Universal Design Initiatives and Measures Taken in the Field of PC Products

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Abstract

The NEC Group implements universal design as one of the tasks of its IT enterprise and is developing products, services and solutions that can be used by more people. In this way it aims to contribute to the creation of a society in which all may benefit by using information communication networks. This paper is intended to introduce the universal design efforts that are being made by the NEC Group together with actual examples of applications of universal design in PC products and their development processes.

Keywords

universal design, user-centered design, aging society, JIS8341, product development process usability checklist, user test

1. Introduction

The population of Japan is aging at a rate that is globally unprecedented. The "u-Japan Policy" of the Japanese Ministry of International Affairs and Communications sets a target of allowing all to join in the progress of society via information communication networks at anytime and anywhere, regardless of age or handicap. The Guidelines for Elderly Persons and Persons with Disabilities in the JIS X8341 series have been publicized in order to promote this purpose.

Due to the current trend in the aging and diversification of society, the idea of "universal design," (to design products, services and solutions in consideration of allowing more people to use them as equally as possible) is becoming more important than ever.

2. Efforts at NEC

(1) Universal Design Policy

The NEC Group aims to develop hardware, software and content as well as solutions in order to make information available for as many people as possible."

This policy is applicable not only to all employees of the NEC Group but also to everyone involved in NEC products and services. As an IT company we develop universal designs in order to contribute to the creation of a society in which every member can use the information communication networks. We develop our products, services and solutions so that they may be used by an increasing number of people.

(2) Promotion System

In order to promote universal design, NEC founded the Universal Design and Brand Strategy Office as a part of its Advertising Division in October 2007. This office functions as a base for the promotion of the Universal Design Initiatives for the entire NEC Group.

(3) Universal Design Activities

The NEC Group conducts the following activities as Universal Design Initiatives.

1) Universal Design Seminars

In-house seminars and group workshops are held periodically to train employees and to share knowledge among them and these are already being received by a total of more than 1,000 employees.

2) Universal Design Simulation Experience

Simulated experience of being elderly or handicapped is effective for understanding the necessity for universal design and to experience the actual feelings of the users. The employees in charge of product development receive actual experience type training, in which they lead their daily lives and use products while wearing goggles, weights, supports, etc.

3) Universal Design Monitoring Organization

An independent UD monitoring organization is run to promote cooperation into user surveys and product evaluations.

4) Exhibitions

UD Guidelines for Exhibitions have been established that

deal with “methods of providing counters and exhibition stands with easy wheelchair access,” “considerations of information guarantees,” “measures for handicapped persons,” etc.

3. Universal Design of PCs

The PC has recently been disseminated so widely that it is used by a large number of people of different age groups from children to the elderly. The PC is composed of hardware such as the main body, display and keyboard and of software such as the mail and word processor applications. Its operation is very complicated because both of these have a large number of functions. In order to deal with this issue universal design has been introduced in the specifications and designs with the aim of developing PCs that are easier to use for a greater variety of people.

3.1 Product Case Study

(1) Hardware

When NEC Personal Products, Ltd. started commercialization of the VALUESTAR N desktop PC, it was decided to introduce the concept of universal design in cooperation with NEC Design, Ltd. in order to make it easy for anyone to carry the product around and use it as desired.

In addition to reduce the weight of the product, a design mindful of ease of carrying was adopted by installing a flexi-bar at the top of the product body. Considerations were also made for the design of the back stand that uses the same mechanism as a photo stand, so that it could be installed easily by anyone. Other measures taken to enable easy operation by everyone include wireless implementation of the keyboard and mouse, slot-in type DVD drive, a gadget storage pocket on the rear panel and an auto screen brightness setting according to the scene of use (**Photo 1**).

(2) Software

It is not unusual for a purchaser to find that a PC is difficult to use in the condition that it arrives from a store (default setting). This issue is particularly noticeable with beginners and the elderly.

In order to solve this problem, NEC Personal Products, Ltd. has developed software called “PasoRaku Settei” (which means easy PC setting) (**Photo 2**). This software has the following three features that are designed to facilitate changing the PC setting by a user with little computer knowledge.

