Improving Information Accessibility of FMV Series of PCs

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(Manuscript received October 6, 2004)

Fujitsu is improving the accessibility of its FMV series of personal computers in processes from planning to operation so they can be easily used by as many people as possible, including older persons and persons with disabilities. With these efforts to improve accessibility, Fujitsu aims to ensure that everyone can easily access information anywhere and anytime. This paper describes our efforts to improve accessibility in four areas: Website production, hardware, software, and electronic manuals. First, it describes the basic concepts in each Website production process and gives some examples of our efforts in this area. Then, it describes some examples of our efforts to improve hardware from various viewpoints. Regarding software, it describes some utilities that make applications easier to use and describes how some software was made accessible-ready. Lastly, it describes examples of how we are improving our electronic manuals.

1. Introduction

To adapt to the two social trends of an aging population and computerization, it is important to achieve an information-oriented society in which older persons and persons with disabilities can also live comfortably.[1)]

The elements of the information-oriented society include information and communications equipment and services, buildings and facilities, and working environments such as offices, and the accessibility of these elements must be improved to achieve such an information-oriented society. Fujitsu has promoted the improvement of accessibility, especially that of its FMV series of personal computers (PCs). These are typical Fujitsu products that we provide to individual customers and are becoming key products in the information-oriented society.

Fujitsu has been providing high-accessibility products since 1990, which was before "accessibility" commonly came to mean "the ability of older persons and persons with disabilities to use information and communications equipment and services."[2)] Some examples of these products include screen reading and zooming software that operates under control of MS-DOS, Braille display software, and high-accessibility keyboard covers. In addition, Fujitsu has been improving the accessibility of its Websites, PC hardware, and electronic manuals.

In June 2002, Fujitsu widely promoted Website accessibility by releasing the "Fujitsu Web Accessibility Guidelines Version 1"[3)] to the public. Since then, we have made many of our Websites compliant with the Fujitsu Web Accessibility Guidelines and these efforts have been highly valued.[note), 4)]

During the initial phase of making these

note) The Fujitsu portal site and FMWORLD.NET took the first and eighth places, respectively, in the Corporate Site Usability Ranking of Nikkei Personal Computer (Mar. 29, 2004 issue).

guidelines public, the only site that complied with them was FMWORLD.NET [**Figure 1 (a)**], which provides information for general users.[5] However, using the expertise we gained from making this site compliant, we started to make another site, called AzbyClub [**Figure 1 (b)**], also compliant. This site provides user-support information and the latest drivers for FMV users. We are currently promoting compliance of these two sites to these guidelines.

By combining its expertise with the results of cognitive research and the latest technologies, Fujitsu is striving to improve the accessibility of its FMV series of PCs to ensure that as many users, including older persons and persons with disabilities, can easily use them.

This paper first describes the concept of promoting accessibility for the FMV series and then introduces various efforts to improve accessibility for the FMV series in the processes from planning to operation through the use of Website production methods, hardware, software, and electronic manuals.

(a) FMWORLD.NET

(b) AzbyClub

Figure 1
Example sites that conform to Fujitsu Web Accessibility Guidelines.

2. Concept of promoting accessibility for FMV series

The following are two accessibility requirements from JIS X 8341, "Guidelines for older persons and persons with disabilities," which Fujitsu was closely involved in the creation of:

1) "Consideration shall be taken from the planning, development, and design stages so that elderly people and people with disabilities can operate and use the information processing equipment" (JIS X 8341-2: Guidelines for older persons and persons with disabilities - information and communications equipment, software and services - Part2: information processing equipment 4. Basic Principles a).
2) "Always consider the accessibility and its improvement in processes from the planning to the operation of Web content." (JIS X 8341-3 Part 3: Web content 4.1 Basic Policies c).

Both of these JIS standards call for careful consideration of accessibility improvement from the planning stage of products and services. This is the concept of universal design: to ensure that equipment is planned and designed from the beginning so that as many people as possible can use it.

Even before the JIS standards were made public, Fujitsu had incorporated these requirements in its policy for human centered design.[6]

Users want PCs that are easy to use so they can, for example, easily find information about products on the Web, use PC applications and manuals, and find help on the Web when they have

problems with their IT equipment.

