The Future of Signs:
Interactive Information, Inexpensively!

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Abstract

We present an inexpensive, interactive ubiquitous computing system that supports information presentation on demand using a novel "card reading" interaction style. We've deployed this system in our office as a means of supporting wayfinding, sales presentations, project context sharing, and notification (e.g., is there any free food in the kitchen?). However, since the system is essentially an information appliance embedded in our physical space, it also enables people to navigate through our information space—that is much more challenging and exciting.

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General Terms: Design, Documentation, Experimentation, Human Factors, Performance, Reliability

Keywords: Content management system, environmental user interface design, information architecture, pervasive information environments, ubiquitous computing, wayfinding.

INTRODUCTION

Despite a great deal of academic work, ubiquitous computing systems still have a reputation for being exotic, expensive luxuries [2]. This perception is an important barrier to the adoption of information systems that fade into the user's environment. We present an inexpensive, interactive ubiquitous computing system that supports information presentation on demand using a novel "card reading" interaction style. We have deployed this system within our offices at MAYA Design and use it to support wayfinding, sales presentations, project context sharing, and notification (e.g., is there any leftover free food in the kitchen?). Because its primary purpose is to assist people in navigating the physical space of our office, we call it the MAYA Wayfinding System. But because it is essentially an information appliance embedded in our physical space, it also lets users find their way through MAYA's information space; a much more exciting prospect.

SYSTEM GOALS

MAYA's office space can be somewhat confusing for new visitors. It has a complex layout, with many obscured sight lines. Traditionally, architects overcome such difficulties by adding a simple information layer to the space: signs [1].

Although signs work well, interactive and database driven ones provide much more flexibility, enabling a host of other applications.

Interactive signs can support us in sales efforts by displaying portfolio pieces on demand as we give prospective clients tours of the office. They can display meeting room availability dynamically, and list which people are in or out of the office. They can display simple signs that act as labels, or more complex signs (like maps or calendars). They can also display highly dynamic information, (e.g., when the next bus is leaving outside the office). They can even present information custom-tailored to the particular person viewing the sign.

Clearly, a dynamic information system like this is a valuable addition to a physical space. The problem is simple: signs are cheap. Dynamic displays are not. Consequently, we made it part of our goal to re-use as much information technology as we could. We didn't want to develop special hardware, and we wanted to develop as little special software as we could, while still providing an exciting and useful new kind of experience.

DESIGN AND IMPLEMENTATION

We decided we wanted six interactive locations in the office, each near a meeting room or common space. Each location should support all of the features mentioned in the "System Goals" section.

For hardware, we used obsolete laptops. We modified the screen hinges so that the laptops could be made to open flat, covered the keyboard and trackpads with foam core, and hung them on the wall at each location. Each was connected to our network.

This solution produced nice screens, but left us without any way of providing input other than through the network. Rather than require people to use a network-capable PDA to manipulate the signs, or a cumbersome keyboard, we attached an inexpensive barcode reader to each laptop, exposing the reader in a slit at the bottom of the sign. We then printed barcodes on cards that would cause the sign to react in different ways. These cards are hung on the sign itself or, for user-specific features, are carried around. This provides a pleasant interaction style: if you want to see if there is food in the kitchen, grab the "food" card and swipe it through the reader. The sign displays a photograph of the kitchen table for thirty seconds, and then returns to what it was displaying before you swiped the card. If you are a client and want to know details about your meeting schedule, swipe the card

we gave you when you arrived in the morning and the system will present your schedule.

We used a more artistic (and more expensive) hardware design in our entrance area. We hid an LCD projector in an overhead light fixture, suspended above a glass table. On the table we placed a faux newspaper, all of whose pages were blank but for a single barcode. When opened, the newspaper covers the table. On the edge of the table we placed a vase filled with flowers that concealed a more expensive omni-directional barcode reader. When the pages of the newspaper are flipped, the projected image changes dynamically, updating the newspaper on the fly. People find this effect rather charming (and are surprisingly often unable to locate the suspended projector).

We also integrated a more old-fashioned kind of dynamic sign: a six-foot scrolling LED display similar to those found in bus stations and stock exchanges. It lacks the ability to present media-rich content (such as our portfolio pieces), but is good for displaying simple notifications. We control it using the same system as the other signs.

Each sign is running a simple application written in Macromedia Flash. It is basically a control loop that listens to the barcode reader, and opens a network connection to a server. It sends the scanned code to the server, which sends back an XML file describing what content to fetch and display on the sign. This content can be as simple as a single image, or it can be a complex animation that pulls more data from the server. If there is no code to be scanned, the Flash script asks for a default playlist tailored to its location instead. In this way, the client code for the signs is kept extremely lightweight and simple, and very extensible. As we design new features, we don't have to change the signs at all. We simply print a new barcode; update the server with content to match that barcode, and everything works.

On the server we keep most of our content in a standard Microsoft Access database. We wrote a simple web-based content management tool that lets administrative users control which sign is displaying which content by default, and edit things like the employee in/out list. This tool simply edits the database; thus the signs automatically reflect the changes. Since we have an XML based middle tier, we can support multiple clients (Flash driven signs or LED displays) and multiple back-end data sources (such as the Web for bus schedules) quite simply.

CONCLUSION AND FUTURE WORK

We produced an inexpensive interactive display system suitable for use as part of a physical space. It implements wayfinding, sales support, and a variety of other useful features. It was developed using hardware we either already had (and considered obsolete) or could buy cheaply. It was developed using standard commercial software, plus some custom code for the clients, the middle tier, and the content management system.

Given that dynamic interactive signage can be developed inexpensively, we feel that future work should focus on integrating it cleanly into physical spaces. What are the architectural ramifications of dynamic information in a physical space? Can it be provided reliably and tastefully? Given that information technology becomes dated or even obsolete far faster than a building does, what does that imply for the design of such a system? We are currently investigating these issues both internally and with clients.

ACKNOWLEDGMENTS

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