Berner Fachhochschule
Wirtschaft

Creating a transportation app for visually impaired people

Bachelor Thesis

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Management Summary

Client for this thesis was Bernmobil. Bernmobil provides public transportation services in the Bern area by busses and trams. The idea for this assignment came from the interest to provide services for a specific target group, visually impaired people.

The goal of this thesis was to develop a concept of an assistive mobile application for visually impaired users to help them use public transportation by themselves. Literature research was used as the research method, which was based on the previous projects and reports on this field, including guidelines of the assistive application development and documentations about existing public transportation applications for visually impaired. The analysis and research for this project started by defining the problems, which visually impaired face when using public transportation. From a list of existing problems, four were picked which were found to be the most relevant. Guidelines for assistive application development define what is to be taken into consideration when developing an application for visually impaired users. Research of existing applications were used to define which features this kind of application includes, where they are used, and how the application for the visually impaired works. The conceptual design and interface of this application was based on the literature research.

The four major features of the conceptual application (planning the route, information about arriving vehicle, information while on board and information about abnormalities on the route) solve the problems defined by the literature research. Interaction between user and the application works by screen reader and touch-based gestures. The interface is designed to be simple, only including features that are relevant and necessary.

As a conclusion, companies and developers have made big efforts to design assistive applications for visually impaired. There is a lot of research concerning this matter on the general level. On the field of public transportation, there is still work to do. There are some public transportation applications that work locally in different parts of the world. World-wide there are only a few public transportation applications but they are not designed specifically for visually impaired users. So there is a gap to fill for Bernmobil to provide more accessible public transportation for their customers.

1 Introduction

1.1 Starting position

The principal of this thesis was Bernmobil. This thesis was made for Bernmobil to provide new services and experiences for customers in order to distinguish them from other public transportation competitors. Bernmobil is a Swiss company that provides public transportation in the Bern area, and it is owned by SVB Städtische Verkehrsbetriebe Bern. Their transportation services include travelling by busses and trams. They provide services which help customers to travel as easy as possible. myBernmobil and ÖV-plus-App are applications that provide information about their timetables, bus and tram routes, stops, the quickest routes to your destination, and real time footage when the bus or tram arrives. The applications work both on computers and smartphones.

1.2 Problem

Bernmobil offers information through apps and internet that is sufficient for customers, who don´t have any limitations which effect their travelling.

So the company was interested in providing help for short-sighted or blind customers. This thesis focuses on how to improve information about public transportation for people who have bad eye sight or are blind.

The problem asks which features would provide easier transportation for people with bad eye sight. It is to be determined what is possible and what is not for the target group. On the developer point of view, it is important to find out how a visually impaired person uses mobile devices and what guidelines there are, when developing an application for short-sighted or blind. Based on that, it is to be determined how the application should be designed so it would be user friendly for visually impaired users.

It should be taken into consideration how visually impaired person uses the public transportation, what are their preferences, what are the main problems when travelling, are there already assistive systems or applications for this target group and if there are, how they can be exploited?

1.3 Objective

The main goal of this project was to create a concept for a public transportation application for visually impaired. The process started with analysis and research. Gathering information about the topic by literature research and getting familiar with existing applications and assistive systems. Literature research was used to provide information about how to develop an application for visually impaired. Research also covers how a visually impaired person uses public transportation and what is to be taken into consideration. Besides travelling we had to find out how they use mobile applications and assistive systems, what are the preferences, when interacting with mobile applications and what features would bring most value for the visually impaired traveller. The next step was to decide what features the concept should include to help them travel on easiest way.

Searching and getting familiar with similar applications helped to find out solutions to questions and problems mentioned above. Similar applications might have already resolved existing problems so there was no point to spend effort to re-investigate them. The goal of this part was to exploit existing ideas and features by improving them.
After the analysis and research, the development of the concept with essential features could begin.

Based on the concept the user interface was designed as mock-ups so the functionalities of the application could be represented concretely.

1.4 Methods

The process started by getting familiar with the topic through reading studies and articles about the usage of public transportation by visually impaired, and finding out what the situation has been with public transportation assistive systems before, including what there are currently and what are the plans for the future. After acquiring basic knowledge, the literature research went for more in-depth on the state of application development for visually impaired. It included existing research projects, reports and guidelines on application development for visually impaired. More precisely, the purpose of the literature research was to find answers to following questions:

- Defining existing problems that visually impaired encounter when using public transportation
- What approaches there are to develop an application for visually impaired people
- Demands of the applications functionality
- How visually impaired use the mobile applications?

Searching for similar applications was used to get to know what is already available on the market. Getting familiar how they work, what methods they use, examining whether they are used locally or worldwide, and looking at whatever is relevant for an application like this. The analysis of the results is used to perceive what features this kind of application should include.

The user interface design part will include designing mock-ups for the app. They were designed by using a mock-up designing application. Mock-ups were evaluated and then improvements were made based on the evaluation. It was preferred; if possible, that visually impaired person would have evaluated the user interface.

1.5 Structure

The thesis began with the literature research. Information found was documented on the 2nd part of the thesis. It starts by introduction to target group, how many visually impaired there are world-wide and then more precisely in Switzerland. Next phase was defining the problems, which exist on this topic when visually impaired person uses the public transportation. After defining the problems, the research focused on the application development. Defining what development of an application for visually impaired includes like how interface should look, what are the principles and sound design. Next part was getting familiar with existing applications and assistive systems.

The 3rd part includes the conceptual design. It was defined how the application should work, functional and non-functional requirements, functionalities, use cases based on the requirements and functionalities, and the principles of the application.

Based on the conceptual design, the 4th part is about the visual design of the application. The mock-ups demonstrate how the application should work and look like. They were made based on the use cases defined on the conceptual design part. Design of the mock-ups follows the guidelines of the application design defined on the 2nd part.

