

Design and Evaluation of a Mobile Ticket system

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Master's Thesis

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2014



Abstract

The purpose of this master thesis was to examine the possibility to develop an overall alternative solution, to the current mobile applications used for public transport in the region of Skåne, Sweden. The aspect and development of the new application was based on interaction design and usability. The thesis has two main parts; a study and analysis of usability and design in the present applications as well as a study about the usage of the applications including ticket purchasing. The other part is designing and developing an application-prototype for Windows Phone. The solution is a travel-planner with functionality of purchasing tickets.

During the analysis several methods were used for gathering data and analyse these. Different approaches were also used in the testing phase of the project. The development of the application had two parts, design and implementation. Design features and functionality in the mobile application were chosen through a series of methods, such as brainstorming, interviews, expert reviews and design patterns.

A Lo-Fi prototype was developed in the beginning of the design process. This prototype was the foundation for the development of the application. By combining the theoretical with the design and development part, a Hi-Fi prototype was developed and tested on users which concluded in a refined final prototype.

Sammanfattning

Syftet med examensarbetet var att undersöka möjligheterna att utveckla en applikation som en alternativ lösning till de befintliga mobila applikationerna som används för kollektivtrafik i region Skåne. Den nya applikationen grundade sig i och utformades utifrån perspektiv inom interaktionsdesign och användbarhet.

Examensarbetet hade två huvuddelar, studie- och analysdel gällande användbarhet och design samt utveckling av applikationen. Utformningen av applikationen skulle göras till operativsystemet Windows Phone och skrevs i programmeringsspråket C# med Visual Studio som utvecklingsmiljö. Applikationen skulle utvecklas som en helhetslösning med både reseplanerare och biljettköpsfunktion.

I analysdelen av projektet utnyttjades flera olika metoder för att samla relevant data som sedan skulle analyseras och användas vid den senare implementationsdelen. Det gjordes användartestning av de befintliga apparna samt den nyskapade applikationen.

Utvecklingsdelen bestod av två delar, designutformning och implementering. Den bakomliggande designen och hela den grafiska utformningen av applikationen samt funktionalitet valdes utifrån insamling av data genom olika metoder som brainstorming, intervjuer, expertutvärdering samt specifika designmönster.

En Lo-Fi prototyp utformades i början av designprocessen. Denna prototyp låg till grund för den slutliga applikationen och användes för testning och utvärdering. Slutligen utformades en Hi-Fi prototyp för Windows Phone.

Acknowledgements

We would like to give special thanks to our supervisor Fredrik Stål and contact person Ola Persson, but also the other employees at Softhouse Consulting AB for the support and feedback during this master thesis. Also a big thank to our supervisor at the Department of Design Science, Lund University, Joakim Eriksson for good feedback and involvement during the design process and report writing.

Abbreviations

API Application Programming Interface

SDK Software Development Kit

Lo-Fi Low-Fidelity

Hi-Fi High-Fidelity

XAML Extensible Application Markup Language

UX User Experience

IxD Interaction design

GUI Graphical User Interface

UI User Interface

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Chapter 1

Introduction

1.1 Background

The idea for this master thesis came from Softhouse Consulting AB which in the summer of 2013 launched a ticket buying extension to a current application used for traveling with public transport, mainly in Skåne, Sweden. Due to the growth of Windows Phone, the public transport company wanted to examine the possibilities for launching an application on this platform. As a step in this process Softhouse came up with the idea of making a master thesis project out of this with the goal of presenting a prototype for a Windows Phone application.

To achieve a well designed and thought through application usability evaluation in different ways along with other design methods were used before creating the final prototype.

1.2 Softhouse Consulting AB

This master thesis was conducted at the IT consulting company Softhouse Consulting Öresund AB in Malmö.

1.3 Skånetrafiken

Skånetrafiken is the company responsible for the public transport in Skåne, Sweden. This is the company that is the potential customer for the Windows Phone application.

1.4 Purpose

The purpose of this master thesis is to investigate the possibilities of developing a public transport application for Windows Phone. By examining the target group along with existing applications we will finally produce a Hi-Fi prototype which Softhouse may use in further development towards a complete application to Windows Phone.

The focus will be to analyze the usability of the existing applications to improve a users interaction with the system, the systems design and functionality before developing and testing the final prototype for Windows Phone.

1.5 Target group

We had from the beginning a good perspective of the target group for this project. The preliminary target group was specified through research made by Skånetrafiken that was studied and analysed. Besides analysing the business plan conducted by Skånetrafiken, the target group specified by the developers of the present applications was also taken into account. A survey was also conducted as a third complement to the studies, to gather information about the system in terms of frequency of usage, the age of the users, how the system is used and more.

According to statistics taken out of the business plan conducted by Skånetrafiken, the age-spectrum of travelers are very wide. Travelers are specified as "someone who travels at least once a month or more". The age segment is according to the statistics, 15-75 years of age. We decided to split this large group of ages into smaller segments to be able to analyse and gather information more easily. The age segments follow the ones in the business plan contributed by Skånetrafiken [1].

1. **Ages 15-19** – This group mostly consist of students in elementary school and gymnasium. We have come up with the conclusion that this group most certainly uses the travel application frequently. This is based on the fact that this age group is up to date regarding the present technology and the use of smartphones are high. Our assumption is that although these people uses the application often they do not purchase tickets through the application. This is based on the fact that this group instead uses the "school-card" from Skånetrafiken. With this card they travel for free in different towns and therefor they do not need to purchase tickets. This age group represents 13% of the total amount of travels with Skånetrafiken. This is approximately 33 000 persons. Every year the different municipalities distribute approximately 35 000 school cards which shows that our assumptions seems to be correct [1]. Unofficial statistics from Softhouse regarding ticket purchasing also gives an indication that our assumptions are accurate.
2. **Ages 20-25** – This group is in our opinion very important. By this age the persons are not allowed to use the school cards distributed from the municipality and therefor they need to purchase another type of traveling card or buy tickets. This is the age segment that travels most frequently after the group 15-19 [1].

3. **Ages 26-44** – This group travels less frequently than the younger age segments but the number of person in this segment is much greater and therefor they represent 32% of the total number of travelers [1]. That makes this group very important because if you can affect these people in a positive way and make it easier for them to use the application. The purchasing feature will then increase in usage which can lead to decreasing the number of ticket dispensers that cost a lot of money in i.e. maintenance for Skånetrafiken.
4. **Ages 45-64** – This age group is the largest in terms of number of people. They travel the most but not as frequently as other age groups. The application needs to focus on simplicity to make it possible for people to use it because the technical knowledge may be below medium in this age segment.
5. **Ages 65-75** – This is an age group that we will not be focusing on so much. They will not be ignored but the usage of smartphones is not as high as for the other age segments. Transportation services are used more often in this segment and the traveling frequency as well as the marketshare of the total traveling is low compared to the shares for the other groups [1].

After analysing the statistics in the business plan conducted by Skånetrafiken as well as statistics from Softhouse along with the results from the survey, we came to the overall conclusion that the target group is very broad but the age-group of 20-25 is the main target group because it is the segment that travels most frequently. Besides the main target group, we will also be focusing on a sub-target group in the age segment 26-44. The reason for this is because it is, as mentioned, a large segment with many people. These are the prioritized target groups.

Chapter 2

Theoretical background

2.1 Technical study

2.1.1 Tools and software

To develop and design applications for Windows Phone there are some useful tools and software to help you with this. Through reading, on mainly Microsoft's official Windows Phone developer page, we conclude that using Microsoft's own developer tools was the best choice for us. These are the tools we used:

- ***Windows Phone SDK 8.0***

The SDK on Windows Phone's development page includes all tools needed to get started with developing and designing Windows Phone applications. The mentioned software below are for example included. The SDK 8.0 is especially created to develop applications for Windows Phone 8.0, but has also support for Windows Phone 7.5 devices. In addition there is also multiple emulators included for testing the applications without a real Windows Phone device [5].

- ***Microsoft Visual Studio Express 2012 for Windows Phone***

Microsoft Visual Studio Express 2012 for Windows Phone is a development environment for creating Windows Phone applications. This software can be described as the main software for creating the applications with the possibilities of coding, testing, debugging, designing and controlling your applications along with features for launching them into an emulator or a connected Windows Phone device [6].

- ***Blend for Visual Studio 2012***

Except for the built-in design tools in Visual Studio it also comes with the separate design software Blend. By using Blend when designing your application you can take advantage of its more powerful HTML and XAML design tools. Blend makes

it easier to customize the appearance, structure, layout and much more of your application instead of implementing everything in code [7].

- ***Adobe Photoshop CS2***

Adobe Photoshop is a very powerful software for creating and editing icons, images and much more. Photoshop can be very helpful when creating a GUI for an application or web page [8].

2.1.2 Developing for Windows Phone

When developing applications for Windows Phone you can choose to implement the system in different ways, you can for example choose between different development environments and coding languages. The, by Microsoft, recommended environment for developing Windows Phone applications is Microsoft Visual Studio for Windows Phone and for coding C#. For the design part of the application a separate framework is used, the most common one is XAML. To create a XAML-based application there is a basic drag-and-drop based XAML-visualiser in Microsoft Visual Studio along with a more advanced one in the separate software Microsoft Expression Blend. After creating the graphical user interface in XAML you then connect these components with code written in C# or any other supported language to create your application [9] [10].

Another important thing to remember when designing applications is to, as much as possible, follow the design and development principles and guidelines for the chosen platform. Just like most other platforms Windows Phone also has its own principles and guidelines.

2.1.3 Designing for Windows Phone

When designing applications, depending on which platform or operating system you use, they all have components and libraries especially created for that given platform or operating system. Windows Phone is not an exception, and below follows some of the most common components and libraries.

Pivot

A common way to implement navigation in mobile applications is with tabs. Each tab can show a different view from the application. The user can often choose to navigate between the tabs by just clicking on them or by swiping left or right. One way of implementing this in Windows Phone is by using a Pivot control which supports both clicking on the tabs and swiping. A difference between the pivot and a traditional tab navigation is that the tabs only is presented with a text and not with text inside a button [11].

Grid- and list view

Grid views and list views is used to present a collection of content to the user in a way that is optimized for touch. The grid view in Windows Phone presents the content in squares which you swipe through horizontally and the list view presents it in a list which

you swipe through vertically. Both views are often used when creating menus in Windows Phone applications [12].

Application bar

The application bar provide users with easy access to commands or navigation which often is specific for a certain page in the application. The commands often reflect the content shown on the active page and could be used to for example manipulate a photo. Navigation through the application bar often takes you to another page within the application, like the start page. The application bar is often shown in a clear color, and the options with an icon and a text beneath it [13].

Windows Phone Toolkit

The Windows Phone Toolkit is an external library which provides developers with components and functionality which are not part of the original Windows Phone library. The toolkit is open source which makes it free to use and integrate in your own applications [14].

2.1.4 Types of mobile applications

There are three standard types of ways to develop a mobile application. Each of these have their strengths and weaknesses and the way of choosing the right development type is often based on what the company specialises in and what the purpose of the application is. When talking about developing applications and more specific mobile applications, the three types Native, HTML5 (Web based) and hybrid applications are often discussed [15].

HTML5-based application

This development standard is a web-based method that is built as several web pages and uses a specific technique called Responsive Web Design. This technique allows this type of application to automatically fit the size of the hardware device that the application is started on. It also makes the application compatible with almost all web browsers on the market like Safari, Opera, Google Chrome, Internet Explorer and Mozilla Firefox. This development type has its strengths in the way that it can fit the screen size of the used device as well as it is compatible on most platforms as mentioned before. This is from a developers point of view a great benefit because of the fact that the application only needs to be implemented as one application [15]. In the aspect of usability, this type of method is not as good compared to the other development methods. One other disadvantage compared to Native and Hybrid is that it does not have a specific platform that it is mainly used in. This way, there is not a direct API that can be used when developing in HTML5 [4].

Native application

Native applications is the type of applications that uses a certain platform API. Developers can develop a native application for each of the platforms Android, iOS and Windows

Phone and get access to its features and functions for the specific hardware in an easy way. Functions that a native application can use compared to HTML5-applications [15]:

1. **Integrated features** – Camera, calendar, contacts, gps-positioning and more.
2. **Graphics and animations** – Fast graphics which results in the use of animations.
3. **Multi-touch** – The ability to use multi-touch on the smartphone for functions like zoom.

One big disadvantage when developing Native applications is that the code is only compatible with one API depending on which platform the application is developed for. This means that if a company wants to release an application for several platforms, separate native applications need to be developed for each of the platforms [16]. This can cost a lot of time and money if the application is complex and difficult to develop. This also means that a native application has to be implemented in different programming languages.

Platform	Programming language	IDE
Android	Java	Eclipse
iOS	Objective C	XCode
Windows Phone	C#	Visual Studio

Hybrid application

Hybrid applications use a strategy that combines the web-based type along with a native bridge. This type allows the application to be coded using web-based development in HTML5, CSS and Javascript but it is able to bridge the implementation to the different platforms native features [15]. Therefore this type is much more cheap to implement if the purpose of the application is to run on different platforms.

Comparison of the application strategies

When deciding which type of application to use, there are several key points to be discussed and decided upon. The type of application is very dependent on these key points and one strategy type may be better suited for one type of purpose while another type is more suitable for another type of system.

Performance

If performance and speed is the most desired feature of the application, the native type is by far the best solution. A native application has direct and full access to the platform including the features that come with the platform and API's. Native applications are fast and it is the best type of application when aiming for high performance and high quality of graphics. It is the best type when it comes to i.e. gaming applications [4]. A web-based or hybrid application has none or limited access to these features and API's. Although web-based engines are getting faster in most of the present browsers the performance grade is still lower compared to native applications. Although everybody gains on as high performance as possible there are several occasions where this is not the highest priority. In that case an evaluation is necessary to determine which type of application to develop.

Cross-platform compatibility

In terms of compatibility on several different platforms a web- or hybrid application is more suitable. This is because these type of applications run in a browser and not explicitly on the device platform and therefore it is not bound to the different platforms. This saves time and money during the development process because only one application has to be developed [15].

User experience

If the best user experience is the main focus then native applications are the best to develop. The design features are the best and the UI is rich. This type of application allows the user to access device features and can use the applications in "offline-mode" comparing to the other types. Hybrid- and web applications may for the user often feel slow which degrades the whole user experience and can be irritating for the user. Native applications are also the best when it comes to animations or special UI features. In this area HTML-based applications are behind by far[17].

Development speed and cost

Although native applications are the best in terms of performance and user experience some companies choose to develop their applications using the other types because they are much cheaper and takes much less time to develop [17]. Web applications are written in HTML, CSS and Javascript and the code is therefore usable in every browser so the limitations that native applications have regarding cross-platform usage are not present for web applications. Another aspect of this is also the knowledge needed to develop a web application versus a native application. Developing web applications have been done for over 20 years so programmers have a good base in programming this type of applications comparing to programming native applications for different platforms where a programmer needs knowledge in different languages to be able to program this type of applications. Developing, testing and supporting different device platforms are incredibly costly and therefore in terms of development speed and cost, web applications and hybrid applications are cheaper [4].

