Requirements for future ultrasonic location systems

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UbiComp summerschool
August 7-14, 2002

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Introduction: Phenom project

- *Phenom* = Perceptive Home Environments
  - Context Aware applications for the in-home domain...
  - …given future home networks of consumer devices

- Co-operation: Philips & Technical Univ. Eindhoven

- 4 PhD students ; 4 Research areas
  1. User Interaction
  2. Learning and user profiling
  3. Middleware
  4. **Indoor (ultrasonic) location technology**

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Contents

- Introduction
- Applications using location information
- Requirements for location technology
- Location technology selection
- Research goal / progress
- Conclusions

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Applications

- Survey of applications scenarios was done.

- Many in-home Context Aware applications require location information.

Examples

- Graspable User Interfaces

- Location-based filtering & selecting
  - Tour guides
  - Phenom application: photo-browsing

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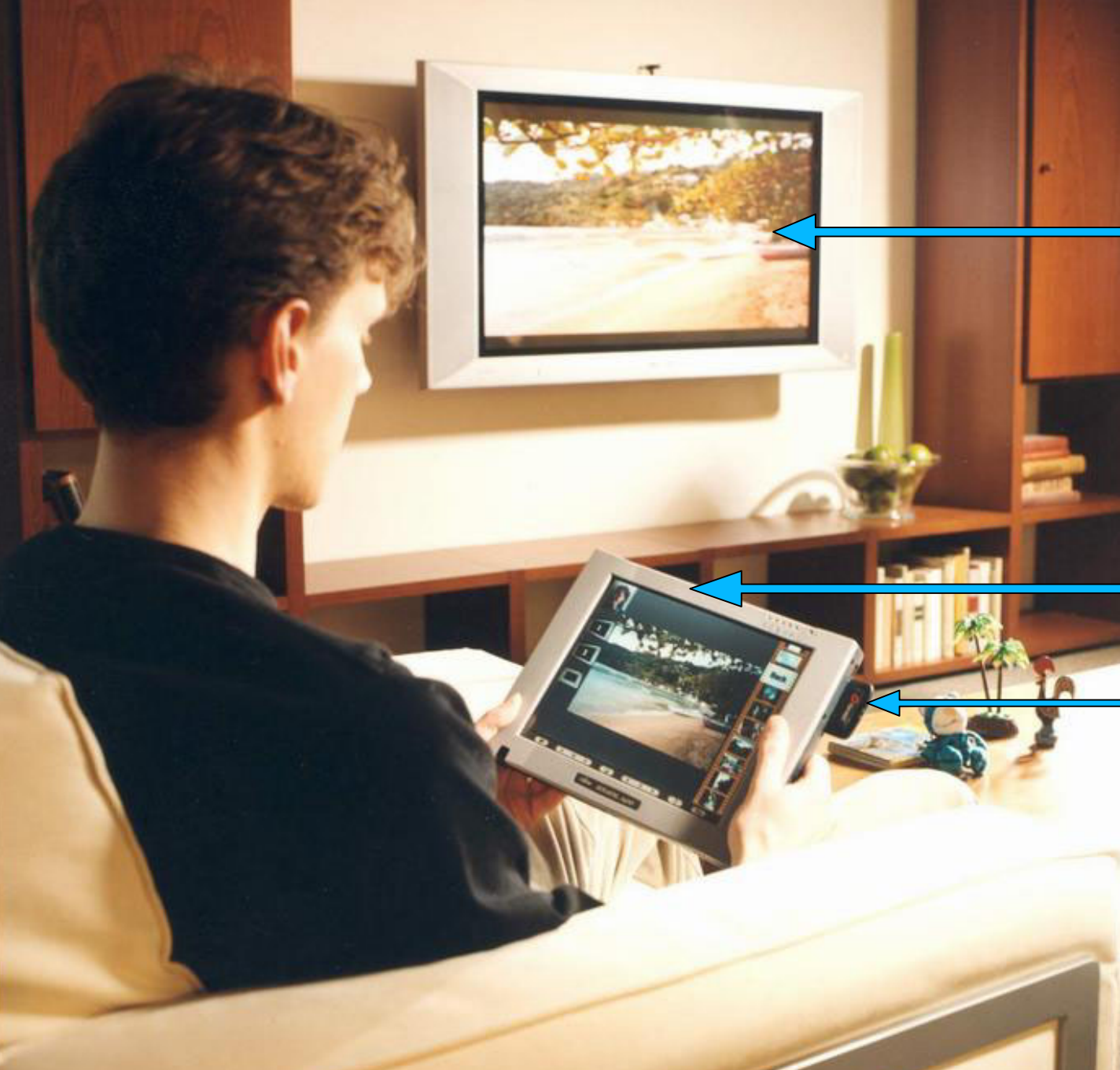
TV screen can
show photos

Photo-browsing
device

Wireless
Ethernet link

Requirements for location technology

- Application requirements
  - What kind of *location information* is needed by applications.

- User/domain requirements
  - domain = in-home

Location information

What location information do we need?

Type of information: **About:**

Proximity / range   } {   Persons

Position 2D / 3D   Devices

Which-room   Objects

Orientation

Movement patterns

Note: for clarity, this list has been simplified a bit.

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Requirements for location technology

- Applications with similar requirements can be grouped

- Result: number of *requirements sets*

- Selected: one *set* that enables sufficient applications of interest

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Requirements set

- Application requirements
  - Robust 3D device location in a room ;
    - possibly orientation too
  - 1 *cm* - 1 *m* accuracy range ; dep. on applications
  - Response time < 1 *sec*

- User/domain requirements
  - Low cost, mass production electronics
  - Low power consumption
  - Easy "plug-and-play" installation by non-expert user
  - Minimal maintenance
  - Acceptable form factor

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Location technology: selection

- Survey was performed
  - Acoustic, EM/RF, optical, mechanical systems

- No system/technology meets all requirements

- Promising technologies
  - Acoustic (ultrasonic)
    - mature technology
  - RF Ultra-Wide Band (UWB)
    - immature, but much interest. Recently, FCC approval!
    - **www.uwb.org**

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Research goal

- Improve on existing ultrasonic positioning technology...

- ...to better meet the user/domain requirements

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Conclusions and Outlook

- Location information = important

- Ultrasonic and RF-UWB technologies promising
    - For high resolution positioning

- We hope to improve on existing ultrasonic technology
    - To meet the user/domain requirements

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Thank you!

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