New Interaction Paradigms using Mobile Location-Based Services
AR Navigation

INSTAR – Information and Navigation Systems Through AR
AR Navigation

INSTAR – Information and Navigation Systems Through AR
Method and Device for Displaying Driving Instructions, especially in Car Navigation Systems

EU, Patent EP 1 415 128 B1
USA, Patent US 7,039,521 B2
GER, Patent DE 102 36 221 C 1

Method and Device for Displaying Navigational Information for a Vehicle

USA, Patent US 7,216,035 B2
AR Navigation

The Solution

Step 1 Navigation Digital Map
AR Navigation
Impressions
AR Navigation
The Future
Initial Paradigm
Draw Gestures and Read with See-Though Displays
Geo Gate
Location-Triggered Interaction Paradigm
Geo Display
Location-Triggered Interaction Paradigm
Geo Advertising
Location-Triggered Interaction Paradigm

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Geo Advertising
Location-Triggered Interaction Paradigm
Geo Message (SMS)
Location-Triggered Interaction Paradigm
Technology
Location-Triggered Interaction Paradigm
Technology
Location-Triggered Interaction Paradigm
Technology
Location-Triggered Code Execution

Central Server System
(1) Position
(2) Geo Search
(5) Web-Request →
(9) Web-Response

Third Party Vendor
(6) Internal Request
(8) Internal Response

GPS

(3) Data

(4) Data Illustration
(10) Action Illustration

Mobile Device

Geo-Sensor

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Sensor Types
For Location-Triggered Code Execution

ENTRY SENSOR

EXIT SENSOR

SINGLE TRANSIT SENSOR

DOUBLE TRANSIT SENSOR
Geo Logistics Hödlmayr
Real Use-Case
Smart Information Campus
Real Use-Case
Indoor Localization
Fingerprinting System (JKU and Siemens)
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Indoor Localization
Future Aspects – Rotating Antennas
Energy Consumption for Location Determination
## Energy Consumption for Location Determination

<table>
<thead>
<tr>
<th>Technology</th>
<th>Accuracy</th>
<th>Precision</th>
<th>Energy</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-GPS</td>
<td>10m</td>
<td>95%</td>
<td>6,616Ws</td>
</tr>
<tr>
<td>WiFi</td>
<td>50m</td>
<td>90%</td>
<td>2,852Ws</td>
</tr>
<tr>
<td>Cell-Id</td>
<td>5km</td>
<td>65%</td>
<td>1,013Ws</td>
</tr>
</tbody>
</table>

Energy Consumption
Finite State Machine for Energy Savings

Start

A
Best Accuracy
iOS: Best For Navi (1)
Android: GPS+Network

1. background & moving & unobserved & no POIs & $\Delta t > 3$min

B
Less Accuracy
iOS: Kilometer (5)
Android: Network

2. foreground | observed | POI near

C
Region Monitoring
iOS and Android: via system event

3. background & not moving & $\Delta t > 2$min

4. background & not moving

5. moving

Background Mode
Energy Consumption
Implementations in App “Spotnick”
Energy Consumption
HTC Desire HD / Android 2.3.5

Standby
100 %

GPS
9,7 %

GPS + HTTP
7,5 %

Spotnick
65,5 %

Improvement
operating times
8,7 times longer
compared to
worst case

Standby time is
13,3 times longer
Energy Consumption

iPhone 4S / iOS 6.01

Standby
100%

GPS
8,1%

GPS + HTTP
7,9%

Spotnick
50,5%

Improvement
operating times
6,3 times longer
compared to worst case

Standby time is
12,6 times longer
Accuracy

iPhone 4S / iOS 6.01
Accuracy

HTC Desire HD / Android 2.3.5
Accuracy

Limitations

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Recent Projects
VIATOR – Interaction Paradigms for Disabled People
Prospect
Individual Navigation Instructions

In 50m turn left

Turn left now!

After the gate turn left
Prospect
Innovative Interaction Paradigms using LBS