objSampler: A Tool for Recording and Recalling Encounters with Real World Objects

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Abstract

This paper proposes a tool, called objSampler, for recording and recalling encounters with real world objects, such as products, places, and individuals. It consists of a state-of-art device called objPipette to record conscious encounters, uCore for recording unconscious encounters, and objScope associated with objDish for recalling encounters on GUI. We adopted RFID technology to record conscious encounters and RF beacons for unconscious encounter recording. Since objSampler does not require a public backbone network between these devices, the recorded information is kept in private without security problems. We also proposes a filtered recording that is configurable with area coverage and detention time, and a filtered recalling that shows recorded encounters with prioritized order. These contribute to reduce noise in the recorded encounters.

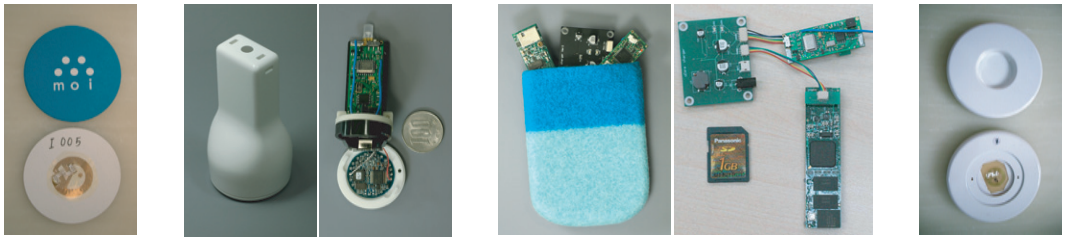
1 Introduction

We encounter various things, individuals, and places in the real world. In a shopping mall, for example, we walk around there visiting several shops, and pick up interesting products with our hands. In a research conference, we talk to other researchers, and sometimes exchange name cards. These activities include **conscious encounters**, in which we are aware of the encountering objects, such as shops, products, and individuals. In addition, we often pass over real world objects. In the shopping mall, we walk pass shops and products. We pass other researchers on the conference venue. These are **unconscious encounters**, in which we are unaware of the encountering objects.

The difference between these is that we can recall conscious encounters but not for unconscious ones. While we can refer to web pages of a product, a shop, or a researcher that/who interested us in a conscious encounter, we cannot do so for objects we just passed over. This means that though we have unconscious encounters with objects that potentially interest us, we are unable to be aware of them. Furthermore, due to the volatility of our short term memory, we sometimes forget conscious encounters. Therefore, if we need to recall a conscious encounter, we make a note on a paper or in a PDA, or take a picture of the encountering object. However, even with such notes, one may loose the paper note, or forget the fact that he/she took the picture. In addition, we cannot take a note of objects that we are unaware of. These are lost encounters that we cannot recall.

To reduce the lost encounters of us, we propose objSampler, with which we can record both conscious and unconscious encounters using a hardware tool called objPipette, and recall them on a GUI tool called objScope. The objPipette is a small handheld sensing device that reads RFID tags attached to the real world objects (object sampling) to record conscious encounters, and communicates with sensor nodes embedded in the surrounding environment to record unconscious encounters. The objScope is used to show, organize, and rank the encounters recorded in the objPipette when one gets home. Encounters are sampled into the objPipette, and shown on the objScope by putting the objPipette on a digital dish called objDish. Therefore, we can recall all the conscious encounters without using additional paper notes, PDA notes, or pictures. In addition, unconscious encounters shown on the objScope let us notice interesting objects that we were unaware of during the ordinary activities. The objSampler does not require any backbone network for recording or recalling encounters and the recorded encounters are transmitted to the objScope only through the registered objDish. Therefore, it is privacy-safe.

This paper describes the design and implementation of the objSampler, and shows its usability study. The usability study proves that the objSampler provides a novel and useful tool to reduce lost encounters. The rest of this paper is organized as follows. Section 2 proposes objSampler describing its design and implementation. Section 3 talks about its applications. Section 4 surveys related work. Section 5 concludes this paper.



objTag objPipette uCore objDish

Figure 1. Devices of objSampler

2 objSampler

objSampler is a tool to record conscious and unconscious encounters with objects, and to recall the recorded encounters.

