TACT: Mobile Wireless Terminal for Digitally-Enabled Environments

Michimune Kohno Yuji Ayatsuka Jun Rekimoto
Sony CSL
3-14-13 Higashi-Gotanda, Shinagawa
Tokyo 141-0022 Japan
TEL: +81-3-5448-4380
mkohno@csl.sony.co.jp aya@csl.sony.co.jp rekimoto@csl.sony.co.jp

ABSTRACT
In this paper, we introduce TACT, which is a general interaction tool for ubiquitous computing environments. This device is dedicated to the operation of various kinds of connections, including audio, video, and data transmission between remote/surrounding computers. With TACT, whenever a user wants to utilize a nearby computing resource, the user can open a session and manipulate its endpoints without caring about network addresses. We demonstrate a few typical scenarios to show how TACT is used in various situations.

Categories and Subject Descriptors
H.5.2 [**Information Interfaces and Presentation**]: User Interfaces – *user-centered design, input devices and strategies, voice I/O.*

General Terms
Design, Security

Keywords
IP phone, ubiquitous computing, VoIP, FEEL, Pick-and-Drop

1. INTRODUCTION
Wireless networking is aimed at enabling service availability anytime and everywhere, but communication between computing objects is still hard to achieve. We are typically surrounded by a number of computing objects – for example, many people always carry a mobile phone and often have a notebook computer with them. These devices are both wireless networking objects, but connecting them requires a cable and is inconvenient. In addition, the kinds of data they can exchange are strictly limited; for instance, they cannot even synchronize the current time.

A truly ubiquitous computing environment will require that a user be able to temporarily utilize the resources of surrounding embedded computers, including their displays or cameras. To achieve this will require some means allowing the user to easily make a connection between the user's terminal and those computers and operate them. However, it will be troublesome for the user to have to input or choose the network address of the corresponding computer because it will be hard for the user to know such addresses if many computing objects are available. A more workable approach would allow users to remain unaware of underlying network technology details, such as IP addresses.

Our goal is to develop the fundamental technology and an actual device that will enable the above features. Towards this end, we have created TACT as a general interaction tool for ubiquitous computing environments (Figure 1). This is a mobile wireless device, which is dedicated to the operation of various kinds of connections, including audio, video, and data transmission between remote/surrounding computers. We designed TACT as a replacement for current mobile phones so that people can conveniently carry it with them at all times. With TACT, whenever a user wants to utilize a nearby computing resource, the user can open a session and manipulate its endpoints without caring about network addresses.

2. TACT
Figure 1 illustrates TACT, a mobile wireless terminal. The TACT consists of the embedded Linux operating system, an 802.11b wireless transceiver, an infrared transceiver, and display and buttons. This device is designed to seamlessly integrate two types of wireless communications. One is remote communication such as

Figure 1. TACT is used for browsing images on a digital enabled table. The white light is slowly blinking during a connection is established.

Figure 2. People can share document stored in a file server by operating their TACT devices. Just an intuitive “pointing” operating is enough to establish a wireless connection.

Figure 3. A voice session between TACT devices can be extended to a visual channel onto external public displays.

voice over IP (VoIP), and the other is near field communication such as controlling devices around users, and sharing information among nearby people and devices.

3. SCENARIO

3.1 Near Field Communication

TACT can be used to manage network connections by simple and intuitive operations.

Figure 2 shows that two people are having a discussion at a digitally-enabled table. They are going to share a document that is stored on a file server. When a TACT device is pointed at the digital table, a connection request is transmitted via infrared from the TACT to the table. This transmitted request contains the IP address of the TACT, and a session key to protect wireless communication.

Once the digital table accepts this request, a wireless connection is established between the digital table and the TACT. Synchronously blinking LEDs on the both devices indicates the established wireless connection. A menu file that describes the mapping between controls and buttons are transferred to the TACT.

As a result of this operation, the subjects can use the table surface as a shared display. With TACT, users do not have to enter address information or password information. Just an intuitive "pointing" operation is enough to establish a wireless connection. At the same time, this connection is automatically encrypted.

3.2 Remote Communication via IP phone

TACT can be used as a mobile IP phone. In this scene, a user receives a phone call from his colleague. By answering this call, he creates a wireless voice stream between his TACT device and the caller's TACT device.

While in mid-conversation a visual channel is desired. So each user walks up to a nearby public display, and establishes a network connection by pointing at a d isplay with his TACT. As the same as the case of near field communication, a synchronizing light blinking on both devices indicates the connection has been established. As a result of this operation, the existing voice stream is extended to contain a video stream between the two commandeered display devices.

From the technical viewpoint, in the above scenario, the TACT devices are exchanging the service type and the IP addresses of the currently connected public displays through the active VoIP session. Further details on the system may be found in [2-4].

4. CONCLUSIONS

This paper introduced TACT, a newly created mobile wireless device. We used TACT as an enhanced mobile IP-phone and a universal control of surrounding computers. By using TACT and the mechanism of transferring endpoint information, we already built several kinds of interactive systems. With these systems, a user can easily control multiple endpoints like a “conductor.”

A small wireless terminal has great possibility to realize ubiquitous computing. Our future direction will include the integration of presence information. It will also include incorporating voice recognition and synthesis.

5. REFERENCES

[1] J. Rekimoto. Pick-and-Drop: A Direct Manipulation Technique for Multiple Computer Environments. *11th ACM Symposium on User Interface Software and Technology (UIST'98)*, pp. 31-39, 1998.

[2] Michimune Kohno and Jun Rekimoto. New Generation of IP-Phone Enabled Mobile Devices. *4th International Symposium on Human Computer Interaction with Mobile Devices (MobileHCI2002)*, pp. 319-323, September 2002.

[3] Jun Rekimoto, Yuji Ayatsuka, Michimune Kohno and Hauro Oba. Proximal Interactions: A Direct Manipulation Technique for Wireless Networking. *INTERACT2003*, September 2003.

[4] TACT: Mobile Terminal for Session Manipulation. *1st International Conference on Mobile Computing and Ubiquitous Networking*, pp.26-31, January 2004.