The 5th and the last part are the summary and the outlook of the thesis. The summary describes what have been done for now. It is an overview of the project by telling the main points of the project without going into specific details. The outlook focuses on the future development of this work. What is missing for now, what should be added and how project should continue from this point.

2 Analysis and Research

2.1 Clarifying problems

2.1.1 Introduction

Referring to the WHO´s (World Health Organisation) research of the amount of the blind in the world: “The estimated number of people visually impaired in the world is 285 million, 30 million blind and 246 million having low vision; 65% of people visually impaired and 82% of all blind are 50 years and older” (1). In Switzerland the estimated amount of visually impaired people is 80 000-100 000 (2). So the amount of people struggling with everyday actions because of their disability is quite high.

2.1.2 Problems when using public transportation

The visually impaired people encounter many difficulties and problems when travelling in urban environment independently without assistant.

The knowledge of problems is based on literature research. There have been many studies and researches about how the blind and short-sighted people use public transportation. So the problems are well known already. The main difficulties are as follows:

- Finding the stops
- Lack of information when the right vehicle arrives
- Vehicle identification
- Lack of information when travelling (getting out on the right stop)
- Lack of information about the physical environment of the stop
- No possibility to inform driver if there is a visually impaired person on the stop
- If there are road constructions and the stop is moved for example 20 meters away from original spot, how can blind person find the stop? (3)

2.2 Approaches to develop an application for visually impaired users

2.2.1 Introduction

When manufacturing devices and apps, companies have made a big effort to design their devices accessible for visually impaired users. Even though on most cases these features aren´t enough. Often times on app developing, it is not assumed that the user of an app is visually impaired. Information output on most user interfaces is based on the graphical design so it is not accessible for blind users.
Visually impaired users have some special needs that have to be taken into consideration while app is developed.

For visually impaired and completely blind people there are some ways to communicate with an app, e.g. speech recognition, screen reader software, gesture recognition and screen magnifiers. Also there are apps, which includes graphical designs that are user friendly for visually impaired. The following section considers only developing touch screen based applications for visually impaired. (4)

2.2.2 Demands of the user interface

The problem is, how to provide sufficient communication between user and the app. It is important that users can receive the information quickly and get the overall information of the situation, if they don’t know what is going on, (5). For users the applications must be easily learnable.

The most designers, who don´t have problems with their vision, may have limited understanding how visually impaired users experience the usability of the mobile applications. There are several challenges that the designer faces on the process.

1. Platforms: The interaction with phone like tapping, swiping and pinching varies a lot on different platforms. There is no universal “language” for the visually impaired to interact with touch screen.
2. Most used touch screen based devices are smart phones. Even though there are many other devices, which vary on the screen size e.g. tablets, touch screen computers etc. However, there is little information available how the develop an app for larger screens.

3. Gesture recognition: It is fair to expect that visually impaired users perform gestures differently than sighted users. Visually impaired might present gestures differently than sighted user or they prefer different gestures. It needs to be considered that the gestures are suitable for blind users. (6)

Graphical interface should be designed as accessible as possible. Locating right places of the screen is hard for visually impaired. Also person who can´t see the screen might be less precise when targeting the right spot. The problem is how to reduce the possibility to tap wrong button and find the right one?

1. Developers should favour the edges of the screen and place all the functions there. The sides and corners work as landmarks for visually impaired user, making it easier to find the right functionality.

2. The buttons have to be large enough; increasing the size of them is important.

3. Using the approximate targeting methods are also useful. It works by allowing user to touch near the target and then find the target precisely by moving their finger.

Using symbols that are used in print writing should be avoided. Visually impaired user might not be familiar with them or they are not comfortable to use them.
Performing time-based gestures as recognition feature are hard for the visually impaired because they use gestures in different rate than sighted people. (6)

2.2.3 Interaction with the application

There are some points to consider about the interaction with an application.

1. Comfortable usage of speech commands and keyboard (hot-key commands) must be enabled. In this case, graphics can be used as an additional output for not totally blind users.

2. Commands, speech synthesis output (mode and type), information data structure and other features of the system should be easily configured and customized.

3. The speech command dictionary should support speech commands. Dictionary allows expressing commands in several ways, making the interaction more intuitive.

2.2.4 Demands of the sound design

The sound design plays an important role when designing an application for visually impaired people. When user is travelling outside finding his/her way to the destination, he/she is dependent of the sound guidance. There are two different origin of the sound when visually impaired person is travelling outside by foot or riding a vehicle. The user must be enabled to recognize the origin of the sound, whether it is environmental, e.g. arriving vehicle or it originates from the application. There are two types of auditory information coming from the application:

- The notification alerts, which inform user if there is something to do e.g. when it is time to leave a public transportation vehicle or turn on the right corner when travelling by foot. They inform user that there are instructions coming.

- Synthesised voice commands, which are voice commands that are generated by the computer. Usually generated by the assistive systems as IOs VoiceOver or Android´s TalkBack. (7)

2.2.4.1 Drawing user´s attention by using sound

Sound alerts ahead of audio instructions are a good way to draw user´s attention from the other factors. It takes users concentration away from the environment and alerts him/her to focus on the information that application is providing. Lack of differentiation from the audio instructions and the environmental sounds makes the user constantly focus on the technology because of fear of missing some information. Similarly, without the notification and alarm sound the user can miss instructions because of the overriding environmental sounds. While an alarm sound signals user that there is an upcoming instruction, it provides time for user to shift his/her focus from the other factors like conversations with companion etc. (7)

2.2.5 Screen reader compatibility

Screen readers are defined as audio interfaces. They are used to inform the visually impaired person, what information there are on the screen. Screen reader reads the content of the screen to the user by converting the text into synthesized voice (8). In order to make the application accessible for the screen reader, the interface must be simple. The same guidelines as described on the previous chapter are compatible for screen reader accessibility also.

