MouseField: A Simple and Versatile Input Device for Ubiquitous Computing

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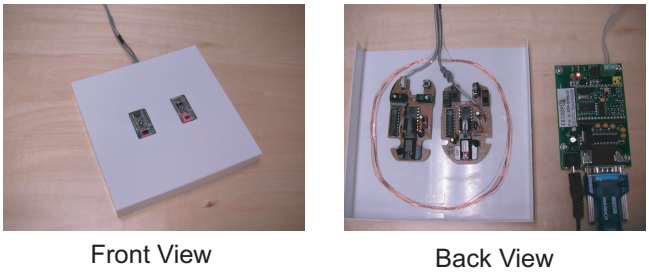

Figure 1: An Implementation of a MouseField.

MOUSEFIELD

A MouseField is a robust and versatile input device that can be used at almost any place for controlling information appliances. A MouseField consists of an ID recognizer and motion sensors that can detect an object and its movement after the object is placed on it. By placing an object with an RFID on a MouseField and sliding or rotating the object, a user can control various systems just like he can use a standard mouse for controlling standard PCs.

Figure 1 shows an implementation of a MouseField, which consists of two motion sensors (taken from standard optical mouses) and an RFID reader (Texas Instruments' S2000 Micro Reader) hidden under the surface. The RFID reader and the two optical mouses are connected to a PC through a USB cable, and they can detect the ID and the motion of the object put on the device. When a user puts an object with an RFID on the MouseField, it first detects what was put on the RFID reader. When the user moves or rotates the object, motion sensors detects the direction and rotation of the object.

These information are similar to the information we use when we control GUI widgets on PC screens. Just like we can control the sound volume by clicking a knob of a slider widget and move the slider up and down, we can do the same thing by putting a volume control object on a MouseField and sliding or rotating the object. In this way, we can perform almost any kind of GUI operation by putting an object on a MouseField and moving it. For example, a user can put a "TV block" on a MouseField and rotate it to change programs, just like he can select a program using a pulldown menu. He can then put an "Internet block" on a MouseField and move it to browse various Web pages or see mail messages.

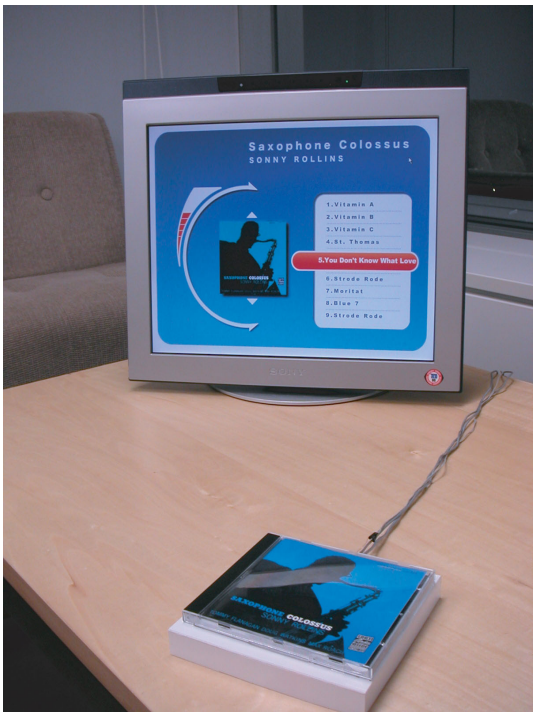

Figure 2: Playstand++: A Music Player with MouseField.

Although various interaction technologies for handling information in the ubiquitous computing environment have been proposed, some techniques are too simple for performing rich interaction, and others require special expensive equipments to be installed everywhere, and cannot soon be available in our everyday environment. A MouseField is made up of cheap devices that can easily be put into a transparent waterproof package. Despite its simple structure, it allows versatile interaction in the wide range of ubiquitous computing environment.