2.1.5 Application type for this master thesis

For this master thesis we will focus on a native prototype. The reason for this is because it already exists native applications for the other platforms and it is easy to gain access to the mobile device functions, such as gyroscope and gps, which will be needed in some of the applications features. One other huge reason for developing a native prototype is that we want to focus on user experience and in that area a native application is the most suitable type.

2.2 Guidelines and Principles

2.2.1 The Eight Golden Rules

When designing an interactive system there are a lot of guidelines and principles of which the “Eight Golden Rules” are some of the most used ones. These principles have been used and refined over the years and are a good base when designing an interface even though they might need some tuning for specific design domains.

The Eight Golden Rules [2]:

1. **Strive for consistency** – You should as much as possible be consistent throughout your system. Navigation, fonts, colors, layouts, terminology and so on should be consistent.
2. **Cater to universal usability** – Design your interface so that all groups of users can use the system. The users can for example differ in age, experience and disabilities, this should be kept in mind when designing the system.
3. **Offer informative feedback** – Every user action in a system should have some kind of feedback. This feedback can be of any kind but in a graphical user interface a visual or audible feedback is common. The feedback is important for the user to know that an action has been performed.
4. **Design dialogs to yield closure** – If having sequences of action to execute a task they should be organized into groups with a beginning, middle and end. At the completion of each sequence there should also be an informative feedback which gives the user the satisfaction of accomplishment.
5. **Prevent errors** – When designing a system you should always try to do it in such a way that the user, as much as possible, cannot make serious errors. And if there can be errors there should be a way for the system or user to handle this. To prevent errors you can for example disable features which cannot be used for the moment, not allow alphabetic characters in numeric fields and so on.
6. **Permit easy reversal of actions** – Actions should, as much as possible, be reversible. This can be as easy as navigating back in a sequence of actions or undo a certain task. This gives the user the opportunity of exploring the system and trying out actions without having to worry too much about the consequences of the actions.
7. **Support internal locus of control** – Experienced users often want the sense that they are in charge of the interface and that it responds to their actions. Surprises and changes in familiar environments are often unwanted and frustrating for these users and should be considered when designing the interface.
8. **Reduce short-term memory load** – Humans have a limited capacity for processing short-term memory information. This is an important thing to remember when designing an interface. The designer should not require the user to remember information from one screen to proceed or edit something on the next one.

2.2.2 Norman's design principles

When designing i.e. a graphical user interface for a mobile device, one should always consider the principles Norman describes in the book "The Design of Everyday Things". The principles are [19]:

1. **Visibility** – The user should easily see what can be done with the system or product only by looking at it. If functions are more visible, then it is more likely that a user will know what can and should be done in the next step.
2. **Feedback** – Feedback is about notifying the user what action has been done and give information of what the user accomplished. This can be done in several forms, i.e. audio or tactile feedback. This gives the user some control which allows the user to continue with the activity.
3. **Constraints** – This concept refers to ways of restricting a user's interaction with the system in certain moments. One example of this is to highlight pushable buttons on one page and grey mark another button that is not supposed to be used on the same page. This way one can minimize the risk of users making errors.
4. **Mapping** – This principle is about the relationship between controls, i.e. buttons and their effects in the real world. The up and down arrows which is used to represent directions of the cursor on a computer keyboard is a good example.
5. **Consistency** – Consistency refers to designing interfaces to have similar operations and elements for achieving similar tasks. This makes it easier for users to learn how a system or product works.
6. **Affordance** – Affordance refers to that objects attributes allows users to know how to use it. A user should, only by looking at the object, understand how to use it.

2.2.3 User-centered design

User-centered design means that the system or product is designed with the end-user in mind, early in the process. The three ground principles to accomplish this are [3]:

1. **Early focus on the end-user** – By determining the target group for the system or product as early as possible will give the chance for the determined users to take part and affect the design- and development process.
2. **Empirical measurements** – When measuring in this type of process, empirical measurements are often used. This is a measurement of the user's behaviour towards the system or product.
3. **Iterative design process** – This is an agile form of process which means that it is done in iterative steps, i.e. design, usability tests, revision of the tests. By using this type of process with several iterations, it can be easier to optimize the system in terms of usability.

2.3 Usability

The definition of usability

To be able to handle and measure usability in this thesis-project, the understanding of the term usability, the reason why it is so important in developing new systems and how to measure this phenomenon is very important. There are many ways to describe the term usability. Three known definitions of usability [20]:

1. The International Standards Organization identifies three aspects of usability, defining it as “the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use”. (ISO 9241-11)
2. The Usability Professionals Association (UPA) focuses more on the product development process: “Usability is an approach to product development that incorporates direct user feedback throughout the development cycle in order to reduce costs and create products and tools that meet user needs”.
3. Steve Krug provides a simple perspective: “Usability really just means making sure that something works well: that a person of average (or even below average) ability and experience can use the thing - whether it’s a website, a fighter jet or a revolving door - for it’s intended purpose without getting hopelessly frustrated”.

The common denominators in all definitions of usability are [20]:

- A user is involved.
- That user is doing something.
- That user is doing something with a product, system, or other thing.

Usability versus user experience

There is a difference between the terms usability and user experience which is very important to distinguish. One can say that usability refers to the ability of the user to perform a predefined task successfully where as the term user experience is not as narrow in the sense of measurements. User experience can be viewed in a broader spectrum, where usability is a part of the user experience. Other than that it also involves the user’s thoughts, perceptions, feelings, dislikes of the whole experience of the task performed or about the system which the user has interacted with [20].

The importance of usability

The importance of usability is indescribable because it impacts every person in many different ways. As technologies evolves, becomes more complex and gets more and more integrated in persons everyday lives, the more important usability becomes. Even though the complexity is increased and more functions and features arises it is to no use if the users

does not have the knowledge to use them. Therefore usability is necessary so anyone understand and know how to interact with the system, regardless of age, technical background and mobility [20].

2.4 Usability testing

Usability testing is a term often used when referring to a process of which people from the target audience participate in testing if a product meets its usability criteria. There are a lot of different techniques for evaluating a product in which most of them involve representative users as just mentioned, but there also exist techniques where no representative users are required such as brainstorming and expert reviews [3].

2.4.1 Brainstorming

Brainstorming is a good way of coming up with new ideas and discuss them. Brainstorming is often done in a group of people where everyone have the opportunity of presenting their ideas. For brainstorming to be effective no criticism should be applied, this way even the most unusual ideas can develop into something extraordinary. It is also encouraged to combine and improve different ideas [21].

2.4.2 Surveys

Using surveys for usability testing is an inexpensive and easy way of reaching out to a large number of users. Surveys can be conducted both on paper and online which makes it easy to distribute. The tools for creating online surveys also often comes with the opportunity of summarizing the answers which can be an appreciated feature. To get the most out of surveys it is important to have clear goals of what to achieve and then construct questions which focus on reaching the goals [2].

2.4.3 Interviews

Interviews is a good way for getting more detailed information from users. The interviewer have the possibility of pursuing specific issues of concern and discuss questions and answers with the users. Interviews can be expensive and time-consuming which often makes for a smaller group of participants than for example with surveys [2].

2.4.4 Observations

Observations can be a good way of getting a lot of data about the interaction between the users and the system. Just like interviews it is often an expensive and time-consuming process which also can be hard to perform without the right equipment. A risk with observations is that the presence of the observer can affect the participants and give a false image of how a user interact with the system which is something to have in mind when using this technique[2].

2.4.5 Expert reviews

Expert reviews are often conducted in the beginning or end of the design process. As the name implies some kind of expert in the area is involved i.e. an expert in the application or user-interface domain. Depending on what you want to accomplish with the evaluation, the experts can be represented by colleagues, customers, consultants or other people with good knowledge in the area. The outcome of the review may result in a report with problems identified and recommendations for changes as well as a discussion with the participants [3].

2.5 Prototyping

When developing a software application, prototyping often means that you create some kind of low- or high detailed model of the final application which i.e. can be used for usability tests. In the early stages of the application development a commonly used Lo-Fi model is the paper prototype which is both easy, fast and inexpensive to create due to the fact it is a paper model of the application. In a paper prototype you often exclude the details and make it as simple as possible. Later in the design process a Hi-Fi prototype is often used. In this prototype you have more details than in a Lo-Fi prototype like the paper prototype. A Hi-Fi prototype for a mobile application can look and feel very much like the final result but is often only a shell with very few or no working functions [2].

Chapter 3

Designing the prototype

3.1 Designprocess

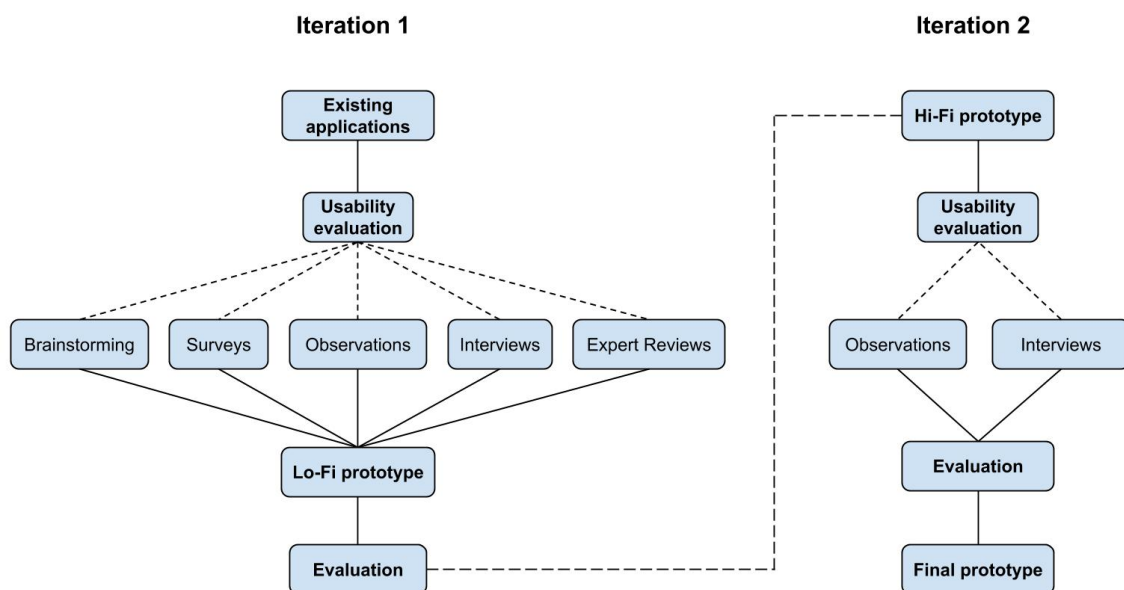


Figure 3.1: Flowchart of the design process

We chose to use an iterative design process to get the user involved in every step of the design process. This process is also one of the ground principles of user-centered design, as mentioned in the theoretical background, to make it easier to optimize the system in terms of usability. User-centered design also means having an early focus on the end-user which is something we have achieved by first of all determining the target group and then get the users involved with surveys, observations and interviews. After each iteration an

evaluation was done to summarize the results.

3.2 Existing applications

Before any kind of prototyping took place we wanted to get information from users and experts about what functionality they would like to see in a travel application and which kind of design they prefer, regarding everything from navigation to icons and feedback. Because there already exists mobile travel applications on other platforms (Android and iOS) released by Skånetrafiken and partially developed by Softhouse we had the possibility of using these when doing usability evaluation and expert reviews. Softhouse also gave us access to demo versions of the applications which gave us the opportunity of buying demo tickets for free, which were very helpful when the users bought tickets in our tests. Because the applications on Android and iOS differ in some aspects like navigation and menus, some of the tests were done on both applications which gave us the ability to compare the users opinions and get more out of the tests.

Because these applications already existed we chose to do most of the user tests on these applications instead of first creating a Lo-Fi prototype to do tests on. We thought that this choice would give us more information than testing on a Lo-Fi prototype would do in an early stage.

3.3 Usability evaluation

We decided to use different methods of usability evaluation on the existing applications to gather information and impressions from the users before designing our prototypes. This way we got important and relevant information that we could analyse and use in our design process. The usability evaluation methods we decided to use were:

- Brainstorming
- Surveys
- Expert reviews
- Observations
- Interviews

The choice of these methods were made because we thought that we would be able to gather a lot of common information from a lot of users as well as more detailed and specific information by combining the different testing methods. We thought that these methods were suited for this type of project and system.

3.3.1 Brainstorming

The first step we did was to look at information and statistics received from Softhouse and Skånetrafiken, brainstorm and discuss possible questions for the survey. We decided to have a totally open brainstorming session where as soon as anyone of us got an idea for the application or a relevant question for the survey, spoke out directly and wrote down the idea without the other one criticising anything. In the middle of the session all ideas were then gathered into different sections and discussed openly. By the end of the session, some of the ideas that had been up for discussion were removed and some new ideas came up and the whole session gave us good questions for the survey as well as ideas for possible features and designs for the prototypes.

3.3.2 Surveys

A survey was used to get information about the system in terms of frequency of usage, the age of the users, how the system is used and more. The reason why a survey was used was because it is a quick way of reaching out to a lot of different people at once and one can easily collect data. The collected data has to be seen as non-absolute. It is not a tool used to get a deep pool of complete data but it is a good way to get an average and a complement to further analysis and research.

We had from the beginning a good perspective of the target group for this project. The preliminary target group was specified through research made by Skånetrafiken that we studied as well as taking into account the target group specified by the developers of the present applications. The survey gave us a complement to this research and a verification that the target group is very broad and helped us set a final target group.

From the survey we also got information about what the users mainly are doing with the system, which functions that are used more frequently, which functions that are unnecessary and what kind of functions that are desirable.

The survey was made as a digital online-survey and it was answered by sixty people between the ages 19-61.

Of the participants in the survey, 60% travel with Skånetrafiken at least once a week, 24% of the people travel with Skånetrafiken every day and 16% travel with Skånetrafiken less than once a month or never.

The present travel applications are used by approximately 82% of the participants.

The reason why not all participants that travel at least once a week uses the application varies but the majority prefer the web page. Some of the participants did not even know that there were travel applications from Skånetrafiken. Some of the participants found the application too difficult to use and preferred other travel applications instead.

From this survey we could easily see that the main reason the people use the application is to check the time for arrivals/departures, which is expected, but we can also see that the function which allows the user to see all the bus lines for a specific bus stop is used by more users than we expected it to be.

As can be seen in figure 3.2 the results from the survey show that only 18% of the users have purchased a ticket with the mobile application at least once. The majority of the users, 82%, do not use the ticket purchase function in the application because they have a jojo-card (Skånetrafiken's discount card) which cannot be used for purchasing tickets in

the applications available on the market today. Some of the participants did not know that one could use the application to purchase tickets and a couple of the users found the feature too complicated, as seen in figure 3.3.