2.3 Existing applications and assistive systems

2.3.1 Applications

In order to cover more information what kind of applications there are already available at the market, the existing similar apps are covered in literature research. There are already many applications to make the visually impaired people more

independent travellers when using public transportation. Mostly the applications are designed to work locally, in the country or only in the city where they are developed. Few applications are made accessible worldwide. List of the applications and descriptions of them are presented below:

- TrAVEI
- Busalert system
- Transportation for Edinburgh
- One BusAway with StopInfo
- Moovit
- Blindsquare within TransitApp

Locally working applications:

The TrAVEl (Travel Assistant for the Visually Impaired and the Elderly) works only in one region, Singapore. It was developed to make the use of public transportation easier for visually impaired and elderly people. The application navigates you directly to the stop and informs when the right bus is arriving. The application informs user when it is time to disembark the vehicle. (9)

The Busalert system has similar functionalities as the TrAVEI but it works in Brasil. (10)

The Transportation for Edinburgh app is designed for regular users but there are functionalities for visually impaired users. The application allows a visually impaired user to use the built-in compass of the phone to identify which bus stops are around them in various directions. (11)

The OneBusAway works locally in the United States at Seattle area. It gives information about the location of the busses. There is integrated application called StopInfo for visually impaired. It describes the physical environment of the stop for example where are the bench, info spot etc. (12)

World-wide applications:

The Moovit (13)application provides worldwide public transportation information and can be used in many languages. It is like any other public transportation app

but the user interface is made accessible for visually impaired persons as well. For usability, The Moovit uses approximate targeting methods to help the user find the desired functionality (14).

With the BlindSquare within the TransitApp a visually impaired user can plan his/her trip, navigates the user to the stop, set reminders when it is time to leave home and gives notifications if there are some disruptions on the route. (15)

	Information during travel	Arrival information	Navigation to stop	Physical environment info about stops
TrAVEl	X	X	X	
Transport for Edinburgh			X	
Busalert system	X	X	X	
OneBusAway-StopInfo				X
Moovit	X	X	X	
Blindsquare within TransitApp	X	X	X	

Table 1 Transportation applications for visually impaired

Many of these applications cover the problems which were defined on the literature research. Even though, based on the research, there is no similar app that operates locally in Switzerland.

2.3.2 Assistive systems

Assistive systems help visually impaired user to use public transportation without mobile based applications. There have been assistive systems for a while before smartphones and mobile applications became popular. The examples of these systems can be found from Austria and Czech Republic. In Austria a remote system has been developed to help visually impaired people to board the right vehicle. A visually impaired person has a remote controller, which can be turned

on when the vehicle is arriving. Vehicles remote system reacts to that and sends signals of the line number and the direction of the route. The system in Czech Republic is similar to the system in Austria but it also gives acoustic information to the driver about the intention of the user to board the vehicle.

The problems of these systems are that the devices are patented and they are not mass produced like smart phones have been many years for now. This causes that the deployment costs can get really high. Even though, these same features can be adapted on mobile phones on some level. As described on previous chapter there are already mobile applications, which cover the functionalities of these devices. (3)

3 Creating the concept

3.1 Clarifying requirements and features

3.1.1 Requirements based on problems

Because of the target group, it is clear where to focus when designing a concept for this type of application. The target group use devices differently than people without disabilities have used to use. It is important that the conceptual design covers the needs of the visually impaired. At the level of the usability, the important requirement is: How to make it accessible for blind people? The conceptual design for the usage and the interface of this app is based on the chapter 2.1. “Approaches to develop an app for visually impaired”.

The second point, which has to be taken into consideration, is the features of this app. What features would bring the most valuable information for visually impaired when travelling alone? Defining the features based on the problems defined on the chapter 2.3 “Problems”. To make the app to meet the needs of the target group, the conceptual design has to cover the existing problems and bring solutions to them.

3.1.2 Defining requirements

This project includes the requirements which are defined to be the most important for our target group. From the list of problem´s, the four most challenging features were defined. They were separated to functional and non-functional requirements.

Functional requirements:

1. Navigation to stops
2. Application informs when the right vehicle arrives
3. Boarding and information while on board

Non-functional requirements

4. Information about the abnormalities

1. When user is planning for the trip, he/she types the starting point, which can be his own location or location he knows. Then the user types destination. The app searches for the nearest stop based on user´s location, and open an external navigation app to guide him/her there.

2. When a visually impaired person is waiting for the vehicle at the stop, it is hard for him to know when the right vehicle arrives. The app informs user how many minutes and stops there are left as well the vehicle number. An alarm sound triggers when it is time to board the vehicle.

3. While on board, user informs the app that he has boarded and the vehicle has left. The application calculates the road to destination and informs how many stops there are left, stop names, time to destination and when it is time to leave the vehicle. In case the user needs to change the vehicle during the trip, the app informs which stop to get out and where to head next.

4. In case there is a road construction and the stop is moved temporary, the user is informed that there is abnormality and he/she is guided to right place.

3.2 Functional and non-functional requirements

3.2.1 Introduction

The functional requirements are described as use cases. The non-functional requirement “Information about abnormalities” is included in the use cases as exceptions because it is strongly related to every functional feature.