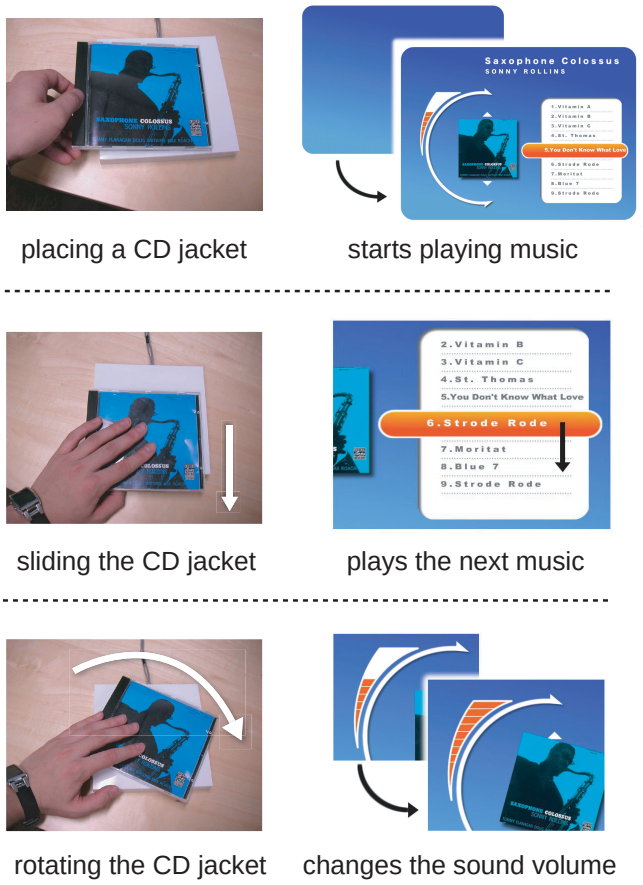

Figure 3: Controlling the Music Player.

PLAYSTAND++

The PlayStand++ system (Figure 2) shows how a user can enjoy music using a MouseField and CD jackets for controlling the player. All the music in the CD are saved in a music server, and an RFID tag is attached to each CD jacket. When a user places a CD jacket on the MouseField, a music player is displayed on the screen, shows the contents of the CD, and starts playing the music. The user can change the sound volume by rotating the CD jacket, and move to the next or previous song by sliding the jacket to the front or to the back (Figure 3). When the user removes the jacket from the MouseField, the sound stops and a screen saver is displayed on the screen. PlayStand++ is not only very simple to use, but it allows users to control various parameters without using special controllers.

OTHER APPLICATIONS

Just like a mouse can be used for various purposes, a MouseField can be used for whatever purpose you like in the ubiquitous computing applications. It can be used for invoking an application (just like a mouse-click can invoke an application), controlling parameters (just like using sliders and menus), selecting objects (just like dragging a mouse cursor), transferring data (just like mouse-based drag and drop), etc.

If we use multiple MouseField devices, we can utilize them for conveying information between locations. When we perform an operation on one MouseField and perform another operation on another MouseField, those series of operations can be interpreted as cooperative tasks. For example, a person can use one MouseField to tell the system that he wants to retrieve some information at the location, and use another MouseField to tell that he wants to convey the information to the new location. In this case, virtual Drag and Drop (or sometimes called "Pick and Drop"[3]) can be performed. If a person selects a TV program on a MouseField by using a TV block, he can bring the object to a different place with another MouseField and use the object to see the rest of the program there. In this way, MouseField can enable various interaction techniques which were only available with special and fragile input/output devices.

RELATED SYSTEMS

FieldMouse[4] is a device which has the same configuration as MouseField: a FieldMouse consists of a motion sensing device and an ID recognizer. While MouseField is a device installed in tables and walls, FieldMouse is a device carried by people to control various information appliances. Advantages of using a FieldMouse is that people can operate real-world GUI[2] without installing many sensors everywhere. A disadvantage of FieldMouse is that a user always has to carry a FieldMouse to control information appliances. Since a FieldMouse consists of an ID recognizer and a motion sensor, it is always heavier than simple RFID tags.

"Phicons"[1], or physical icons, are sometimes useful for handling information in the ubiquitous computing environment. Using a MouseField, almost anything can be used as a phicon, if an RFID tag is put into it.

CONCLUSIONS

We developed a simple, robust and flexible input device called the MouseField for controlling information in the ubiquitous computing environment. Despite its simplicity, MouseField is flexible enough for handling complex information at various places where conventional input devices like keyboards and mouses were not conveniently used. We hope MouseField will be one of the standard input devices used in the ubiquitous computing age.

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