Hitachi Handheld PC PERSONA for Windows CE

Masaki Kawase
Eiji Matsuda
Katsufumi Takagishi
Mitsuo Taniguchi

OVERVIEW: The market for portable data terminals supporting mobile uses such as data portability and accessing data from outside the office is projected to increase enormously in the coming years. Besides providing address book and schedule management for individuals linked to PCs, demand is especially strong for portable machines that can serve as mail terminals for critical communication in pursing business activities and as business terminals that, for example, can be used to prepare and submit business reports as part of a public-relations or business support system. Considering the affinity of this type terminal with Windows[1] PCs and the desire for simple connectivity with the Internet and intranets, Hitachi, Ltd. developed the handheld PC PERSONA that runs the Japanese version of the new operating system Windows CE 2.0 from U.S.-based Microsoft. Intending to make the product faster and more readable and touch-typeable than other machines in its class, the PERSONA comes with a high-speed 100-MHz CPU, large-capacity 16 Mbyte of memory, a large 8.1-inch color display, and an ample keyboard that is conducive to touch typing. In addition, a 33.6-kbit/s high-speed modem, a digital cell phone, and Personal Handyphone System (PHS) datacom interface come as standard equipment, thus making the PERSONA*[2] a pleasant-to-use and convenient communications environment for e-mail and other datacom applications.*

INTRODUCTION

MANY mobile professional businessman are beginning to use notebook computers, personal digital assistants (PDAs), and other types of portable data terminals when they go on business trips, consult with clients, or engage in other business activities away from the office. Observing this trend, we developed the PERSONA HPW-200JC, a handheld PC offering excellent portability that permits users to seamlessly manipulate data whether they are in or out of the office.

Running Microsoft's Windows CE for the basic operating system, the PERSONA HPW-200JC supports a very high degree of interoperability and data compatibility with Windows 9X/NT PCs. It provides practically the same computer environment as in the office from virtually anywhere. Standard software that comes bundled with the PERSONA naturally includes personal data management capabilities such as scheduling and addresses, but also includes communications capabilities such as mail and Internet access as well as the abilities to exchange data with the office, send in reports, and obtain critical information from the home office while one is out in the field.

Fig. 1—Handheld PC PERSONA.
Hitachi's handheld PC PERSONA runs U.S.-based Microsoft's new operating system Windows CE 2.0. Built to provide speed, a more readable screen and a keyboard that is conducive to touch typing, the PERSONA is a high-end portable machine providing full support for data communications capabilities including e-mail.

*[1] Windows is a registered trademark of U.S.-based Microsoft Corp. in the U.S. and in other countries.
*[2] PERSONA is a registered trademark of Hitachi, Ltd. in Japan.

PERSONA also comes with Visual Basic*3 for Windows CE, a suite of powerful development tools enabling developers to effectively harness development resources from within or outside the company around the world. Several hundred independent software and hardware third-party vendors have already committed themselves to pursue development for Windows CE platform.

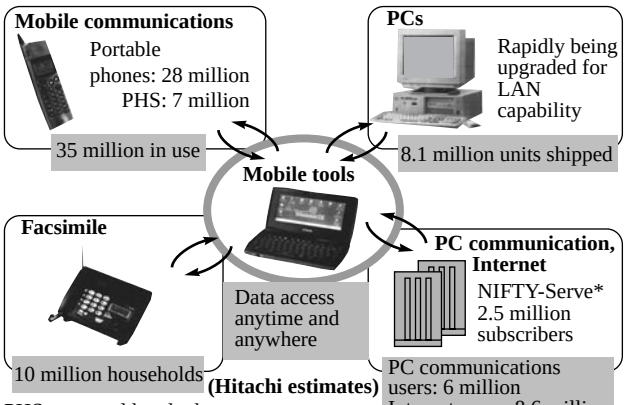
This article reviews the basic concepts motivating the development of Hitachi's handheld PC, provides an overview of the end product, and describes a number of scenarios which exploit the capabilities of the PERSONA.

