Using the Internet in a Mobile Public Transport Navigation System

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Abstract. In this demo, we present a Java ME application for mobile phones that supports people traveling in a city and relying on public transport. Our application is able to retrieve destinations and connections from various web services. In this way, it is an implementation of a ubiquitous Internet-based information retrieval system. In the current version, our system runs in the metropolitan region of Nuremberg, Germany, and maintains 2,200 bus, tram, train, and sub way stops along with all lines. The abstract sketches the system architecture and describes how the system uses information from the Internet.

1 Introduction

Everybody knows the situation from own experiences: just arrived at the train station in a city never visited before, a lot of baggage with you. You do not know the way to the hotel. No taxi around, but many busses waiting at several bus stops. Which one could bring me to my hotel?

The answer is to ask ROSE, the mobile **ro**uting **se**rvice for people that use public transport for moving. ROSE is a Java ME program running on any mobile phone that supports GPS internally or can connect to a GPS receiver by bluetooth. Using GPS, ROSE locates you, lets you enter a destination, searches for the nearest bus (or subway, tram, ...) stop offering a connection to your destination, and navigates you to the bus stop.

2 How does ROSE work?

In this section, we present ROSE's system architecture. We outline how connections are retrieved from the Internet based information service maintained by the German railway. Finally, we go through an example session and give details on how users are supported by the ROSE during a trip.

2.1 Architecture of the System

When the user is looking for a public transport connection, the user may select a destination stored previously on the phone in the list of his favorites. Normally however, the destination must be retrieved from elsewhere by either

– entering an address and looking for its GPS coordinates on Google Maps, or
– entering a name and searching GoYellow for the GPS coordinates, or
– entering the name of a monument, location, etc. and looking for the GPS coordinates on the WikiPedia site.

The list of services is not exhaustive as the server is implemented in such a way that other web services may be added. The ROSE server itself does not implement a search algorithm, this is done by each service. Therefore, also structured data, such as RDF data or database content, can be processed.

For finding a connection, ROSE sends a request to the WAP service of the German railway. The request contains the GPS coordinates for a bus stop near the current location and the destination. The WAP service is able to process this data and returns a connection that is sent back to the mobile phone where it will be displayed to the user. Using this WAP service, ROSE is able even to retrieve connections between to GPS coordinates across Europe.

2.2 Integrating Knowledge from Various Internet Resources

The ROSE server retrieves data from different web services. It can be configured with a script that knows how to format a request for a particular web service and how to analyze its response in order to extract the required information.

In our development version we integrate a recommender (described in [2, 1]) that analyzes texts about monuments, museums, events, and other touristic information for sightseeing. The user can express his current interests such as *I want to do something outside to relax, maybe with music.* The recommender extracts topics and emotions out of this query and compares it with the above mentioned tourist information texts that it gets from various Internet sites.

In a current experimental version of ROSE, we are testing to incorporate web services that provide other useful information beyond GPS coordinates or connections. Interesting examples are information about delayed flights or trains. This kind of information is different from that obtainable from the other web services as it does neither provide GPS coordinates nor connections and therefore requires changes in the user interface.

2.3 The User Interface for Navigation

Up to now, the user interface supports three phases of a trip. First, a foot walk from the current position to the bus stop (see **1** in Fig. 1). The arrow indicates the direction towards the bus stop. The display also shows the departure time for the next bus and the distance to the bus stop. Finally, it tells the name of the bus stop and the bus line to further help the user. In a menu, the user can request an update of the information in the display at any time. He can confirm to be arrived in time or to be late. In this case, the system looks for the next connection. Second, on the bus the user is informed about the arrival time and the name of the station where he has to leave the bus (see **2** in Fig. 1). If this is not the destination, ROSE tells the user to which bus to change and where

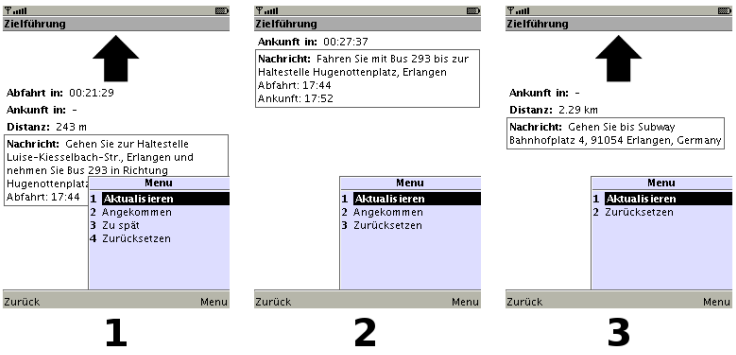

Fig. 1. ROSE's Three Phases of Navigation

the right bus stop is located. Finally, like in phase 1, in the last phase the user is guided on his foot walk to the location of his destination (see **3** in Fig. 1). Multilinguality of the interface can be achieved by changing the configuration of the text prompts.

3 Other Navigation Systems

Most public transport information tools are browser based and do not help much when your desktop is far away. WAP services give connection information, but do not support users with life information during the trip. Many mobile applications implement e-ticketing, but do not combine this with connection information or even navigation. On the other hand, navigation solutions for pedestrians do not care about public transport. The same is true for point of interest finders and tourist information system. Most of them are web-based and therefore cannot assist during a trip. Mobile versions lack Internet connectivity and therefore may contain outdated information.

To conclude: the combination of services with a public transport navigation system is an innovative solution to a well-known problem for traveling people. We are currently working on implementing a route planning algorithm that takes user preferences into account. Together with public transport providers we are preparing a series of studies to get feedback from people that use the system in their everyday life.

References

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