

# Microsoft Surface Technology

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Seminar “Advances in Human Computer Interaction”  
Saarland University, 06/12/2007

# Structure Of The Talk

1. Conventional interfaces
2. What is **Microsoft Surface**?
3. Architecture
4. How can it be used?
5. Pros and Cons
6. PlayAnywhere
7. Conclusion

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# Conventional interfaces

- **User interaction**

Traditional point-and-click experience.

- It's impossible to scale and rotate an image simulatenously.

- **User experience**

One user interacts with one application at a time.

- It's impossible to manipulate two images at the same time.

- **User interface**

Basic knowledge about the interface is necessary.

- It's impossible to use the system right away.

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# What is Microsoft Surface?

**Microsoft Surface** is a **software + hardware technology** that allows people to interact with digital content as they interact with everyday items.



The core of **Microsoft Surface** consists of

- **multi-touch** user interaction
- **tangible** user interface

# What is Microsoft Surface? (2)

- PC
  - Windows Vista OS
  - black table base
  - touchscreen  
(76cm, size of a coffee table),
  - 5 cameras
  - an acrylic frame.
- 
- Dimensions: 56 cm high,  
107 cm wide.



# Origins and brief history

- Vision: **bridge the physical and virtual worlds.**
- Idea: design a natural user interface.
- Over 85 prototypes since 2001.
- First design as a **virtual game table** (family entertainment) (2001).
- Expected release: 2007-2008.



*"Tub" model prototype*

# Features of Surface Computing

- **Multi-touch contact** (demo, popularm, 00:37, 01:15)

Digital content is manipulated by the use of

- natural motions
- hand gestures
- physical objects

**Picture manipulation and navigation** are intuitive and require no technical knowledge, e.g. for

- rotation
- scaling
- sliding digital images across the table.

# Features of Surface Computing



# Features of Surface Computing

- **Multi-User experience**

The horizontal orientation makes it easy for several people to gather around surface computers.

- **Collaborative computing experience**
- But: Surface can't distinguish between different people using it simultaneously.
  - Further details: see Henning's talk about Multi-Touch technology.

# Features of Surface Computing

- **Object recognition** (demo, popularm, 02:10-03:07)

Users can place physical objects on the surface to **trigger different types of digital responses**.

- physical objects can be recognized by their shapes or by embedded ID tags.
- Surface can act as a mediator between devices.
  - E.g. data exchange between digital camera and a mobile phone.

# Features of Surface Computing

**Contoso 4680z**  
**\$247<sup>.95</sup>**

**1.3 Megapixel Camera**  
Take high-quality pictures to print or send to your friends!

**HTML Web Browser**  
Surf the Web with this convenient HTML browser.

**Windows Media Player**  
Windows Media Player lets you play audio and video files.

**Expandable Memory Slot**  
The Memory Slot allows you to add extra memory for all media.

**Universal Instant Messaging**  
Send and receive instant messages with Windows Live Messenger.

**Contoso 601**  
**\$49<sup>.99</sup>**

**0.3 Mp Camera w/ 4x Zoom**  
Use the digital zoom to get a close-up picture without getting too close.

**Web Browser**  
Surf the Web from anywhere.

**Windows Media Player**  
Windows Media Player lets you play audio and video files.

**Instant Messenger**  
Send and receive instant messages with Instant Messenger.

**Games Included**  
Enjoy your down time more with fun games included on your phone.

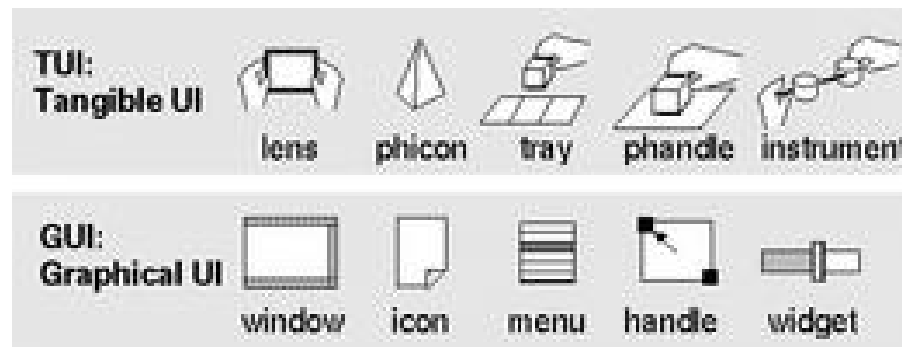
PLANS SERVICES CONTENT ACCESSORIES COVERAGE

# Features of Surface Computing

## Tangible user interface (TUI)

In Surface object recognition incorporates TUI.

