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Some Consideration on User Interface Switching Functions for the Weaker at IT

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Abstract: We have already proposed a new concept of 'universal multimedia access' intended to narrow the digital divide by providing appropriate multimedia expressions according to users' (mental and physical) abilities, computer facilities and network environments. Previous works, have evaluated some types of multimedia user interfaces according to users' (mental and physical) abilities, computer facilities and network environments. In this paper, we discuss the user interface switching functions.

Keywords: Multimedia, User Interface, Switching Functions**.**

I. INTRODUCTION

Recently, immense multimedia information has come to be exchanged on the Internet, where 3DCG, video, image, sound, and text are involved in various circumstances with terminal devices, networks and users different in their competences and performances. This fact may easily lead to 'digital divide' so called unless any special support is given to the weaker.

The universal design concept is proposed to support handicapped people in their social activities1. In the computer science field, the universal web2 has been proposed to evolve this concept. However, this does not support to switch the contents, media and its quality of service (QoS) function to work the devices and network environments in their full performances. On the other hand, many studies about the QoS function proposed to optimize the video quality for priorities on users' requests3. These studies focused on performances of devices and network environments but neither users' abilities nor contents. Of course, there were also several studies on 'universal multimedia access (UMA)' but they could not narrow the digital divide because they concerned 'content switching' only4.

Considering this fact, we have already proposed a new concept of UMA and its switching functions5 intended to narrow the digital divide by providing appropriate multimedia expressions according to users' (mental and physical) abilities, computer facilities and network environments. In this paper, we redefine these switching functions and propose a concept of user adaptive interface for UMA.

II. UNIVERSAL MULTIMEDIA ACCESS

The digital divide is caused by the differences in users' personal competences, computer facilities and network environments with such detailed items as follows.

(1) Personal competence: sight ability, hearing ability, handling ability, language ability, computer skill and culture,

(2) Computer facility: processing power, resolution, color quality, sound quality and battery life,

(3) Network environment: bandwidth availability, specification and transfer mode.

Therefore, multimedia information is necessarily accompanied by switching user interface, media and QoS parameters reflecting these differences. Here, we present a new approach to UMA for handicapped people to work their devices and network environments in full performances. Our purpose is exclusively to develop a new mechanism for switching appropriately user interfaces, media and QoS parameters based on such a concept as shown in Fig.1.

III. SWITCHING FUNCTIONS

UMA is to selectively provide three kinds of switching function, namely, user interface switching

(UIS), media switching (MS) and QoS switching (QS). Fig.2 shows these switching functions working as follows:

(SF1) UIS: switch to user interfaces (UI) appropriate for users' competences and display devices,

(SF2) MS: switch to media appropriate for users' competences, performances of terminal devices and networks,

(SF3) QS: control media qualities appropriate for users' competences and terminal devices.

These functions are applied in the ascending order (from SF1 to SF3) at beginning to play multimedia information or in the descending order at playing.

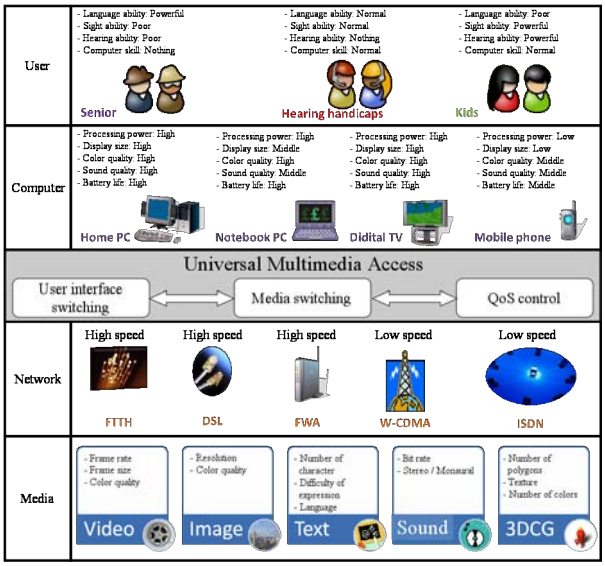

Fig.1. Universal Multimedia Access

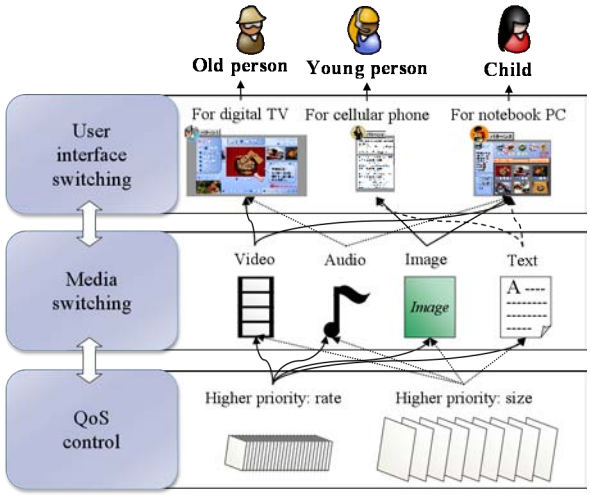

Fig.2. Switching Functions

IV. USER INTERFACE SWITCHING

UIS sets up the following items according to computer skill and computer facilities.

