Proposal of a New Concept of Universal Multimedia Access

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Abstract: 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. In this paper, we propose a new concept of 'universal multimedia access' which easily narrows the digital divide by providing appropriate multimedia expressions according to users' (mental and physical) abilities, computer facilities and network environments.

Keywords: Universal Multimedia Access, Multimedia Representation, QoS, Digital Divide, Multimedia, Web

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 activities [1]. In the computer science field, the universal web [2,3] has been proposed to evolve this concept. However, this does not support to switch the contents, medias 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 to give priority on users' requests [4,5]. 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' only [6,7].

In this paper, we propose a new concept of UMA which easily narrows the digital divide by providing appropriate multimedia expressions according to users' (mental and physical) abilities, computer facilities and network environments.

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 contents, medias 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 user interface, contents, medias and QoS parameters appropriately with such a concept as shown in Fig.1. This mechanism is operated by the management system as shown in Fig.2 that switches multimedia representation and controls media transmission mode, referring to users' abilities, computer facilities and network environments.

1. Management system

The management system collects information of computer facilities and network environments automatically and asks the users about their physical and mental abilities by a certain questionnaire. After that, the user is to be provided with appropriate contents, formats and medias reflecting his/her personal abilities, computer condition and network status. In order for such services, the system consists of 4 components as follows:

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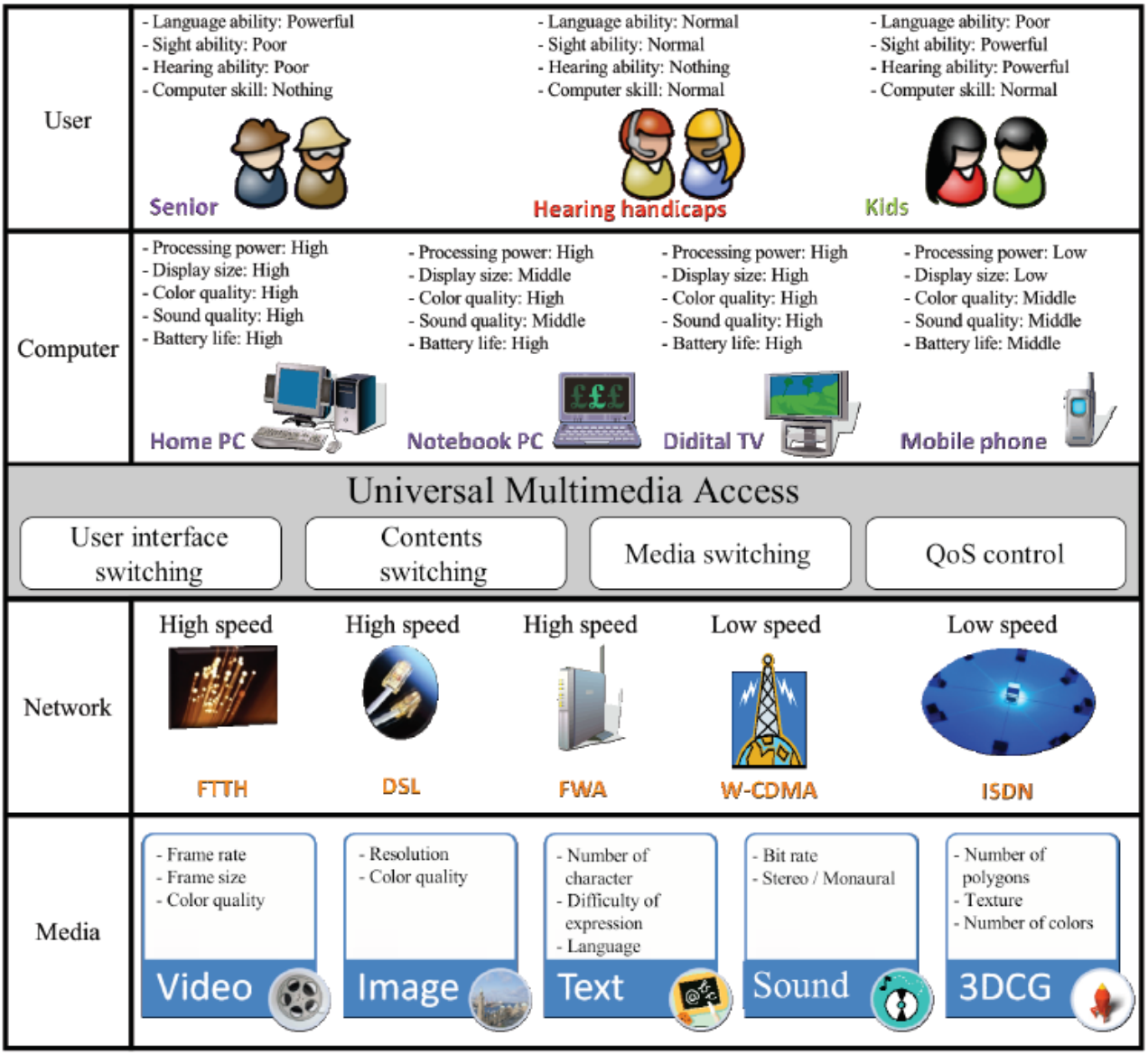