- Surface aims to **provide a physical form to digital information.**
  - one can draw on the Surface with any (physical) paint brush.
  - placed on the Surface, squares of glass can play videos (puzzle)
- But: Surface doesn't offer the Metadesk's TUI as presented in Salin's talk about **Tangible Bits.**
  - Hand gestures are preferred to physical instruments.



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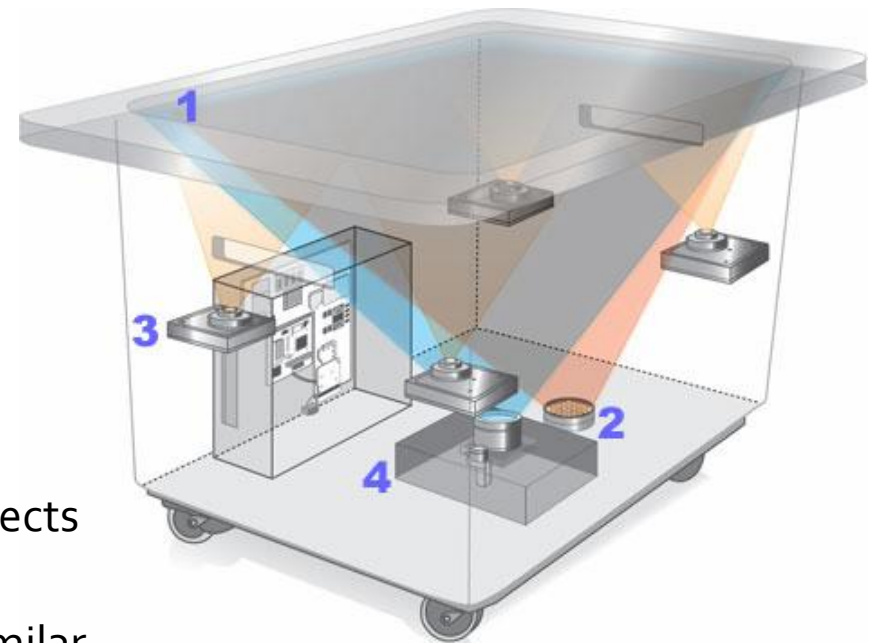
# Architecture

## (1) Screen

- diffuse illumination
- top layer works as a diffuser
- display is clearly visible at any angle
- **Multi-touch** technology.

## (2) Infrared

- an 850-nm-LED is aimed at the screen
- when the surface is touched, the light reflects back
- and is picked up by **5 infrared cameras** (similar to optical mouse, on a larger scale).



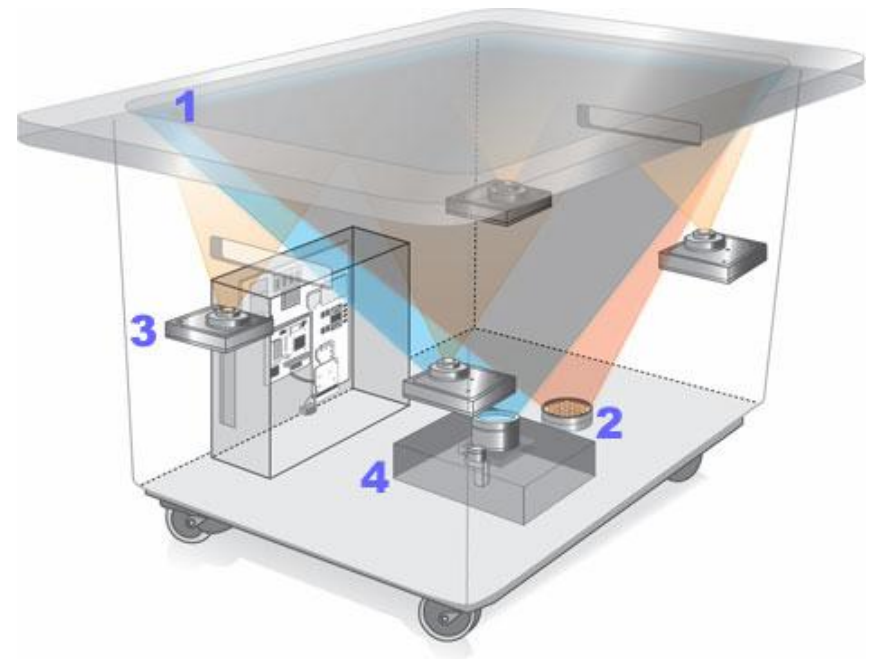
# Architecture (2)

