements.

In this context, Sociology has re-discovered its tradition of qualitative studies on field, and by collaborating on multidisciplinary applied analysis, is able to provide models and innovative solutions. What is needed is to extend the notion that workplaces are socio-technical contexts, and that human and non-humans are inextricably related [3],[4]. A truly holistic approach to services – at which we want to give a response of improvement – needs help from all theoretical and methodological fields: CSCW points mainly to system design and then analysis of the cooperative work is functional to it; Participatory Design qualifies mostly for the active involvement of workers in the design of technologies and the emancipatory function of themselves; Workplace Studies [6],[7], [17] focus instead on understanding the social organization of the work and subordinates the technological design to the same working practices. Combined together [14],[15], these methodologies give a good response to traditional methods of task analysis. Thus, what becomes important is not what one does in terms of work, but how she do it, what sense and what relations are established with it. In that way the work is increasingly seen as a wide and complex interaction. The results are design activities that maintain a better and closer contact with the end-users and clients, generating a holistic Work Practice-Centered Design Process.

3. Results: Need for further skills

Nowadays, the current roles involved in the Service Design construction and provisioning process are identified under the term “Participatory Design Process” that puts together under the same umbrella technicians and social scientists. The extension we aim at requires an organizational review and the development of a tech-savvy environment. What we think should be the main step to perform a change in the organization, introducing new figures, to mediate and optimize relationships and processes (cfr Figure 3). We call them cross-skill facilitators. In our project, visual and organizational Ethnography has produced very good and promising results [2]; in addition, we noticed that skills on Economics could be crucial as well, to manage relationships with managers and decision makers, both in the organizations and in the Public Administration.

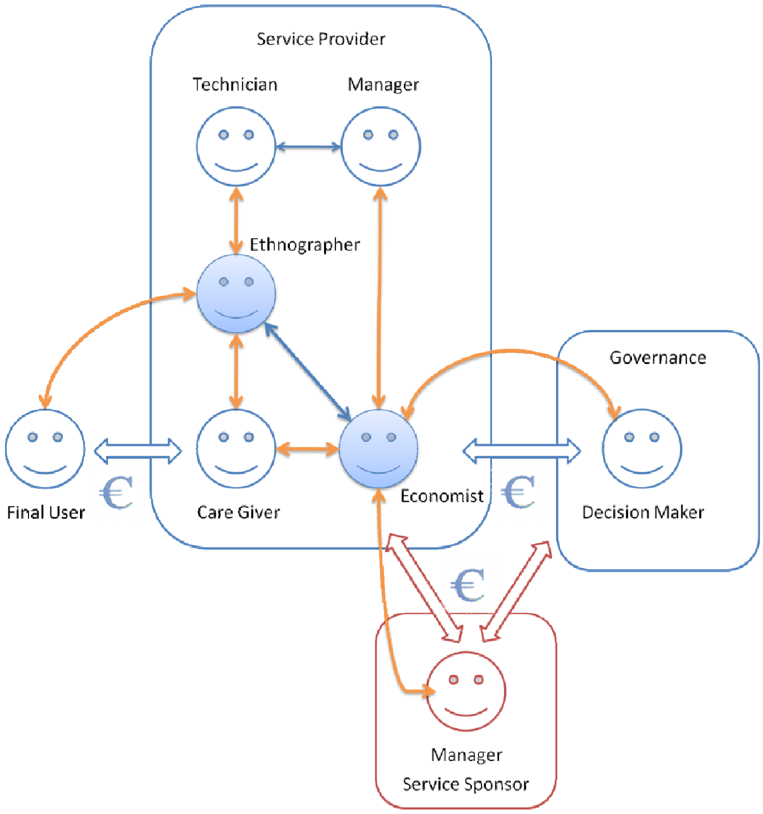

Figure 3. Mediated relationships to achieve project and service results.

The ethnographer and the economist have to closely collaborate and, eventually, to "glue" in a common skill, able to manage and mediate the relationships. In addition, the ethnographer and the economist are not "classical": They are newer professional figures acting as mediators amongst the others. In some sense, they are "horizontal", with respect to the vertical specialists (care givers, technicians, managers, etc.) [20], [29]. Therefore, the main drivers of this model are the following:

- Technology:it creates a common substrate (both hardware and software) on which the services are based and acts as a facilitator for the stakeholders. It should fit in the current working practices, introducing improvements in the business processes in place without interfering with the personal and social interactions within the working team and with the assisted people. It also enables the cooperation amongst institutions and private entities in the healthcare and social domains offering a shared communication infrastructure [5].

- Organization:the service model proposed aims at attracting providers and also sponsors of these services with the promise of earnings and customers loyalty (e.g. a grocery with delivery at home of the shopping can create its own business with the customers subscribing to its services sponsored by the local municipality) [29].
- Human: technology cannot solve problems without a network of people that benefit from it in their daily activities. Instead, both the technological and organizational aspects should be in sync with the human needs: the organizational level should capture the real needs of the citizens and translate them into services appealing for the citizens; the technological level should identify ways of consumption that are accessible and usable by caregivers and users. The network of caregivers will grow or shrink depending on the type of services activated. We should consider patient's relatives, operators of the call centre, family doctors, nurses, social workers [18],[25].

4. Conclusions

In the MOPAL project we have experienced that workplaces are socio-technical contexts, and that human and non-humans are inextricably related. A truly holistic approach to services at which we want to give a response of improvement, needs help from all theoretical and methodological fields. Combining together CSCW, Participatory Design and Workplace Studies gives a good response to traditional methods of task analysis. What becomes important, therefore, is not so much what you do in terms of work, but how you do it, what sense and what relations are established with it. In that way the work is increasingly seen as a wide and complex interaction. Finally, we outlined that there is a need for new professional figures, able to manage the increasing complexity of the service model. They need to be skilled on Social Sciences and Economics, being tech-savvy at the same time, to effectively mediate and communicate with users, providers and stakeholders.

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HARNESSING COLLECTIVE WISDOM ON ACCESSIBLE AND ASSISTIVE ICT, THE CARDIAC PROJECT

Ilse Bierhoff[1], Yiannis Laouris[2], Patrick Roe[3]

Abstract

The aim of the CARDIAC project was to create a platform that can bring together the various stakeholders in the area of accessible and assistive ICT. Research & development gaps and emerging trends were identified, and a research agenda roadmap consisting of 14 research lines was generated by an international acknowledged interdisciplinary team of experts. The various rankings indicate that the three research lines to emerge as a priority are "Innovative user interfaces" (top of ranking in terms of joint impact and probability of requiring public funding) "Holistic approach to human computer interaction" (second in ranking in terms of joint impact and probability of requiring public funding top of ranking in terms of impact), and "Advanced design and development methodologies and tools" (third in ranking in terms of joint impact and probability of requiring public funding). The developed roadmap was applied in studies on Smart Homes and eLearning. These two studies reviewed in detail the research actions of the CARDIAC Research Agenda Roadmap, with a view of assessing how relevant or not they were to their particular fields. The findings have showed that the CARDIAC Research Agenda Roadmap can be applied and extended to more specific fields even though the roadmap has been drafted with the broader perspective of accessible and assistive ICT in mind.

1. Introduction

The aim of the CARDIAC was to generate a research agenda roadmap highlighting research priorities in accessible and assistive ICT that will favour eAccessibility. Assistive devices have helped many people with activity limitations – these devices vary from inexpensive low technology aids for daily living to sophisticated special computer terminals. However the trends in technological development mean that it is increasingly important for all users to be able to use mainstream systems and services. All too often these systems have been designed for what has been perceived as a 'typical' user, and little allowance has been made for people with activity limitations. Prioritising research for social inclusion in the emerging information society is not just about determining what new technological developments to fund, but how to influence mainstream design teams to take into account the needs of people with activity limitations when designing new products or services. In the longer term the full

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[2] The Cyprus Neuroscience & Technology Institute, Cyprus
[3] École Polytechniques Fédérales de Lausanne, Switzerland

integration of various technologies offers exciting possibilities to provide a wide range of services that are inclusive and able to support people when necessary. Whilst the core objective of the project was to advise the European Commission as to where to direct research funding in the short, medium and more distant future within the context of ICT for independent living, inclusion and governance, the results are also of value to all stakeholders involved in the field of accessible and assistive ICT. Within the CARDIAC project the application area Smart Homes was selected as a case study for R&D in Accessible and Assistive ICT. This case study consisted of a thorough review, from a literature as well as a practical point of view, of the recent developments in this area and how these developments are related to the roadmap developed within CARDIAC.

2. Methods

To formulate the research agenda roadmap an innovative method called Structured Dialogic Design Process (SDDP) was chosen. The strength of the methodology is that it explores the links between the different factors in a democratic, structured and methodological way that leads to an influence map that could otherwise not be drawn up intuitively by the participants. The method consists of five steps: the generation of ideas, the clarification of ideas, the clustering of ideas, the voting of most important ideas and constructing a relational map displaying the influences among ideas of higher relative importance (the influence map).

Three SDDP workshops were organised and the participants expressed a great sense of pleasure being included in a group of experts exploring shared areas of interest. Furthermore, the process gives the participants a sense of ownership. This sense of ownership and engagement comes from the ‘shared journey’ and the fact that the methodology provides all participants with an equal opportunity to submit ideas. Much of the richness of the process lays in the discussions themselves and this ‘collective learning process’ is observed throughout clarification and structuring sessions.

All contributions are well documented and in this way ideas can evolve throughout the process. Through this documentation, all interesting elements can eventually be part of the final roadmap, even if they did not have received enough votes. A wide range of multidisciplinary experts and stakeholders were involved in these workshops. The overall result is a research agenda roadmap containing 72 different research actions structured into 14 research lines, reflecting the complex issues involved that require a holistic and interdisciplinary approach.

3. Results

Main result of the work within the CARDIAC project are the following 14 research lines.

Research Line 1: Human Factors Studies: The progress to full accessibility, usability and usefulness of network applications requires a design centred on the user, taking into account human diversity and avoiding all types of barriers that affect users with permanent or occasional limitations of activity due to cognitive, sensory or physical restrictions or occasional limitations of activity due to contextual factors.

Research Line 2: Privacy, safety and trust: Most ICT designers concentrate their work on the functionalities of services and applications. They do not take care of problems potentially caused by their possibly inadequate provision or of the impact on the privacy and autonomy of the user.

Research Line 3: Holistic approach to inclusive HCI: Since designers are used to advanced design environments, inclusive methodologies must be sound and usable in the context of large-scale software development projects in order to be adopted by the industry. In addition, it is necessary to reduce the complexity of the interface and therefore the effort required for the interaction: many users experience frustration and displeasure when trying to perform a task using computers, just because they require an extra effort due to the cognitive overload imposed by the interface.

Research Line 4: User modelling and adaptive user interfaces to tailor the interaction: Initially applications included a single and inseparable user interface. Due to human diversity only a part of the users were able to adapt themselves to the (physical, sensory and cognitive) requirements of the interface. Currently, the separation between the application and the interface allows the design of interfaces that are adapted to the specific characteristics and needs of each user.

Research Line 5: Innovative user interfaces: The access to services provided by ICTs is frequently prevented by the use of “traditional” user interfaces. Recent advancements in sensoring, wireless networking, among other technologies, make possible the development of new kinds of user interfaces able to avoid the barriers imposed by previous interaction systems.

Research Line 6: Access to advanced ubiquitous computing environments: Advancements in ubiquitous computing allowed the design of Ambient Intelligence and Ambient Assisted Living environments that provide ad-hoc local services. People with disabilities can very much profit from these services if barriers to Assistive Technology are removed and dynamically adapted user interfaces are provided.

Research Line 7: Interoperability and standardization: The diversity of procedures, layouts, behaviours, etc. of the diverse interfaces required to access ICT products and remote services creates important accessibility and usability problems to people with disabilities. Interoperability of equipment can provide a way to access to diverse services and devices using a unique interface well adapted to each user.

Research Line 8: Role of end users and their needs: The ‘accessibility’ of a product or service is not a feature in its own. Instead, it can be regarded in relation to the person who wants to use the product/service, to her intentions, capabilities and her assistive tools etc., and the conditions, environment and circumstances under which the persons uses the product/service.

Research Line 9: Design and development methodologies and tools: Researchers and developers of Assistive ICT or mainstream ICT need to get easy access to well elaborated and well-described technical instruments that facilitate the realisation of Assistive or accessible ICT products and services. These instruments may comprise e.g. methods, procedures, modules of software or hardware, technical descriptions, guidelines, standards, development/test tools and environments, technical experiences and evaluations.

Research Line 10: Test and evaluation methodologies and tools: A set of clear and unambiguous accessibility and usability guidelines (like developed for web sites) would help to advance in accessible HCI evaluation. In addition, this experience can be used to benefit the development of similar tools for the automatic evaluation of non-Web application interfaces and services. Since these tools are mostly based on finding barrier patterns in mark-up languages (such as HTML), the definition of suitable User Interface Description Languages seem to be a good option to advance in this field.

Research Line 11: Collaborative research and knowledge sharing: Sharing knowledge and resources and collaborating in R&D can broaden the reachable population, increase the size of the markets and lower the prices of Assistive Technology. In developed countries Universal Accessibility is defined with a narrow focus. Availability of resources, infrastructures and education means is taken for granted. Nevertheless, disfavoured populations both in developed and developing countries are excluded from this focus because they do not have access to the basic requirements.

Research Line 12: Social Networking and applications: The Web from a repository of information has become a virtual space where people can meet, discuss and cooperatively produce information. Moreover it is also developing toward a Web of services, where service providers of users themselves can make available services and applications addressing different aspects of access to information and interpersonal (group) communications. This can be very important to favour eInclusion. In addition to living in an intelligent environment, people can be immersed in a virtual space where human intelligence may be available to help them. A carefully planned cooperation of machine intelligence in the environment and human intelligence in the network can be an invaluable support for inclusion of people.

Research Line 13: Social context and impact: Inclusion of people can be supported by a careful use of technology, particularly in activities connected to access to information and interpersonal communications. Sometimes, difficulties in using technology are caused by an insufficient care given to the problems of adaptation of it to people, especially if they have some activity limitations. Other times, this is due to an insufficient knowledge of all the important stakeholders of the problems encountered by some people in using systems, services and applications and of the solutions available to solve or reduce the problems.

Research Line 14: Market, service delivery and public procurement: The improved accessibility of ICT products and significant innovation in Assistive ICT products can stimulate the market by addressing and reaching a greater number of potential customers. At the moment, the market for Assistive ICT in Europe is rather a local than a global one. It is highly fragmented. Service delivery models vary significantly between the EU member states. Often, different models are applied in parallel in a state. – This is even more true for countries outside the EU, especially developing countries.

Additional consultation was carried out where the respondents were asked to score the research lines in terms of impact, probability of requiring public funding and feasibility. The analysis of the responses to the questionnaire has identified some priorities amongst the research lines according the impact, probability and feasibility. However, the main finding has been that the overall scores for all the various aspects investigated through the questionnaire have been closely grouped together. This has made a strong case for not removing any of the research lines and has been an important step in in the consolidation of the overall Research Agenda Roadmap.

Nevertheless the various rankings indicate that the three research lines to emerge as a priority are "Innovative user interfaces" (top of ranking in terms of joint impact and probability of requiring public funding) "Holistic approach to human computer interaction" (second in ranking in terms of joint impact and probability of requiring public funding top of ranking in terms of impact), and "Advanced design and development methodologies and tools" (third in ranking in terms of joint impact and probability of requiring public funding).
Progress in these three priority research lines is also valuable the area of Smart Homes. With respect to "Innovative user interfaces" the focus in the Smart Homes area is on the increasing possibilities for personalization, the use of robots in the home environment, serious gaming, platforms that offer a wide range of services and open platform that enhance possibilities for third parties to add services.

In the Smart Home area the focus doesn't limit itself to a holistic approach to HCI but widens to a holistic approach to service delivery. Moving away from a technology push and placing the user in the centre of the design process has been promoted in the past few years, also within EU research projects. Older persons and their informal carers where mainly considered to be the users. Although different levels of other important users where identified their role within the design process has received less attention. This means that organizational models needed to offer the new services weren't taken into account. This caused a lot of problems when trying to commercialize interesting project results and create sustainable project outcomes.

There is a lack of empirical evidence to support or refute the use of smart home technologies within health and social care. Companies and services suppliers do not have the abilities and budgets for performing large research projects, and particularly for developing methodologies and tools. Besides, research regarding smart homes should be interdisciplinary as smart homes involve not only technical issues but also social, psychological, cultural, ethical, political and economic aspects, and therefore, any research team should comprise researchers representing these interdisciplinary disciplines.

4. Discussion/conclusions

The core aim of the Coordination Action has been to generate a Research Agenda Roadmap in the field of Accessible and Assistive ICT that would be relevant to all the stakeholders involved and useful to the main stakeholder, the European Commission, in shaping future research calls and support.

For this purpose, a democratic structured dialogic process known as SDDP was selected, involving as many stakeholders as possible, so that the resulting roadmap would reflect a wide range of views and could also be partly owned by the multidisciplinary group of experts who have contributed to it. Applying this methodology to this particular area of creating research agendas is new and it has been a ground breaking experience for all involved. It is hoped that the collected wisdom both from the structured dialogues themselves and the systematic step-by–step roadmapping process will serve as an experience for any such future endeavours.

The resulting CARDIAC Research Agenda Roadmap with its 14 research lines in different areas reflects the multidisciplinary nature of the process and people involved. The CARDIAC consortium believes that this holistic, all-encompassing approach to the problem can serve, through its implementation, to address the higher long-term aim of the project, namely to ensure that there is an increasing amount of products and services available on the market in the field of Accessible and Assistive ICT.

For further reading: The detailed roadmap can be found on www.cardiac-eu.org.

UNDERSTANDING THE PSYCHOLOGICAL PROFILE AND MOTIVATIONS OF THE ELDERLY USERS

Silvio Bonfiglio[1], Giovanni Pioggia[2]

Abstract

Some of the products designed for the elderly users aim at interacting with them by providing feedbacks and advices and foster better motivation towards a healthier lifestyle and better suited habits. It has been proven that people often resign from following lifestyle adoptions due to a lack of self motivation. Therefore it is justified the attention given to the motivational aspects when designing for elderly. The efforts done have shown up to now a lack of effectiveness due to a poor focus on personalization; the solutions have been too generic and neglecting the psychological specificity of the individual user and therefore unable to adopt accordingly the most suited approach fostering a behavior change. This paper describes how the "psychological profile" was included in the design of elderly addressed services in four research projects devoted to the senior citizens: OASIS of the FP7-ICT Program, EASYREACH and NOBITS of the AAL JP Program and i-MOTION, a project co-financed by the Regione Lombardia in Italy[3].

1. Introduction

It has been proven that general health conditions of the people and specifically of the senior citizens can be enhanced through lifestyle interventions and risk factor modifications. Therefore some of the applications/services provided to the senior citizens (e.g. Health Education, Activity Coach, Nutritional Advisor, Social Inclusion)

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[3] OASIS (Open architecture for Accessible Services Integration and Standardization) is an Integrated Project of the EC Framework Program 7 (Grant Agreement: # 215754; Strategic Objective: ICT and Ageing – Starting date:1 January 2008; ending date: 31 December 2011) – www.oasis-project.eu;

EASYREACH (Fostering social interactions of home-bound and less educated elderly people) - www.easyreach-project.eu - and NOBITS (Nostalgia Bits) are two running projects of the Call 2 (2009) of the Ambient Assisted Living (AAL) JP; both projects are expected to be completed during 2013.

i-MOTION is an Italian Research Project co-financed by the Regione Lombardia in the Health sub-program and is related to the monitoring of older adults living alone at home through non-invasive and innovative technologies. The project (15 months long) will be completed in the first half of 2013 – www.imotion-project.it.

aim at interacting with the users by giving them feedbacks and guidelines. At the same time it is well known that people and mainly older adults often resign from following lifestyle adoptions due to a lack of self motivation. Therefore it becomes important in a strategy addressed to the older population to consider the motivational aspects. We notice in the solutions currently available a lack of effectiveness due to a poor focus on personalization; they are too generic and neglect the specificity of the individual user. The assessment of the Psychological Profile of the elderly person allows to identify the *"motivation model"* characterizing the specific user and to define accordingly the most suited approach fostering his behavior change.

2. Methods

The Psychological Profile we introduced has a multi-parametric structure with each element assessing a specific aspect of the psychological status of the elderly person. In its complete structure it includes the following parameters:

Indicator	**Description / Notes**
Motivation	It defines the level of self motivation of the user
Psychological stability	It defines the variability of the psychological status
Life satisfaction	the willingness of enjoying the life even if in presence of constraints (e.g. unsatisfactory health status).
Self esteem	Evaluated according to specific metrics (e.g. the Rosenberg Self-Esteem Scale (Italian Version by Prezza))
Depression	Evaluated according to specific metrics
Perceived health status	It defines how his own health is perceived by the user regardless of the objective health conditions
Perceived extension of the zone of desired control	Or perceived locus of causality i.e. perception of controlling the situation, of having choices (the contrary of a perception of being under surveillance, of inability to control the events)
Mindfulness or mindlessness	interest in new thinks, open mind (on the contrary perception of the new as a threat)
Task orientation or goal orientation	orientation of doing everything in the right way, as it must be done regardless if the outcomes (on the contrary focus on achieving the objective regardless of how)
Activeness in everyday behaviors	independence and autonomy, willingness of being active continuously
Perception of loneliness	intensity of the perceived link with other people; to measure it the Italian Loneliness Scale (Zammuner), mainly adapted from UCLA Loneliness Scale was used.

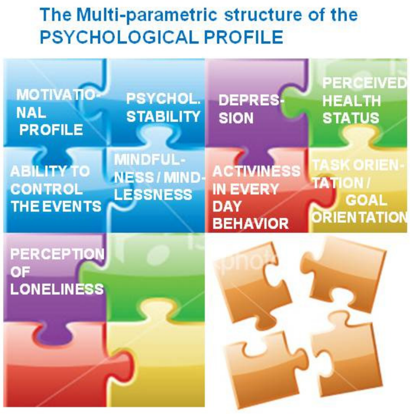

Figure 1. The various elements of the psychological profile

For the purpose of the services designed in the above mentioned projects the focus was on motivation, psychological stability and on the perception of loneliness.

2.1 Motivation

We adopted the theory developed by Deci and Ryan [1] and adapted to the older adults by R.J. Vallerand and B. P. O'Connor [2] where four levels of motivation are identified: intrinsic motivation, self-determined extrinsic motivation, non self-determined extrinsic motivation and "amotivation":

a. Intrinsic motivation: no reward, no constraint; just the inherent pleasure derived from doing so;
b. Self-determined extrinsic motivation: own perception of a benefit in doing so, not driven by someone else;
c. Non self-determined extrinsic motivation: actions done in view of a reward from someone else or in order to avoid a punishment;
d. Amotivation: no perception of any link between own behavior and outcomes; simply a non-motivated behaviour.

These levels represent a continuum from high to low level of self-determination.

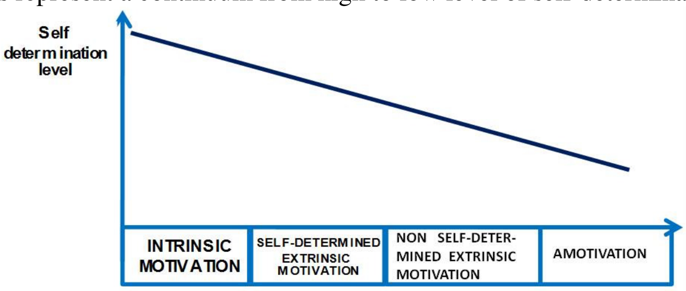

Figure 2. The four levels of motivation

2.2 Psychological stability

The psychological status of the elderly changes over time often highly influenced by external factors; this parameter intends to measure this variability.

2.3 Perception of loneliness

It measures the intensity of perceived connections with other people (friends, relatives). Typically the UCLA Loneliness Scale is used for its measurement; we adopted the Italian Loneliness Scale (Zammuner) derived from it.

In the above mentioned projects, a questionnaire was proposed to the users and the analysis of the answers allowed to determine their motivational profile. The questionnaire is based on the ELDERLY MOTIVATION SCALE (EMS-72) [3] which assesses the intrinsic and extrinsic motivation of elderly individuals. It is divided in six LIFE DOMAINS (health, biological needs (eating, sleeping, ...), relations with others (family, friends, and people in general), religion, leisure and information (news)). Each domain has three different SITUATIONS; and for each of them the user is requested to give their agreement to the same four sentences (“I choose to do it for my own good”, “I don't know and I don't see what it does for me”, “I do because I am supposed to do it”, “I do for the pleasure of doing it”).

