SIGN - Adapting Navigation Instructions to Individual Users

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Outline

introduction
• personalized mobile services

SIGN
• motivation
• basic idea

terminology
• from navigation systems
• from situation-based systems
• interconnection

back to SIGN
• architecture
• general procedure

conclusions
Personalization of Mobile Services

**technological aspects**

- small displays
- limited interaction capabilities
- bandwidth
- communication cost

**usage aspects**

- mobile usage (ad hoc, short, as support)

→ „intelligent“ services
Example: Navigation Systems

Navigation systems support two modes:

- In 500 meters turn right!
- In 750 meters turn right!
- In 200 meters turn right!
- In 100 meters turn right!
- Now turn right!
Example: Navigation Systems

Navigation systems support two modes:

- **off**
SIGN - Basic Idea

SIGN module
situation-dependent guidance and navigation

suiting navigation to local knowledge
backlight on, notification sound, „left into Schillerstraße“
SIGN - Notions

**familiarity**  
describes routes a user knows (local knowledge)  
as an absolute concept

**habits**  
describes routes a user usually takes  
as a relative concept

**expectations**  
describes route features a user expects (due to  
familiarity and habits)

**side conditions**  
limits familiarity, influence habits, e.g.,  
• weather,  
• daylight,  
• season,

→ modeling of a user‘s history and  
comparison required
Terminology
**Terminology from Navigation Systems**

**link**

a basic road element

e.g., “Wilhelmstraße” from “Behrenstraße” to “Unter den Linden”

![Link Diagram]

e.g., NAVTEQ: (53500573,0)

**segment**

an ordered set of successive links

![Segment Diagram]

**route**

triple (startpoint, endpoint, ordered set of succ. links)

![Route Diagram]
**situation**

A situation is a set of characteristic features – or characteristics – valid during a time interval.

symbolically

\[(t_b, t_e, C)\]

characteristic features:

\[a \rightarrow a_1 \rightarrow a_2 \rightarrow a_3 \rightarrow a_4\]

\[a = A(a_1) \quad b = B(b_1) \quad c = C(c_1)\]
**Situation terminology**

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>situation</strong></td>
<td>invariant feature holding during a time interval</td>
</tr>
<tr>
<td><strong>feature</strong></td>
<td>logical proposition defined over a dimension: e.g., location(office)</td>
</tr>
<tr>
<td><strong>dimension</strong></td>
<td>predicate defined over a concept hierarchy (DAG)</td>
</tr>
<tr>
<td><strong>pattern</strong></td>
<td>conjunction of features</td>
</tr>
</tbody>
</table>

*Based on predicate logics*
### Situation terminology (cont’d)

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>situation sequence</strong></td>
<td>ordered set of non-overlapping situations</td>
</tr>
<tr>
<td><strong>transition</strong></td>
<td>difference in the patterns of two neighboring situations</td>
</tr>
<tr>
<td><strong>event</strong></td>
<td>change in the situation of a user (time, transition)</td>
</tr>
<tr>
<td><strong>sequences</strong></td>
<td>pattern sequence</td>
</tr>
<tr>
<td></td>
<td>transition sequence</td>
</tr>
<tr>
<td></td>
<td>event sequence</td>
</tr>
</tbody>
</table>
Routes and Situations

e.g., intermodal routes including different transportation
  • public as well as individual transportation

pattern sequence

situation sequence
Routes and Situations (cont’d)

routes as situation sequences

situation-dependent preferences

integration with weather, daylight conditions

inferring familiarity and habits
System Architecture
SIGN - Architecture
Back to the Example
knowledge-dependent navigation instructions depend on familiarity and habits

route representation

as pattern sequences

- Platz der Vereinten Nationen
- Mollstraße
- Karl-Liebknecht-Straße
- Alexanderplatz
- Karl-Liebknecht-Straße
- ...

integrating additional features, e.g.,

- daylight conditions,
- guided (yes/no),
- season

advantage

“string” manipulation functions applicable
**SIGN - Basic Algorithm**

new route

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**basic procedure**

(1) Identify familiar routes.

(2) Compute familiar segments of the new route.

(3) Compute the optimal segment combination.

(4) Derive Instructions.

to work  !left  to TU  !straight  !left
Conclusion
## Conclusion

**personlization**
- uses the notions of
  - familiarity,
  - habits, and
  - expectations

**SIGN approach**
- based on describing and comparing situation sequences

**application of SIGN**
- in individual motorized transportation
- also applicable in public transportation (?)

**some further research issues**
- familiarity extraction
- familiarity dependent routing
Thank you very much!