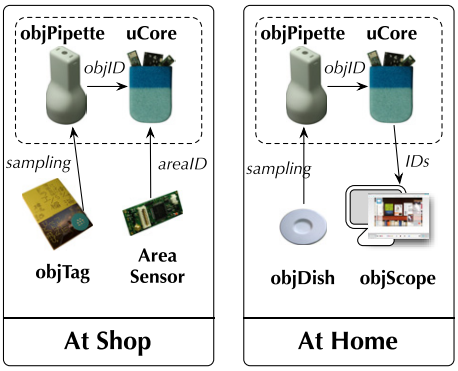


Figure 2. System Architecture

Figure 2 illustrates the system architecture of objSampler. Each product is tagged with an RFID tag containing product IDs that we call **objTag**. Places, such as shops, restaurants, and so on, are associated with their IDs, and the IDs are transmitted from Area Sensors through a wireless datalink. The users of objSampler system carry a small state-of-art device called **objPipette** and its master device called **uCore**. The objPipette is used to record the conscious encounters with objects; users can scan product IDs from objTags pasted on products that interest the users, and the scanned IDs are transmitted to the uCore. The uCore receives area IDs via the wireless datalink from area sensors to record unconscious encounters with places. The objPipette also embeds an objTag, which contains its user's ID, therefore other users can record the conscious encounters with him by scanning the objTag.

When a user come back home, he put his objPipette onto a digital dish called **objDish**. This starts transmitting recorded encounters stored in the uCore to the viewer application called **objScope**. With the objScope, the user can view the encounters along the timeline, rank them, and share them with other users through the Internet. In other words, the objScope is the digital microscope that magnifies objects sampled in the uCore.

2.1 Hardware

Figure 1 shows a devices of objSampler system. This section details each of these devices.

objTag objTag is used to identify objects. It is pasted onto signboards, shop cards, price tags, etc. We assume that the cardboard can have arbitrary paintings or Braille on its front face to attract users. This is the advantage of the use of RFID tags over visual tags; visual tags occupies a certain area and needs extra area to print such paintings or Braille.

objPipette objPipette samples objTags when it is faced in a few centimeters to them, and sends the IDs scanned from the objTags to the associated uCore. An objPipette consists of an RFID reader, a wireless sensor node (Smart-Its particle 2/29), and two-color LED as a means to give a visual feedback to users.

uCore uCore (Ubiquitous Core) stores both objIDs sampled by an objPipette and areaIDs transmitted from area sensors. uCore consists of 3 devices: a Smart-Its particle sensor node, a gumstix tiny PC and a battery charging board.

objDish objDish is the cradle for objPipette, which is a disk on which an RFID tag is pasted behind. When a user put her objPipette on an objDish, she can browse her encounters on an objScope software, which will be described shortly.

2.2 Software

Figure 3 illustrates a system diagram of objSampler system.

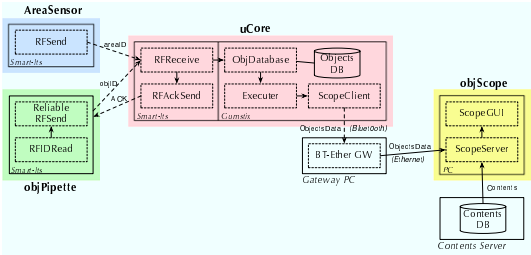


Figure 3. Block Diagram of objSampler

objIDs sampled by objPipettes and areaIDs from area sensors, namely recorded encounters, are transmitted to uCore using wireless communication function of Smart-Its. uCore stores received IDs into a database in gumstix. When the uCore reads objID corresponding to an objDish, the uCore transmits the records of IDs to an objScope associated with the objDish. Then objScope gets contents and visualizes it.

uCore Smart-Its in uCore sends received IDs to gumstix by serial communication. Then objDatabase module on gumstix retrieves IDs received previously. If uCore has received the same ID previously, it compares last modified time with received time. The difference between the last modified time and received time represents a duration of user's stay. Therefore this system rates importance of encounters using this duration of time. If a type of received ID is of objDish, an Executer module executes a ScopeClient program. ScopeClient program retrieves all IDs from the database and transmit it to objScope corresponded to the objDish. In addition, when uCore communicates with objScope, uCore connects a gateway PC using Bluetooth PAN profile. Then the gateway PC creates Bluetooth to Ethernet bridge, and forwards IP packets.

objScope objScope is a software to visualize web-based contents related to objID and areaID transmitted from uCore. Figure 4 shows a screenshot of objScope and a picture showing a user browsing contents with objScope. It has a timeline area on the bottom, which aligns icons of encounters through the timeline. Users can show the digital content associated with an icon by clicking it. To show the content associated with an ID, it queries to Object Name Service to get URL of the content. At the top of the objScope, there are button icons that lets users to rate or search items. The contexts of encounters are reproduced on the objScope. The contents of a bookstore imitate a book shelf, and contents of a DVD store imitate a movie theater. Items in the contents are displayed in the context of user's encounters. For example, when a user encountered with books in a bookstore, those books are put on a shelf in the objScope window. Therefore, users can recall their encounters intuitively.