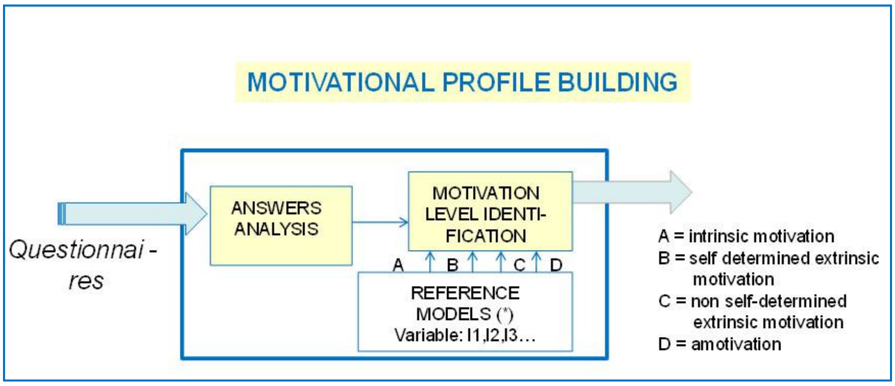

Figure 3. Building of the motivational profile of the elderly

Once the level of motivation of the specific elderly has been assessed, a motivation strategy can be adopted aiming at enhancing the self determination and the self responsibility of the elderly and at promoting a behavior change and a condition of “intrinsic motivation” towards better suited lifestyles. In the applications developed in the above mentioned projects, we linked to the “motivational profile” of the elderly the way how the feedbacks / recommendations were given to him. The psychological profile of the elderly has an evolution and the objective of some of the services addressed to them is to foster this change i.e. to produce an enhanced psychological functioning; therefore it is important to assess this profile on a periodic basis, i.e. to determine the variability of the psychological status of the elderly which often is highly influenced by external factors.

We preferred to avoid the invasiveness of a continuous and automatic assessment of the psychological status and of the mood of the elderly user through the automatic monitoring and analysis of parameters such as his voice and the speech characteristics or of some physiological parameters. We monitored the changes of the psychological status of the older user by involving him twice a day in a simple self assessment by using a very simple tool, the "*Smiley Face Scale*" already adopted by another European project. Twice a day (in the morning after the wake up and in the afternoon after lunch) the elderly was asked to declare his mood simply by selecting the more appropriate face.The faces are rated 1-5 with face 3 indicating a "neutral" feeling. The elder had the opportunity of entering some notes.

Figure 4. The self assessment through the Smiley Face Scale

The morning and afternoon mood was visualized with a graph and an algorithm allowed to calculate the daily change or the change over a defined period of time (e.g. during a week):

a. Daily change = (mood factor in the morning – mood factor in the afternoon);
b. Change in the period T = (max mood factor – min mood factor) in the considered period (by considering the values related to the same evaluation time (e.g. the morning values).

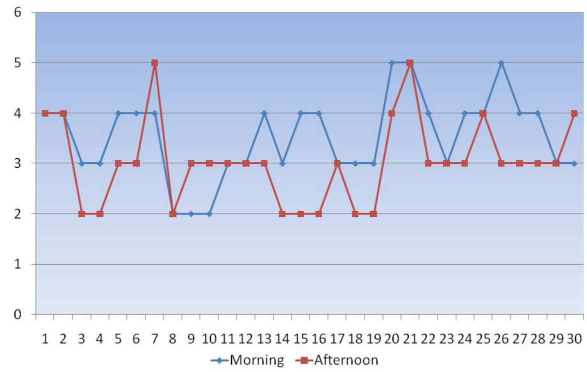

Figure 5. Monthly graph of the elder's mood

3. Results

The above described solution was adopted in four services specifically developed for the senior citizens in the European OASIS, EASYREACH and NOBITS projects and in an Italian project co-financed by the Regione Lombardia (i-MOTION project).
The use of the "motivational profile", of the "psychological stability" and of the "perceived loneliness" indicators added a new perspective in services/ applications where the aim is to empower the older adults in the self-management of their physical and emotional wellbeing by adopting better suited lifestyles.

4. Conclusions

We tested the above mentioned applications in pilots involving hundreds of older adults:
Health Education, Nutritional Advisor and Activity Coach applications were included in the overall platform of services provided by OASIS and the "user profile" was enriched by the above mentioned "psychological" indicators. The trials were conducted in five countries (Italy, UK, Germany, Bulgaria and Romania). The outcomes of the pilots demonstrated the validity of the approach in terms of effectiveness of the provided services and the feedbacks received from the users (mainly related to the usability and acceptance of the proposed solutions) were positive and useful to refine the design.

In the two AAL JP projects (NOBITS and EASYREACH) and in the Italian project (i-MOTION) – still running - we will add in the psychological profile the further dimensions of "self esteem" and "perceived loneliness"; the features offered by the services will be adapted accordingly and dynamically. We did already some preliminary field tests by getting encouraging results.

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"WHY DO WE NEED IT?" – AN ANALYSIS OF AFFECTIVE-MOTIVATIONAL FACTORS IN THE USE OF ASSISTIVE TECHNOLOGIES

Dieter Ferring[1], Gabrijela Reljic[1], Peter Roelofsma[2]

1. Introduction

There is a plethora of research addressing the relation between Assistive Technologies (ATs) and their users. A pertinent discussion among researchers involves topics regarding Assistive Technologies and Communication Technologies that may improve "quality of life, extend length of community residence, improve physical and mental health status, delay the onset of serious health problems and reduce family and care-giver burden" [3].

Although making no pretence that their search was exhaustive, Blaschke et al. [3], in their review, summarize that AT intervention studies show promising but no clear evidence that ATs including behaviour monitoring tools, smart home tools and telehealth tools will be both efficient and cost-effective. The authors call our attention to the fact that "we are far from knowing what types of ATs and ICTs work well *with what types of users under what conditions and for how long*. The research to date provides suggestions and tantalizing hints, but the accumulated lessons learned that can be generalized across age, gender and nationality are few" (p. 651).On the other hand, what does it mean to have results generalized across age, gender and nationality and/or is this really possible? In the end, we are all a unique constellation of cognitive, motivational and emotional factors and much more than that. At this point we take the position that our reaction toward an object is mostly defined by who we are and by what a particular object represent for us.

While reviewing technology acceptance models we noticed a predominant focus on cognitive processes which is why we support Beaudry and Pinsonneault's [2] observation that cognitive models cannot capture all the factors involved in the complex process of acceptance/rejection of technology. Here we argue that individual needs and motives as well as emotions play a crucial role in determining the choice, use and acceptance of assistive and other technologies. The paramount aim of this paper is thus to elaborate the role of these affective-motivational factors in the use of assistive technologies by older adults and to provide some hints why technologies are not always willingly accepted by everybody even if they are designed to serve the best purposes.

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2. A heuristic model of technology use by elderly persons

In the following, we will present a heuristic model (see Figure 1) that - without claiming to be exhaustive – describes the interplay of personal and contextual factors that can be used to explain differing attraction by the use of assistive technologies as well as technological solutions in general. The model is anchored in life span developmental psychology, as well as in theories on human motivation and self-regulation. The model starts with the notion of *person-environment fit*. This term describes that individuals adapt to and shape their living context in such a manner that it guarantees the best possible way of psycho-physical functioning. Psycho-physical functioning describes fulfilment of basic needs and learned motives as well as achievement of goals[3]. Given that human beings always have several needs, motives and goals that also change with increasing age, a given living context may be adaptive - in the sense of need fulfilment - only at a given time for some individual needs only (e.g., living at home may no longer serve fulfilment of physical and other needs in advanced age). This basically describes the idea of person-environment fit within the context of the present model. As the second general feature, the model differs between three time segments used to systematize the encounter with a specific technology: There are ***antecedent personal and contextual factors*** that set the frame for the choice of a given technology; these are followed by the process of encountering the technology - the ***user experience*** - comprising features of the specific tool as well as immediate and long-term reactions that will lead to durable ***outcomes at the personal and contextual level***. Due to the limited space, we will shortly elaborate some of these model components in what follows.

Antecedent factors of technology use. At the personal level, we choose to highlight *gender*, *age*, *education* and *cultural background* as well as *health status* and *intellectual capacity* as more general characteristics that cover for a differential probability and necessity of assistive technology use. This is followed by *personality traits* that describe habitual behavioural tendencies of a person. Referring to the Big Five Personality model [8] one may for instance assume that different openness to experience will have a direct impact on the choice of a given technology. Moreover, a person with a high tendency towards conscientiousness may approach technology in a different way than a person with a minor tendency towards such behaviour. Besides these, the *personal belief system* also plays a central role in technology use. Here, we differ between generalized as well as specific control beliefs. Control beliefs describe individual convictions about the internal and external sources of individual reinforcement, i.e., they reflect the biographical experience of need and goal fulfilment. Two extreme cases describe this continuum. While one person may be convinced that positive experiences in life are completely dependent upon other persons, another has the conviction that s/he is able to achieve positive events in life by his/herself. These beliefs can be generalized or specific with respect to a given domain of functioning. Due to prior experiences, a person may, thus, be convinced that

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[3] We will use the terms "needs", "motives" and "goals" as basis of the motivational system here to describe primary needs serving life conservation and health, learned motives (e.g., achievement) serving especially social life as well as goals as the future commitments to individual needs.

s/he is able to successfully deal with technology in a way that it serves individual needs, or s/he may repeatedly make the experience of needing help and assistance. These experiences lead to different convictions that will have a direct impact on behaviour. This is also the case for self-efficacy beliefs that represent a further significant part of the belief system; these reflect the individual conviction that one has sufficient means to cope with demands of life in general and technology in particular.

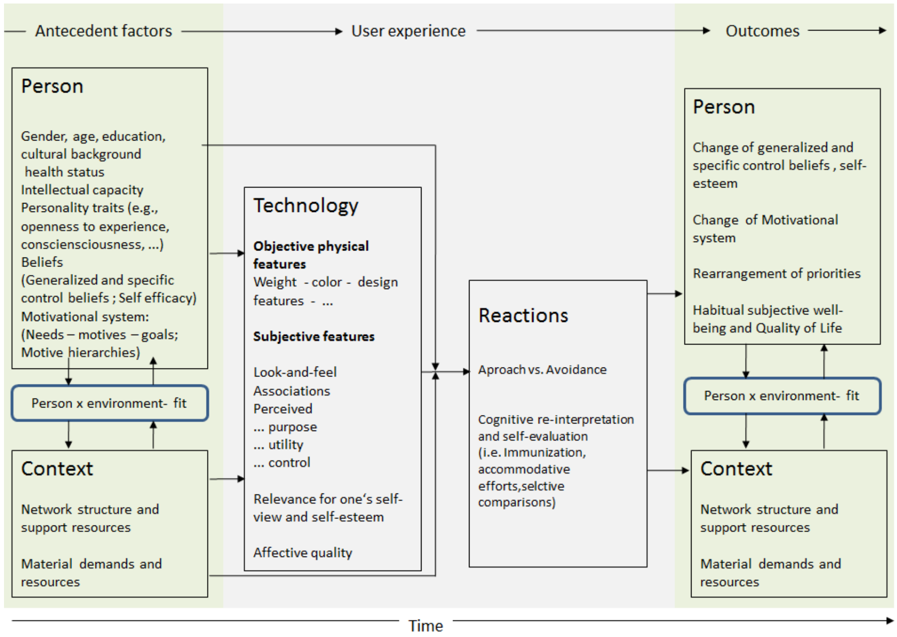

Figure 1. Heuristic model of technology use

The *motivational system* finally describes the *hierarchy* of needs, motives, and goals that exert the influence on behaviour in a given life situation. These are hierarchically sorted according to their importance for individual functioning, since the most deprived motives exert the strongest influence on behaviour [7]. Quite trivially, a person who has a burning need for food will exclusively supervise his/her behaviour to satisfy this need. After one specific need, motive or goal is fulfilled, other motives within the hierarchy exert an influence on behaviour. The motivational dynamic is even more complex since individuals may have conflicting needs, motives or goals[4]. One may, for instance, be motivated to promote ones health by stopping to smoke but, on the other hand, is craving for nicotine. One may be motivated to indicate one's children that one will use the tele-alarm device but, on the other hand, be motivated to avoid this since it personally represents a sign of frailty and dependence. All these personality factors interact with one another and influence the choice of behaviours in a given situation or more specifically the decision to use a given technological tool.

[4] Lewin (1935) has described this nicely in his typology of psychological conflicts.

The context variables that have an evident impact on technology use in advanced age comprise the *network structures* and the *availability of support resources* as well as *material demands and resources*. Effects of these may, however, not always be linear or straightforward: Having a large and supportive network may both raise or lower the probability of technology use depending on the personal evaluation and motivation. A person may thus see no necessity given the available support; on the other hand, s/he may be motivated to reduce the burden of close persons by using a specific technology. However, having no supportive network may raise the probability of persons to look for and use assistive technologies if they have the material resources to deal with this. This second factor which we describe as "material demands and resources" covers the material world of a given living context. Material demands and resources comprise financial means of a person but also the characteristics and quality of individual housing and this also sets the frame for the use of specific technologies.

User experience comprises in the first differentiation the interplay of objective and subjective features of a given technology. Objective physical characteristics such as weight, colour, as well as design features [9] exert a direct influence on perception and evaluation (e.g., reflected in evaluation such as too heavy, too bright, too delicate etc). This represents the look-and-feel-experience as the first of the subjective features that comprise several interlinked factors. Moreover, a specific device induces associations (e.g., a gift from a daughter that just implied the disability of the parent by buying the device, or using a computer-based device that the user associates with the previous boring job s/he had). Furthermore, the perceived purpose of a specific tool will be a crucial element for its acceptance and use. The user thus has to have the conviction that a given device serves a meaningful individual purpose, and this does not necessarily correlate with the intended use by the product developers.

If the purpose is clear, the utility of the technology is judged - a crucial question here concerns if a tool can be easily handled, manipulated and regulated. This is also linked to the estimation of control that one may exert over the tool. In this context, the relevance of a specific assistive technology for one's self-esteem gets evident as well. In general, using a wheel chair, a tele-alarm device or a mobile phone will clearly have different implications for one's self view and self-esteem, more specifically this also depends as well on all the other subjective features already mentioned here. Finally, affective quality describes the feeling (including the physiological reactions) that are associated with the "experience" of a tool and its perceived usefulness in serving an individual need. It goes without saying that this view is certainly not exhaustive and further factors not considered here may also play a role in this.

The interplay of objective and subjective features includes the first evaluation of the tool with respect to current needs and motives which trigger physiological and affective responses. The extremes may serve again to illustrate this: If a person has a pronounced need for a specific technology, if s/he is motivated to learn to use it, has the intellectual and functional capacity to do so, and if s/he then finds that this tool corresponds to one's expectation, this will probably result in positive feelings and evaluations. On the contrary, if one is not willing to use a given technology and makes the experience that the specific tool is not attractive and difficult to use, then this will result in anger and other negative effects.[5] It goes without saying that these reactions also reflect the impact of prior personality and context variables: Habitual individual reactions reflecting prior experiences may thus help to explain what appear to be spontaneous and routine reactions (e.g., "I never liked these...").

Reactions and actions associated with and following the user experience encompass "approach" as well as "avoidance" as general behavioural tendencies. This also includes cognitive manoeuvres serving to integrate the specific user experiences into ones self-view. A successfully used and useful technology may be evaluated now as something "that came at the right time" or in the situation of frustrated needs as something "that is of no use at all". These manoeuvres comprise strategies of immunisation and accommodation that are described in self-regulation models that help to maintain self-esteem [4].

Outcomes of the technology experience cover the effects on the person and the context as well as their interaction. Here, a positive scenario would be the following: Successful use of a tool results in changed control beliefs and self-efficacy as well as it affects the motivational system. The person may be reinforced in their control beliefs given that need satisfaction is now guaranteed by a technological solution, and s/he may develop new needs and aspirations. Furthermore, the successful use of technologies contributes to a person's habitual well-being and quality of life. All this has an impact on the context as well, since social support resources are relieved from certain tasks and can offer new ones. Material demands may have changed since a person no longer has to pay for certain services. A scenario of a non-successful use could be as follows: The person resets his or her priorities by evaluating a given technology as unnecessary and rearranging one's needs. If the technology is really needed and there are less or no alternatives, it is also evident that the person will be frustrated and experience lower subjective well-being and quality of life. All these experiences will then exert an effect if the person faces again the use of a specific assistive technology.

3. Concluding remarks and outlook

"Why do I need it?" is a crucial question that may determine the acceptance and use of assistive technologies. Although there are very convincing arguments for positively answering such a question by external perspective of service providers and social networks - the internal or subjective view may significantly differ. People may be convinced that they do not need a "necessary" tool due to different personal and contextual factors which we have described in the heuristic model. We are aware that the model is far from being exhaustive; however, we are of the opinion that it contributes to some new insights that have not been considered closely so far. Further work will be dedicated to the elaboration of recommendations that may guide the

[5] Frustration may not be as negative as some studies show, boredom seems to be worse when it comes to learning: although frustration has been regarded as negative in some previous studies, some recent studies show that it is actually better to be frustrated than bored [1].

development as well as the implementation of assistive technology by service providers.

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SHIFTING FROM LIVING LABS TO EXPERIENTIAL DESIGN LANDSCAPES (EDL)

Carl Megens[1], Michel Peeters[1], Caroline Hummels[1], Aarnout Brombacher[1]

Abstract

Innovative interventions are often needed to disrupt current situations, creating new opportunities for sustainable growth. The size and amount of computing power we carry with us is increasing everyday and thus provides new opportunities for designing disruptive and radical innovative intelligent products, systems and related services that enable people to change their lives, to change (transform) society and move towards substantial and sustainable solutions. Designing for these types of transformation however is not easy. Firstly, in the new technological opportunities lie also the dangers of fully aiming at 'the how' (technological means) and totally overlooking 'the why' (human values, meaning etc.). Secondly, creating these type of transformations on a societal level often needs a long process with a high degree of structural uncertainty. It is difficult to predict whether new concepts will lead to sustainable behavioral change and for instance an active and healthy lifestyle. For industry it is therefore very unappealing and difficult to try to create and introduce these radical and disruptive innovations without a solid basis of evidence. Over the last years Living Labs have been promoted to involve customers directly in product development to validate products in a near-everyday-living environment. In spite of its successes, for the class of intelligent products and systems this method has failed. In response to this we proposed the Experiential Design Landscape (EDL) for developing and testing new radical innovative concepts in everyday life with citizens towards sustainable transformation. Since ambient assisted living is moving more and more towards intelligent systems, products and services, we are developing the EDL method to be used e.g. for ambient assisted living. This paper describes the EDL method in comparison with living labs and shows example projects using the EDL method.

1. Introduction

Our society is faced with a number of major challenges, which include the aging society, healthy living, the economic recession, safety and attaining a sustainable level of energy and material consumption in light of the available resources. Brand and Rocchi [16] propose to tackle these societal challenges and move towards a sustainable world by accomplishing a paradigm shift towards a transformation economy, where stakeholders work together on designing local solutions for local issues, that stem from our large global issues. Solutions to the big collective issues, leading to e.g. true sustainability and well-being, typically require behaviour change

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on a societal as well as an individual level, where the collective is even more important than the individual. We believe that involving all stakeholders including citizens (or people, clients, users, consumers, depending on the frame of reference one takes) and aiming at individual / societal behaviour change, require that we move into the wild during the development process. This move into the wild is necessary since these complex societal challenges cannot be solved by small incremental solutions that are developed behind the drawing board, but they require more disruptive innovative solutions to realise behaviour change on a societal level. With disruptive we mean the absence of a well-established frame of reference for people or the market. Not only the product as such is new, but it also enables the creation of radical new meaning for the user, the market and society. And due to this disruptive character, we cannot predict this meaning nor any behaviour change; we have to explore it in the wild, in the everyday context with all stakeholders involved. Therefore, we propose the Experiential Design Landscape (EDL) [1] for developing and testing new radical innovative concepts in everyday life with citizens towards sustainable transformation.

2. From Living Labs to EDL

Over the last years Living Labs have been promoted to involve customers directly in product development to validate products in a near-everyday-living environment [2]. In spite of its successes, for the class of intelligent products and systems this method has failed. Living labs generally serve the purpose of analyzing propositions largely known to the user in a well- defined context, whereas an EDL incorporates the entire design process up to launching 'production-ready' products and services in context. Moreover, during the creation phase, the user is still unaware of what patterns will emerge in the future. Whereas in living labs users (and designers) are in most cases far more focused on what is happening in the interaction between an individual and a product.

Many other attempts besides Living Labs have been made to involve customers directly in product creation, validation and innovation via co-creation [3][4], empathic design [5] and participatory design [6]. While these methods work for developing products and systems tailored towards users' (functional) needs, they do not accommodate processes where the value, meaning and impact of the design solutions can change and get redefined during prolonged use. Intelligent products and systems have the ability to adapt to individual users and situations, often over a longer period of time. As a consequence it is likely that also users will adapt themselves to these products and systems.

As a second consequence the diversity of product-market combinations can grow to the level of individual user/product(system) combinations while, in the meantime, all kinds of, often unpredicted, usage patterns may emerge. In a lab or field setting users do not get the freedom or time to try the new proposals freely and long enough to evolve these types of behavior. This difference in nature between lab and/or field settings and the Experiential Design Landscape is depicted in figure 1.

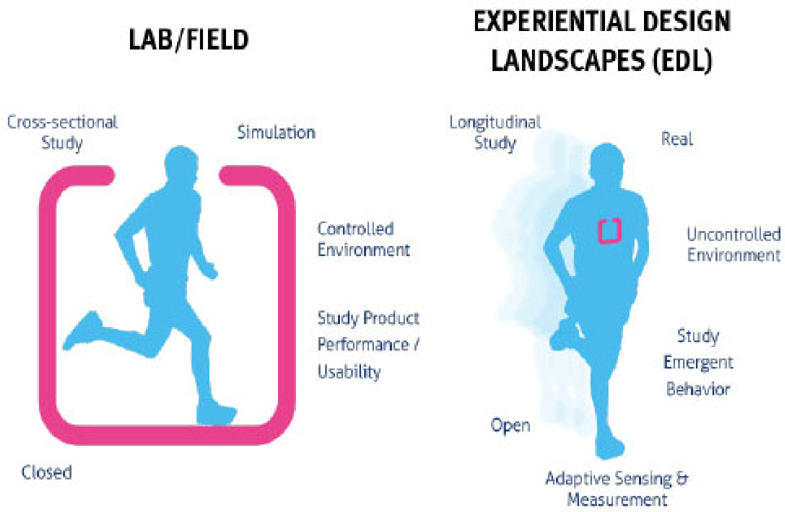

Figure 1. Lab/Field vs. EDL

An Experiential Design Landscape (EDL) is an infrastructure that is created to stimulate the creation of new, disruptive propositions in a (semi-)open environment where these new propositions are used as probes to facilitate new and emerging behavior. In this environment designers can involve people into the development of new products or systems by allowing them to use the concepts in their everyday living environment. In parallel the environment and the probes enable detailed analysis of the emerging data and behavior patterns as a source of inspiration for designers of future products, systems and services.
In order to design for an EDL a different approach to design is needed, in which envisioning the change in society is one of the main drivers of design in combination with exploring in the everyday context in collaboration with users. For this we use the Reflective Transformative Design Process [7], a method to create intelligent products, systems and related services that aim for societal transformation.

In the Experiential Design Landscape designers set up ‘Experiential Probes’ (EP) to gain a first person perspective, to understand people in the EDL and give them the means to create meaning in interaction. Further on in this paper we will explain what these experiential probes are and how they work. Doing so we use three examples of experiential probes that were built and set out for a minimum of three weeks. The probes were designed for a more active and/or healthy lifestyle, in whatever way this was envisioned.

3. Experiential Probes

The proposed concepts in an EDL, which we call ‘Experiential Probes’ (EP), are highly intelligent, open, networked, sensor-enhanced product-service systems. They are probes with built-in intelligence to gather data on the use of the concept in real life. Through adaptive questionnairing and sensoring [8] people provide feedback without being obtruded (too much) in their natural use of the concept. In this way the designer gets insight and understanding in the (latent) needs, behavior and experiences of the people using their concepts, allowing them to further develop the concept towards a changing or new behavior. Moreover, it allows the designer to gain a first person perspective and understanding of the people in the EDL.

The designer searches and explores the opportunities together with the people using the concept through the experiential probes. This is a different approach to probing as with ‘Cultural Probes’ [9] or ‘Technology Probes’ [10], where the designer tries to gain a third person perspective of the current situation, the researcher creates a distance between the participants and him/herself. With experiential probes it is important that they do not obtrude or change the current situation of the participants. They merely try to probe, distill and understand the current situation as inspiration for the designer.