3.2.2 Use cases

According to the Michael Shrivathsan “A use case is a series of related interactions between a user and a system that enables the user to achieve a goal”. (16) So use case describes how the user interacts with the system and what is needed to reach the desired result. Use cases are more detailed descriptions of the requirements mentioned on chapter 3.1.2. This part includes the use case diagram and descriptions of all the main use cases of the three functional features defined above. Use cases contain information how the use case is completed successfully from the beginning to the end on “Main success scenario”. “Extensions” include all the other scenarios for the use case from exceptions to errors. Extensions are indicated by the numbers of Main Success Scenario. So if point 2 on Main Success Scenario has an extension, it is indicated as extension 2.1. (17)

3.2.2.1 Use case diagram

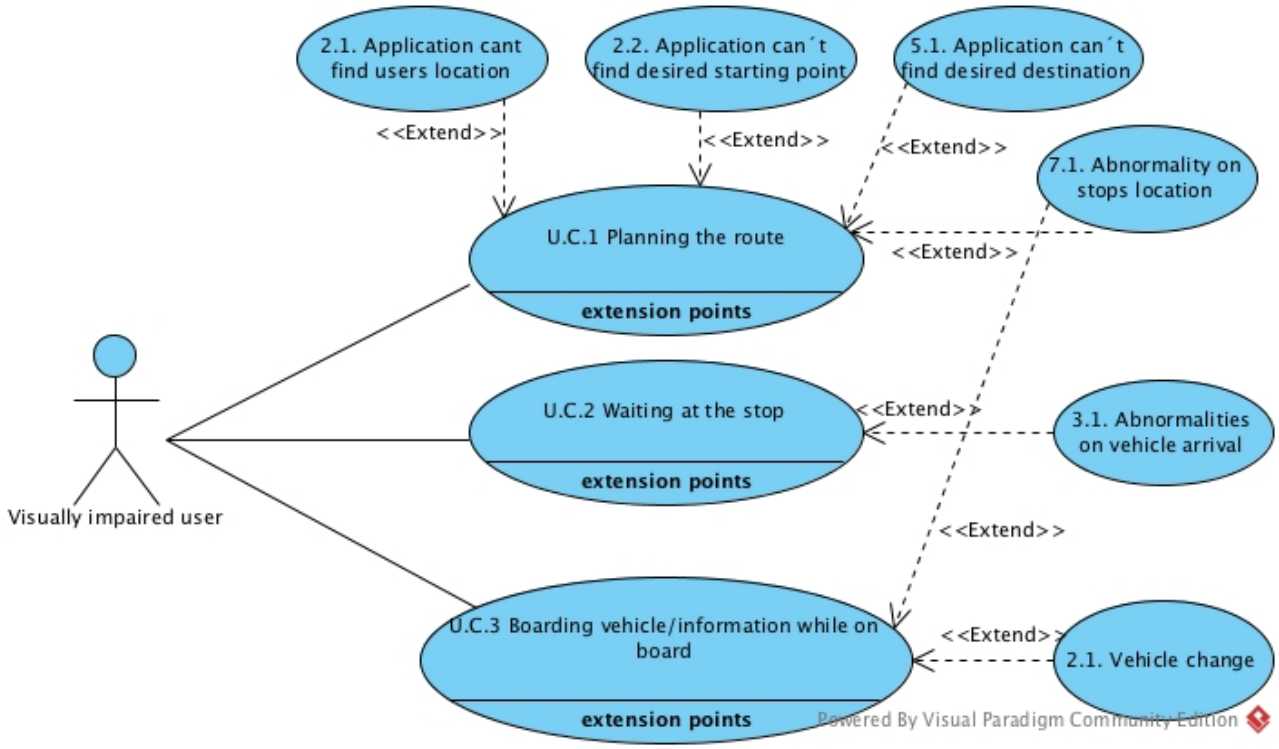

Figure 1 Use case diagram

Use case diagram describes all the relations between use cases. More detailed information of every use case can be found from the use case tables.

3.2.2.2 Use case 1 Planning route

ID:	U.C.1
Title:	Planning the route
Description:	User enters his starting point based on his location and the destination point where he wants to go. Based on users input the app suggests locations to the user and he/she chooses both locations based on them. Interaction via screen reader.
Primary Actor:	Visually impaired user
Preconditions:	GPS is enabled
Post-conditions:	User gets suggested route to his destination
Main Success Scenario:	1. User inserts desired starting location or lets application locate him/her. 2. Application displays a list of suggested starting locations 3. User chooses desired location. 4. User types desired destination. 5. Application displays list of suggested destinations 6. User chooses desired destination 7. Application calculates the route and displays route plan
Extensions:	**2.1. The application can´t find users location** 2.1.1. Application displays error message that location could not be found 2.1.2. User checks that GPS is enabled or moves to location that connection is working again **2.2. The application can´t find desired starting point** 2.2.1. Application displays error message that desired location couldn't be found 2.2.2. User checks if location is misspelled and if yes, tries again **5.1. The application can´t find desired destination** 5.1.1. Application displays error message that location could not be found 5.1.2. User checks if location is misspelled and if yes, tries again **7.1 Abnormality on stops location** 7.1.1. After the route is calculated, the application informs user if the stop is moved for example because of road construction.
Frequency of Use:	Every time route is planned
Priority:	High

Table 2 Use case 1

3.2.2.3 Use case 2 Waiting at the stop

ID:	U.C.2
Title:	Waiting at the stop
Description:	When user is waiting at the stop, the application informs how long is it going to take that the right vehicle arrives
Primary Actor:	Visually impaired user
Preconditions:	User is at the right stop
Post-conditions:	User knows when the vehicle has arrived
Main Success Scenario:	1. User arrives to the right stop 2. User informs application that he/she is waiting at the stop 3. Application tells user the time and number of stops left 4. Alarm when the vehicle has arrived
Extensions:	**3.1. Abnormalities on vehicle arrival** 3.1.1. While the user is waiting for the vehicle at the stop. The application informs if there are abnormalities regarding the arrival of the vehicle e.g. Vehicle is late, problems on the line etc.
Frequency of Use:	Every time when user waits at the stop
Priority:	High

