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DTMap Demo:Interactive Tabletop Maps for Ubiquitous Computing

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Abstract

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DTMap Demo: Interactive Tabletop Maps for Ubiquitous Computing

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ABSTRACT

Interactive tabletops are an increasingly common form factor for group collaborations. Visual data, such as maps, are particularly well-suited for interactive tabletop applications. In this demonstration we present *DTMap*, a prototype application developed to illustrate the power of combining visual data with a multi-user tabletop environment. It was developed for DiamondTouch (DT) [2], highlighting DT's unique ability to support simultaneous input from multiple users and to identify the owner of each touch. A multi-user interactive tabletop that facilitates direct-touch manipulation of user interface elements provides a shared focus of attention for collaborating users, and has the potential to make a strong contribution to ubiquitous computing environments.

INTRODUCTION

Historically, tables have been virtually ubiquitous in collaborative meetings. Computationally, however, tables have not kept up with wall displays in today's meetings spaces. Recent technological advances in multi-user input devices (e.g., DiamondTouch[2], DVIT[4]) make computatiaonlly-augmented interactive tabletops an attractive addition to ubiquitous computing spaces. In contrast to projected-wall displays, interactive tables have the major advantage that users can place paper, devices, and even coffee cups on top of them. Tables change the dynamics of collaboration by supporting better eye contact and democratic seating arrangements; the information flow and interaction is typically many-to-many, although one-to-many is supported as well. Seated meetings require less physical effort than standing at a wall, and have more socially acceptable interpersonal arrangements.

Visual data is particularly well-suited for tabletop displays, as it minimizes some of the orientation and readability issues found with text-based data. "Maptop" displays, featuring a birds-eye-view of some region, are particularly compelling when displayed horizontally, such as onto a projected-tabletop display. Using Magic Lens [1] techniques, we can provide access to multiple layers of information about a particular spatial region, in essence combining multiple maps into a dynamic, interactive display. DTMap provides a multi-user, tabletop display for maps exploiting Magic Lens interactions customized on a per-user basis. The demonstration was developed using DiamondTouch technology.

Underlying Technology

DiamondTouch is a multi-user, multi-touch technology first presented at UIST 2001 [2]. It allows multiple people to simultaneously interact with a surface; it can distinguish *who* is touching *where*, and also whether a person is touching in multiple locations. It enables a group of people to interact with a surface without interfering with each other. Furthermore, objects placed on the surface do not interfere with DiamondTouch operation. The DiamondTouch SDK provides support for developing multi-user applications, including APIs for C/C++, Java, and an ActiveX control. The DiamondTouch SDK [3] was demonstrated at CSCW2002.

DEMO APPLICATION

DTMap is a prototype multi-user, tabletop cartographic analysis application. Its display contains a satellite map image. Different views of the same area can be overlayed atop portions of the map. In the examples shown in Figure 1, four 'layers' of information are provided: satellite imagery, depth charts, topographic data, and street maps. Users can interact with the application in parallel; each person has his own customized view, including which layer to display and lens shape. As each user touches the DiamondTouch display, his or her lens appears, revealing the appropriate customized information. Figure 1 (top) shows two users simultaneously interacting with the demo; Figure 1 (middle) shows an overview shot with three people.

Figure 1 (bottom) provides the details of the application; it shows a sample screen shot (contents of the display only). A thumbnail view (bottom–right corner) previews the entire data (map) area. Users navigate the larger map display by touching the image directly, or using the compass buttons to move the currently selected region. That region is then shown in detail on the work surface.