In the EDL however we want the probes to actually disrupt the current situation and position the designer in the middle of the disruption together with the person using the probe to design the outcomes of the disruption to reach sustainable transformation. Any individual use, mis-use and unexpected behavior can therefore lead towards design inspiration for a high diversity in people.

Earlier work has shown that ‘Experiential Probes’ work best when the intention and meaning of the probe is preferably not fully defined by the designer. As we want to find out what values and meaning are important to the people using the probes this can best be left open for them to define. In this way unexpected use will happen a lot easier, since the designer doesn’t fully define the expected use with the experiential probe. An EP is therefore not the same as a product prototype. It doesn’t try to fulfill any functional needs of users; instead it aims at disrupting people's current behavior and frames of reference. In some of the examples shown later in this paper it is unclear at first what the probe actually does for/to people, therefore they start to explore what it can mean and do.

This shows the importance for the designer to always have a good understanding of what people are doing with the probe and how their behavior changes or emerges. In this process the designer should understand the new behavior and iteratively tailor the probe towards the types of behavior he/she finds fitting with their envisioned transformation. The process therefore starts out in a very explorative way, in which real people in their real lives also take part in the design process.

4. Cases

Three different experiential probes were designed and are described in more detail below:

Social Stairs Social Stairs is an intelligent staircase that was installed in the university's main building, which made ascending/descending sounds as you walk up and down them. The concept aimed at stimulating people to move by making the stairs more appealing, and early EDL experimenting showed that social engagement encouraged more active behaviour. To encourage this social behaviour, which is also how it differentiates itself from the wellknown Piano Stairs [12], people who worked together whilst using the Social Stairs were treated with a louder, orchestral chime that echoed up the stairwell. Next to this, the system provided the designers with long-term user data, which was used to test whether the intended effects were actually achieved. The Social Stairs got university wide popularity, which made the recorded data very rich and diverse.

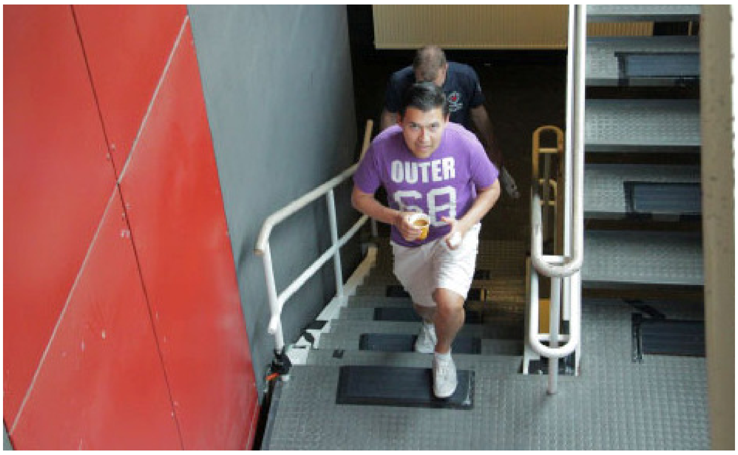

Figure 2. Social Stairs Face-it

Inspiration for this experiential probe came from real people's behavior; being easily distracted from work because of the urge to visit Facebook (too) regularly throughout the day. First ideas and probes aimed at tracking this event, where more insight was gained in the overall concentration people have during the day. Face-it is a screen frame to be placed on the outside of a notebook screen and acts in the periphery of the viewer. The screen frame consists of an array of LEDs which light up sequentially at a certain pace. With a control unit both pace and fade-in/fade-out intensity of the LEDs could be personalized. Face-it was designed to support people in staying focused during work.

Figure 3. Face-it Bouncers

Bouncers is a live wallpaper for your Android smartphone. The wallpaper was designed to be non-obtrusive and provide a subtle way of displaying information during everyday use of your smartphone. Bouncers visualises physical activity using the accelerometer data of the android smartphone. An individual’s activity is represented in the speed of one circle in the wallpaper. Other circles represent the physical activity of a selection of your friends. The information about one's physical activity and lifestyle is therefore shared in a small and close group of friends. As illustrated in Fig. 4, Bouncers shows different circles, each with their own unique color. The large circle (red circle in the image) represents the owner of the phone and the smaller circles represent his/her selected friends. The speed of each circle corresponds to an individual’s activity, measured and processed by the internal accelerometer, processed as a rolling average. Therefore the results are not immediate and can only be perceived over time. Thus the speed correlates with the general amount of physical activity of the individual.

Figure 4. Bouncers

5. Reflections and Discussion

In the different EDL projects there was a high diversity in design approach, tools, involvement of people, running time of the probe, and (data) returns from the EDL. Below we reflect in-depth across the different projects.

5.1 Designing the experiential probe(s)

One of the more difficult things of setting up an EDL appeared to be defining a point of departure. Some designers found inspiration in observing real people's behavior/habits; other designers defined their design approach based on their own vision, personal experiences and design beliefs. The designers of the Social Stairs looked into the opportunities to make people more active during their workday. Their inspiration came from people's, often unconscious, decision to take the elevator instead of the stairs for only one or two floors in a building. With the first experiential probe they designed, people first had to cycle a few minutes on a home trainer that was placed in the elevator, before they gained access to the control buttons of the elevator. In the reflection sessions it was decided this was not the 'right' approach. Instead of offering people an open disruption where they can choose how and if they (re)act upon it, their actions were now predefined and decided on by the designers, comparable for instance to speed bumps. After this reflection, the decision was made to try and probe people on the stairs instead of the elevator, trying out ways to disrupt the moment of (consciously) choosing to take the elevator or stairs. They defined new design actions eventually leading to the Social Stairs. They learned that people don't want to be 'punished' for their decision to take the elevator. Furthermore, people also didn't like the fact that it is was decided for them that they didn't get access to the control buttons of the elevator before they spent some time on the home trainer. Lockton et al. [2010] describe this as design becoming a tool of the 'nanny state' which 'knows what's best for you'. In order to really change people's behaviour the designers found it important that people themselves reflect on what's best for them. After an in-between experiment of covering a flight of stairs with bubble-wrap plastic they dove into ways of making the stairs engaging and fun. Through this experiment they learned that people were immediately attracted to take the stairs, and wanted to try and play with the new stairs.

The designers of Face-it gained inspiration from their peers. They noticed that their peers were often easily distracted from their work because they visited Facebook quite a lot throughout the day. Based on these observations they immediately started designing their first experiential probe. Through this first probe they gained more in depth insight on the behaviour of the people using the probe. This led to the design of the Face-it probe.

Bouncers was designed by a vision. People desire to have social relationships. One of the ways to form social relationships and create a social status can be achieved by joining a sports club. However, in our current society the social role of sports clubs is disappearing, resulting in a lower participation level in sports [12]. For society this creates a challenge, as the lower participation in sports can lead to several health issues, like for instance obesity, diabetes, etc. Next to the trend of declining sports participation social media is also starting to take over part of the social interaction, taking over the role of sustaining relationships. Based on these observations a virtual sports club for an active lifestyle was created, to stimulate people to become more socially connected by means of physical activity. Because people have the urge to fit in, their behaviour is influenced by others around them [13]. The influence others have on a person differs by means of their relation to the person [14]. This opened the opportunity to create a virtual sports club through which people can motivate each other to be more active: Bouncers

5.2 Value Proposition

One of the difficulties all designers came across when designing their first probe was to balance the open character of an EP with a value proposition. For many of the people who used their experiential probes it was often unclear what was asked from them as most experiential probes had a too open character and didn't address or convey an explicit meaning or intention. Many designers were afraid of losing the probing character of their designs when a very clear proposition and meaning was defined. This is all about finding the right balance. While the probes have to be open enough for people to find their own way of interacting with it and defining their meaning and value for it, a too open character will not engage people into interacting at all, as they don't see a point why they should engage. Some designers got this right early on, others needed to re-iterate their probe.

The Face-it designers didn't define any specific meaning for the screen frame; its only function was a 'walking' LED light over the frame. However, their design did embody a certain value proposition. Their inspiration for Face-it came from real people's behavior being easily distracted from work because they have the urge to visit Facebook (too) regularly throughout the day. By giving people the screen frame it was immediately clear they could place the screen frame on the outside of their notebook screen. Several probes were made to fit the most popular notebooks in our department. Face-it already acts in the periphery of the user during their work. Furthermore, giving them full control over the behavior of Face-it offered opportunities for people to give meaning to the probe themselves. Instead of the earlier mentioned 'nanny state' [15] which 'knows what's best for you', the behavior of Face-it (which is defined by the user) is open to any type of meaning. Initially Face-it was developed with the intention of a time management tool but soon it became a 'pace-indicator' supporting people in doing different paced tasks such as writing emails, searching on the web etc. For each task, people would alter the pace of the LED to a pace they found fitting to their job at hand. Others however would synchronize the pace with their music.

Social Stairs also wasn't initially designed for the immediate situation in the particular staircase. Moreover, it was not communicated as a social staircase value proposition with pre-defined meaning. Through interaction people (individually, in groups etc.) discovered that Social Stairs had different types of behavior. The people interacting with Social Stairs eventually defined its meaning (together) and thus its possible value propositions. Here the designers of Social Stairs also learned that even the smallest alterations they made to their probe had large effects on the people in the EDL using the probe. Moreover, as the Social Stairs aimed at long-term behavioral change, they could already see a difference in use of the staircase. The staircase was used more often and it was perceived as a more social and fun place.

5.3 The Designer in the EDL

In all EDL projects the role of the designer was questioned, and the designer was perceived as the contact person/ambassador of the experiential probe. For example, while designing Faceit the designers were seen as part of a co-creation session. Based on feedback from the people who used Face-it the probe was tailored and given back to them. While the designers were more aimed at designing for long-term behavioral change and transformation, people saw them as experts who knew a lot about their use of Face-it. Based on this information the behavior of Face-it was tailored to the user's needs and wishes.

With Bouncers, the designers came across an ethical dilemma. Bouncers could monitor the activity level of each individual 24/7. As they were monitoring their peers for the designer this started to feel really creepy. Basically they could literally see in the dataset what each individual (their friends) was doing, and when. Here they became aware of the ethical side of experiential probing and their responsibility as a designer to be aware of the thin line between ethical and unethical.

The Social Stairs designers started to develop a certain attitude towards the people using the experiential probe. As they were designing 'in the wild', a real staircase in the university's main building, a small amount of people complained about this work. The designers found this interesting to note as they didn't expect this to happen in such an innovation driven environment that should be open for change. As the stairs were fully open for everybody to use, this only applied when they were physically working on the probe. Next to numerous questions that arose in the university from people who didn't see them on what the probe was about. In the end even the attention of the internal university's newspaper was raised, for whom it took a while to find out who was responsible for this probe.

5.4 Returns

One of the more difficult aspects of experiential probing within an EDL is to get proper returns that can tell the designer what is happening with the people using the probe. Because of the interactive nature of the probes sensor data could be logged to gain insight into the probe's usage. Trying to distill behaviour and changes in behaviour out of the data of a single sensor however turned out to be difficult. However, when different sets of sensor data were combined, or when combined with other ways of getting returns like interviews, video analysis, etc. it became a lot more insightful and easy to see behaviour patterns in the returns. What also worked is actually discussing returns with the people in an EDL. As they are already part of the design process, they can understand and interpret the returns from their perspective. This however depends on the setup of the EDL, depending on whether the people participating were known or not.

The Social Stairs designers developed a public EDL, everybody could enter and use the experiential probe. Therefore it is hard to say anything about behavioural change on an individual level based on the returns. Instead, the probe sampled the behaviour patterns and changes of the community in the university building. The Social Stairs measured the use of each step on the stairs. Next to this a concealed video camera was placed, allowing the designers to see in hindsight what people would do with their probe. Together with the data from the steps this gave quite some insight on the change of behaviour, which prompted an iteration on the probe to emphasize social behaviour. This change too could be monitored and followed by the designers.

In the case of the 'Face It' probe the people who participated were known as the designers handed out the probe to them. In this way the designers could combine the measurements of how the user would set the speed of the LED's on the screen frame, with individual interviews. Doing so, by means of the sensor data the designers first found that the range of the sensor was too narrow; the user wanted a higher speed of the LEDs than what was possible. Through interviewing they found that people didn't use the 'Face It' for relative time keeping, but for pace. Because of this process several following iterations were made. In Figure 5 an example can be seen of the combination of returns.

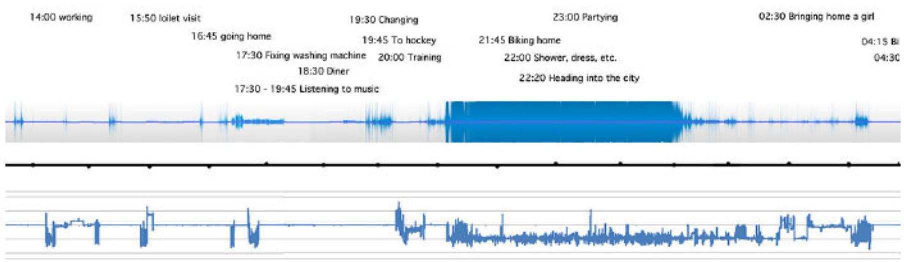

Figure 5. Example of combination of returns in the EDL: interview returns plotted on graph of data of multiple sensors.

Bouncers received a lot of user data as different sensors of people's mobile phones were. The participants in this case were also known so these returns could be complemented with individual interviews. In this case the designers received a huge amount of data points, which made the comprehension of the behavioural patterns a lot more complex. This shows a trade-off will have to be made between the amount of data you can retrieve and how much you actually need.

6. Conclusions

As said in the introduction of this paper already, the turn to the wild is not easy. In our research we are constantly working on developing the EDL method through design experiments like the ones described in this paper. Different aspects are continuously being explored and redefined. The method as such is still in its early stage of development, we are just beginning to understand the impact of taking design into the wild (i.e. society). This paper shows a part of this process, where we and the designers got hands-on experience with this way of designing. Through the creation and results of the 'Experiential Probes' we have learned what their impact can be and what insight they can create in the design process. In this section we will sum up some of the conclusions we found.

6.1 People, not users

In this paper we have referred a lot to the term people, instead of using the word users. This is a deliberate choice. In the EDL method the move is made into the wild, into real people's lives. We are looking for ways to change these lives in order to have impact on society. How can we change and create new behaviour that will transform society. The term 'users' therefore doesn't apply anymore, as this defines a group of individuals by the fact that they use a certain artifact. This works well in terms of looking at functionality or usability, but behaviour is subject to personality, habits, human values, relationships, daily life, social structures, etc. In order to experiment and explore with different ways of changing and emerging behaviour we like to fully involve all aspects of human beings. This is also why we keep the 'Experiential Probes' open for interpretation of meaning. We strongly believe in letting people create meaning in the process of designing in order to empower them towards a different and improved society.

6.2 Designing probes, not products

One of the challenges for the designers was to actually design a probe, instead of a product. As they are being trained in becoming professional designers this is of course their normal expectation in a design process. A probe however is different from a product, or a design concept. A probe can at first merely be to disrupt current situations in order to find inspiration for a design direction. By continuously creating small loops of development on the probe and setting it out in real life again probes will however become better tailored towards the envisioned transformation. We believe that this in the end will turn probes into valuable design concepts which can lead to products and/or systems with related services. Unfortunately the probes described in this paper only ran for a few weeks due to educational scheduling. This meant that only the first few steps could be made. More developments and experiments will be needed in the future to gain more insight into this process. The three 'Experiential Probes' described in this paper would probably need different timelines in the wild. Based on the outcome and returns of the wild the designer will have to decide when to reiterate and how long to keep an Experiential Probe running. In these cases three weeks was definitely the minimum to gain insight and create 'Experiential Probes' based on 'open scripts and intentionality'.

6.3 Turn to the wild

In order to truly change society in a sustainable and structural way through design we need to rethink the processes of design in order to reach a paradigm shift towards the transformation economy. In our view the turn to the wild is inevitable here, since these complex societal challenges cannot be solved by small incremental solutions aimed at functional needs and requirements. Disruptive innovative solutions are required to realise behaviour change on a societal level. By turning the process into the wild we put people central of this process, they are important stakeholders in the creation of radical new meaning. Due to this disruptive character, designers cannot predict or define this meaning on their own anymore. We have to explore meaning and behavioral change in the wild, with real people in their real lifes, with families, friends, neighbours, jobs, pets, hobbies, diets, wishes, needs, concerns, obligations, habits, quirks etc. We strongly believe Experiential Design Landscapes can facilitate this process and will keep on developing the method in the near future.

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ESENIOR – A USER-DRIVEN INNOVATION PROJECT

Veslemøy Ramsfjell[1]

1. Introduction

eSenior is a large scale Scandinavian Interreg IV A project with cross-border cooperation between Norway and Sweden. Main partners in the project are the municipalities of Gothenburg, Oslo, Sarpsborg and Fredrikstad, in addition to Borg Innovation which is the project manager.

The aim of the project is to develop and test new products and services that can secure senior citizens a safe and well-functioning life at home. Our focus is to keep seniors, receiving few or none nursing and care services, at home as long as possible. User involvement is crucial, and testing of new products will be done in real-life settings. This to ensure products adapted to the user's need. There will be close interaction between all parties (seniors, next of kin, healthcare employees and companies) in the test pilots. Totally 250 homes will be involved in the pilots, which starts up in Oslo this autumn, followed by the three remaining municipalities in the beginning of 2013.

The project is financed by EU- and Norwegian Interreg grants, in addition to the four participating municipalities and Østfold county council. The total budget is 3.109.030 EUR and the project period is from 2011-08-01 to 2014-07-31.

2. Methods and results

To find out what technology to be tested in eSenior, we have focused on analyzing 1) the challenges the technology shall solve, 2) how the results will be measured, 3) what is required of changes in organization and work processes and 4) who are the users and what is important to them. Such an approach has been necessary to ensure that the selected solutions address the real needs and that resources are prioritized in areas where they provide the greatest impact on users and the community. When we know the problem we will solve, what users need and what is required of the organization – then we can ask what "gadgets" can help us reach our overall goal?

We hope for new integrated solutions composed of "gadgets" from different suppliers. In an innovative public procurement approach, the project therefore just recently (September 13, 2012) invited companies and other interested parties to an open dialogue conference. At this milestone of the project, Gothenburg, Sarpsborg and Fredrikstad presented their challenges related to seniors staying at home.

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The three municipalities have many different challenges they want to solve. Common to them all is the focus on prevention efforts to strengthen senior citizens to stay at home longer. For example, the municipalities want solutions for medication management with deviation response, fall prevention, grocery shopping and dietary advice, and communication with municipalities, friends and relatives.

The companies are asked for their creative contributions on how technology can help solving these challenges. Companies that want to be part of the continuing dialogue process, have to return written input by September 27, 2012, to be invited to one-to-one meetings with the municipalities. Besides stimulating innovation and cooperation among the companies, the municipalities want to learn more about technological possibilities and limitations.

The challenges presented on the dialogue conference were based on analyses of the municipalities' "bottlenecks" and the needs of senior citizens who wants to stay at home for as long as possible. The seniors have participated in focus groups where some of the actual questions discussed were: 1) What do you think about years ahead related to mastering your own life and feeling confident in your own house? 2) What are your needs today? 3) What experience do you have with technology?
It is obvious that the senior citizens want to be confident with their disease at home. The possibility to follow up their disease at home and have an easy and safe medication management without being dependent on healthcare employees, were highlighted by the seniors. Furthermore, they want more information about 1) social arenas, 2) who to contact in the municipality, and 3) different aids, to mention a few things.

User-driven innovation is essential in this project, and seniors. Therefore, seniors, next of kin and healthcare employees will be involved in further stages of the pilots and the innovation process together with the companies. This interaction will lead to increased knowledge about technological solutions for the users and the companies - a better understanding of the users' needs and a quality assurance of the products.

Additionally, eSenior is in the process of establishing display environments that will offer an opportunity for the companies to show their products to a greater audience.

3. Discussions/conclusions

Three of eSenior's participating municipalities are in the phase of earning knowledge about technological possibilities and limitations. In 2013 they will test technology together with senior citizens in about 150 homes. Oslo, hovewer, is about to start testing in 91 apartments this autumn.

To succeed with our pilots several aspects, besides choosing the correct technology for testing, are important. Training and follow up of the users, both the seniors, next of kin and healthcare employees have to be put into system. Furthermore, we believe personal characteristics of the "teacher" are of key importance to create trust and confidence with the users related to using technology. The “teacher” has to be a good ambassador and trusting person the users gladly contact if they have any technology-related questions. The interaction between the project members and technology supplier is another key factor. Agreements about evaluation, adjustment of the technology and the use thereof have to be made.

Changes in working processes due to introduction of technology, is also practically, organizationally and psychologically challenging and have to be well planned. Experiences gained through the pilots will be of importance in future recommendations for implementation of technology in eSenior’s four municipalities, and hopefully for other regionsas well.

DESIGN FOR CONNECTEDNESS: COCREATION WITH OLDER ADULTS AT THE HEART OF THE DEVELOPMENT PROCESS

Sabine Wildevuur, Dick van Dijk, Thomas Hammer-Jakobsen, Mie Bjerre, Anne Äyväri, Jesper Lund

Express to Connect (E2C) is an Ambient Assisted Living project. E2C proposal addresses the overall European challenge of preventing loneliness and isolation amongst elderly people as stated in this AAL call. The E2C solution is targeted at a point in the service ecology (value chain) where it can contribute to a decrease in care- and health related social costs, and a rise in quality of life among elderly people. The Ambient Assisted Living (AAL) Joint Programme II of the European Union is looking for ICT-based solutions for Advancement of Social Interaction of Elderly People. E2C was funded by the European Commission under the Ambient Assisted Living Joint Programme. The project ran from March 2010 to March 2013. The overall objective for the E2C Consortium was to develop, test and deploy a web-based service, which stimulates and facilitates personal storytelling, and to enable interest-based connections and communications among elderly people, thus empowering them and enriching their lives. The consortium was formed by partners in the Netherlands, Finland, Sweden and Denmark. The consortium includes both companies and research institutions: Copenhagen Living Lab, Waag Society, Multi Media Table BV, Halmstad University, Halmstad municipality, Forum Virium Helsinki and Laurea University of Applied Sciences.

1. Insights

As a starting point for Express to Connect (E2C), the partners in the consortium wanted to know more about the lives of older adults and the challenges they face. To get a grip on their views on life, we wanted to engage them in an in- formal dialogue, to see which topics are most relevant and feel most important to them. We therefore invited people aged 65 and over from Finland, Den-mark, Sweden and the Netherlands to join us in locally organised workshops. The workshops started in April 2010, when participants were selected in the four participating countries to join a REALplay screenplay, using Lego bricks as a means of supporting the process.10 Copenhagen Living Lab (CLL) – one of the partners within the consortium that contributed experts in anthropological studies – brought in eight kilos (!) of Lego bricks from Denmark to every location where the workshop was held. Why Lego bricks? First, to support the hand-mind connection. The workshops enable the participants to overcome the barrier of not being able to define, express and share tacit insights and perspectives from their everyday lives. Secondly, to stimulate a shared language. The workshops enable the participants to gain a better understanding of each other's insights and perspectives, because they are presented in a way that includes both how the participants make meaning, and the personal experiences behind this conferral of significance.

Since talking about loneliness and social isolation on a personal level is a taboo subject, we talked about the opposite, discussing the positive factors, such as social activities and social relations. We addressed the questions in a different way, that is: What spoils or challenges social relations in the lives of the elderly? What do they do to maintain and create social relations? What are the barriers to escape loneliness when it occurs? Participants were encouraged to play with the bricks and build toy models in answer to specific questions we had. Having to use toy blocks was surprising to the participants at first, but they soon discovered that it brought out creativity and helped them to express their insights actively. By building associations and ideas, participants could sidestep the domination and anxiety of words. One participant, for example, built a clock to illustrate how she feels pressured by everyone telling her that now is the time to enjoy her life. She felt it was 'five minutes to twelve'. Someone else built a big brick wall illustrating how her more limited mobility due to physical constraints made her dependent on others to break through barriers. We gained a better understanding of social relations and activities through the first workshop we held, but we also learned more about 'taboo' themes such as loneliness and (social) isolation. At the end, we were better informed about the specific user groups among 'the elderly' and were beginning to understand their particular situation, the needs and wishes related to the specific user groups, and approaches to the situation that are engaging and meaningful to them.

The insights from the Lego Real Play workshops were used to help define the scope of a number of ethnographic studies, carried out in Finland, Den- mark, Sweden and the Netherlands. Expertise was gained through qualitative, ethnographic based study. Key research questions were:

- What is important in social relations? What does it take to stay socially connected when seniors leave the job market?
- Why is it important to stay socially connected?
- What are the barriers for staying socially connected?

