AwareCover: Interactive Cover of the Smartphone for Awareness Sharing

Ayumi Fukuchi[1], Koji Tsukada[2,3], and Itiro Siio[1]

[1] Ochanomizu University, 2-1-1 Ohtsuka, Bunkyo-ku, Tokyo 112-8610, Japan
[2] Future University Hakodate, Japan
[3] PRESTO, Japan Science and Technology Agency, Japan
`ayumi.kawakami@is.ocha.ac.jp, {tsuka,siio}@acm.org`

Abstract. Although there are many systems that support communication by sharing activities of people in separate locations, these systems still have problems to be used in daily environment. Smart phones are promising platform to solve these problems since many people always carry them. Therefore, we focus on the cover for the smart phones, and propose a cover-type system called AwareCover that supports users to share remote awareness by attaching the sensors/actuators in a cover of a smart phone. We also implement PadPet as a prototype based on this concept.

Keywords: Smartphone cover, tablet cover, awareness sharing, tangible.

1   Introduction

Although there are many systems that support communication by sharing activities of people in separate locations, these systems still have problems to be used in daily environment. For example, some systems installed in the environment (e.g., furniture or wall) can be used in only limited locations. Other systems carried by users have advantages in presenting personal information in almost any locations; however, the users often have difficulty to carry such systems all the time. Smartphones are promising platform to solve these problems since many people always carry them. However, we need to design the systems not to disturb main functions of the smartphones (e.g., phone, email, or web). Therefore, we focus on the cover for the smartphones and propose a cover-type system called AwareCover that supports users to share remote awareness by attaching the sensors/actuators in the smartphone cover.

2   AwareCover Concepts

The main concepts of the AwareCover are as follows:

- Sharing awareness by extending the smartphone.
- Cooperation between the cover and smartphone.
- Appropriate display methods suited for the cover material

First, smartphones are suited for the platform of awareness sharing system since many users already carry them. To avoid disturbing common use of smartphones, we designed the system as a smartphone cover.

Second, we install only small numbers of devices (e.g., actuators, sensors, and communication) in the cover since the smartphone itself has several sensors, enough computing power, and a battery.

Third, we need to select a proper display method that is suited for the shape and texture of the cover and avoid disturbing common use of smartphones.

Here, we focused on the soft texture and selected the fur material. Based on the above concepts, we implemented a prototype system called the PadPet that helps users share awareness using pet metaphor: the actions of the ears and a tail of a pet.
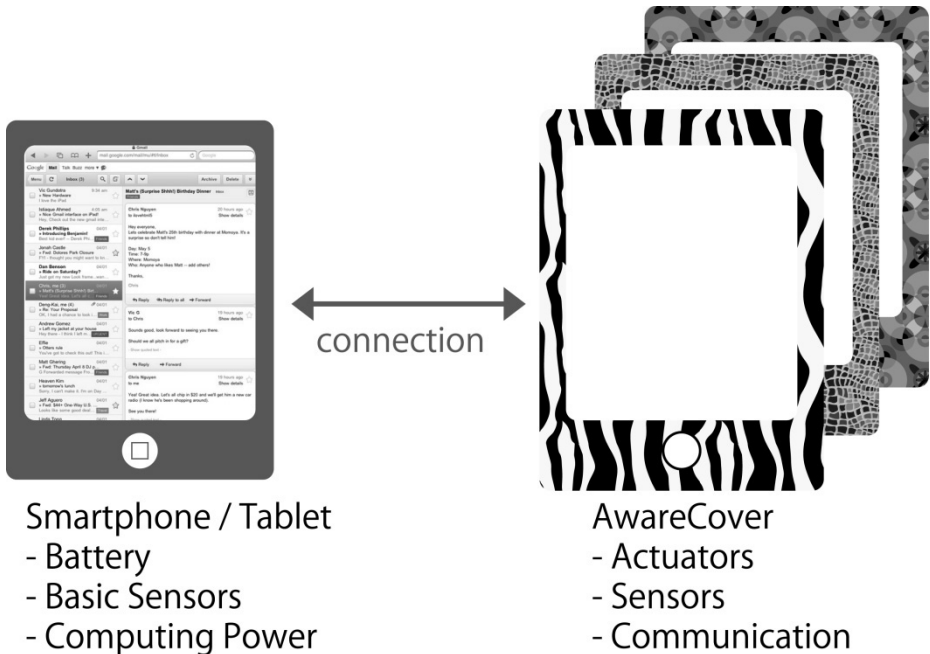
connection