Table 3 Use case 2

3.2.2.4 Use case 3 Information while on board

ID:	U.C.3
Title:	Boarding vehicle and information while on board
Description:	When user boards a vehicle he informs application that he has left the stop. Application informs user when it is time to disembark vehicle.
Primary Actor:	Visually impaired user
Preconditions:	User has boarded the right vehicle
Post-conditions:	User disembarks from the vehicle on the right stop
Main Success Scenario:	1. The user boards vehicle 2. The user informs application that he has boarded and vehicle is moving 3. The application alarms when it is time to disembark
Extensions:	**2.1. Vehicle change** 2.1.1. While on board, the application informs user if he has to change the vehicle in order to get to the destination **3.2 Abnormalities on the stops location** 3.2.1 After the user has disembarked and in case if user needs to navigate to the other stop, the app informs if the location of stop is moved and guides user there as described earlier in U.C.1 extension 7.1.
Frequency of Use:	Every time when the user boards vehicle
Priority:	High

Table 4 Use case 3

3.3 Principles of the application

3.3.1 Introduction

The principles of the application describe how a short-sighted or a blind person uses the application. How the user can navigate inside the application, how communication between the user and the application works and how the user can stay informed what to do next. By following the earlier study about designing an application for the visually impaired user, the principles and the usage of the application were designed to be as accessible and user friendly as possible.

The goal when designing an accessible application is that the commands are simple and easily executable without causing confusion to the user, instructions from the application are read out loud and can be repeated.

3.3.2 Usage of the application

Communication between the user and the application happens by using assistive screen reader software e.g. IOs VoiceOver. When the user opens new window of the application, the screen reader reads out loud the name of the window and each element on the screen. So the user knows which window he is currently using and what features are possible to use. The navigation between elements happens by tapping the screen and the cursor of the screen reader moves from one element to another. While navigating the screen reader tells which element user is currently on. To use the element, the user double taps the screen. If the user wants to navigate between the windows, it happens by swiping the screen with two fingers. By swiping left the user can go further and by swiping right, user can go back to the previous windows.

If the user is partially blind and he/she can see, the application can be used without screen reader software. Interface is designed to be very simple. The buttons and used font of the text are large. In some cases, user can also communicate with the phone by shaking it.

3.3.3 Instructions to the user

While travelling it is important that the user receives all instructions that application provides. An alarm sound is used before upcoming instructions to draw user's attention from disturbing factors like passing vehicles or if the user is using mobile device for something else at the same time. Application will buzz two alarm sounds, one before the instructions and one after to indicate that the instruction has ended.

The instruction can be started over or repeated, if necessary, by shaking the mobile device.

4 Visual design

4.1 Mock-ups

4.1.1 Introduction

The mock-ups are used for designing user interfaces. They are full-sized models of the target that is to be designed, in this case an application. They are drawn on paper by hand or as computer images, so the mock-up demonstrates only the visual design of the applications user interface without any working functionalities. On early phase, before any working functionalities and implementation, the mock-ups are a good way to receive feedback and validation about usability, functionalities and the basic idea of the user interface. So it is an easy way to communicate between the designer and the user because the changes can be made easily with low costs. (18)

4.1.2 Mock-ups for this application

As described on previous chapter the mock-ups for this application were made to perceive how the application should look like and how it should work. The mock-ups were designed based on the guidelines of how to develop an application for visually impaired person. So they follow the rules and recommendations described on chapter 2.2. After the first version of the mock-ups, they were validated and the new versions and improvements were made.

Interface is designed to be as accessible for visually impaired as possible. The buttons are large and the background colour is bright with high contrast so it is easy for a visually impaired people to locate a button and use it. For the text, large font is used and the space between characters is increased. This helps the user to read the text clearly if the user is short-sighted and able to read the text. Otherwise, the screen reader reads the content out loud for the user. The elements are separated from each other to minimize confusion where the right button is located.

