Swing, Snap and Stamp It!: Device Interaction with Fun

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Abstract
As networked mobile devices and home electronics became popular, they began to have abilities to collaborate each other. In order to make them collaborate, the users first have to specify source and distance among the devices intuitively. Current researches on Real World Pointing do not cover specifying devices over a network. In this paper, we propose "Distance Based Interaction" and the enabling technologies for "Out of Box Experience" of device collaboration.

Keywords
Input devices and strategies, Interaction techniques, Device Collaboration

ACM Classification Keywords
I.3.6 Methodology and Techniques, Interaction techniques

Introduction
Today, a variety of devices, such as mobile phones and electrical equipments, have become network reachable and computing capable. Users, therefore, can receive desirable services from not only one single device but also the collaboration of multiple devices via the network. However, the first setup to make the multiple devices interact is always complicated and difficult. This paper presents a multimodal interaction method and

back-end system to realize easy and intuitive device collaborations.

Real World Pointing for Device Collaboration

In order to initiate device collaboration, a user needs to follow the following three steps; 1) Pointing devices to be controlled, 2) Connecting their resources and functions in order to form the service and 3) Controlling the service. This paper focuses on the first pointing step, because the conventional technique to specify devices, such as finding IP and a host name, are not user-friendly.

There are already various intuitive pointing methods proposed that assume ubiquitous computing environment, integrated information technology in the real world [1, 3, 4]. They try to adapt the concept of Direct Manipulation, which Shneiderman [5] proposed, to the real world. The pointing methods in these researches, however, are designed only for the specific situations.

Device Collaboration in the future ubiquitous environment will cause dynamic change in the relationship between people and devices. For example, the distance changes when a user moves. The whole set of devices to control changes when a user buys a new one. We attack the following two problems to handle the dynamic change in the device collaboration.

1. Enabling Intuitive Pointing of Devices in Any Situation

The most suitable way of pointing depends on the relationship between the user and the device. For example, we use either a wireless remote controller or a push switch of a home appliance depending on a distance to the appliance. In order to provide suitable method of pointing, the system needs to prepare several methods of pointing.

Also in the device collaboration, we need to consider various invisible devices such as devices over the network or cloud computers that emerge in recent years. Existing studies, however, tend to put weight for pointing devices in a narrow visible field. The system needs to deal with invisible devices in one of its pointing methods.

2. Intuitive Participation of Devices to the Network

It is necessary to set easily devices to be a target of real world pointing even in the situation. A growing number of mobile devices also increase the situation that the relationship between people and devices changes dynamically. To achieve the goal, there are following requirements: Users can 1) set up without any network information, such as IP and the host name, 2) register the device to the network with fewer steps, and 3) do 1 and 2 intuitively. The existing researches of real world pointing, however does not satisfy these requirements to achieve the easy installation.

Approach

1. Distance Based Interaction

Users can choose appropriate interaction method based on the distance between them and devices. We classify the distance into Touchable, Visible and Recallable, and provide three interactions suitable to each distance. The distance is not simply a spatial one, but is led with several factors such as physical and a social state. We will classify the formula through the future evaluation.

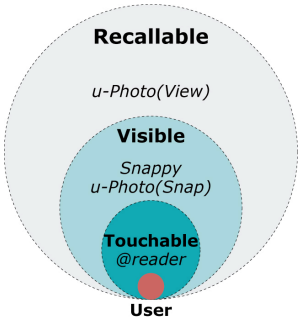

figure 1. Distance Based Interaction

2. Out of Box Experience
In order to manage the dynamic change of the set of devices, we designed a local server to manage the unique code for the device that is bound to the interaction method. When connecting a new device for the first time, the server generates a new code automatically and prints it to attach the device. The code works as a target of multiple interaction methods by integrating following functions into a single code: RF tag, Visual Marker and Gesture Code.

Interaction Method

We propose following three interaction methods based on the three classes of distances shown in figure 1.

Stamp Based Interaction Method: @reader
@Reader [7] is a stamp shaped handheld RFID reader. Users can retrieve information from the object with RFID by just stamping it on objects with RFIDs. The interaction is suitable to the touchable targets.

