IODisk: Disk-type I/O interface for browsing digital contents

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ABSTRACT
We propose a disk-type I/O interface, IODisk, which helps users browse various digital contents intuitively in their living environment. IODisk mainly consists of a force-feedback mechanism integrated in the rotation axis of a disk. Users can control the playing speed/direction contents (e.g., videos or picture slideshows) in proportion to the rotational speed/direction of the disk. We developed a prototype system and some applications.

Author Keywords I/O device, tangible interface, disk, force feedback

ACM Classification Keywords H5.2 [Information interfaces and presentation]: User Interfaces.

General Terms Design and Human Factors

INTRODUCTION
As digital cameras and online streaming services (e.g., Youtube [1]) have become popular recently, users have increased their use of various digital contents such as pictures, videos, and music. Moreover, after the appearance of set-top boxes (e.g., TiVo[2], Apple TV[3]), users have come to enjoy these digital contents in their living rooms or bedrooms.

We propose a disk-type I/O interface, "IODisk", which helps users browse various digital contents intuitively in their living environment.

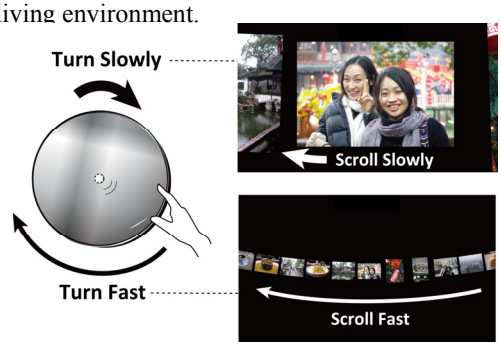

Figure 1. The concept of the IODisk. Users can control the speed/direction of digital contents in proportion to the rotating speed/direction of the disk.

[1] http://www.youtube.com/

[2] http://www.tivo.com/

[3] http://www.apple.com/jp/appletv/

IODISK
IODisk mainly consists of a force-feedback mechanism – a low-speed motor and a rotary sensor – integrated in the rotation axis of a disk. Users can control the speed/direction of contents (e.g., videos or pictures) in proportion to the rotating speed/direction of the disk (Fig. 1).

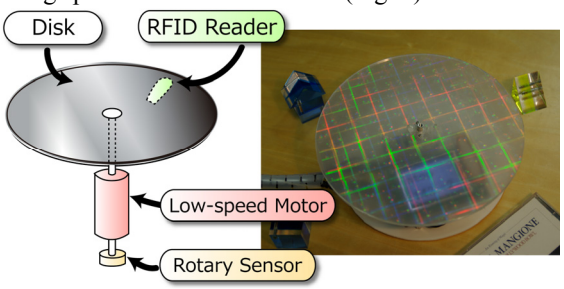

Figure 2. The prototype IODisk.

We have developed a prototype system, as shown in Fig. 2. The low-speed motor consists of a DC motor and low gears. We can smoothly control the speed of the motor by controlling the current. The rotary sensor (ALPS RDC80) detects the rotating angle of the disk – turned by the motor or a user – and outputs the angle as an absolute value. We also attached a RFID reader (Texas Instruments S2000 Microreader) and full color LEDs under the disk (Fig. 3). The RFID reader detects objects with RFID tags (e.g., Phicons [3]) and changes the operation mode of the system. The full color LEDs are attached optionally for visual feedback. These sensors and actuators are connected to a PC via I/O units: a USB motor controller (Phidget MotorControl) for the motor and a USB I/O device (Phidget InterfaceKit) for the rotary sensor and LEDs. These devices are controlled by the IODisk Server (written in C#) running on the PC.

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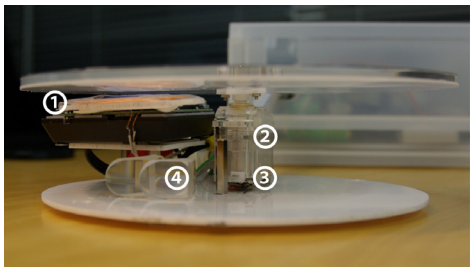

Figure 3. Device architecture. (1. RFID reader, 2. low-speed motor, 3. rotary sensor, 4. full color LED)

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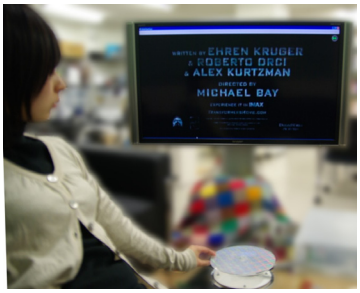

Figure 4. IODisk installed in a living environment.