Figure 4. Screenshot of objScope

3 Experimental Demonstration

We conducted an experiment of objSampler on October 21 and 22, 2005 in Tokyo, JAPAN. We built four "virtual shops" shown in Figure 5 in the experiment site, and placed actual products there. Each product has an objID on it. Examinees walk around the shops as they like carrying objPipette and uCore. Each shop transmits an RF beacon with a unique shop ID, and uCore records the ID when the examinee enters a shop. They sample products, which interests them, using objPipette to record the products as conscious encounters. The products that are not sampled are recorded as unconscious encounters. The unconscious encounters with shops, and conscious/unconscious encounters with individuals are not recorded during this expriments.

Figure 5. Virtual shops in experimental demonstration

After finishing the "virtual shopping", examinees go back "virtual home" that we also built at the experiment site. They put their objPipette on objDish place at home to recall the encounters. A PC is used to show objScope visualizer. After the experiments, each examinee is requested

a questionnaire about the usability of objSampler. During the two days experiments, 56 examinees answered the questionnaire.

Usability Study

First of all, 78% of examinees are affirmative for the whole system usage. This represents good usability of the user interface of objSampler, which consists of objPipette and objScope. Second, 60% of examinees recognize the recording method in objSampler, carrying objPipette and scanning RFID tags with it, easy. Over 60% of them feel the use of RFID is easier than barcodes or two-dimensional visual tags that require cameras. Among those who are negative for Q2, half of them indicated the need of objPipette to be embedded into cellular phones. This means that they do not want to carry additional devices. Other half insisted the functionality of objPipette is too simple.

About recording encounters, 80% and 54% of examinees feel it useful to record conscious encounters with shops and unconscious encounters with products in a shop, respectively. In addition, 96% of them are affirmative for the style of objSampler, with which they can recall encounters after daily activities. These results support the basic idea of this research strongly.

For the open question, many examinees wanted to integrate objPipette with their cellular phones or other handheld devices. Many of them requested earliest possible deployment of objSampler in the real shopping malls.

4 Related Work

Several researches propose systems to embed digital information into places and objects. Rekimoto [5] proposes an augmented reality system, with which users can see the digital notation of a real world object overlaid on the real-time view of the object. The system uses a handheld computer equipped with a camera. The augmented reality systems like this aim at real-time use of the digital information, and not at recording and recalling it. In addition, with the camera-based augmented reality system, users need to move the camera to the target object to see the digital notation. Therefore, it cannot be used to record unconscious encounters. In objSampler, we aim at recording the digital information of both conscious and unconscious encounters and recalling it later on a computer display.

Kindberg [4] proposes a system called CoolTown, where RFID tags, barcodes, and infrared/RF beacons are embedded in a whole town to associate URLs related to the particular places. Users can refer to the URL on a handheld computer equipped with readers corresponding to the tags and beacons. Since this research adopts infrared/RF beacons in addition to tags, it can be used to detect unconscious encounters with places. In our research, objSampler provides functionalities to record products and individuals in addition to places with objPipette hardware, and to visually recall encounters on objScope with an effective filtering mechanism.

In order to acquire content associated with product ID and area ID, both a directory service for looking up a server address, and a description language of products and shop locations are needed. EPCglobal proposes ONS (Object Name Service)[1] to search server's IP address where product information exists from tag data format called EPC. Because ONS is developed based on DNS (Domain Name Server), it enables large-scale applications such as product distribution system. Meanwhile, several descriptions such as PML (for product) [2] and POIX (for location) [3] are proposed. We will actively introduce these system and specification to objSampler, in order to disseminate our system in daily life.

5 Conclusions

This paper proposed a tool, called objSampler, for recording and recalling encounters with real world objects, such as products, places, and individuals. It consists of a state-of-art device called objPipette to record conscious encounters, uCore for recording unconscious encounters, and objScope associated with objDish for recalling encounters on GUI. We adopted RFID technology to record conscious encounters and RF beacons for unconscious encounter recording. Since objSampler does not require a public backbone network between these devices, the recorded information is kept in private without security problems. The experiment has shown a good usability and lacking functionality of objSampler. This paper has shown the second version of objPipette hardware that we developed based on the usability study. In the future, we will introduce several standardized technology for objSampler, and we expect that our system will be used extensively as a social infrastructure.

References

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