Har du använt biljettköpsfunktionen i applikationen?

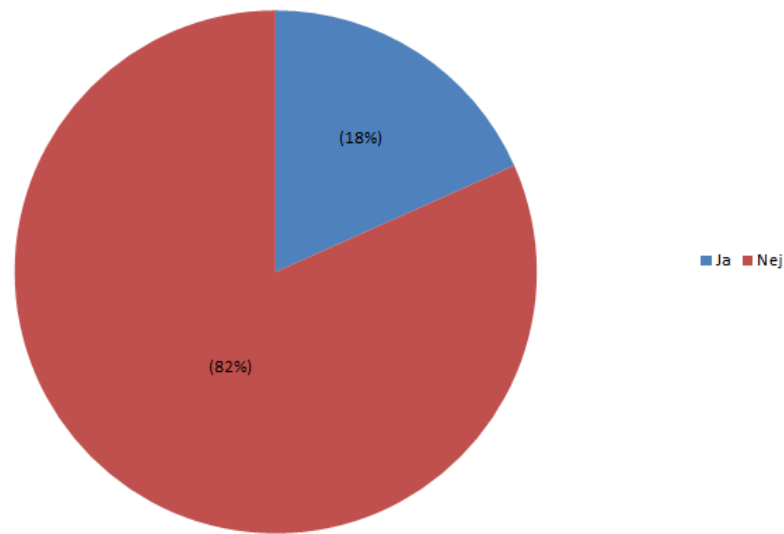


Figure 3.2: Number of users that have bought a ticket through the application

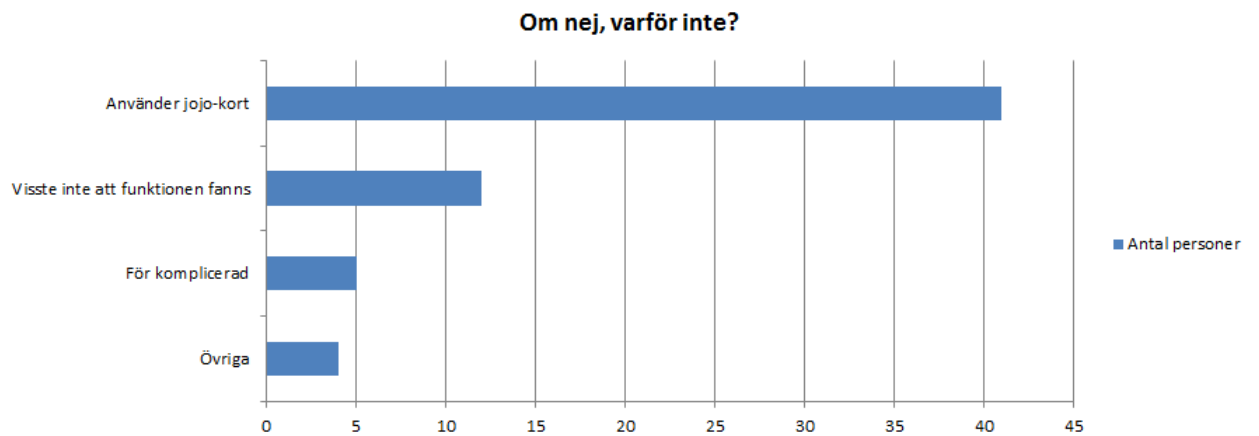


Figure 3.3: Why users have not bought tickets through the application

The results from the survey show that some of the features in the existing applications are not desired while there is a demand for features that are not present at the moment.

The desired features are:

- Travel search
- The ability to see the balance on the jojo-card
- Ticket purchase
- The ability to purchase a ticket using the jojo-card
- The ability to refill the jojo-card
- Timetables for departures
- The ability to save and load destinations from “Favorites” in an easy way
- The ability to see where a train or bus is at the moment

A diagram over the desired features from the survey is shown in figure 3.4.

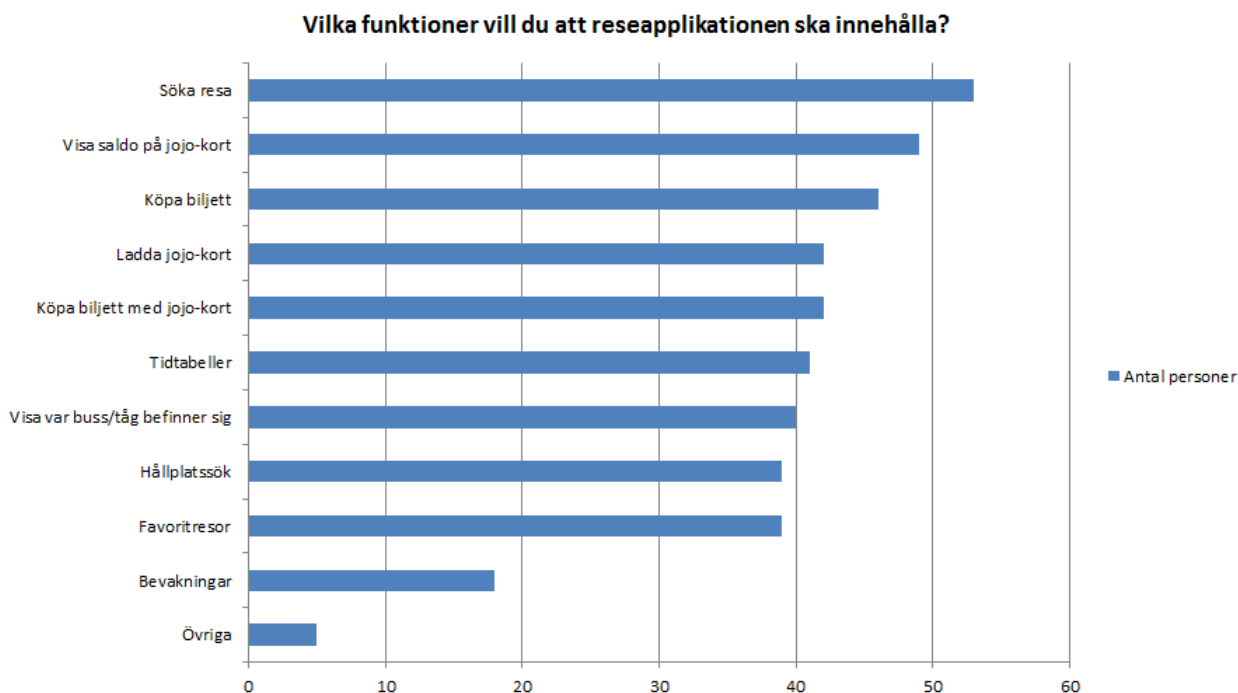


Figure 3.4: Diagram over desired features

Besides these there are present features that are desired by some of the participants but with modifications.

We could easily see that the functions which almost every participant wanted in the application involved the jojo-card. They also wanted the ability to see the location of the transport vehicle in real-time. One function that was not desired was “Bevakningar”. Instead there was a desire that the application should be updated and synchronized with

Trafikverket, in real-time, to be able to notify in time if a departure is pushed forward or cancelled. The participants also wanted a modification to “Hållplatssök”. They wanted to be able to see the closest bus stop on a map with GPS-tracking from the users location. They thought that it would be more useful in cases when the user does not know the city or place well enough.

Other comments received in the surveys:

- A redirection from the website to the application when surfing with the smartphone.
- The function regarding purchase of a ticket is good but not every bus driver know how it works or if the ticket is valid.
- The application is good, much better than the old service with short-message tickets.
- The user should be able to register himself/herself and be able to choose a different means of payment, i.e. a billing that is paid in the end of every month, just like Västtrafik has in their system.
- It was not easy to use (the application).
- It was easy to use.
- It was complicated, not user-friendly.
- It feels old-fashioned and not up to date. The design is aesthetically ugly.
- In events of traffic disruption it is not well synchronized with the information from Trafikverket.
- I wish it was as fast and easy for Android as it is for iOS.
- It is not intuitive and I prefer Google Maps because it shows the travel path in a better way and it is more informative about the best change of transport and gives better information regarding the fastest travel path.
- It's a very good application (5/5).
- “Travel in STHLM” is a better example, it is very good and uses notifications of when a bus or train leaves.
- It is too slow and I need to do too much and click many times before I get the desired information.

3.3.3 Expert reviews

Expert 1

UX-expert with a masters degree in Computer Engineering and Science

Android

The overall design in terms of colouring, layout, icons, continuity, terminology and font was good. The expert liked the start page in Android because of the fact that the user gets choices on what can be done in the application instead of getting directed to the travel planner directly, as it is in iOS where a start page is not available. He thought that a user, especially a first-time user, more easily can get a better picture of the whole application if there is a start page. Although he liked the layout on the start page with four icons he thought that they could be redesigned so that it becomes more obvious to the user that the icons are buttons which can be pressed. The overall graphics in the application was good. The expert disliked the placement of the search button in the travel planner. He pointed to the fact that when using the phone with one hand, it becomes much easier for a user to push the search button if it were placed in the right-bottom corner instead of the right-upper corner because that location makes it difficult to keep the same grip of the phone when pushing the search button. He did not agree with the placements of buttons throughout the application. He thought that buttons which are important and most likely often used should be placed in the bottom of the pages if there is enough space.

The expert thought that the feature "Favoritresor" could be difficult to handle for a first-time user or someone who does not use the feature often. The expert suggested that the feature, instead of being placed in "Sök resa", could be integrated and linked to the timetables or other features. He suggested another grouping of the features. The feature "Lägga till tidtabell" was much better in the Android application compared to the iOS application due to the fact that when searching for a timetable, the user can search for an address and a list of suggested bus stops pops up with the specific bus lines. Although this was good, the feature lacked feedback to make it clear that the user should search for a bus line, e.g. a number and not an address. In iOS the user can only search for a bus line which is not obvious for the user when searching for a specific timetable and it is lacking the feature of being able to search for an address and then get a bus line from a list such as in the Android application.

In terms of mapping, affordance, visibility, feedback and constraints he found the two applications almost equally good with slightly better feedback in some ways in the Android application.

iOS

Expert 1 thought that the overall colouring was quite good and followed the company's colouring theme. The layout was not as good as in Android system where the start page for example shows all menu alternatives in a more visible way, while in iOS the user gets all the alternatives at the bottom of the screen but much smaller and not as obvious as in the Android application. Also, on iOS the first page shown is automatically the travel planner which may confuse some people and does not give a good overview. The font is neutral and icons, terminology and continuity is good although the icons could have been

more visible and the icon for tickets looks more like money than a ticket. Overall Expert 1 thought the graphical experience was neutral.

When looking at the cognitive aspects such as mapping, affordance, visibility, feedback and constraints, Expert 1 thought they were good overall, but that some improvements could have been made regarding affordance and constraints.

When looking at the navigation the overall experience was negative but slightly worse in the iOS application. This also had to do with the start page as mentioned before. It also demands too much from the user to perform common tasks, e.g. buying a ticket, add a timetable and register a credit card. It was also confusing how to search for a specific timetable.

It was not clear how to add and remove “Bevakningar”. The placement of “Bevakningar” and “Favoritresor” in the same menu alternative where you search for a specific travel, Expert 1 would like to put those in a separate menu alternative and also integrate “Favoritresor” with options to buy tickets faster. Expert 1 also said that he and probably many others often travel the same distance and therefore should be able to buy a ticket and search for departures more easily for a specific route.

Expert 2

Software consultant with a masters degree in Computer Engineering and Science

Android

The expert did not think that the design of the application in aspect of colouring, icons, terminology and font was good or bad. He classified these as "Neutral" because there was not anything which stood out. The layout was better and classified as "Good" on Android even though the start page could have been made easier to access. The only thing about the design that was not up to par was the continuity of the design throughout the whole system. It was unclear where the user should navigate in the menu to carry out different tasks such as buy a ticket. The graphical interface was not preferred by the expert who thought it was bad and not very attractive.

In terms of the cognitive aspects the Android application was good in mapping, affordance, feedback and constraints. The only thing the expert disliked was "visibility" which he thought could be much better. The main reason the visibility was not good was, as mentioned, because of the main menu on the start page which is completely hidden when you have chosen a menu alternative.

Navigation in the system was neutral. It can be difficult for a first time user to navigate in the application and it also takes too many steps to perform some tasks but overall it is relatively good. For example regarding the purchase of a ticket the expert thinks that it is too complex because the user has to go through the whole system to buy a ticket which can be solved in a different way to make it easier and more intuitive. The same goes for "Favoritresor", this can also be improved very much. But other tasks such as searching for a departure is quite easy.

The overall impression of the system is good according to the expert. There are flaws and room for improvements but it gives the user a good user-experience.

iOS

Compared to the application in Android, the expert thought that both the layout and the icons were better in iOS. Especially the menu layout were much better because you can access it directly at the bottom of the screen no matter where you are in application. Otherwise the characteristics were the same as in Android. The expert thought the graphical interface in iOS were good and preferred this interface over the one in Android.

In comparison to the Android system the cognitive aspects were slightly more neutral in the iOS system. The visibility was handled better in this system, although there was room for more improvements. The visibility was mostly better because of the menu placement which makes it visible all the time. Except for the menu nothing really stood out, but nothing was bad either.

The navigation part of the system is better in iOS than in Android, much because the user does not have to go back step by step when inside the system to access the menu and instead can go back directly to a certain point in the system.

The ticket purchasing and "Favoritresor" is the same in this system as in the Android application, these features can be improved.

All together the iOS system can be improved in different areas and the system as a whole gives a neutral impression.

The expert had some suggestions of improvements, for both the Android and iOS applications:

- The possibility to register a new credit card before the procedure to purchase a ticket.
- Give the user the choice to pay the ticket by getting the cost on a bill in the end of the month.
- The system should have the feature to buy a ticket before choosing a specific route. If the user only wants to buy a ticket for a city-bus in Lund, a specific route is unnecessary.
- There should be better support for danish letters in "Hållplatssök" because as of now, it is not working good at all.
- "Quick choices" from the start page, as in the ticket-boxes on the stations. The choices should be based on the most regular routes.
- Be able to adapt the graphical interface to your own choice.

Expert 3

Software consultant and UX expert with a masters degree in Computer Engineering and Science

Android

This expert thought that this system is bad in terms of layout and that the icons is not good enough. He described the icon-choice as if the developers more or less 'googled' the images and picked something that possibly could be a good button-icon. He does not think that the overall design is good and describes it as neutral regarding colouring, font, terminology and continuity.

The expert also thought that the system was lacking in giving the user enough feedback. The system just uses the integrated feedback-mechanism that is provided by the Android-system. There are other feedback-mechanisms that can be used in different areas in the application which are not present. In regards of other cognitive aspects as affordance and constraints the expert finds the system neutral.

The navigation in the Android application is far from optimal. The expert pointed out that it is difficult for the user to navigate quickly between different layers in the application due to the fact that there is not a 'home-button' present and that the user need to use the 'back-button' to navigate backwards layer by layer.