All the interviews took place at the participants' homes. We conducted in- depth, qualitative interviews in all four different countries with five 'informants' from each country, varying in age between 62 and 82 years old, to gain insights into personal perceptions and experiences.

Co-creation is at the heart of E2C's development process. Co-creation is a method for engaging users in design processes. Through co-creation (thinking, designing and building together in multi-disciplinary teams), personalised and unique experiences emerge. Henry Ford is often quoted as saying: "If I'd asked my customers what they want, they would have asked for a faster horse." Co-creation goes deeper than asking users what they want. It is interesting and valuable in combination with ethnographic insights in an early phase of the process to overtake the question behind the question. By asking for concrete feedback and input from end-users on ideas, concept, game play and visuals, we allow and enable crucial information and ideas in the development process. This introduces information and ideas that we might overlook if we limit our perspective to a developer's or researcher's point of view and be unable to implement at a later stage.

Four co-creation sessions (2010-2011) were held in the Netherlands where a group of six to eight Dutch seniors (60+, still reasonably active, male/female) gave us insights into their daily lives, hopes and anxieties through exploring and building solutions to challenges that arose from the ethnographic studies conducted by Copenhagen Living Lab. In the first sessions, we identified five conceptual themes, which were strongly connected to the innovation tracks.

Conceptual themes

- Eating and sharing: eating and cooking are highly social activities that are different in each transition;
- Using existing expertise and learning new things: it is very important to stay 'relevant';
- Being creative: learning, socialising, tapping into new sources of energy;
- Easy-to-use communication tools;
- Playing and challenging: although the subjects may be intense, they can be addressed playfully.

By using collage material taken from magazines, scrap material and a lot of imagination and flexibility, the seniors and the design team materialised ideas for activities that would facilitate connectedness. Ideas ranged from food as an interesting way of passing time, through an assistance tool for help with planning activities, an organisation and a platform that would allow seniors to exchange their fields of expertise, to early ideas on gaming. All the participants expressed a desire to incorporate the joy they got from spending time and engaging in a meaningful conversation with the (younger) design team into any solution we would propose. The co-creation sessions with seniors were interchanged with a number of co-creation workshops with the consortium partners in order to ensure we used all expertise at our disposal, including the resources provided by the municipality and the small businesses and mid-sized enterprises involved.

2. Storytelling games

As a result of our exploration of solutions, we developed a set of storytelling games, by now called Storyville, in which personal material (photographs, music) is incorporated into interactive, intergenerational multiplayer games. A number of different games have been developed (with even more still in the conceptualisation stage), in which digital archive material, personal material and social media (e.g. Facebook) are used to promote interaction between players. The aim of the games is to encourage story sharing. When people physically sit together to exchange stories through an iPad, this creates connectedness, rather than isolating people in their individual use of a screen. The photos on the iPad generate interaction and provide opportunities to explore each other's stories in more depth. The game was designed according to the principles of Design for All so as to accommodate people with declining eyesight or hearing, as well as those with little or no experience with computers or tablets. It is important to offer a range of different games, both to provide variety and to accommodate people's personal preferences. Intergenerational exchange offers value for all those involved. On the one hand, it gives young people insight into older people's experiences; older people were all young once, with their own ideals and dreams. At the same time, it encourages older people to be more involved in young people's lives.

3. Content

The games act as triggers for stories and conversation. The conversation starts from shared memories, shared interests and activities, recognition and personal associations. Each game uses media such as photos or questions to start interacting and sharing. Since we want the game to be uplifting and empowering, the content should support these qualities – creating or renewing the contact by connecting to good, positive moments in life and recalling resources that had been forgotten. We do not steer the conversation towards bad memories or troublesome periods in life, except perhaps from the perspective of growth and becoming stronger (empowering solutions to challenging situations). Personal pictures create opportunities to reflect on personal and shared events and to get to know the others better. Some generic images have that potential too; this seems to be true especially when displaying events and experiences or representing an era or the town that people live in. Photos can be imported via iTunes or Facebook, or taken with the camera in the iPad. A default set of photos is available in each game.

4. Evaluation

The games have been evaluated and tested with people from the target age bracket in several senior focus groups and game play workshops with the aim of evaluating game mechanics and content. Participants played the game while researchers observed them. The main themes that guided the observations were GamePlay, Coolness/Entertainment, Humour/Emotional Immersion, and Game Feedback. The results concerned everything from traditional usability issues to issues related to game play and game mechanics. The games were altered based upon the input from these sessions.

Afterwards, an initial (two-week) field trial was conducted to test all the games in two different contexts: family set- tings where participating older adults and their families played together, and service centre settings where seniors and personnel were testing the games. The main aim of the field trials was to provide the development team with feedback for game design as well as to learn about such aspects as playability, usability, sociability, willingness to pay, and support for social interaction. The trial started with a background questionnaire that was handed out to the participants.

During the testing, the involved seniors filled in two weekly questionnaires. The trials ended with a concluding interview and a final questionnaire. Additionally, general feedback was gathered via an app on the iPads as well as through a Facebook group for the Swedish participants via grandchildren to the seniors involved.

The participating seniors in Sweden were positive, interested and curious about the games. In Finland, the seniors were more sceptical. Half of the participants did enjoy playing and primarily thought it to be positive as a tool to support togetherness, reminisce and tell stories – in other words, exactly what we were trying to achieve with the games. The seniors who were interested in the games were quite willing to pay for them (around 20-50 euros).

5. Field trials

After several usability studies, a senior focus groups and game play workshops conducted by Halmstad University field trials were conducted in Sweden and Finland and were run for a period of three weeks in a real-life setting. The trials were set in two different contexts, a family setting where people over the age of 65 played the games with their families played together and an activity centre setting where seniors played with their age peers. The main objectives for the test and evaluation activities in the final field trials were to provide input for the impact evaluation and the commercialisation work package.

This is a fragment of the book Connect-Design for an Empathic Society (2013).

TRACK F RATIONALE: SIDE EVENTS

Side events are sessions and field visits, which are accessible for all registered persons. The difference with all other sessions in the tracks A – E is that they take place before or after the main programme. Nevertheless, they will be very interesting and part of the AAL domain. Therefore, all descriptions, extended abstracts and video's will just be taken in all official dissemination channels like the ones in the main programme.

Track F covered the following 8 side events:

Session F1 – AAL: navigating between Active Ageing and Frailty

In the Netherlands, the worlds of 'Zorg' (Care) en 'Welzijn' (Wellbeing) often seem unable to link up into a joint strategy of health care. Ambient Assisted Living is assumed to enable to connect both worlds, aiming at good quality of life, limited health care costs and high health care performance. Is it really possible? In this workshop we explore implementation and diffusion strategies, by examining the 'match' between two newly designed AAL-applications and changing practices of elderly care in The Netherlands.

Session F2 – Designing for older adults – Lessons learnt and recommendations from past experiences

To design products and services for older users is not an easy task. The older population is characterized by a wide variation in cognitive abilities (which diverge with increasing age profile), a generally cautious outlook with which older people view technology (and ICT in particular) and the gap between the experiences of the developers and those of the users they are designing for. Furthermore there are cultural differences and ethical issues to be considered.

This session intends to address some of these challenges from a practical perspective, by sharing the experiences and the lessons learnt in conducting research work for and with senior citizens.

Two AAL JP Projects (EASYREACH and NOBITS) both fostering the social inclusion of the senior citizens are adopting a participatory design methodology specifically adapted to the elderly users.

A large-scale collaborative project, NETCARITY, was just recently completed and it can be considered a successful project. The experience made and the insights gained can provide useful suggestions to current and future projects and allow them to overcome obstacles and improve their results.

Session F3 – Innovate Dementia

Innovate Dementia is an INTERREG IVB North West Europe programme, an transnational programme with eight partners from different regions in North West Europe that aims to develop innovative solutions in care for persons with dementia. In this session the Innovate Dementia project will be introduced.

Ageing is a large socio-economic threat in Europe and a top priority issue at EU level. Dementia is a leading psychiatric condition for people over 60. It is a slowly progressing, non-curable, condition with approx. 70% having Alzheimer disease. 60 % of all care is given by informal carers and most of them are overburdened (Alzheimer Nederland, 2008). Dementia needs higher recognition as cases are expected to double in 2025.

Innovate Dementia aims at boosting innovation and employment by strengthened cooperation at international level between all concerned parties to develop, implement and integrate innovative, long-lasting solutions to the socio-economic challenges linked with ageing and dementia.

Session F4 – The 7th Companion Robotics Institute Workshop: User-specified Inclusive Co-Design for Open Innovation-Open Evaluation of Social-Assistive Robotics

The European Research in Ambient Assisted Living is moving towards the integration of social-assistive robotics into adapted legacy-home and smart-home environments to provide support for the older and impaired persons living at home independently. The research in this area has to meet the challenges of user-centred prioritisation of system affordances through co-design of usability features that best support the targeted user-system relationship. Such research has to arrive at socio-ethically and technically acceptable and persona-adaptive systems that can be easily re-adapted and re-trained to remain safety, privacy, and dignity preserving, useful, affordable, and responsive to the users' changing needs.

The design of such advanced systems for enhanced quality-of-experience, irrespective of whether they may be specifically intended as assistive-rehabilitative systems or for enhanced empowerment and comfort of all types of users, demands a dynamic usability modelling approach (e.g. UI-REF) to ensure that user-led dynamic prioritisation of system functionalities is guaranteed by co-design. Ultimately the objective has to be to deliver a spectrum of solutions within a framework architecture for graceful semantic integration of the intelligent sub-systems that need to cooperate seamlessly to provide for safety-care-and-comfort support of the user.

This workshop, the 7th in the series of CRI workshops, is led by the CompanionAble Consortium and includes different experts, stakeholders and end users. Results of usability evaluations will be presented and affordability design and engineering consistent with legacy and emergent social value networks and pre-competitive procurement will be discussed. Demonstrations will be given in the exhibition.

Session F5 – EIT HWB: Power boost for European SME's

Sustainable energy supply, intelligent traffic management and increasing the quality of life are just some of the challenges that society, business and politics will face in the future. Innovative ICT technologies offer new ways of giving a much needed boost to finding alternative solutions.

EIT ICT Labs is selected as one of the first three Knowledge and Innovation Communities (KIC) supported by the European Institute of Innovation & Technology (EIT). Its mission is to turn Europe into a global leader in Information and Communication Technologies innovations. The knowledge triangle of research, business and education has to be transformed into ICT innovations that act on the challenges and opportunities of the Digital Society and enhance the quality of Life. The so called Action Line Health and Wellbeing fits in the deployment of the EIT ICT Labs strategy. Achieving the overall goals of the action line requires close collaboration in the knowledge triangle of education, research and business development.

ICT for Health & Well-being (HWB) and Active Healthy Ageing (AHA) are two areas in which Europe can credibly claim to lead the global field. To consolidate and spur this position, EIT ICT Labs has taken the initiative to start up the EIT Health & Well Being Business Community through its Action Line H&WB to strengthen, integrate and mobilize local ecosystem actors and invite innovative SMEs from various European countries to take part. The programme focuses on identifying new large-scale business opportunities and offering the support needed to ensure international business development and successful implementation.

Global and societal trends like the aging population and the growing consumer empowerment, call for an innovative and entrepreneurial ICT enabled & supported approach towards Health and Wellbeing. The Action Line (AL) Health and Wellbeing (HWB) will improve the quality of everyday life via the development of ICT enabled services supporting a sustainable healthy lifestyle in the context of Ambient Assisted Living (AAL) and Active Healthy Aging (AHA).

Session F6 – Various: Tour d'Horizon on AAL subjects

The call for contributions of the AAL Forum 2012 has resulted in a large number of interesting ideas, views and solutions beyond the fixed AAL FORUM topics. In this session a variety of projects and initiatives will be presented that are part of the AAL research and/ or business community. A tour d'horizon will be made along aspects and items that can give you new inspiration and imagination for further work in this broad and interesting area.

Session F7 – Personalised user interfaces in AAL

This joint workshop of the European projects Cloud4All and UniversAAL will present and discuss current technologies and solutions being developed for personalised user interfaces in AAL. This workshop is open to the public, in particular to members of the AAL Open Association (AALOA).

UniversAAL has published a series of reference use cases for Ambient Assistive Living (www.universaal.org/en/rucs/universaal-reference-use-cases-rucs). These use cases include situations in which a user interface adapts itself to the user and their needs and preferences. While UniversAAL has developed a broad technical framework for AAL services and user interfaces, the topic of personalization and user preference profiles has only been marginally addressed in this project. The Cloud4All project is currently devising a common format and semantics of a personal needs & preferences (PNP) profile, which is supposed to be standardized as ISO/IEC 24751.

The workshop will provide opportunities to discuss how the currently existing technologies and the emerging user PNP profile could be employed in AAL use cases and scenarios. We want to generate a roadmap for future development and standardization work, within the two projects and beyond.

Goals of the workshop are to share information, learn and discuss about currently developed technical frameworks, the emerging user PNP profile standard and technical solutions for personalized user interfaces in AAL. Another goal is to identify potential cross-project cooperation and reuse of technologies.

Session F8 – 2nd AALIANCE2 Stakeholder Workshop: Enabling Technologies for AAL solutions

AALIANCE2 Project is a Coordination Action funded in the FP7-ICT-2011.7, which focuses on the Ambient Assisted Living (AAL) solutions based on advanced ICT technologies for ageing and wellbeing of elderly people in Europe. One of its main objectives is to build consensus upon research priorities in the AAL roadmap and Strategic Research Agenda for the upcoming decades.

This second AALIANCE2 Stakeholder Workshop will focus on five enabling technologies, i.e. sensing, reasoning, acting, interacting and communicating, and in particular on how these technologies could support people, or should be developed to do so, according to previously described AAL activities and scenarios (First AALIANCE2 Stakeholder Workshop). The workshop objectives are to probe and build on the contents of the first AALIANCE Roadmap, published in March 2010, to design a new improved and enriched AALIANCE2 Roadmap.

Experts' experience must include at least substantial analysis and insights of end-user needs and motives, assessment and experimentation with (innovative) technologies in realistic cases, or exploration and design of innovative Product Service Systems for AAL.

TRACK F PAPERS

INCLUSION SOCIETY; NAVIGATING BETWEEN ACTIVE AGEING AND FRAILTY

T. Gudmundsson[1]

1. Innovation

1.2 Aim

The aim for the InclusionSociety project is to provide “proactive preventative health care solutions”, - giving parties responsible for care the opportunity to act before elderly people at home suffer degradation into worse condition because of failure to detect & address downward trends before the crisis point that triggers demand for acute health care.

1.3 Main challenges

The main challenges the InclusionSociety solution has to solve are:

- Ensuring end user motivation and confidence to use digital technology. (many types of device were considered before establishing that a tablet was the preferred format)
- Supporting different levels of care, from self-management, to friends and family care to professionally managed remote care.
- Enabling a stable framework for extensive personalization and future evolution of system capability.

1.4 Design

To fully address the challenge of end user confidence and motivation with users in the target profile, the project team has applied an experience led design methodology which involves considerable amount of direct end user research early in the process and extensive mapping of the service experiences that need to be achieved to overcome barriers set by users with little or no experience of computers. The design inspired by this approach has a selection of distinct attributes: it supports a lot of ‘passive’ pushed content delivery, where no interaction is required – a form of personalized digital news & reminder service to which all forms of content can be send via remote access from a ‘Friends and family’ web portal. The tablet UI itself is extremely inclusive with large type and controls developed jointly with users. The service architecture also offers an access platform for trusted service providers using a 3rd party service access module. The design also includes the user interface for a PC based Care management application.

[1] CEO hospital Organiser AS, Norway

1.4 Algorithm development

To break the damaging link between technology investment and the range of conditions and circumstances that need to be addressed, the Care Management system includes a tool to allow service providers to create and customize their own monitoring tests by matching responses to simple "green, yellow or red" status. This allows the care manager opportunities to focus effort where required. The tests will come in a broad range from a "well- being index" questionnaire for people in care to readings associated with a range of approved remote sensors.

2. Demand

Hospitals in Norway run at very high cost
During comparing data from 2002 and 2009, hospitals treated almost same number of patients but costs almost doubled, raising from 6,6 billion Euro till 13,6 billion Euro.

- The government has taken measures now to improve the preventive care services where patient / inhabitants should be given the best possible services at home. This is the main strategy in the new large reform, which is the similar all over Europe, - but solutions are lacking!

Considerable increase in demand of health care in future
According to official statistics Norway's projections of the population will continue to rise steadily to 5.4 million in 2030 and 5.8 million in 2050. Number of persons over 80 years and older may increase from 190,000 in 2000 to almost 320,000 in 2030 and over 500,000 in 2050. "Age- Load" capacity shows the relationship between the economically active population and the older part of the population. In 2000 there were 4.7 people of working age for each older citizen, while the coefficient of age carrying capacity will drop to 3.5 in 2030 and 2.9 in 2050. The future care challenges show that the municipal care service expenditures will increase from 3.4 percent of GDP in 2005 to 4.7 percent in 2030 and 6.7 percent in 2050. That show the demand to focus on solutions which can maintain more people living at home longer.

The "wave of elderly"
The huge challenge for the foreseeable future will be to meet demands of coming "wave of elderly" and it`s why today's health care system need to be improved. The challenge for the future is to establish efficient health systems in which more patients will be treated at lower cost. In 2007 there were 415,000 emergency admissions in Norwegian hospitals. A study done in 2007 showed that up to 50 percent of these could have been avoided if there had been better information available in the municipality about the patient and there were service options at municipal level.

- Here the InclusionSociety solution provide activeageing use their homePad as well as supporting the frailty being part of municipality service system, from light care services to health care givers at home and in institutions by monitoring sensors/equipment's to EMR.

High significant costs between home and hospital
The cost relationship between the cost of a hospital day and a day at home has a ratio 100:1, where it costs approx. 800 Euro as average rate per day in the university hospitals in Norway compare to the connection cost to service center.

- Use of InclusionSociety will lead to reduced pressure on the hospitals as more patients can be treated by better information flow in the municipality and at earlier stage.
- The step-by-step philosophy of InclusionSociety by starting by individual homePad used as "facebook for health elderly population" to be later connected to the municipality care center portal and at last part to the full scale health support by use of nursePad with full Electronical Medical Record, EMR, functionality.

3. Design of the concept

InclusionSociety is a new product in new market. Although several pilots have been created on AAL and FW7 projects, we have not found in UK or in Scandinavia any directly matching product that could be benchmarked. To address this challenge we used experience led methods to create early paper and digital visualizations of 'options for how things could be' and used these in extensive user testing in the UK with care recipients and care delivery organizations. Although the commercial environments are different in the UK and Norway, the actual user issues are very similar for both end users and careers. This exercise allowed the team to create a very sophisticated specification of the detailed needs of end users (across a broad ability range) and care operators.

- The experience led methods have delivered a considerable anticipation of user needs, this will be followed by extensive trialing of early working systems by one of the partners, Vivit, who have the specific responsibility to ensure high usability of the final results as separate body in the development process.

4. Standards and interoperability

In order to ensure that InclusionSociety will be best possible prepared for integration, a separate partner, Mediq AS, Denmark, is responsible to work out actual requirements for standards in the field of interoperability between hospitals, GP, municipalities and national "core EMR".

- Mediq has extensive competence in the field of interoperability being a active body in Denmark as well as cross boarder in EU.

- At the same time the Norwegian and UK partners have investigated their national requirements for interoperability, security and privacy issues as part of the InclusionSociety requirements.
-

5. Business development

Two of the partners in InclusionSociety project, Alloy and Hospital Organiser has established common distribution unit WellTogether ltd, WTL, in UK to ensure professional marketing and sales focus on the business site of the project. WTL will in their plans carry out marketing analyzes prior to 01.08.12 and the first draft of the business plan shall be in place 01.09.12.

- There is a expectations, that at end of the project when the pilot has been accepted that the first sales can take place, especially towards the big care home operators for a total solution and telecom operators with the isolated homePad as front – end in the "early movers market"

SOCIALROBOT: ELDERLY HOME CARE AND SOCIALIZATION

Christophoros Christophorou[1], Paulo Alvito[2], Panayiotis Andreou[3], Eleni Christodoulou[4], Jorge Miranda Dias[5], George Samaras[6]

Abstract

Most elderly people prefer to live independently, for as long as possible, in their preferred environment. Nowadays, the predominant care model for supporting elders living alone at home is based on informal carers' assistance (i.e., relatives, friends, neighbours, etc.). Considering the shifting demography of the elderly population, this model is expected to pose major challenges both in the economy as well as the society. The SocialRobot solution, funded under the FP7 Industry-Academia Partnerships and Pathways (IAPP) Marie Curie Programme 2011, is an innovative practice-oriented elderly care robot system that integrates state of the art, standardized and interoperable robotic technologies, ICT-based care services and a virtual social care network[7]. ICT-based services address the categories of Care & Wellness, Guidance and Mobility Monitoring. SocialRobot provides daily care assistance to the elder through close virtual social interaction with their informal and formal carers thus reducing the demand for on site actual care.

1. Introduction

According to recent demographic studies, by 2050 the elderly population aged 60 and over is predicted to increase in nearly every country in Europe, matched with an increase in the retired population. Insofar as this shift will tend to lower both labour force participation and savings rates, unable to let the health care budgets grow in a proportional way, it raises major challenges about a future slowing of economic growth. In order to address these challenges, there is growing attention for assistive technologies to support seniors to stay independent and active for as long as possible in their preferred home environment. Robotic systems are among those initiatives offering functionality related to the support of independent living, monitoring and

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[7] SocialRobot extends the Virtual Social Care Network developed in Co-Living (http://www.project-coliving.eu/).

maintaining safety or enhancement of health and psychological well-being of elders by providing companionship.

With SocialRobot, technological innovation is provided mainly in the areas of i) human-robot interaction (emotion recognition, intelligent dialogue) and behaviour modelling considering related context of daily routine occurrences of the elderly as they aged; ii) new methods for gesture recognition and tracking; and iii) robot-human learning and understanding.

2. Methods

The main SocialRobot's end-user target group consists of people with light physical or cognitive disabilities who can find pleasure and relief in receiving assistance or stimulation to carry out their daily routine at home. SocialRobot considers the elder as an active collaborative agent able to make personal choices and adapt the care model to his/her lifestyle, personalized needs and capabilities changes over the ageing process.

To ensure that the SocialRobot system will meet the standards and interoperability, state of the art, standardized and interoperable robotic technologies, ICT-based care services and a virtual social care network (SoCo-net) will be integrated in the Robotic platform. The SocialRobot components (see Figure 1) will be integrated to provide a set of interoperable services making use of SoCo-net. The SocialRobot platform consists of a 2-wheel robotic base, with a structure body and robotic head while the integrated sensors are mainly cameras, Kinect sensor and laser range finders. The integrated SocialRobot solution will provide, for an end user, adaptable multi-modal (text, voice, images, video, etc.) interface that will support an affective and empathetic user-robotic interaction, taking into account the capabilities of and acceptance by elderly users and the end-user's application's needs, security and privacy issues.

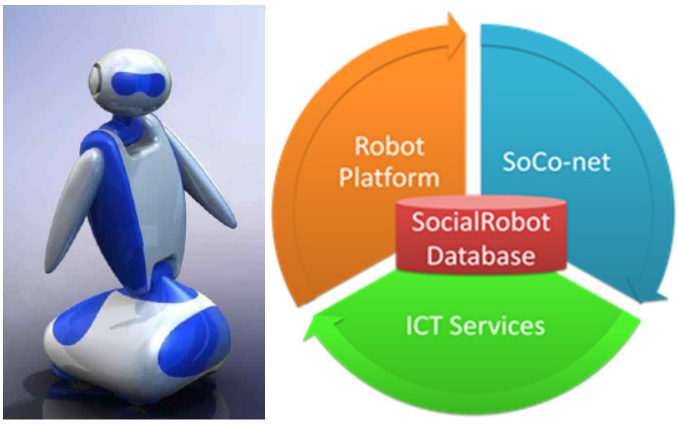

Figure 1: SocialRobot Platform and integrated components

To ensure usefulness and usability of the SocialRobot system, end-users were involved from the beginning of the project in the collection of user requirements and specification of realistic use case scenarios. Different end-user groups were selected representing a diversity of physical and cognitive abilities. SocialRobot emphasisizes in supporting the elders to maintain their self-esteem in managing their daily routine at home, by addressing the elder's security, privacy, safety and autonomy; it allows them to decide whether and when they want to have the system on or off.