CONCEPTS OF PERSONA

Handheld PC Environment

Fueled by the rapid dissemination of PCs and evolving communications infrastructure, we are seeing the emergence of an information-driven society centering on the office. It is generally predicted that the demand for portable data terminals permitting mobile users to take their data with them or access data from outside the office will make this a high-growth market (Fig. 2). At the same time, it is also demanded that portable data terminals preserve compatibility with Windows-based PCs and support simple connectivity to the Internet and corporate intranets.

In response to these needs, U.S.-based Microsoft Corporation in partnership with a number hardware vendors proposed Windows CE as an open platform operating system with a high degree of compatibility with Windows 95, thus promoting the development of handheld PCs (H/PCs) positioned as a companion to desktop machines. Hitachi proceeded with its own product development based on the compelling advantages of H/PCs running the Windows CE operating systems, such as: (1) the ability of Windows users to begin using Windows CE-based H/PCs immediately without studying the manual, (2) the availability of vast Windows development resources, (3) implementing the OS and applications in ROM not only improves reliable, it also makes applications available without booting up as soon as the machine is turned on, (4) the system has a long battery life because it consumes little power, (5) the system can be compactly implemented thus improving its portability because no hard disk is required, and (6)



PHS: personal handyphone system
*Nifty-Serve: PC communications service sponsored by Nifty Corp.

Fig. 2—Deployment Status of Datacom Equipment in Japan (1997).
Information technologies are increasing their penetration, especially in the workplace, fueled by the dissemination of PCs and communications infrastructure. It is expected that the marketplace for portable data terminal equipment will continue to grow.

communications capabilities are upgradable.

As an economical machine optimized for mobility yet still within the Windows family, H/PCs are conceived as a simple, convenient tool that can be used anytime and anywhere providing the look and feel and productivity of Windows-based PCs (Fig. 3). Data transfer and synchronization between H/PCs and desktops at home or office are well supported using communications and synchronization functions, so identical versions of one's data can be maintained on both handheld and desktop machines.

In November 1996, Hitachi along with six other companies announced first-generation English version Windows CE 1.0 devices at Comdex, the annual computer trade show where new products are unveiled. Two Japanese companies then announced a localized Japanese version of Windows CE 1.0 in June 1997. Approximately 500,000 Windows CE 1.0 H/PCs were sold worldwide. Hitachi thought that a Japanese-version first-generation H/PC was premature, and thus waited for the far more robust second generation Windows CE 2.0 to launch its product.

PERSONA Concepts

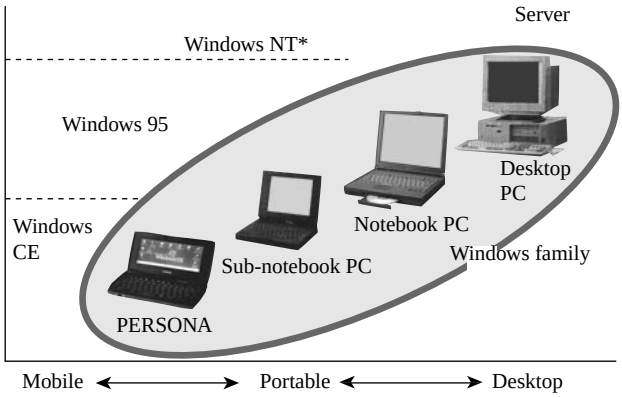
Target purchasers of H/PCs are people who are fairly familiar with handling digitized data; in other words, PC users. To date, approximately 70 percent of PCs are used for office applications while about 30 percent are used by individual consumers. H/PCs are projected to follow a similar pattern, so figuring out how H/PCs can mesh with business applications is a

*3 Visual Basic is registered trademark of U.S-based Microsoft Corp. in the U.S. and in other countries.

key issue affecting their eventual sales potential. Note that according to estimates, approximately three-fourths of the first-generation H/PCs are used for business applications.

To promote greater demand for H/PCs, we surveyed purchasers and would-be purchasers of first-generation devices to identify the main ways handhelds are actually being used and to discover the features that users would most like to see improved. We found that H/PCs are primarily used for (1) schedule management, (2) address and telephone book management, (3) word-processing, (4) to create tables and perform calculations, and (5) mail. The five areas that users would most like to see improved were (1) faster processing speed, (2) greater memory capacity, (3) a more readable display, (4) easier data input, and (5) longer battery life.