It takes too much effort from the users to do certain tasks such as buying a ticket for a route, adding a route as a 'Favorite' and registering a credit card. The expert pointed out that it demands a lot of the user because there are too many levels to pass through from the homepage down to the ticket purchasing and that the short-term memory of the user is really put to the test.

The overall graphical impression is not good according to the expert and there is much room for improvement in that area.

iOS

The design in the iOS application is not better nor worse than the Android application regarding colouring, layout and other attributes. They are different in some areas but the design as a whole gives the expert the same final impression.

In terms of the cognitive aspects the two systems are equal in every area except regarding feedback where the expert thinks that the feedback is slightly better in the iOS application due to some different features in that application.

The navigation is much better in the iOS system and the reason for this is because the user always has access to an application bar. This makes it easier for the user to navigate between specific pages in the system with just one button press. Although the expert finds it easier to navigate through the iOS application it does not minimize the effort it takes for the user to do different tasks. The system still demands that the user performs the same processes for different tasks. The application bar only helps the user navigate between pages quickly but when i.e. buying a ticket the same process needs to be done in this system as well.

The expert pinpointed different problems with both the systems but one that stood out for the iOS system is the lack of error handling/error prevention. The whole system uses an event called 'onTouchDown' when a button is pressed. This is an abnormal behavior because when a user presses a button it reacts directly when pressed down and forwards the user although the button is still pressed down and not released. This takes away the user's ability to regret a button-press. It is not a good solution and needs to be changed in the experts opinion.

Other problems that are present in both the systems are i.e when a user does a travel search, the whole system "dims down" when connecting to the travel list. He explained this problem as crucial if a user gets a timeout during this search because it leaves the user unable to proceed with anything so a restart of the whole application is then necessary. Another problem is the fact that a user needs to go through a long searching process every time a ticket is being purchased. This is not necessary because a user actually buys a ticket for

a direction rather than for a significant route. There is also an issue that a user is unable to register a credit card whenever they want to. This is though a problem that lies in the back-end solution of the system.

The expert also pointed out that the developers have not thought about the placements of certain features. Overall settings are placed in "Biljetter" because there was room in that category. He thought that the placement is illogical and in his opinion the page "Settings" should be placed somewhere else.

3.3.4 Observations

To get more specific information of how the users interacted with the applications we chose to observe some users carrying out common tasks a user would do when using the applications in a real-life situation. To get even more out of it we asked the participants to "think aloud" when carrying out the tasks, which means they were actually saying what they were thinking and doing during the whole observation.

The observations were done on a group of 12 participants with different age, gender and experience. Some of the observations were filmed with a camera stuck to a helmet which filmed the screen of the mobile device through a user perspective and some of them were filmed in a usability lab with a camera filming from the ceiling.

By analyzing the video recordings we came to the following conclusions about the different tasks:

Task 1: Buy a ticket from Lund LTH to Lund C and activate it.

- Half of the users thought that tickets were purchased from the menu choice "Biljetter" which were incorrect, but their second thought to do it from "Resepanerare" was correct.
- Some of the users had problems to find the search button when searching for a travel because it is placed in the upper part of the screen instead of the bottom part where the users agreed on is a better placement.
- When paying for a ticket there was some confusion about how to add a new payment card.
- Due to the fact that there is no formatting when entering a payment card number it is easy for the user to enter the wrong number. And due to this fact there was one user who entered the wrong number and also had a hard time understanding the error message shown.
- Most of the users also complained about the actual ticket, they thought it was a little confusing when the ticket was showing two different clocks ticking, and some, for the user, unnecessary animations also made them irritated.

Task 2: Add a favorite route from Lund C to Malmö C.

- The users had difficulties finding where to add a favorite travel. After finding it a couple of them also had difficulties adding it.

- Most of the users wanted the favorite travel part to be quicker. They thought that the feature should both make it easier and faster to search for a travel and buy a ticket.

Task 3: Do a travel search with the newly added favorite route.

- After adding the favorite route no one had any problems using it to do a travel search for the specific route.

Task 4: Add a new travel coverage from Lund C to Lund Univ-sjukhuset.

- A couple of users had some problems finding the alternative to add a travel coverage, but after finding it there were no problems adding one.

Task 5: Add a new payment method.

- Most of the users thought they could add a new payment card from the menu option "Biljetter", partly because there is a payment card symbol in the menu on that page, but there exists only the option to delete cards. They all thought that there was an option somewhere to add a card without having to buy a ticket, and they all agreed that there should be one on this page.
- The users thought that the menu where you can delete cards should include more than just deleting a card, as mentioned, there should at least be an option to add a card.

Task 6: Search for departures from the bus stop Lund Univ-sjukhuset.

- None of the users had any problem carrying out this task but some of them thought that this function was redundant.

Task 7: Add a timetable for the route between Lund and Malmö.

- Overall this task was executed without any greater problems but they all thought that you should be able to search for destinations with letters and not only on a specific route with numbers only.
- The timetables have too much information which make them difficult to read and the text is too small.
- On the Android application the timetables opens in a separate pdf-program which also confuses some users because the Skånetrafiken application then is minimized.

Task 8: Delete the timetable you just added.

- There were no problems when the users deleted the timetable.

In addition to the information we got on the specific tasks we also got some overall comments:

- In Android you have to press the back button several times to get back to the home menu, this is done better in iOS by having a menu which is shown all the time.
- The text is too small overall in the application.
- The placement of many buttons such as the search button is misplaced at the top of the screen which makes them hard to see and to reach with a one hand grip.
- The overall feedback could have been better.

3.3.5 Interviews

In combination with the observations we also thought that it would be a good idea and opportunity to have a quick interview with each one of the participants after each observation. This way we could follow up on things we noticed during the observations and also gave the users the possibility to ask questions. The interviews were of a half structured type where we had some specific questions to the users and they could ask questions to us, this way we got more of a discussion with the users. From the interviews we came to the following conclusions:

Question 1: What do you think about the function for buying tickets?

- They thought the function was easy to use.
- Some of the users thought there should be some kind of quick choice to buy a ticket a little faster and also an easier way to buy a ticket within a city.
- One user thought it was unclear which payment cards that were allowed when paying for a ticket.

Question 2: How do you think the navigation from the start menu to buying a ticket was?

- Half of the test persons thought it was too many steps to buy a ticket while the other half did not.

Question 3: What do you think about the function "Favoriter"? Did it do what you expect or do you think it should be modified in some way? Do you think the feature is unnecessary?

- Most of the users thought that the favorite travel function did not do what they wanted or expected. When they used the favorite function they expected it to help them search a travel or buy a ticket faster which they did not think it did.
- Most of the users also thought that the favorite travels option was misplaced and should be on a different screen or at the home page of the application.

Question 4: What do you think about the function "Bevakningar"? Did it do what you expected or do you think it should be modified in some way? Is the feature unnecessary?

- The users thought it was hard to understand what the function actually did because the name was misleading.
- Some of the users thought the function was good when they understood what it actually did.

Question 5: What do you think about the design of the application? What is good/bad? What would you want to change?

- The placement of the buttons on many of the pages could have been better according to most of the users.

- Some of the icons on the home page and the menus were hard to map to a function.
- Overall the users agreed that the design of the application was alright but could need some improvements.

Question 6: What is your overall impression of the application?

- Most of the test persons thought the application was at least "quite good".
- Some of them thought that a couple of features were redundant.

Question 7: Which functions do you lack and which do you think is redundant?

- Some users thought that bus stop search is a redundant function or that it should work in a different way.
- One of the users wanted to be able to search a specific route but being able to sort out a specific route with a specific bus- or line-switch.
- Users want to be able to see their balance on their Jojo card.
- The map function could be better according to some of the test persons.

3.4 Low-Fidelity Prototype

After analysing the data we received from the initial usability tests of the existing applications we started our own design process based on all the information gathered. The first thing we did was to do a Lo-Fi prototype. We decided to make basic prototypes on paper but with some main functionality just because we wanted the test persons to be able to get an idea of how the prototype should work and not only how it looks. The reason for the choice of pen and paper for our Lo-Fi prototypes was because we both found it relatively simple to do changes quickly in the designs when needed to as well as that we both had experience in working with this type of Lo-Fi prototyping.

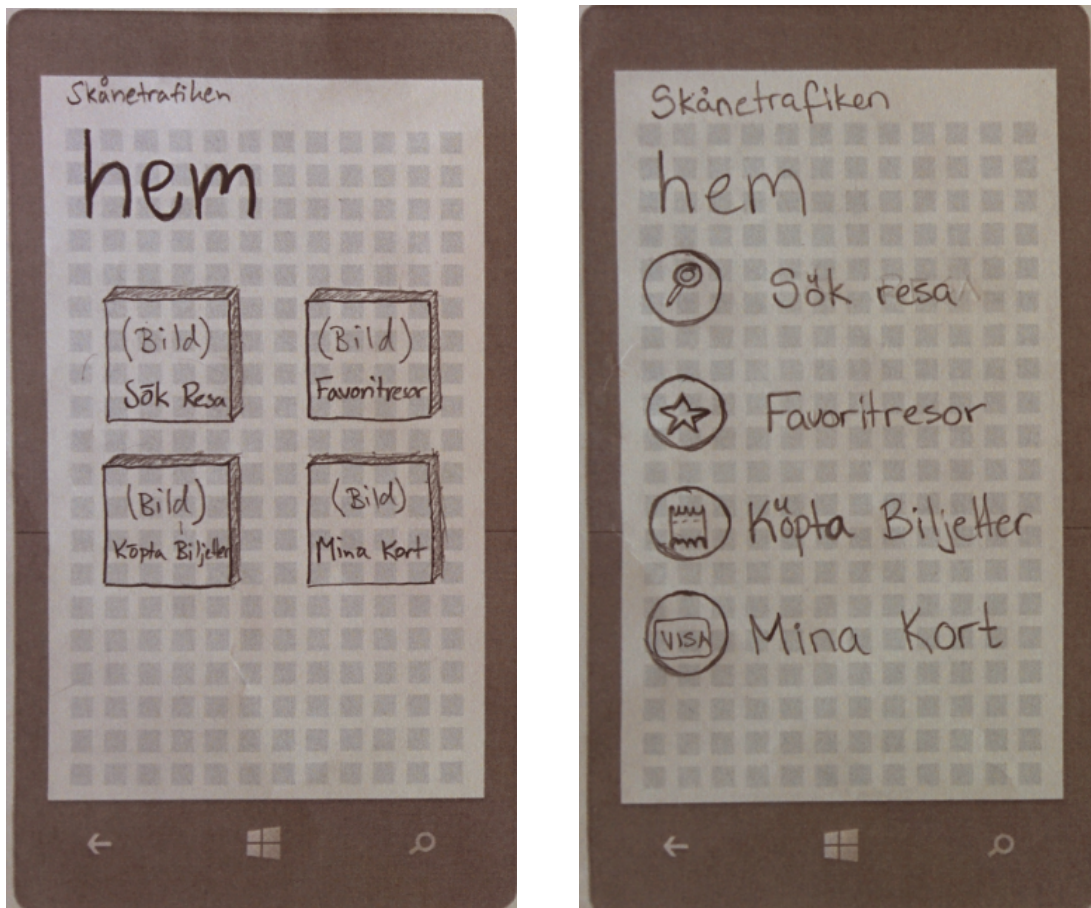
We had already discussed the idea of doing two separate designs and after we had gathered all information from the first usability test, we decided that two designs would be better than just one. One reason for that was because we both had different ideas of designs and we did not want to discard any of the ideas that early in the design process. We also noticed that when we first did the interviews and initial usability tests there was so much room for changes in the current design in both the existing applications. Another main reason for our choice of two designs was because we wanted to incorporate a design pattern specific for Windows Phone 8 as well as one pattern that is more common to mobile users in general, and depending on the feedback, merge them later in the process.

After the initial sketches were done we discussed the two designs and noticed that some of the sketches were almost identical which was not very surprising because we both had the same base for our designs. We therefor came to the conclusion that it would be insufficient and unnecessarily time-consuming for us to draw identical pages. Instead we discussed the matter and decided that the pages that were originating from pages in the existing applications which the users in the previous tests thought were good, was only to be sketched ones. This to save both time and effort but also because we did not want to change the pages which were perceived as good too much.

This process concluded in two different Lo-Fi prototypes with different design patterns; one with a grid layout and one with a list layout as well as some functionality.

3.4.1 Prototype design

Here follows some screenshots from both Lo-Fi designs. The screenshots to the left are from the grid layout design and the ones to the right are from the list design. In some of the cases where the pages were almost identical we sometimes only present one screen.

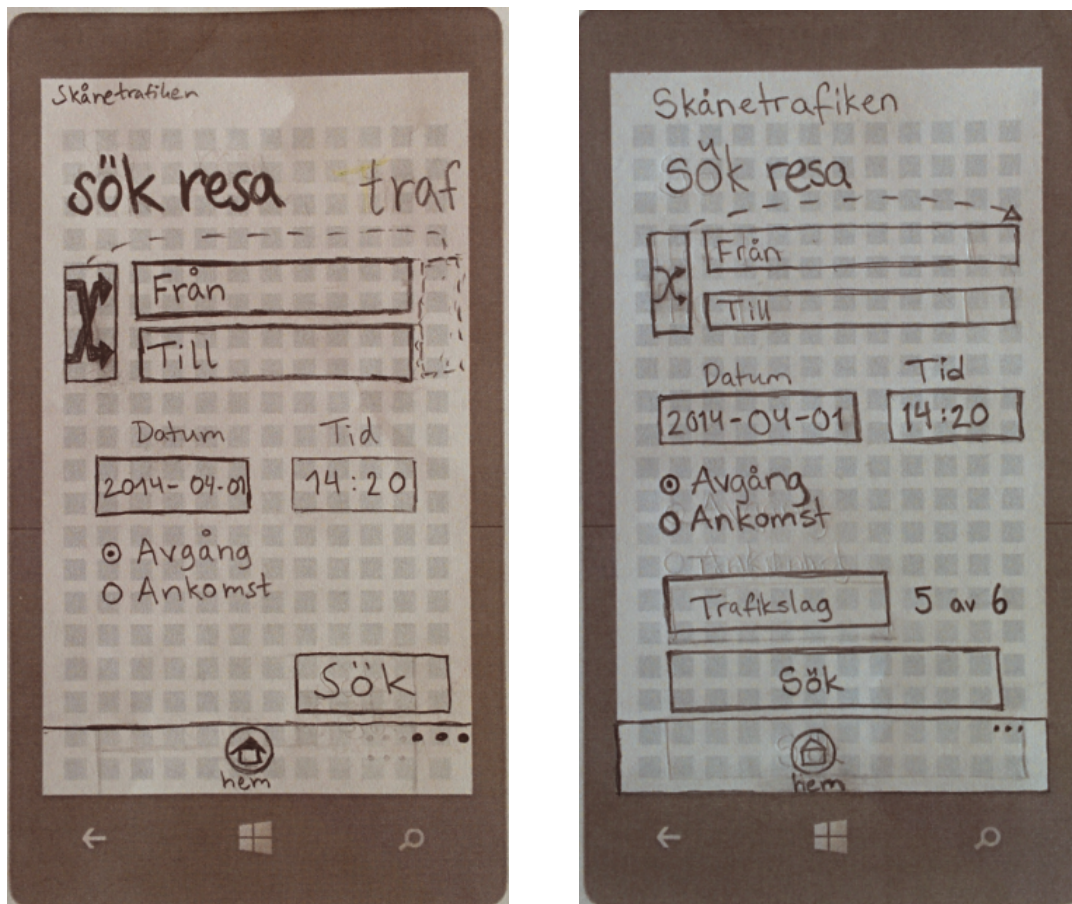


(a) Grid prototype.