## (3) CPU

- Core 2 Duo processor
- 2GB of RAM
- 256MB graphics card
- WiFi
- Bluetooth antennas

## (4) Projector

- DLP (Digital Light Processing) engine (as used in many rear-projection HDTVs).



(demo, 00:40, 1:30).

# Technical Details

- Surface uses the **domino tag (Gamma tagging)** to identify objects
  - similar to bar codes
  - tags consist of a pattern of variously-sized dots
  - geometrical arrangement of the dots implies the position of the object
  
- Surface can respond to **54 touches** at a time.
  - for 4 people
  - and 12 objects



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# How can it be used?

## Concrete scenarios

### Organizing photos and videos

- User places a digital camera with Wi-Fi on the Surface,
- table recognizes the camera,
- at a touch of the screen data is downloaded,
- digital **pictures and videos can be manipulated instantly.**

### Planning trips and events (demo, 2.flv, 00:00-00:57)

- User places a mobile phone on the Surface,
- gets the data about events in the neighborhood,
- slides them towards the phone
- and the **data is automatically copied and stored.**

# How can it be used? Concrete scenarios



# How can it be used?

## Concrete scenarios (2)

### Transforming print to digital

- To share a hand-written paper sketch
- place a photo on the Surface,
- it is **scanned automatically**,
- displayed on the Surface
- and can be manipulated directly.

### Creating music playlists

- browse through a music library,
- choose data by literally **picking favourite artists**,
- and drag it to your mp3-player.



# How can it be used?

## Real-life examples

- **Virtual concierge (Starwood Las Vegas)**
  - Guests can **order food & drinks** via Surface,
  - the order goes to the kitchen automatically.
  - After the meal place a credit card on the Surface,
  - **payment is done automatically.** (demo, 3, 00:50-01:23)
- **New shopping experience (T-Mobile USA)**
  - Customers place cell phones on the Surface;
  - product features and prices plans **appear automatically**
  - features can be compared.
  - Payment via dropping a credit card on the Surface.

# How can it be used?

## Real-life examples



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# Pros and Cons

- **Pros**

- intuitive user interaction with natural gestures
- collaborative computing experience
- object recognition
- mediator between devices

- **Cons**

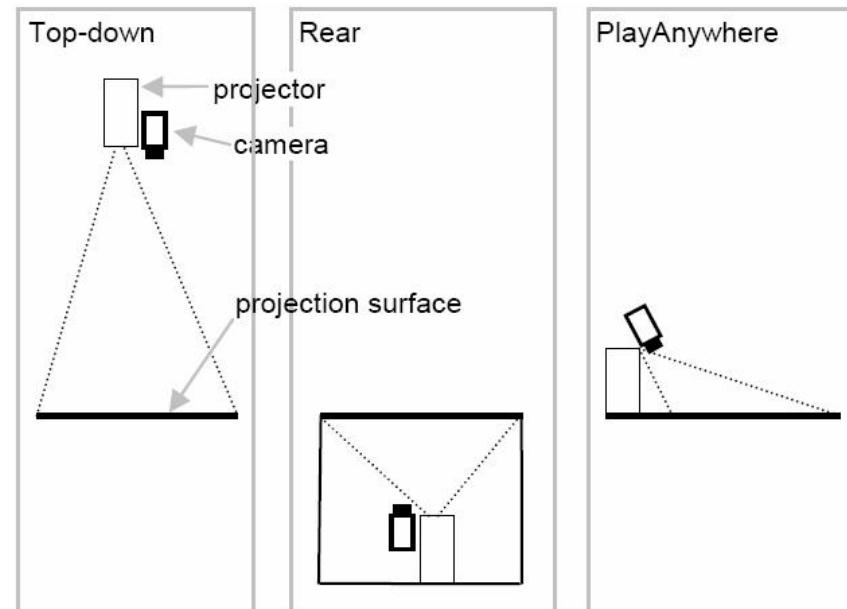
- camera calibration requires high precision
- security and privacy issues
- Surface can't sense pressure
- Surface is not portable (stationary usage)

