

THE CHANGES AND PROSPECTS OF MOBILE PHONE INTERFACE IN MOBILE 2.0

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ABSTRACT:

The biggest difference between the new version (2.0) and the old version (1.0) in mobile web 2.0 is that it is "Mobile web as a platform" mashing up various mobile technologies and applications just as in web 2.0.

Accordingly the mobile device needs to be changed to support mobile web as a platform focusing on the possibility of the quality and basic change of mobile web environments and there shall be user interface supporting this change.

The purpose of this article is to identify the changes of mobile phones in Mobile 2.0 and what direction it will go focusing on the products and graphical interfaces.

We would like to search for the possibility and challenges of the mobile phones and their interfaces in Mobile 2.0 from the physical and tangible perspective that the users will actually feel and experience rather than from the perspective of web 2.0, which emphasizes simple cooperation and participation.

Keywords: Mobile 2.0, Mobile phone, interface

1. INTRODUCTION

- Concept of Mobile Web (Wireless Internet-> Mobile Web)

Web technology could be applied to wireless Internet environments thanks to the success of web in wired Internet. Although the first effort to apply web to wireless network through mobile phones started in 1997 in WAP Forum, it was not developed in full scale until the success of iMode by Japanese NTT DoCoMo in 1999. Afterwards, web technologies and applications were developed in various wireless Internet environments, which led the growth and development of wireless Internet environments.

Mobile Web means World Wide Web connected through mobile devices such as mobile phones, PDAs and other portable gadgets, which has already been connected to public network.

Nowadays more and more people connect Internet using mobile devices rather than desktop computers. It is different from wireless Internet based on wireless network in the perspective of mobility.

- Characteristics and Restrictions of Mobile Web (Mobile 1.0)

Although the demand of web on various mobile terminals was getting bigger and bigger, web browsing in real world was not as convenient as we had expected because of various restrictions and weaknesses in reality. Mobile web is much different themselves in the size of the terminal, CPU performance, storage, screen size, network speed and input device. But anyway, it is far behind of desktop environments except that it provides high mobility.

- The Emergence of Mobile 2.0

There have been various efforts to rectify weaknesses of the mobile web and to create new business opportunities. With the increased interest in web standards and technology with the trend of web 2.0, there became various trials to see the mobile web from the new perspective

different from existing mobile web environments. These new trials became developed into the concept of “Mobile web 2.0”.

The factors evolving the mobile web into “Mobile web 2.0” can be summarized as follows;

First, wireless network technology has been developed a lot. The establishment of highspeed wireless infra such as HSDPA and WiBro solved the problems of mobile applications such as network speed and communication cost. Such development improved the perception on mobile application and maximized the strength, which is mobility.

Second, the performance of the mobile terminals has been improved. The new mobile terminals have better performance and the screen resolution and memory capacity have been improved so that they can deal with more applications. Therefore the absolute restriction of terminal performance has disappeared to some extent.

Third, the convergence into mobile terminals is in place. Through the mobile terminals the functions such as LBS, GPS, RFID, MP3, and DMB converge on, ubiquitous web applications such as the web integrated with broadcasting and the web applications combined with RFID and LBS become possible.

Fourth, it solved the biggest problem –user interface- in various ways. The inconvenience of entry of URL in early versions was removed with the automated entry such as RFID tag recognition, image recognition and code entry. Browsing itself becomes diversified from the simple keyboard entry to the gesture and voice browsing.

Fifth, there was change in the perception on web standard technology to include various terminals. They rediscovered the value of web standard and its technology with the new user interface web applications based on web standard focusing on web 2.0 Trend such as AJAX. There has much improvement in the perception on the necessity of ubiquitous web environments and wired and wireless compatible contents through mobile web standardization activities such as MWI and MobileOK in W3C.

Finally, there are new efforts to reevaluate the existing services and to discover new profit model with the key words of “Sharing”, “Open”, “Cooperation” and “Participation” from the perspective of web 2.0. They reduce risk and redundancy with open service model and search for new applications and strengths through web service and mash up connecting wired network and wireless network.

As a matter of fact, the biggest difference between the new version (2.0) and the old version (1.0) in mobile web 2.0 is that it is “Mobile web as a platform” mashing up various mobile technologies and applications just as in web 2.0.

Accordingly the mobile device needs to be changed to support mobile web as a platform focusing on the possibility of the quality and basic change of mobile web environments and there shall be user interface supporting this change.