Based on these results, Hitachi sought to make its H/PC faster, more readable, and touch-typeable than conventional devices. The PERSONA is thus designed with a high-speed 100-MHz CPU, large-capacity 16 Mbyte of memory, a large 8.1-inch color display, and a key pitch of 16.5 mm that is conducive to touch typing.



*Windows NT is a registered trademark of Microsoft Corp. in the U.S. and in other countries.

Fig. 3—Positioning of PERSONA in Mobile Terminal Lineup Server.
PERSONA is a cost-effective, Window's-savvy machine that is optimized for mobility.

Considering that about 70 percent of medium and large-scale companies use e-mail, it was apparent that the ability to handle e-mail is an essential application. Communications capabilities are also critically important in light of the widespread and growing popularity of the Internet and corporate intranets.

TABLE 1. PERSONA HPW-200JC Specifications
PERSONA specs are optimized for speed, screen readability, and comfortable touch typing.

Hardware		CPU	32-bit RISC microprocessor SuperH RISC engine family SH-3 (100 MHz)
		Main memory	ROM: 24 Mbyte (ROM exchange upgrade capability), RAM: 16 Mbyte (expandable to 32 Mbyte)
		External memory	Flash memory card (PC card), compact flash memory card (can be used concurrently)
		Display	Touch-screen 8.1-in. DSTN color LCD (640 × 240 dots (256 colors out of 260 thousand colors)
		Card slots	1 PC card slot Type II, 1 compact flash card slot
		Interface	1 serial port, 1 infrared port, 1 CRT display (combined use as a serial port, 256 colors out of 260 thousand colors), 1 microphone, 1 digital phone/PHS interface
		Internal modem	Software modem (data: 33.6 kbit/s, fax: 14.4 kbit/s)
		Input method	Keyboard (featuring automatic application startup (8 fixed and 2 user-defined)), stylus pen
		Outside dimensions	253 (W) × 131 (D) × 32 (H) mm
		Weight	Approximately 820 g
		Power consumption	10 W
		Power source	AC adapter, lithium-ion battery (about 8 hr of continuous use)
		LAN	Ethernet* via a LAN card
		Printing	Via infrared interface
		OS	Windows CE V2.0
Software	Application software	Office software	Microsoft Pocket Word (cut-down version of Word for Win95), Microsoft Pocket Excel (cut-down version of Microsoft Excel for Win95), Microsoft Pocket PowerPoint (viewer capable only, can be output to VGA monitor)
		PIM software	Pocket Outlook (calendar, address book, task manager), Microsoft voice recorder, handwriting memo pad
		Communications software	Pocket Internet Explorer, In box, NIFTY-Serve autopilot, cc:Mail, fax software
		Accessories	Calculator, world time, games, dictionaries
		Utilities	PC screen capture, PIM data synchronization, viewing of Word and Excel files, data backup and restore
	PC-related software (comes installed on the PC)		Windows CE Service 2.0 (PIM data synchronization, data backup and restore, program add and remove capability)
	Development environment		Windows CE Toolkit for Visual C++ 5.0 (Japanese localized version)
			Windows CE Toolkit for Visual Basic 5.0
			Windows CE Toolkit for Visual J++ 1.1

RAM: random access memory VGA: video graphics array *Ethernet is a registered trademark of U.S.-based Xerox Corp.

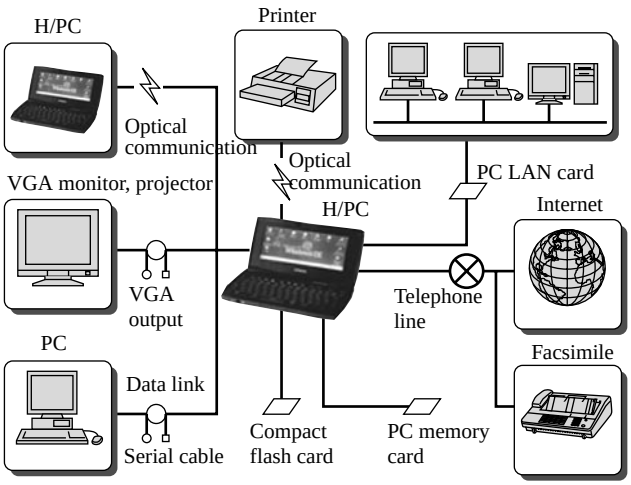


Fig. 4—PERSONA HPW-200JC System Connectivity. PERSONA can be seamlessly interconnected to PCs and other peripheral devices, and achieves excellent expandability.

