Context-Awareness in Wearable and Ubiquitous Computing

Gregory D. Abowd, Anind K. Dey, Robert Orr & Jason Brotherton
GVU Center & College of Computing
Georgia Institute of Technology, Atlanta, GA USA 30332-0280
{abowd, anind, rjo, brothert}@cc.gatech.edu

Abstract

A common focus shared by researchers in mobile, ubiquitous and wearable computing is the attempt to break away from the traditional desktop computing paradigm. Computational services need to become as mobile as their users and be extended to take advantage of the constantly changing context in which they are accessed. This paper will report on work done in the Future Computing Environments Group at Georgia Tech. We describe solutions we have generated to provide a flexible context-aware infrastructure and several applications that take advantage of context-awareness to allow freedom from traditional desktop computing.

Keywords: Context-aware computing, ubiquitous computing, tourism, voice-only interaction.

1. Introduction

Researchers in the fields of wearable computing, mobile computing, and ubiquitous computing agree that it is time to shift our research focus away from the traditional paradigm of desktop computing. Rather than force the user to search out and find the computer's interface, our new aim is to provide an interface that can take on the responsibility of locating and serving the user. In this poster, we present a summary of our research in context-aware computing to support this shift away from the desktop. We have created some general mechanisms and architectures to support context-awareness and justify their utility here through a number of case studies of applications that benefit from context-aware services. The four projects reported here form a summary of research within the Future Computing Environments (FCE) Group at Georgia Tech. Greater details of each project can be found at our Web site (http://www.cc.gatech.edu/fce).

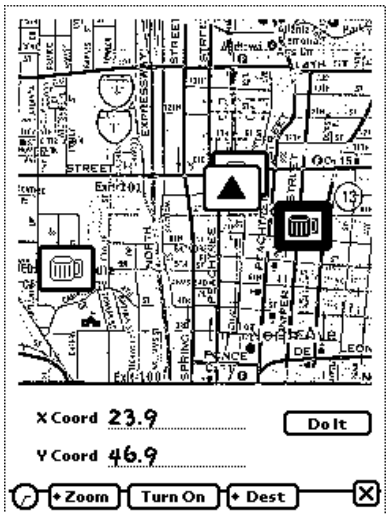

Figure 1: The CyBARGuide interface: an interactive map indicating user's location (arrowhead) and location of establishments previously visited (beer mugs)

2. CyberGuide: Using location to provide context

The CyberGuide project [1] was initiated to experiment with location and orientation as a context cue. We have developed a number of CyberGuide prototypes that support both indoor and outdoor tours. Figure 1 shows a version of an outdoor CyberGuide used for touring local establishments in Atlanta. As the user moves around, her location is updated on the map. She can explicitly query the map for information on the local surroundings, or that information can be automatically provided using a proximity algorithm. We have experimented with capturing historical context (sights already visited), and are interested in capturing users' reactions to exhibits and locations of other users for use in suggesting places of potential interest.

3. CyberDesk: using informational context to automate service integration

In the CyberDesk project [3], we use informational context to aid in the integration of user services. Informational context refers to any artifact (e.g. words on a screen or a picture at a museum) that a user is attending to. Examples of user services are an e-mail browser, Web-based map service, or contact manager. CyberDesk uses informational context to change the set of resident services and offer relevant suggestions to the user. For example, as shown in Figure 2, a user can be reading an e-mail message which has information (Web address and e-mail address) on a new book written by a favorite author. The user highlights the e-mail address (a), explicitly announcing the context. The system gives him some suggestions (b) on what he can do: search on the author's name, save the contact information, call the author, or send an e-mail. The user chooses the first two options (c and d) and saves the e-mail.

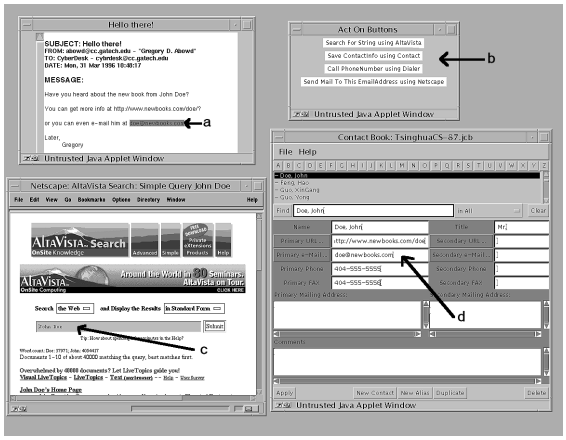

Figure 2: A CyberDesk scenario.

4. Savoir: using physical and informational context to support more effective voice-only interaction

In the Savoir project [4], we are exploring a number of issues related to context-awareness and voice-only computer interactions. We have developed a Wizard-of-Oz infrastructure that allows a user to retrieve information from the Internet using a telephone. We are currently developing an interactive tour guide facility, using this infrastructure, that utilizes position data. It will interpret a user's voice commands and use position data to help predict what information a user might request. Our aim is to enable a user to travel from place to place and to request and receive relevant information based on location and other contextual information (e.g. time of day, user history). In Savoir, we use informational context (since user requests are likely related to information recently heard) to provide the speech recognition engine with a relevant grammar, improving recognition of continuous speech. We also plan to use physical context in this way. If a user is standing in front of a bank, we would load a grammar containing the words 'money' and 'account'.

5. Classroom 2000

Our final example application, Classroom 2000 [2], involves the use of ubiquitous computing in education. It attempts to augment both teacher and student in a lecture-room environment. The purpose of Classroom 2000 is to use automated tools to capture different streams of classroom activities, such as prepared lecture materials, audio, video, and handwritten notes on an electronic surface. The captured material is then integrated together and made accessible via the Web to provide a facsimile of the actual classroom experience. The most obvious use of context is the time at which different events occur. We provide a lot of synchronization of class materials based on common times (e.g. linking handwritten notes on an electronic whiteboard to the lecturer's audio track). If the system could detect when a student becomes confused, it could provide a pointer during review that would bring up the various streams of activity when the confusion began.

6. References

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