Resource-adaptive mobile Navigation Systems

Collaborative Research Center 378

„Resource adaptive cognitive processes“

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Sonderforschungsbereich 378
Ressourcenadaptive
Kognitive Prozesse

Hintergrund

- Informatik -- Schwerpunkt auf intelligenten Systemen
- Umgang mit wechselnden technischen und kognitiven Ressourcen
- Design von robusten und flexiblen Benutzerschnittstellen

Resource-adaptive navigational aid for pedestrians (REAL)

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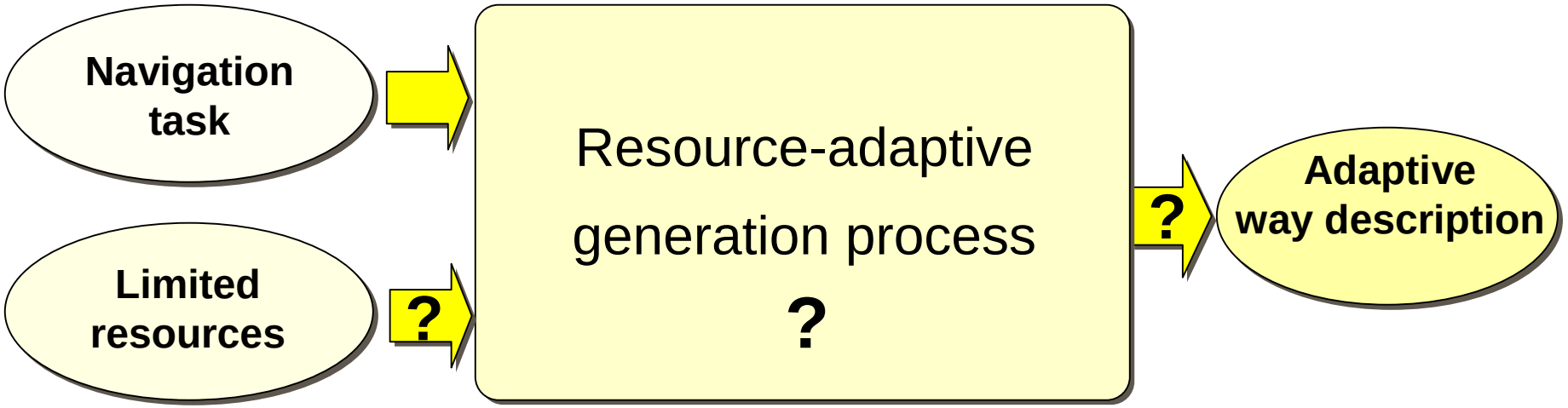
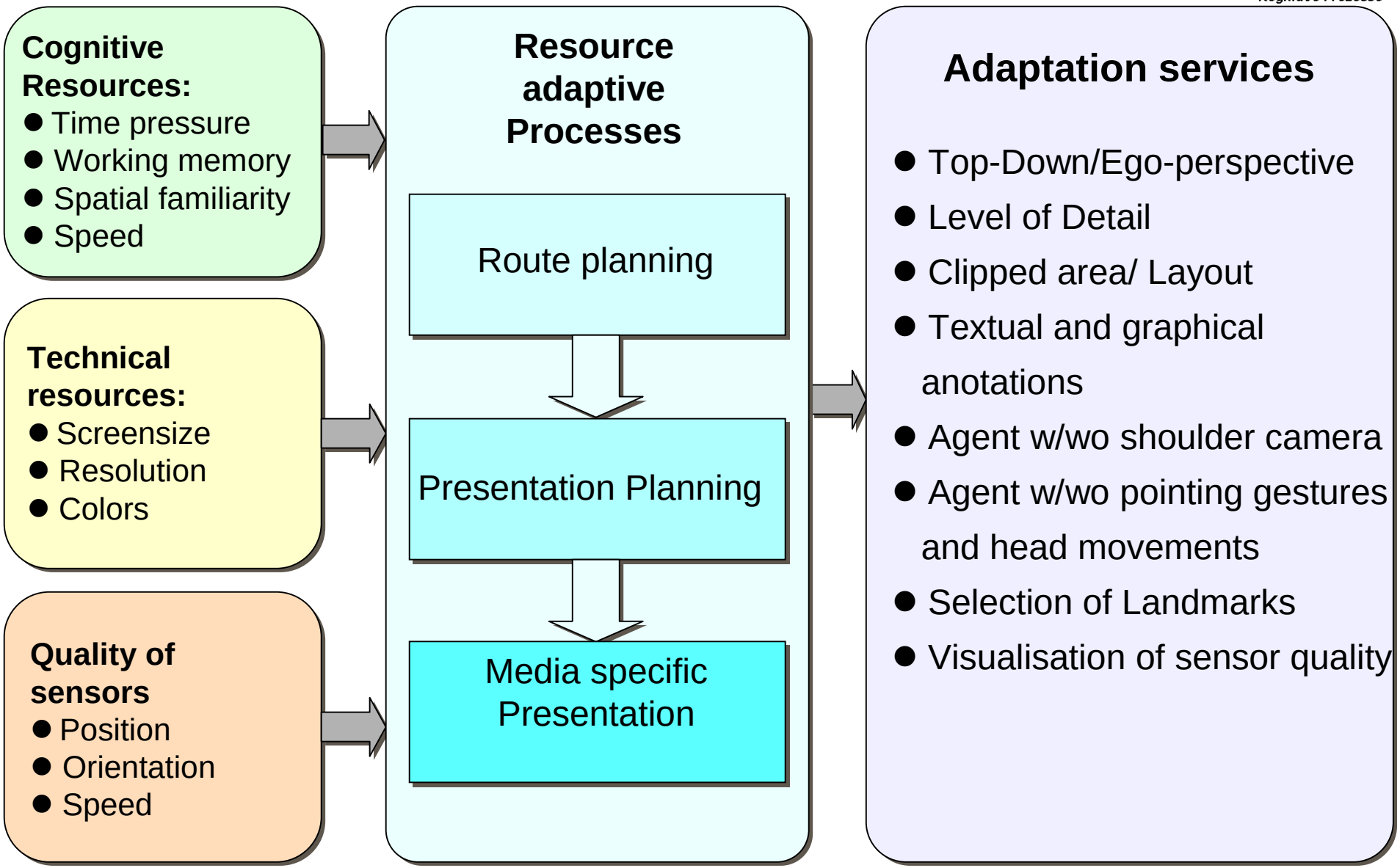
Basic Question:

