“In Your Space” Displays for Casual Awareness

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ABSTRACT
We demonstrate several of our current explorations aimed at bridging the gap between digital information and the physical spaces in which people work and collaborate. These include casual displays, such as large LED signs to provide information relevant to a group in their open spaces, and a system that allows a wide variety of electric devices to represent awareness information of people and collaborative work. A major design goal was to use readily available, off-the-shelf devices, components and protocols so people could use them easily in their own settings with information that is meaningful to them.

Keywords
Awareness, Casual Displays, Opportunistic Collaboration, Physical Devices

INTRODUCTION
As collaborative work becomes increasingly mediated by computers much of it recedes from public view, becoming visible only through an individual’s computer screen. A number of researchers have explored ways of bridging the gap between digital information and the physical spaces in which people work and collaborate [1,2,4,5]. Our work follows in this tradition, but aims to move these ideas out of the lab so we can understand how people will use them in the real world settings in which they collaborate electronically. This drove our need to develop flexible, robust, and easily deployable tools that connect to standard collaborative applications such as Lotus Notes email and discussion databases and the Lotus Sametime synchronous infrastructure which supports functions like buddy-lists and chat.

DEMONSTRATIONS

Casual Information Displays
While technology has increased the amount of information available at our desktop, access to information at other times and places is still somewhat limited. A current Lotus Research project is investigating the use of "casual" information displays to keep people informed while out of their offices. Casual displays are those that are not intended for a person to sit down and work at and include such things as scrolling LED signs and spoken background audio. We have built a prototype display server that takes requests from any number of information-providing clients (e.g., Sametime user awareness, group calendars with reminders of meetings and talks, mail-in message databases, web-based weather and stock prices) and drives any number of casual displays. Our goal is to keep people informed of group-relevant information as they move around the environments in which they work, and to place digital information in common areas as a focus of shared experience and conversation. The LED display we are using in our initial prototype is located in our group’s main entranceway, which also serves as our common printer area. (Figs. 1,2) We have already observed a number of occasions in which information on the LED screen has prompted new discussions.

Figure 1. The LED sign placed in our group’s entrance and printer area.

The Casual Display server is implemented in the Java programming language and runs on the Sun Microsystems JRE 1.3. It is designed to be scalable and can handle both multiple simultaneous connections from clients and support a variety of displays devices.

Figure 2. Examples of messages displayed on the LED sign. Longer messages scroll automatically.

On startup, the server checks for available Casual Display devices and loads the appropriate Casual Display Writer (CDW). A CDW is a Java class which translates the server's internal message queue into a device-specific byte stream. The messages to be displayed are represented in a Casual Display Markup Language (CDML), based on XML, until they pass through the device interface layer. At this point the messages are converted from CDML into the device-specific byte-stream using an XSL transform.

CDML is specifically tailored to the properties of casual display i.e. low bit-rate and low-end display capability. The root element of a CDML file is a slide-set, which consists of one or more slides. Each slide in turn contains the actual text of the message. Slides may contain different messages or be used to break long messages into smaller pieces.

A client connected to the server can send an instruction to add, delete or change a message. Clients can only delete or change a slide-set that they have previously sent to the server. The client sends the CDML slide-set to the server which in turn pushes the message into the queuing layer. During the session, a start and end time for displaying the slide-set can also be scheduled. At the scheduled time, the queuing layer dispatches a message to the driver interface, which results in the slide-set being displayed or removed. The slide-sets are stored in non-volatile memory so that the server can be restarted without losing current messages.

This general server architecture has been tested with a variety of display devices including WAP-based cell phones, speech synthesizers using VoxML, programmable LED signs, and Palm Pilots with infrared beaming capability.

Sametime Control of Electric Devices

When people share a common space, many clues naturally contribute to a background sense of situational awareness. This includes knowing who is around and having some idea of what they are doing. People notice colleagues coming in and out of their offices, and are aware of their activity as they talk on the phone or move around their office.

Tools such as Lotus Sametime and AOL's Instant Messager buddy lists provide a sense of awareness to colleagues who are not colocated. These require deliberate activity by the user to check a person's availability; the user must look over to the tool's window (and occasionally foreground it), and locate the relevant name in a list to observe the status. Through our experiences using the Sametime Connect client and Prairie Dog, its experimental predecessor, we have found that there are several classes of people about whom users would like awareness information. These range from colleagues in the same team who are generally online and with whom they have tight, frequent interactions, to members of an extended community who are rarely online but whose presence might lead to opportunistic interactions. Our goal is to provide awareness of such people in a background, non-disruptive yet non-fleeting way, without requiring users to continuously monitor an onscreen display.

While we initially considered auditory cues, the momentary audio alerts provided by current awareness tools are ephemeral, indicating that someone has "arrived" or "left" only at the time the status changes. Although others have explored the use of environmental sounds [3], these can be distracting and intrusive.

Our current system hooks the Sametime API to an X10 home powerline controller, allowing us to control an electric socket that goes on whenever a designated Sametime user or group is online (Fig.3). The outlet can also be dimmed to reflect such things as the percentage of a group's members who are online or the recency of a user's activity. We chose X10 as the underlying controller technology because there exist many API's for it, it is inexpensive and off-the-shelf, and it has been in existence for many years. X10 technology uses existing power lines to control X10 modules into which lamps and appliances can be plugged. These modules can be controlled by computer through an additional plug-in module connected to the serial port.

Figure 3. A desklamp that goes on whenever a specified colleague is available online.

We use a combination of Lotus Sametime, Lotus Notes, X10 modules, desk lamps, and bubble columns to facilitate peripheral awareness of online activity. Our software provides two methods of controlling X10 devices: one at the serial port on the user's computer, and one as a TCP/IP X10 server on a remote computer. The server architecture provides a single point of coordination for X10 requests from a number of people, and does not require that they continuously dedicate a serial port.

The architecture is written in Java, using existing Lotus Sametime, Lotus Notes, and X10 API's. The program uses a model/view/controller architecture and the JDK 1.1 event model. The program fires X10 NotificationEvents in response to Sametime events. Our software also enables the use of infrared proximity detectors which send RF signals to an X10 connected transceiver to set Sametime status and messages based on physical presence *("Online but out of the office")*.

A GUI is being constructed to mirror the existing Lotus Sametime Client, allowing users to specify peripheral awareness of both people and groups from the same tool they use for traditional PC-based awareness monitoring.

Representing Collaborative Activity with Electric Devices

When people work with physical artifacts in shared spaces, much of their activity is visible to others, aiding coordination and increasing opportunities for collaboration. A commonly reported problem with discussion spaces on the web or in Notes databases is that people are unaware of new activity unless they deliberately check for it.

We are exploring ways of using the X10 server and architecture described above to make activity in Notes visible in the physical environment (Fig. 4). To this end, we have implemented a Lotus Notes agent that triggers X10Notification commands in response to events such as new mail arriving or new contributions on a specified topic in a discussion space.

We are also developing frameworks to help us map between such events and appropriate ways of representing them with physical devices and device behaviors. These clearly need to be sensitive to context and content. For example, one might want a light indicating new material in a database to get dimmer over time if the database contained current news, but brighter over time if the database contained problem reports that would become more critical as more time passed without their being resolved.

Figure 4. A "Bubble Lamp" whose luminance and bubble flow reflect activity in a discussion database.

Ongoing Research

We are working to deploy the technologies described here in a wide variety of field settings so we can observe and understand how people use them, where they add value, and what modifications to our tools and infrastructure may be required.

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