Concept of the application supporting blind and visually impaired people in public transport

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ABSTRACT

The subject of the research is support of blind and visually impaired people using a system designed by the author. Presently, in Central Europe, the urban public transport is developing, however, the equal opportunities for handicapped people are not always ensured regarding travelling. For instance, blind people experience hardness on the vehicles as significant part is not informing the passengers about the upcoming and current stops through the speakers. Entering the correct bus is also problematic as they are not able to see what exact vehicle has arrived. In those cases asking other people can be uncomfortable or sometimes even impossible (empty bus or empty bus stop). The TraView application offers a solution for such hard situations for blind and visually impaired people travelling by public transport.

Keywords: Disabled, application, visually impaired, mobility, public transport.

INTRODUCTION

Approximately, 1.8 million blind or visually impaired people live in Poland. People with visual impairments face many difficulties in everyday life situations. In cities, the main difficulty is spatial orientation. It is problematic for them to get to the desired location. While traveling by public transport, they are confused about stops they are passing by and especially on which stop they should get off. Theoretically, every stop should be announced in the vehicles of public transport but often it does not happen. Most of them are new, but even those do not automatically announce the name of the upcoming stops. Usually in this kind of situation blind or visually impaired passengers have to ask someone for help. Lack of appropriate solutions (technological and organizational, etc) gave the idea of the TraView application – that is described in the study.

The TraView is an application which aims to increase independence of blind and visually impaired people in moving around the city by accompanying them from the user location to their desired destination. Using the application they may feel safe while traveling, regardless whether they are in a vehicle announcing stops or not.

SYSTEMS SUPPORTING BLIND AND VISUALLY IMPAIRED PEOPLE

Figure 1 shows systems used in supporting blind and visually impaired people. The diagram is divided into two levels: organisational, technical and technological level. In the organisational level there are three groups:

- Support at home;
- Support at work;
- Support outside of home and work.

In the technical and technological level there are solutions based on Internet of things, beacons, speech synthesizers or navigation. Inside of solutions at home we can find:

- Artificial intelligence;
Figure 1: Systems supporting blind and visually impaired people.

- Internet of things;
- Beacons, bar and QR codes.

Artificial intelligence can be the talking home assistant, communicating with users through voice and reacting on user's comments. Internet of Things (IoT), “a world where physical objects are seamlessly integrated into the information network and the physical objects can become active participants in business processes. Services are available to interact with these ‘smart objects’ over the Internet, query their state and any information associated with them, taking into account security and privacy issues” (Haller et al., 2009). The Internet of Things in an Enterprise Context (2009) composes one common system, for example, lighting system, heating solutions, radio and surveillance system in the user's homes allowing communication between them as well as control.

Beacons are Bluetooth radio transmitters. It is like a lighthouse: it repeatedly transmits a single signal that other devices can see. Instead of emitting visible light, it broadcasts a radio signal that is made up of a combination of letters and numbers transmitted on a regular interval of approximately 1/10th of a second. Beacons can be used for navigation at home helping to find rooms or objects that the user may need. Bar and QR codes placed on the objects facilitates its recognition as well as describing the components of the products, for example, food.

Support of blind and visually impaired people at work is also possible by:

1) IoT;
2) Beacons, bar and QR codes;
3) Compatible office software containing speech synthesizer and Braille keyboard.

IoT at work connects printer, computer, telephone and headsets to each other. Beacons allow localization of office rooms as well as objects in the office. Bar and QR codes can be used for the same purpose as at home but more concretely for office objects usually used for work purposes like computer, chair or objects in the office and kitchen allowing the blind or visually impaired person to be independent during lunch break.

In support outside of home and work there are:

1) Beacons;
2) Navigation;
3) Travel information systems of public transport.

Beacons may be used for public transport station and flat identification which is useful for navigation to the destination. Moreover, beacons can be placed on Typhlographic maps and also on vehicle of the public transport for indicating when to get in. Beacons are very innovative and its usage may be very useful. The TraView application is placed under the “support outside of work and home” as it concerns mobility in the city.

