Location-Dependant Domestic Information Appliances

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1. Introduction

Domestic computing researchers study the use of information within various home settings. Their hope is that new technologies will help people manage existing information as well as the influx of digital information without radically disturbing their home environment. Yet unlike goal and task-driven behaviours typically found in work settings, people in domestic environments do their 'work' in quite subtle ways. These often arise from the habits, opportunities and expectations encountered as people move through their household routines [9]. Exploiting these routines may lead to the Calm Technologies as originally envisaged by Weiser and Seely-Brown [10], where technology is integrated into the home so that it exploits rather than disrupts normal routines.

The area we are most interested in is *home information*: any item in the home that is used to communicate with other members of the household or between the home and the outside world. Homes are currently filled with paper information: paper on tables, counters, desks, bulletin boards, and walls, including notes, calendars, reminders, to-do lists, mail, messages, letters, and pictures. What is important is that individuals within a household add value to this information by the way they place it in specific locations, where locations exploit the daily routines of its occupants [2,3,5].

While paper practices work well, dynamic digital information is becoming increasingly relevant within the home. This includes new information (e.g., arising from RSS feeds, alerting services) and old information as paper moves to digital forms (e.g., digital home calendars, photo sharing). At issue is how this digital information is displayed and managed within a domestic environment. Today's desktop computers are not the best answer, for they stand apart from family routines. For example, when a home inhabitant wishes to know the state of some digital content, he or she must "go to the computer," which is typically located in an out-of-the-way corner and devoid of social meaning. They must turn it on and navigate, search or poll the information that they require, be it a phone number, the details of an errand, whether an email has arrived, or the weather. Much of this is because digital devices, like computers, are still primarily designed with an office setting in mind. For digital information to be useful in a domestic setting, it has to spread throughout the home [2,3,5,6]. It must exist in and be a part of the various places of communication.

Our overall research goal is to design information management and display technologies for the home. The specific goal of the work presented in this video is to create information appliances whose purpose depends on its location within the home. Another paper [5, in submission] lays the intellectual foundation behind the design of these appliances as well as their implementation details. This video focuses on illustrating the system and providing a sample scenario of use.

2. Location-Dependant Information Appliances

Prior research shows that people locate information in the home in a way that exploits the properties of those locations [2,3]. Location determines when and how others see that information; it frames

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expectations of timeliness as people pass by these locations when doing their routines; and it determines who attends that information by the ownership implicitly associated with a location [5]. Our idea is that people should be able to repurpose information appliances by these contextual locations: people assign information to a location, and that appliance then automatically displays that information when it is moved to that location. Moving the appliance to another location changes what it displays.

2.1 Scenario

Kathryn is particularly interested in monitoring her husband's availability in her instant messenger (IM) on a particular day as she needs to talk to him. Using a special 'IM card' associated with her husband's IM state, she links the information to several relevant locations in her home (by swiping the card over special bases at those locations): next to her home office computer, and on the kitchen countertop. While working in her home office, Kathryn places an appliance (e.g., Figure 1) on that location and the device shows her husband's IM state. Later, she leaves her office to prepare lunch and moves her appliance to the kitchen location; it too directs the appliance to show her husband's IM state. Alternatively, she could have placed different information appliances at both locations, and the appliances—regardless of their form factor—will immediately display the IM state in a meaningful way. After finally contacting her husband, she changes the meaning of the kitchen location to display family reminders that she and her family will see as they come home and move about the house. Using a special 'reminders card', she reassigns the meaning of the kitchen location to show reminders. Now, any appliance placed on that location shows reminders instead of her husband's IM state.

This scenario shows a fairly dynamic use of locations. In practice, many locations will be assigned quite stable information, e.g., electronic billing status associated with a paper pile of bills on the household desk, IM state of a parent next to their photo on the mantle, late items (books, DVDs) near the front door. The key point is that it is the home inhabitants that decide what meaning is assigned to a location, and the appliance then shows the relevant information as best as it can.

2.2 Abstract Appliances

We have built six simple prototype appliances, illustrated in Fig. 1, using (with one exception) Phidgets hardware [7] and physical prototyping materials. All appliances also contain RFID tags that identify the appliance type. Each device also includes 'on demand' capabilities (a touch sensor or button) where people can query the appliance for further information. The appliances are not tied to any particular information sources. Instead, their various display properties are mapped onto one or more of five data representations, where each serves as a data abstraction making the appliance less dependent on a specific information source. For example, a single light on an appliance may be abstracted from a binary representation (on = true, off = false), while a moving component (e.g., a gauge) may have its position abstracted to display a continuous value in a range. The five states are:

- **binary:** either true or false,
- **discrete:** several discrete or distinct states,
- **continuous:** a value within a continuous range,
- **textual:** purely textual or numerical information,
- **multimedia:** could include images, sound, video, links etc.