The purpose of this article is to identify the changes of mobile phones in Mobile 2.0 and what direction it will go focusing on the products and graphical interfaces.

We would like to search for the possibility and challenges of the mobile phones and their interfaces in Mobile 2.0 from the physical and tangible perspective that the users will actually feel and experience rather than from the perspective of web 2.0, which emphasizes simple cooperation and participation.

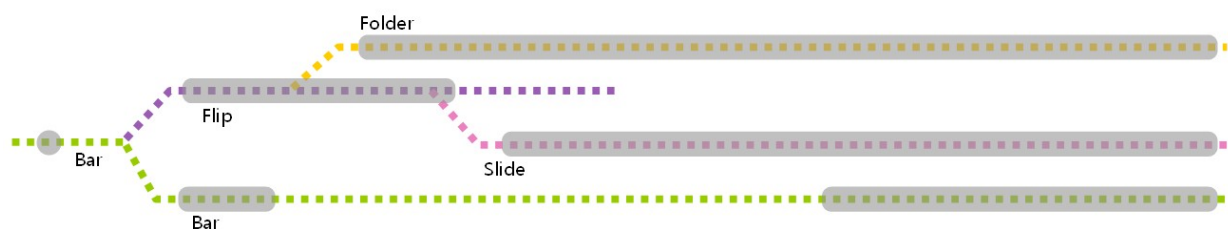
2. MOBILE PHONE PUI IN MOBILE 2.0

Basically it can be divided into Basic Structure, Output and Input. As output, we will review external or internal LCD display, speaker, and earphone jack about the characteristics such as size, location, direction, material and shape. As input, we will review keypad, side buttons, micro key grouping method and unique button method.

Additionally, it includes featured interface such as camera, MP3, DMB, and memory.

2. 1. HISTORICAL TREND

2.1.1. Structure



(Fig 1) Historical trend of mobile phone structure

When mobile phones were initially introduced to the market, they had bar shapes. When they became smaller in 1990s, they were changed to be flips and folders. In late 1990s, 'Light Weight' became an importance issue and they tried to make mobile phones smaller and lighter. In 2000s, slide types won popularity with the efforts to diversify exterior color and shapes and swivel types such as cameral phone, camcorder phone and MP3 phone were introduced with the trend emphasizing multimedia contents. In 2004, 'Slim' became the trend in full scale and diversified multimedia functions converged on the slim device. Since 2005, various trials have been made

including acceleration in device slimming, the rotation of opening part to landscape to watch DMB on LCD screen and various openings. Currently most of the phones have rounded straight line in folder, slide or bar type. It is very interesting to see the bar type phones are getting popular although they are slimmer than those in the past. It is to implement large LCD in slimmer device and is partly from the interface, which uses full screen as display because keypads are substituted for touch screen.

2.1.2. Display

Display has been developed to increase its size. In 1990s, there were efforts to increase the lines that can be shown in one screen. With the color display in 2000s, it is being developed to show more detailed color expressions. As the size of screen is getting bigger, sub screen functions and wide screen were introduced with multimedia functions such as camera and MP3 in 2004. Currently, however, the maximization of the facial screen became the biggest issue as the structure of the mobile phones was changed into slide and bar types again. It shows the legibility of the message becomes more important because of the importance of information search and management and the convergence of media functions has made wide and large screen more important.

2.1.3. Keypad

In early times, numeric keys used to be very important. But with the introduction of more diversified functions in late 90s, navigate and soft keys were introduced and function keys and numeric keys came to share the functional areas. In 2000s we could see the variations of keypads grouped in various ways. After 2004, button grouping became stabilized in linear arrangement as the protrusion of the buttons was reduced with the slimming process. Currently, as the areas for keypads are minimized because of the slimming process, feedback from button recognition becomes more important and there are some additional functions such as qwerty keys for messaging and mouse functions.

2.1.4. Function Key

The navigation keys which used to be located in external parts up to 2000 became embedded as shortcut keys to control multimedia contents such as camera, MP3 and voice recognition after 2002 and various external keys such as joy stick control were introduced. Currently, as slim, minimal and convenient design becomes more important, the number of external buttons such as scroll type direction buttons, action recognition function and touch pad is reduced and the importance of those buttons is also reduced. However, the importance of the feedback is getting increased.

2.1.5. Others

As contents storage and play are getting important, the importance of external memory is getting increased. Camera became a basic function not an option and is getting more sophisticated.