We must therefore study the physical characteristics and use environments of users and consider accessibility from the planning and design stages. Then, we must use the study results to provide easy-to-use Websites that give product specifications and user support information and easy-to-use PC hardware, software, and electronic manuals.

To help us accomplish these tasks, we periodically hold meetings in the "Work Group on Compliance of FMV Series with Universal Design" for developers who are involved in planning and designing products and services. The work group has started considering more practical ways of achieving good accessibility by building a consensus about accessibility through information exchange and discussions concerning users' characteristics, standardization trends in and outside Japan, current problems, and suggestions.

3. Efforts to improve accessibility during Website production

3.1 Website production process and accessibility

Fujitsu improves the accessibility of its Websites through a wide range of processes from planning to operation. This subsection introduces some of the considerations that are made in each process (**Figure 2**).

1) In the planning process, the planners consider whether it is necessary to present information about certain plug-ins (Java Script, Java applet, Flash, PDF, etc.) to users. The planners also study the physical characteristics and use environments of Fujitsu workers to support assembly line accessibility at the element technology level.
2) In the design process, the cognitive aspect is also considered to check whether a Website

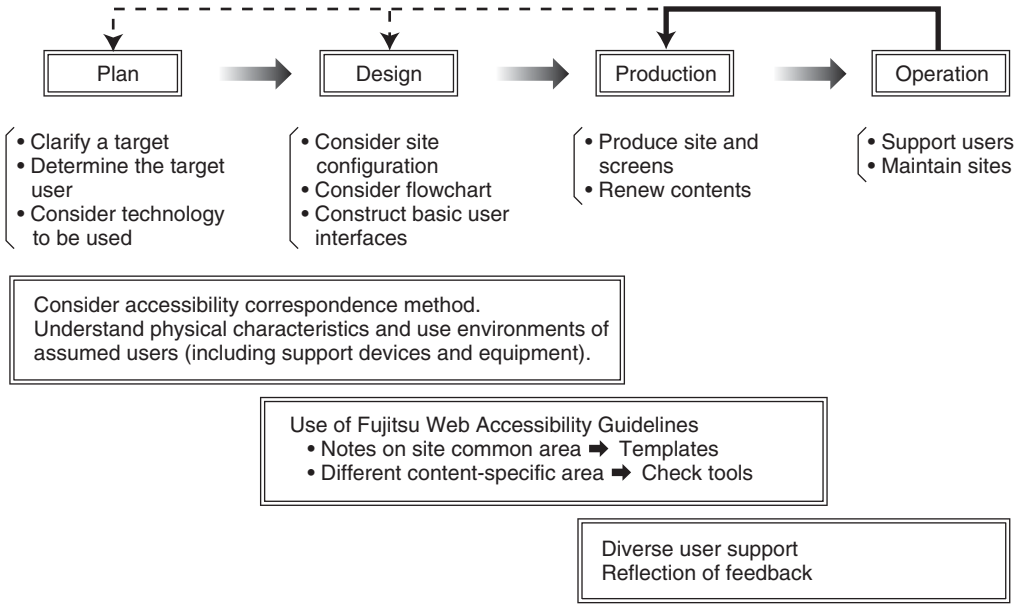


Figure 2
Consideration for Website production process and accessibility.

has an easy-to-understand structure and can be operated without relying on the user's memory. Also, common, high-accessibility templates are used throughout Websites.

3) In the production process, Fujitsu Accessibility Assistance[7] is used to automatically check the syntax of Website text. As a result, all the text is checked and the check results do not depend on the producer's syntax-checking skills.

4) In the operation process, requests and suggestions for a Website that have been received from its viewers are periodically collected and quick action is taken for those requests and suggestions that can be responded to at the page level.

3.2 Examples of compliance during Web production

This subsection introduces two examples of efforts made to comply with the Fujitsu Web Accessibility Guidelines in the production process.

3.2.1 *Improving character viewability*

It has been reported that the number of PC users who are 60 years or older is growing at an annual rate of 1.33 and this rate is the highest of any age group.[8] This rate is expected to increase in the future.

Many older persons find it difficult to see small characters on PCs, especially if the contrast between the background color and character color is low. Therefore, to make the characters on Websites easier to see, we minimized the use of characters that are displayed using image data and avoided the use of fixed fonts.