3. Results

The project is still in progress and two pilots for testing the technology are scheduled to be carried out in the Netherlands and Cyprus. Up to 50 elderly people and their caregivers will use the SocialRobot system over a six month period where it will be investigated up to which point the SocialRobot services improve the self-management of daily routine at home, and how the services can leverage economic opportunities. Initial involvement of the selected end-user groups in system development and prototype testing have shown positive end-user acceptance related to the increase of the elders' motivation and reduction of their hesitations in carrying out their daily routine with the support and company of the SocialRobot.

4. Discussion/Conclusions

SocialRobot focuses in the growing high potential elderly care market in Europe and beyond, tackling initially the area of preventive care at an early stage of the ageing process. It will provide a care platform that supports carers, both family members and therapists, in their daily tasks. The main ongoing developments are:

1. Recognition of Abnormal Behaviour and Alerting
2. Reminder Service and Assistance
3. Face Recognition, Navigation and Tracking.
4. Suggestions based on Elderly Preferences
5. Fall Detection and Alerting (home use)
6. Registering to Activities and Activity Reminders
7. Creating Activities and Inviting Friends
8. Guidance of Daily Activity Tasks

The system will be introduced early enough in the life of the elderly when the first signs of physical to cognitive disabilities appear, providing thus initially for simple essential personalized functionality covering daily care needs. This will ensure that the elderly will be given enough time to become acquainted and increase acceptance of more complex robot care functionality introduced gradually to address further ageing capabilities degradation.

SocialRobot is expected to launch the final product onto the market two years after the project end; in 2016.

COMPANIONABLE: A COMPANION ROBOT SUPPORTING PEOPLE WITH MILD MEMORY IMPAIRMENTS

C. Huijnen[1], H. v.d. Heuvel[1], A. Badii[2]

1. Purpose

CompanionAble has developed and piloted an assistive environment for people with mild cognitive impairments (MCI). It has found the synergy between social robotics and ambient intelligence technologies, to support persons suffering from chronic cognitive disabilities. CompanionAble keeps an eye on people's wellbeing, offers life-style management, homecare, companionship, and supports social inclusion. The companion robot working collaboratively with a smart home environment provides intelligent day-time-activities planning and management by: keeping to-do lists; an agenda with context-aware reminders for appointments and medication; interruption support; greeting the user in the morning and whenever the user returns home; reminding the user about important things to note before leaving home; cognitive training; analysis of emotions; music and photo albums; safety reminders and prevention of dangerous situations; video-conferencing; smart home control; and fall detection and recognition of distress signals.

Figure 1. CompanionAble robot at Smart Homes

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2. Method

The user studies and pilots in CompanionAble have been driven by the UI-REF methodology of participative and inclusive co-design and validation approach [1]. All phases included care recipients and their close carers as well as the wider stakeholders, and were performed at four sites in Europe (Spain, France, Belgium, The Netherlands). This has ensured end-to-end usability, viability, and flexibility, as well as a focus on overall care support, audit and integration with quality of experience issues such as dignity-privacy-security preserving responsibilities. Accordingly, insights gained through extensive user-centred engagement have led to a coherently integrated requirements formalisation, prioritisation and usability evaluation. Collaboration of gerontologists, care institutions, industrial and academic research partners, including a strong cognitive robotics and smart home capability has made for an excellent confluence of expertise [2].

Figure 2. CompanionAble robot and test user

3. Results & Discussion

Through several user-centred design cycles, including many evaluation sessions with MCI patients, re-design cycles and prototype updates, a large set of key findings have been extracted. Based on these findings, the final design has been concluded for the finishing pilot sessions. These pilots comprised of experiencing and living with the complete CompanionAble system for 2 full days by couples of end-users – one person with MCI and his/her spouse. These pilots have been very successful, both for the participants as for the researchers. Overall, MCI patients value the vision of having a companion robot, its autonomous capabilities, the enhanced natural and inspiring interaction, and having such lifestyle support delivered in a trusted manner.

Most important finding is the fact that the partner or informal carer is indispensible in creating a truly supportive system, making sure the system integrates seamlessly with the smart environment, with external services, and especially with the life of the user. Another aspect of major importance is the robot's character [3], which seems the most important determinant of the degree of users' acceptance in terms of perceived reliability and satisfaction, rather than the robot's physical embodiment. This character relates to the degree of pro-activeness of the system, the level of attentiveness, the tone of voice, use of certain words, and the physical behaviour, possibly all combined and defined by a companion persona, such as a slave, a guardian angel, a friendly helper, or an active entertainer.

As a main result, it is clear that a pro-active environment such as CompanionAble is able to bring added value to people's live. This mainly relates to offering day-structure, guidance, companionship, peace of mind, as well as a reduction of burden for the caregiver. In all these aspects, the motivation and personality that the robot brings is of key importance – it is a mobile interaction buddy that activates and stimulates people.

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MAKING VIDEO COMMUNICATION MOBILE BY USING A SMALL HUMANOID SOCIAL ASSISTIVE ROBOT

Paul Panek[1], Christian Beck[1], Raymond Cuijpers[2], Georg Edelmayer[1],
Peter Mayer[1], Wolfgang L. Zagler[1]

Abstract

There is a high need among older persons to maintain their social contacts and to stay involved in the social life. In this area of social communication ICT and assistive technology can bring a significant support provided that the actual needs and preferences of the user groups are actually met. The paper describes an innovative solution consisting of a mobile video communication facility using a LED projector which is integrated in a social assistive robot system developed in the framework of the KSERA project.

1. Introduction

There is a significant need for social inclusion and for supporting social connectedness of older persons and their care persons. The BRAID report outlines the need for staying connected with people, in particular (a) friends & family (b) care givers and (c) peer professionals [3]. There are already several projects [7] and products on the market providing ICT support via large phones, smart phones, touch screens [5]. The research project KSERA ("*Knowledgeable SErvice Robots for Aging*") develops a SAR that supports older persons, especially those with Chronic Obstructive Pulmonary Disease (COPD), in their daily activities and care needs. By provision of the means for effective self-management of their disease the independent and self-determined way of life and the overall quality of life can be enhanced [4]. As robotic platform the small NAO humanoid from [1] is used. It serves as an interface between the user and the system which is embedded in a smart home environment which enables ubiquitous monitoring of the users' activities and health status and of the environmental conditions. A small LED projector unit was developed to be carried on the back of this small humanoid social assistive robot [6]. This projector unit on the robot's back allows to project video information towards a wall next to the user. A camera in the robot's head is used to transmit the older person's video stream towards the communication partner. The main innovation is considered to be the mobility of the solution, as the assistive robot with its video communication equipment can come to

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the user in his or her flat wherever she or he is. This is an added value compared to the state of the art solutions where the user has to move to a stationary device or where the equipment has to be carried around by the user (e.g. a smart phone).

2. Methods

The prototype system is expected to bring added value by the mobility aspects. It is able to approach the user wherever the user is in the flat. This is considered to be a logical evolution from current technology. The main application areas are: (a) social communication (friends, family members, informal carers) (b) video communication to e.g. medical services and (c) video communication in case of emergency. For designing the concept as well as for concept validation experts from the care domain and older persons were presented with early prototypes and took part in "Wizard of Oz" tests in order to explore the potential of the solution from point of view of primary and secondary users of the system [11]. The levels of user acceptance, user interest and user engagement were high regarding the mobility of the video communication.

Figure 1. Prototype of LED projector unit (left) mounted on the humanoid NAO robot (right)

The open standard SIP is used for video communication. Additionally, the proprietary Skype protocol is supported. This enables openness to the industry standards and connectivity to wide spread proprietary protocols as e.g. Skype.

3. Results

An ethical sound involvement of the users during the laboratory tests was ensured, an ethical expert supported and monitored all trials [13] [14]. Data protection is

considered by offering possibility to use secure SIP server and by ensuring the identity of the calling parties before accepting a call in a future product system.
A workshop with experts from the care domain was organised in the laboratory setting. The experts rated the quality of audio and video connection good and sufficient for emergency scenario and for social communication. Added value of the KSERA mobile video communication was clearly stated, especially since the video channel provides information regarding the actual state and emotional situation of the user in a better way than an audio connection only. Particularly in emergency scenarios, when the operator of the emergency centre needs to explore the severity of the situation quickly, the video connection is able to provide this information.

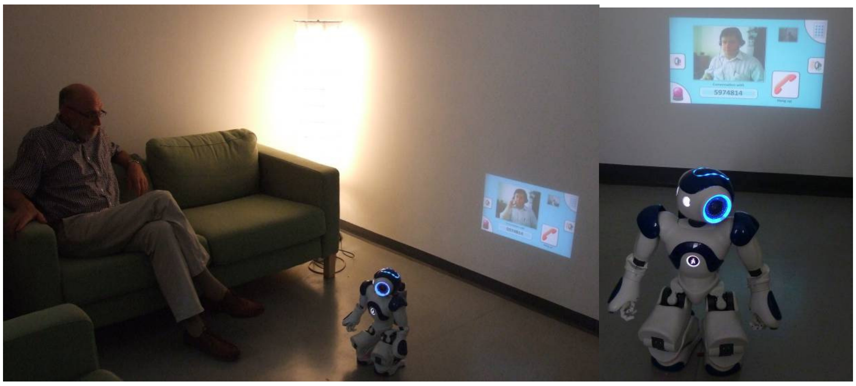

Figure 2. Setting for mobile video communication in the laboratory: NAO robot with a LED projector unit on its back using its integrated head camera for video communication between KSERA user (sitting on a couch) and a call center operator.

Interestingly, all the experts assume that the relatives would be willing to pay for the video communication feature as it offers added value for their own communication with their parents even over great geographical distances and it provides means to improve the older person's integration into a social network.

4. Discussion/conclusions

Despite the promising findings up to now, several imitations of the current prototype system have to be considered, e.g. the low brightness of the used LED projector (30 ANSI lumen). By using blinds at the windows and artificial light in the test room a realistic environment could be set up but it was at the lower limit of ambient brightness recommended for living areas. Based on the technological improvements it is expected that brighter projectors will be available in near future. Further work will be done in the framework of the KSERA project by carrying out a validation of the integrated KSERA prototype in near to real life settings with older users in Austria and Israel in fall 2012.

Acknowledgements

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THE AMBIENT ADAPTABLE LIVING ASSISTANT IS MEETING ITS USERS

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Abstract

The need for communication is essential especially for elderly people living alone. In this paper, we introduce the current achievements of the ALIAS project which aims to create a robotic communication platform. This platform will enhance the social inclusion of elderly people by providing them a variety of services to stay in touch with their social environment. To realize this objective, two major tasks – technical development and user inclusion – have to be harmonized by bringing together experts from both fields. The technical realization for creating a robotic platform featuring a multimodal communication and an interactive behavior raises challenges from different research directions covering audio and image processing, multimedia technology, human factors, control engineering, etc. The user inclusion has to tackle the problem that elderly people are a heterogeneous group with different wishes and needs. This goal is realized by applying different forms of user surveys ranging from questionnaires, interactive workshops and user trials.

Keywords: service robotics; communication for quality of live; user inclusion; business models

1. Introduction

European societies are affected by a dramatic demographic change taking place in the years to come [1,2]. The Ambient Assisted Living (AAL) research programme tries to compensate the drawbacks of the aging society by applying modern information and communication technologies (ICTs). The AAL-JP call2 funded project **Adaptable Ambient LIving ASsistant (ALIAS)** aims to improve the communication of elderly

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people ensuring a safe and long independent life in their own home. ALIAS is embodied by a mobile robot platform without manipulation capabilities.

Objectives and Approach
The ALIAS robot serves as a communication platform for improving the social inclusion of the user by offering a wide range of services. These services comprise an intuitive and natural dialog system which is able of handling natural speech and several web applications that support basic communication, cognitive games, web search or multimedia presentation centered around events. To realize these services, the ALIAS robot is equipped with sensing devices including cameras, microphones, a touchscreen and a Brain Computer Interface (BCI) to perceive the user's input. ALIAS can also interact with users using different modalities: audio output via loudspeakers, a graphical user interface on a screen and proactive and autonomous navigation. User inclusion is a core aspect within the entire ALIAS development cycle in order to ensure that the robotic platform meets the requirements and needs of elderly people. Different use case scenarios have been drawn within the project providing a roadmap for the technical development.

Related Work
ALIAS is not the only project applying robotics in the field of AAL [3]. Hence, robots are developed to directly assist elderly people, or the nursing staff, or both. Paro[1] is a robot in form of a baby harp seal that is developed for people with dementia. The robotic platform Nao from Aldebaran Robotics[2] is an humanoid robot which can be used for different use cases, e.g. in the project ROBO M.D. [4], it is used for remote health applications. The Care-O-bot®3 platform [5] is designed as a butler for assisting people and like the Nao, it can be used for different AAL applications. The remainder of this paper is organized as follows. We present our user inclusion approach in Section 2. The functionalities of ALIAS are described in Section 3. We give an overview of activities to evaluate the ALIAS system in real world environments in Section 4. Finally, we conclude and outline future work in Section 5.

2. An User Inclusion Approach

2.1 User Inclusion Process

To account for the acceptance of a mobile robot system by the elderly people, one focus of the project lies on social acceptance of robot systems in general and within specific user groups in particular. Therefore specific methods of open innovation processes are used. In the project ALIAS, we use a participative approach of open innovation. The early and sustained involvement of potential users as well as professionals in the field of care ensures that the modules and functions of the robot platform are developed adequately and in line with demand. Therefore one aim is to improve the acceptance of the final product by identifying requirements in early stages

[1] http://www.parorobots.com

[2] http://www.aldebaran-robotics.com

of design, testing the prototypes throughout the innovation process and giving feedback to technicians to optimize the robot. We use specific methods of open innovation processes to integrate users from the very beginning. Several realities of men and women and differences between different age groups, lifestyles and life stages have a relevant impact on the development of products and their implementation. In the scientific view of gender relations, the analysis of causes and backgrounds of gender differences and their impact on social phenomena is highly valued. Elderly people cannot be seen as a homogenous group, even if "the elderly" are addressed in public debate often as one group with common goals and interests. The user inclusion is not limited to the end user itself, but also including potential markets/stakeholders (such as care staff, family members, etc.).

A challenge of ALIAS is the continuous involvement of users and their relatives to identify their needs and preferences as well as analyzing the environmental conditions for future use of robots. The sum of generated user feedback through a series of written and oral evidence runs directly in the development of prototypes of the robot. The user's perspectives were measured early in the course of the project and led into the technical development process, to improve the acceptance of the ALIAS platform. Quantitative (e.g. surveys) and qualitative (e.g. brainwriting, Walt-Disney-Method) research methods were used. Secondary analysis, surveys, interviews and workshops enable to further specify the needs, wishes, technical requirements and environmental conditions of the elderly. The results were permanently fed back to the technical partners and used for the development of the robot. The robot itself is then tested in field trials with the seniors. Through this permanent feedback between the seniors, social scientists and engineers it is possible to ensure a mobile platform of high quality for the end users.

2.2 Scenarios

Various scenarios have been elaborated during workshops with elderly people. We provide below two representative use cases supported by ALIAS.

Emergency Call

The ALIAS robot can call for remote help via telephone when the user needs assistance. In this case, a telephone connection with a video call to a doctor can for instance be established. To trigger this function, the user can shout a vocal command "ALIAS Help!". ALIAS will start a countdown of 20 seconds while the user can stop the emergency call by either saying "Stop" or clicking an icon on the screen. If the countdown is not stopped, the video call will be established. From the technical side, this video call is handled like a regular telephone call. Additionally, the person called can be enabled to remote control the robot – e.g. to get a clear picture of the users' state and its surrounding. The emergency call functionality is an important feature, because it provides a sense of security for elderly people.

Entertainment Scenario
Online communities are publishing an increasing volume of multimedia content on the Web, but finding pictures or videos that we once shared is a challenge. This is one of the objectives of the EventMedia application installed on ALIAS.
By publishing multimedia content on the web or private photos coming from a family member, the EventMedia application is organizing those media items around the notion of events where those media were originally captured. The application enables then to re-live a past event by showing different galleries. It can also support search for upcoming events and pro-actively suggest activities to do such as organizing a birthday party for a nephew or inviting friends for an upcoming exhibition of a favorite artist.

3. ALIAS Functionalities

For realizing a natural and intuitive communication with the user, the ALIAS robot has to cover a wide range of functionalities that we present in this section.

3.1 Autonomous Navigation

The key benefit of a mobile robot (see Figure 1) is the capability to move autonomously. To do so, the robot is able to recognize its surrounding environment (and obstacles) by using a laser range scanner, a sonar array, and a set of cameras. These sensors are also used to detect persons. The robot contains a map of its environment and could transform its own position and recognized person hypotheses into this map. The person hypotheses are used to form a safety zone around each person. During autonomous movement, the robot is able to plan its path towards a goal by taking into account the recognized persons and to avoid obstacles using the E* planning approach [6].

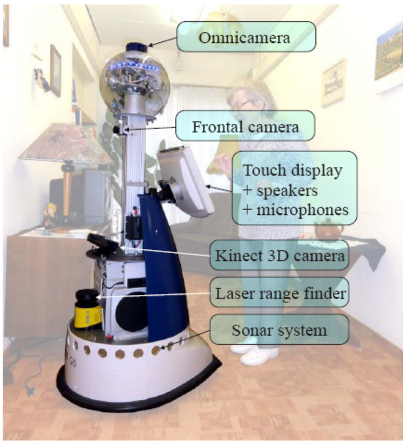

Figure 1: Image of the robot with its sensors and interaction devices.

The robot can also actively approach a person in a polite manner to support interaction with the user [7,8]. The robot is able to reconfigure the navigation system to enable a remote user to control the robot in a way, where only the collision avoidance is active, and the remote user is able to drive the robot around. This is an important safety feature of a robot system, which static systems could not provide. The navigation system reports its state to the dialog system by sending events and is entirely controlled by the dialog manager.

3.2 Interaction

A natural and intuitive human-robot interaction with ALIAS is realized via a dialog system. The dialog system itself is composed of different components which can be described in terms of input and output modalities. For the input modalities, there are cameras, microphones, the BCI and the touchscreen. For the output modalities the ALIAS system has the touchscreen and loudspeakers as well as actuated eyes and animated lights in its head.

Dialog Manager
In order to be controlled in a reasonable way, the dialog system has a so-called dialog manager which handles the interplay between input and output modalities of the ALIAS robot. Therefore, the dialog manager communicates with all involved modules of ALIAS and controls them and thus is the central decision making unit for the behavior of the ALIAS robot and its interactions with the human user.

Touchscreen
The touchscreen of the ALIAS robot is mounted on a flexible arm. It is used to display graphical user interfaces (GUI). Different widgets and elements of the GUI can be controlled via single touch events of the user, such as general web applications (mail, calendar, web browser) or specific ones (EventMedia).

Automatic Speech Recognition
The ALIAS robot uses two automatic speech recognition (ASR) systems that work in parallel as depicted in Figure 2. The first ASR system has smaller vocabulary size and very strict input expectations. This ASR system can be considered as a keyword spotter. The second recognizer continuously analyses the spoken content. By this two-way approach, the keyword spotting system can do a reliable search for important catchwords, whereby the second recognizer tries to understand more contexts from the spoken sentence which can then be further analyzed by the dialog manager for its decision processing. More details can be found in [9,10].

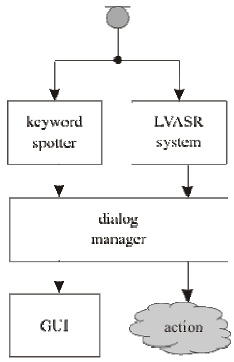

Figure 2: Parallel ASR systems for ALIAS

BCI

The Brain Computer Interface (BCI) provides another input modality for the ALIAS robot [11]. A BCI uses electroencephalography (EEG) to acquire signals for controlling the ALIAS robot. The usage of the BCI is advisable if the user suffered a stroke and has problems with speaking or using the touchscreen. The ALIAS BCI system applies two different approaches: steady state visual evoked potentials and induction of P300 response in the EEG signals. The entire ALIAS user interface can be controlled by the BCI system.

4. Evaluation in Real Settings

4.1 Workshop and Field Trials

We have evaluated ALIAS during multiple workshops and field trials. Through workshops, the requirements regarding the needs and preferences of the seniors have been assessed leading to various scenarios. During the first field trials in fall 2011 and now in fall 2012, the usability, user friendliness and system performance of the ALIAS robot have been tested with three scenarios (emergency call, games and e-ticket purchase for an event). The results of the first trials showed that the seniors are pleased with the functions of the robot but requested some modifications. These changes have been implemented and are now evaluated in the second field trial campaign focusing on task oriented test processes.

4.2 Market Study

The overall goal of the ALIAS project is to reach market maturity 2-3 years after the end of the project. Currently we are conducting a detailed market study and develop an associated business model. However, in discussions already now it clearly shows that the market potential of the ALIAS robots depends on two factors: the price and the benefits of using the system in accordance with the customers' expectations. There are two potential customer groups: single persons living at home and nursing homes.

5. Summary and Conclusions

We have presented the current achievements of the ALIAS project that aims to create a robot which serves as a communication platform and provides a variety of services for the elderly users. To achieve this goal, a user-centered design approach involving elderly users in the entire development cycle has been followed. To establish a natural and intuitive human-robot interaction, especially for elderly users, the technical realization of the robot has to take their needs and wishes into account. The interaction between the ALIAS robot and the user relies on different communication channels (touchscreen, natural speech and BCI) whereas the robot has loudspeakers, a screen and autonomous navigation for realizing a proactive interaction. To fulfill its promise, a real communication platform has to provide the user a variety of applications ranging from gaming, web browsing, event search, video-telephony etc. for staying in touch with the wider world. Final project goal is to reach market maturity within two to three years after the project's end.

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CO-LIVING: INNOVATIVE END-USER DRIVEN ICT PLATFORM FOR ACTIVE SOCIAL LIVING

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Abstract

The growing number of older, but generally healthy and self-supporting, adults creates an increasing demand for new concepts of care which will allow these elderly to maintain their lifestyle and activities as well as their level of social interaction as they age, in order to live an optimal and satisfying life in their preferred environment as long as possible. Technological and socioeconomic innovation can respond to the needs of our ageing society, and address issues of social exclusion, isolation and loneliness, common risks faced by older people, which can lead to a cascade of deterioration in their health and threaten their ability to lead an independent life at home. In this paper we present the innovative end-user driven ICT platform developed within Co-Living project, to addresses the challenge of helping people to be socially active and connected as they age. Key innovation of this platform is the Virtual Collaborative Social Living Community dedicated to elderly people and their caregivers. The solution is further based on an interoperable suite of ICT services addressing the context categories of Care & Wellness, Guidance and Mobility Monitoring. Co-Living achieves user driven innovation, by involving end-users throughout the development process, in extensive series of interviews, focus groups and questionnaires. Furthermore, pilot trials in the Netherlands and Norway assess and validate the social, economic and psychological dimensions of the Co-Living solution in order to drive the successful commercialization of the most promising outputs.

1. Introduction

The starting point of the Co-Living project (Ambient Assisted Living Joint Programme, 2nd Call) is an important and widely accepted premise: Elderly people want to perform meaningful activities, stay socially and physically active and live in

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their homes as independently and as long as possible. Nevertheless, as ageing gradually affects the different domains of an individual's life, age-specific barriers arise and inevitably lead to an increasing demand for support and care [1]. This affects all the different everyday life activities a person carries out and has in important impact on basic social needs, such as maintaining links to societal networks and places people have progressively built up in their lifetime, spending time with family, friends and other important relatives, having real physical contact with people living in the neighborhood, and being active participants in different communities (church, hobbies, voluntary organizations) [2].

Socialization and wellbeing are closely interlinked. Studies have shown that older adults who are embedded in active social networks tend to enjoy better physical and mental health than do elderly people who do not maintain strong ties with others [3]. Based on this rationale, Co-Living takes advantage of technological innovation to build an ICT platform dedicated to the active social living of older adults. A novel Virtual Collaborative Social Community is built around the elderly, seamlessly connecting them to a network of social and care contacts and offering supportive ICT services to empower them to remain active and motivated to perform necessary daily life activities despite the different age-related constraints. Co-Living adopts an end-user driven approach for the creation of new solutions for sustainable care for the ageing population. Elderly and caregivers are systematically and continuously involved in the service innovation process, and consulted in pilot trials to realistically investigate the impact of the solution on enhancing the quality of life of the elderly and mitigating the care effort and associated economic cost.