1) A single piece of software is capable of multiple settings.
2) The user can select the setting modes (two modes including “auto setting” and “manual setting” modes) according to his or her proficiency level.
3) The results of setting changes can be previewed on the screen before a final decision is made.

However, even a PC that incorporates measures as described above may sometimes still be difficult to use by some physically-handicapped users. To improve ease of use according to the properties of each kind of handicap, software such as “OperateNavi” for upper limb handicapped persons and “ZoomText Magnifier” for visually handicapped persons have also been made available.

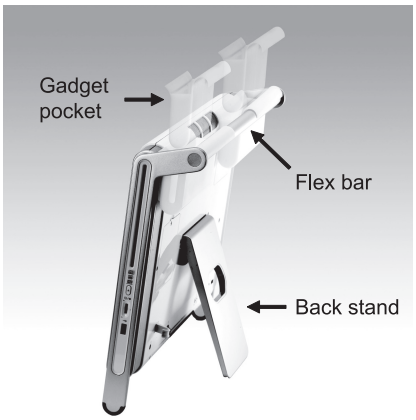

Photo 1 Universal design-oriented PC, VALUESTAR N.

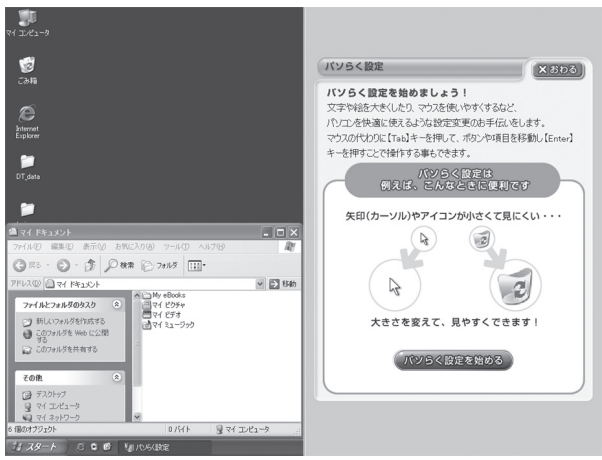

Photo 2 Display of PC Setting Software “PasoRaku Settei”

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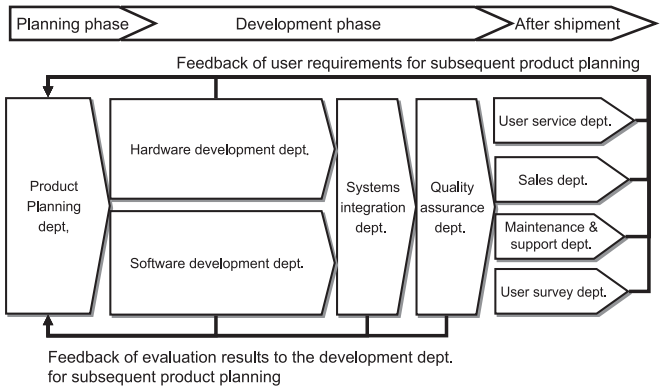

Fig. Product development process considering universal design.

3.2 Actual Measures

The following paragraphs describe the measures taken to develop a PC that is easy to use and understand for most people.

(1) Product Development Process

Each stage of the PC product development process is given mechanisms for achieving a universal design-conscious product (**Fig.**).

1) Planning Phase

At the planning phase, the product plan is checked to confirm that it supports universal design.

For example, the hardware check items include;

- Are the positions of the connectors and the forces required to push the buttons optimum?
- Are the LED lamp colors easy to distinguish?

The software check items include;

- Are the characters easy to read?
- Are multiple operation method options available for use according to the proficiency level? These check items are specified in the Usability Guidelines (which will be detailed below).

2) Development Phase

At the development phase, the product under development is actually run in order to confirm that the considerations of the planning phase are implemented in the actual product. The checklist used includes specific items such as startup time, display character font/size, number of operations, consistency in screen colors and screen layouts.