(b) List prototype.

Figure 3.5: Home screens of the two different prototypes.

These pages show the alternatives for what the user can choose to do in the application. The home screen of image (a) in figure 3.5 only consists of four buttons aligned in a grid layout. This is similar to the home screen on the Android application with the difference that we wanted to make it more visible for the user to see that it actually are press-able buttons rather than just icons without any mark that it actually is a button. "Sök Resa" is placed as the first button from the left in image (a) and as the first button in the list prototype in image (b). This is because it is the most used feature in this type of application and it is common that a user scans the screen from the top left corner and then travels down, from left to right. In image (b) the design of the list is quite common in applications for Windows Phone. We decided to have a home screen in our prototypes to increase the visibility for the user on what the system provides and what can be done in the application which is one of Norman's design principles.



(a) Grid prototype.

(b) List prototype.

Figure 3.6: Screenshots of the page "Sök resa".

These screenshots, in figure 3.6, shows the page where the user is able to do a travel-search. The two images are quite similar but there are differences. In image (a) the pivot design is used to switch between the pages "Sök resa" and "Trafikslag". The current page is highlighted while the other page is in the background. In image (b) a button is used for "Trafikslag". The search-button is placed differently in the two prototypes and the size of the button is different. The decision to place the search-button in the bottom of the screen instead of in the upper-right corner, as in the current applications, is because that was one of the inputs we received from the usability tests we did on the current applications. In both the prototypes an application bar is present, to allow the user to easily navigate back to the home screen, regardless where the users are in the system.

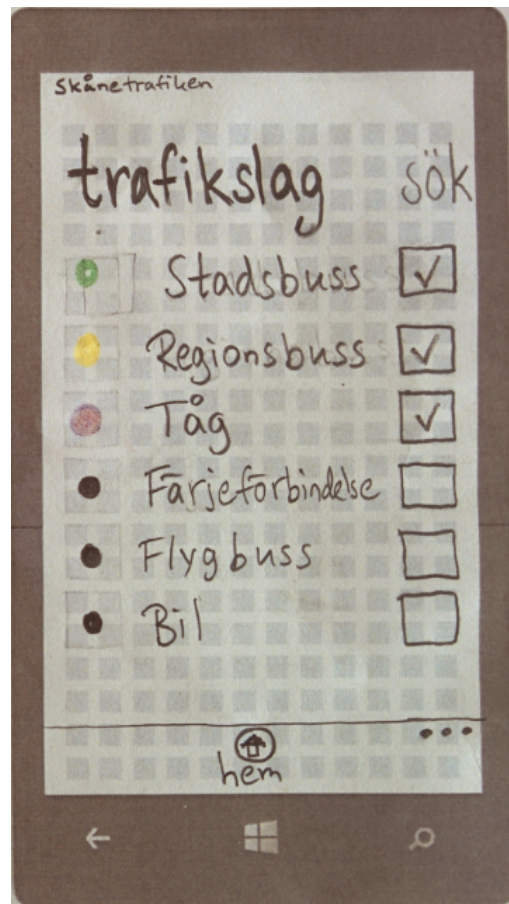


Figure 3.7: Screenshot of the page "Trafikslag".

This page in figure 3.7 is identical in both prototypes with the difference that it is accessed in different ways, either through a button or with a pivot. The page shows the different choices of transport which can be used for a travel search.

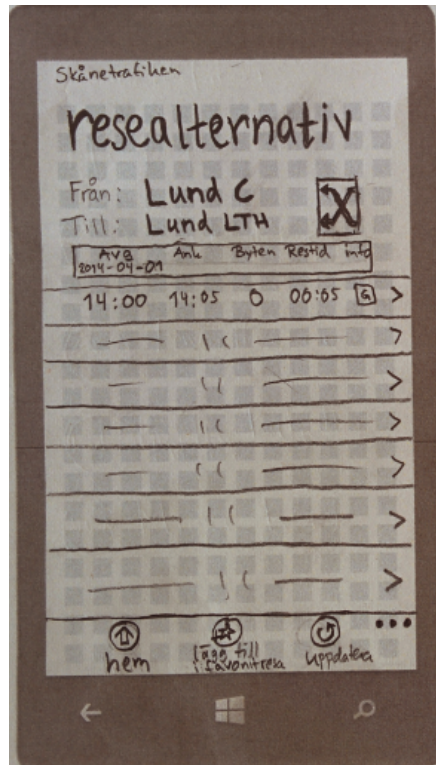
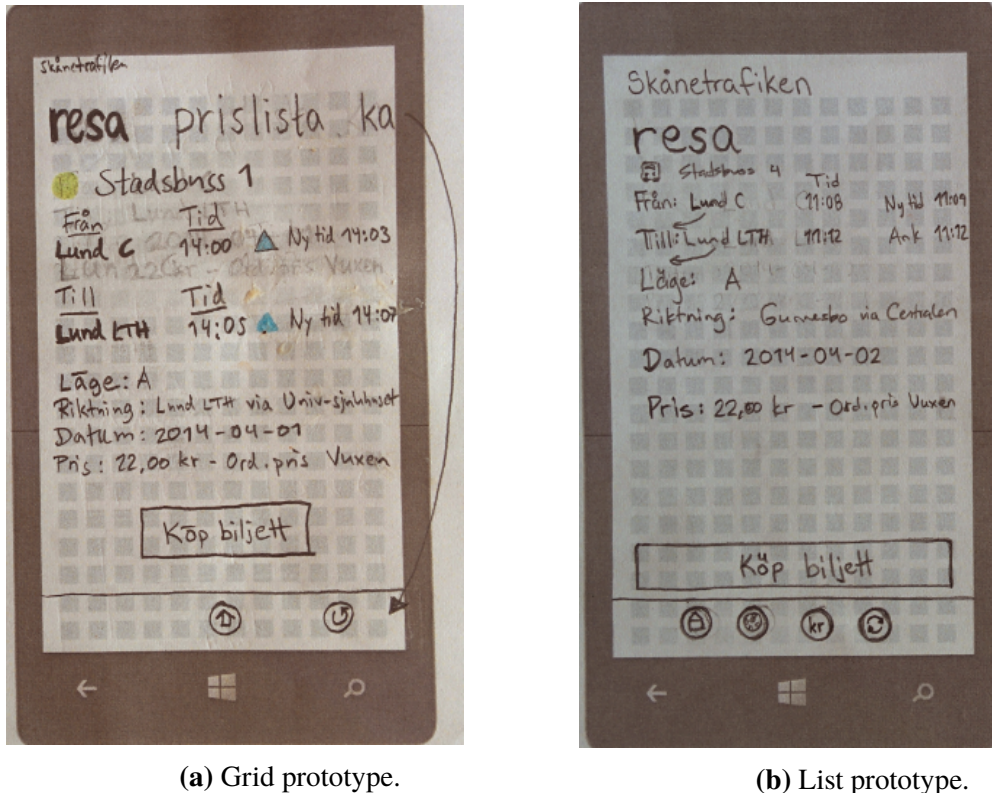


Figure 3.8: Screenshot of the page "Resealternativ".

The screenshot in figure 3.8 shows the specific destinations the user has done a travel search for. It lists the different times for departure and arrival as well as the total time the travel takes. This page is similar to the page in the existing applications with some modifications. We decided to let the button for swapping start- and end-destination follow along from the previous screen because the user should be able to swap the destinations without being forced to go back one step in the system. The application bar now contains a home button, a button to save the specific search as a favorite and also an update button to let the user update the page whenever wanted to. To the right on every element in the list we decided to put an arrow to make it more clear for the user that the elements are press-able and will take the user forward in the system.



(a) Grid prototype.

(b) List prototype.

Figure 3.9: Screenshots of the page "Resa".

The images in figure 3.9 shows details about a, by the user, chosen travel. Both designs are quite alike and shows the same information about the chosen travel, the main difference is the placement of the ticket price information and the map which shows the travel route and position of the buss. In the grid prototype these options have been put in pivot pages like earlier, and in the list prototype they have been placed as buttons in the application bar at the bottom of the screen. In both prototype there is also a application bar button to update the travel page if there has been changes in arrival time. At the bottom of the screen above the application bar the we have put the button to buy a ticket for the selected travel.

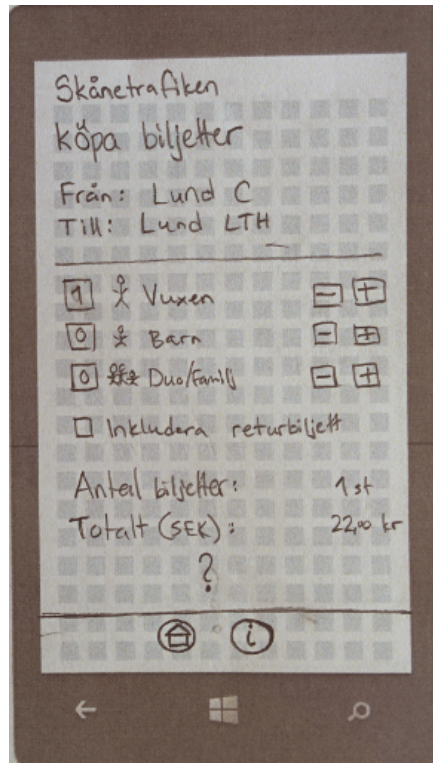


Figure 3.10: Screenshot of the page "Köpa biljetter".

The screen in figure 3.10 shows the page for buying tickets and looks the same in both prototypes. This page is also very similar to how it looks in the both existing applications but still with some small changes. The ticket information button has like some buttons in the earlier described pages been moved from the top of the screen to the application bar at the bottom. Just above the application bar there is a question mark where you in the existing application can chose a payment card or add a new card, but as mentioned in the observations and interviews this button was confusing and did not work as the users expected. When creating these prototypes we did not have any good solution to this problem and chose to wait until later and ask the test persons what they thought.

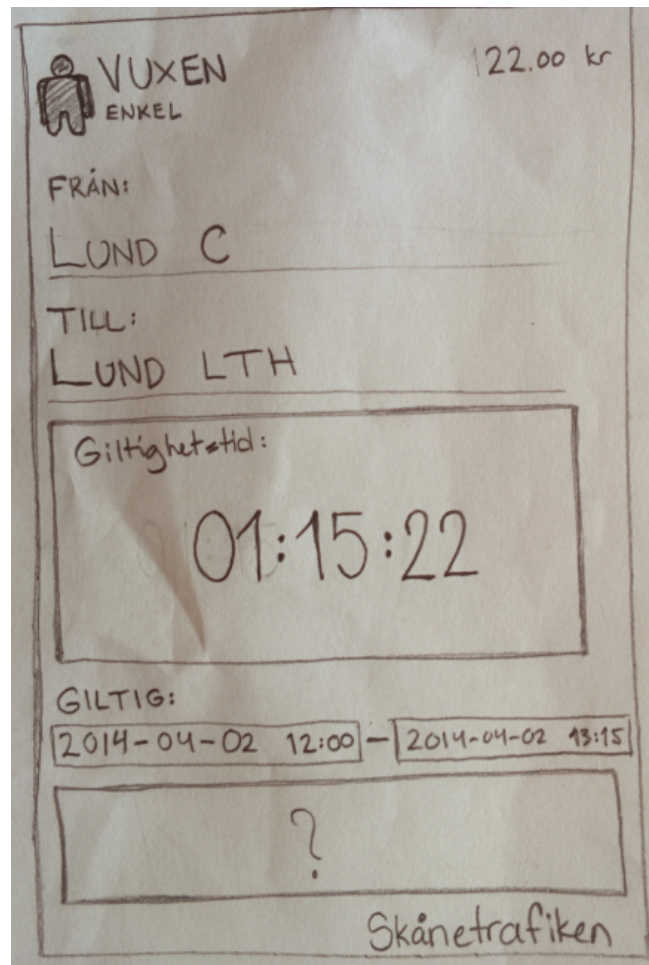
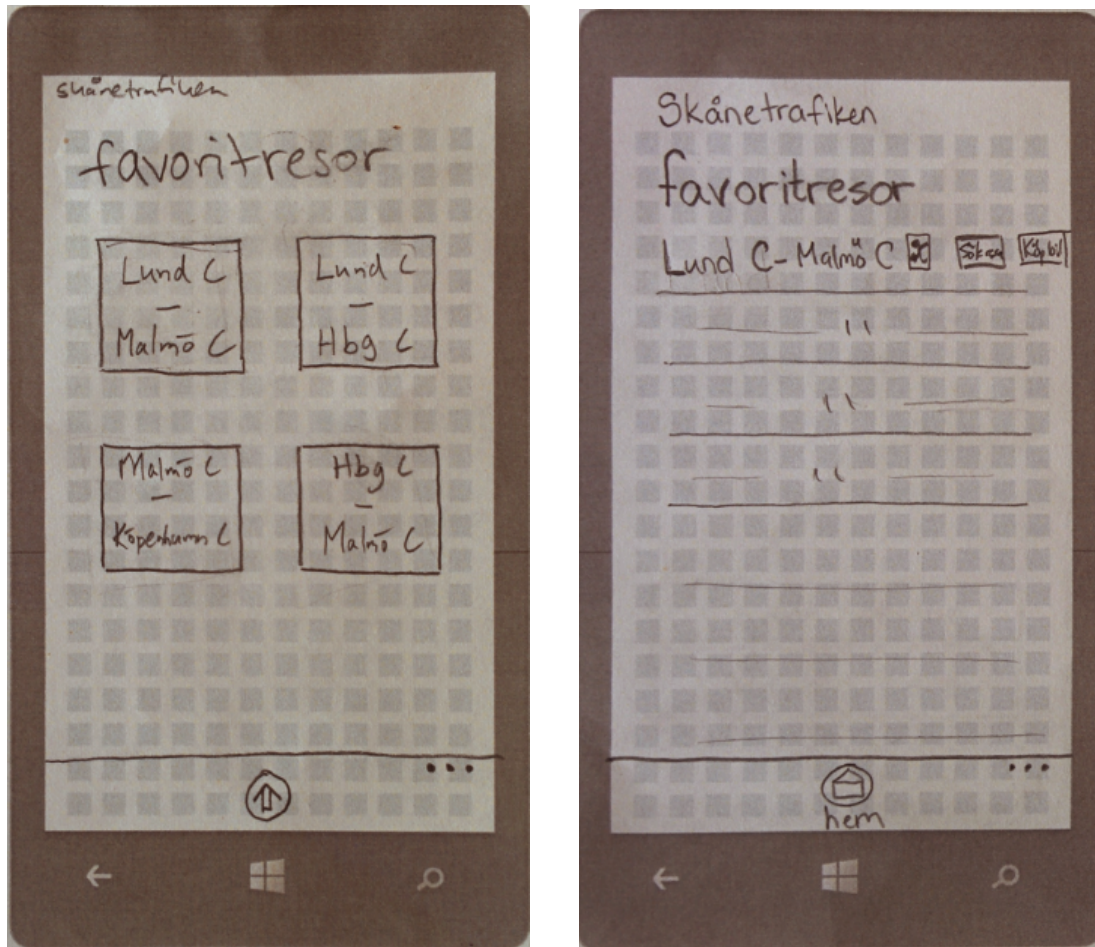


Figure 3.11: Screenshot of a ticket.

