



# Building a gesture based information display

Diplomarbeit Kickoff Presentation  
by Nikolas Dörfler

Feb 01, 2008

Chair for Computer Aided Medical Procedures & Augmented Reality  
Department of Computer Science | Technische Universität München



# Overview

- What is the problem?
- Related work
- System design
- Initial test setup
- Acoustic Touch (Click) Detection
- Touchless Interaction

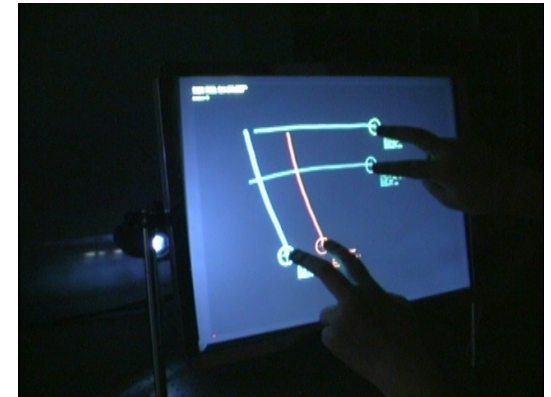
# What is the problem?

- Normal ways to use a computer:
  - Mouse & Keyboard
  - Not very intuitive for beginners
  - One Person per Computer ( PC )
  
- Virtual touch screen
- Multi touch
  - Multiple Persons
  - Natural gestures
  - Finger Pointer
- May be the end of our point & click mouse



# Related Work

- Multi-touch Display by Jeff Han,
  - Works with FTIR ( frustrated total internal reflection)
    - Similar to our Tisch
- Play Anywhere, Andrew Wilson, Microsoft Research
  - Tabletop Multitouch system
  - Finger, Marker and Page tracking
- SiViT ( Siemens virtual touch screen )
  - More detail on next page

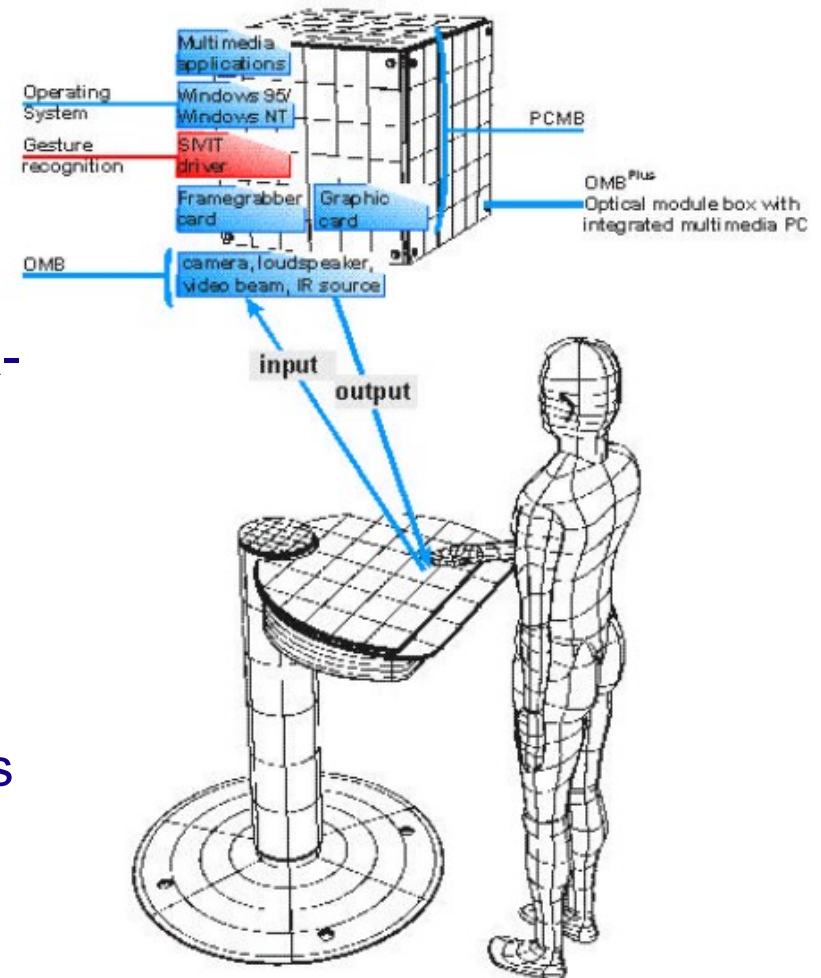


# The SiViT ( Siemens Virtual Touchscreen )

- Originally designed as Information Terminal
- Setup:
  - Optical Module Box with PC, IR-Camera, IR Spotlight
  - Beamer displays output to the table