2. 2. PUI FOR MOBILE 2.0

2.2.1. Structure

Main structures of the current mobiles phones are portrait or landscape folder, swivel, portrait or landscape slide and bar type.

						
Motorola Razr V3c	Nokia E90 Communicator	Nokia N93i	Nokia N95	LG- SB310	Apple i-phone, LG F9100	Nokia E61i

(Table 1) Types of the structure

- Typical folder type has restrictions in web environments because of the limited LCD size.- -The folder type that opens in width direction has bar structure and a slide in its side to have two displays. Using the embedded 'qwerty' keys, wide screen and lap top interface, you can use contents such as web freely. It is very effective to protect LCD and keys in idle times.
- The swivel structure just like camcorder can be used in both wide screen and folder. However it is difficult to manipulate and to use keypads.
- Double-sided slide type provides clear selection of the keys according to the slide direction, the use of keypads is limited and there is limitation in LCD size.
- Width direction opening slide type has bar structure where slide type 'qwerty' keys are ported outside. When the qwerty keys are exposed, screen angle is converted automatically and transited to the message menu. It is not convenient to use and has drawbacks in web environments because of the restrictions in LCD size.
- Bar type with full screen display and multi touch use is appropriate for most of the users, who prefer large LCD and emotional design trend. It is highly favorable and user-friendly. It has strength in intuitive use.
- Bar type with qwerty keys has restrictions in LCD size although it gives strong and clear feedback from the key operation.

Consequently, width direction folder type which provides the usability of lap top and full-screen display bar type seem to be the most appropriate structure for the operation of mobile 2.0 environment contents.

2.2.2. Display








			
Nokia E90 Communicator	Nokia N93i	Nokia E61i (2.6-inch) Samsung Blackjack (2.2 inch)	Apple-I phone (3.5inch)

(Table 2) Types of the display

- Wide screen with width direction folder type provides high legibility and is very good for the reproduction of web contents.
- Wide screen through rotation provides good legibility. However, because of the soft keys, LCD size is limited and has shorter width than folder types.
- Bar type wide screen has relatively smaller screen so that it cannot reproduce web contents accurately and provides relatively bad legibility.
- Full screen bar type can reproduce contents properly because it allows the use of screen in both directions and supports the differentiated usability.

Conclusively, the width direction folder wide type, which has good legibility with long width and can reproduce the contents in the near original ratio, and the bar type full screen are the most appropriate for web environments.

2.2.3. Keypad

						
Motorola Razer	Nokia N93i N95	Nokia E61i, Samsung Blacjack	Nokia E90 Communicator	Apple I phone	Digital Screen Keypad	Camera based Mobile UI

(Table 3) Types of the keypad

- The shallow and even numeric keys are beautiful but have bad feedback. It is not good for contents operation because of high possibility of manipulation mistakes.
 - General numeric keys provide good touches and strong feedback. However they are not much different from the keys of existing mobile phones and don't support free browsing for web environments.
 - Qwerty keys are good for messaging and contents production but have low usability because of narrow spacing between keys.
 - Qwerty keys long in width are good for messaging and contents production. They are considered as the biggest size keypad that can be held in one hand. It is user-friendly and convenient to use because it is similar to PC keyboard.
 - Touch Screen (Qwerty soft keyboard) has possibility of misuse or incorrect feedback but it gives flexible use because the keys appear when necessary. It is convenient to use with user-friendly key arrangements.
 - Digital screen keypad, the next generation entry technology, allows each button to have different functions according to situations and displays the functions visually. It can be used for multi purposes as custom made and has good feedback and usability.
 - While existing mobile entry devices deal with information through the direct contact to the devices, camera based mobile entry devices detect the movement of the fingers before they contact to the device, judges the meaning of the specific gesture and operates. It is similar to the recently released Nintendo's 'Wii', the next generation action recognition video game player. It allows simple and concealed exterior design and implements the interface similar to the actual physical environments.
- Therefore, it will be tried to overcome the limitations of mobile entry interface from the width direction qwerty key and touch screen type (qwerty soft keyboard) type, digital screen key pad (next generation technology) and camera based mobile UI

3. MOBILE PHONE GUI IN MOBILE 2.0

We will review the web browser and other applications which characterize Mobile 2.0 and mobile phone software OS over which the advanced applications are ported and operating.