Figure 3.11 shows the screen for the actual ticket that a user can purchase. From the previous made test session we got data that the ticket in the existing applications are quite confusing. To the prototype we decided that the most relevant information a user would want in a ticket should be highlighted in some way so that it draws the attention to that information rather than to less relevant information. Therefore we made the the text box showing the tickets period of validity large and centered. The validity time is a timer that is decreasing to make it clear to the user how long they can travel with the purchased ticket. The start- and end-destinations has a larger font size to be more clear and in the bottom of the ticket there should be some kind of animation so users are unable to make a fake ticket.



(a) Grid prototype.

(b) List prototype.

Figure 3.12: Screenshots of the page "Favoritresor".

In figure 3.12 the pages for favorite travels are shown. The option to save favorite travels is also possible in the existing applications but works in a completely different way. As it works in the existing applications when you chose a favorite travel you do this from the search travel menu option, and it just fills in the destinations in the text fields. As mentioned in the user tests the users thought it was a good idea with favorite travels but they expected to get more out of it. First of all we have chosen to put the favorite travel option on the start menu for faster access instead of having it under the search travel option. In the grid prototype there is a grid pattern showing the two destinations, if you click on a grid tile the departure times for the travel are shown directly. In the list prototype you can do a little more, here you have the option to swap the destinations instead of adding two different favorites to travel in the different direction, you can also chose to search information for a travel as with the grid prototype but also to directly buy a ticket for the given destinations which are functions the users wanted.

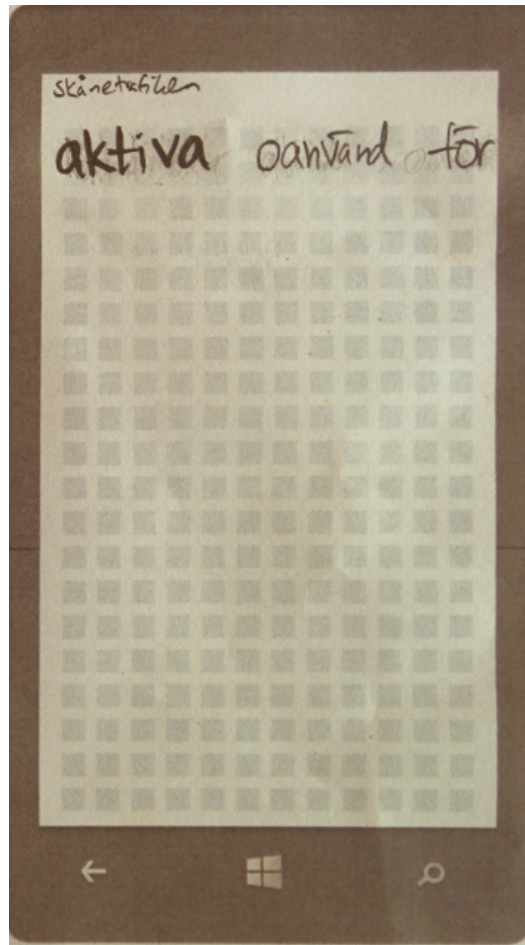


Figure 3.13: Screenshot of the page "Köpta biljetter".

The image in figure 3.13 shows the page where all the tickets a user have bought are shown, regardless if the tickets are used or not. This page uses the pivot design to make it easy for the user to swap between the pages: "Aktiva", "Oanvända" and "Förbrukade". We named the page "Köpta biljetter" to clarify for the user that it is tickets that are bought which will be listed on this page. In the existing applications it is only named "Biljetter" which, the usability tests, showed was unclear to the test persons what one actually could do on that page. The test persons thought that it was on that page the buying of the ticket was done. We also moved "Betalkort" and "Inställningar" because it was illogical to have these features in a page where access to the tickets is the main purpose.

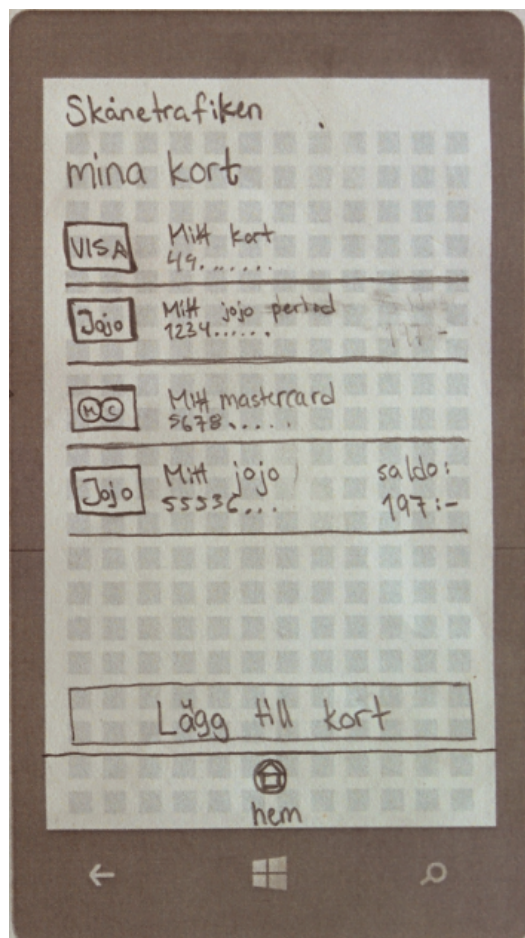
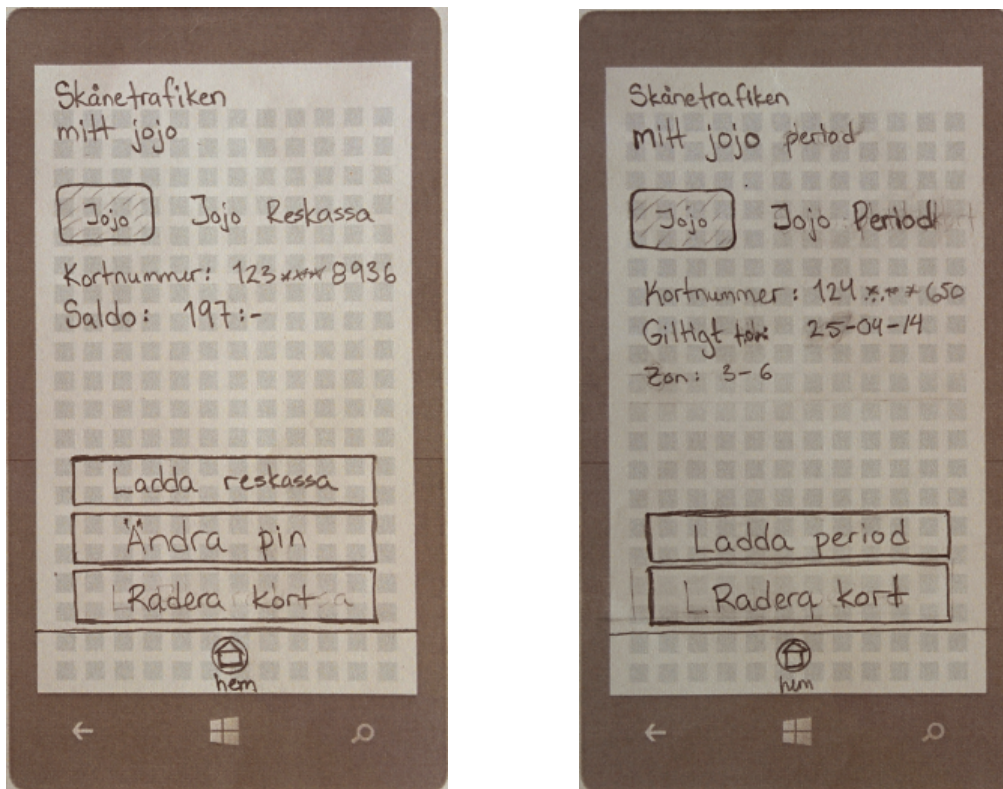


Figure 3.14: Screenshot of the page "Mina kort".

In figure 3.14 the page for the users payment cards is shown, this looks exactly the same on both prototypes. This page exist in the Android and iOS applications but has a lot more features in our design. In the current applications there is a page under the menu option tickets to access the page my payment cards, and the only thing you can do is show the cards you have when paying and deleting them. The test persons had a couple of things to say about this feature. First of all, when asking the users to open the page for payment cards most of them had problems finding it which we have solved in our prototypes by having the option on the home page. It also makes more sense to place it here in our prototypes because there also exist more features on this page than just the delete feature as in the existing applications. From the surveys we got a lot of information about which features the users wanted to see in our application and especially features connected to payment cards. The following features are those the users said they wanted which we have implemented in our prototypes; the opportunity to pay with Skånetrafiken's jojo-card, be able to add a payment card without having to first buy a ticket with it, should be able to see the balance on the Jojo card and to deposit to it, you should also be able to extend the period on your Jojo period card, and as in the existing applications you should be able to delete each card. Because each card have different options depending on which kind of card you chose the alternatives is shown by clicking on the card.



(a) "Jojo Reskassa" card.

(b) "Jojo Period" card.

Figure 3.15: Screenshots showing options for two different payment cards from Skånetrafiken.

Two example pages of this, "Jojo Reskassa" to the left and "Jojo Period" to the right, is shown in figure 3.15. To make it even easier for a users to see their balance on a jojo-card, this information is also shown on the main page for my cards as shown in figure 3.14.

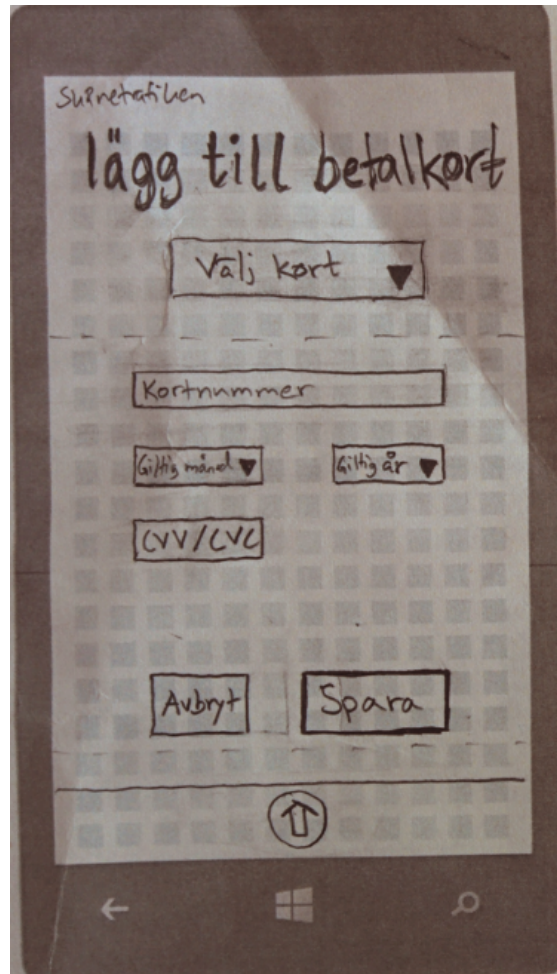


Figure 3.16: Screenshot of the page for adding a payment card.

Figure 3.16 shows the page where a user is able to add a payment card like "Visa", "Mastercard", "Jojo Reskassa" and "Jojo Period". This page has a standard design which can be seen in different applications and Internet sites that has some form of payment feature. It is therefore common for users and they are used to do this process when adding a payment card. To make it visible for the users which buttons are made as a dropdown-list we added a familiar down-arrow to those buttons.

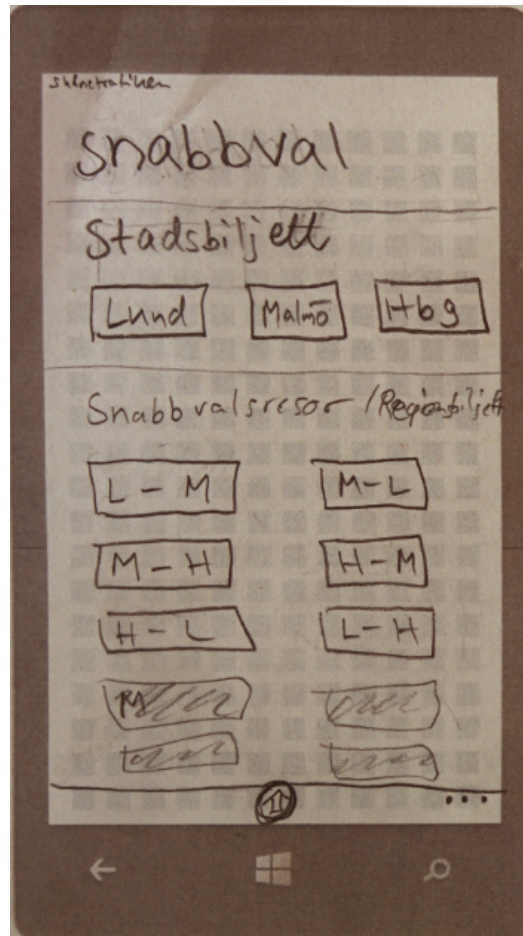


Figure 3.17: Screenshot of the page "Snabbval".

Figure 3.17 shows a first design of a feature called "Snabbval". It is designed so that a user can purchase a city ticket and tickets to common travel routes in an easy way. This to give the user the choice to skip the entire process of searching and choosing a specific route and departure.

3.5 Evaluation

Before creating the Lo-Fi prototypes our thought was to do more usability test, but because our time-schedule did not allow that we decided, after creating the prototypes, to instead bring in two computer-experts with knowledge and expertise in UX and IxD to evaluate and discuss our prototypes. This gave us the opportunity to get important input and relevant information from people with expertise in the area instead of not getting any information at all in this step. The experts were not involved in the project and therefore not biased.