2. Methods

Co-Living goes beyond simple computer mediated interaction and "technology push" providing a novel user-driven ICT solution to address the realization of the ageing-at-home vision. A literature study on the subjects of satisfaction of life, self-esteem, social relationships and social participation provides the theoretical background for the design of the social community model underlying the ICT platform. End-user involvement is crucial for the identification of particular wishes and needs in terms of meaningful factors, relationships and communication aspects that generate the greatest impact on daily life socialization and self-management of the elderly. Focus groups, structured interviews and questionnaires with several target groups (including elderly, family, friends and care personnel) are employed to give detailed insight into issues such as participation in the community, social activities, levels of dependency on social care services and barriers of the independent living and social interactions of older adults.

In order to facilitate a better understanding of the individual requirements of elderly, and to maximize meaningful innovation, during the requirements specification phase, different scenarios, considering concrete known persons from the two test sites of Trondheim Kommune (Norway) and Orbis Hoogstaete Living Village (the Netherlands), are investigated and evaluated extensively to uncover those use cases that fit into the users' daily routines and into the care provision process, reflecting the socialization of the elderly with different support actors. The results of the scenarios' assessment flow into the definition of different ICT-based services, addressing the context domains of Care & wellness, Guidance and Mobility monitoring of the elderly.

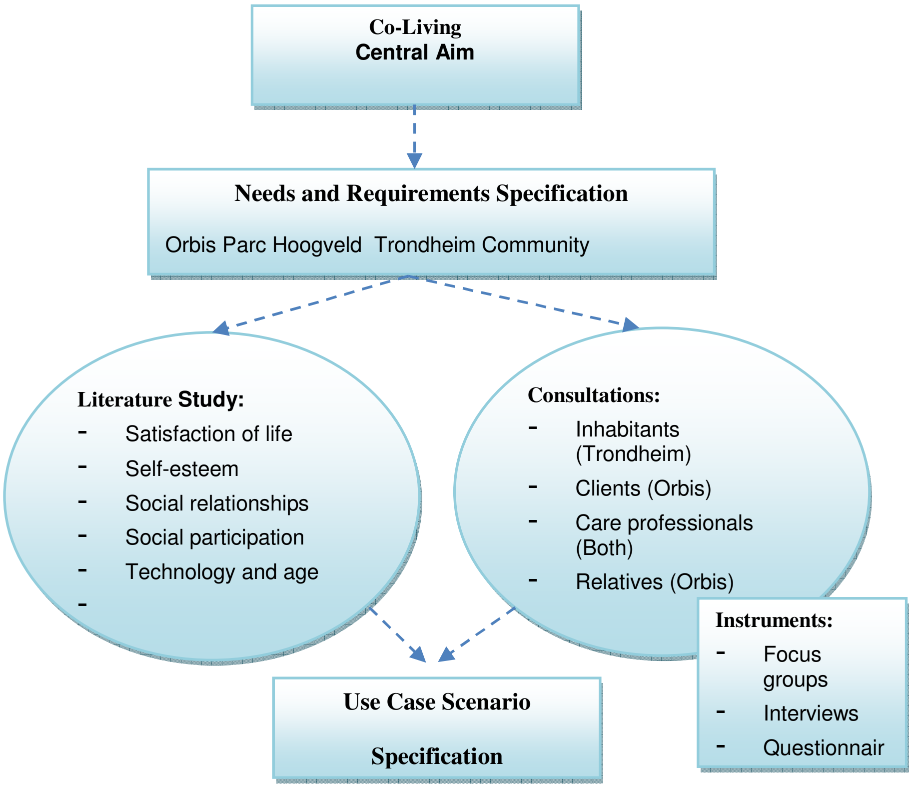

Figure 1: Specification of User Needs and Requirements

3. Social Community network and ICT services

Co-Living scales up the mPower [4] open source middleware platform enhancing the existing services for elderly and cognitively disabled patients with a suite of application and platform services to support socialization and wellbeing. The Co-Living platform is designed to be a very flexible solution, compatible with various state of the art devices (i.e. smart phone, tablet) with minimal hardware requirements. Architecturally, it adopts the service oriented architecture (SOA) principles[5], ensuring abstraction, transparency and standards-based interoperability, offering the possibility to gradually integrate new customized services, developed internally or by third parties, to adjust to specific or changing needs and circumstances of the end-users.

To enhance the services with support from (in)formal caregivers, Co-Living relies on an innovative Social Community network (SoCo-net), bringing together people with different social and support roles (i.e. friends, relatives, care professionals, etc.) that can assist, collaborate and actively communicate with the elderly to improve their daily lives. SoCo-net is web-based and organized into several care teams (Figure) seamlessly connected around the elderly to enable a rich stimulating social environment which effectively contributes to their health, overall quality of life and social inclusion.

The ICT-based services of the Co-Living platform support, encourage, remind, guide and assist the elderly and the members of their social and support network. The suite is organized into the following functional categories:

- Care & wellness: Services to promote an active social lifestyle and encourage the elderly to undertake physical exercise. The elderly and their virtual care team can organize, invite and register to group leisure activities. Elderly can share and discuss their achievements with their family and care givers, keeping them informed about their social life. Elderly can also join physical activities, organized by caregivers who monitor their progress and reinforce their motivation to be physically fit.
- Guidance: Services to assist the elderly in their daily life providing guidance through context based reminders or voice indications for activities and accessories, weather forecast or walking directions. This set of services helps elderly to keep themselves active and independent and mitigate the negative effects of the cognitive failure in their mental and physical status.
- Mobility monitoring: Services to promote and follow-up the socialization and physical activities of the elderly at any time in indoor and outdoor environments. The services identify the position of the elderly in real time and correlate information regarding the surrounding environment. Persons located near each other are automatically notified and have the opportunity to easily arrange meetings. The services also offer valuable real-time information to the caregivers and family members who can follow-up the participation of the elderly in different activities, by verifying e.g. safe arrival and return at home.

  In order to promote personalized care and support, the Co-Living services are enhanced with a behavior analysis component featuring algorithms to build and maintain profiles reflecting the disabilities and abilities, and changing needs and preferences of each elder. By observing the user's interaction with the system and analyzing historical data regarding the socialization activities of the elderly, the analysis algorithms extract patterns reflecting their social behaviour. The component acts proactively to identify possible signs of decline and triggers the elderly, directly or through their support groups, to take specific actions to recover and maintain a well-balanced and active lifestyle.

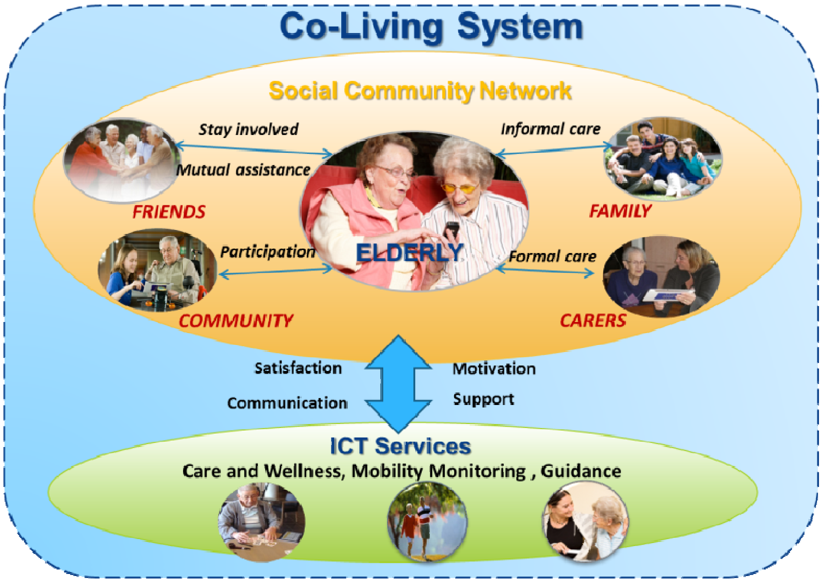

Figure 2: SoCo-net and ICT-Services

4. Use Case Scenario

Abovementioned innovations are choreographed together in use cases, reflecting typical daily life activities of elderly persons and their formal or informal caregivers. A scenario, inspired by the Orbis Hoogstaete Living Village pilot site, can illustrate how an occupational therapist; an elder and a set of caregivers offering day to day informal care are seamlessly connected through SoCo-net and supported by the Co-Living ICT services. For the elderly living in Hoogstaete, social interactions are essential for their everyday lives. In personal interviews, the residents reveal that they enjoy participating in group activities but feel insecure about inviting others and often don't feel motivated to participate in activities organized by the caregivers, due to, among other reasons, feeling unsafe outside their home. As a consequence of the lack of initiative of the elders, volunteers often visit them personally to remind and encourage them to join different activities.

The Co-Living application offers a suite of supportive services to address the desires and insecurities of the elderly and mitigate as much as possible the efforts of the caregivers to keep them active. Occupational therapists list social activities, e.g. playing cards together, for their elderly residents through a simple web interface. In turn, the elderly can register for participation using their mobile or tablet. Features like the personal agenda where the elder and his caregivers can schedule and view activities, reminders about planned activities, guidance for the selection of the right accessories based on context (i.e., the weather) or the user's needs facilitate the process. To support social interactions elderly may invite friends from their social network and interact sharing their comments about past and upcoming activities with their informal caregivers through a personal web site. Therapists can follow the organization of the events receiving information about elderly that registered, can follow-up with assistance, and verify safe arrival at the activity and home.

5. Security And Privacy

Co-Living services thrive on personal information of elderly and therefore security and privacy are important. In addition to common requirements like authentication and secure communication Co-Living explores self-empowerment. In a questionnaire a large majority of elderly answer the question "who is involved in protecting your privacy?" with themselves next to relatives and others. Further discussions with elderly revealed for example that elderly want some control over who can see their location or activities they participate in.

To meet the security and privacy requirements Co-Living provides single sign on authentication, secure communication, authorization and auditing. In particular Co-Living follows an innovative approach for authorization, which is technically based on the XACML policy expression language. This enables both administrators and elderly control over which person or service has access to which data or service. This functionality is exposed to users through a simple web interface that allows administrators and also elderly to manage their policies. To maximize self-empowerment for elderly this is optimized for usability and only targets cases where they have real choice. An example of such choice is who from their social collaborative network has access to their personal webpage.

6. Ethics

Ethics are an important consideration for Co-Living. The Co-Living ethical committee and local ethical boards of end-user partners oversee operational aspects of the Co-Living project such as user studies and trials. The Co-Living system is also developed with ethical principles in mind. Co-Living builds on the ethical basis provided by several European research projects in the area of assisted or independent living, including Companiable, SOPRANO and in particular PERSONA [6]. PERSONA basis its ethical foundation on article 25 of the European Charter of Fundamental Rights recognizes the right of the elderly to live independently and with dignity, which leads to a number of ethical principles. The Co-Living system design adheres to these principles with special attention to the autonomy principle, the privacy principle and the protection of personal data. For example, the intensive involvement of the social collaborative care team with the elderly through the Co-Living system requires careful balancing with the autonomy principle and careful service and system design. Similarly, the privacy principle is addressed by the innovative security and privacy functionality of Co-Living.

7. Trials and Evaluation

Two well selected test sites, in the Netherlandsand Norway, are selected for the evaluation of the Co-Living solution regarding user acceptance, technical viability and impact on the wellbeing of elderly residents of typical independent living environments: an assisted living complex and an urban neighborhood. The Orbis Hoogstaete Living Village is the Co-Living pilot site in the Netherlands. The setup includes an assisted living complex with several modern apartments and a multifunctional centre, both located around a municipal park: the Garden of Wellbeing. This is the perfect place for elderly people to undertake different physical activities and socialize, with each other and the local community, supported by the Care&Wellness and Guidance services. The Norwegian trial is taking place in the Trondheim Kommune and is operated by the Information Centre for Seniors in the local municipality.In this test site, elderly citizens live independently at home and are supported by the center to improve and maintain their social and physical activity. The Care&Wellness and Mobility Monitoring services will be tested in the environment of their neighborhoods across in the municipality of Trondheim.

Parallel pilot trials are currently ongoing with the number of end-user incrementally expanding. The continuous analysis of the user experiences permit a retrospective assessment of the approach taken in defining and improving services, setting up and running the trials. These indicators serve as inputs for the overall evaluation of the impact made by Co-Living on the quality of life of the targeted elderly group and their community members. Specific parameters of interest include user self-management, social interaction, satisfaction and autonomy, examined in the different environments of an assisted living complex and an independent neighborhood.

8. Conclusions and Market Perspective

Co-Living targets a growing and high potential consumer-driven market in Europe and beyond, focusing on wellness, convenience and comfort, rather than illness, impairments and limitations. The project provides a proactive solution for people at the very early stages of the aging process, when they are still capable to have a non-assisted independent living. The first field tests yielded positive results and high user acceptance indicators: 84% of the elderly and 100% of the care professionals find the services useful and important to their daily routine. In terms of ease of use, 72% and 100% respectively find the application intuitive and user-friendly.

Co-Living realistically contributes to their needs of active social participation. The results reinforce the statement that support from a social care network can be of great importance to the realization of the elderly's desire to continue living independently with a higher level of autonomy and satisfaction from life. At the same time, evaluation outcomes confirm that the solution presents promising opportunities to facilitate the daily work of the care and support groups working with the elderly, leading eventually to a reduction of the care associated effort and cost.

Aspects like the high involvement of elderly in the definition of the services and their continuous involvement through pilot evaluation trials, and characteristics of the platform such as interoperability, modularity, flexibility and standardization, which easily facilitate the integration with different technologies, give added value to the final Co-Living solution, strengthening the expectations for a successful market entry by 2015.

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IMPROVE HEALTHCARE BY STIMULATING THERAPY ADHERENCE

Frans Copini[1]

Abstract

Qolpac received the 2012 NFC innovation of the year in Londonfrom the5th annual Global Contactless&Mobile Intelligence Conference last April. Qolpacspecializes incontactlesssmartmedicinepackaging thatcommunicates witha Smartphone(app). Thisstores informationabout a person's druguse, glucose score, weight or blood pressureand othermeasurements.The user canshare the information withothers.

1. What's the need?

The World Health Organization states that improving adherence to therapy will contribute a lot more to human health than new therapies ever can do. In The Netherlands the costs op non-compliance in Healthcare are estimated on € 3 billion each year. In Europe it likely to be more than 200 Billion euro each year! Objective therapy Compliance Measurement (OtCM) can reduce these costs for a considerable part for less than 10 % of the benefits.

2. When and by who?

Smartmedicinepackagingis already available and will be used for the first time in the UK starting in October 2012 in a research that is being carried out for the National Health Service by the University of East Anglia. Negotiations for introduction in the USA are in progress. Qolpac is a spin-out of the former DSM Specialty Packaging Parma activities and DSM is a minority shareholder in Qolpac. Qolpac's sister organization, Healtheness, developed an app to use in combination with the OtCM products. Qolpac continues to evolve from a smart packer to a health monitoring-solutions company, driving increased consumer engagement in their healthcare and empowering people to live healthier lives. Qolpac is focused on helping make healthcare work better for everyone and harnessing technology to empower consumers to better manage their health (Personal pack). The Healtheness app will deliver possibilities for peers to monitor from a distance the therapy adherence of its relative (family pack), but also therapists and caregivers can use this information for therapy monitoring (healthcare business pack).

[1] , Doorn, The Netherlands

3. What's the innovation itself?

The app features an electronic patient file in the Smartphone that may be used in case of emergency or when visiting a family doctor for consult. Qolpac's OtCM products can be combined with any software system within any ecosystem and should exist in:

- Healthenessapp or your own app;
- Smart package technology (OtCM). This is the heart of the innovation: every time medication (mostly pills) is taken from the package (mostly blister) nano-electronics register this fact and create a time stamp and release the created dataset by Near Field Communication or Blue Tooth to the Smartphone app that gives feedback to the user/monitor.
- Web portal with graphics, analyzes, sharing possibilities

4. How did we design the trilogy?

Endorsement comes from several trials that report, evidence based, an enduring and considerable increase of therapy adherence amongst end-users. Qolpac participates in the development of business cases to tune the products for the relevant stakeholders in Healthcare in the different countries. For instance a partner organization in the USA was beside of the pill-taking monitoring also interested in monitoring the use of the so-called auto injector. Qolpac is now developing an OtCM project for the auto-injector.

5. Standards and interoperability

The Healtheness ecosystem uses the new standard for short range wireless communication, NFC and Blue Tooth. For further communication between Smartphone and web portal we the standard communication to the internet. Because of this our products are interoperable with diagnostic equipment (e.g. blood test for use at home) that uses NFC as a protocol (a growing number) or Blue Tooth. Qolpac delivers primarily the OtCM products that are interoperable with any system in any country.

6. Ethical questions

Qolpac wants to support the quality of life from the view of the individual end-user (patient). The central position of the patient's self management and self directive makes it possible to maintain his/her own privacy for numerous situations. Off course we noticed that for instance pharmaceutical industries maybe interested in the data that is created and that can be used for further development of their product or the relationship with clients and endorsers. Also we know that pharmacist want to improve their role in adherence. They would love to collect these data. We also believe that the patient is de owner of his personal health file and should carry this file with him or her in the Smartphone. The family doctor will be enabled by the client to look into the file and put in mutations in the file by using a code given by the patient. Another ethical matter is the following: Insurers may find the data collected by the patient interesting to find out how adjustments in therapy can be legitimated, but also how costs can be reduced. Especially when high priced therapies are at stake, the insurer may want to have therapy compliance data to make sure that their money is being spent properly. Qolpac stands for the idea that the client is in charge and that the client has the power to collect data and share this with anyone that he may way suitable.

7. Qolpac's health management tools for any kind of person?

7.1 Healthy persons that want to maintain their health

This category can use the Healtheness app to registrate data about themselves, on weight, bloodpressure and other values. The can even, in the future, collect data about their mobility or eat and drink behaviour. In their personal health file they can register data about bloodgroup, special information about allergies, or food preferences (vegetarian), they can even put in information about organ donation and peers that need to be informed in case of emergency.
They can also use OtCM products for the use of daily pills for anti conception, or vitamins and minerals.

7.2 Junior patients

Children with diseases that require a close adherence to their therapy like ADHD, can benefit easily from OtCM. The reminders including the information about the adherent behaviour can also send to mom or dad so they can coach from a distance at the time that is needed. Therapist can remotely monitor the therapy and adjust it when necessary.

7.3 Persons with a temporary health issue

This category may find it hard to follow their therapy simply because they are not used to taking pills or apply a cream of using an inhaler and truly finish the therapy. These persons may find benefits in using both the Healtheness app in combination with OtCM products and use the help of peers.

7.4 Persons with a chronic disease

This is the largest group that may benefit the most from this new ecosystem for monitoring. Especially to find the right dosage in case of diabetes patients or matching the right therapy to the personal features by the therapist. The benefits in healthcare costs are also very large here because if a chronic patient can balance his health in the first line of healthcare we can keep him out of the hospital (60% of hospital patients suffer from a chronic disease). In fact for many chronic diseases therapies are available that enable patients to balance their in towards high quality of life. It's the lack of adherence to a fitting lifestyle including therapy that disturbs the balance of health.

7.5 Persons with a severe disease like cancer or MS

Those therapies are often quite expensive and adherence is in many countries not an issue. However motives for lowering adherence can be found in financing the therapy (when patients need to contribute in these expensive therapies they may tend to extensive the intake of medicine. Also the unwanted side effects may influence the adherence of the intake.
In any case objective monitoring may help to a better matching between patient and the therapy and may improve the effectiveness of the dialogue between patient and therapist about the therapy.
The OtCM monitoring system may fit in any platform that supports the communcation between the different stakeholders in healthcare. Specially in this category stakholdermanagement is crucial!

7.6 Seniors with aging problems with (peer or professional) caregivers help

Qolpac products and services are solutions fit for seniors and caregivers to use as a tool to help age in place and retain their autonomy and quality of life as much as possible. Older people can stay in their preferred home environment as they assisted in their daily living tasks including the proper intake of medication.

HOMEBRAIN: A CASE STUDY

Jan Havlík[1], Lenka Lhotská[1], Marie Přibová[2], Petr Panýrek[3]

Abstract

A new project Home Brain – a TV computer – has been started in the Czech Republic. The paper deals with the pilot study of user's experiences. The group of users were used the new system for the evaluating period and after that they have told their meaning about the system during moderated discussion. They specified the most frequently used functions and the advantages of the system in their meaning. The paper introduces the results and overall summary of the study.

Keywords: smart home, HomeBrain, TV computer

1. Introduction

Currently there is an increasing demand for smart solutions for the elderly and impaired persons. The optimal solutions allow the elderly live at their natural environment – at home – instead of institutionalized care. [1] A new project – Home Brain – has been started in the Czech Republic. Home Brain – the home TV computer - is the unique system put into practice in the end of 2011. The system is the product of more than five years of research and development and offers new possibilities of using assistive technologies in daily life. [2-3]

2. Realization

The system is designed as a small device like set-top-box connected to a standard TV set. The control of Home Brain is solved using a double-sided remote controller adapted to the elderly. It fulfils several main functions, namely gate to the internet, multimedia services, senior monitoring, health state monitoring, social networking, remote control of home devices, intelligent security system etc. Additionally, it can be connected to telebanking, e-services (including e-government), and other electronic services. There has not been proposed any system similar to HomeBrain in the Czech Republic yet. The system allows networking of the elderly (or handicapped persons) in the social sense without need to use sophisticated devices with complicated control.

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3. Results

During the pilot study the Home Brain has been tested by 5 users, 4 women and 1 man, from 66 to 78 years old. The user experiences have been investigated by a moderated discussion. As a main advantage of the system the users highlighted the simplicity and the intuitiveness of system control. The respondents had no manuals, they learned only by using the system. They agree that the most important issue is to not be afraid of using the Home Brain. As the most frequently used functions they sign watching TV, using a TV archive (instead video-recorder), listening to radio, Skype calling, instant messaging, using the photo archive, managing details about their home (payments, important decisions, dates of medical visits etc.) and evidence of health status. [4]

The respondents have been also asked for arguments for potential new users. As crucial arguments they mention the simplicity of the use, the comfortableness, the enhancement of communication possibilities and the cheap opportunity to gain information.

4. Conclusion

The overall summary of the study has been done as an evaluation of benefits. The function benefits have been evaluated low, it means the system does not provide new possibilities, but only the integration and new comfort in comparison to formerly used devices. On the other hand the psychological and self-expressive benefits have been evaluated high. The system provides easy possibilities of communication with the family and friends, the users are pleased with watching pictures of their family etc. They are proud using a modern device.

Acknowledgement

This work has been supported by the ENIAC JU Project MAS “Nanoelectronics for Mobile Ambient Assisted Living (AAL) Systems”, its Czech co-financing No. 7H10019 and the research program No. MSM 6840770012 of the Czech Technical University in Prague (sponsored by the Ministry of Education, Youth and Sports of the Czech Republic).

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AGE@HOME: ICT-SOLUTIONS FOR SELF-DETERMINED AGING IN FAMILIAR ENVIRONMENTS

Kurt Majcen, Maria Fellner[1], Alexander Stocker, Klaus Dobbler, Harald Mayer, Thomas Orgel, Roland Mörzinger, Bernhard Rettenbacher, Susanne Rexeis, Georg Thallinger[2], Peter Beck, Bernadette Pierer, Stephan Spat[3]

Abstract

Funded by the Austrian Federal Ministry for Transport, Innovation and Technology (bmvit) the project age@home is dedicated to the development of innovative ICT solutions to facilitate self-determined aging for elderly people. Given the research and development competencies of JOANNEUM RESEARCH – DIGITAL / HEALTH, three demonstrators for AAL technologies have been developed in age@home: vibro-acoustic gait analysis, analysis of activities of daily living based on the Kinect sensor and mobile tablets for a communicative future. While the first two demonstrators which use sensor based technologies are currently in an experimental stage only, the social communication demonstrator for mobile tablets was already successfully evaluated with elderly persons.

1. Introduction

The demographic change is a huge challenge for the modern world, and we believe in technology to support in many ways. As a non-university research organization, JOANNEUM RESEARCH therefore decided to contribute to the ongoing discussion and development of AAL technologies. Having deep background knowledge in sensors, data-mining and web-based technologies, the Institute DIGITAL of JOANNEUM RESEARCH even added Ambient Assisted Living as one interdisciplinary research topic to its research strategy. Hence DIGITAL's researchers are called upon to investigate the future application of technologies for elderly people. This is done in several research groups contributing to an interdisciplinary approach:

- The research group **Audiovisual Media** focuses on harnessing information from multimedia content, especially video, film, image and audio. This provides the basis for developing automated solutions, be it for the detection of

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ghost drivers on motorways, the removal of dust, brightness variations and other defects from film or the counting and tracking of pedestrian flows.

