Proceedings of HCI International '95, pp.261-264, Elsevier Science, July 1995.

InfoBinder: A Pointing Device for a Virtual Desktop System

Itiro Siio

Tokyo Research Laboratory, IBM Japan, Ltd.
1623-14, Shimotsuruma, Yamato-shi, Kanagawa-ken 242, Japan
e-mail: siio@trl.ibm.co.jp

InfoBinder is a new wireless pointing device that provides an information-binding function in a virtual reality environment. Each device has a unique ID number and is mapped to an object such as a telephone directory in the computer system.

1. Virtual desktop

This paper discusses the application of InfoBinder to a virtual desktop system, shown in Figure 1, where a computer-generated image is projected onto a work table. This type of desktop display was proposed by P. Wellner [1]. The projected image used in my system is a common desktop metaphor consisting of icons and windows. In this metaphor, icons and windows represent computer objects such as documents, folders, trash cans, printers, and database objects. An icon represents an object that has been shrunk to make it easier to handle. A window represents an object that has been opened to allow the information it contains to be browsed and manipulated.

In addition to these computer objects (virtual objects), real objects such as sheets of paper, telephones, and calculators can also coexist on the same work table.

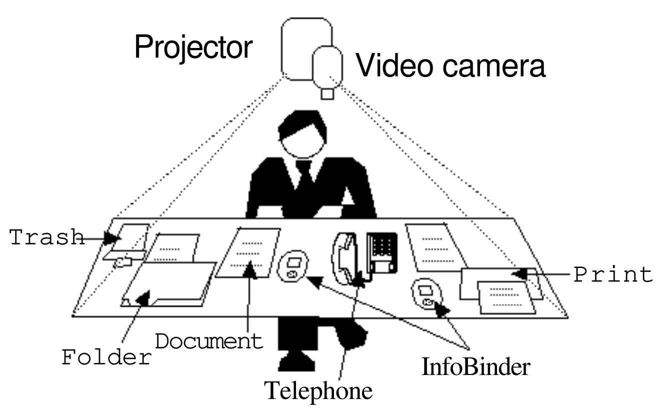

Figure1. Virtual desktop system

2. Issues in virtual desktop

InfoBinder is intended to resolve the following issues in virtual desktop systems.

1. Projected objects are difficult to handle because they have no solid bodies that can react to manipulation by the user.

2. Real and virtual objects on the desktop could work cooperatively, that is, the functions of real objects could be expanded by means of a virtual objects. For example, projecting a list of phone numbers could give a telephone an additional function as an online directory. It should be easy for users to add the new functions to real objects and to understand them.

3. InfoBinder hardware

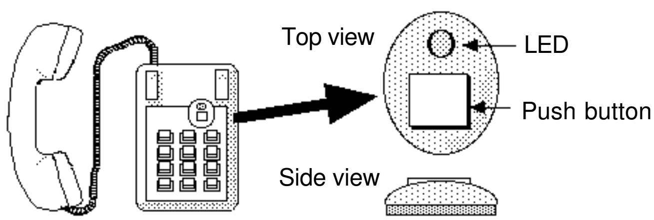

Figure 2.
Right: InfoBinder device
Left: It can be attached to a real object such as a telephone by velcro

Figure 2 (right) shows an InfoBinder, a small pointing device less than 2 inches long, with a push button and an LED. When a user pushes the button, the LED is lit by a battery inside the device. The position of the device is detected by means of a video camera positioned over the table that senses light from the LED, as shown in Figure 1.
The light from the LED is modulated to carry a unique ID number for each InfoBinder. This mechanism allows each InfoBinder to be identified. More than one InfoBinder, each with a unique ID number, can be used at the same time on the desktop.

4. InfoBinder mode

InfoBinder works in two modes:

1. Pointing device mode

This is the initial mode. An InfoBinder works like a conventional pointing device such as a mouse. It can manipulate open objects in window form.
When a window is closed, the InfoBinder goes into the information binding mode.

2. Information binding mode

Each InfoBinder can hold an object if the object's windows is closed. This follows the analogy of a paper binder that holds information written on sheets of paper. In this mode, the icon of the object follows the InfoBinder when the user drags the device. Since each InfoBinder is identified by a unique ID number, each can hold a different object.
When the device is double-clicked, the bound object is released and opened as a window. The device then goes into the pointing device mode.