Check methods include examination from the user viewpoint and evaluation by usability experts. Optimum methods are selected according to the product properties and the development situation.

3) After Shipment

After the shipment of products, the results of user satisfaction questionnaires and the opinions addressed to the call center are analyzed and fed back to support the planning of future products. A successful example of user opinion feedback is the design of swiveling LCD panel.

This design, which allows only the screen area to be moved, was adopted based on a user opinion that changing the screen orientation with a PC integrating the LCD panel and main body is not easy to do because such PCs are very heavy.

(2) Usability Guidelines

Usability guidelines are compilations of requirements related to ease of use (usability) to be met during product development. In the case of the PC, they may be divided roughly into hardware and software guidelines.

1) Hardware Usability Guidelines

The requirements of these guidelines have been selected based on the results of evaluations of ease of use (usability tests) of multiple PCs. The tests were made also on elderly and visually handicapped persons as well as on younger people.

The results of the evaluation tests identified many issues requiring improvement, including the visibility of characters and markings and the ease of distinguishing different buttons. On the other hand, the tests also made it clear that innovative ideas in design and operating procedures are also effective for providing universal ease of use, including for the elderly. The usability guidelines list such items to be improved related to universal design (**Table**).

2) Software Usability Guidelines

Similarly to the hardware guidelines, the software guidelines were also elaborated by conducting usability tests on more than five kinds of major PC software. The test sub-

Table Example of hardware usability guidelines.

■ Keyboard (Major Item)

Test class (Middle item)	Element (Minor item)	Level	Guideline item
Keyboard	Most basic and highly important functions.. All should be able to operate securely as a minimum requirement, regardless of presence of handicap.		
	Key layout	Mandatory	The key layout should not be changed arbitrarily.
			It is desirable that the key layout information of all models is made public on the web, etc in advance of the product release.
			It is desirable not to place another key in the proximity of the Enter key.
			It is desirable that the up-down/left-right arrow keys are laid out in a cross shape so that the relationship between their positions may be easily understood.

jects included men and women aged from their 20's to their 70's.

As a result of these tests, the items to be considered for universal design were reconfirmed. For example, in consideration of a disabled person's difficulty in performing mouse operation, to enable operations exclusively by use of the keyboard, and to avoid information presentation by exclusively using colors in consideration of a person's difficulty with color distinction. These items were also included in the software usability guidelines.

(3) Usability Test

The usability test is the evaluation of a prototype or final product by users who have actually used them.

NEC Personal Products, Ltd. conducts usability tests in collaboration with NEC Design, Ltd., by selecting two or three PC models with new concepts immediately after release of each model. At the same time, PCs from our competitors are also evaluated for the purpose of comparison.

Each test covers the entire series of operations including basic operations from connecting the power cable to booting the PC as well as the operability of buttons, keyboard and mouse and the ease of connection of cables and peripherals. The test subjects are selected to include elderly and handicapped persons from the viewpoint of universal design. They are asked to perform a specific operation such as "turn power on" or "connect this cable," and their operations are observed in order to identify any difficulty (**Photo 3**).

With PC software "PasoRaku Settei" mentioned above, the usability test was conducted on the prototypes mainly to check the guidance messages displayed during operation and the flow of the display, which varies as an operation advances. Prototype testing was repeated three times to improve the usability of the software. One of the most significant improvements to be enabled was the implementation of the "auto setting" mode in addition to the "manual setting" mode which was provided from the beginning of development.

The results of usability tests are fed back to the exterior design staff and to the development staff so that all concerned in the product development can understand the relevant issues. This process is not only used to enable a quick improvement in the quality of subsequent products but also to review the usability guidelines.

Photo 3 Hardware evaluation by elderly person.

4. Conclusion

The universal design efforts made in support of the PC development process are slowly but gradually proving to be effective. A comparison of user satisfaction surveys (NEC's independent surveys) before and after the start of these efforts has shown that the number of users expressing satisfaction with the product operability was improved by 4%.

Considering the trend of more people making use of PC services including the Internet and their desire for easier use of PCs, it is expected that the universal design concept will surely increase in importance in the field of PCs.

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