Fig.1. Concept of universal multimedia access

(C1) User interface (UI) - Display medias controlling the layout of contents

(C2) Media component (MC) - Transmit each media guaranteeing a certain QoS

(C3) Adaptation component (AC) - Select attributes, layout, media and QoS parameter reflecting each priority level

(C4) Priority control component (PCC) – Control priority level for attribute, layout and media to reflect user's abilities, device facility and network bandwidth

2. Multimedia storage

A multimedia representation (R) here is defined by such a triple of contents (C), formats (F) and media (M) as (1) below.

$$R = <C, F, M> \quad (1)$$

The three constituents of a multimedia representation are stored in the multimedia storage. These constituents are to be switched to suitable ones and transmitted to reflect QoS parameters by using Table 1-Table 3.

3. Media transmission mode

In the media transmission, the management system selects and processes the medias based on the priority and the QoS parameter, respectively. The QoS parameter 'Size' means as follows:

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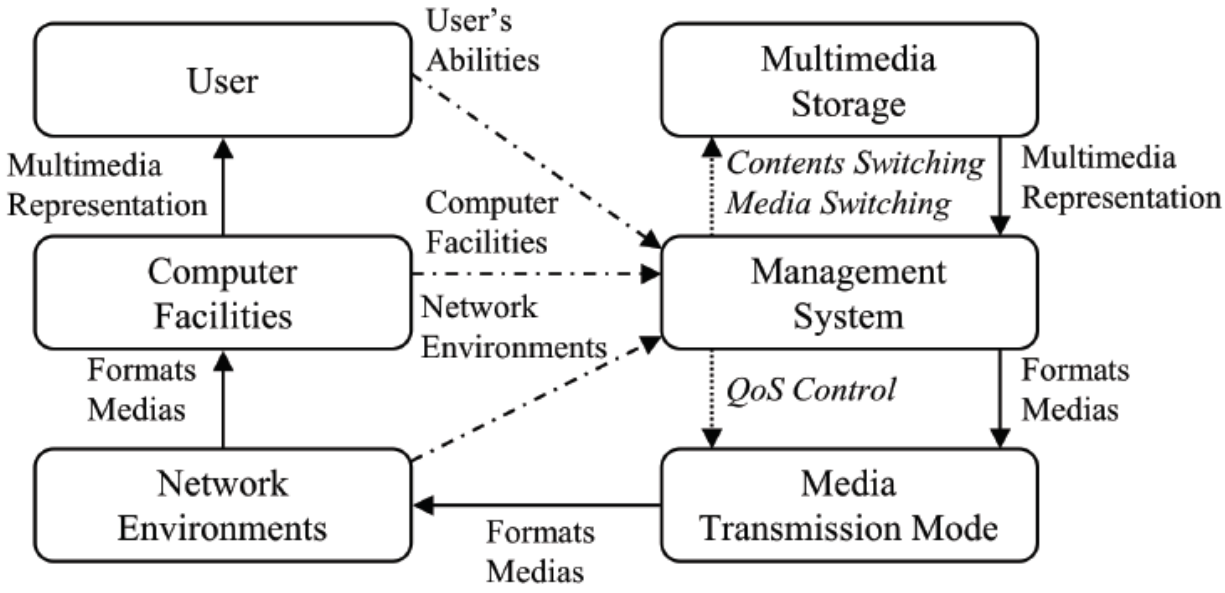

Fig.2. Mechanism for universal multimedia access

Table 1. Computer facility and multimedia representation

	Type of parameter	High	Middle	Low	Nothing
Processing power	Media	Audio Video	Text Image	Text	None
	QoS	Rate	None	None	None
Display size	Media	Image Video	Image Video	Text	None
	QoS	Size	Rate	Rate	None
Color quality	Media	Image Video	Image Video	Text Audio	None
	QoS	Size	Rate	Size	None
Sound quality	Media	Audio	Text Audio	Text Image Audio	Text Image Video
	QoS	Size	Rate	Rate	None
Battery life	Media	Image Audio Video	Image Audio Text	Text	None
	QoS	Rate	None	None	None