(U1) Writing style appropriate for language ability,

(U2) UI type and annotation option appropriate for computer skill,

(U3) Media size, font size, number of media and number of characters appropriate for display device size.

Additionally, I/O function is reflected by the users' disability.

1. Operations and Media

UI provides for operations and media according to computer skill and computer facilities. Computer skill is graded to select operation as follows.

(G0) No Knowledge about Computer: Unable to operate any computer functions.

(G1) Computer Beginner: Able to startup an application software such as Web browser and play media.

(G2) General Web User: Able to operate general Web pages and select to play a media.

(G3) Internet Expert: Able to use efficiently interactive online applications such as a search engine.

On the other hands, computer facilities are composed by some components and classified to 4 levels (None, Low, Middle, High) to setup media.

2. User Interface

A. Template for User Interface

UI is different at each level depending on computer skills and facilities. Considering such differences, 12 types of UI are expressed in a matrix as shown in Table.1.

Computer beginners are supposed to select Broadcast Operation (BO) so as to play media according to the program without complicated operations. The user can get information just like watching TV because it is not necessary to operate any application software fundamentally. Choice Operation (CO) is intended for general Web users so as to select media only. But it takes user much time to select one from a lot of media. Search Operation (SO) is supposed to support Internet experts by providing a keyword search function.

Low power terminals are supported to play AA and text with only low graphics power and narrow bandwidth of network. Middle power terminals are to

display contents such as combinations of still image and text. High power terminals play video requiring not only high power CPU but also high power Graphic device.

B. Layout of Media

A layout is used to put media on UI and to specify the display region, display size and number of media for resolution of the terminal device and the media. Typical resolutions in terminal devices are shown in Fig.3 and the numbers of available media are affected by these resolutions. These relations enable a layout to specify the display position according to the display size and the number of media. Typical devices can display the number of media as follows:

(Ex.B1) Cellular phone (Resolution: 240 x 320 [pixel])
Character (10.5pt): 374
Image (96 x 120 [pixel]): 6
Video (QCIF: 176 x 144 [pixel]): 1
(Ex.B2) PDA (Resolution: 800 x 600 [pixel])
Character (10.5pt): 2394
Image (96 x 120 [pixel]): 40
Video (QCIF: 176 x 144 [pixel]): 1
(Ex.B3) Notebook computer (Resolution: 1024 x 768 [pixel])
Character (10.5pt): 3942
Image (320 x 240 [pixel]): 9
Video (DV: 720 x 480 [pixel]): 1
(Ex.B4) Desktop computer (Resolution: 1280 x 1024 [pixel])
Character (10.5pt): 6643
Image (320 x 240 [pixel]): 16
Video (720p: 1280 x 720 [pixel]): 1

C .Expression of Media

An expression is to facilitate the options of writing style, Kana-Kanji conversion, alternative media and language in order for better readability.

(Ex. 1) For children (supposed to be lower in language ability): simple Kana text with notes

(Ex. 2) For aged person (supposed to be higher in language ability): replacement of loan words by Japanese traditional words

In addition, cross-media switching, for example text to video conversion, has been provided for better readability, including such functions as to filter out harmful media contents.

3. Approach to User Interface Switching

In order to introduce UIS, we focused on CO because willing users are supposed to perform this operation driven by necessity. On the other hand, they will not use any operation without CO. From this point of view, CO is applied to UIS switching from a current UI to desired one and controlling types of UI with buttons just like TV remote control.

V. Implementation

Our ideas were implemented as Flash applications running on a web browser as shown in Fig.4. These applications conduct a person the way from the Fukkodaimae station to Fukuoka Institute of Technology providing abovementioned 12 UIs. These UIs can be switched to a desired one using 'software remote controller (SRC)' as shown in Fig.5. SRC is supposed for general Web users and over so as to select a UI with simple button operation because other users would not like complicated operations.

