A Pilot User Study on 3-D Museum Guide with Route Recommendation Using a Sustainable Positioning System

Takashi Okuma¹) Masakatsu Kourogı¹) Nobuchika Sakata²) Takeshi Kurata¹)

¹) Information Technology Research Institute, AIST
²) Graduate School of Engineering Science, Osaka University
Our 3-D museum guide system based on indoor positioning

Pilot user study on our system
  - Usability evaluation
  - Investigation of the effect of the different types of display (HMD / Handheld) on usability
Research background

- Content related to a user’s position
- 3-D map viewer is now available

Expected Services in the next generation

3-D guide service
Technical issue: Indoor positioning

Based on Kourogis method

- Walking detection + Dead reckoning
  - Self-contained sensors (three-axis accelerometers, gyro sensors, and magnetometers)
  - Embedded computer (footstep detection and travel distance estimation)

- External references
  - GPS (only for outdoor)
  - RFID (mainly for indoor)
  - Wi-Fi radio-wave-based method

- Map matching

3-D Museum Guide System: Software configuration

Measurement system

MySQL
Course data
Flash content position
Event time table
System status/history

Query

HTTP Server + PHP Scripts

Position and Orientation
Update Request
KML generation

Google Earth
3-D visualization
Platform

Query for Flash content

Display controller

Query for Flash content

Adobe Flash content data
Adobe Flash content data
Web browser pop-up control

Web browser + Flash Player
Adobe Flash content presentation
3-D Museum Guide System: Hardware configuration

- **Monocular HMD**
- **Self-contained Sensors**
- **Embedded Computer**
- **Battery**
- **RFID tag**
- **Hand-held PC (558g)**
- **Belt bag (562g)**

*Augmented Reality Interaction Subgroup*
Real World-based Interaction Group / Information Technology Research Institute

*AIST*
Pilot User Study : Goal

Participants recruitment advertising

Evaluation

- Usability of our guide system
- Effect of different display style on usability
- System robustness and measurement accuracy
- Focused on qualitative evaluation
Science Museum (5 floors : about 2500m² each)
4 days
- 2 sessions/day, maximum 3 participants/session
- Troubles observed during the pilot study are corrected promptly

22 participants
- 12 females, 10 males, from teenagers to 50’s
- 2 hours test + questionnaire, group interview
- Participants under 16 years old ▼ Hand-held only

Support staff
- Dealt with system trouble
- Ensured security
- Recorded participants’ activities
Result: about 3-D map

- Controversial
  - both positive and negative feedback
- Negative opinions...
  - 'difficult to understand'
  - 'the visualized position was different from my actual position'
    - Actually, this participant recognize the correspondence.

The 3-D map gave useful visual cues.
Visualization of raw measurement data made participants confused.
- Ex) virtual camera position might be too near:
  - easy to see details of the map
  - measurement error was enhanced
Result: about navigation and route recommendation

Many negative feedbacks

- Participants didn’t / wasn’t able to follow
  - Traveling direction was not clear
  - Destination was not clear

- Some problems are caused by the visualization
Result: about navigation and route recommendation

- Negative feedbacks are reduced after the improvement
- Presentation of destination is future work
Result: Comparison HMD with Hand-held

- **HMD**
  - Not easy to see / eyes are easy to get tired
    - Monocular HMD: requires concentration to see
  - Easy to experience hands-on exhibits
  - Not good device for the Science Museum
    - Many children visit but they cannot use it…

- **Hand-held**
  - Easy to see
  - Comfortable for eyes
  - Comfortable to see exhibits
  - Heavy
  - Allow sharing of information

![Comparison HMD with Hand-held](image-url)
3-D museum guide prototype system

Pilot user study

- There has been no study of 3-D indoor guide systems comparable in scale to this pilot study.
- Ensure usability of the 3-D map
- Got knowledge of 3-D visualization method for map/position/navigation route.
- Ensure characteristics of HMD/Hand-held Display for Museum Guide System
Future works

- Statistical analysis of questionnaire
- Analysis of recorded activities
  - motion log / recorded movie & voice
  - Using relive tools for activity log analysis
- Improvement of user interfaces
  - UI design for users of all ages
  - UI can be adapted to users of all ages
  - Effective visualization of position that contains measurement error
Thank you for your attention

청취 감사합니다

ご清聴ありがとうございました