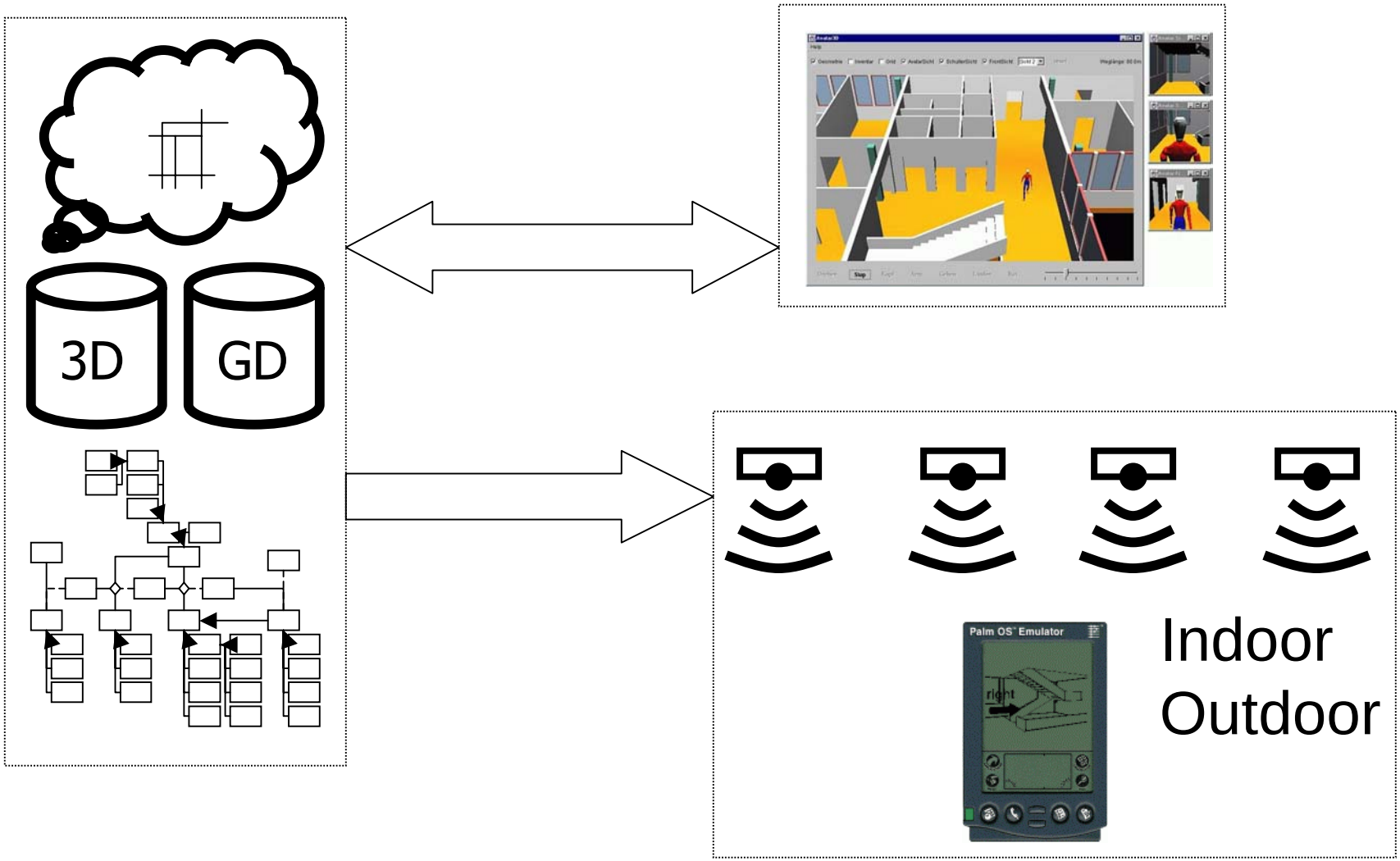
How to adapt the multimodal presentation of way descriptions to the cognitive and technical limitations of the user?