- The research group **Space and Acoustics** has more than three decades of experience in the areas of space technology, telecommunication and acoustics. The Intelligent Acoustic Solutions team develops systems for acoustic monitoring, vibration and audio & multimedia applications from idea to functional prototypes. The team has key expertise in data acquisition and management, sensor and measurement technology, digital signal processing including artificial intelligence methods and algorithms as well as software architecture and development for real-time systems.
- The research group **Intelligent Information Systems** develops new approaches to gain access to information in complex networked applications. It places a special focus on the arts, media and safety & security markets, bringing to bear their extensive expertise in database management systems (RDBMS), client-server technologies, service-oriented architectures (SOA) and Rich Internet applications. It is dedicated to the analysis of user behavior and activities, information dissemination in social networks and user generated content in Web 2.0 or Social Web applications.

DIGITAL has made previous experiences in researching AAL technologies:

- The project **ALICE** (www.aal-alice.eu) [1] supported by the Ambient Assisted Living (AAL) Joint Programme researched, developed and integrated a set of ICT based services to be used in the existing TV set, allowing elderly people to enjoy new experiences of communication and social interaction.
- **Learn & Network** (www.learn-and-network.at) [2] and the recently kicked-off project **Learning4Generations** are both supported by “benefit” the Austrian national programme for AAL research and investigate how to teach and motivate elderly people in adopting social media. The latter one even follows an intergenerational approach to bring together elderly as learners and digital natives as teachers.

The AAL project age@home [3] is funded by the Austrian Federal Ministry for Transport, Innovation and Technology (bmvit) and adds to this list of AAL projects conducted at JOANNEUM RESEARCH. It researches and develops technologies aimed at empowering elderly people to stay at their beloved homes as long as possible. This includes both assistive technologies and technologies enhancing communication between elderly people and other stakeholders. The idea is to support activities of daily living. This paper describes the chosen method for age@home, elaborates on the results of the project and concludes with a brief discussion.

2. Scenario

Sabine is 80 years old. She lives alone in her little fine apartment. Reading newspapers and books keeps her mentally fit but moving around is not easy for her. On several days she does not feel well at all and is in danger of falling down. Although her mobile care assistant visits her three times a week the probability falling down when she is alone is rather high. Beside these motoric problems *Sabine* suffers also from Diabetes Mellitus Type 2. For better coping with this illness she has subscribed to a disease management programme which ensures structured treatment of her illness. She and her doctor within that programme define some goals regarding nutrition and body activities once a year and the doctor tells about healthy target ranges for blood pressure and blood sugar. It is important that *Sabine* takes the right drugs at foreseen daytimes, that she eats and drinks according to a diet plan and that she performs sufficient fitness exercises each day. Most time during the year *Sabine's* physical parameters are well under control but there are episodes of instability sometimes. In these phases she wants to have more intensive contact with her doctor. Due to her insufficient mobility *Sabine* is also in danger of losing her social contacts and she feels lonely more and more. Many of her friends have already died and her family cannot visit her as often as she would like this.

3. Methods & Results

With regard to the above described scenario (showing various difficulties of elderly persons in daily live) and as a consequence of the aforementioned competencies within DIGITAL three use cases have been developed in the mentioned research groups:

- Vibro-acoustic gait analysis,
- Analysis of activities of daily living, and
- Communicative future.

These three use cases were continuously elaborated in several workshops also involving external stakeholders. Researchers from the Institute HEALTH of JOANNEUM RESEARCH contributed to use case 3 and added a smart diabetes diary. For each of these three above mentioned use-cases, demonstrators were developed to make the value of the AAL-technology visible to the end user.

4. Vibro-acoustic gait analysis

It is known from empirical studies that much information about the current health condition of elderly people can be acquired from their walking pattern (especially sudden changes in the pattern are suggestive of changes in mobility). One way to detect where and when a person moves, is to measure vibrations of the floor. Current approaches have a number of limitations: For instance the tested person has to be the only person in a particular room, which is however only feasible in laboratory conditions and not applicable to real-life situations. Against this background age@home investigates a new approach, i.e. it applies vibro-acoustic sensors to derive motion patterns including normal walk, slow walk and hobbling, person localisation and tracking, which are more feasible for day-to-day home conditions. By smartly processing the signals from a couple of sensors, events are detected. The demonstrator shows, how people are moving in their homes and makes visible if their movement changes.

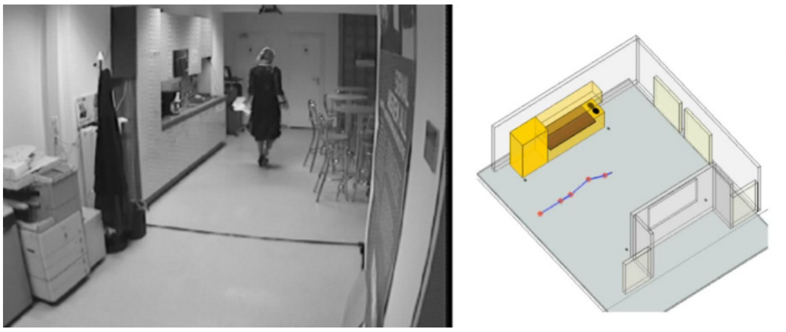

Figure 1. Detecting events and movements with vibro-acoustic sensors

5. Detection of Activities of Daily Living

This demonstrator takes advantage of a sensor, which is available to anybody at a very low price on the consumer market: the Kinect currently sold by Microsoft for its Xbox game console. The Kinect allows detecting and supporting the activities of daily living. Possible scenarios are automatic detection of eating, drinking, walking, taking drugs and more. In the first stage the data collected by the sensor are used to detect one of the ADL. If an ADL is detected it could be compared to the same ADL detected hours or days before. If deviations occur an alert could be triggered. Another application based on this sensor is to build a model of normal activity by monitoring the scene over some time. After this time the model could be used to detect, if something unexpected happens.

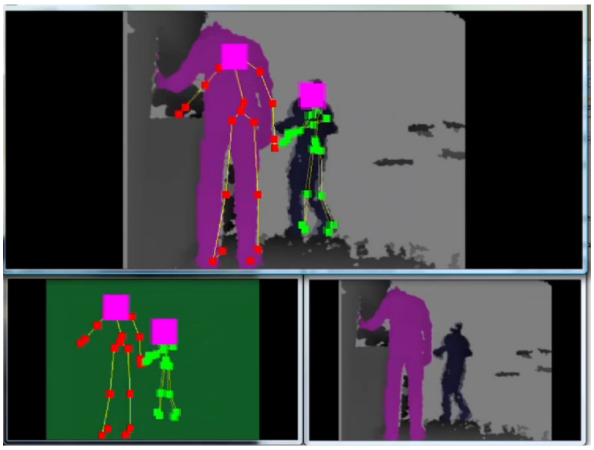

Figure 2. Monitoring activities of daily living with the Kinect sensor

6. Future communication on mobile devices

The developed demonstrator is running on mobile tablets with an android operating system and includes on the one hand a smart diabetes diary which allows patients suffering from diabetes mellitus to communicate with their doctors. On the other hand it features an easy to use interface to Facebook, which assists people not to get lost in Facebook's complexity and dynamics. This demonstrator will empower elderly people to stay in touch with their beloved ones by actively using social networks via their mobile tablet. The central element is the (social) activity stream, creating awareness of the personal network when aggregating social interactions from platforms like Facebook. The user interface for the mobile tablet will reduce the complexity of Facebook's too often and rapidly changing user interface which is not tailored to the needs of elderly people with limited ICT practice.

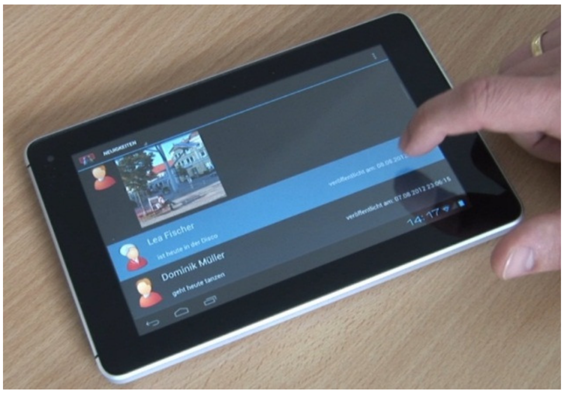

Figure 3. Social Activity Stream

7. Discussion / conclusions

All three demonstrators were designed to be used separately. However during a creativity workshop the question was raised, if and how all three demonstrators can be linked to generate value for elderly people, which is bigger than the sum of the values gained by each demonstrator alone. There may be different options to achieve this, but the activity stream developed in use case 3 proved to be a solid one.

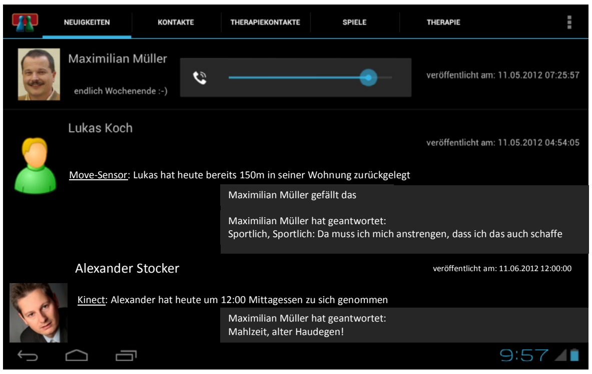

Figure 4. Adopting the activity stream as an information hub

The activity stream is not only capable to cover information created by the personal network (i.e. created by elderly people and their family and friends directly), but also semantically enriched information created by the sensors adopted in use cases 1 and 2. For instance an elderly person may be immediately informed when her friend has conducted the daily walking-exercises (which was detected by the sensor) and will be motivated to catch up. Such notifications may launch a friendly competition among the participants, contributing to their mental and physical fitness.

To sum up, the project age@home is at different development states regarding the aforementioned use cases. Sensor based technologies in use cases 1 and 2 are more in an experimental stage, whereas the use case 3 demonstrators including the social communication platform and the diabetes diary have already been subject to usability tests with elderly persons.

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HOMAGE FOR LIFE – A PERSONALIZED SELF-SERVICE PLATFORM FOR THE AGING-IN-PLACE INDUSTRY.

Shoshan Shacham-Ramat Hasharon- Israel[1]

Abstract

Homage for Life[2] is an ICT-based[3], "Best Practice" innovative paradigm addressing the "Independent Living" challenges of the 21st century. Meeting this challenge is powered by the potential for significant economic and social impact expected from the introduction – on a wide scale – of innovative AAL solutions. While this potential has been recognized for some time, breakthroughs in terms of widespread availability and deployment of solutions have yet to be achieved. The way to proceed towards the Homage for Life solution is presented here.

1. Introduction

Homage for Life, an Israeli innovation, provides a new, Best Practices, innovative approach for addressing Aging-in-Place challenges. It offers a comprehensive solutions platform based on a wide-range of interdisciplinary research, business participation (services, products) and currently available and implementable information technology tools and structures (i.e. ICT, Internet, Social Media Networking) to provide a sustainable, high quality, on-demand platform answering the needs of the aging 70+ population.

Homage for Life supports the principles of:

- Adding viability to the vision of living life independently in the place of one's choice, i.e. living in one's own home and community, surrounded 'virtually' by family and friends.
- Providing full support when it is needed (and only then), by an effective, comprehensive, sustainable, on-demand system in line with the "best practice" model for Assisted Ambient Living.

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[2] Homage for Life, now in the advanced phases of structuring, began assembling talent in 2005. Its highly qualified team includes talented Israeli and International academic and business figures with expertise in such fields as: Gerontology, Geriatrics, Psychology, Health, Medicine, Finance, Insurance, ICT, Internet, Construction, Sales & Marketing. Venture Capital and, last but not least, Service Provision (provision of helper services). Their impressive potential adds to Homage for Life prospects for success.

[3] ICT: Information Communications Technology

2. Methods

The initial steps for making such a solution available are:

- Providing an ICT-based, sustainable self-service platform that complies with the FP7 Multi-Stakeholders Partnership Braid Project framework (www.braidproject.eu).
- Gaining the commitment of a respected segment of industries that would benefit from integrating their products in our platform solution.
- Acquiring a significant 70+ end-user base.

In order to successfully implement an ICT-based operational system, at least five critical success factors need to be addressed:

1. Establishment of a proven, mature ICT & Internet infrastructure
2. Identification, analysis and prioritization of 70-+ needs/aspirations
3. Commitment to participation by members of the 70+ group.
4. Availability of a persistent, ongoing, self-service operational infrastructure (24X7)
5. Initial commitment from significant players representing those industries that are expected to participate as service suppliers.

3. Discussion/Conclusions

The Homage for Life initiative is based on current research regarding the changing needs and aspirations of the elderly and the potential of social media and emerging technologies to help meet these needs. It also addresses the new Danish Welfare initiative regarding the elderly (See September 2010 AAL - Ambient Assisted Living-Forum, Odense). Homage for Life presents members of the aging population with a platform that greatly enhances their ability to take advantage of the relatively new creative concept of enjoying required and desired support, services and social benefits while continuing life independently and unregimented in the environment of their choice, which is often the home and community of their “middle-age”. A 70-plus world offering this kind of choice is possible thanks to advances in many medical, technological and social disciplines that have made viable the possibility of catering to modern aspirations of the third age.

Currently, Homage for Life is active with the middle-class and upper-middle class population. This is a population segment often characterized by the need (sometimes financial) and desire to care for itself. Homage for Life is dedicated to finding and making available economically viable, suitable, palpable and most importantly advantageous solutions for the third and fourth circles of life.

FOOD: A FRAMEWORK FOR OPTIMIZING THE PROCESS OF FEEDING

Laura Boffi[1], Laura Burzagli[2], Dominic M. Kristály[3], Paolo Ciampolini[4]

1. Introduction

Feeding is a primary function, necessary to life and closely tied to health. Elderly people, however, are prone to become careless about food, due to many different reasons: shopping difficulties, cooking effort, loss of interest, lack of information about nutritional principles and healthy food, etc. Food management is among most complex and demanding daily living activities, and can be jeopardized by incipient physical and cognitive impairments. Cooking also implies dealing with sharp tools, hot plates, fire and so on, thus emerging as one of the riskiest home tasks: most home accidents actually happens in the kitchen, indeed. Furthermore, food is gaining a prominent role in social life and local cultures too. Difficulties in managing food and feeding processes can thus pose a severe threat to the chances of independent life of elderly people: the "FOOD" (Framework for Optimization Of feeDing process) project, funded by AAL Joint Program in the framework of call 3, aims at tackling some of feeding-related problems, looking for solutions fostering independency and gratification in accomplishing kitchen tasks.

Figure 1: FOOD project logo

The project partnership includes 9 partners, coming from 5 European countries (Denmark, Netherlands, Romania, Sweden and Italy); field trials are planned in the Netherlands, Romania and Italy.

This abstract illustrates the basic ideas and some preliminary results coming from FOOD project: more specifically, Sect. 2 deals illustrates the FOOD system infrastructure, Sect. 3 discusses the service perspectives and users involvement in the different phases of the project.

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[2] Consiglio Nazionale delle Ricerche, CNR, Italy
[3] SC Vision Systems SRL, Romania
[4] Università degli Studi di Parma, Italy

2. Food system architecture

FOOD infrastructure is shown in Fig. 2, and is centered around a “gateway” gathering information coming from the ambient. The FOOD gateway manages communication with peripheral devices (environmental sensors, kitchen appliances) and toward the Internet (with local and wide-area networks). Through the local area network or Internet, the user can access and operate the system through many different “interfaces”: a tablet computer, smartphones, etc. For interoperability’s sake, the gateway stores all information in an abstract fashion, independent of the actual physical or electrical nature of the originating device.

To achieve system openness, multiple communication media and protocols are accounted for (both wired and wireless). Most important, the network includes smart kitchen appliances, capable of network communication and thus enabling monitoring and remote control. In FOOD setup, white goods will exploit the IEEE 802.15.4/ZigBee wireless communication protocol. Besides inherent advantages of standardization, ZigBee fosters interoperability by making available specific “profiles”, aimed for instance at “home automation” and “health management” applications. Environmental and personal (i.e., wearable) sensors may be connected to the same wireless network. Wired communication is accounted for as well, providing a cheaper option for connecting low-cost sensors and devices: a smart Internet interface (FEIM, [1]) is exploited to include devices not featuring native connectivity. Also powerline communication (PLC) fits the framework: in particular, an ultra-low-cost, low-bitrate approach will be tested in the trial sites, based on the “power modulation” (PM) concept developed by Indesit Company [2]. Supervision of such a heterogeneous system will be taken care of by CARDEA [2] software, already exploited in AAL contexts.

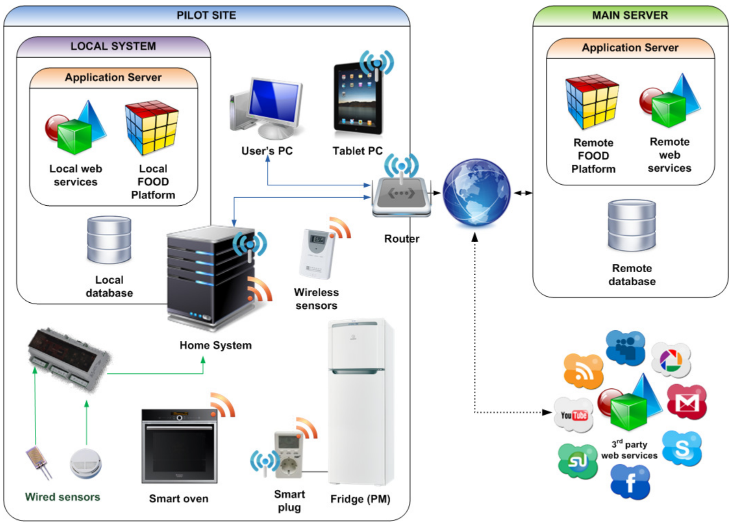

Figure 2. FOOD system architecture

From the software architecture point of view, two zones can be identified: a local one (i.e., the user's house) and a remote one (an outside resource that enables the FOOD systems to communicate with each other through the global network).

The FOOD gateway machine (seen in Fig. 2 as *Home system*) runs an application server that houses the web services that work together to provide services to the user. By implementing the services in a SOA (Service Oriented Architecture) context, the openness of the software platform is strengthened; also, it provides chances for developing new services, by combining existing web services in different ways, using the *Domotic Resources Gateway Library*. At local level, the web services relate, mainly, to the infrastructure, offering access to data stored in the local database by the sensor network and the smart appliances. It also allows to send commands to smart appliances (e.g., sending a text message to be shown on the smart oven display).
The users can access external services (through the internet), provided by the remote FOOD server (*Main server*) or by third party (e.g., Amazon). Finally, local and external services can be fused to provide higher-level functions. Besides distributing web services, the *Main server* also deals with system administration and maintenance tasks, exchanging data with all the local systems for updates, debugging and statistics.

3. Food services

In order to define services, we first strove for framing FOOD functions within a more general perspective: to this purpose, we refer to documents issued from AAL Association and by the World Health Organization. With reference to AAL function classification proposed in [3], we found FOOD services could fit several categories, including Comfort, Energy management, Multimedia and entertainment, Healthcare, Security and Safety, Communication. The WHO International Classification of Functioning, Disability and Health (ICF) deals specifically with "Domestic Life" (Chapter 6, [4]), and explicitly considers shopping activity, meals preparation, kitchen cleaning, food supply management, as well as appliances use and maintenance. FOOD services therefore fit a fairly wide range of acknowledged needs and could be prospectively extended to broader classes of users.

Then, we focused more strictly on available technical features and possible innovative functions enabled by these. Smart appliances introduce new features, including the possibility of accessing and controlling their status, getting warning (e.g., when the fridge door is left open, or when the oven is too hot for safe manipulation), controlling power consumption, selecting operating cycles, etc. Through networking, such functions may be combined with environmental and personal information, allowing for building more complex services and extending their scope to different areas. For instance, once the user has succeeded in preparing a good meal, he/she is allowed to share with friends not only the plain recipe, but also the oven settings and the cooking time cycle, together with a snapshot of the completed dish. This introduces meaningful elements of social interaction and inclusion, possibly enhancing user's awareness and motivation in his own feeding. Of course, this calls, on one hand, for accessible and familiar interface devices, conjugated with carefully designed interaction strategies.

On the other hand, given peculiarities of both the user's profile (very often elderly people with limited computer skills and familiarity) and the main topic (food) social interaction needs to be managed in a specific way: designing effective and appealing tools to manage both the technical and the social facets of kitchen life is among the most challenging project goals. The highly flexible and heterogeneous technical infrastructure introduced in the previous section should reflect in a versatile and adaptive approach toward the user, allowing for easily accessing services of interest and for introducing new features when needed, following the evolution in time of user's needs.

For these reasons, FOOD service design is strictly user-centered, and significant efforts have been devoted to involve users in the FOOD concepts assessment. Since the project start (Sept. 2011), a thorough fieldwork-based analysis has been carried out, coordinated by specialists at Copenhagen Institute of Interaction Design and aimed at involving elderly people living in the three countries involved in the project pilots (either alone or together with a spouse). FOOD project researchers have met people in their own living contexts, sharing a few days with them, accompanying them in daily activities such as shopping, meeting friends, preparing meals, etc. The main goal was gaining insights on the perceptions and feelings about food and food-related activities. More specifically, we focused on the following aspects: shopping, food choice, cooking and having meals, and on social aspects implied by such phases. We sought for answers to the following questions:

- What best motivate elderly people to cook and have food?
- How food and feeding impact their physical and psychological wellness ?

We exploited design ethnography methods: interviews, observation techniques and cultural probes (diaries, postcards and photos), designed to support different phases of the interaction with researchers. We met 15 persons, and for each of them interviews have been carried out, as well as "shadowing" (i.e.: following them without explicitly interfering with their activity) throughout the whole day. For each person (or couple) CIID researchers prepared documents (slideshows and short videos) aimed at introducing the users and their context to the wider project partnership. Though storytelling, partners not directly involved in fieldwork have a chance to share in the personal, empathic involvement in the user's interaction experience. These techniques give project partnership a rooting in the perspectives of the user, and enabled researchers from multi-disciplinary background to participate in subsequent brainstorming, discussion and analysis phases in a more egalitarian frame.

From the fieldwork, a *design insight* map (shown in Fig. 3) was worked out, aimed at providing hints for the following design phases. Also, an *opportunity areas* map (Fig. 4) was prepared, identifying grounding areas for technology and service design.

Maps were exploited for driving discussion among partners, facilitating convergence toward meaningful use-cases and scenarios. Such tools therefore greatly fostered matching among technical features and service opportunities, and are currently being used to select actual services to be first deployed at trial sites.