Table 2. User's ability and multimedia representation

	Type of parameter	Powerful	Normal	Poor	Nothing
Language ability	Representation	Advanced text	Simple text	Audiovisual	Don't use
Sight ability	Media	Text	Text	Text Image Video	Audio
	QoS	None	None	Size	Size
Hearing ability	Media	Audio	Audio	Text Image Video	Text Image Video
	QoS	Rate	Size	Size	Size
Computer skill	Userinterface	CUI	GUI	GUI	GUI
	Notification	None	None	Available	Always

Table 3. Network bandwidth and media priority

	Narrowband	Broadband
Text	1	4
Image	2	3
Audio	3	2
Video	4	1

(S1) Video – Put priority on the frame size
(S2) Audio – Put priority on the sampling resolution and stereo sound
(S3) Image - Put priority on the size of image
(S4) Text – Enlarge the character

The QoS parameter 'Rate' means as follows:
(R1) Video – Put priority on the frame rate
(R2) Audio – Put priority on the sampling rate
(R3) Image - Put priority on the display timing
(R4) Text – Take priority over any other medias

III. DISCUSSION OF APPLICATION

In order to narrow the digital divide due to the users' abilities and computer network environments, multimedia information is necessary to switch contents, medias and QoS parameters reflecting these differences. Here, we discuss 2 types of case as shown in Fig.3 and Fig.4.

In the case 1, a senior person collects information of a restaurant using a digital TV over FTTH environment. In this case, the value 'high' is set on the processing power, the display size, the color quality, the sound quality and the battery life. The value 'powerful' is given to the language ability and the 'poor' is provided to the sight ability, the hearing ability and the computer skill. The value 'broadband' is put on the network bandwidth. After setting these parameters, the multimedia information is applied as follows:

Computer facility and multimedia representation - Use the video with the QoS parameter 'Size' in primarily

User's ability and multimedia representation - Use the GUI for always notification and put

priority on the advanced text and the QoS parameter 'Size' among the text, the image and the video

Network bandwidth and media priority – Put priority on the video, the audio, the image and the text in that order

From these results, the case 1 uses the GUI with notification and many videos with the QoS parameter 'Size'.

In the case 2, a young person collects information of a restaurant using a cellular phone. In this case, the value 'low' is set on the processing power, the display size and middle is given to the color quality, the sound quality and the battery life. The 'powerful' is provided to the sight ability, hearing ability and the computer skill. The 'middle' is set to language ability. The 'narrowband' is put on the network bandwidth. From these parameters, the multimedia information is applied as follows:

Computer facility and multimedia representation - Use the text without QoS Parameter and the audio with QoS parameter 'Size' in primarily

User's ability and multimedia representation - Use the GUI available for notification and put priority on the simple text, audio and the QoS parameter 'Rate' for the audio

Network bandwidth and media priority – Put priority on the text, the image, the audio and the video in that order

From these results, the case 2 uses the GUI, the simple text and the audio with the QoS parameter 'Rate'.

Fig.3. Application for senior person (Case 1)

Fig.4. Application for young person (Case 2)

IV. CONCLUSIONS

In this paper, we proposed a concept of universal design based multimedia access and discussed its application. Our concept consists of the management system, the representation and the transmission providing a contents switching facility, medias switching facility and its QoS functions for the users. Currently, we are specifying the system and defining the multimedia representation and the transmission protocol. In the future, we will implement and evaluate our proposed concept.

REFERENCES

[1] Ronald L. Mace, Graeme J. Hardie, and Jaine P. Place (1996), Accessible Environments: Toward Universal Design. AUED

[2] Kazuhiko Yamazaki (2001), Achievement of universal Web (1) (in Japanese). Design study research 48:330-331

[3] Kazuhiko Yamazaki (2002), Achievement of universal Web (2) (in Japanese). Design study research 49:392-393

[4] Kiyokuni Kawachiya and Hideyuki Tokuda (1996), Dynamic QOS Control Based on the QOS-Ticket Model. In Proceedings of the 3rd IEEE International Conference on Multimedia Computing and Systems (ICMCS '96):368-377

[5] Mohan, R; Smith, J.R; Chung-Sheng Li (1999), Adapting multimedia Internet content universal access, IEEE Multimedia Transcations 1(1):104-114

[6] Joseph A.I, Thomas-Kerr, Ian S Burnett, Christian H. Ritz, Sylvati Devillers, Davy De Schrijver and Rik Van de Walle (2007), Is That a Fish in Your Ear? A Universal Metalanguage for Multimedia, IEEE Multimedia 14(2): 72-77

[7] Fernando Pereira and Ian Burnett (2003), Universal Multimedia Experience for tomorrow, IEEE Signal Proccesing Magazine, IEEE 20(2): 63-73

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