Limited resources and adaptation services



A Hybrid Navigation System



Dynamic Navigation Aid: Adaptiv generated Camera Path with 3D-Arrows

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Presentation agent supports way description with pointing gestures and head movements

Adaptation to different Output Media

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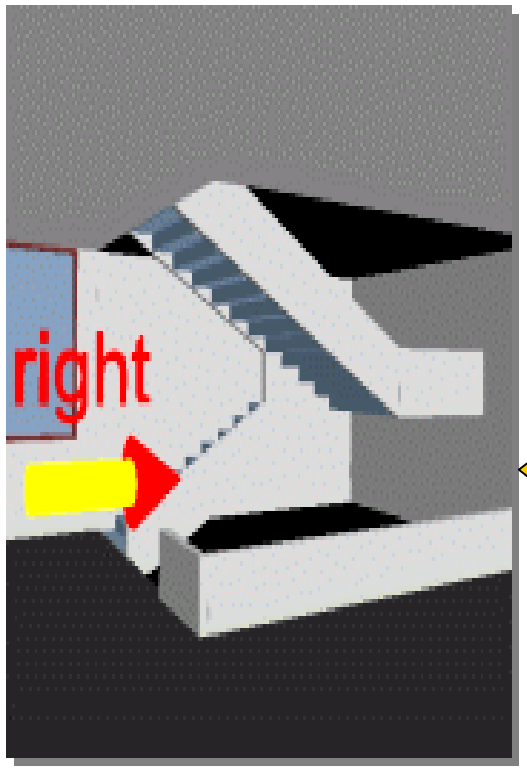
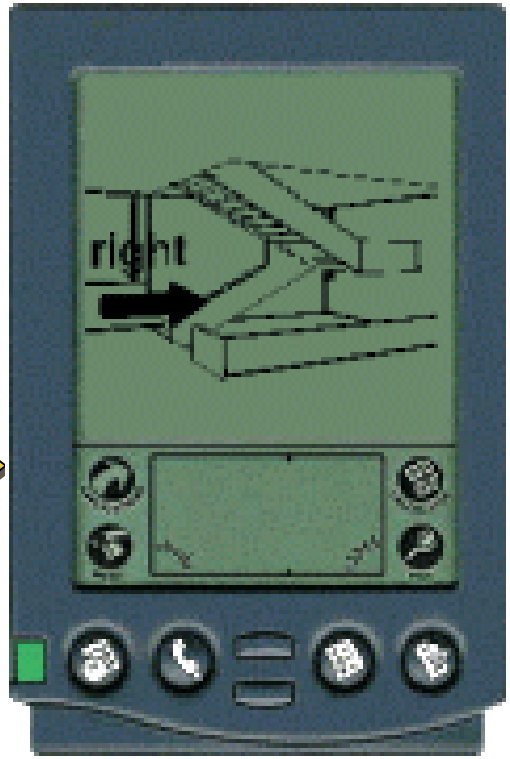


