Ubiquitous Computing and Interaction

Group

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New Group! Who are we?
What do we do? - Teaching

**Teaching - Bachelor**
- Great ICT Innovations
- Interaction Design
- Pervasive Computing
- Interactive Media
- Product Design Project
- Bachelor Project

**Teaching – Master/PhD**
- Context Awareness
- Positioning
- Augmented Reality
- Innovation Project
- Peer-2-Peer Web-tech
- Peer-2-Peer Project

- Physical Design and the Product Design specialization of the ICT-bachelor
- ICT-Product Design Pillar from Aarhus School of Architecture
What do we do? - Research

Research themes
› Interaction Design
› Hypermedia and Social Media
› Positioning (GPS, WiFi,...)
› Context Awareness
› Mobile Computing
› Peer-2-Peer
› Augmented Reality
› Sensor actuator based interaction
› Kinesthetic and Aesthetic Interaction

Projects/Centers
› Center for Interactive Spaces
› Galileo Platform for Pervasive Positioning
› Mobile Home Center project
› iSport project
› + many more previous projects
Examples of concepts and results

Positioning
Galileo Project – GPS Positioning indoor?

- Supply with other sensors
- WiFi, Bluetooth
- Dead Reckoning (Compass, Accelerometer, Barometer,..)

(e) Warehouse (82m x 38m)
(f) School (136m x 134m, floor sep.:4m)
(g) Shopping Mall (242m x 150m)
(h) Tower block (60m x 15m, floor sep.:4m)
Indoor positioning based on sensor fusion

Demonstrating Positioning Improvements for Pedestrian Tracking by combining GPS, WiFi and Inertial Positioning using a Particle Filtering Approach
Examples of concepts and results

Augmented Reality
Workspace for Architects
Augmented reality: GPS + camera

GPS with digital compass
Topos software
Tablet PC
Video camera
Tablet pen
Augmented Environment supporting navigation – based on Galileo project
AR Applications for smartphones

Layar Position/Compass-based AR

- Point of Interest (POI) based
- Supports viewing of information Layers on top of video feed from phone camera
- Utilizes position and compass direction for alignment of information to places
Examples of concepts and results

Interaction Design

Kinesthetic Interaction
Movement based remote control

- Accelerometer used to measure gestures
- Gestures shift channel, turn up and down volume etc.
- Radio-based proximity used to select equipment to control
- Grab ’n throw: move digital material between displays as if it was physical

Developed in 2003 in the ISIS iHome project with B&O
TacTower tested by GF handball players
Interactive floors – multitouch, camera-based technique

- Users’ body contacts with surface are tracked and used as “mouse pointers”
Conclusions
Kinesthetic interaction - challenges

- Filter “noisy” moves from significant movements
  - Signal processing, similar to speech recognition
- Develop natural “body-language” that users can master
  - Gestures, movements, hits, clicks etc.
  - Physical grammar
- Quick tracking of multiple objects and users
  - Avoid lacking tracking and feedback
  - E.g. image processing of video in real-time
- Permanent unique identification of objects and users
  - Quick hit of a touch sensor is hard to tie to a specific user
  - In camera tracking, blobs can mix and shift identity
Positioning, Context-awareness, Augmented Reality - challenges

› Sensor fusion techniques
  › Seamless indoor-outdoor positioning
  › Improving position accuracy
  › More precise overlays

› Using position and sensor readings to map behaviors
  › Cattle behavior
  › Crowd behavior
  › CO2 foot printing
  › …

› Use positioning for improved logistics
  › Not just trucks and container ships, but also indoor work processes
  › …
Ubiquitous Computing and Interaction

› Watch out for courses and research projects to join!