We asked the experts to be completely honest with the prototypes and give feedback whether it was good or bad so that we had a clear idea of the improvements that had to be done when proceeding with the Hi-Fi prototypes.

We decided that it would be most sufficient to have a sit-down meeting with only one of the experts at a time. This way we could receive input and each one's initial thoughts and tips and see if they agreed on certain aspects and where they had completely different ideas. To be able to understand their input we wanted them to explain the underlying reason for the specific input.

From these evaluation sessions we got the following important input:

Two different prototypes – The experts agreed with our opinion to keep both Lo-Fi prototypes and from these also create two Hi-Fi prototypes, this way we would be able to get more feedback from the users when doing our usability tests on the Hi-Fi prototypes.

"Snabbval" feature – We were unsure where to put this feature in the prototypes. We had discussed to put it in the same page as "Favoriter". When consulting with the experts, their opinion was that it should instead be a separate page and an alternative on the home screen. The reason for this was because it would be too much functionality on one page if we would have merged both "Snabbval" and "Favoriter" on the same page. One other reason was that because it is supposed to be quick choices a user should have the ability to access the page from the home screen and not have to navigate to another level/page before getting access to the quick choices. The experts also had critics regarding the actual page. They thought that we should come up with a different solution to minimize the number of available quick choices. It can otherwise be too many alternatives for a user and therefore it would be harder for a user to quickly choose a route.

Swap button – One of the experts commented on the placement of the swap button on the "Sök resa" page. By placing the button to the right of the search fields instead of left it is easier for the user to reach it when holding the mobile device with just one hand, it is also not the first thing to get the users attention.

Pivot pattern – The experts both gave the advice to be careful with the pivot pattern. They said that although it is esthetically pleasing and looks good and seems like a good feature it can be the other way around. From a usability perspective it can be very hard for a user to actually see how many pivot elements the page consists of just because it only shows two pivot elements at a time. They said that it can be a good feature if it is suited for the actual page and there is a threshold on maximum numbers of elements.

"Mina kort" – A comment we got on the page showing the users payment cards was whether to show the expiration date of the "Jojo period" card directly on the main page for "Mina kort" or to only show this when navigating to the specific cards page. The experts thought it was a good idea to show the expiration date directly on "Mina kort" just like we showed the balance for the "Jojo Reskassa", this way the user gets a better overview directly on the main page.

Miscellaneous – Other aspects we discussed together with the experts were fundamental interaction design principles as alignment and grouping of similar information and buttons. We had discussed amongst ourselves about different pop-ups for feedback purposes as well as for error prevention and told the experts that we had ideas on how and where in the system we think that it would be applicable and they agreed on most of the ideas we presented.

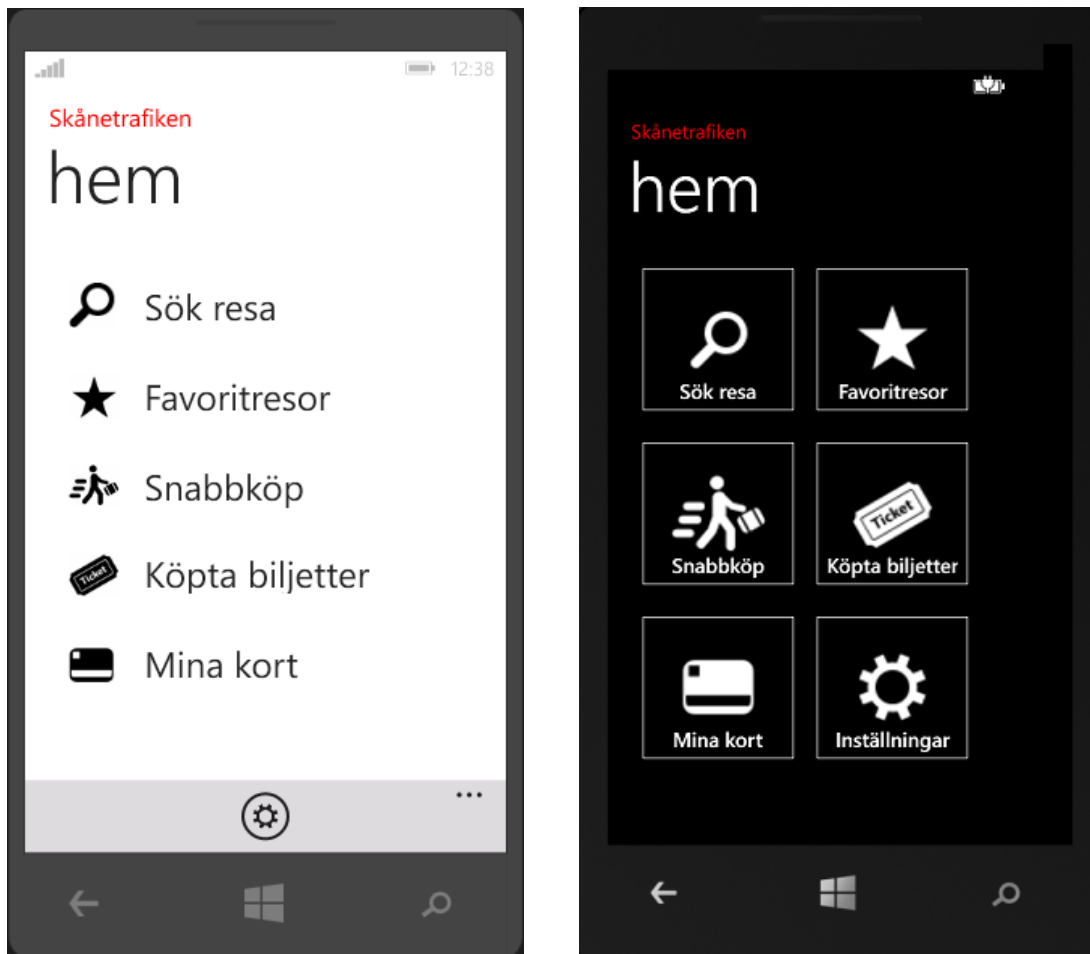
We got very relevant and good feedback on our Lo-Fi prototypes and this evaluation process also gave us new ideas for the Hi-Fi prototypes.

Chapter 4

Implementing the application

4.1 High-Fidelity Prototype

After the evaluation of the Lo-Fi prototypes we started to design the two different Hi-Fi prototypes which we earlier decided to do. The two prototypes focused on different design patterns to get as much information as possible from the coming usability tests, but the functionality was exactly the same. Later on, this resulted in a final prototype where the two designs were combined to one. The main differences between the prototypes are presented and described in the following figures.

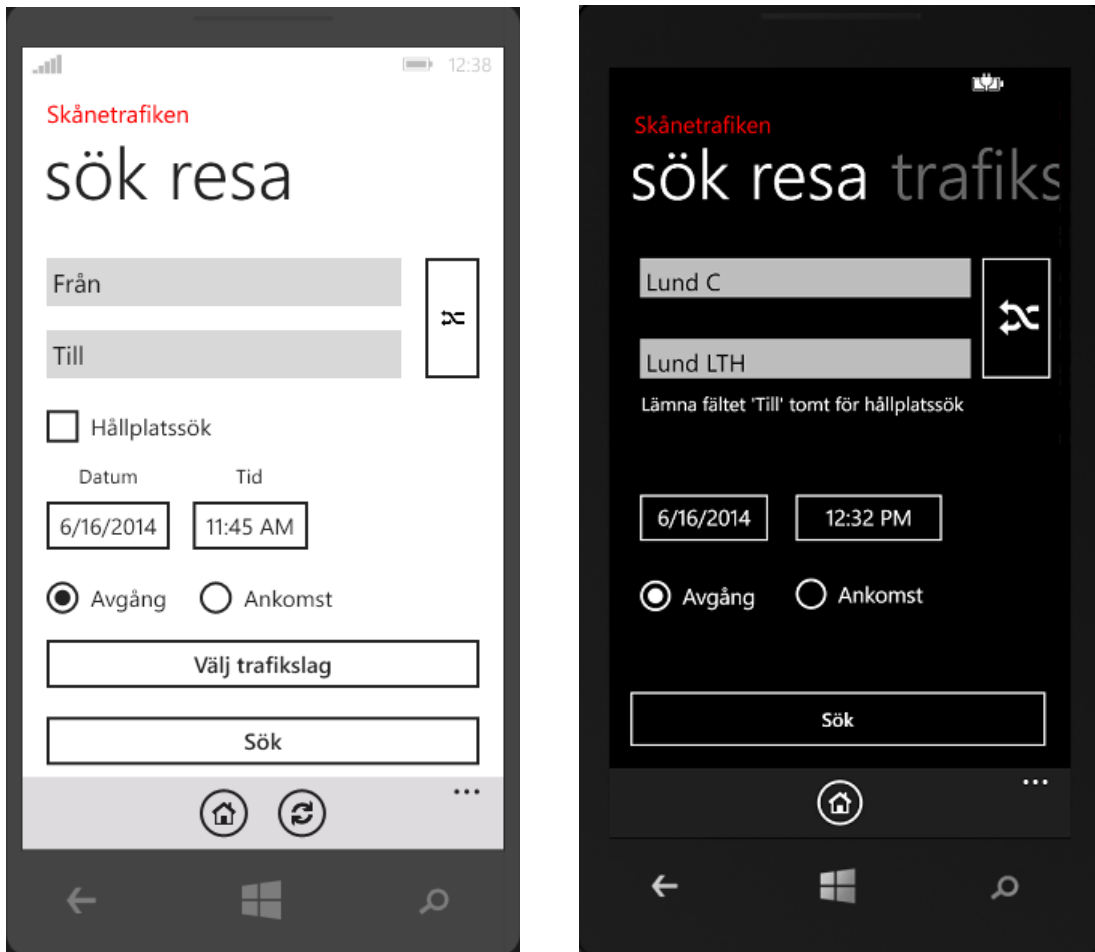


(a) Home page of the list-design.

(b) Home page of the grid-design.

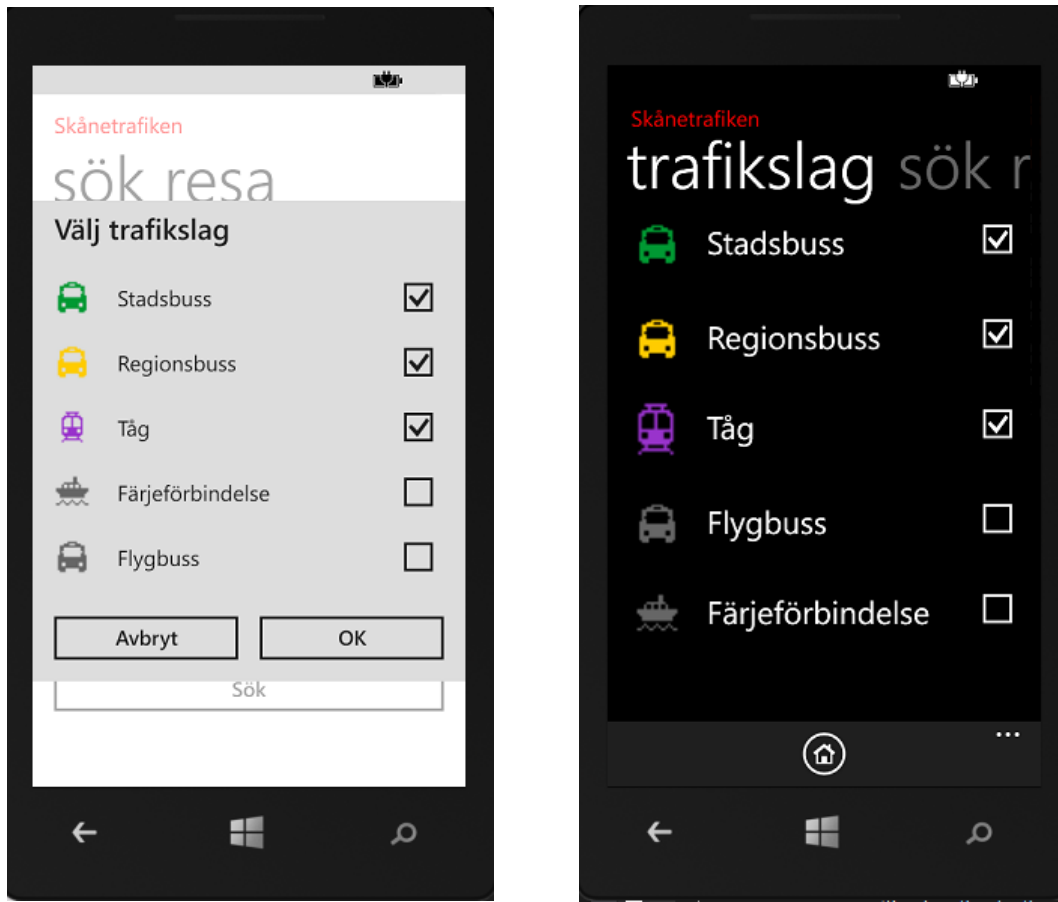
Figure 4.1: The home page of the different designs.

As shown in figure 4.1 one design is focusing on navigation based on lists while the other design is based on a grid pattern. These two kind of navigation layouts are both very popular on mobile devices and commonly used on Windows Phone which is why we wanted to ask the users which one they preferred. We also wanted to ask the test persons which placement of the settings choice they liked the most, more hidden like in the left image in the figure or visible as a menu alternative like in the image to the right in the figure.



(a) The page "Sök resa" with the list-design. (b) The page "Sök resa" with the grid-design.

Figure 4.2: The different designs of the page "Sök resa".

