How to Inform People with Reduced Mobility about Public Transport

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Abstract. The German project BAIM supports the active and independent participation of people with reduced mobility in public transport. It focuses on the provision of accessible and adaptable information services with target group oriented information about suitable travelling options or potential barriers, before and during the journey. The information is provided via internet and via an interactive telephone service with speech-recognition. The system has been implemented and tested in two integrated public transport systems, Rhein-Main-Verkehrsverbund and Verkehrsverbund Berlin-Brandenburg, covering a population of 11 Mio. people, with a strong emphasis on user participation in all project phases. Main parts of the system went public in January 2008.

Keywords: accessible public transport, people with reduced mobility, information service, barrier-free travelling.

1 Introduction

About 20–25 % or even more of the population are estimated to have "a reduced mobility" when using public transportation systems, comprising physically disabled people, persons with sensorial disabilities, mentally disordered people, but also people carrying heavy luggage, a baby carriage, or a bicycle. Those people often face problems in planning journeys with public transport [1,2]. Information about the accessibility of vehicles, buildings, stations, and stops is often either not available at all or not available in an appropriate accessible form, or general information is given but not detailed enough [3].

During the past few years, many established information systems were enhanced with information regarding the accessibility of the public transport facilities. Some services, like those developed in the EU projects ASK-IT [4] and MAPPED [5] provide the user with most up-to-date information on mobile devices while travelling. Other information systems, like those at London or Vienna, offer their customers route planning that considers some accessiblity features.

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BAIM Project. In January 2008 a pilot of an information service went public that supports or enables the active and independent participation of people with reduced mobility in public transportation by the provision of usergroup-oriented, accessible information services on barrier-free travelling opportunities. The information service has been developed within the German project BAIM (Barrier-free information for people with reduced mobility in public transport) [6].

Project Consortium. The project consortium consists of two public transport associations: Rhein-Main-Verkehrsverbund RMV (coordinator) and Verkehrsverbund Berlin-Brandenburg VBB; their traffic and information technology provider: IVU Traffic Technologies AG; the information service provider HaCon Ingenieurgesellschaft mbH; the service provider of spoken dialog based systems SemanticEdge GmbH; the rehabilitation centre Evangelische Stiftung Volmarstein with its Research Institute for Technology and Disability (FTB).

2 Development of the Travel Information System

To make public transport easy to use for everyone, detailed information about all stages of the journey has to be provided, comprising information about stations, stops, and vehicles. To ensure that the information is accessible for everybody, at any time and any place, different ways of presentation are necessary. The focus of the BAIM project is on internet-based services.

The BAIM information services can be used with standard devices such as personal computers and mobile phones or smart phones. New or special devices are not developed within the project. The usage of standard devices is regarded as an important advantage because potential users are already equipped with such devices.

BAIM is a pilot project. Advanced information services are developed for two test regions: Berlin-Brandenburg and Frankfurt RheinMain. These regions have different characteristics, e. g. one has a monocentric structure, the other is polycentric.
One aim of the BAIM project is to work out a basis for a nation-wide or European standardisation.

2.1 Analysis of the User Requirements

Based on an elaborated classification of the target user groups, the user requirements with their priorities were analysed at the beginning of each development phase [7]. Wheelchair users and blind travellers have the highest information needs. The importance of the information (“attributes”) about vehicles, buildings, and information services etc. before and during the journey were evaluated for each of the target user groups. For most users the personal computer is the most relevant information medium for planning the journey, while spoken language (telephone) is important before and during the travel. Mobile phones are applicable, both, for spoken as well as for text information, depending on the user groups. It was found that PDAs are rarely used by the target user groups.

2.2 Data Management

In order to establish a barrier-free travelling chain ("routing"), a detailed modelling of the "accessibility" features of all possible elements of the travelling chain is necessary. Therefore, at the beginning of the project, data about 1,600 railway stations and stops was acquired in the Rhine-Main area, and of about 700 buildings in the region of Berlin-Brandenburg. There are different sources of static and dynamic information about buildings and vehicles: transportation enterprises provide data on e.g. the stops and platforms, the equipment of the vehicles, the plan schedule, deviations from schedule, and real data from escalators; local providers give information on the equipment of buildings, and the length and duration of inter-connecting footpaths inside the buildings.