Abstraction

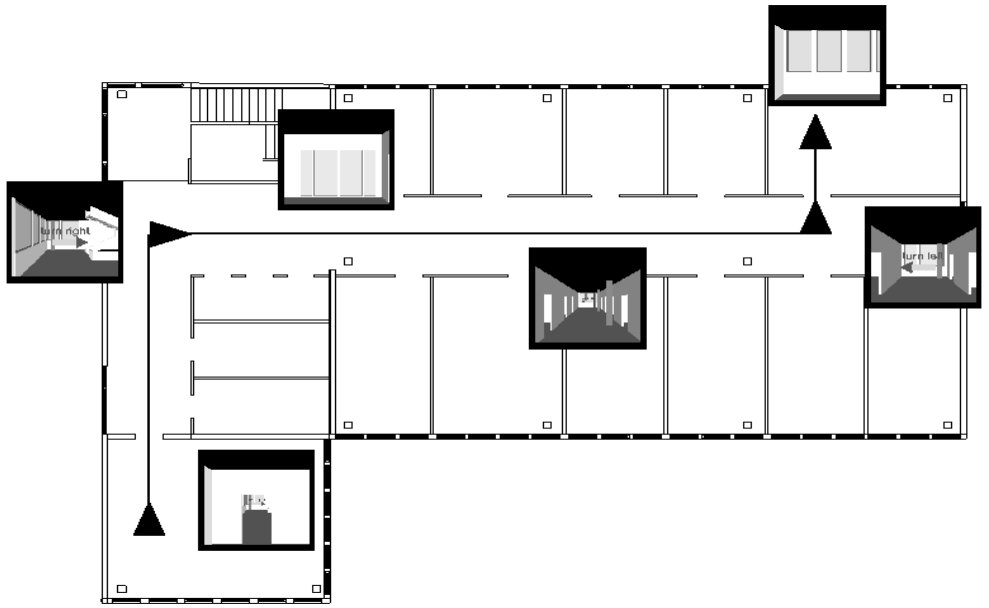


Information kiosk

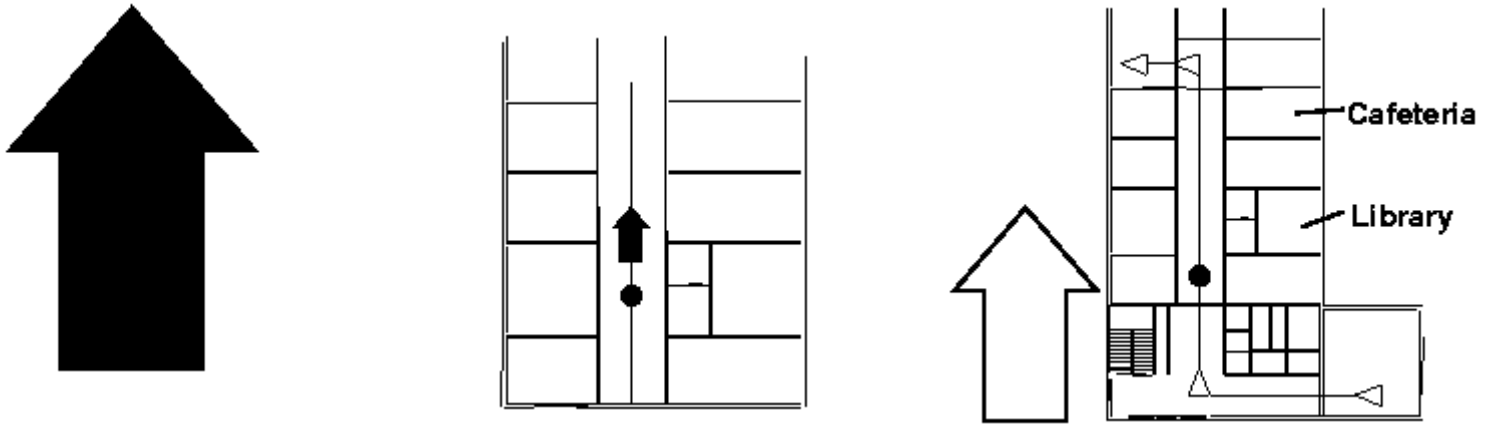
Handheld PDA

Structure of Way Descriptions

- Starting Point
- Path Segment
  - Orientation/ Reorientation
  - Continuing
- Endpoint

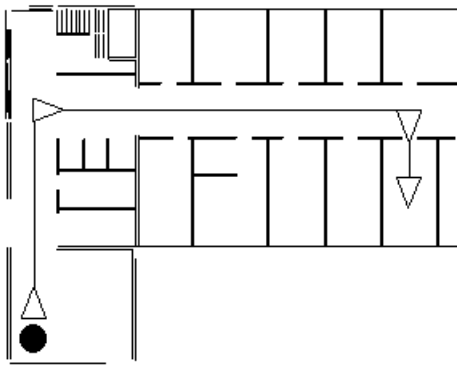


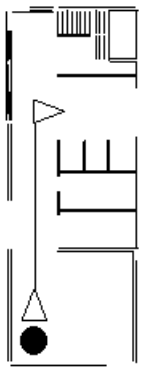
Adaptation example: Mobile Device Time pressure

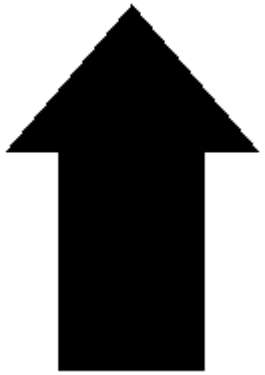


Time

Adaptation example: mobile Device Quality of position







Quality of Position

Location sensitivity

Passive location sensitivity:
Mobile device receives and presents information directly that has been prepared for the location

Examples: RDS, GSM Cell-Broadcast

Active location sensitivity:
mobile device receives information on the location and then generates or selects relevant information

Examples: GPS-Nav., IR-Beacons

Combination Indoor / Outdoor

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IRREAL

Infra**R**ed **REAL**

- Indoor navigation
- Passive location sensitivity
- IrDA sender, range up to 20 m
- Generation of Presentation on server
- Orientation of user tracted with infrared