1. Planning the route

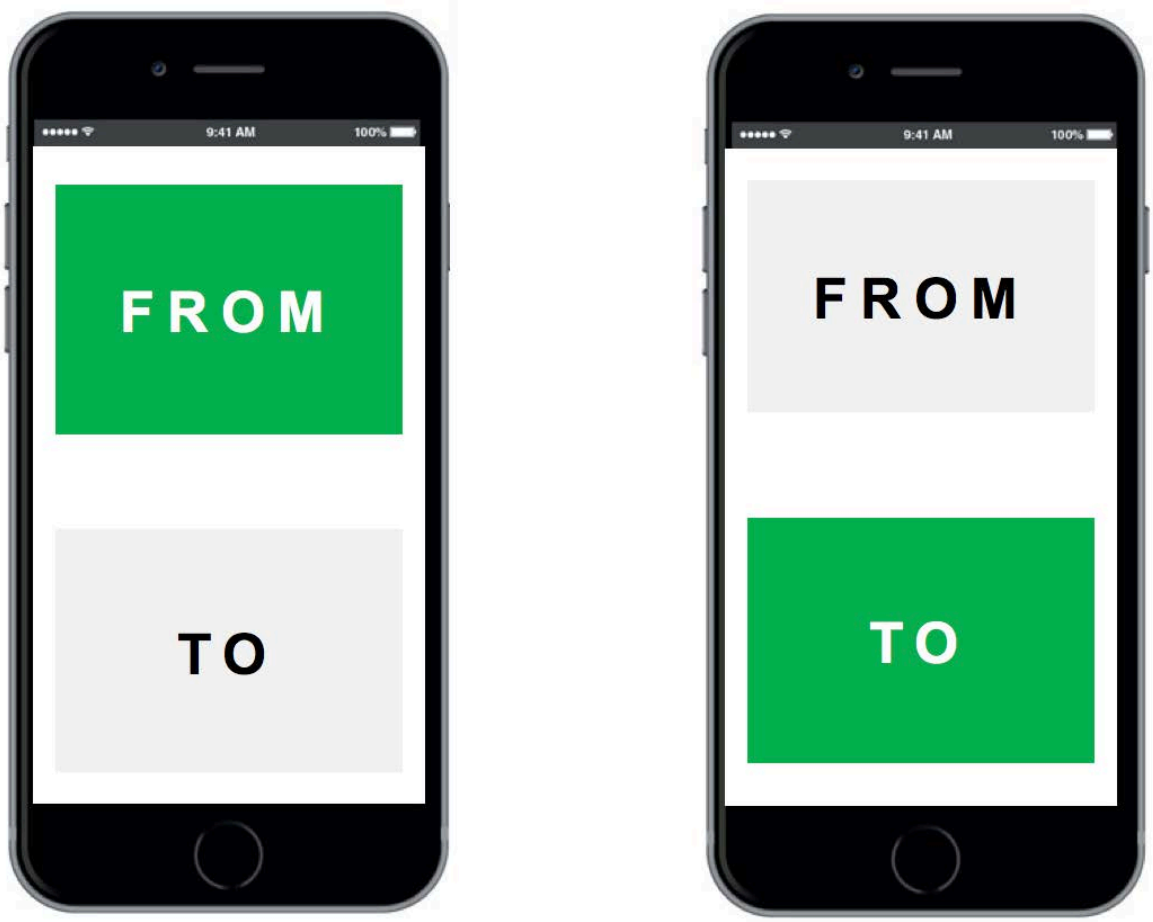

Figure 2 Mock-up 1, planning the journey

The mock-up 1 which is the first screen that user interacts with, when he/she opens the application and starts planning route. This mock-up is based on the U.C.1 (Use Case 1). Green colour indicates that which button should be used. If the button is green, the user should tap it in order to proceed on the right order. Like in this mock-up, user first chooses the starting point by tapping “FROM” where he/she can choose the starting point of journey. After this the button “FROM” turns grey so it is not to be used and button “TO” turns green to indicate that the user should use it next. When the user has tapped either the buttons it goes to screen as shown in Figure 3 Mock-up 1.1.

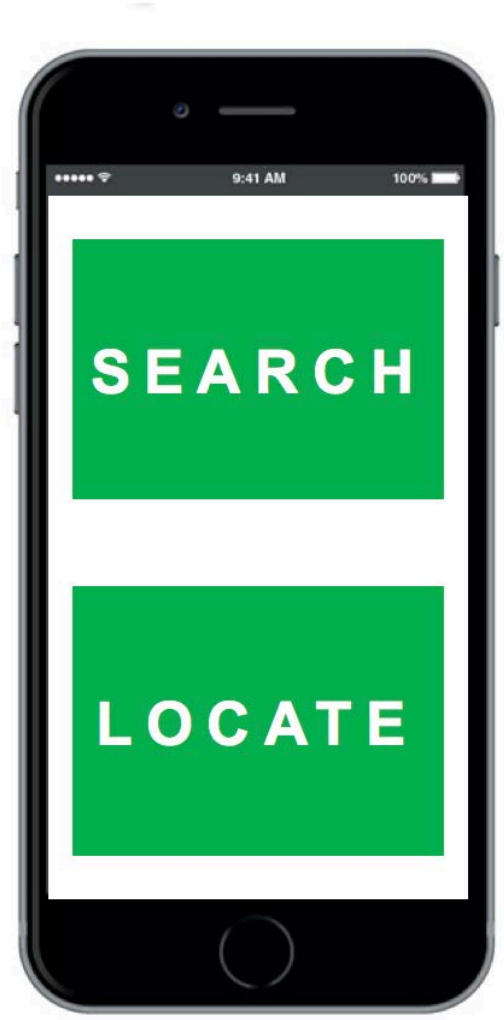

Figure 3 Mock-up 1.1, Searching for the stop/locating user

On Mock-up 1.1, the user can choose either to search for the stop by typing a name of the stop or the area he is in. Then the application shows the stops based on his input. If the user types the area, the application will show him/her the nearest stop on that area. When user decides to use the locate feature, the application will locate the user via GPS and suggest the nearest stops. This screen is the same no matter if user uses “FROM” or “TO” buttons. After the starting point and destination has been given, the application automatically calculates the best route and opens an external navigation application.

2. Waiting at the stop

Figure 4 Mock-up 2, waiting at the stop

Once the user has arrived to the stop, he/she taps the green waiting button to inform the application that he/she is now waiting for the vehicle at the stop. After tapping the button, the application calculates the vehicles destination and informs the user where it is located. The time of the arrival is shown as a big number “4” in minutes. Every time when minute changes, the application informs how much time is left. While waiting, the user can receive more information about the arriving vehicle by shaking the phone or tapping grey waiting button. The information is shown in Figure 4 Mock-up 2.1.

