Indoor Positioning Systems for Intelligent Museum Visitors Support Service

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Motivation

- Majority of museums has a limited space for visitors causing visitors traffic jam and increasing waiting time for them.
- Google Art Project allows visitors to see online interesting information of museums exhibition. It is possible to show this information for museum visitor (“Internet guide”).
- There are many research approaches and projects are focused in the area of museum guides: SMARTMUSEUM (FP7 project), HIPS, CRUMPET, KUBADJI projects, and etc.
Task Definition

The main goals of Intelligent Museum Visitors Support Service:

- Organize excursion plans depending on the context information in the museum and museum visitors preferences.
- Provide actual textual, graphical, video and audio information of exhibition for the museum visitor.

Needed: Indoor Positioning Systems Based on Communications Supported by Smartphones (Wi-Fi, Bluetooth, GSM)
### Comparative Analysis of Indoor Positioning Systems (1)

<table>
<thead>
<tr>
<th>Solution</th>
<th>Type</th>
<th>Positioning technology</th>
<th>Declared Accuracy</th>
<th>Architecture</th>
<th>Context information</th>
<th>Navigation functions</th>
<th>3D positioning</th>
<th>Statistic information</th>
<th>Platforms</th>
<th>Using Maps</th>
</tr>
</thead>
<tbody>
<tr>
<td>IWAYtours</td>
<td>IPS</td>
<td>Cell and Wi-Fi fingerprinting</td>
<td>1-5m</td>
<td>Standalone</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>Android</td>
<td>Google Maps</td>
</tr>
<tr>
<td>Wifarer in-venue navigation</td>
<td>IPS</td>
<td>Wi-Fi fingerprinting</td>
<td>1,3m</td>
<td>Client-Server</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>iOS, Android</td>
<td>Individual Maps</td>
</tr>
<tr>
<td>Walkbase</td>
<td>API</td>
<td>A-GPS</td>
<td>10-50m</td>
<td>Client-Server</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>Android</td>
<td>-</td>
</tr>
<tr>
<td>Smartmuseum</td>
<td>IPS</td>
<td>RFID</td>
<td>0.5m</td>
<td>Client-Server</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>Windows Mobile, Symbian</td>
<td>-</td>
</tr>
<tr>
<td>Google Maps (indoor module)</td>
<td>IPS</td>
<td>Cell and Wi-Fi triangulation</td>
<td>5-10m</td>
<td>Client-Server</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>iOS, Android, Blackberry</td>
<td>Google Maps</td>
</tr>
<tr>
<td>Skyhook Location</td>
<td>API</td>
<td>Cell and Wi-Fi triangulation</td>
<td>10m</td>
<td>SDK</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>Android, Linux, Windows, Mac OS</td>
<td>MapQuest</td>
</tr>
<tr>
<td>Qubulus LocLizard</td>
<td>API</td>
<td>Cell and Wi-Fi fingerprinting</td>
<td>1m</td>
<td>SDK</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>Android</td>
<td>Google Maps, Bing Maps</td>
</tr>
</tbody>
</table>
## Comparative Analysis of Indoor Positioning Systems (2)

<table>
<thead>
<tr>
<th>Solution</th>
<th>Type</th>
<th>Positioning technology</th>
<th>Declared Accuracy</th>
<th>Architecture</th>
<th>Context information</th>
<th>Navigation functions</th>
<th>3D positioning</th>
<th>Statistic information</th>
<th>Platforms</th>
<th>Using Maps</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nokia Indoor Navigator</td>
<td>IPS</td>
<td>Bluetooth 4.0 and Wi-Fi triangulation (HAIP)</td>
<td>0.3-1.0m</td>
<td>Client-Server</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>Windows Phone 7, Symbian</td>
<td>Navteq Destination Maps</td>
</tr>
<tr>
<td>Microsoft RADAR</td>
<td>IPS</td>
<td>Wi-Fi fingerprinting</td>
<td>2-3m</td>
<td>Client-Server</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>?</td>
<td>Bing Maps</td>
</tr>
<tr>
<td>Horus</td>
<td>IPS</td>
<td>Wi-Fi fingerprinting with location clustering</td>
<td>2-3m</td>
<td>Client-Server</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>Windows XP, Linux</td>
<td>Individual Maps</td>
</tr>
<tr>
<td>Indoor Localization Application by Eladio Martin et. al.</td>
<td>IPS</td>
<td>Cell and Wi-Fi fingerprinting</td>
<td>1.5</td>
<td>Standalone</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>Android</td>
<td>Individual Maps</td>
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<td>Place Lab</td>
<td>IPS</td>
<td>Cell, Bluetooth, and Wi-Fi centroid, fingerprinting, particle filter</td>
<td>13-30m</td>
<td>Client-Server</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>?</td>
<td>Individual Maps</td>
</tr>
</tbody>
</table>
Ontological Approach of Smart Museums Service

Visitor 1

Wi-Fi positioning

Mobile device i

Visitor i

Mobile device n

Wi-Fi positioning

Visitor n

Cloud 1

Profile

Context

Ontology

Smart Environment

Services

Positioning

Information

Current situation

Museum / Exhibition
Case Study

- Personal Inf.
  - Name: John Smith
  - E-mail: john.smith@yahoo.com
  - Phone: +358000000
  - Date of Birth: Jan 01, 1960
  - Language: English
  - Gender: Male
  - Position: School teacher

- System Inf.

- Preferences

- Types of Exhibits: Paintings
- Style: Impressionism
- Mandatory: Black Square
- Excursion Duration: 3 hour
- Exhibits Occupies: Medium

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**Mona Lisa**
(also known as La Gioconda or La Joconde) is a sixteenth-century portrait painted in oil on a poplar panel in Florence, Italy by Leonardo da Vinci during the Renaissance. The work is currently owned by the Government of France and is on display at the Musée du Louvre museum in Paris under the title Portrait of Lisa Gherardini, wife of Francesco del Giocondo. The painting is a half-length portrait and depicts a seated woman whose facial expression...
Conclusion

- The innovative approach of smart museums service for supporting visitors has been presented.
- The approach allows different devices in the museums smart environment to interact with each other, transfer their positions for the purpose to suggest visitors a museum which is currently better to attend and propose excursion plan to the visitor in the area of museum.
- Comparative Analysis of Indoor Positioning Systems based on communications supported by modern smartphones has been presented.
Thank you for Attention
Questions are Welcome

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