APPLICATION

We developed two applications for the IODisk to control digital contents: a video browser and a picture browser. We supposed these applications would be used with an external display, as shown in Fig. 4. As mentioned above, the IODisk enables users to control the speed/direction of videos/pictures in proportion to the rotational speed/direction of the disk.

The basic usage of the video browser is shown below (Fig. 5).

1. When a user puts an object with a RFID tag on the disk, the system selects the video list, and shows the first video on the display.

2. When the user turns the disk in a clockwise direction, the system detects the rotation of the disk using the rotary sensor, and plays the video. At the same time, the system activates the motor to keep the disk turning.

3. When the user turns the disk faster, the system fast-forwards the video and keeps turning the disk fast.

4. When the user slows the disk speed, the speed of the video and the disk also slows.

5. When the user turns the disk backward, the system rewinds the video and keeps the disk turning backward.

6. When the user stops the disk for a moment, the system stops the video and the motor.

In addition to these basic operations, the IODisk can recognize several gestures by turning the disk very quickly or slowly. For example, when the user turns the disk clockwise very quickly, the system generates click by turning the motor backward for a moment, and selects the next video. The picture browser works in a similar manner to the video browser.

We developed the video/picture browsers with Adobe Air. These browsers connect to the IODisk Server via a TCP Socket, and receive the rotational speed of the disk. Then, the browsers control the videos/pictures in proportion to the disk speed.

In this way, users can not only intuitively control the video along with the rotational speed/direction of the disk, but also select multiple videos by turning the disk clockwise/backward at very high speed.

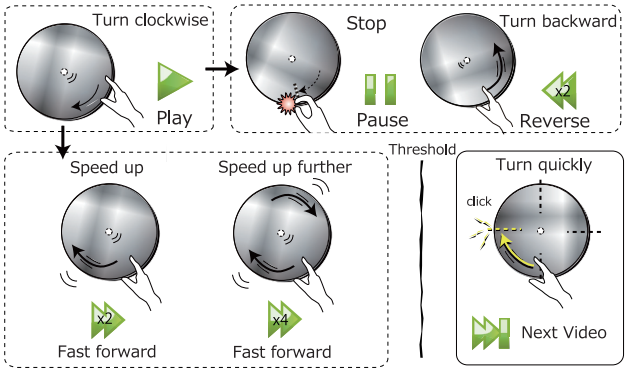

Figure 5. Basic usage for controlling videos.

RELATED WORK

The MouseField [5] is a simple and versatile input device for ubiquitous computing. It consists of an ID recognizer and motion sensors that can detect an object and its movement after the object is placed on it. InTouch [1] consists on two connected objects each consisting of three cylindrical rollers mounted on a base. When one of the rollers is rotated, the corresponding roller on the remote object rotates in the same way. Jamming Gear [4] is a unique approach for controlling music through the tangible arrangement of gears.

The uniqueness of IODisk is in its ability to help users browse videos or pictures intuitively by controlling the speed/direction of the contents in proportion to the rotational speed/direction of the disk. Moreover, users can easily recognize the playing status of the digital contents visually or tangibly.

REFERENCES

1. Brave, S. and Dahley, A.: inTouch: a medium for haptic interpersonal communication, in Extended Abstracts of ACM CHI 97, pp.363–364 (1997).
2. Igarashi, T. and Hinckley, K. : "Speed-dependent automatic zooming for browsing large documents", In Proceedings of ACM UIST'00, pp.139-148 (2000).
3. Ishii, H. and Ullmer, B.: Tangible Bits: Towards Seamless Interfaces between People, Bits and Atoms, in Proceedings of ACM CHI 97, pp. 234–241 (1997).
4. Kanno, S.: Jamming gear: research on gearwheeled timing playback devices. In Proceedings of the fourth international conference on Tangible, embedded, and embodied interaction (TEI 2010), pp. 377-378 (2010) .
5. Masui, T., Tsukada, K. and Siio, I.: Mouse-Field: A Simple and Versatile Input Device for Ubiquitous Computing, in Proceedings of UbiComp2004, pp.319–328 (2004).