Smartphone / Tablet
- Battery
- Basic Sensors
- Computing Power

AwareCover
- Actuators
- Sensors
- Communication

Fig. 1. The AwareCover concepts

2.1   PadPet Concepts

The PadPet presents suitable information of the human presence and emotion by moving its ears and tail based on the pet metaphor. Pet animals (e.g., dogs and cats) are important partners for many people. They have soft fur and body, and communicate with humans by physical gestures. The pet breeders are usually familiar with reading the pet emotion from these gestures. Here, we focused on the gestures with the ears and tail that are especially well-known among people: a dog shakes his tail quickly

when he is happy and a cat shakes her tail slowly when she is in a good mood; both dogs and cats bend their ears when they are scared.

The PadPet applies these gestures to provide awareness information without disturbing the main functions of the smartphone.
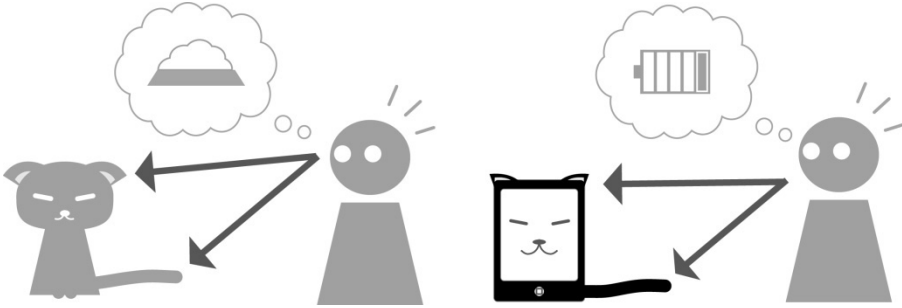

Fig. 2. The PadPet concepts

3   Implementation

We explain the implementation of the system. The PadPet consists of a covering unit, a motion unit that drives the tail / ears, and a control unit to communicate with a smartphone and control the motion unit. We chose the Android Tablet (Acer ICONIA TAB A500) as a smartphone. Figure 3 shows the appearance of the PadPet prototype. For the covering unit, we sewed fake fur on the rubber tablet cover (Mobile Gears Tablet Case) to attach the control unit and wires without affecting the appearance. Moreover, we placed some cushions between the fake fur and devices to keep the softness like stuffed toys. We used muscle wires (Toki BioMetal Helix) as actuators in the motion unit. The muscle wire is a linear shape memory alloy that is shrunk when powered. Compared to common motors, the muscle wire has several advantages in calmness, smooth movement, and softness. In these reasons, we selected the muscle wires as actuators to keep the softness of the fake fur and comfort use of the smartphone. Additionally, we designed the muscle wires to bend to fixed direction without complicated mechanism: by adjusting supporting points, fabric shapes, and fabric materials (Figure 4). For example, we integrated different materials for the ear parts (thin/stretchy fabric on the front and thick fake fur on the back) to bend the ears to the front direction when the muscle wires are activated.