ARREAL

Augmented **R**eality **REAL**

- Outdoor navigation
- Active location sensitivity
- GPS based
- Generation of Presentation on Client
- Orientation of user tracted with electronical compass

Seamless integration of both approaches

cf: Wahlster, Baus, Kray, Krüger 2001

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IRREAL

InfraRed REAL

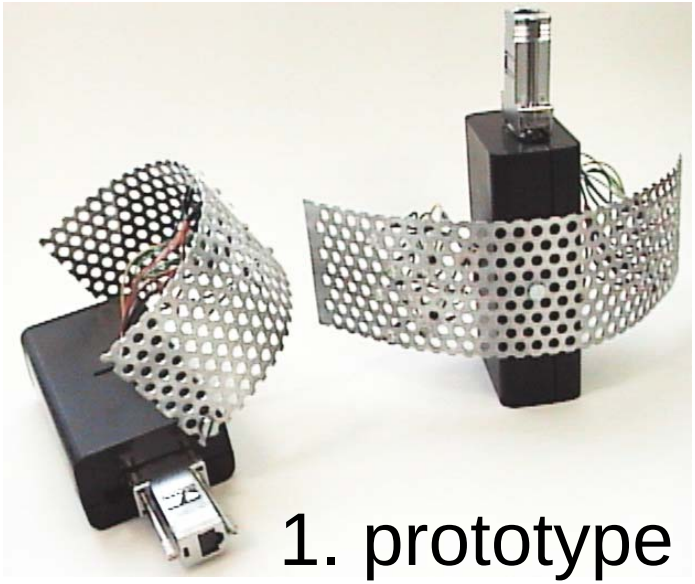
- Indoor navigation
- Passive location sensitivity
- IrDA sender, range up to 20 m
- Generation of Presentation on server
- Orientation of user tracted with infrared

ARREAL

Augmented Reality REAL

- Navigation im Freien
- Aktive Lokationssensitivität
- Einfaches GPS
- Generierung lokations-abhängiger Daten
- Richtungsinformation durch 3D-Maus mit elektronischem Kompaß