Swing Based Interaction Method: Snappy
Snappy [2] is an interaction method to select a device by swinging a mobile device following the arrow in the code. The arrow is a combination of some of four directions. Snappy enables users to select the target easily that they cannot touch.

Snap Based Interaction Method: u-Photo
u-Photo [6] is a special camera that takes a picture with information of the devices taken in it. Users can choose available devices visually in the photos, and control the device with intuitive way. With u-Photo, users can easily recall and control devices even in the different place the photo was taken.

figure 2. @reader

figure 3. Snappy

figure 4. u-Photo

System Architecture

Figure.5 shows the system architecture. We implemented system API to allow the interaction methods to discover or utilize services. The figure shows three APIs, which offer abstract operation of service discovery, service utilization, and connection resolution. Settings of every device in this system, including IP address, service protocol and its parameter, are described in the USDL (Universal Service Description Language). The single format enables to deal with all devices with a single way. Each interaction system can access to the devices without having device-dependent implementation.

Demonstration Video

There are two scenarios in our video, one is about the travel, explaining "Distance based interaction", and the

other is about the birthday party, explaining "Out of box experience". The first scenario introduces device collaboration by @reader and Snappy within actual usage. The second scenario explains the procedure to make the new device collaborate with other devices by adding it to the home network. Furthermore, it emphasizes that the pointing method, which does not depend on the distance between the users and devices, is achieved by proper use of Snappy and u-Photo.

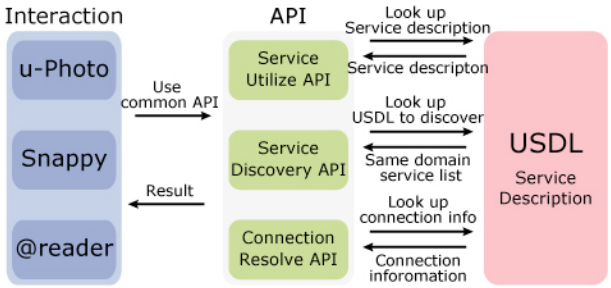

figure 5. System Architecture

Conclusion & Future Work

In this paper, we propose two concepts, Distance Based Interaction and Out Of Box Experience to realize real world pointing for device collaboration. We focus on mainly a distance for designing pointing interaction easy and intuitive. We assume, however, that user's physical situation and social situation, such as he is right now on a busy street, affect this distance. To reveal this issue, we will evaluate three interaction methods for device collaboration.

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Reference

[1] Hosoya, E., Sato, H., Harada, M.K.I, Nojima, H., and Onozawa, A. Arm-pointer: 3d pointing interface for real-world interaction. ECCV Workshop on HCI 2004, Springer-Verlag (2004), 72-82.

[2] Ito, T., Hashizume, K., Kawada, K., Nakagawa, N., Namatame, N., Ito, M., Nakazawa, J., Takashio, K., and Tokuda, H. Snappy: A snap-based human interaction for multiple device collaboration. In Adj. Proc. Pervasive 2009, Springer-Verlag (2009).

[3] Rekimoto, J. Pick-and-drop: A direct manipulation technique for multiple computer environments. In Proc. UIST'97, ACM Press (1997), 31–39.

[4] Rukzio, E., Leichtenstern, K., Callaghan, V., Holleis, P., Schmidt, A., and Chin, J. An experimental comparison of physical mobile interaction techniques: Touching, pointing and scanning. In Proc. Ubicomp 2006, Springer-Verlag (2006), 87-104.

[5] Shneiderman, B. Direct manipulation: A step beyond programming languages. Human-computer interaction: a multidisciplinary approach, Morgan Kaufmann Publishers Inc. San Francisco, CA, USA, 1987, 461–467.

[6] Suzuki, G., Aoki, S., Iwamoto, T., Maruyama, D., Koda, T., Kohtake, N., Takashio, K., and Tokuda, H. u-Photo: Interacting with Pervasive Services Using Digital Still Images. In Proc. Pervasive 2005, Springer-Verlag (2005). 190-207.

[7] Yura, J., Ogawa, H., Zushi, T., Nakazawa, J., and, Tokuda H. objsampler: A ubiquitous logging tool for recording encounters with real world objects. In Proc. RTCSA '06, IEEE Computer Society (2006). 36-41