The quality of data is crucial because each false information may break the travelling chain. Fig. 1 gives an overview of the principle data flow in the BAIM information system.

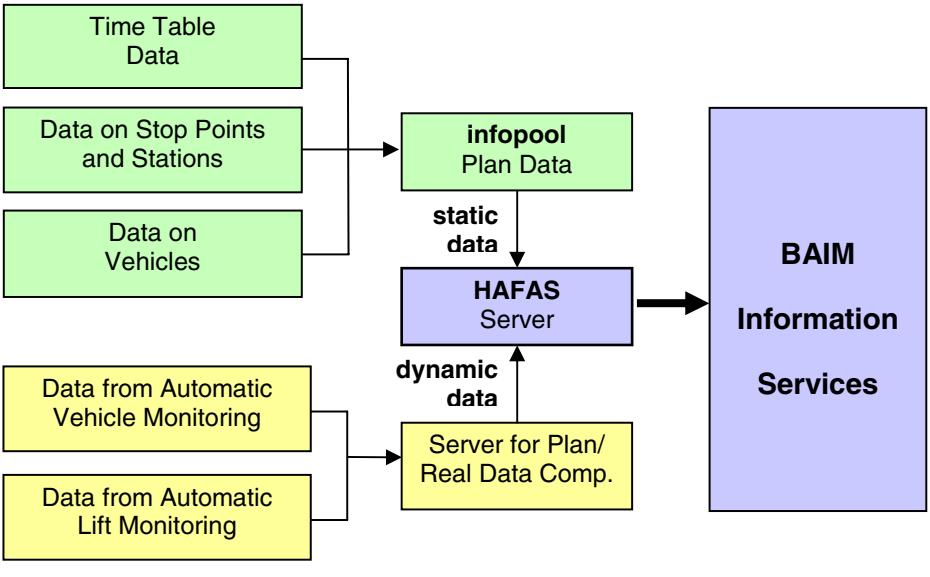

Fig. 1. Flow of static and dynamic data in the BAIM information system

The transportation companies provide the schedule data to the data management system "infopool" by the partner IVU. Additionally, the BAIM system receives data describing the stops and stations, including footpaths. Before exporting the data to the HAFAS server by the partner HaCon, they are processed by an inference system that generates attributes necessary for routing. The HAFAS server provides all data and services for the BAIM information system.

2.3 Barrier-Free Routing

For each element of a potential travelling chain there are assigned information attributes (fig. 2).

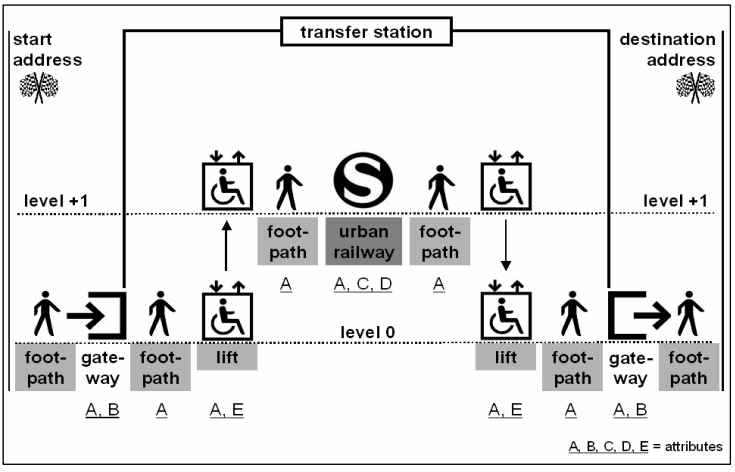

Fig. 2. Example of a travelling chain with attributes for barrier-free routing (source: IVU)

Lifts, stairs, and ramps etc. are internally treated as footpaths. The HAFAS routing algorithm searches for travelling chains with attributes corresponding to a given user requirements profile, then it investigates the fastest or most convenient connection.

2.4 BAIM Information Services

Journey Planner

The most important BAIM information services are the improved and extended versions of the existing web based journey planning services www.vbbonline.de and www.rmv.de of the participating transportation authorities.