IRREAL - sender



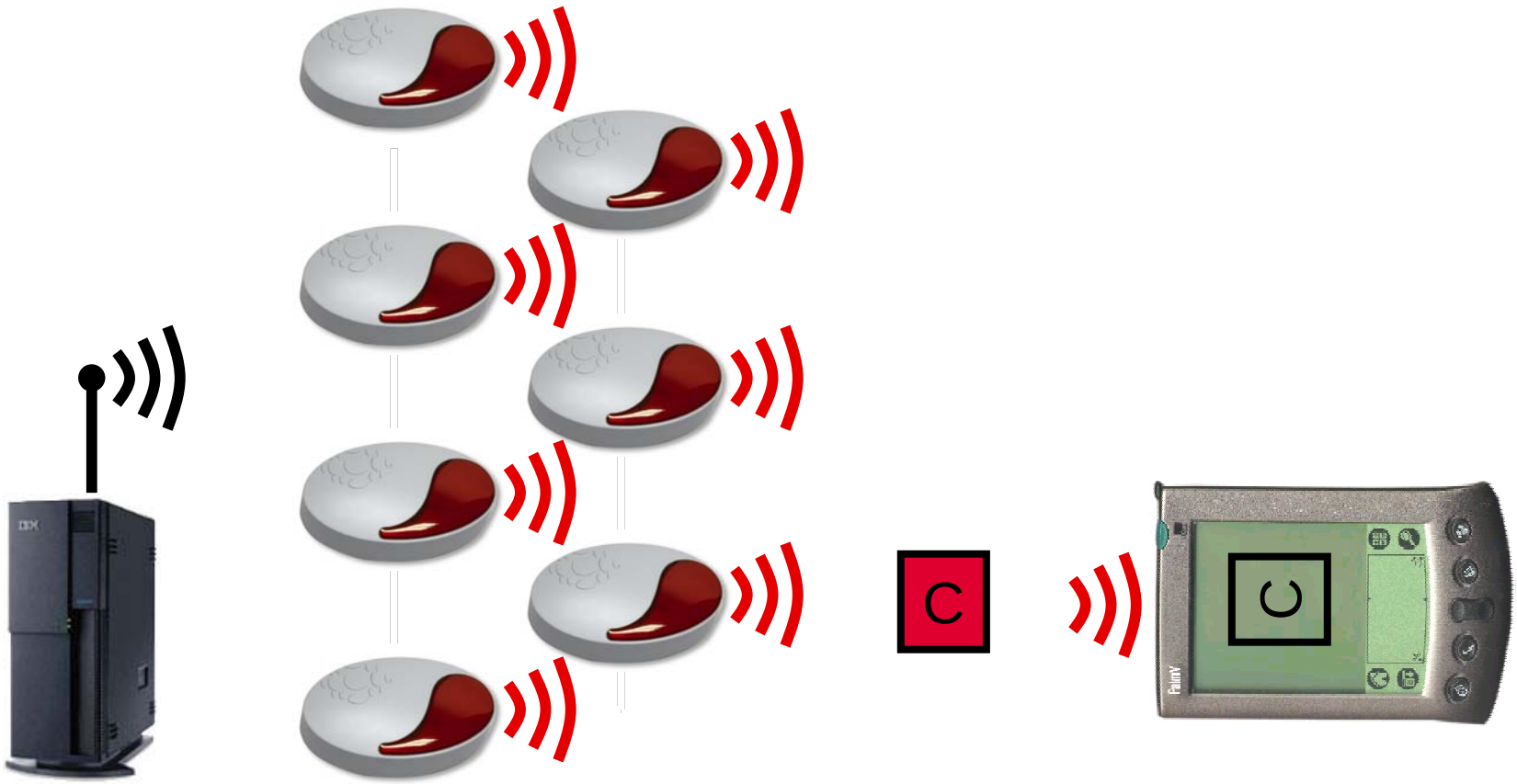
1. prototype

- IrdA compliant
- Mechanical configuration
- Serial connection to server

- Optical Configuration
- Logics on sender
- Wireless connection to server

eyeled

IRREAL: functional principle



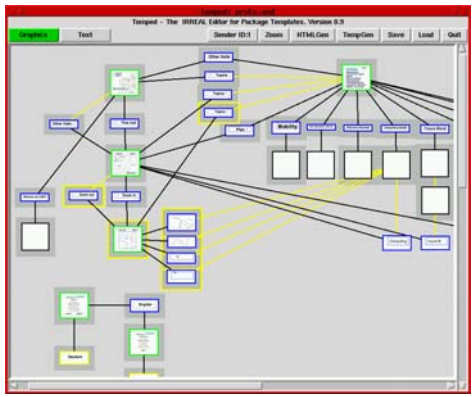
IR Beacons (www.eyeled.com)