1) Use of text-format characters in images

The size and color of characters in images cannot be changed using a browser. Therefore, changes were made so these characters are not described using images but are described in text format whenever possible (**Figure 3**). This enables users to change the size of characters so they are easy to see. Describing characters in text format also enables persons with visual disabilities to read text using a voice browser.

2) Change of character size by the user

There are two ways to specify character size:

– By using a style sheet
– By using a relative value

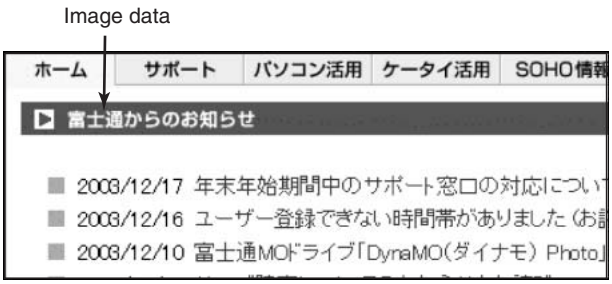
For example, the character size is specified as "font-size: 120 %" instead of "font-size: 14 pt."

This enables the user to change the characters to a legible size.

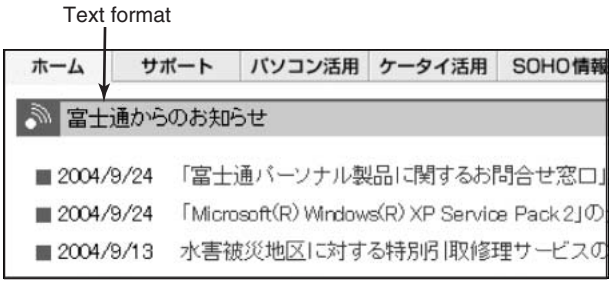
The use of text-format characters in images and the ability to change character sizes are basic requirements specified in both JIS X 8341-3 Part 3: Web content and the Fujitsu Web Accessibility Guidelines.

3.2.2 *Minimizing table format layout*

Information written in tables is difficult to read using a voice browser. The table format is often used because it aligns the beginnings of lines and makes them look orderly. However, because voice browsers read table-format data from left to right and from top to bottom in order of ①, ②, ③,



(a) Before change: Title is image data.



(b) After change: Title is changed to text format

Figure 3
Improvements in title display.

and ④ in **Figure 4 (a)**, depending on how the table is arranged, the information sometimes cannot be read in the correct order.

Therefore, conventional table-format data was changed so that the list tag appropriate to the document structure is used instead of the table tag and the layout is specified using a style sheet. This enables data to be read in the correct order [**Figure 4 (b)**].

4. Efforts to improve hardware accessibility

The fruits of ergonomic research and various evaluation results have been reflected in hardware design to improve usability.[6] To improve usability, questionnaires and interviews are conducted in the planning and design stage, heuristic evaluations and cognitive walk-throughs by experts are conducted in the basic design stage, and task analysis and protocol analysis are conducted when a prototype is built.

This section gives some examples of how we improved our PC hardware.

(a) Before change: Display in table format.

(b) After change: Display in a list.

Figure 4
Change of data display format.

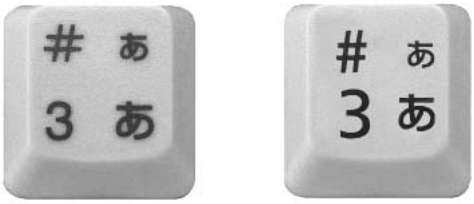
4.1 Improved viewability

1) Easy-to-see key tops

For persons with certain visual disabilities, the symbols on key tops may become so difficult to see that they cannot select the correct keys. Therefore, as shown in **Figure 5**, these symbols were made easier to see by improving the contrast between the key color and the symbol color and by using large, easy-to-read symbols. For example, symbol "3" in Figure 5 has been elongated.

2) Easy-to-see symbols

If the connectors for headphones and USB devices are difficult to see and identify, it can take a long time to connect them and they might be connected incorrectly, which reduces operability. Therefore, to reduce connection errors and enable connections to be made quickly, we placed high-contrast symbols that are easy to see next to the connectors (**Figure 6**).



(a) Conventional key. (b) New key.

Figure 5
Improvement in fonts on key tops.

Figure 6
Examples of pictograms.