The journey planning services now take into account the specific additional requirements of the traveller with reduced mobility. In order to address the individual requirements for an optimal journey suggestion, several attributes are necessary to model the individual situation. To keep things simple in the RMV version, requirement profiles (fig. 3a) are pre-defined for different user groups with a range of discrete values for each attribute, e.g. weight categories of wheelchairs or slope categories of tilted ramps. If necessary, the user can easily make adjustments to the requirement profile, for instance by selecting a different wheelchair weight category.

The results of the trip planner are barrier-free journeys with detailed information regarding paths and rides according to the specified requirement profile. There exist direct links to available information about train stations or bus stops and vehicles. So this information is easily available through the trip planner.

Station and Vehicle Information

The static station layouts and maps of the surrounding area (fig. 3b) were supplemented by interactive station layouts which provide additional functionality in two ways: On one hand it is now possible to select specific station attributes to be shown thus adjusting the view to the user's requirements. This reduces the amount of information presented and yields more clarity. On the other hand, depending on the

Fig. 3. (a) Choice of a user profile on a mobile phone. – (b) Map of the surroundings.

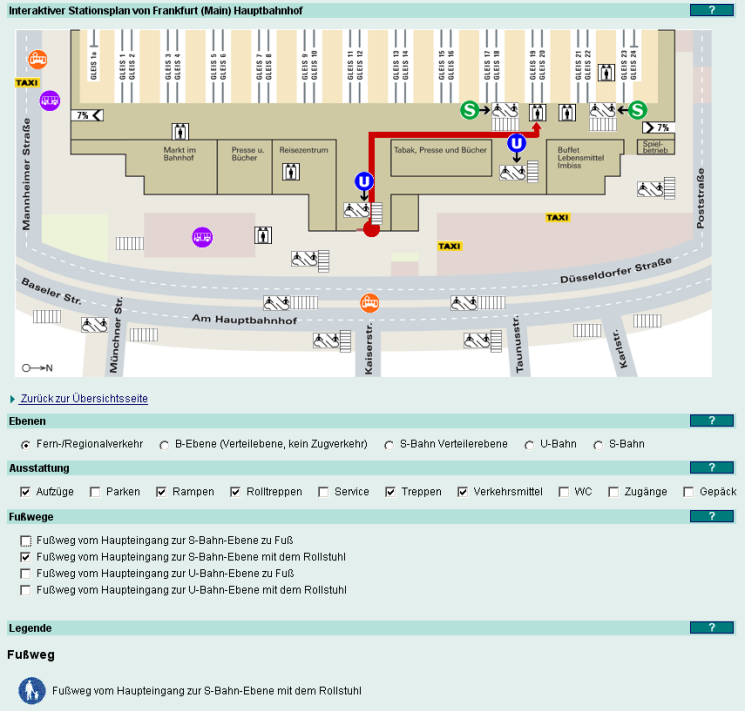

Fig. 4. Interactive station plan with footpath information for wheelchair users, Frankfurt/M. main station.