16-bit code

Palm OS / WinCE Library

- Range >= 4-8 m
- Weight: 80g
- Batt.-life:1-3 years

Software components



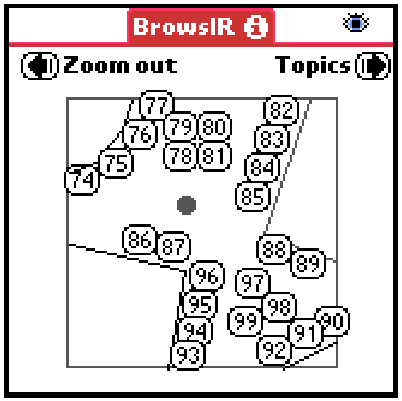
TempEd

$$w'_{ik} = \frac{1}{c^{i+1}}, c \geq 1$$

$$S = \sum_i \sum_k w'_{ik}$$

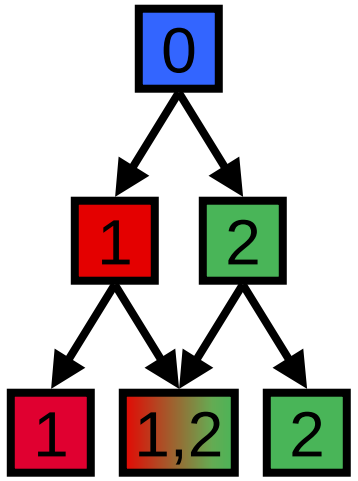
$$w_{ik} = \frac{w'_{ik}}{S}$$

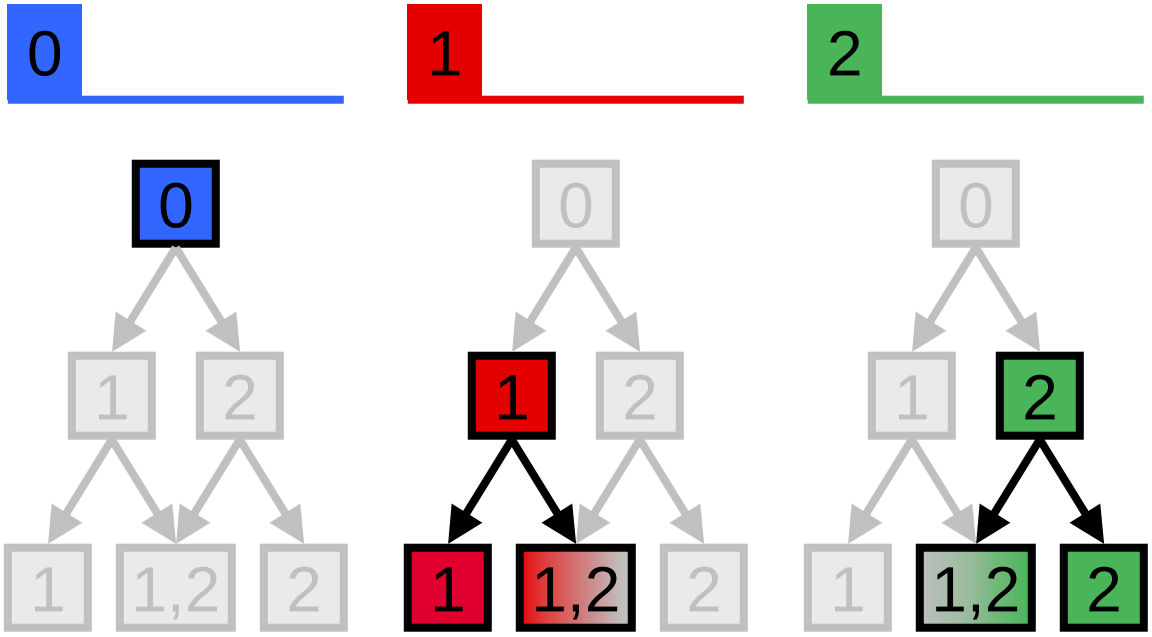
IRD



BrowsIR

Usergroups & Filtering





IRREAL: Example of Indoor Navigation

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Adaption to the walking speed and orientation of the user by using a stochastical broadcast-protocol

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IRREAL

IntraRot REAL

- Navigation in Gebäuden
- Passive Lokationssensitivität
- InDA Sender, 20 m Reichweite
- Empfang lokationsabhängiger Daten
- Richtungsinformation durch Infrarot

ARREAL

Augmented **R**eality **REAL**

- Outdoor navigation
- Active location sensitivity
- GPS based
- Generation of Presentation on Client
- Orientation of user tracted with electronical compass

Components of ARREAL

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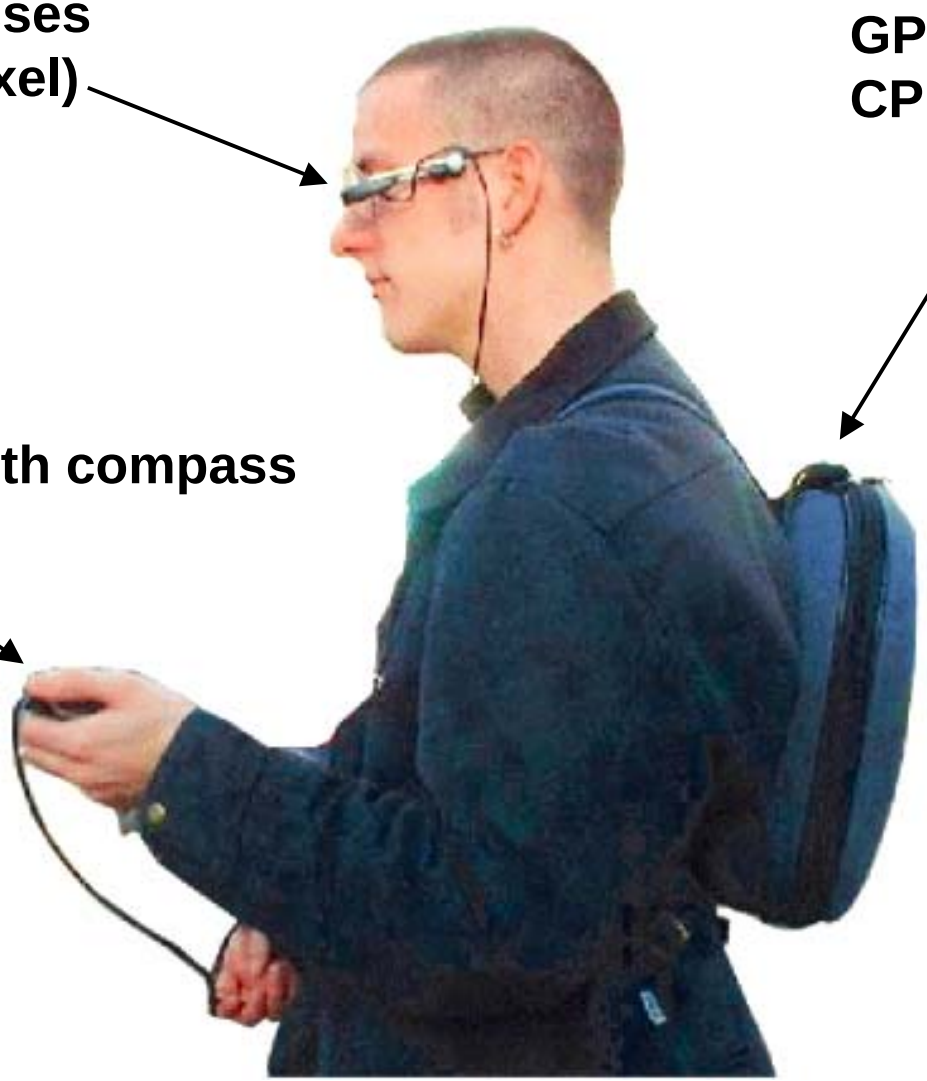
Clip-on glasses
(640x320 Pixel)