4.2 Improved usability

1) Frequently used connectors of PCs are located on the front panel.

USB connectors, which are in common use for connecting peripheral devices, are located on the front panel so devices can be easily added and removed (**Figure 7**). These connectors are positioned so the cables do not hinder operation.

2) Easy-to-use keyboards (notebook PCs)

The following operability improvements were made to the keyboards of notebook PCs (**Figure 8**):

– Stable keys

The rubber and pantograph in the keys were improved to achieve stability (①).

– Easy-to-view keyboard

An ergonomic white keyboard was used to improve viewability (②).

– Comfortable keystroke

The keystroke was set to about 3 mm to achieve a similar feel to that of a desktop PC's keyboard (③).

– Comfortable palm rest

The palm rest was tilted slightly to facilitate typing (④).

4.3 Other improvements

1) Use of color coding to make connectors easy to identify

PCs use the same type of connector for keyboards and mice, so it can be difficult to know which connecter is which and misconnections can occur. To reduce the possibility of misconnections, we color coded the connectors and cables (**Figure 9**).

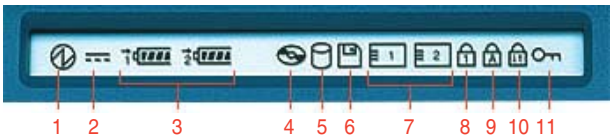
2) Addition of a PC status LCD

An LCD was added so users can see a PC's status at a glance (**Figure 10**).

Figure 7
Connectors at front of FMV personal computer.

Figure 9
Color coding for connectors.

Figure 8
Keyboard improvements.



Displays
1: Power supply
2: Adapter
3: Battery status
(charging status and capacity)
4: CD access
5: Hard disk access
6: Floppy disk access
7: PC card access
8: Num Lock
9: Caps Lock
10: Scroll Lock
11: Security

Figure 10
PC status LCD.

5. Efforts to improve software accessibility

The FMV PC has the following software products that improve accessibility:

- "@KAKUDAI Tool" screen magnification software
- "@MENU" linked applications launcher
- "@EIZO-KAN" photo editing software

In addition, Fujitsu jointly developed and commercialized a high-accessibility Web browser called Raku Raku Browser with the Ministry of Economy, Trade and Industry.

The usability of these software products was improved using two methods.

5.1 Providing utilities that make applications easier to use

The utilities include @KAKUDAI Tool and Raku Raku Browser. @KAKUDAI Tool zooms in on the characters displayed by Internet browsers and mail software such as Outlook Express and helps persons with visual disabilities read small characters (**Figure 11**). The character size can be changed in three steps, and the screen can be returned to the standard setting just by clicking a button.

The Raku Raku Browser automatically converts kanji characters on Web pages to hiragana, which is very useful for people who cannot read kanji characters. This software also supports a software keyboard and an external input switch for users who have difficulty operating keyboards and mice due to a physical disability.

5.2 Making application software easier to use

The launcher software "@MENU" and image-processing tool "@EIZO-KAN" installed on the FMV DESKPOWER and BIBLO series were made accessibility-ready based on JIS X 8341. For example:

1) Basic operations can be done with the keyboard alone, which helps people who have difficulty using a mouse, for example, because of trembling hands or muscle weakness.
2) Character sizes can be adjusted to suit the user's eyesight.
3) The color and placement of screen elements were chosen to help beginners and persons with visual disabilities.
4) Explanatory texts were added to images. This is effective when persons with visual disabilities use reading software.

(a) Standard characters

(b) Enlarged characters

Figure 11
Character enlargement using @KAKUDAI Tool.

6. Efforts to improve accessibility of electronic manuals

Fujitsu's FMV PCs are supplied with electronic user manuals on their hard drives. After the Fujitsu Web Accessibility Guidelines Version 1[3] were made public in June 2002, in addition to improving its Websites, Fujitsu made this electronic manual compliant with these guidelines.[5]

This section introduces some of the accessibility features of Fujitsu's "Manual to be Viewed on the Screen" electronic manual and the "Fujitsu Service Assistant" user support tool group, which provides PC user-support information, including help on using the Manual to be Viewed on the Screen.

1) Text and figures were considered

Persons with certain visual or memory disabilities have difficulty understanding operation methods if they need to look at both text and images to obtain the necessary information.

