Personalized Museum Tour on a Mobile Device

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Introduction

• Museum experience

• Motivation
  – Improve experience by personalized tour

• Problem statement
  – Virtual tour to physical tour
Approach

• How a personalized tour can be implemented on a mobile device:
  ► What makes a good museum tour? (both)
  – Which technologies can be used for a mobile museum tour? (both)
  – How can we import a virtual museum tour and synchronize user data on a mobile device? (Rody)
  – How can a virtual museum tour be mapped to the physical space? (Yuri)
  – How can we retrieve the user’s position in a museum? (both)
  – How can we implement user guidance in a mobile museum tour? (both)
Approach

- Exploration phase
- Design phase
- Implementation phase
Approach

- Exploration phase
  - Museum tour analysis
  - Scenarios
  - Requirements
  - Technology analysis

- Design phase

- Implementation phase
Approach

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- Design phase
- Implementation phase
Exploration phase

Museum tour analysis

- Different types of museum tours
  - Human guided tours
  - Audio tours
  - Online internet tours
  - Multimedia (PDA) tours

- Criteria
- Derived properties of a good mobile museum tour
Exploration phase

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Exploration phase

Museum tour analysis

• Different types of museum tours
• Criteria
  – Tour properties
  – Physical space
  – Locator
  – Content
  – Interaction
• Derived properties of a good mobile museum tour
Exploration phase

Museum tour analysis

- Different types of museum tours
- Different criteria
- Derived properties of a good mobile museum tour
Approach

- Exploration phase
  - Museum tour analysis
  - Scenarios
  - Requirements
  - Technology analysis
- Design phase
- Implementation phase
Approach

- Exploration phase
  - Museum tour analysis
  - Scenarios
    - RFID Reader scenario
  - Requirements
  - Technology analysis
- Design phase
- Implementation phase
Approach

- Create tour and upload tour:
  - Client:
    - Mobile device
    - Mobile tour
    - Mobile tour data
  - Server:
    - Web server
    - CHIP demonstrator
    - CHIP data
  - TCP/IP

- Perform the tour in the museum:
  - Client:
    - Mobile tour data
    - Mobile device
    - RFID reader
  - Physical museum space:
    - Artworks with RFID tags
  - Radio Frequency
Approach

• Exploration phase
  – Museum tour analysis
  – Scenarios
  – Requirements
  – Technology analysis

• Design phase
• Implementation phase
Exploration phase

Requirements

- System requirements
- Synchronizing data
- Filtering and ordering
- User guidance and positioning
- Content
- Help
Approach

- Exploration phase
  - Museum tour analysis
  - Scenarios
  - Requirements
  - Technology analysis
- Design phase
- Implementation phase
Exploration phase

• Technology analysis
  – Device classes
    • PDA / Smart phone
    • Mobile phone
    • PMP (Portable Media Player)
  – Operating systems
  – Application type
  – User positioning technologies
  – Connection type
  – Communication standards
Exploration phase

- Technology analysis
  - Device classes
  - Operating systems
    - Windows Mobile
    - Symbian
    - Palm OS
    - Embedded Linux
  - Application type
  - User positioning technologies
  - Connection type
  - Communication standards
Exploration phase

- Technology analysis
  - Device classes
  - Operating systems
  - Application type
    - Web application
    - Standalone application
  - User positioning technologies
  - Connection type
  - Communication standards
Exploration phase

- Technology analysis
  - Device classes
  - Operating systems
  - Application type
  - User positioning technologies
    - GPS
    - RFID
    - Infrared
    - Bluetooth
    - Location-based wireless
  - Connection type
  - Communication standards
Exploration phase

• Technology analysis
  – Device classes
  – Operating systems
  – Application type
  – User positioning technologies
  – Connection type
    • Online
    • Offline
  – Communication standards
Exploration phase

- Technology analysis
  - Device classes
  - Operating systems
  - Application type
  - User positioning technologies
  - Connection type
  - Communication standards
    - Wi-Fi
    - UMTS / GPRS / EDGE
    - Bluetooth
    - Infrared
Approach

- Exploration phase
- Design phase
- Implementation phase
Design & Implementation

- Importing and synchronization
- Mapping
- User positioning
- User guidance
Design & Implementation

- Importing and synchronization
- Mapping
- User positioning
- User guidance
Design & Implementation

• Importing and synchronization
  – Tours
  – User Model

• CHIP RDF to XML
  – Mobile device supports XML
  – CHIP mobile data application provides XML interface
Design & Implementation

**Mobile device**
- Application data model
- Tour package
- Tour list

**Web server**
- Mobile user model
- CHIP user model
- CHIP RDF
- Navigation data
- Tour data

Object model | XML | TCP/IP
---|---|---
Application data model | Tour package | TCP/IP
Tour list | Mobile user model | TCP/IP

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Design & Implementation

Synchronizing the User Model

- PostUserModel Servlet
- GetUserModel Servlet
- User model in XML

- CHIP Mobile Data Application
- XML Writer (DOM)
- SeRQL
- User model

- Mobile User model
- Website User model

Mobile device

CHIP Demonstrator RDF datastore

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Design & Implementation

- Importing and synchronization
- Mapping
- User positioning
- User guidance
Design & Implementation

Mapping a virtual tour to the physical space

Artworks in virtual tour → Filter unavailable artworks → Unordered set of artworks → Ordered set of artworks → Apply constrains → Artworks in PMTMD
Design & Implementation

Mapping a virtual tour to the physical space

- Filter unavailable artworks:
  - Restricted to current exhibition
  - Rijksmuseum: Location data from CHIP RDF
Design & Implementation

Mapping a virtual tour to the physical space

- Ordering of tour artworks:
  - Locations play a role in physical space
  - Determine a logical order
  - Uses distances between artworks
Design & Implementation

Mapping a virtual tour to the physical space

- Apply constraints:
  - Set number of artworks or set duration
  - Estimate # of artworks and tour duration
  - Use walking time and attracting power
  - First removes lowest rating artworks and then most off-route artworks
Design & Implementation

Mapping a virtual tour to the physical space

Visualization:

- Filter unavailable artworks
- Set # of artworks
- Set tour duration
- Browse filtered artworks
Design & Implementation

- Importing and synchronization
- Mapping
- User positioning
- User guidance
Design & Implementation

User positioning

- Inspired by tour at NAI using Infrared technology
- We implement RFID technology
Design & Implementation

- Importing and synchronization
- Mapping
- User positioning
- User guidance
Design & Implementation

User guidance

Routing framework:
- Floors
- Rooms
- Doors
- Artworks
- Waypoints
Design & Implementation

User guidance

- Route calculation:
  - Basic route finding algorithm
- Adaptive user guidance:
  - Users do not follow proposed tour
  - Visit non-tour artworks
  - Different order
Current status

Mobile tour concept application

Future work:
- Interface improvements
- Multiple client applications
- Online tour
- Social functions
- More adaptation
Conclusion

We add dynamic, adaptive and personalized functions to mobile museum tours.

We proposed methods to:
- Import and synchronize tour and user data
- Map a tour from virtual to physical space

We add innovative elements:
- User positioning using RFID
- User guidance using the route framework

We showed how a museum tour can be implemented on a mobile device
Demonstration