OVERVIEW OF PERSONA

Having considered the concepts guiding the development of Hitachi's H/PC, let us now examine the PERSONA HPW-200JC in greater detail.

<Speed> Seeking to realize a three-fold increase in speed over first-generation H/PCs built around a 30-MHz CPU, PERSONA is implemented with a 100-MHz CPU. We also responded to the needs of mobile professionals to access data or check their schedules immediately by providing quick-start keys enabling them to start up applications and their Personal Information Management (PIM) software instantly even when power is turned off. There are ten quick-start keys, two of which can be defined by the user.

<Readability> To enhance the readability of the PERSONA, we implemented a large 8.1-inch backlit color display that is about 1.6 times larger than was available on any of the first-generation H/PCs.

<Typeability> The PERSONA keyboard provides enhanced typing comfort with a key pitch of 16.5 mm (17 mm on the English-language version), and a stroke length of 2.5 mm that has a responsive feel.

To support communications and especially mail capabilities, the PERSONA comes with an internal 33.6-kbit/s high-speed modem, a digital cell phone, and PHS data communications interface as standard equipment. Connectivity to a phone line, a digital portable phone, or PHS is easily implemented by connecting a cable. A multi-communications interface is provided so that, in addition to regular e-mail, various other mail programs are supported including Lotus*4 cc:Mail*5, and the e-mail capability of Hitachi's integrated groupware product. PERSONA thus has a wide range of user-friendly and fast data communications capabilities.

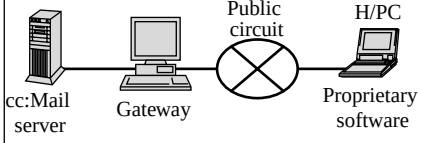
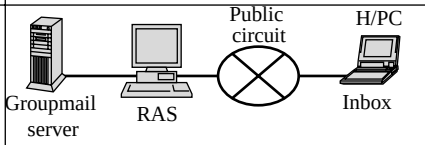
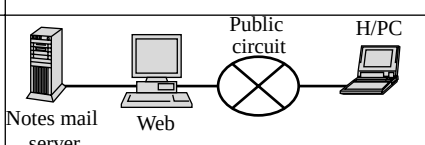
The PERSONA's high-capacity and high-performance lithium-ion battery pack provides a long service run time of approximately 8 hours even with the standard backlit color liquid-crystal display.

In addition to those features and capabilities that have already been covered, the PERSONA can also be readily interconnected to a wide range of peripheral devices, as schematically shown in Fig. 4.

Turning to software, the PERSONA comes bundled with Microsoft Pocket Internet Explorer*6, Microsoft Pocket Word*7, Microsoft Pocket Excel*8, Pocket PowerPoint*9, and Pocket Outlook*10. Scheduling information, addresses, and other kinds of data can be easily transferred and synchronized between PERSONA and a desktop machine over a serial cable, the infrared interface, a LAN connection using LAN card, or over a phone line. Besides the ability to obtain data over the Internet and manipulate it in various ways, the PERSONA also comes with an array of original software. These programs include (1) a file viewer capability enabling the user to view Microsoft Word and Microsoft Excel files that are sent as attachments via e-mail; (2) three dictionaries including an English-Japanese dictionary, a Japanese-English dictionary, and a native Japanese dictionary; (3) a handwriting memo function permitting the user to quickly jot down memos without going through a file recognition procedure; (4) a screen-capture capability enabling the user to capture an image on a PC screen as image data and display the image on the PERSONA. This function can also be used to capture displayable data from software that is otherwise not supported.