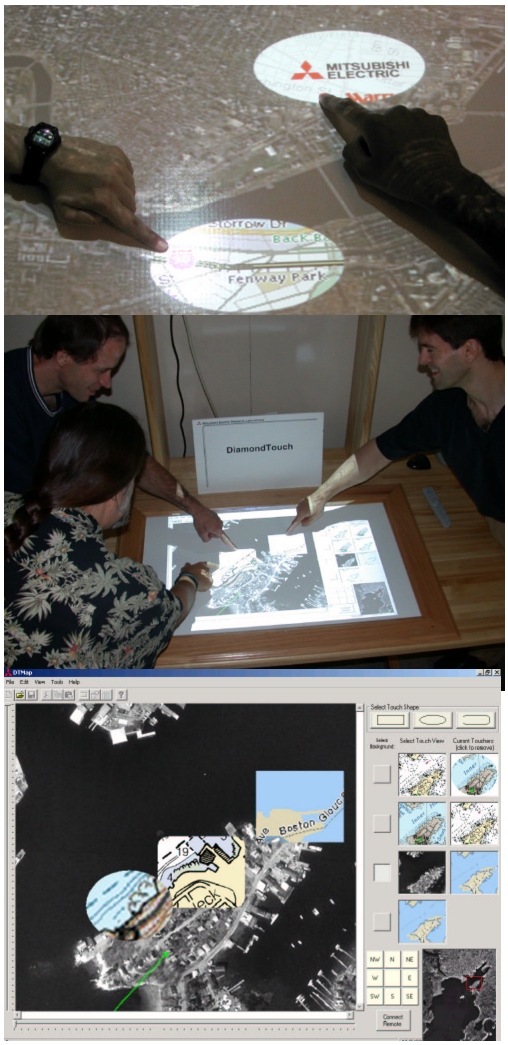

Figure 1: **(Top) Two users simultaneously interacting; (Middle) An overview shot; (Bottom) Screen shot to illustrate application details.**

The screen shot in Figure 1 (bottom) is taken from the interaction in Figure 1 (middle). The oval on the left, controlled by user 1, reveals topographic information. The rounded rectangle in the center, controlled by user 2, provides depth information about the water near this island. The rectangle in the upper right, controlled by user 3, provides a street map view. Lens positions track users' touches.

At our UbiComp demo, we will use a four-layer dataset taken from the 2004 earthquake/tsunami in South Asia — US commercial satellite "QuickBird" images (0.6m resolution) of the city of Bandal Ache, which is in North Sumatra, one of the most damaged areas hit by the Tsunami. The data includes before and after images (background and magic lenses, Figure 2) that can be used in concert with other data sources (analyzed data and contour/street map) to analyze the disaster and its resulting damage. One can easily imagine how a group of specialists (e.g., geologists, seismologist, oceanologists) together with decision makers in charge of disaster operations might work together using the DTMap interface.

Figure 2: **Tsunami dataset (screenshot); three magic lenses reveal "after" data.** *Includes material (c) 2005 DigitalGlobe, Inc. ALL RIGHTS RESERVED.*

RELEVANCE TO UBICOMP

While much tabletop research has begun to appear in HCI-oriented conferences (e.g., CHI, UIST, CSCW), it has been noticeably absent from the UbiComp forums. This demonstration will expose the UbiComp community to tabletop computing in general, and with the DiamondTouch technology in particular. Live, hands-on experience with an interactive multi-user tabletop is very different from reading (or merely thinking) about it.

DiamondTouch is a research prototype; MERL relies on outside collaborators (both industrial and academic research institutions) for feedback on and development of the technology and its applications. DiamondTouch has been successfully used by numerous institutions, primarily from the HCI community. We would like to broaden its exposure to other communities that could benefit from its unique capabilities.

Our prototype demo application is well-suited for command posts and control rooms. The more general idea behind our demo (visual display of data on an interactive tabletop) has possible applications for both business and technical meetings, and a variety of casual applications in the home, at schools, and in retail settings — all excellent application domains for ubiquitous computing.

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REFERENCES

1. Bier, E., et al. "Toolglass and Magic Lenses: The See-Through Interface," SIGGRAPH 1993.
2. Dietz, P. and Leigh, D., "DiamondTouch: A Multi-User Touch Technology," UIST 2001.
3. Esenther, A., Forlines, C., Ryall, K., Shipman, S., "DiamondTouch SDK: Support for Multi-User, Multi-Touch Applications," Demonstration, CSCW, November 2002.
4. SMART Technologies. "Digital Vision Touch Technology," White Paper, February 2003. http://www.smarttech.com/dvit/DViT_white_paper.pdf.