

GRID

Intuitive Interaction on Large Displays

Introduction

Within Human Computer Interaction (HCI), it is of particular interest to realize an intuitive and efficient interaction with the computer. Users should be able to focus on a given task rather than being distracted by handling the information technology. In order to fulfill this requirement, HCI is developing intuitive user concepts for industrial business processes.

Since teamwork gains importance in industrial business processes, systems have to be developed that support creative ways of collaboration. These are for instance brainstormings or design reviews, in which team members should be able to work on a given task even if they are geographically distributed. In particular net-based collaboration becomes increasingly important due to globally distributed development teams.

Today, the digital basis for synchronous working is very limited. Technologies exist that support writing and sketching on large vertical whiteboards, but in many cases the collaborative work is constraint by the fact that only one user can interact per time interval. Thus, collaborative teamwork is still tied by the 'turn taking' behavior.

If horizontal interaction spaces are used, a support of an intuitive user interaction becomes even more complicated. On a tabletop surface, additional objects like coffee mugs, ball pens, or laptops could irritate a digital interaction system and thus make any interaction impossible. Although first solutions to this problem exist in research, the systems rely on projections, which front- or back-project the content of the digital horizontal interaction area (see Figure 1). The drawback of such systems is that either the users cast shadows with their body, or feet or legs are placed accidentally in the light path of the projection.



Figure 1: Horizontal interaction space using a back-projection (projector is integrated into the frame of the table, the image is projected onto the tabletop surface via a mirror)

Another drawback of projection systems in general is low resolution and limited brightness, which makes them hard to operate under normal office illumination conditions. Thus, new solutions have to be developed to overcome the problems mentioned in the above.

Task description

The goal of the proposed project is to develop an interaction technology which allows a multi-user interaction on conventional LC-screens. It should be possible to interact with the system by using special devices, but also by simply using the fingers. In addition, the system should not be irritated by additional objects on the tabletop's surface.

Approach

First feasibility studies showed very promising results. The system's functional concept relies on the fact, that typical LC-matrixes are transparent for infrared light. Infrared sensors were attached behind the LC-matrix, which could detect any infrared light coming from the interaction devices in front of the screen (Figure 2). The position of a device can be determined by an interpolation of the different sensor values. In order to allow capturing multiple devices on the tabletop, all existing devices are sequentially interrogated. This is done so fast that the user has the impression of simultaneity.

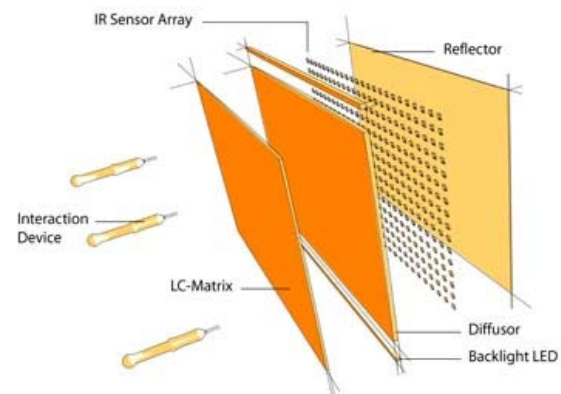


Figure 2: The components of the new tracking system together with the components of a standard LC-display.

State of development

The current prototype is able to detect position, state (button pressed or released), and orientation of up to 6 different interaction devices. In principle, an unlimited number of interaction devices could be detected, but this will reduce

the detection rate of the overall system. The current system is a 20" LC-display, which is able to read out and process all sensor values 2000 times per second. In addition, it is possible to detect devices in position, status, and orientation even in a certain distance to the display, which supports e.g. pointing gestures using a pen. The development costs of the current setup are approximately 3000 CHF per m².

The design was realized in such a way, that all components of the tracking system are scalable. Thus, it would be possible, to implement such a system even into 65" displays.

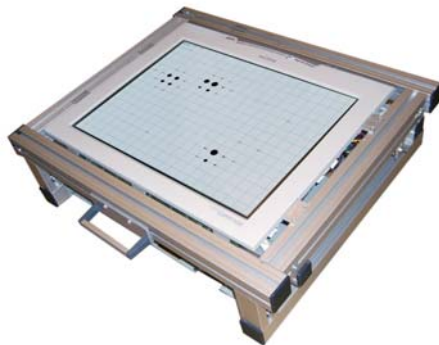


Figure 3: The current 20" prototype: a conventional LC-display with a multi-device tracking.

Benefit

The project generates know-how in the field of new basic interaction technologies and demonstrates the benefits by realizing a prototype. In addition, it will be possible to evaluate new ways of interaction capabilities, which are not possible so far with standard interaction devices.

Status

The project is currently running. In addition to the technology mentioned in the above, a tracking for finger touch will be implemented. Thus, it will be possible to use specialized devices as well as fingers to interact with the system.

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