Figure 1. Six location-dependant Information Appliances

We can now describe our appliances in Fig. 1 in terms of these data abstractions.

a) **Text LCD** is a very simple text display that allows 2 lines of 20 characters each to be shown at once. A button cycles through additional lines.
b) **Flower in Bloom** [8], is a flower that partially blooms to correspond to a continuous value.
c) **Picture Frame** is a display that shows multimedia images such as photos.
d) **FlowerBud's** single flower contains multiple LED lights (to make them visible in well-lit rooms) that can be collectively turned either on or off; it is a binary display.
e) **FlowerPots** is a discrete state display consisting of eight LEDs—four red and four green—embedded in the centers of felt flowers. Each light can be lit alone or in combination.
f) **GloLamp** is another discrete state display consisting of a small lamp and a rotating shade. The shade has five different colored panels on it, providing five different states.

2.3 Information

Various data sources are collected from small custom applications; each transforms that information into the above abstract representations. These abstractions are then fed to a central server. When a device is placed at a location, it queries the server for the transformed information associated with that location (see 2.4), but only displays the information that is appropriate for the device.

2.4 Location

Devices become associated with the data stream by the use of *smart locations*: locations that are aware of the information associated with them and what appliance is currently placed there. The smart location is a base that contains an RFID reader (Fig 2a) connected to a server. Each data stream is associated with an RFID tag (done through a separate process), and waving the tag over the base tells that location what data it should display (Fig. 2b). When an appliance is placed on the base (Fig 2c), the base uses the appliance's RFID tag to determine what kind of appliance it is. Finally, it displays the associated data in a way that best matches the device's capabilities.

Figure 2 a) Smart location base. b) Information card assigns a data stream to a location. c) Appliance placed on a base.

2.5 Example

Consider weather information. The custom application collects the raw weather information (e.g., an RSS feed, an alerting service, or scraped from a polled web page) and transforms it. Its binary representation could be true if the weather is worse than the seasonal norm and false if it is not. Its discrete representation could indicate a 4-state progression from sunny, to sun and clouds, to cloudy, to raining. A continuous representation might map the current temperature from the range -40 to +40 C^{o}. Its multimedia property may be a weather map, while its textual property may be a weather synopsis. After the data stream client composes this information, it publishes it to a notification sever containing a distributed, persistent shared dictionary [1]. At the same time, a person can create a 'weather card' by passing it over a reader attached to the computer.

When a person passes the weather card over the base (Fig. 1b), the base automatically associates itself with the weather data stream. When the FlowerBud appliance is placed on the base (Fig. 1c), the base recognizes it (from its RFID tag), looks up its type, and activates its binary status based on the binary representation of the weather data.

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DIRECTIONS IN PERVASIVE COMPUTING AT THE iLAB

Moving a Media Space into the Real World Through Group-Robot Interaction

James E. Young, Gregor McEwan,
Saul Greenberg, Ehud Sharlin

Group media spaces are often static and separated from the physical world.

AIBO Surrogate uses a robotic dog to enable distributed group members to extend their interactions into the real world, operating across an office, city, or from anywhere in the world.

All group members can collectively see what the robot sees, and control its walk, gaze, and actions.

Integrated into the CommunityBar groupware system.

Collocated users get physical presence of the tele-embodiment of the distant group.

Location-Dependant Domestic Information Appliances

Kathryn Elliot, Mark Watson,
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Saul Greenberg

Our ethnographic studies show that people contextualize information in the home by location.

We constructed small displays and distributed them across the home. Each knows its location, and displays information appropriate only to that location.

For example, a device placed in the family room might show a relative's IM status and, when moved to the front door, a list of overdue library books.

A device used to display the contextual information at a given location

RFID tags used to set the context of a location

A base used to mark a location. Contains an RFID reader and a USB hub.

Feline Fun Park: A Distributed Tangible Interface for Pets and Owners

James E. Young, Neko Young,
Saul Greenberg, Ehud Sharlin

Pet owners often leave pets unattended for long hours while away from home.
Advanced technology should benefit *all* family members.

We offer a cat toy that
- senses cat activity
- responds by activating motors and lights
- reports activity to remote owner
- owners can remotely play with their pet

Interactive, distributed pet entertainment not possible with traditional toys.

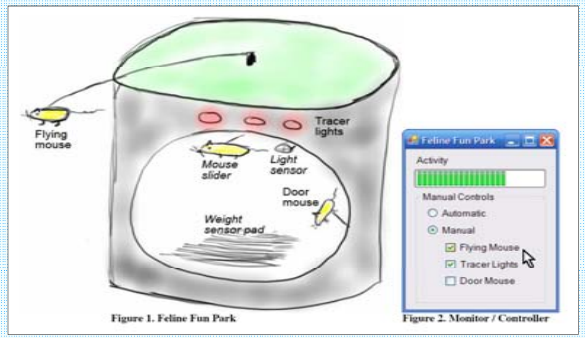

Figure 1. Feline Fun Park

Figure 2. Monitor / Controller

iLab = Interactions Lab, University of Calgary

See videos and papers at: http://grouplab.cpsc.ucalgary.ca

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