**THE CONCEPT OF THE TRAVIEW APPLICATION**

The concept concerns TraView application which will support blind and visually impaired passengers travelling...
by public transport. The following points describe features of the application:

- Application will allow users to set desired location and chose the best route from those proposed by the system;
- Navigation during the journey;
- When passengers will arrive the stop the application in the next step will give information about arrival so the user will know when to get inside the vehicle in a public transport;
- After the user enters the bus the application will inform him/her about the stops, the person passing by and indicate when to get off;
- When leaving the vehicle application will continue navigation to the set direction;
- The user and the application will communicate with each other using speech synthesizer and voice recognition;
- The application is planned to work on Android operating system;
- Application will be available on all means of transport;
- Information about the real time arrival of the public transport vehicle will be supplied from GPS location database shared by Public Transport Authorities or using beacons technology.

The biggest value of the application is life facilitation. Passengers using the application will become more independent in their daily routine activities. One of these activities is traveling by public transport. The application will allow the user to get to the desired location without anyone’s help, which will increase comfort of blind and visually impaired people. The user will be independent in all kind of means of transport as well as walking on the street. The application will be available free of charge which may be attiring for users as many applications are payed.

The solution is planned to work on mobile devices. Figure 2 presents the logical structure, the High Level Diagram. Application will be formed of several modules: GPS, Operating System, Application TraView, Speech synthesizer, Voice recognition and Public Transport Authority’s application or database which could be used in the application. The application will communicate with the GPS Space Segment, User and the application from the Public Transport Authority. The application from the public transport organisation will share information about the real time location of vehicles. Public transport time table will be the database used for planning the route.

Based on the GPS coordinates, application will verify the position of the passenger during the navigation from the base location until the destination. When traveling by public transport it will control which stop the vehicle is approaching.

Speech synthesizer will be used for navigation process as well as, for sharing information like name of the bus arriving to the stop. All names of bus stops will be announced as well as, the target stop so the user may independently decide where to get off without asking for help of other passengers.

**POSSIBILITIES OF APPLICATION DEVELOPMENT**

Application can be built in two ways. The first one is development of the solution from scratch; it means creating every module of the application separately from the beginning. The second option is the Enterprise Service
Bus (ESB), being part of the Service Oriented Architecture (SOA) concept. New application can be a sum of the best features from TraView and already existing applications connected through ESB.

ESB is an efficient, productive and agile solution allowing communication between mutually interacting software applications. The solution is cheaper and faster than development of the application from zero. For instance, ESB could join the best ideas from already existing applications like: TraView, Georgie Buses, Seeing Assistant Move, Virtualna Warszawa and form together one common App. Additionally, some applications which are not used for navigation but for other purposes could be used to form a larger scope like BeMyEyes and Uber App.

The features used on the Traview could be available on all means of transport (buses, metro, train and tram), voice recognition (ability to communicate with the application using user’s voice) and vibrations (signalisation); beacons technology is planned to be placed inside the vehicles of the public transport. From Georgie Buses solution informing buses real time location could be used. Navigation algorithms used by Seeing Assistant Move could be applied for navigation from the user location until the destination. BeMyEyes is related to support in cases when eyesight is necessary. It connects the user with the volunteer who may assist. Virtualna Warszawa uses beacons which allow navigation inside and outside the buildings. Connection with Uber App would add one more means of transport to the list: taxi. Using this application user could request for taxi and use other services of Uber like Uber Eats - application for ordering meals.

Figure 3 presents the High Level Diagram of the solution using ESB. On the figure there is customer segment (user device) and the application being the collection of the best features from different applications previously mentioned. ESB can be an easy solution for the future to implement new ideas into the scope.

Application is planned on Android system as it is used by most smartphone users [http://www.idc.com/promo/smartphone-market-share/os (07.08.2017)]. In 2017, Q1 85% of users chose Android. In the future improvement of the application could also be deployed on iOS being the second most famous system in the world.

In further development utilisation of beacons technology inside the buildings could also be considered to enhance the navigation solutions especially in cases when GPS technology is not enough.

CONCLUSION

The TraView application reduces mobility barriers of blind and visually impaired people. There is no such application on the market containing all the features of the TraView and in the same time being available free of charge. There are two options of development in terms of building the application: from scratch or using ESB which is cheaper and faster but requires licences from the owners. In the first phase application is planned for Android technology.
but in the future it could be deployed also on iOS.

Beacon is a future technology for solutions supporting blind people. It could be used inside of buildings and public transport vehicles where the functionality of GPS is limited or in many other solutions such as the border of the pedestrian crossing. All of these solutions can be collected and placed in the proposed application – TraView.

REFERENCES


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