Therefore, more detailed instructions were given so users could understand how to perform tasks just by reading the text (**Figure 12**). Important details were added to figures and photographs so tasks can be performed just by looking at them.

2) Explanations were added to images

When a browser is set so it does not display images or persons with visual disabilities use a voice browser to read text on Web pages, the text in images cannot be read.

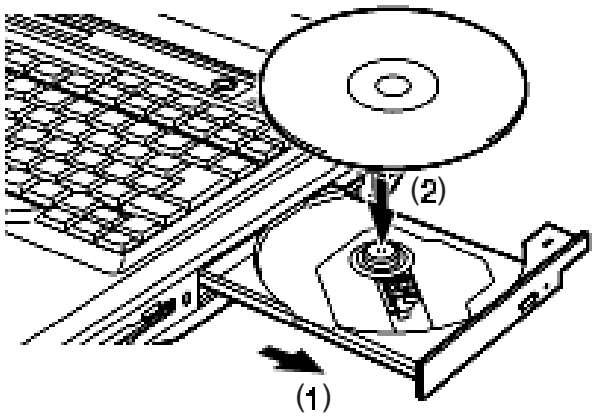
Therefore, in the Manual to be Viewed on the Screen, information to be conveyed using images was added as alt attributes (**Figure 13**). As a result, because voice browsers read alt attributes, the user can read the text information in images.

3) Color schemes were improved

Persons with certain visual disabilities have difficulty identifying certain colors. Generally, increasing the brightness contrast between characters and their background makes them easier to read and makes it easier to distinguish between character and background colors. Therefore, in Fujitsu Service Assistant and the Manual to be Viewed on the Screen, we used color schemes that are easy for even persons with color blindness to view (**Figure 14**).

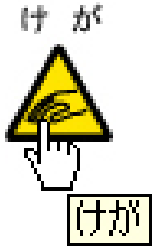
4) The buttons are enlarged

Persons with certain visual disabilities have difficulty seeing and identifying small buttons.



Pull out the tray (1). Then, hold the tray and secure the CD onto the tray's hub with the label facing up (2).

Figure 12
Improving texts and figures.



<img src="injury.gif"alt="injury">

Figure 13
Addition of alt attribute "injury" to icon.

(a) Fujitsu Service Assistant

(b) Appearance of (a) to person with red color-blindness

(c) Poor color coding

(d) Appearance of (c) to person with red color-blindness

Figure 14
Example of color coding for Fujitsu Service Assistant.

Also, trembling hands and other physical disabilities make it difficult to click buttons accurately. Therefore, in the Manual to be Viewed on the Screen, control buttons were enlarged whenever possible so they are easy to see and use.

5) Screen operations can be done with a keyboard alone

Some visual disabilities make it difficult to view a small mouse pointer. Also, trembling hands and other physical disabilities can make it difficult to accurately move a mouse and select objects. Therefore, in the Manual to be Viewed on the Screen, we made it possible to move around the screen by using the tab key and click buttons using the Enter key, which improves operability.

6) Most of the information is in HTML (text) format.

If text is represented using images instead of text data, users who have difficulty reading small characters cannot enlarge them using the character size change function of a browser. Also, such images cannot be read using a voice browser or displayed on a Braille display. Therefore, most of the information in the Manual to be Viewed on the Screen is in HTML format so characters can be enlarged, read using a voice browser, and output in Braille.

7. Conclusion

This paper described Fujitsu's efforts to improve accessibility in Website production, hardware, software, and electronic manuals to make the FMV series of PCs easier to use.

Fujitsu will also make strong efforts to cooperate with other manufacturers whenever we have difficulty supporting accessibility for new technologies by ourselves. For example, Flash Web technology has conventionally been difficult to make accessibility-ready. However, we have overcome this problem through the ingenuity of our portal site producers and information exchanges with Macromedia.[9)]

Many developers outside of Fujitsu are working on applications that will be pre-installed on Fujitsu PCs, hardware procured from inside and outside of Japan (including peripheral equipment), and Websites that provide useful information. Therefore, information about accessibility must be open to the public to make the entire PC environment easy to use. Fujitsu Accessibility Assistance,[7)] a Web-page check tool, is already available to the public. In the future, Fujitsu will further promote the release of information about accessibility.

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