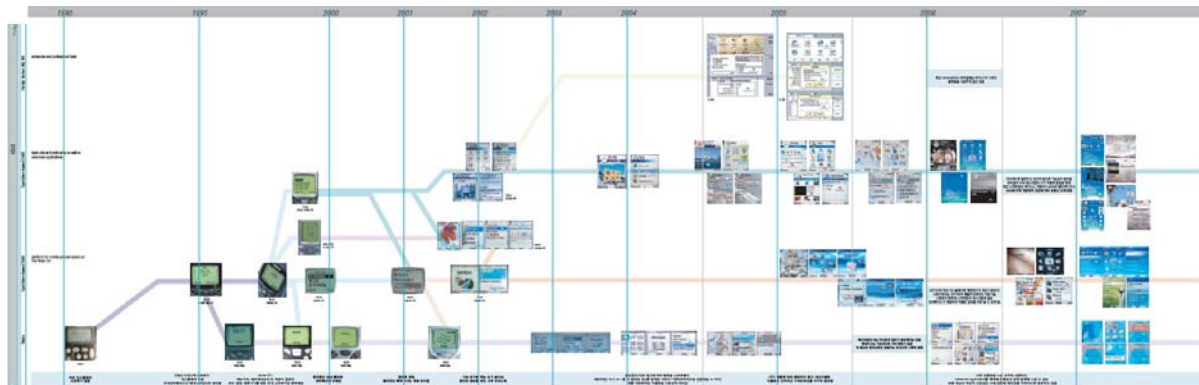
3. 1. HISTORICAL TREND



(Fig 2) Historical trend of domestic mobile phone GUI

In Korea, from 1988 till 2000, icons showing simple functions such as indicators and menu alarms using 2Grey monotone image were used. In 2001, they were changed into color and developed into detailed and diversified color expressions. After 2004, more sophisticated and splendid colors and images came to be used. In menu structure, the number of menus came to increase and they became diversified as 3*3, list and rotation type. Graphic interactions were provided in the form of flash animation. After 2006, monotone was applied with simple layout as minimal style and GUI using mono tone based key color is the mainstream.

In domestic market the same software is applied to all the products and graphic Look and Feel is modified according to the design. Flash based touch interface is proposed. GUI is applied according to the device's outlook, which shows the importance of the connectivity of interior and exterior not only in style but also in usability.




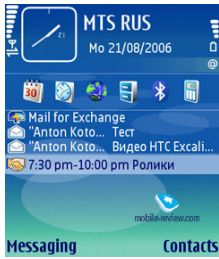

(Fig 3) Historical trend of foreign mobile phone GUI

In European market, the software has been developed as a series in full scale after 2000 and it becomes specialized for the segment it serves. They developed basic OS, Advanced Application Series on the top of basic functions and Specialized OS for Enterprise for each target segment and then the supporting differentiated usability follows. Among them too much specialized OS has decayed and over average OS that can port advanced applications are constantly developed and improved.

3. 2. GUI FOR MOBILE 2.0

3.2.1. Mobile OS

We will review Window mobile, Symbian and OS X as major mobile OS.

		
Window mobile	Symbian	OS X

(Table 4) Examples of mobile OS

-Window mobile applies the interface and usability of Windows Explorer in Windows PC to mobile layout. In graphics, it brings business-like look and feel of windows such as linear division and text oriented list-up. It shows hybrid look combining the conventional mobile UI by following option menu control through soft keys, which is the decisive characteristic of the mobile.

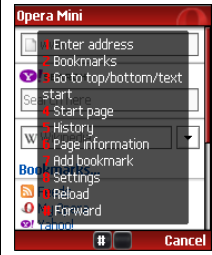
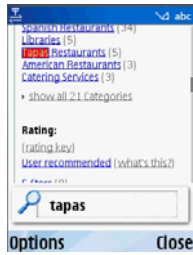




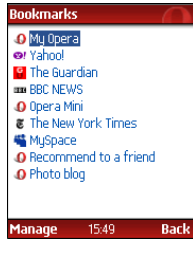


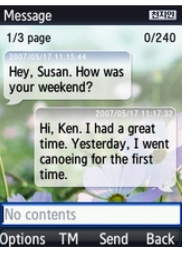
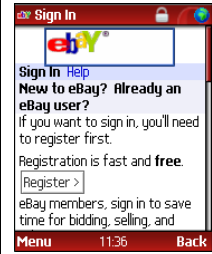
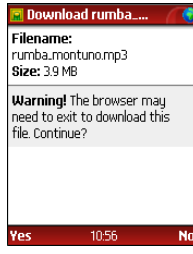
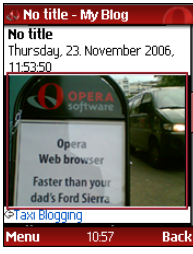

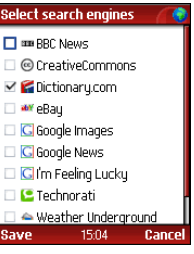
-Symbian was developed for Mobile OS from the beginning and it is the nearest to the mobile usability. It uses large font and icons and shows cool and gentle graphic through large icons, empty spaces and gradation color rather than text list. In case of S60, it doesn't seem to be a full-scale OS but an application that can control advanced applications more properly. Pocket PC level advanced series (S80, S90) are not being used any more.