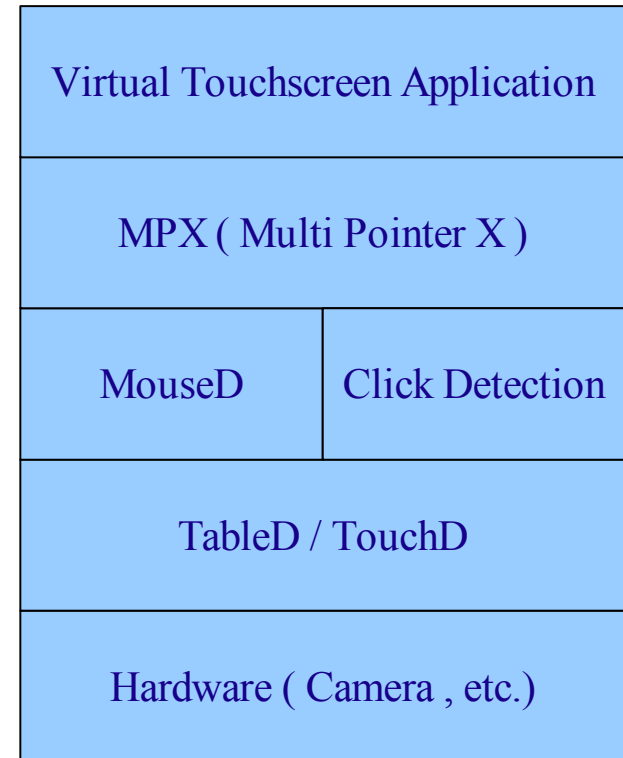
## Original functionality:

- Single Hand with index finger as pointer
- „Click“ when pointer is on a specific location for some time



# System Design

- New Components:
  - TableD / TouchD:
    - Image processing and Hand / Finger tracking
  - MouseD:
    - manages multiple Mouse cursors.
    - Simulates (X) Mouse Events
  - Click Detection
    - Detects finger click and Drag/Drop events
  - Multi Pointer X
    - X Server which supports the use of multiple pointers
  - Virtual touchscreen application
    - e.g. Chair tour, photo album



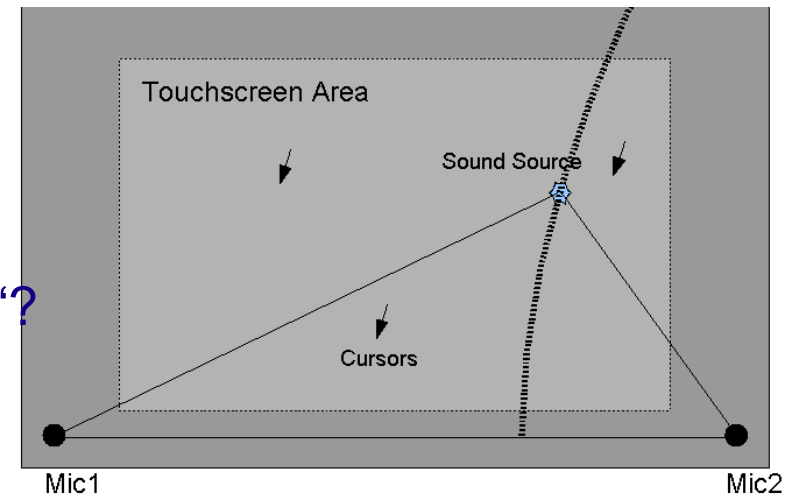
# Initial test setup

- Test Mockup using the Camera and IR Spotlight
- TableD finger tracking:
  - Finds hand or finger tip
    - Background subtraction
    - Thresholding
    - Blob generation
    - Tip is on one side of the major optical axis
  - No tracking of individual fingers
  - Unstable Cursor Position



# Acoustic Click Detection

- Single Microphon:
  - Detection of „Knock on the table“
  - Problem: Which pointer has „clicked“?
- 2 Microphones
  - Calculation of TDOA
    - Phase shift calculation via cross correlation
    - Active Cursor must lay on ( near ) hyperbola.
- Problems:
  - Room noise
  - No simultaneous clicks possible
  - Speed of sound is very high in solid materials ( about 2000 m / s )
    - High sample rate
- Possible Solution:
  - 3 or more Microphones





# Interaction without touch detection

- Alternative „Clickless“ Methods ( <http://www.dontclick.it> )
  - Special application design
  - Click is simulated
    - By gesture e.g.
      - Linear motion, left to right
      - Circular motion
    - By holding the cursor on a button for some time
  - Problem with these methods:
    - Unwanted activation is possible!
    - Drag and Drop





# Questions?

## ▫ Literature

- <http://www.dontclick.it/>, Institute for Interactive Research, Alex Frank
- Andrew D. Wilson, Microsoft Research, PlayAnywhere: A Compact Interactive Tabletop Projection-Vision System,, Proceedings of the 18th annual ACM symposium on User interface software and technology, Seattle, WA, USA, Pages: 83 - 92, 2005
- Han, J. Y., Low-cost multi-touch sensing through frustrated total internal reflection, Proceedings of the 18th annual ACM symposium on User interface software and technology, pages: 115 – 118, 2005
- Murray, J. C., Erwin, H. R., and S. Wermter, "Robotic sound source localization using interaural time difference and cross-correlation". In proceedings of the KI-2004, September 2004.