Table 1. User Interface According to User's Operati on and Types of Media

Operation	Media			
	AA (Ascii Art)	Text	Image&Text	Video
Broadcast	- No operation - Displaying a AA according to the program	- No operation - Displaying a text according to the program	- No operation - Displaying images and text according to the program	- No operation - Playing a video according to the program
Choice	- Selection - Displaying a AA according to the program	- Selection - Displaying a text according to the program	- Selection - Displaying selected images and text	- Selection - Playing a selected video
Search	- Keyword search - Displaying a AA according to the program	- Keyword search - Displaying a text according to the program	- Keyword search - Playing searched images and text	- Keyword search - Playing a searched video

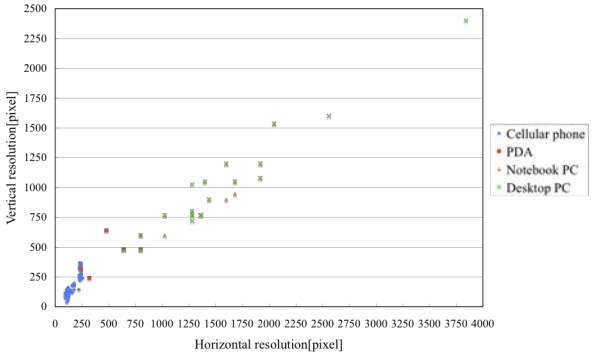

Fig.3. Resolution of Terminal Device

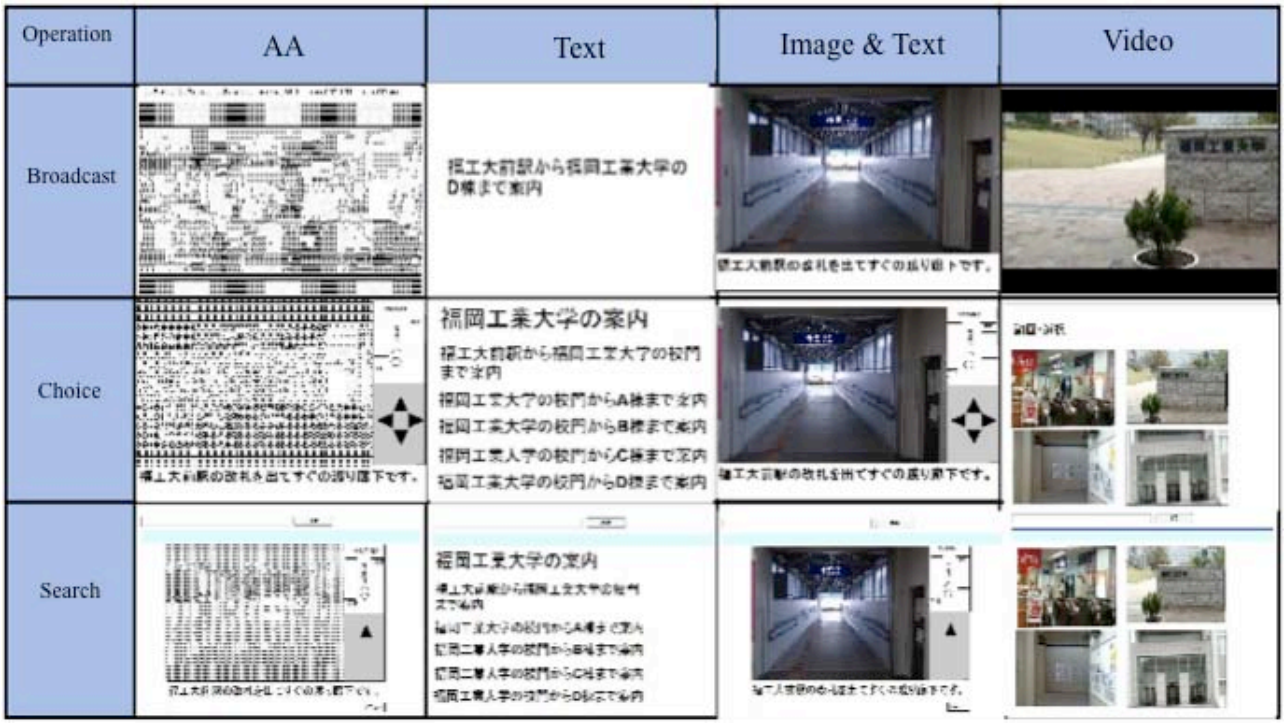

Fig.4. Implemented User Interfaces

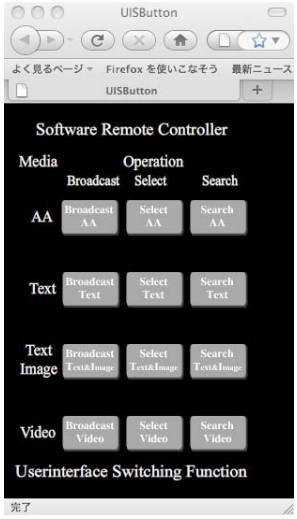

Fig.5. Software Remote Controller

VI. CONCLUSION

In this paper, we discussed the UIS and its UI appropriate for computer skills and facilities. Especially, we introduced SRC into UIS for simple button operation. SRC is simple solution to switch a desired UI employing UIS function. Currently, we are evaluating SRC and its UI. In near future, we will construct some types of contents for evaluating UIS and other switching functions for UMA.

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