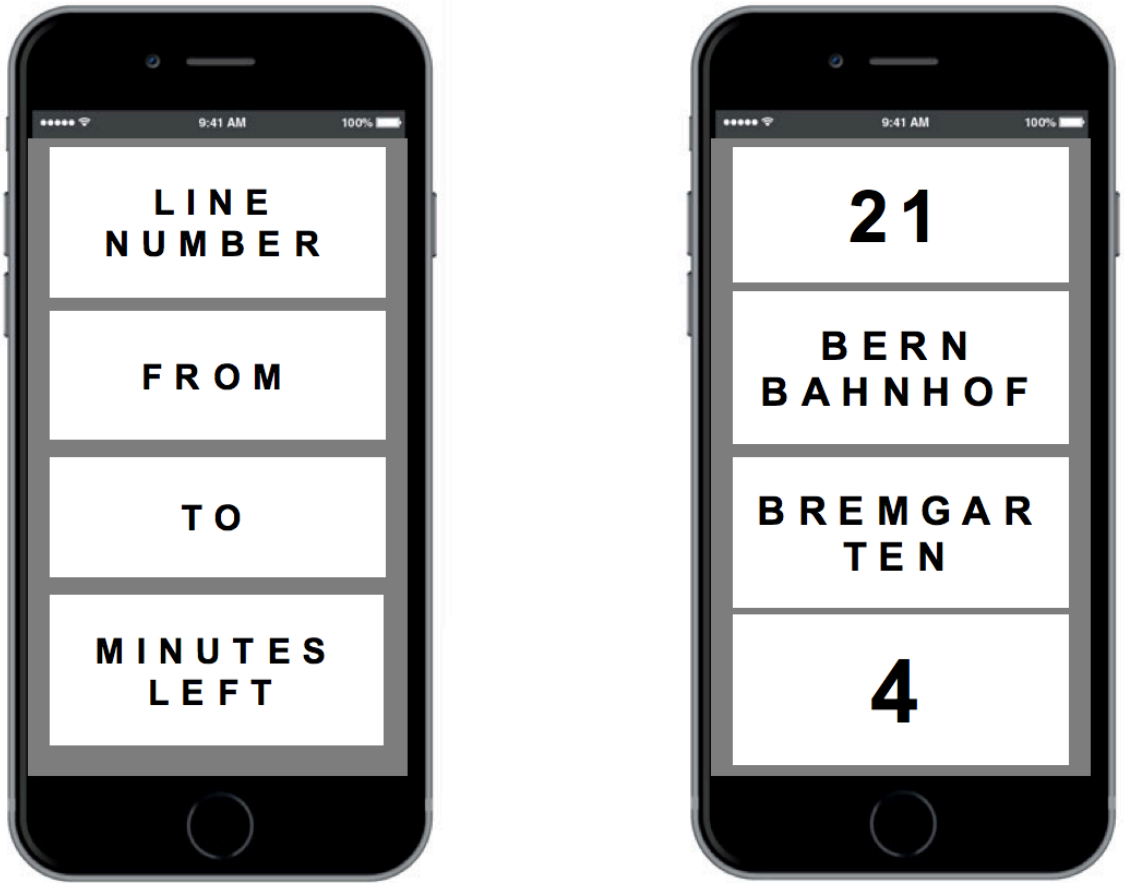

Figure 5 Mock-up 2.1, Information about arriving vehicle

The information screen shows to the user more information about arriving vehicle. It shows the line number, the planned route and the minutes left. The benefit of this screen is that user can be sure that he is waiting for the right line and his/hers starting stop and destination stop is right. What the user sees, is shown on the picture on the right side. User can´t see the text on the left picture but the screen reader will read all the information out loud.

“Line number 21”

“From Bern bahnhof to Bremgarten”

“Minutes left 4”

So the user knows what each block of information means.

Figure 6 Mock-up 2.2, Alarm that the vehicle has arrived

After the vehicle has arrived the application plays the alarm sound and vibrates the phone to inform user. Alongside with the alarm sound the screen reader tells that it is time to board.

"Time to board, tap the board button"

User can tap the "BOARD" button before he/she boards vehicle, or when user is seated. Now the application will start calculating the route of the vehicle while on move and give information to the user during the ride.

3. Information while on board

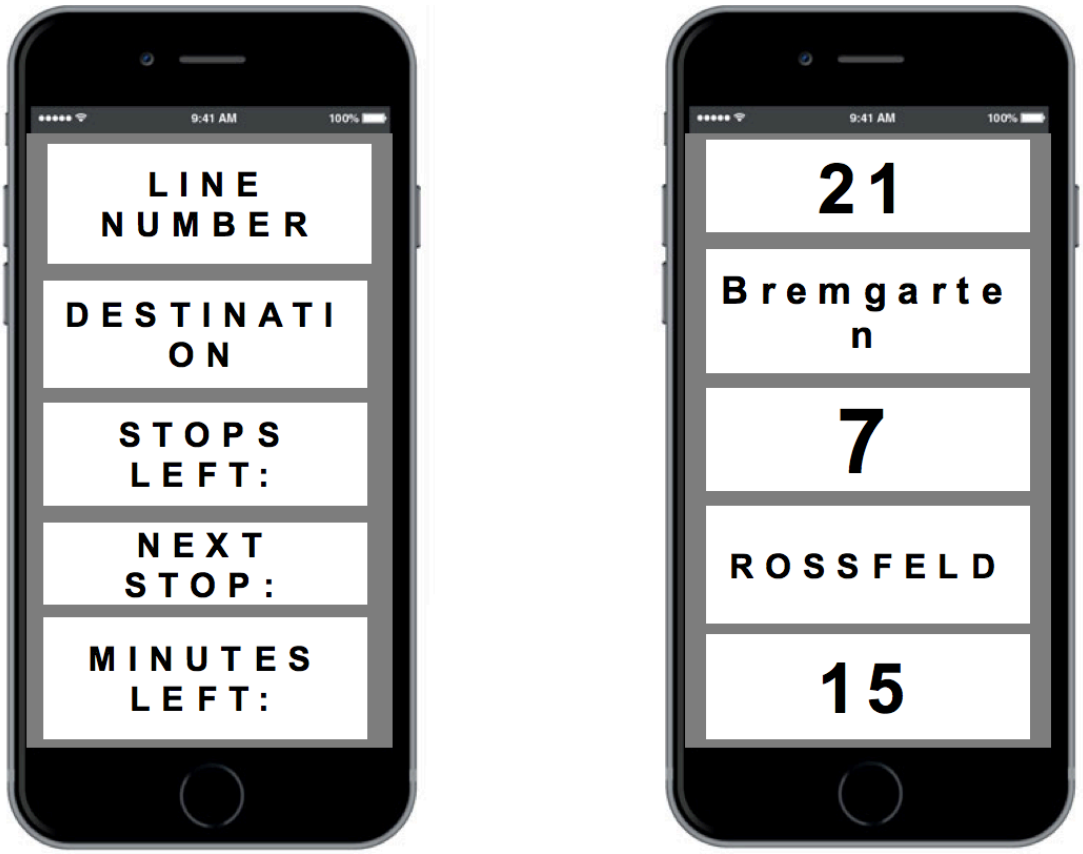

Figure 7 Mock-up 3, information while on board

This information screen works in the same way like on the Figure 4 Mock-up 2.1. So the text on the right side of the picture is visible and the screen reader will read information on left side of the picture.

