

Ubiquitous Interactive Displays in a Retail Environment

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Abstract

A steerable projector-camera system is used in a store to transform ordinary surfaces into interactive displays where customers look up products. Directions to products are projected on signage boards hung around the store.

1 A 13 Mpixel Ubiquitous Interactive Display

Several researchers have explored virtual interactive display systems that combine projectors with cameras and computer vision methods that detect interaction with the projected image (for instance, Crowley et al. [2000]). To increase the flexibility and ubiquity of such systems, we have been building steerable projector-camera systems — called *Everywhere Displays projectors (ED-projectors)* —, where a pan/tilt mirror deflects the light from the projector to different surfaces, while a pan/tilt/zoom camera detects interaction with the projected images (see Pinhanez [2001]). Since the mirror pans about 200° and tilts 40° , and given that in our projector each pixel covers a solid angle of approximately 1.8×10^{-7} steradians, the total number of interactive pixels that can be created is about 13×10^6 . However, a view of at most 800 Kpixels can be displayed at any given time, (6% of the total display).

2 A Ubiquitous Interactive Product Finder

We believe that the biggest potential uses of these 13 Mpixel ubiquitous interactive displays are in public spaces. ED-projectors can be installed on the ceiling, preventing accidental damage and discouraging vandalism and theft.

The first application developed for these scenarios is a system to help customers to find products in a large store. Figure 1 shows a conceptual view of the *ubiquitous product finder*. ED-projectors are installed in every aisle and small white boards placed in strategic locations on the shelves. These passive boards can be easily moved to different positions to respond to marketing and customer needs. A large table is placed at the entrance to the store (the right side of Figure 1). On the table, a large version of the product finder interface is projected so customers can get acquainted with the system. Signage boards are hung from the ceiling, allowing the system to show directions to the product requested by the customer or to display advertisements when the system is idle.

Figure 2 shows a fully functional laboratory prototype of this application using a single ED-projector. As the user enters the space, a list of product categories is projected on the table. The user can move the wooden red slider on the left of the table to find a product as shown in Figure 2.a. As he does this, the product list scrolls up and down mirroring the motion of the slider. The movement of the slider is detected by the camera without the help of any embedded sensor. Once the user touches the “where” symbol on the right, arrows guiding the user to the location of the highlighted product are projected on signage boards hanging from

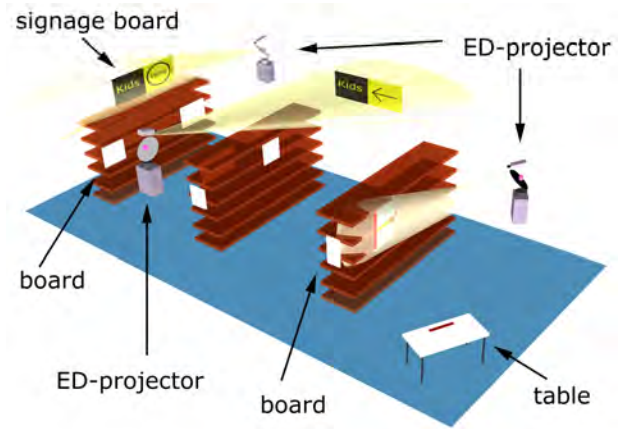


Figure 1. Concept of the ubiquitous product finder.

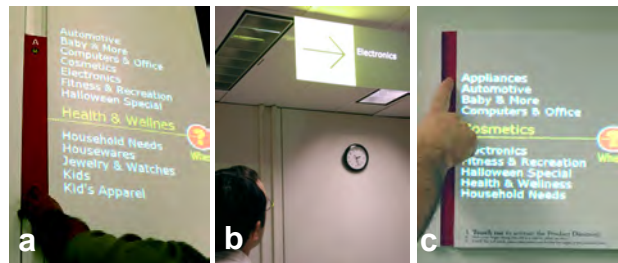


Figure 2. Prototype of the ubiquitous product finder.

the ceiling as shown in Figure 2.b. Smaller foam-core boards, visually similar to the table with the slider, are placed on the walls. Touching these boards (also detected by cameras) triggers the projection of the product finder interface as shown in Figure 2.c. In the wall version, the user slides his finger up and down a red velvet strip to scroll the product list.

An initial design walk-through study with a small number of subjects seems to validate the usefulness of the application. Some difficulties in seeing the directions projected on the signage boards were detected and we are currently exploring variations of the prototype design to solve the problem. Also, our current prototype does not address one important issue present in real stores: the ability to help more than one customer at a time. The severity of this is yet to be tested in a real-world deployment, but we expect that customers may tolerate reasonable waiting times, as the situation is similar to when they consult an information desk in a real retail environment.

References

- CROWLEY, J.L., COUTAZ, J. AND BERARD, F. 2000. Things that See. *Communications of the ACM* 43, 3, 54-64.
- PINHANEZ, C. 2001. The Everywhere Displays Projector: A Device to Create Ubiquitous Graphical Interfaces. In *Lecture Notes in Computer Science 2201*. Abowd, G.D., et al. Eds. Springer-Verlag, 315-331.

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