Accessibility of Mobile Phone Applications

Gerhard Weber
Technische Universität Dresden
Dept. Comp.Science
Nöthnizer Str. 46
01602 Dresden, Germany
+49 351 4363 38467
gerhard.weber@tu-dresden.de

ABSTRACT
Applications on mobile phones are offering a new service quality for eGovernment applications. We discuss the development of access to electronic time table displays as an example for the difficulties of inclusive design. The mAIS system provides personalized presentation of such information on a mobile phone. It has been implemented in two iterations each followed by evaluation in a field study with more than 55 people having a large variety of specific and contradictory needs. The user-centered design process terminated successfully and usability has been confirmed for looking up time-table information remotely or locally by each user group. However, inclusive design requires a better understanding of the communication needs when design new applications.

Keywords
Mobile system, multimedia messaging, accessibility, public transportation

INTRODUCTION
Mobile phones are more and more accepted by people who rely on assistive technology. For example, blind people install a screenreader and gain access to applications using the GUI offered by Symbian operating system, similar to people with low vision who would install a screen magnifier but perceive as little as what is spoken out through speech synthesis or presented on a mobile Braille display. Hearing impaired people may avoid interferences with modern hearing aids when calling and some deaf people like the use of SMS for exchange of text messages. People relying on a wheelchair use it also to carry a mobile phone and gain some more independence. Moreover, mobile phones are more and more common among elderly people for similar reasons. Each of these groups uses public transportation often since driving a car is experienced as challenging if not impossible.

Some public transportation operators offer web-based access to real-time time table information, even suitable for mobile phones, but there are several limitations when trying to use browsers as a user interface. The identification of bus stops and trains station requires some expertise typically not available to the less frequent traveler. Route planning is not accomplished beforehand but adapted on the fly under real-time conditions depending on the available connections, other interests such as shopping and knowledge about transportation modes. It appears, quick lookup of time table information provide those displays found at bus stops and train station platforms and positioned at a considerable height to secure them from vandalism.

Such electronic time table displays are largely inaccessible to blind or visually impaired people. In addition, information is not listed about lowered floors allowing access by wheelchair to a vehicle. Commonly only numbers and final destinations are listed, adding little to improve orientation for all people.

Very common are SMS based services to look up the time table for some bus stop. They require learning to apply the syntax for a query, read the bus stop number posted somewhere, and interpret the response, which may be overwhelming for busy places. We found no train operator offering a SMS-based service, probably for this reason.

LOCATION-BASED LOOK-UP
The mAIS system consists of Bluetooth beacons mounted at bus stops to identify them appropriately [1]. Beacons operate independently and are plain transmitter boxes requiring no service and no network. A pedestrian requests from the mAIS server display information by a Bluetooth enabled mobile phone while implicitly providing the bus stop identification and a user profile. Beacons are detected by our client software when triggered upon user request. The transaction involves look-up of the transportation operator's database. In our study both real-time data and plain time table data were used.

Figure 1: Displays with time-table data in Flensburg

The system was implemented in three cities in Northern Germany: Kiel, Flensburg and Neumünster, each operated by different service provides and consisting of different data base systems deploying different types of electronic displays (see Figure 1). This technical demonstration also

allowed involvement of a considerable number of potential users.

Evaluation

The system personalizes the time table data. It takes multiple user profile into account and uses speech synthesis, provides color contrast and enhances the presentation. Users have confirmed this adaptability in field trials.

Initially there was no remote query planned. After the first trail most users have noted absence of such a feature. As the developers were themselves using public transportation not often and where well mobile, this major design flaw was only discovered in the field study.

Table 1 shows how the mAIS was used after the second trial. Remote requests were issued by all type of users.

Discussion

The mAIS system aims at one task: look-up data on electronic displays for public transportation. We have applied user-centered design and based the design on two user surveys [2]. The context of this system makes it necessary to include a considerable variety of people with different needs. Each type of message was designed with a particular user group in mind. Moreover, the concept of inclusive design [3] was applied in order to gain insight into the adaptability of such a system. Only user testing seemed to be possible as no expert was found to apply heuristic evaluation for this large variety of users. However, it appears the design process still needs further guidance in order to understand the number of iterations needed.

In particular in the early phases of design, which typically consist of mock-ups, it was difficult to include end users, as mock-up techniques for mobile phones could not be applied. In particular we found it very difficult to understand the type of accessibility problems we could encounter in mobile phone applications without implementing a sample application. Many participants had used mobile phones not as rich client but just for SMS and phone calls, thus had no experience relevant to our questions.

When designing for many types of users a more economic approach is needed. More indicators have to be developed in order to understand if each user group has to participate in parallel or if some user groups represent also others.

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	Control group	**Elderly**	**Blind People**	**People w. Low Vision**	**Hearing Impaired**	**Mobility Impaired (Wheelchair)**
Local request	2	1	7	3	1	4
Remote request	15	1	16	2	3	10
At bus stop	3	2	8	3	2	6
From within bus	0	0	2	0	1	0
From within a train	0	0	7	0	1	1
Other location	6	0	10	1	1	2
40 min in advance	2	0	5	0	1	4
20min in advance	2	0	11	0	2	4
10min in advance	2	1	11	1	1	6
3min in advance	2	0	10	1	2	4