Innovative Interfaces, Report on Displays and Video-Augmented Environments

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1 Overview

The first paper [3] on Digitaldesk considers augmenting an ordinary desk with computer generated projections, while interacting with the computer by computer vision and cameras. The next paper [2] considers use of video and an ordinary object (the whiteboard) as a user-interface to the computer. The last one [1] is about creating larger and higher-resolution projections. Interestingly the first paper from 1993 is the more innovative and complete of the three, while the other papers consider the input and display respectively in isolation and more detail.

Digitaldesk main purpose was to highlight opportunities both in augmenting environments projections, and the possibility of interacting with a computer by having it analyse human movement and everyday objects. The papers following take a closer look at these problems discretely. Together, all the three papers point towards the possibility of augmenting reality with computers, and having computers disappear as prominent objects.

Several research and technology today have brought these ideas forward into different forms. Consumer products such as the XBox Kinect and Wii are now exploring human motion as applied to gaming. Research at MIT Media Lab combine projections and video to enable augmented interaction with a range of ordinary objects. For example displaying flight times on boarding cards, or projecting a calculator in the palm of ones hand, in a similar way to the calculator application described in the Digitaldesk.

2 Interacting with paper on the Digitaldesk

Digitaldesk [3] is a video and projector augmented desk, the video enables human input by monitoring hand and body movements, and the projector provides the computer display rendered on top of any common horizontal desk or tabletop, made of common material. The system enables many office and computer functions such as word processing and graphical editing. All

other computer applications may also be be activated in this environment, the differences from a normal computer is the size of the display, and different type of human input. So applications must be somewhat rewritten enable them, and to take advantage of the setup.

Enabling applications in this type of environment enables new ways accomplishing common tasks. A book may for example be places on the Digitaldesk, and sections cut out of it and dragged into a graphical editor. This uses a combination of computer vision and augmented interaction with the help of the projector.

It is worth noting that common keyboards and mice provide a layer of abstraction between the user and the object of manipulation. But using computer vision on humans and objects is more direct and opens up a new dimension of interaction. Keyboard and mice provide abstractions that are unambiguous, but everyday objects and human motion are unbound in their variety and interpretation. Our relationship to computers based on such technology may therefore be defined at any level of complexity, and the opportunities become more diverse as technology in computer vision and augmented reality develops. One of the challenges to use such technology effectively is defining a protocol of interaction that is intuitive to the everyday user, while providing for increasing opportunities in technology.

3 Brightboard: A Video-augmented Environment

Brightboard [2] is a video-augmented whiteboard, it considers using a conventional whiteboard as an input device for a computer. The user interacts with the computer by writing and drawing on the board, while the computer uses cameras and computer vision to capture the markings and interpret them as commands and objects. With Brightboard the commands are predefined, so the user needs some knowledge about how to go about drawing to communicate correctly with the computer. The main purpose of this technology is to show how ordinary objects can be turned into user interfaces. Video cameras were getting small and cheap, so a remarkable result is that the computer hardware itself is almost disappearing, suggesting that computer power may becoming pervasive and invisible. It is easy to imagine with the use of daily objects (as user-interfaces), and further computer sensors and types of feedback, the ability to interact with a computer can be brought to a finer level in ones daily interactions.

4 High-Resolution Interactive Displays

The paper [1] considers the problem of creating large, high-resolution projected displays. Large tabletop displays, like the Digitaldesk, have a number of potential advantages above normal computers. Such as larger quantities,

and different types of information may be easier to manage, they offer more methods of user-interfacing, and they may have benefits when collaborating with others.

A problem with large displays is that they require the same high resolution as ordinary monitors to be useful for certain types of applications, like word processing and graphics editing. Since they are much larger, they require proportionally more pixels, this isn't something commodity computers are inherently designed to manage today.

To achieve the large display several projectors must be used together and aligned, six or eight projectors may be desirable. But when when merging the projections together, misalignments and distortions may occur along the edges. A few solutions are considered to mitigate these problems.

Large displays have potential benefits, but one may wonder if it isn't easier to achieve the same results using several LCD screens, or larger LCDs. Another technology that may superseed large displays are mediated reality displays. These will eventually have the ability to superimpose data and objects onto ones visual field. It is evident though, that using multiple projectors is one of the most reasonable ways to achieve high resolution displays, and is a useful interim technology for research into current application that require it.

References

[1] M. Ashdown, Tuddenham P., and Robinson P. High-resolution interactive displays. *Human-Computer Interaction Series*, 2010.

[2] Q. Stafford-Fraser and Robinson P. Brightboard: a video-augmented environment. *Proceedings of the SIGCHI conference on Human factors in computing systems*, 1996.

[3] P. Wellner. Interacting with paper on the digitaldesk. *Communications of the ACM*, 1993.