

Ubiquitous Computing for Face-to-Face Collaboration

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ABSTRACT

This position paper describes our research initiative in the area of computing support for face-to-face collaboration. Ubiquitous computing has the potential to positively impact how users interact in co-located environments. However, it is essential that we explore issues from the perspective of the user to minimize the growing complexity associated with multiple heterogeneous devices and the plethora of networking technologies. Within this research area we present and discuss our ideas related to device integration, contextual awareness and mobile computing.

Keywords

collaboration, awareness, integration, mobile, heterogeneous devices, groupware, wireless networks.

1. INTRODUCTION

In the business world, it is not uncommon for a single businessperson to carry a laptop computer, a personal digital assistant (PDA), and a mobile phone. For a business presentation, the businessperson may also bring a liquid crystal display (LCD) projector to a meeting, or to a client's office, he or she may bring a portable printer. However, though all the devices belong to this single businessperson, each intelligent device acts separately with minimal cooperation between the other devices. The laptop may attach to the projector for a PowerPoint presentation, the PDA may synchronize with the laptop, but the environment is device-centric, and the businessperson must configure the devices individually to work together. In a network view, the world would see each device individually, but belonging to the businessperson.

Our interest in this area of research is to develop applications and devices that facilitate and improve the way people collaborate in a face-to-face environment. We believe the work environment must be replaced with a user-centric paradigm. In a user-centric environment, there may be one user with a number of devices. The devices and the applications should be integrated to allow the user to perform tasks using the devices best suited for it. Configuration of the devices should be minimal, with very little administrative overhead.

Inversely, there may also be devices that have more than one user, such as a large screen display. Again, a user-centric environment should allow multiple users to seamlessly interact with shared resources. Instead of a multi-user device being associated with only an individual person, all users of the device should have the capability of being represented within the system

Finally, people in a face-to-face environment often need or want to collaborate with others. It is important that applications and devices support this process and allow users to move seamlessly between independent and collaborative work.

Our research in the Exploring Dynamic Groupware (EDGE) Lab at Simon Fraser University focuses on finding innovative ways to

support users face-to-face collaboration. This position paper discusses our main research theme related to collaboration across heterogeneous devices as well as our current projects related to the theme of this workshop. This workshop is timely in that it will contribute significantly to our current research and help shape our ongoing work.

2. RESEARCH THEME

The major theme of our research involves integration of devices and applications to support face-to-face collaboration across devices. To fully realize the vision of ubiquitous computing, it is essential that applications and services on multiple heterogeneous platforms be able to work together. In addition, the functionality of these platforms should compliment each other rather than overlap. Our research in this area focuses in three main areas: integration, awareness and mobile computing.

Integration: Our aim is to develop devices and applications that integrate seamlessly to promote a user centric environment. This integrated environment will support collaboration across multiple heterogeneous devices. The key is to provide an effective user model to support this infrastructure where users can easily move between devices and utilize each to its full potential. This builds on previous work by Want et al. [6] looking at causal interaction and context sensitivity.

Contextual Awareness: Understanding how devices and services function in different contexts and utilizing that information is also a focus of our work. In particular, awareness of proximity can be utilized in a face-to-face environment to facilitate interactions. For example, when people are in close proximity to each other, they can take advantage of physical gestures that may be more natural than interacting solely through a graphical user interface. As well, face-to-face collaborative environments can be very dynamic in nature, where activities change frequently, roles change, and even the environment changes. Having a system of passive awareness, and dynamic access controls will allow users to collaborate in the ways they want too, rather than be tied to the controls of the system [3, 4].

Mobile Computing: As computing extends beyond the desktop computer to mobile devices, it is important that we investigate issues surrounding variable connectivity, particular in cases where only a peer to peer network is available between multiple co-located devices. This issue of ad-hoc networking will become important as the proliferation of short-range wireless networks becomes more widely available. Again, our focus is to provide a user centric approach to enable people to work together while minimizing the overhead required of the user. This relates to the work on nomadic computing by La Porta et al. [5].

3. CURRENT PROJECTS

The EDGE Lab has two major projects exploring issues related to the theme of this workshop. The first project, in partnership with Synchronpoint Wireless Inc. (a local start-up company), is focusing on developing testbed business applications to explore collaboration across heterogeneous computing devices. This testbed environment will include the following features:

- Communication between heterogeneous devices (e.g. PDA's, laptops, tablets, desktop computers, and an electronic whiteboard) where each device can be utilized to support tasks that are best suited to it.
- A wireless network – initially an 802.11b wireless LAN and Infrared (IrDA) communications, and Bluetooth™ in the future.
- The creation of ad-hoc groups [1], where users can easily create informal groups. Discovery tools will enable applications and services to be found depending on the user's connectivity.
- A method of detecting proximity.

Once the testbed environment has been developed, we will explore various user interface issues to support collaborative activities across devices. The focus will be on how aspects of the interface can be simplified when users are in a face-to-face environment, taking advantage of gestures and verbal interactions that occur in face-to-face environments.

A second project we are pursuing will utilize the above developed infrastructure, but from the perspective of entertainment. In cooperation with Electronic Arts, we are developing the E³ (E-cube), an *Extreme Entertainment Environment*, to begin exploring issues surrounding face-to-face entertainment in living rooms of the future. We are developing a multi-user game environment that will utilize many aspect of ubiquitous computing, including a variety of heterogeneous devices, shared artifacts, tangible interfaces, etc. By focusing on entertainment in this project, our main goal will be user satisfaction and engagement, trying to find ways to ensure that the computing aspects do not interfere with the main goal of having fun.

While both of these projects are just beginning, our earlier work in this area explored the concept of supporting face-to-face collaboration with handheld computers. Our first testbed environment was Geney™, a game to encourage children to explore genetics concepts utilizing Palm™ handheld computers [2]. The focus of this research was to investigate how “personal” devices, such as PDA's, could be utilized to support face-to-face collaboration, in particular, for collaborative learning.

In collaboration with Synchronpoint Wireless Inc., we also created a second prototype application, Meeting Cards, using handheld computers and Bluetooth wireless networking. Meeting Cards, utilizes short-range wireless technology to improve the way business people conduct meetings. The application provides functionality to trade business card information via Bluetooth, and then provides a graphical representation of the information, which the user can manipulate to maintain a seating plan during a meeting. Again, the focus was on providing functionality to facilitate users' interactions in co-located environments.

4. CONCLUSION

In conclusion, this research initiative begins to explore some of the many issues that are arising in ubiquitous computing. Our overall research goal is to develop new approaches to support face-to-face collaboration using multiple heterogeneous devices. The widespread use of mobile devices and the emergence of ubiquitous wireless networks is creating new opportunities to support users' daily interactions and to provide a positive user experience. Our focus, particularly in the area of face-to-face collaboration will bring an important perspective to this workshop and insights gained during the sessions will help shape research directions for ubiquitous computing.

5. REFERENCES

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