User Presence Detection in SmartRoom using Innorange Footfall Sensor

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User Presence: Scenarios

SmartRoom provides a set of digital services to many participants

- $S_1$: User arrival to the room (spatial physical area)
- $S_2$: User waits for beginning of the main activity
- $S_3$: User joins and leaves during the main activity
- $S_4$: Activity statistics
Human participation

- End-users have personal computers and mobile devices
- User devices are connected to SmartRoom WLAN
- Mapping: MAC ↔ user
Passive Radio Detection using RSSI

- Received Signal Strength Indication
- Estimate RSSI threshold (rough estimation)
- Low implementation cost
- Accuracy is satisfactory for typical instances of scenarios $S_1 - S_4$
Innorange sensor: Footfall Technology

- Based on the methods of passive radio detection
- Detects presence of WLAN and BT capable devices
- Custom OpenWRT-based software
- Choosing Wi-Fi wireless channels
The sensor sends its measurements: MAC address, RSSI value and timestamp

Backend processor:
- HTTP endpoint to receive presence data from sensor
- Presence information processing and store to SIB
Presence Detector KP

<table>
<thead>
<tr>
<th>Name</th>
<th>Last seen</th>
<th>Degree of presence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Person 1</td>
<td>1 min</td>
<td>Full</td>
</tr>
<tr>
<td>Person 2</td>
<td>2 min</td>
<td>Full</td>
</tr>
<tr>
<td>Person 3</td>
<td>35 sec</td>
<td>Physical</td>
</tr>
<tr>
<td>Person 4</td>
<td>50 sec</td>
<td>Virtual</td>
</tr>
<tr>
<td>Person 5</td>
<td>1 min</td>
<td>Full</td>
</tr>
</tbody>
</table>

- The KP detects presence information change (enter and last seen timestamps)
- Determines the degree of a user’s presence (e.g. absent or full)
- Publishes data in the SIB for other services and **User Notifier**
Degree of presence

- User of the SmartRoom system has 3 basic triggers:
  1. **Registered**: User registered in the system by registration service or client
  2. **Logged**: User logged in the system with the client
  3. **Detected**: User detected in the system by using Innorange sensor

- The user may be in different states at the same time
- Combinations of states determine differently the **degree of presence**
Degree of presence

- Absent
- Virtual
- Physical
- Full

+ Registered
- Detected
- Logged

- Registered
- Detected
- Logged

- Registered
- Detected
+ Logged

+ Registered
+ Detected
- Logged

+ Registered
+ Detected
+ Logged

Dmitry Korzun
Presence Detection in SmartRoom
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Expansion of the SmartRoom Ontology

Triples example:

\langle Presence \rightarrow uuid, enter, 1362052175 \rangle
\langle Presence \rightarrow uuid, isPresent, True \rangle
\langle Presence \rightarrow uuid, lastSeen, 1362052175 \rangle
\langle Presence \rightarrow uuid, degree, Full \rangle
Integration of Footfall Sensor into SmartRoom

- Room with floor area of $13 \times 7 \ m^2$
- Sensor is mounted the center of the room
- Personalized devices on different mobile platforms: Symbian, Android and Windows Phone
- RSSI threshold is $-35$
- **Source code:** [http://sourceforge.net/projects/smartroom/services/presence-service](http://sourceforge.net/projects/smartroom/services/presence-service)