

Special Articles on User Interface Research

Research Laboratories *Masaaki Fukumoto*
Tsutomu Horikoshi

Mobile phones that made their appearance in the 1980's and they were simple "telephones." Their "User Interface" (UI) was nothing more than a keypad for entering telephone numbers, a small, numeric display for displaying them, a microphone and a receiver (ear piece). Operation was very simple—just initiating and receiving calls—and there was little chance of confusing how to use them.

Later, however, mobile phones advanced rapidly and continuously. In the beginning, the keypad was used for entering text, allowing only numbers and katakana at first. But with the development of e-mail, this expanded to include kanji-characters and pictorial symbols, and now, people have been known to compose entire novels using their mobile phones.

Another factor that caused major changes was the introduction of the i-mode service in 1999. Since it provided easy access to the wide variety of content

on the Internet, various operating mechanisms (cursor keys, dials, pointing devices^{*1}) were introduced, and improvements on display performance (color, size, resolution) also progressed rapidly. Audio also advanced from monaural to high-quality stereo sound, and video progressed from monochrome still images to color, high-resolution motion and 3D video, expanding the range of media possible.

At the same time, the ways mobile phones were being used also changed significantly. From one-to-one voice conversation and e-mail, to accessing the Internet, SNS and other multi-user communication schemes, and further to enjoying music, video and broadcast media. The amount of time spent with the "Keitai" (mobile phone) increased with these new ways to use it in everyday life.

As the types of media and reasons for using the mobile phone expanded, various interface mechanisms were developed.

In the future, we will research new

interface mechanisms capable of even faster input and simpler operation, and with the various sensors that terminals have been equipped with in recent years, such as GPS, geomagnetic sensors^{*2} and accelerometers^{*3}, we expect very active research on novel types of interface mechanism, anticipating users' intentions and not requiring explicit actions like pressing keys or rotating dials.

It was also important to improve the UI development process itself in order to keep ahead of constantly changing market requirements.

In these special articles, we introduce recent research on UIs at NTT DOCOMO for expanding the world of the "Keitai" and making them easier to use. These include: 1) "Nandemo Interface" that uses Augmented Reality (AR) technologies to allow physical objects around the user to be used as an interfaces, 2) "Using Earphones to Perform Gaze Detection for Wearable Interfaces" that allow hands-free operation by simply wearing a small

*1 **Pointing device:** An input device for indicating a specific location on the screen. This includes devices that move a cursor based on how much they are moved or rotated, such as a mouse or a track ball, and others that allow the location on the screen to be specified directly, such as a

touch-panel or tablet.

earphone device, 3) “Mobile 3D Display Technology to Realize Natural 3D Images” by using a specialized lens and many images from different viewpoints, 4) “Haptic Media for Innovative Real

World Services,” which convey the third mode of communication after vision and hearing: the sense of touch, and 5) “User Interface Development from Conceptualization to Prototype Evaluation through

UCD Processes,” which accurately obtains user preferences and can be used to develop new functionality efficiently.

We hope this gives you a glimpse (or a feel) for the “Keitai” of the near future.

*2 **Geomagnetic sensor:** A component which is able to sense its orientation using the earth’s magnetic field, like a compass. Devices whose resistance varies according to magnetic field are used. Since they indicate the orientation of the terminal, they are used mainly for navigation applications.

*3 **Accelerometer:** A component able to sense the attitude (inclination) or linear acceleration of the terminal. There are also similar devices called angular accelerometers that can sense the rotational acceleration. These are used for navigation, to correct camera shake, and for input to virtual

games.