

Ubiquitous Computing and Interaction

Group

Kaj Grønbaek, Professor,
Department of Computer Science,
Center for Interactive Spaces

www.interactivespaces.net

kgronbak@cs.au.dk

New Group! Who are we?



Kaj Grønbaek,
Professor



Marianne G. Petersen
Assoc. Professor



Niels Olof Bouvin
Assoc. Professor



Karen J. Kortbek
PhD Stud.



Mads S. Andersen
PhD Stud.



Thomas Toftkjær
PhD Stud.



Jakob L. Jensen
PhD Stud.



Mikkel B. Kjærgaard,
Post Doc



Mads D. Kristensen,
Post Doc.



Allan Hansen
Post Doc.



Henrik Blunck
Post Doc.



Kari Rye Schougaard
Post Doc.



Torben Godsk²
PhD Stud.

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

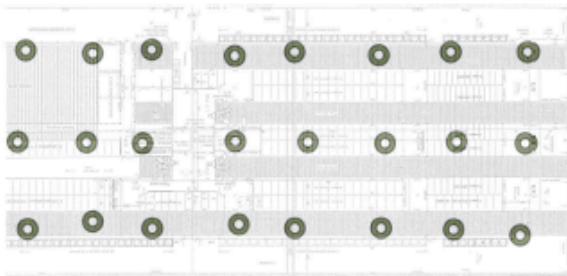
- › Center for Interactive Spaces
- › Galileo Platform for Pervasive Positioning
- › Mobile Home Center project
- › iSport project

- › + many more previous projects

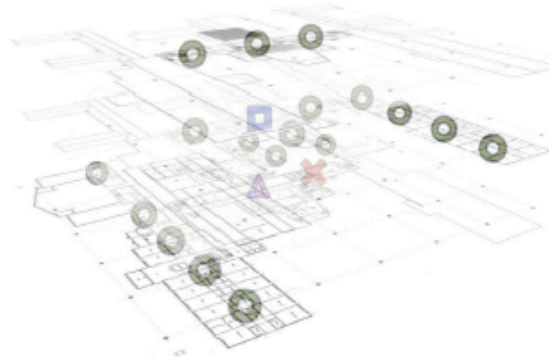
Examples of concepts and results

Positioning

Galileo Project – GPS Positioning indoor ?



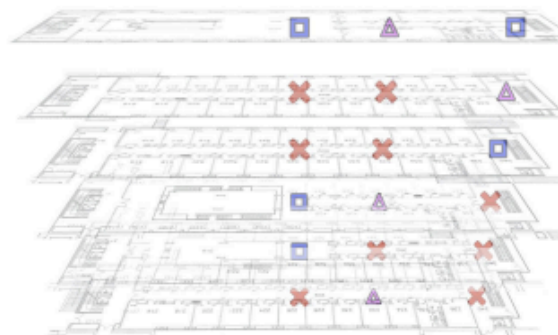
(e) Warehouse (82m x 38m)



(f) School (136m x 134m, floor sep.:4m)



(g) Shopping Mall (242m x 150m)



(h) Tower block (60m x 15m, floor sep.:4m)



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



Indoor positioning based on sensor fusion

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

SYSTEMATIC

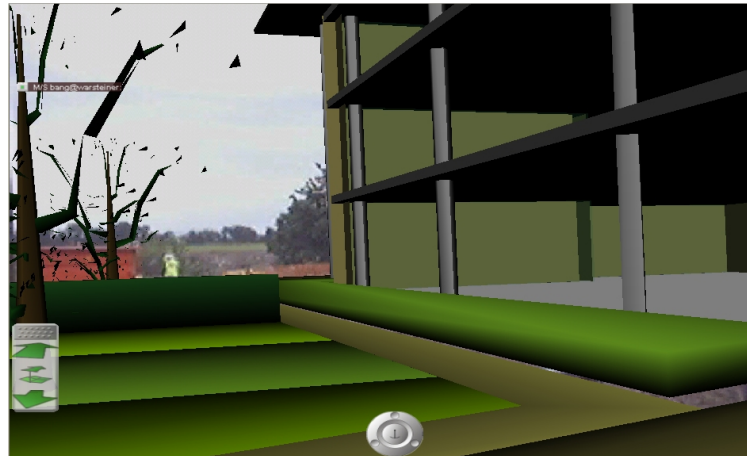


Examples of concepts and results

Augmented Reality

Workspace for Architects

Augmented reality: GPS + camera



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

Grab 



Throw 



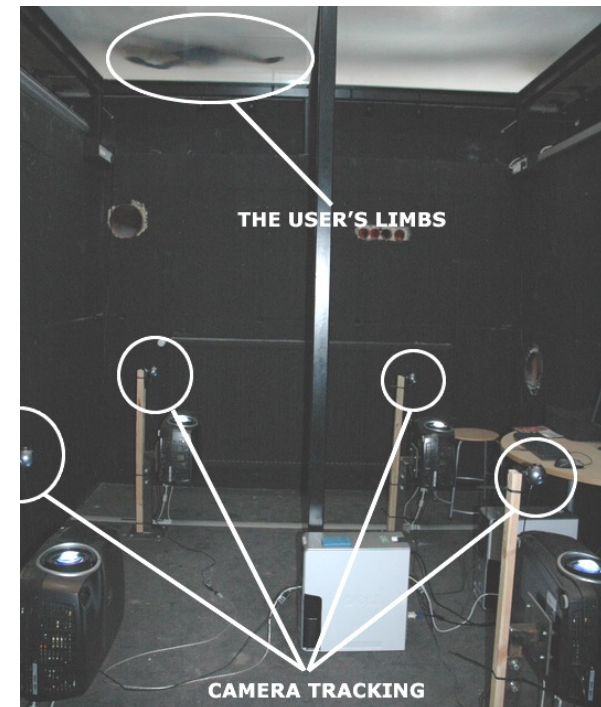
Developed in 2003 in the ISIS iHome project with B&O

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!