The control unit consists of the IOIO module and an original board to control muscle wires through transistors. The IOIO module can easily control sensors/actuators attached to the smartphone via USB using Android ADK (Accessory Development Kit).
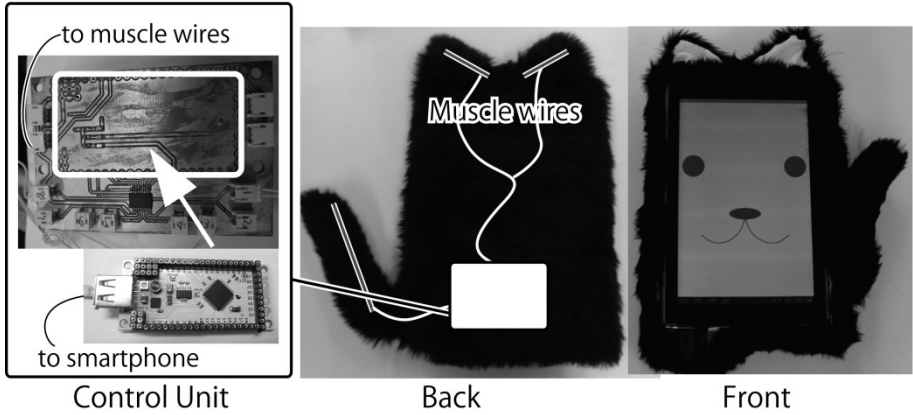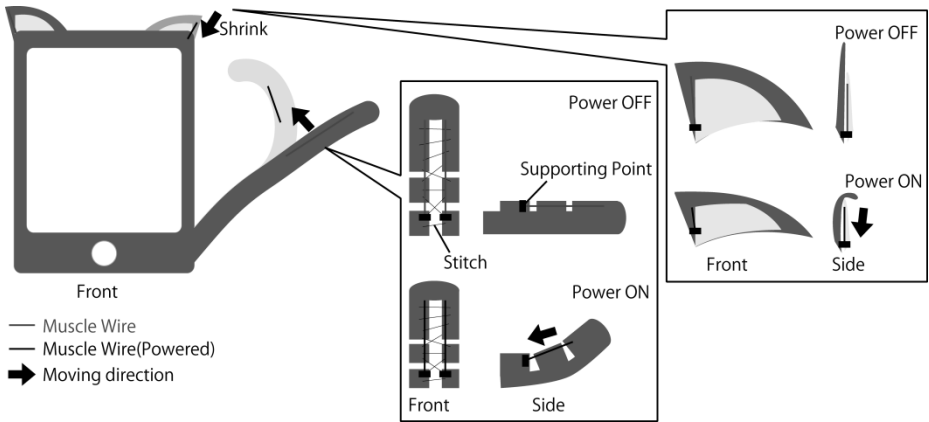
Fig. 3. The PadPet prototype

Fig. 4. Locations and movements of the muscle wires

4   Application

In this section, we propose several applications of the PadPet.

4.1   Sharing Remote Activities

When a pair of PadPet and smartphones is installed remotely, the system can estimate rough activities of the remote partner from the smartphone operations (e.g., touch control or physical movement) and present them as behavior of the PadPet. For example, when users apply this application along with text/video chats, they can also share surrounding information (e.g., posture or physical movement). Moreover, the

system may extract the partner's emotions from their tweets and present them as behavior of the PadPet.

4.2   Presenting Remote Pet Status

Pet lovers often want to know their pet status even when they are away from home. When we install a pet sensing system that can detect pet status using a camera or wireless sensors, the PadPet can present pet status using the pet metaphor without disturbing common use of the smartphone. For example, when the pet moves faster, the movement of ears/tail becomes faster.

4.3   Adjusting Life Rhythm

Pet lovers often adjust their life rhythm based on their pet activities. To utilize this habit, the system might adjust their life rhythm by presenting ideal life rhythm using PadPet movements. For example, PadPet will act sleepy (e.g., bending both ears) when ideal bedtime[1] approaches.

5   Related Work

Calmate [1] and Coconatch [2] are soft robots attached to common PCs that help users share awareness remotely. It is similar to PadPet in integrating soft devices and general computers. Moreover, Calmate presents awareness information using muscle wires to keep softness and quiet. Although these systems are not suited for mobile use since they requires external computers, the PadPet is easily carried with a smartphone. Designing CALLY [3] and Smart Pet [4] are systems that use smartphones as   control units of original devices in the similar way of the PatPet. However, since these systems need to exclusively use the smartphone, users can not use the smartphone in common way.   The PadPet can present awareness information without disturbing common use of the smartphone using the cover-type implementation.

In Sensing Through Structure [5], soft shape sensor made of silicon polymer with built-in electrode is proposed. They also propose a cover-type input device for iPhone based on the same technology. Our device is designed mainly as output device with an exterior of soft cover for mobile devices. FuwaFuwa [6] proposes spherical sensing modules inside flexible cushion containing cotton, and turns it to an input device by detecting distance between the sensor and cotton surface. PINOKY [7] is a sensor and actuator device that can be attached to conventional stuffed toys, and move these toys with computers. PINOKY uses servo motors as actuators, on the other hand, we uses noise-less memory alloy wire to provide devices that is more acceptable in daily life.

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[1] Ideal life rhythm can be set by users with the smartphone.

6   Conclusion

To provide awareness sharing, we proposed the AwareCover that is designed as a cover for mobile computers such as smartphones and tablets. Then, we have implemented a PadPet device that presents pet-like motion. We plan to deploy our cover device to smaller smartphones and to implement applications as mentioned in the application section. We will also implement the input methods and various appearances suited for users' taste.

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