GPS-System
CPU (Sony Vaio C1XN)

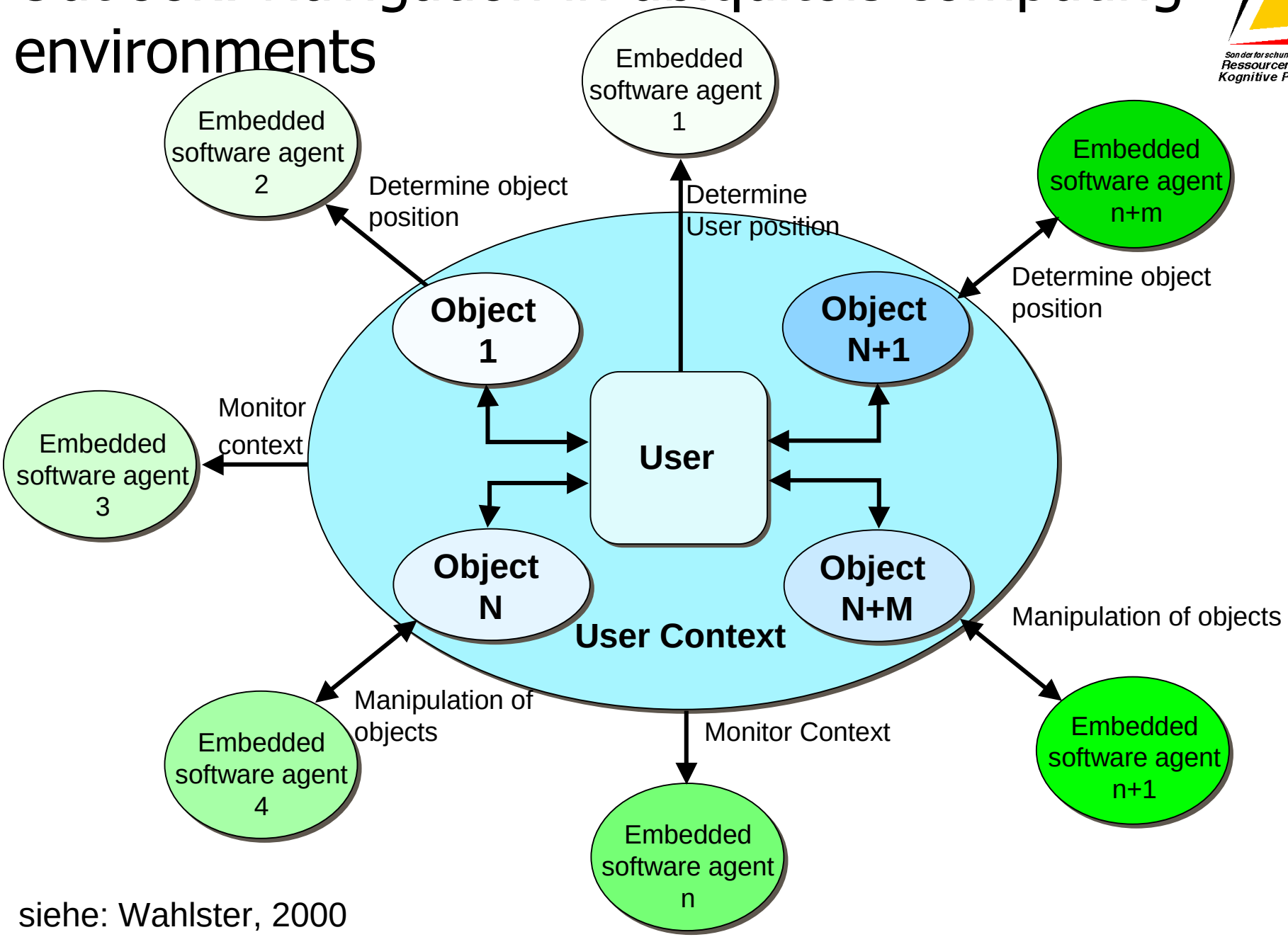
3D-Mouse with compass



ARREAL: Example of Outdoor Navigation

Adaptation to speed, qualtiy of position and orientation by changing the level of detail, the scale and the textual and graphical annotations

Outlook: Navigation in ubiquitois computing environments



siehe: Wahlster, 2000

Outlook: Location-aware services in ubiquitous computing

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Cognitive Resources	Navigational Resources	Technical Resources
Time pressure **Distraction by phone call** 	**Position 100%**  **Orientation 100%**	
No time pressure **No distraction** 	**Position 50%**  **Orientation 0%**	   **Distributed navigational information with ubiquitous computing**
No time pressure **No distraction** 	**Position 50%**  **Orientation 0%**	   **Situated navigational information with physical user interaction**

Discussion…

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Further Information:

w5.cs.uni-sb.de/irreal

W5.cs.uni-sb.de/arreal

www.dfki.de/~krueger

www.eyeled.de