First the application informs about the vehicle and its destination:

"Line number 21"

"Destination Bremgarten"

Then the application tells how many stops are left and the name of the next stop by reading out loud first the next stop and then stops left:

"Next stop Rossfeld, stops left to destination 7"

After this it tells how many minutes are left to destination:

"Minutes left 15"

4.1.3 Screen flow of the usage

Screen flow of the usage was made to show the functionality of the application on more understandable way. They describe the successful process of the use window by window. Process is separated to pictures based on the functionalities.

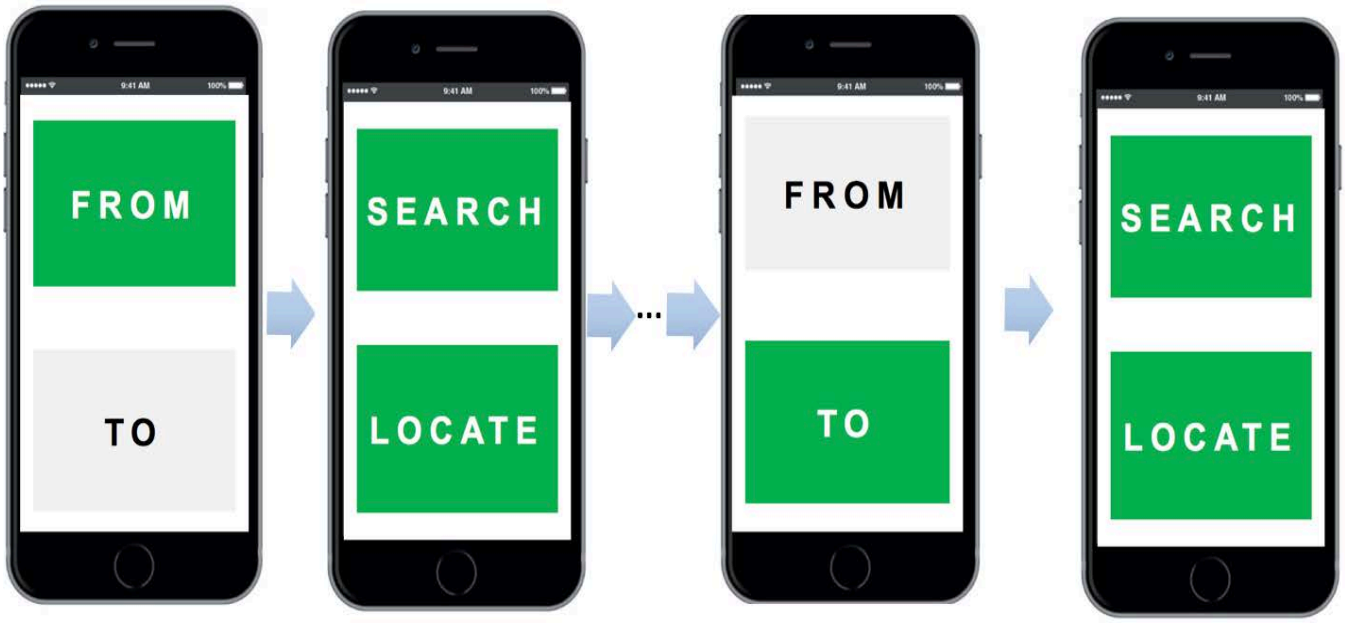

Figure 8 Route planning process

First, user gives his/her starting point and destination point. Arrows with dots indicate that the picture doesn't show the actual search screen.

Figure 9 Information about arriving vehicle

After tapping the “Waiting” – button application shows information screen about how many minutes there are left for the vehicle arrival. By shaking phone or tapping waiting, the user can enter the screen with more information. After reading the information out loud, the application goes back to waiting screen. Once the vehicle has arrives, the application gives audio alarm and user can tap the “BOARD” – button.

Figure 10 Information while on board

When user has tapped board button the application shows the information about the route to destination.

5 Summary and Outlook

5.1 Summary

The final product of this project is a concept of the application. The analysis and research part was based only on the literature research. It wasn't possible to arrange an interview with a target group as was planned. So there wasn't an actual touch with the target group, which would have provided more information and understanding about their situation. The only source of information was research projects of this topic which provided enough information to complete the thesis as planned.

On the conceptual design it was defined what features this application includes. There are 4 features that cover the problems which were found the most essential when visually impaired person is using the public transportation. Features were described as use cases which were further designed as mock-ups. The concept included also the principles of the application. The application is designed simple to use, very few simple gestures that are easy for the visually impaired, simple interface and navigation.

For the visual design, the interface of the application and how user can use it were described as mock-ups. Interface is really simple and clear. Buttons and used font are very large. Different colours were used to help a short-sighted person to use application without the screen reader. The phases of the usage were separated to three parts and for each part there is a picture helping to understand the flow of the usage.

5.2 Outlook

This project ended on the conceptual and visual design of the application. Next phase for the development from this situation would be designing a prototype based on this concept, and further developing it ready for the market.

To support the facts found on the literature research about the problems of the visually impaired when travelling and the usage of the mobile devices, it would provide more precise information to interview visually impaired persons. Interviewing short-sighted and blind persons would help to understand better which are the situations that they find the most difficult to deal with. On that basis it would have been easier to start designing the application to the right direction. Evaluating the user interface with a visually impaired person would have provided valuable information about what has to be improved on the user interface.

The concept includes only the main features that were find out to be the most relevant for the target group. For further development adding more features could make this application more versatile and bring more value for the user.
For visual design the next phase would be creating working interface based on the mock-ups. By this, the evaluation could be made to test the applications usability.

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Abreviations

Selbständigkeitserklärung

Ich bestätige, die vorliegende Arbeit selbständig verfasst zu haben.

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