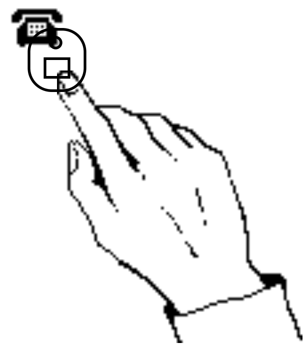

Figure 3. The icon follows when an object is bound to an InfoBinder.

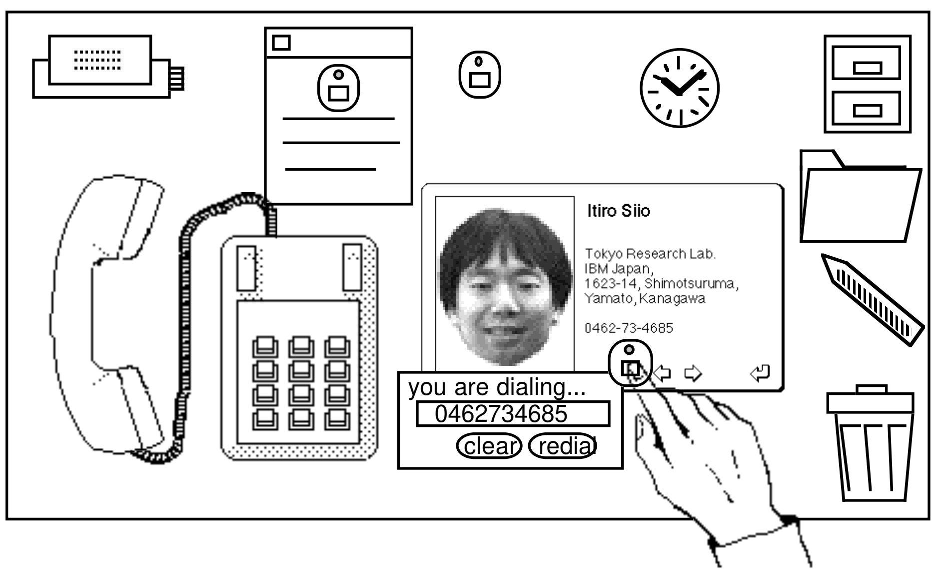

Figure 4. An example of online phone number objects.

5. Example of a telephone directory

To understand how the device is used, let us take an example in which it is holding an online telephone directory. A user can handle the device as if it were a real binder holding a bundle of papers on which phone numbers are written, and can arrange them, store in a drawer, or even move them to another virtual desktop connected by a network.
The InfoBinder can be attached to a telephone with velcro, as shown in the left side of Figure 2. Although the metaphor is a simple one of attaching a memo containing a phone number to a

telephone, it gives an ordinary telephone a powerful directory function. This is an example of cooperative work between a real object (a telephone) and a virtual object (an on-line directory).
To use the phone number object, the InfoBinder should be removed when it is attached to a telephone. If the device is dragged on the desktop, the icon of the object will follow the device (Figure 3). If the icon is double-clicked, a phone number window will be opened on the desktop (Figure 4). At this moment, the InfoBinder will go into the pointing-device mode, and the user can search for a number and dial it.
When the window is closed by means of the device, it becomes an icon and is bound to the device again.

6. Merits of InfoBinder

The InfoBinder device resolves the issues described in Section 3.
First, it provides a concrete representation of a virtual object. It gives solid bodies to icons. Users can handle the objects represented by projected icons easily, because they can feel a reaction, and could arrange, store, and carry such objects as if they were handling, say, a real paper binder holding information.
Second, the functions of real objects could be expanded by attaching the InfoBinder to them. In the above example, a simple telephone acquires an on-line directory and dialing function in cooperation with the projected virtual object. The InfoBinder shows this mechanism in an intuitive manner. Users can easily understand how to add and use the new functions.

7. Implementation

A first-stage prototype was built, using a Proxima projector and a video camera system. The projector and the camera were installed 140 cm above a work table with dimensions of 150 cm x 80 cm, and a computer image was projected on the table (Figure 1).
The prototype InfoBinder device has a red LED and a push-button switch. No ID function has been implemented yet. The position of the device is detected by the video camera system, and transferred to the mouse port of the computer.
An object-holding mechanism and a phone directory object have been implemented and tested in the HyperCard environment. A demonstration video tape will be shown at the conference.

Reference

1. Pierre Wellner, The DigitalDesk Calculator: Tangible Manipulation on a Desk Top Display, UIST '91, November 11-13, 1991. Hilton Head, South Carolina.