-OS X has automatic fade-in and out function that exposes or removes option menus such as phonebook and soft keypads when necessary. It delivers information with information design with 3 dimensional graphic and screen transition like iPod. By testing Mac OS and Safari Browser in I POD and then introducing them to mobile environments, it does not negotiate with the usability of conventional mobile which controls the device with soft keys and option menus but implements independent and unique interface.

To make a long story short, Window mobile and Symbian has three-layer structure such as indicator area in the upper layer, main contents area in the middle layer and soft key area in the lower layer. It is a mobile OS and contents in stand-by screen are composed of personal information display (real-time information through PUSH technology) such as tool bar (frequently used menu), schedule and e-mail. It is a typical mobile OS and provides the usability through soft keys and option menu. On the other hand, OS X implements an interface totally different from Window mobile and Symbian. It does not follow the typical mobile in layout but shows freer and more flexible division and modification.

3.2.2. Mobile Browser

We will review the common characteristics of mobile browsers focusing on NetFront, Opera, Opera Mini, Internet Explorer mobile, S60 Web Browser and Minimo.

				
Shortcuts	Auto complete	Text Search	Toolbar	Navigation
				
Screen viewing	Bookmark & History	Web Feeds	Information Design	Graphic Design
				
Secure connection	Download	Upload Contents	Multiple windows	Search engine

(Table 5) Features of mobile browser

- Shortcuts: Once users are accustomed to mobile browsing they want to do it more quickly. The most important function for this is shortcut. Using shortcuts you can do what you want more quickly. You can customize all the shortcut keys as needed.
- Auto complete: It is bothersome to enter full email address, password and the same search keywords. With 'auto complete' and 'password manager' the browser remembers the information the user entered and completes it automatically.
- Text Search: Text search operates according to the entry of the user. When the user enters text, test search searches the best match and highlights it.

- Toolbar: As floating tool bar (frequently visited sites, page overview, reload, text search, and web feeds) pops up with simple click, you can access some key features easily and conveniently.
- Navigation (zoom, scroll): It supports Pan, Scroll, Scaling, Font Size Customization, Screen Rotation for quick and free browsing and shows web site minimizing horizontal scroll.
- Screen viewing: It allows the user to know the location and overview the whole contents using fitting the width to the screen, zooming out the whole page and automatic collapse of site navigation and long menu lists to reduce the number of scrolls.
- Bookmark & History: It adds new bookmarks from any page that the user visits or from browser history using menu. As it has browsing history, it shows the latest or the most frequently contacted item on Home Page.
- Web Feeds: You can see and manage the feeds of the subscribed news in your mobile phone. RSS is a XML-based format for content distribution that allows the service provider to feed news, contents and advertisement directly to end users' handsets.
- Information Design: It shows the information such as bookmarks and history in easy and intuitive style.
- Graphic Design: It highlights visual elements that give emotional joy to the users such as round shape soft form elements, Smooth scrolling and page up/page down, sliding, scaling, fade-in and out.
- Secure connection: In on-line banking or on-line shopping, the browser supports the secured connection so that the user can use on-line service securely.
- Search engine: It supports various pre-defined search engines to locate on-line information quickly.
- Upload Contents: You can take pictures with phone camera and uploads them to blog, forum or e-mail blog from Opera Mini.
- Multiple windows: You can open multiple windows simultaneously and switch between them easily and quickly. In case of Minimo, it supports built-in tabbed browsing and squeezes taps according to the small mobile screen.
- Download: You can download images or mp3 files to mobile.

To make a long story short, mobile 2.0 browser supports quicker browsing through Shortcuts, Auto complete, Text search, and Toolbar in small screen and with restricted key pad of mobile. It orients the high legibility and the interface for easy and free page reading including the location of the user as we can see in Navigation (zoom, scroll) and Screen viewing. Additionally, with Graphic Design, Information Design functions, it provides customized information automatically

and places importance on the visual pleasure from browsing through Graphic Design and Information Design.