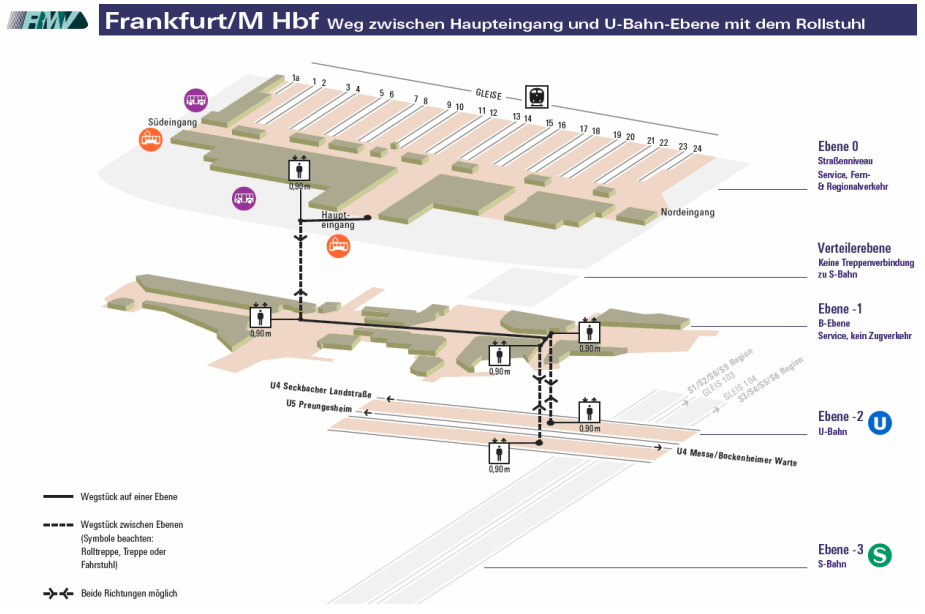

Fig. 5. 3-D station plan with footpath information, Frankfurt/M. main station

requirements of the user, predefined footpaths can be shown: for instance a person using a wheelchair can select a path from the station's entrance to the correct platform (fig. 4), even across different floor levels. 3-D maps give an overview on the levels of complex station buildings (fig. 5).

Blind people and people with low vision have access to textual information: a descriptive overview of platforms, entrances and buildings is followed by descriptions of the most important footpaths, e.g. from the platform to the exit or into the town centre. Using a compatible player the user can replay a corresponding audio file while travelling.

Instead of an elaborated station layout there is a list of accessible equipment available especially for small train stations and bus stops.

In particular for wheelchair users, the location of doors and boarding aids as well as wheelchair parking space within vehicles is of importance.

Speech Based Information Services

Besides internet based information services a phone based service becomes an alternative source of information for travel planning. A phone dialogue system for travel planning which is being used by the "Verkehrsverbund Berlin-Brandenburg" is therefore modified to provide additional information with regard to accessible travel and installations in stations to assist people with disabilities. After the caller has stated the starting point and the terminal point of his journey, he can specify to be given an accessible route and if applicable exclude specific means of transportation. The specified parameters are transferred to the HAFAS routing system and the resulting journey information is automatically spoken to the caller. Additional audio

information such as the layout and environment of all city train and subway stations in Berlin can be requested by phone.

Mobile Services
Currently, an information service on accessible travel routes for mobile devices is under development. This includes a special browser optimized version of the information system. The functionalities of the web based information systems are maintained in this version for use with mobile devices. However alterations need to be made to account for the small display and the reduced means of entering data.

3 Findings

The user participation during the first phases of BAIM has led to considerable valuable input for the design of the system. Preliminary assumptions and requirements from the user side have been confirmed. The majority of the users, taking part in the project, definitely benefit from this kind of information. The requirements of different user groups differ very much. Therefore, a criteria based information retrieval, taking into account the respective mobility restriction, received the highest preference. The results of the first user evaluation have significantly improved the usability of the information system – a prerequisite for the going public.

A final user evaluation will take place in April 2008, taking into account user feedback from the current pilot system.

4 Future Plans

Mobile services are the most advanced stages of the information systems developed within BAIM. They are based on the extensive database which was set up for the internet services and the functionalities developed in connection with the web based journey planner. If a reliable database can be established these services will be made freely available to the general public. The users will then have access to innovative services and a high level of information quality. A comprehensive evaluation of the services by end users will conclude the current development and will be the basis for further development in the future:

Integration of real time data provides an opportunity to make situational adjustments during a given journey: It will be possible to issue a request via the internet to find out whether trains are delayed and if the journey needs to be recalculated. Long term service disruptions (e.g. because of construction work) will be made known via pull services (i.e. as RSS-Feed) and via push services (i.e. as e-mails).

Target group specific information with regard to *location* is of specific importance in the context of mobile devices, too: ad hoc information, people who are hard of hearing or people who are deaf are particularly interested in short term information, for instance, regarding the change of an arrival / departure platform as they are unable to hear what is said via the loudspeakers on the platform or in the vehicle. People who use a wheelchair also require information while travelling just in case a planned journey must be abandoned or altered because it is no longer accessible due to

problems with the infrastructure (elevators, escalators, train delays etc.). For a system to work in such a way the user profile and the planned journey need to be registered (in a personalised private area).

By analysing the user requirements, the project team has identified a need for such additional information services and devised ideas for implementing them. However realisation of those ideas will be the subject of a follow-up project.

Acknowledgement

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