Windows CE 2.0 comes with a complete software development environment furnished by Microsoft Corporation including: (1) Microsoft Visual C++*11 for Windows CE, (2) Microsoft Visual Basic for

*4 Lotus is a registered trademark of U.S.-based Lotus Development Corp.
*5 cc:Mail is a registered trademark of U.S.-based Lotus Development Corp.
*6 Microsoft Internet Explorer is a registered trademark of U.S.-based Microsoft Corp. in the U.S. and other countries.
*7 Microsoft Word is a registered trademark of U.S.-based Microsoft Corp. in the U.S. and other countries.
*8 Microsoft Excel is a registered trademark of U.S.-based Microsoft Corp.
*9 PowerPoint is a registered trademark of U.S.-based Microsoft Corp.
*10 Outlook is a trademark of U.S.-based Banyan Systems, Inc.
*11 Microsoft Visual C++ is a registered trademark of U.S.-based Microsoft Corp. in the U.S. and other countries.

Mail type	System configuration	Comments	
		Server side	H/PC
Lotus cc: Mail		Gateway (Proprietary software) (Proprietary hardware)	•Proprietary software (Produced by Hitachi, Ltd.) •Attached files Viewer software (Produced by Hitachi, Ltd.)
Groupmax e-mail		RAS (Manufactured products)	•Inbox (Standard software) •Attached files Viewer software (Produced by Hitachi, Ltd.)
Lotus notes mail		Web server (Manufactured products)	•Microsoft Pocket Internet Explorer (Standard software) •Attached files Viewer software (Produced by Hitachi, Ltd.)

Sales points
- Viewer provided for viewing Microsoft Word and Microsoft Excel documents.
- Enhanced usability for dealing with mail (large screen and touch-typeable keyboard).

Fig. 5—Typical Business Applications When PERSONA is Optimized for Mail Capabilities.

Windows CE, and (3) Microsoft Visual J++*12 for Windows CE. Software for the PERSONA can be emulated and debugged on a desktop PC to support efficient software development.

SYSTEM USE EXAMPLES

Because a PIAFS (PHS Internet Access Forum Standard) interface supporting PDC (Personal Digital Cellular) and PHS is built into the PERSONA, communications are enabled by simply interconnecting the H/PC to a telephone by cable. The most familiar example is that of e-mail. Fig. 5 shows a typical configuration and the server-side requirements. As shown in the figure, cc:Mail is supported by connecting to a mail server via a gateway. Groupmail and Lotus Notes mail*13 are supported by linking to a server via a Remote Access Server (RAS) and via a Web server, respectively.

One can send Pocket Work or Pocket Excel-formatted documents as e-mail attachments with a handheld PC, but H/PCs do not have the ability to view file attachments that are received. PERSONA HPW-200 is thus implemented with proprietary viewer software enabling the user to view Word and Excel attachments.

EXAMPLES — BUSINESS REPORT SYSTEM

Overview

This system was developed as a more efficient way to distribute business reports that have traditionally been circulated as hardcopy paper reports through digitization and distribution over a corporate intranet. Providing support for up to several tens of users, the system has the following advantages:

- ability to register or record newly issued business reports,
- ability to circulate business reports as e-mail attachments,
- ability to verify the distribution status, and
- ability to retrieve and view past reports.

This arrangement not only promotes a more efficient paperless work environment, it also facilitates the smooth circulation of reports to everyone involved in the workplace. Moreover, one can easily ascertain the current progress status of those involved in a project, the status of contacts with clients, and so on by maintaining the reports in a database. And assuming the availability of a corporate intranet system based on a LAN, the mobility factor can provide expanded and improved reporting capabilities without the need to develop any special applications for the H/PC.

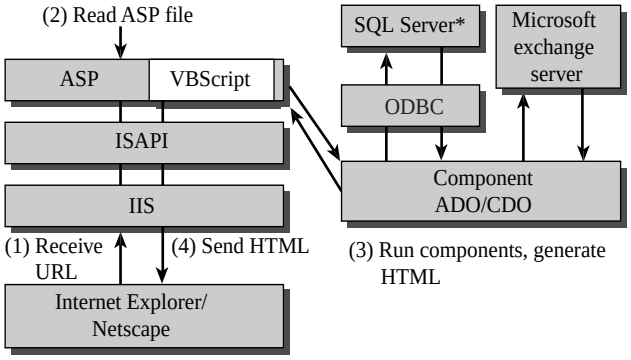
Another system for dealing with business reports could be implemented for the purpose of registering or looking up data from a mobile handheld PC. Such an approach could be easily deployed by linking an H/PC to an existing database system.