Upload Contents, Download, Multiple windows, Search engine, and Secure connection show that the mobile environments are following the Internet environments such as free search, acquired data management and security issues.

4. PROSPECTS

4. 1. PUI

First, it will be developed in the direction to reproduce more accurate and full-scale communication by delivering feelings nearer to the original in the communication method on which emotional contents including active utilization of media as well as writing and speaking converged. Second, mobile phones will get far from ears as their operation method is changed from thumb centered operation to both hands operation so that telephoning and other messaging can be processed even when they are detached from the ears.

Third, there will be connection and synchronization of various devices rather than integrated and complicated convergence on single device. As input elements are detached from the phone and synchronization with other devices will be enforced. Mobile phones will be used as a network hub.

Fourth, uninterrupted connection and speed of wireless Internet will become important. It is expected that the seamless connected environments will be more important with the utilization of leisure time by enforcing basic functions such as message check and information search rather than processing all the functions of the web in mobile environments.

4.1.1 Input

First, it is expected to use touch screen based entry. There will be variable button interface in place, allowing the intuitive use by showing various buttons according to the situation rather than using fixed input elements.

Second, navigation keys that used to be at the bottom of the screen will have changes in location such as outside of the screen.

Third, the number of keys on the screen will decrease. Soft keys will be used but the number of the keys will be limited. Although the messaging function using the full key pad such as Qwerty key board is enforced, more reduced function flow and automation will be the main characteristics in the future because input elements will be placed outside of the phone including interaction using sensing.

4.1.2 Output

First, the screen will get larger unless it does not interfere with the mobility of the mobile phones. Landscape will be used more frequently so that it can be used in both directions recognizing the motion and direction and adjusting itself accordingly.

Second, as the buttons are located in the screen the physical display will be larger. It will add external outputs such as projector and sync with screen so that mobile phone screen can be used wireless - outside of the mobile phone.

4. 2. GUI

First, mobile software will be developed as OS as a platform to respond to the necessity to port the advanced applications and the scalability according to the rapid development. Therefore integration and scalability of various applications will be important.

Second, they will not simply adapt desk top UI to a small screen but try to implement the usability just as the performance of OS. It will be important to create a new mobile OS utilizing the unique characteristics of mobile rather than adjusting conventional PC OS to mobile. Here, conventional (mobile 1.0) soft keys and option menu may not be the best answer for mobile 2.0. It will be important to develop a easy and intuitive use process by reducing function flows according to mobile 2.0 environments emphasizing free and easy browsing, using shortcuts and scroll navigation, automatic pop up and multi touch.

Third, it is important to discover an interface satisfying the needs on quick browsing. As UI overcoming the small screens and restricted keypads of mobile phones, we can consider zoom in, zoom out, smart fit in, and key pad shortcuts. Additionally easy and free page navigation and legibility shall be satisfied, too.

Fourth, it is inevitable to have interface where users can get customized information without special efforts. The software shall be able to provide it automatically based on the users' behaviors and habits. Bookmarks history and web feeds can be the examples.

Fifth, one killer application or independent function can be boring. Interest and convenience from the use of different applications and synergy effects will be emphasized in mobile 2.0. For example, e-mail can be linked to office application and you can edit the attached file, and transmit the file searching for the contact with Personal information management (PIM) while enjoying video chatting.

Finally, not the visuals in still screens but the emotional graphic effects experienced during the use and the usability will be paid attention to. Accordingly, the goal of the mobile OS will be to support the application control easily and intuitively

5. CONCLUSION

Currently, mobile web connection is suffering from the low interoperability and usability. It is partly because of the screen size and partly because of incompatibility of information formats on Internet as well as computer OS with mobile devices. To overcome those restrictions, changes are being made in hardware and software. We need to identify better interface through the analysis and forecast the future changes and the direction of development.

From the study on mobile phones, we will resolve the inconvenience from the small screen by making bigger device in the aspect of hardware and creating manipulation method to expand, contract and move the contents quickly and freely in the aspect of software. Or we can overcome the limitations through sync with other devices externally in hardware and implement functionality of desktop by interoperating necessary applications based on mobile OS. Integrated performance and contents can be realized in mobile devices as well as desktops. It is a very important issue how to implement a new interface effectively where the characteristics of mobile devices and 2.0 environments are well combined. For this, further studies in depth are needed.

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