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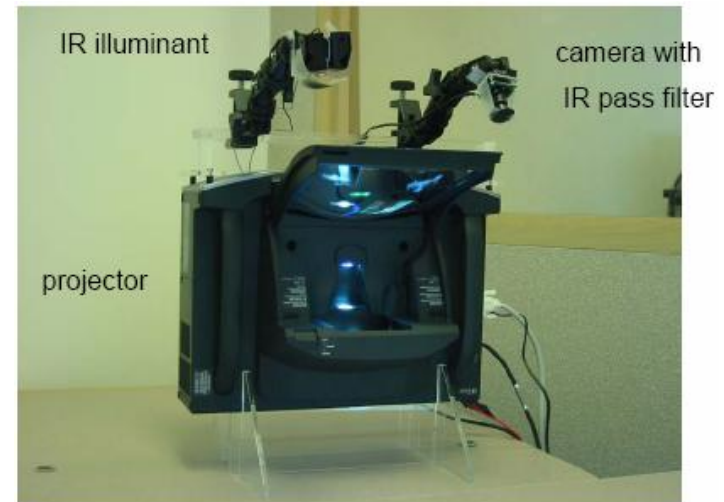
# What is PlayAnywhere?

- A portable table system which can operate **on every flat surface**, including an ordinary desk surface.
  - front-projected
  - vision-based



# PlayAnywhere: Architecture

- **Projector** sits on the surface and projects
  - from a very oblique angle
  - at extremely short distance
- Scene is illuminated by **IR illuminant**
- **Camera** captures movements on the surface
- Visual noise is eliminated by **IR pass filter**