Considering the Network Environment

This system is an intranet-based configuration, and thus assumes fairly large volume data transfers. PHS-based communications via PIAFS interface is therefore applied, which can accommodate throughputs of up to 32 kbit/s. Although the number of places supporting PHS communications is still limited, our primary concern here is its communications speed. The phone numbers of participants who use a router are registered,

*12 Microsoft Visual J++ is a registered trademark of U.S.-based Microsoft Corp. in the U.S. and other countries.

*13 Lotus Notes is a registered trademark of Lotus Development Corp.



ADO: ActiveX Date Object CDO: collaboration data object
ISAPI: Internet server application programming interface
ODBC: open database connectivity
*SQL Server is a trade mark of U.S. Microsoft in the U.S. and in other countries.

Fig. 6—ASP Processing.
ASP is a server-side scripting execution environment on an Internet Information Server (IIS) that dynamically generates and runs interactive Web server applications.

and other users are unable to gain access to the information for enhanced security.

Using Pocket Internet Explorer

Pocket Internet Explorer (PIE) supports HTML Version 3.2, but does not support the same functions as the generally used Internet Explorer and Netscape*[14] browsers. There are still a number of unresolved problems in that scripts such as VBScript and JavaScript*[15], and ActiveX*[16] and Java are not supported. This necessitates the use of Web applications that, to the extent possible, work without browsers. As illustrated in Fig. 6, Active Server Page (ASP) has been adopted for processing Web applications. ASP is a server-side scripting environment on an Internet Information Server (IIS) for dynamically creating and executing interactive Web server applications.

Reduced Circuit Connect Time

The interconnecting circuit must remain continuously open while a user inputs a report. In order to reduce this input time, we have come up with a scheme that enables the user to selectively copy or transcribe headers and other items from past reports in the same project. And to minimize the amount of data that is sent back and forth, the data is modified to text-based screens.

CONCLUSIONS

In this article we have highlighted the basic concepts, the configuration, and a number of actual implementation examples of Hitachi's handheld PC PERSONA HPW-200JC.

The sphere in which the mobile professional operates is not just confined to Japan, but embraces the entire globe. User needs are thus certain to develop in diverse ways, and novel uses and configurations will inevitably evolve. Taking mobility as the key operable term, we will continue to seek ways of enhancing functionality and performance while giving users maximum flexibility and keeping international standards in mind.

*14 Netscape is a trademark of U.S.-based Netscape Communications Corp. in the U.S., Japan, and in other countries.
*15 Java and all Java-related tradenames and logos are trademarks or registered trademarks of U.S.-based Sun Microsystmes, Inc. in the U.S. and in other countries
*16 ActiveX is a trademark in the U.S. and in other countries of U.S.-based Microsoft Corp.

ABOUT THE AUTHORS

Masaki Kawase
Joined Hitachi, Ltd. in 1973, and now works at the Information Media Systems Group. He is currently engaged in the promotion of handheld computer business. Mr. Kawase can be reached by e-mail at mkawase@cm.kaden.hitachi.co.jp

Eiji Matsuda
Joined Hitachi, Ltd. in 1975, and now works at the Products Planning Dept. of the Information Media Systems Group. He is currently engaged in product planning for handheld computer and other new product areas. Mr. Matsuda can be reached by e-mail at ematsuda@cm.kaden.hitachi.co.jp

Katsufumi Takagishi
Joined Hitachi, Ltd. in 1980, and now works at the OA Design Dept. I of the Home Appliances Div. He is currently engaged in the development of handheld computers in the field of compact information terminal equipment. Mr. Takagishi can be reached by e-mail at takagisi@cm.taga.hitachi.co.jp

Mitsuo Taniguchi
Joined Hitachi, Ltd. in 1990, and now works at the Open System Solutions Sales Dept. 1 of the Information Systems Sales Operations Div. He is currently engaged in system construction technology support tools contributing to the indirect expansion of sales centered around personal computers. Mr Taniguchi can be reached by e-mail at mity@o3head.hitachi.co.jp