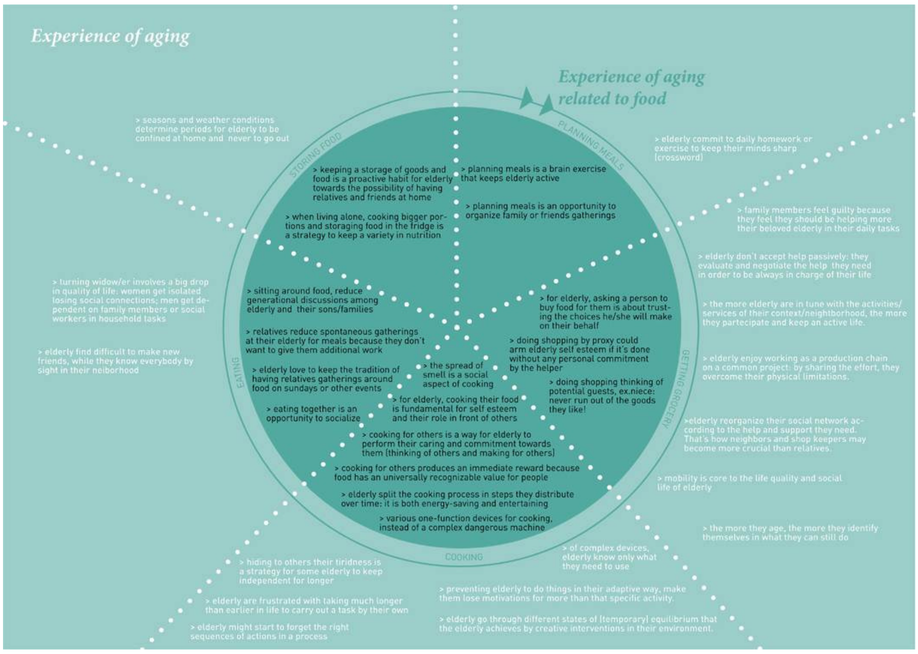

Figure 3. Design insights map

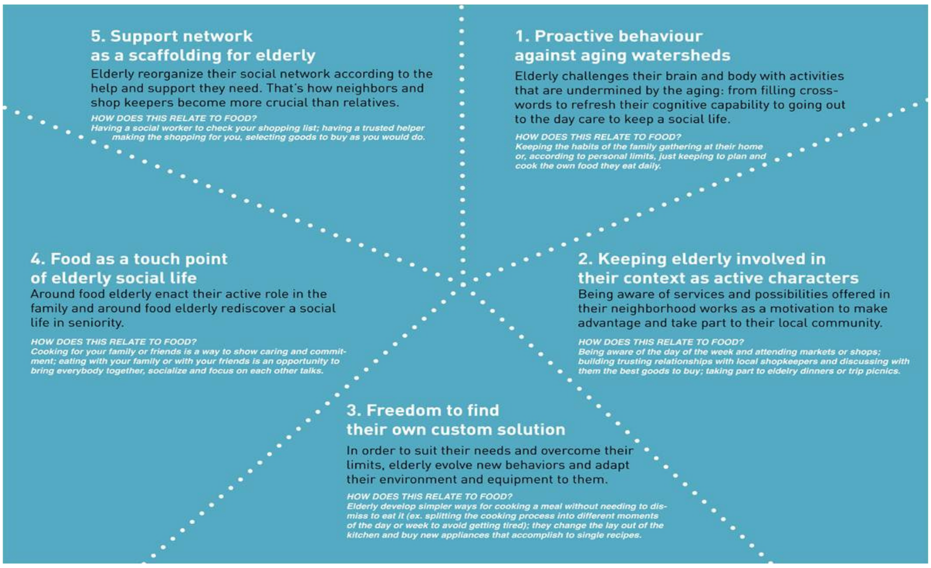

Figure 4. Opportunity areas map

4. Conclusions

FOOD project aims at tackling several issues related to food and feeding, which play a central role with respect to independent life and wellness of elderly people. Starting from technological innovations, which brings into communication networks kitchen environment and appliances, the project moves toward a holistic view, encompassing, in the same framework, both social interaction and inclusion. Since its initial phases, the project has pursued a strongly user-centered approach and much effort has been devoted to assess actual needs and to make all the project partners aware of user's points of view. Specific formal tools were used to this purpose, supporting effective spreading of the fieldwork results and fostering effectiveness in the actual service design, currently being carried out.

Acknowledgement

The FOOD project team wishes to thank all people involved in the fieldwork, for their availability and cooperation. Besides project partners, we would like to express appreciation for support received from Cooperativa Sociale Nuova Socialità in Roma.

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OTHER FORUM EVENTS

FIELD VISITS

The Netherlands has many years of experience in projects and initiatives in the field of smart living for the ageing population. A number of these opened their doors exclusively for the AAL Forum.

The AAL Forum 2012 organisation was proud to offer the visitors the possibility to participate in a broad set of Field Visits in the Brainport region that showed on-going projects, pilots and mature services related to AAL projects.

Telecare in the South of the Netherlands

ZuidZorg, Veldhoven

ZuidZorg is a leading organization in the Netherlands for telecare: video based, domotics integrated. You visit a Home care organization with a professional Telecare call centre which is serving 14.000 clients 24/7. Telecare (video based) started in 2004. September 2012 already 6 Healthcare organizations are participating in the same infrastructure and the Telecare call centre (SP for other Care Organization which we will try to involve in this program for this visit of AAL). At this moment 700 clients with telecare are serviced. Expected growth 30% a year. End 2011 there were 110.000 video-supported planned care moments a year . The visitors will have contact with client en professionals who will tell on-line and off-line about their experience with telecare. During this visit we will tell about recent development of (telecare) services for several segments of clients: for example dementia and their caregivers.

Dynamic Lighting for the elderly

Stichting Onderzoek Licht en Gezondheid, Huizen

Scientific research shows that light has a positive effect on the sleep / wake rhythm in demented patients. With the right intensity, colour temperature, timing, duration and dosage disruption of this rhythm can be delayed or recover for a certain period.

The disruption of the sleep / wake cycle is called Sun downing. Symptoms caused by sun downing are anxiety, restlessness in the afternoon and evening and night-time wandering. Sun downing is usually the reason for admission to a residential care facility, because the behaviour is too burdensome for the family and carers. The purpose of this study was to find out whether and how light administration in the home can be applied, so the start of Sun downing is delayed and admission to a nursing home may be postponed.

The visit at nursing home the Bolder shows a successful use of dynamic lighting for the elderly. Research has shown that cognitive behaviour improved by decreasing restlessness, apathy and agitation. During the visit the wards with dynamic lighting are shown and there will be a lecture about the field study which is recently been done.

Helmond zorgt Slim

Groenkwartier, Helmond

Location: a residential complex for the elderly (seniors) where different parties offer their services not only care related services but also local and social facilities. The question is how can we let the elderly live independent and how can we make this happen in their present home. In this Living Lab-environment the resident is the key to the innovation process and selected home-improvements, the creation of the services only takes place with consultation of the residents. For example: a scoot-mobile pool is organised. Because of lack of space and fire safety, each occupant cannot place his own scoot-mobile in his own home or basement. Therefor we manage a pool, which is linked with an agenda on the digital platform. In relation to the welfare factor of the process of informal care (by friends and family) is embedded through the “zorgsite” www.zorgsite.nl in this project.

Location Suytkade. Patio homes are equipped with the first basic needs, not only digital needs, such as hardware but also with all of the functionalities of the open platform. Because living independently is not only possible with a comfortable home but also stimulated by well-care and care facilities may services in these line of work are added to the platform. Everyone is free to choose his own services and when en how they use them. In the light of the preventive framework we can visit the Foodcampus/ Groene Campus. In the field of the food technology and also with use of deployment of healthy diets, and the use of substances nutritional components, the search for well nutrition and taste, in preferable foods is a selling point. Breakthrough in this line of study can bring good practical use when delivering food to the target group seniors.

Care Robots & Smart Homes: Mobiserv & CompanionAble

Smart Homes, Eindhoven

Robots that support you, and help your family to be there for you; this is not science fiction. Design researchers of Smart Homes develop robot concepts and services, and test these with older people and their carers. Working in close collaboration with technology partners on the one hand, and care organizations on the other, they are trying to make and shape the future.

Smart Homes has just finished another round of extensive user tests with two robot companion prototypes; CompanionAble and Mobiserv. The first offers structure and memory aids during the day to people with cognitive impairments, and helps them to stay active. The second robot monitors your physical health and supports your eating, drinking and activity patterns. Next to these primary care goals, both robots try to become a companion and to offer company and stimulation when needed. This field visit will show you both robot prototypes in their smart home environment, stories from user evaluations with people with early dementia, and the current state of the two FP7 research projects.

Triple O campus – One app a day keeps the doctor way, are you serious?

Triple O campus, Breda

In the health market the development of interactive apps, community platforms and serious games is becoming booming business, more and more. Are these new forms of prevention and self-management really cost-reducing and effective in keeping you away from the doctor?

- See how the triple helix parties works together in the creative AV industry
- Showing examples of serious games, apps and community platforms
- Meet the companies who can assist you: from idea to realisation
- Get to know the University of Applied Science, 2 bachelor's programmes :
- International Game Architecture and Design
- International Media and Entertainment Management
- Get an insight look at the AV house and see how the facilities can work for you

Robot Rose

ROSE & ZuidZorg, Waalre

Robot ROSE is the end result of the project TSR (Tele-operated Service Robot) subsidized by the Dutch ministry of Economic affairs and the province of Noord-Brabant. The goal of the project is the development of a tele-operated robot for home care applications. The robot helps people at home and is controlled by an operator of the health care provider (who controls more than one robot) at a central location or by the client himself by a handheld device. Robot ROSE is developed in close cooperation with ZuidZorg who is a home care provider that represents the end user and has knowledge about fitting the robot into the care financial system . This is very important in order to develop a robot which is both functional and user friendly. At the moment we are preparing for a field test by different home and health care organisations who want to be an early adapter for these kind of technologies.

Wuzzi

Wuzzi, Tilburg

Dementia is one of the diseases that will have a great impact on both patients and their surroundings. With the growing number of elderly suffering from diseases like dementia and a health care system that cannot grow accordingly, people are expected to remain living at home for as long as is possible. A system like Wuzzi, allows caretakers to "monitor" their relatives, instead of "locking them up" in a elderly home: good for the patients and good for the health care system.

It's all about people

OnsPlatform, Eindhoven

We make a contribution to enhancing quality of life, stimulating well-being of residents, and living longer and happier in one's own environment.

Health-Lab

Waag, Amsterdam

Goal of this side visit is to inform and inspire the participants on innovations in healthcare in the metropolitan area of Amsterdam. Participants are welcomed in one of the oldest buildings of the city, the Waag building in the city centre. Health-lab as living lab is presented. After the presentation the participants can get inspiration on a great number of innovations (i.e. mock-up of the living lab, interactive wall, low cost prostheses, stress meter for people with autism, glucose meters). During the lunch a tour in Fab Lab Amsterdam is possible (Fab Lab Amsterdam is located in the Waag building). Transportation to this location is arranged.

Care and technology in occupational training

ROC, Eindhoven

Older people in the neighbourhood visit our ROC school and work together with students on technology applications in homecare and wellbeing. Students are trained in many possibilities that technology enables related with care. Together with technology partners, we enable our students to promote the possibilities of technical applications in homecare. During education there is attention for the ethical aspects of technology in care. Students play a key role in the implementation of technology in the domestic environment.

Care Robotics & Serious Gaming at the Ananz care group

Ananz & Smart Homes, Geldrop

Ananz, a care organisation for older people in Geldrop, is known for her positive, personal, and professional attitude towards elderly. To offer her clients the very best, Ananz participates in several innovation projects. We would like to invite you to come experience three of our projects and share your thoughts with us.

The first of these projects is MOBISERV, a friendly, smart robot to assist elderly in terms of well-being, nutrition, and safety. The MOBISERV robot can both assist elderly living at home as elderly living in a care setting.

The second is the LEAGE project, developing and testing learning games for the elderly. Elderly are challenged to play positive learning games to train their cognition and memory and to slow down the aging process.

The third project involves interactive video revalidation to motivate the elderly to exercise longer and more intense by providing them with real-time video feedback based on their movements.

SENIOR SESSIONS: INPUT AND FEEDBACK FROM INTERESTED SENIORS ON AAL

The main objective of the Ambient Assisted Living Joint Programme is to enhance the quality of life and independence of older adults through the use of ICT. During previous AAL Forums, these (potential) end-users were usually under-represented. For the AAL Forum in Eindhoven, we circulated an open invitation for seniors to participate, to give input in discussions, and to provide feedback on AAL solutions.

Over 140 interested seniors (60+) registered and participated in the AAL Forum 2012. They shared their opinions and feelings about various topics related to ICT & Ageing in general and AAL solutions in particular. Are seniors interested in using and/or buying such solutions? For themselves, or for family and friends? Which benefits do they see and what issues should be addressed in the future?

Wishes and needs

The motivation of the AAL programme is in demographic change in Europe. This implies not only challenges but also opportunities for citizens, social and healthcare systems as well as for industry and the European market. It is a chance to create, to provide and to sell products and services that are useful and usable for seniors, based on their wishes and needs.

For structured feedback from seniors on AAL solutions, special sessions have been organized in the morning of September 25th and September 26th. Sixteen AAL projects gave a short presentation, followed by feedback from the audience via interactive voting and discussion. The chair of both sessions was Louise Richardson, vice-president of AGE platform. This is a European network of around 170 organisations of and for people aged 50+, which aims to voice and promote the interests of the 30 million senior citizens in the European Union and to raise awareness on the issues that concern them most.

During these morning sessions, the following AAL projects have been presented. The rest of both days was available for visiting the exhibition and participating in the other AAL Forum sessions.

- EMOTIONAAL – Mikko Parkkinen
- CAPMOUSE – Anders Rudback
- EXPRESS2CONNECT – Thomas Hammer-Jacobson
- CO-LIVING – Inge Jochem
- SOMEDALL – Mattia Affini
- HOMEdotOLD – Gerard van Loon
- WECARE – Sharon Prins
- AALUIS – Matti Groot

- IS-ACTIVE – Hermie Hermens
- ROSETTA – Johan van der Leeuw
- CVN – Robbert Smit
- FOSIBLE – Mario Drobics
- SENIORCHANNEL – Ernesto Ruiz
- TAO – Beat Estermann
- EXCITE – Amedeo Cesta
- STIMULATE – Djamel Khadraoui

THE AAL AWARD

The annual AAL Award is intended to recognize the most promising project of the Ambient Assisted Living Joint Programme that demonstrates great promise in terms of innovation, human-centric approaches to development and market potential. The AAL JP programme has invested significantly in almost 130 projects since 2008, of which several are now beginning to show results and demonstrating real market potential. We believe that the award is important and will help to create and raise levels of awareness of the AAL JP progress, and results from the projects, whilst at the same time highlighting the core ideas behind the AAL Joint programme.

Selection criteria

1. The level of innovation – in terms of novelty of concept, approach to the development of the solution from both technological and social perspectives.
2. Level and quality of end user integration and potential to improve the quality of life for older adults, their families, carers and significant others
3. Market potential for the project – based on the analysis and understanding of the current and future AAL market trends as well as competition.

Final presentations

Three finalists have present their project at the AAL Forum 2012. This pitching session involved the finalists presenting their projects to the panel that gave positive and supportive feedback and posed questions to the participants. Each presentation was given by the project coordinator or another suitable representative in a defined format.

Winner

The project **HELP** – Home-based Empowered Living for Parkinson’s disease Patients – won the second edition of the AAL Award. HELP is a consortium of Spain, Italy, Israel and Germany, which created a health monitoring system specifically targeted for the needs of Parkinson Disease (PD) patients. The HELP services feature:

- A Body Sensor and Actuator Network made up of portable/wearable and home devices to monitor health parameters (e.g. blood pressure) and body activity (e.g. to detect gait, absence of movement), and to release controlled quantity of drugs in an automatic fashion;
- A remote Point-of-Care unit to supervise the patients under clinical specialists control.

For more information on HELP, visit http://help-parkinson-aal-project.tid.es.

Including the winner, four projects were selected from a panel of recognized experts for the final phase of the award. The other 3 projects were:

- **Fearless**, a fall detection system that would enable older adults to stay safer in their own environment;
- **Health at Home**, a wearable monitoring system;
- **Senior Channel**, offering the possibility for older adults to take part in and watch TV programs dedicated to them.

EXHIBITION

On the various rings and floors of the Evoluon Conference Centre, visitors found an interesting exhibition of 68 booths from all over Europe – including 24 AAL projects and 44 booths from industry, government and research institutes. Together they provided an interactive experience of state-of-the-art technologies and services in Ambient Assisted Living.

VIP TOUR

Before the official opening ceremony of the AAL Forum, a 3-hour VIP tour through the Eindhoven region and the AAL Forum venues was organized. The participants received an introduction to the AAL Joint Programme, the AAL Forum, the Eindhoven region, and its many on-going innovation projects.

Participants

- Constantijn Van Oranje-Nassau – *Head of Cabinet of Neelie Kroes – Vice-President of the European Commission*
- Paul Timmers – *Director Sustainable & Secure Society, DG Connect, European Commission*
- Peter Wintlev-Jensen – *Deputy Head of Unit, DG Connect, European Commission*
- Mike Biddle – *President of the AAL Association*
- Marlies Veldhuijzen van Zanten-Hyllner – *State Secretary for Health, Welfare and Sport*
- Kees van der Burg – *Director Long-term Care at Ministory of Health, Welfare and Sport*
- Wim van der Donk – *Queen's Commissioner of the Province of Noord-Brabant*
- Brigite van Haaften-Harkema – *Provincial Executive for Welfare & Healthcare, Province of Noord-Brabant*
- Bert Pauli – *Provincial Executive for Economic Affairs, Province of Noord-Brabant*
- Rob van Gijzel – *Mayor of the City of Eindhoven, Chairman of the Brainport Foundation*
- Ad van Berlo – *Chairman of the AAL Forum 2012 Programme Committee, Manager R&D at Smart Homes*
- Corien van Berlo – *Director of Smart Homes*
- Mary-Ann Schreurs – *Eindhoven City Councillor for Innovation, Design, Culture and Public Space*
- Carly Jansen – *Cluster Director Spacial Planning, Province of Noord-Brabant*
- Edwin Mermans – *Policy Officer, Department of Social and Cultural Development, Province of Noord-Brabant*
- Karina Marcus – *Director of the AAL Central Management Unit*
- Alexander van der Lof – *CEO of the TKH Group*

Tour Sites

The following venues and sites received a visit by the AAL Forum VIP tour.

Evoluon, Eindhoven: Welcome to the Evoluon Conference Centre and Exhibition Space – main venue for the AAL Forum – by Corien van Berlo and Ad van Berlo.

Jo van Dijkhof, Nuenen: Demonstration of a large-scale rollout of the European project Netcarity – an integrated paradigm to support independence and engagement for older adultse living at home – at the Achipel Care Group, by Lisette Burnett, Carina Vermeulen and Bas Goossen.

Smart Homes, Eindhoven: Demonstration of interactive social robot buddies CompanionAble and Mobiserv for people with early dementia, by Claire Huijnen and Herjan van den Heuvel, including a talk with two participants of the user evaluation studies of these social robotics, performed by researchers of Smart Homes.

Frits Philips Muziekgebouw, Eindhoven: Grand Opening of the AAL Forum in the Frits Philips Muziekgebouw – one of Eindhoven's theatres, located at the city centre's market square.

SUPPORTED BY

SMART HOMES

Smart Homes is the Dutch Expert Centre on Home Automation, Smart Living and e-Health. It was founded in 1998 and acts as an independent and intermediary organisation in the market of technology and aging, bridging the worlds of technology development and those of end-users and care/service providers. Smart Homes participates in many projects on Ambient Assisted Living (AAL) like CompanionAble, Mobiserv, CommonWell, Independent, Caalyx-MV, Cardiac, Leage, Netcarity, and Soprano. Most of these projects deal with care products and services, including context aware software-based services, built around smart technologies such as sensors, actuators, social robots, serious games and more.

Generally, Smart Homes exploits results of these projects through its partner community (about 150 Dutch organisations), educational courses, consultancy work and the Smartest Home of The Netherlands, in which new AAL technologies are integrated, validated and demonstrated. Smart Homes has strong dissemination activities through its own national conferences, its annual trade fair on smart living, its Smart Homes Magazine, newsletter and website.

Therefore, it is not a surprise that Smart Homes is delighted and honoured to be the main organizer of the Forum in Eindhoven.

www.smart-homes.nl

CITY OF EINDHOVEN

Eindhoven is unmistakeably the most adventurous city in the south of The Netherlands. It is a real hot spot for technology, design, sports and culture. As centre of the Brainport region, it is called the research capital of The Netherlands. Our ambition is to excel as an international top technology region in the (near) future.

But Eindhoven also has a rich historical background; at first sight a young and modern city, it is actually one of the oldest in The Netherlands. It received city rights back in 1232. A lively cigar and textile industry developed along the Dommel river. In the Villa park (city centre) you can still see the imposing villas and mansions built by industrialists who settled here. The creation of the light-bulb in 1891 and the first DAF truck a little later was the beginning of the development and flourishing of the city.

Ever since, Eindhoven has grown to become one of the most prominent cities of the world in the fields of technology, knowledge and design. Many top class international high-tech companies are now located in Eindhoven. The Eindhoven University of Technology, the Fontys University of Applied Sciences, and the Design Academy continue to attract students from all over the world.

www.eindhoven.nl

BRAINPORT REGION

Brainport Eindhoven Region, according to the Intelligent Community Forum (ICF) the world's smartest region in 2011, is a top technology breeding ground for innovation and home to world-class businesses, knowledge institutes and research institutions. Together they design and manufacture the technology of the future to ensure a safe, green and caring society and sustainable economic development of the Netherlands. The five focal sectors of Brainport Eindhoven region are High Tech Systems & Materials, Food & Technology, Automotive, Lifetech & Health and Design. Brainport Health Innovation is the initiator of the Innovation Network for Active and Healthy Ageing (Slimmer Leven 2020).

Brainport Eindhoven Region is a powerful innovative player in a European and global context. It accounts for a third of all Dutch private R&D expenditure, invests 8% of the GDP on R&D and is one of Europe's top three regions in terms of patent density. The economic success of Brainport Eindhoven Region is the result of unique cooperation among industry, research and government. This triple helix cooperation generates a very conducive climate for business, for both internationally renowned companies and innovative small and medium-sized enterprises in the region.

www.brainport.nl
www.brainportdevelopment.nl
www.slimmerleven2020.org

PROVINCE OF NOORD-BRABANT

The province of Noord-Brabant stimulates a smart and sustainable regional economy in which key issues in society are addressed in an innovative way, using the innovation power of the triple helix partners in the region. Brabant is one of Europe's most innovative regions, positioning itself as a suitable European trial plot for Active and Healthy Ageing.

To the province of Noord-Brabant the theme of 'Active and Healthy Ageing' is a promising development for which a process of social innovation is essential. As a regional authority, the province strengthens existing partnerships and stimulates new links between the business sector and the public and tertiary sectors. By participating in the AAL Forum 2012, the province of Noord-Brabant contributes to more innovation in the field of Active and Healthy Ageing both on a regional and a European level.

www.brabant.nl/smartcare
www.innovatieveactiesbrabant.nl/english
www.innovation4welfare.eu

MINISTRY OF HEALTH, WELFARE AND SPORTS

The Netherlands healthy and well – this is the motto of the Ministry of Health, Welfare and Sport. The Ministry's ambition is to keep everyone healthy for as long as possible and to restore the sick to health as quickly as possible. The Ministry also seeks to support people with a physical or mental limitation and promote their participation in mainstream society. Through the AAL programme the Ministry supports and facilitates innovation in long-term care. The Ministry also actively supports experiments with Smart home technology.

The Ministry of Health, Welfare and Sport encourages people to adopt healthy lifestyles by exercising more, refraining from smoking, consuming alcohol moderately, practicing safe sex and eating healthily. People with health problems should be able to call on their general practitioner, hospital or other forms of care on time. They are insured for and thus entitled to such care. Together with health insurers, healthcare providers and patient organisations, the Ministry of Health, Welfare and Sport ensures that sufficient facilities are available and that people have sufficient choices.

www.minvws.nl

ZONMW

ZonMW is the Dutch funding organisation for Health Research & Development and AAL in the Netherlands. ZonMw funds health research and stimulates the use of the knowledge developed in order to help improve health and healthcare in the Netherlands. ZonMw's main commissioning organisations are the Ministry of Health, Welfare and Sport and the Netherlands Organisation for Scientific Research.

In the view of ZonMw, two things are needed to improve health and healthcare in the Netherlands: knowledge, and actual use of knowledge. With a range of grant programmes, ZonMw stimulates the entire innovation cycle, from fundamental research to the implementation of new treatments, preventive interventions and improvements to the structure of healthcare. In selecting grant proposals, ZonMw always looks for a combination of innovation and quality, since this is the only way to deal with the complex challenges we face in society today, and ensure that clients receive affordable care of a high standard. ZonMw always strives for the best result.

www.zonmw.nl

AAL JP

The Ambient Assisted Living Joint Programme (AAL JP) is a funding activity running from 2008 to 2013, with the aim of enhancing the quality of life of older people and strengthening the industrial base in Europe through the use of Information and Communication Technologies (ICT). The programme is financed by the European Commission and the 23 Countries that constitute the Partner States of this Joint Programme: Austria, Belgium, Cyprus, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Israel, Italy, Luxembourg, the Netherlands, Norway, Poland, Portugal, Romania, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

The overall budget has been €700 million to co-finance Research & Development & Innovation projects aiming to deliver concrete solutions for independent living or 'ageing well' of elderly people using ICT. Every year a call for proposals is launched. Through the funding of new projects, the AAL JP aims to reinforce the European market for Ambient Assisted Living products and services. The AAL JP also finances other support activities such as the AAL Forum.

www.aal-europe.eu

EUROPEAN COMMISSION

The main tools to support active ageing are in the hands of policymakers in the Member States. However, the European Union can mobilise a wide range of policy instruments to support national governments and other stakeholders in their efforts, such as proposals for funding programmes like the Ambient Assisted Living Joint Programme.

Also with the Innovation Union strategy, the European Commission aims to enhance European competitiveness and tackle societal challenges – such as active and healthy ageing - through research and innovation. Concretely, the European Innovation Partnership on Active and Healthy Ageing (EIP-AHA) gathers stakeholders from the public and private sectors, across different policy areas to work on shared interests, activities and projects to promote successful social, process, technological and organisational innovation.

www.europa.eu
ec.europa.eu/research