# PlayAnywhere: Overview

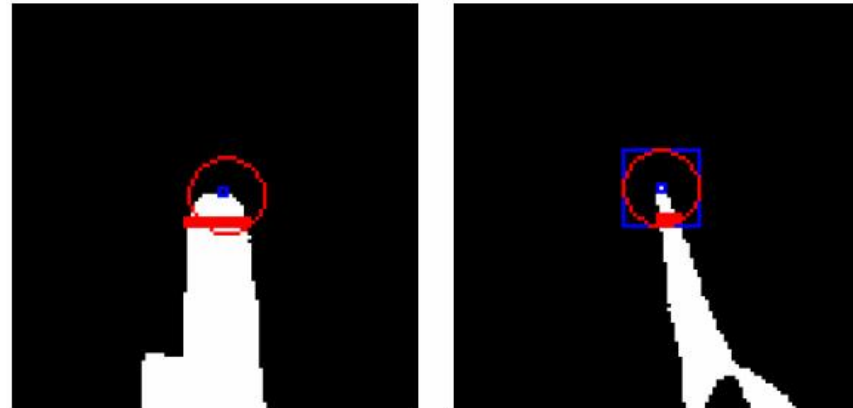
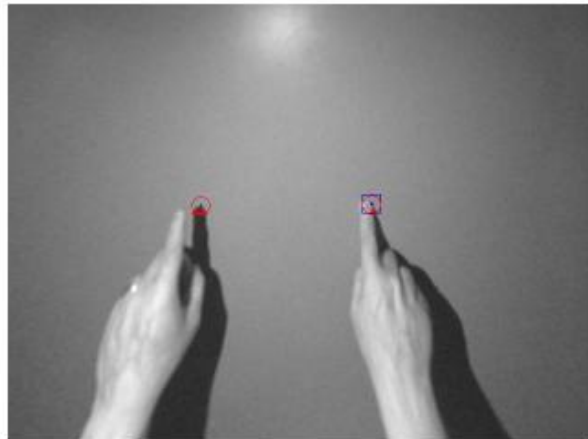
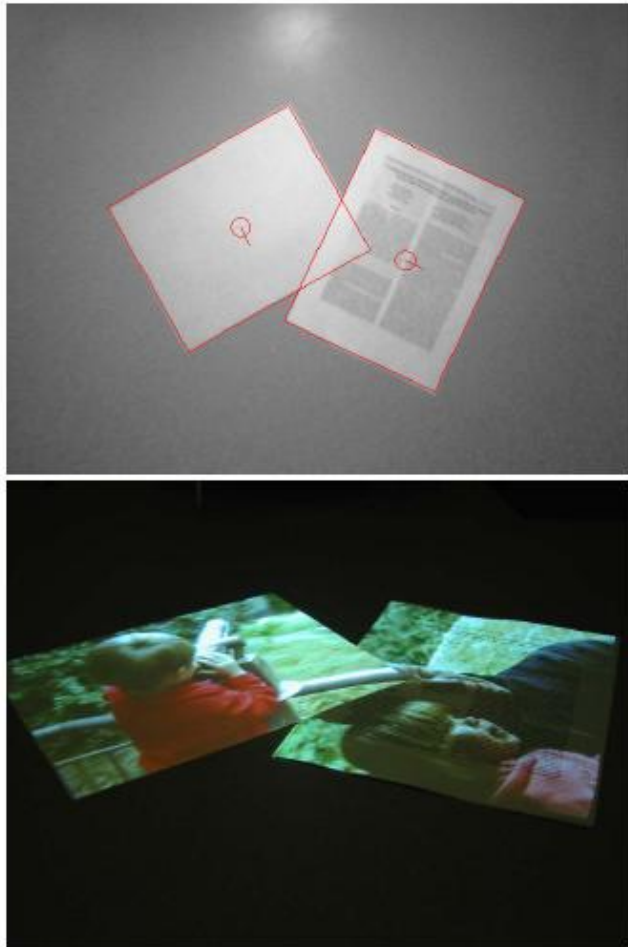


Figure 7: Touch is determined by simple shape heuristics. A finger on the surface occludes almost all of its own shadow (right), while a finger above the surface does not (left).

- Finger tracking and touch detection are based on **shadows shape analysis**.

# PlayAnywhere: Overview



- **Page tracking** uses digital image processing techniques to generate precise orientation histograms and matrices.
  - Hough transform
  - Sobel filter

Overlapping images can be recognized (see left image).

Figure 9: PlayAnywhere's page tracking capability detects two overlapping pages placed on the surface (top). On the table, videos are projected precisely on the printed pages (bottom).

# PlayAnywhere: Problems

## Main advantage

- **highly portable**  
e.g. in future compact versions can be integrated in a cell phone

## As prototype, PlayAnywhere has some issues to address:

- **shadow shape analysis**  
error-prone: overlapping shadows distort the projected image
- **touch precision**  
difficult to distinguish between hover and touch states
- **visual codes**  
system can't recognize objects with occluded visual codes

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# Conclusion: Summary

- **Microsoft Surface** is an attempt to create a natural user interface.
  - **Architecture**
    - rear projection
  - **Features**
    - multi-touch contact
    - multi-user experience
    - object recognition
    - tangible user interface
  - **Critical issues**
    - privacy
    - security
    - lack of portability
- **PlayAnywhere** is an attempt to create a portable natural user interface.
  - **Architecture**
    - front projection
  - **Features**
    - multi-touch contact
    - object recognition
    - tangible user interface
  - **Critical issues**
    - lack of precision

# Conclusion: Evaluation

- **Evaluation:**

- The combination of **object recognition** and **multi-touch** sets Surface apart from similar technologies.
- With future support of RFID chips Surface can be applied to a number of daily routine applications (e.g. shopping).
- **Lack of portability** in Surface might become a significant barrier for mainstream consumer acceptance.
- With Surface, **ubiquitous computing** arises as a realistic vision for the near future.
- Compared to Surface, portable tabletops, such as PlayAnywhere, are more likely to replace PC as the primary computing platform.

# Q&A

Thank you for your attention!

Any questions?

# References

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