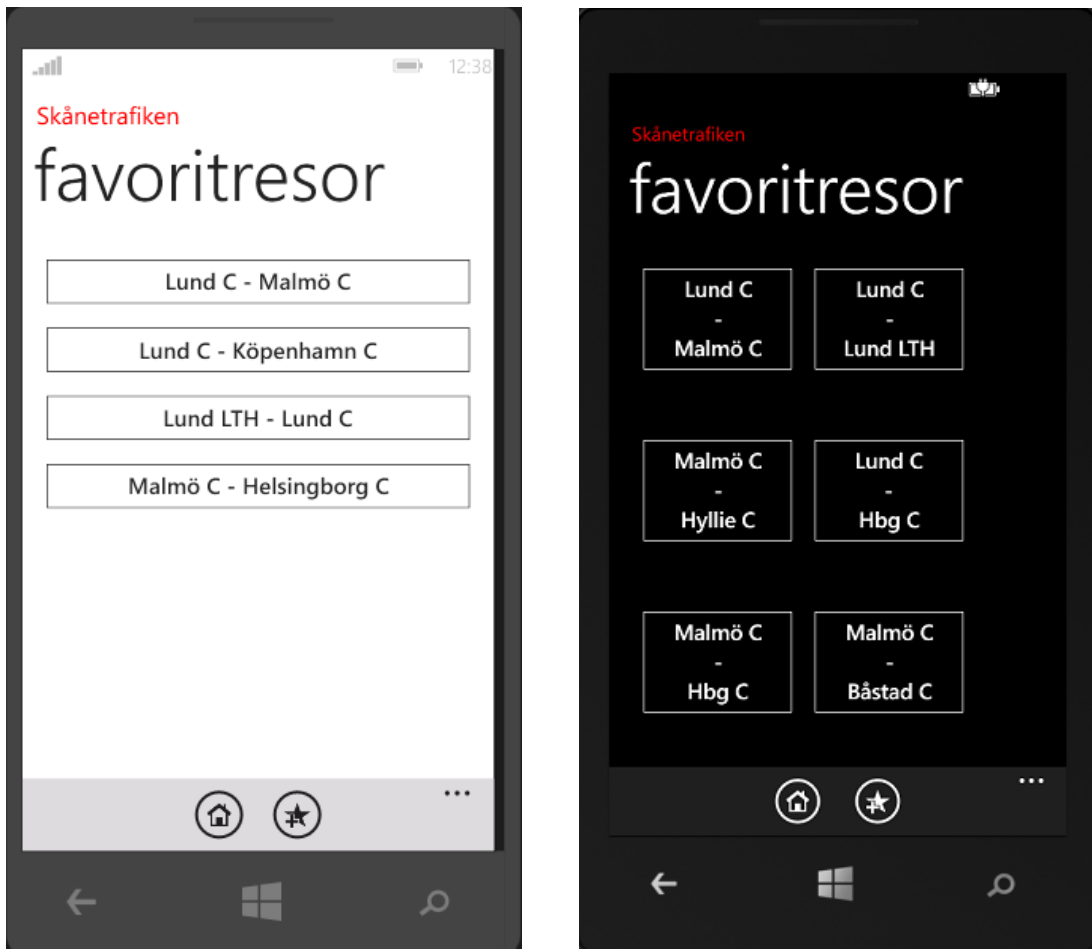


(a) The page "Trafikslag" as a pop-up.

(b) The page "Trafikslag" as a pivot element.

Figure 4.3: The different designs of the page "Trafikslag".

As mentioned earlier in the thesis a commonly used design component when developing for Windows Phone is the pivot page. This is another design choice we wanted to ask the users about, if they preferred the pivot page design as shown in the right images in figure 4.2 and figure 4.3 when choosing "Trafikslag" or a standard button with an underlying page as shown in the left images in the figures.



(a) The page "Favoritresor" for the list-design. (b) The page "Favoritresor" for the grid-design.

Figure 4.4: The different designs of the page "Favoritresor".

The images in figure 4.4 is showing the page for favorite travels saved by the user. As can be seen in the images this page is also shown as an example of the list layout design, the left image, and the grid layout design in the right image.

4.2 Usability evaluation

To get feedback and input on our prototype in terms of features and design we decided to do a usability test on the two prototypes, just like we did on the existing applications. The tests were done in a usability lab and every test were recorded with a camera. To do the testing in an effective way we chose to create tasks and scenarios that would resemble real-life situations. In that way we would be able to see how a user would interact with the application. The tasks were only conducted on one of the prototypes because the only difference between the two prototypes were the design. Therefor the users performed the predefined tasks on one prototype and after that they tried out the second prototype and got questions only about the design. We thought it would be unnecessary to perform the same tasks twice, just because the interaction is identical on both the prototypes. We only wanted to know which design the users preferred. We used the method observations combined with short interview questions to get feedback from the users. This structure gave us all information we needed in the previous usability test and therefor we decided to use the same method on the Hi-Fi test.

4.2.1 Observations

The test was conducted on 15 people with different age, gender and experience. We filmed every test using cameras in the lab and the persons were asked to "think aloud" when performing the tasks or when they had any type of feedback on the application.

By analyzing the video recordings we came to the following conclusions about the different tasks:

Task 1: Buy an adult ticket from Lund LTH to Lund C using a "Mastercard" and activate it.

- None of the test persons had any problem conducting this task. The one's that had experience of the existing applications thought that the steps for this task was similar to the steps in the existing application. Therefor they thought that it was simple to perform this task. The one's that had no or less experience of the existing applications thought that it was easy and clear on what to do to conduct this task.
- Some of the participants wanted the numerical keyboard from the beginning when pressing the pin code box because a pin code often are numbers and not letters.
- The majority of the participants thought that the text was possibly a bit to small on different pages and wanted to increase the fontsize of the text.
- Some of the participants wanted to be directed to the page "Aktiva" after pressing active on the ticket but the majority wanted to get redirected directly to the ticket itself as in the application.
- They all thought that it was good with a new page where the user chooses the payment card and that the page was very easy to understand and use.

Task 2 (Scenario) : *You are going to travel from Lund C to Malmö C and therefor you do a travel search between these destinations. Of unknown reasons you instead want to see the departures from Malmö C to Lund C without doing a new travel search. How do you do this?*

- All the users performed this task without any problem.
- All of the participants were pleased with the new swap-button on the page "Resalternativ". They thought that it was good to be able to swap start- and end-destination on that page and see the departure list update without having to step back in the system, then swap and do a new search.
- Everyone thought that it was a good new feature.

Task 3: Add Lund C - Malmö C as a new favorite

- None of the users had problems with performing this task but the approach and the way they added a new favorite travel differed.
- The majority of the users added the specified route by first doing a travel search with the pre-defined destinations and then adding the travel as a favorite using the button in the application bar.
- Some users navigated to the page "Favoritresor" and then added a favorite travel with the add-button in the application bar.
- All the participants thought that it was a good idea to be able to add a route as a favorite travel on two different pages. They pointed to the fact that some users not always want to do a search before adding the route as a favorite.
- Two of the users suggested that it can be good to be able to add a favorite travel already on the page "Sök resa" just after choosing start- and end-destination.
- The majority of the users recognized the add button and thought that the image of the button is easy to understand because it is known from favorites in web browsers.
- Some users thought that it can be good to have a text on the page "Favoritresor" when there are no favorite routes added that explains that there are no added favorites and where the user can add a route.

Task 4 (Scenario): *You are in a hurry to the bus and want to buy a city ticket within Lund using the application and pay with the pre-registered "Mastercard". How do you purchase this city ticket?*

- A couple of users had some problems finding the where to buy a city ticket. The name "Snabbköp" can be confusing and does not really explain that a user can buy a city ticket on that page.
- Everyone likes the idea of the feature being implemented with gps-tracking of the phone and everyone had the same explanation of why it is good. They point to the fact that they never would have bought a city ticket without being in that specific city.

- Some of the users attention was first brought to "Snabbvalsresor för Lund" instead of "Köp stadsbiljett för Lund". They suggested that the city ticket feature should be more visible and bigger just to draw the attention to that feature first.
- One user did not understand why there was a feature of purchasing a city ticket and a feature of buying a ticket to different pre-defined quick choices on the same page.
- No one had problem of using the city ticket feature and almost everyone would have used the feature themselves.

Task 5: Buy a ticket to Malmö C quickly.

- None of the participants had any problems conducting this task.
- Although the majority of the users understood the concept of the pre defined quick choices, which was that they are the same as for the ticket machines in the different cities, everyone of the users suggested and would have wanted to have their most searched routes as quick choices instead.

Task 6: Do a travel search with the previously added favorite travel.

- Everyone performed this task without any problems.
- The majority of the users would have wanted the choice of searching with the added favorite route but also buying a ticket with it directly in "Favoritresor".
- A lot of the participants suggested that it would instead be two buttons; one search button and one buy button for each of the favorite routes.

Task 7: Add a new payment card. The card to be added is a "Visa" and name the card "Visa".

- None of the users had any problem with adding a new payment card.
- Not one of the participants found it difficult to to perform this task.
- Every user added the card on the page "Mina kort" but thought that it was good to be able to do it when searching for a travel as well.
- Some of the users wanted to have only a numerical keyboard when entering a pin-code just because it is standard to have just numbers in a pin-code.
- Some of the users thought it would be good to have a personal password instead of a pin-code because it would make it more safe in their opinion.
- The participants thought that the procedure was simple.
- One user wanted to have more space between the cards in the list.

Task 8 (Scenario): You are aware of the fact that you do not have a lot of money left on your jojo-card. Therefor you want to do a refill of 200 SEK to your jojo-card and you want to pay for the refill with your newly added Visa-card. How do you do this?

- This task was performed without any problems for all the users.
- They all thought that the procedure resembled the the one when buying a ticket, which was good.
- The majority of the users wanted some kind of feedback when refilling the Jojo-card so that it was more clear that the payment was successful.
- Some of the users wanted to have card information and actual balance on the page "Ladda reskassa" as well.
- Everyone of the participants pointed to the fact that they really miss the feature of being able to refill and buy tickets using their jojo-card in the applications that are present at the moment.

Task 9 (Scenario): You are, at the moment located at Ingvar Kamprads Designcentrum and want to know if you are going to get to Lund LTH in time before the next bus departures. Therefor you do a travel search from Lund LTH to Lund C and use the map-feature to see where the bus is at the moment. Will you manage to take the bus or do you have to wait for the next one?

- The majority of users had problems finding the feature. They searched for it and it was unclear on which page the feature was placed.
- The majority of people also thought that the icon of the map resembled a ticket more than a map.
- Almost every participant liked the feature and the purpose of the feature but had some suggestions on improving it.
- Some users wanted to have the estimated time for how long it would take to walk from the current position to the start destination as well as the estimated time it would take the bus to check in to the same destination. This to make it more clear for the user if there would be a chance to reach the destination before the bus.
- Some users also wanted the whole route for the bus highlighted on the map.
- Some participants suggested that it would be good to point out all the bus stops on the bus route to be able to see if there is a bus stop that is closer to the current position of the user.

Task 10: Do a "bus stop search" from Lund C. Which buses departures from Lund C?

- The task was conducted without any problems.
- The majority of the test group thought that it was good that unnecessary buttons and fields disappeared when the checkbox for "hållplatssök" was checked in. This behavior explained that when you do this type of search only one destination is needed.
- Some of the participants did not know what "hållplatssök" actually did based on the name, until they actually did the search.

- Some users wanted more than just information about which buses departures from the searched destination. They wanted to be able to click on specific buses and then be forwarded to ticket purchasing and some users only wanted the information that was present.
- One user was using another travel application in real-life that did not have this type of feature and that person liked the feature very much and preferred to have it in the other application as well.

Task 11 (Scenario): The period of validity on your Visa-card has expired. Therefore you want to delete the card in the application. How do you do this?

- No one had problems with deleting the Visa-card and they all thought that it was good with a pop-up that made the user confirm the deletion of the card before it was deleted.

4.3 Evaluation

After analyzing the usability tests we came to the conclusion that a lot in our Hi-Fi prototype was good and improved the user experience compared to the existing applications. The feedback we received from the test users was very important because we noticed that there still was things that could be improved to make it even easier for the users to use the application.

In terms of design and layout of the prototypes all the participants preferred the list-type design more than the the grid-type design. It was for them, more esthetically pleasing with a list design and it looked a lot better. They described the grid design as very visible and clear but messy and not near as esthetically pleasing as the list design.

Before the usability test, we were concerned about whether or not the pivot-elements would be too hard for the users to understand and see and if it is a good design pattern to use in terms of user experience and interaction design. We received almost only positive feedback for the pivot-elements. The majority of the users thought that it was a pleasing design pattern that was easy to see and use and they really liked, user experience wise, that one could swipe between different pages from only one page. Some users had no preference on whether it is better to use pivot-elements or regular buttons.

In terms of alignment of buttons, text-blocks and text-boxes the users thought that it was good on most of the pages but they had suggestions for bigger font-size on the text on some pages as well as better icons to get a better understanding of some features. We got split feedback on whether or not the application bar should be visible to the fullest from the beginning so that the user can see each button-text or if it only should show the button icon. Some users thought that it would be more clear to the user what each button represented if it was fully visible but some recognized almost every icon and knew what the buttons represented and did not want the application bar to take so much space from the screen.

4.4 Final Prototype

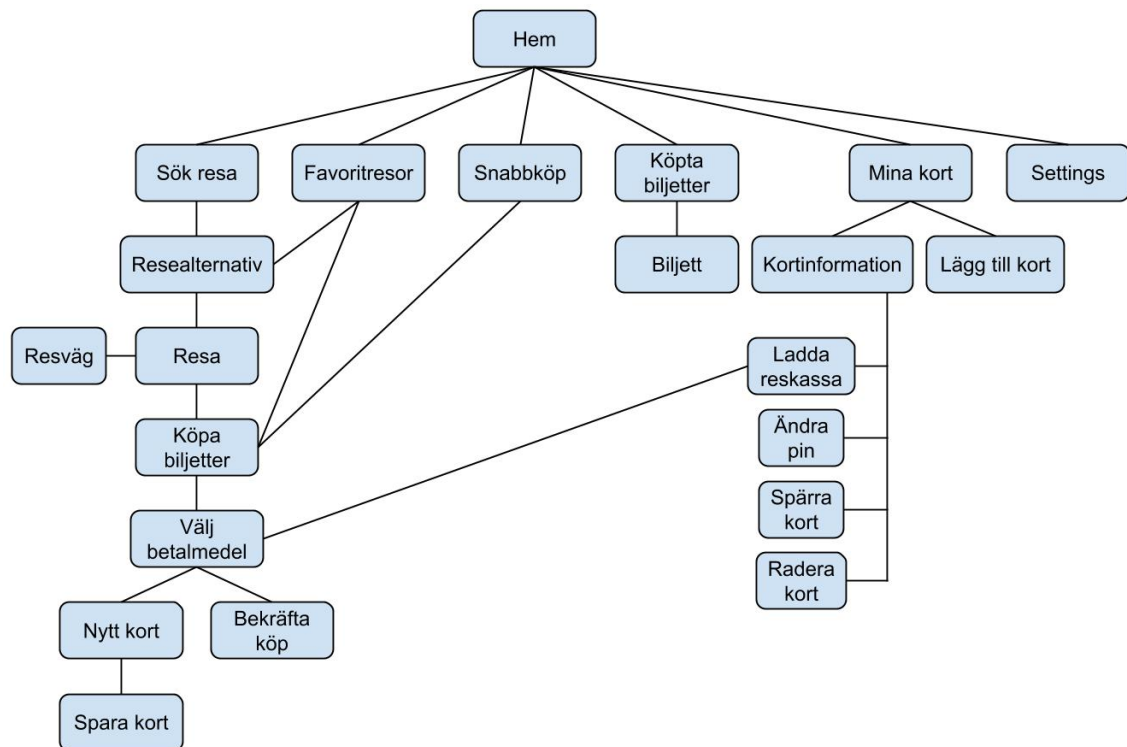


Figure 4.5: Flowchart of the final prototype.

After the usability tests we decided to keep the list-design for our final prototype but incorporate the pivot-elements from the grid-design to the list-design. The final prototype was improved with regards from the feedback received in the usability tests and the design is consistent and follows Windows Phone standards.

In this chapter our final prototype is shown and the final changes made from the Hi-Fi prototype are explained.

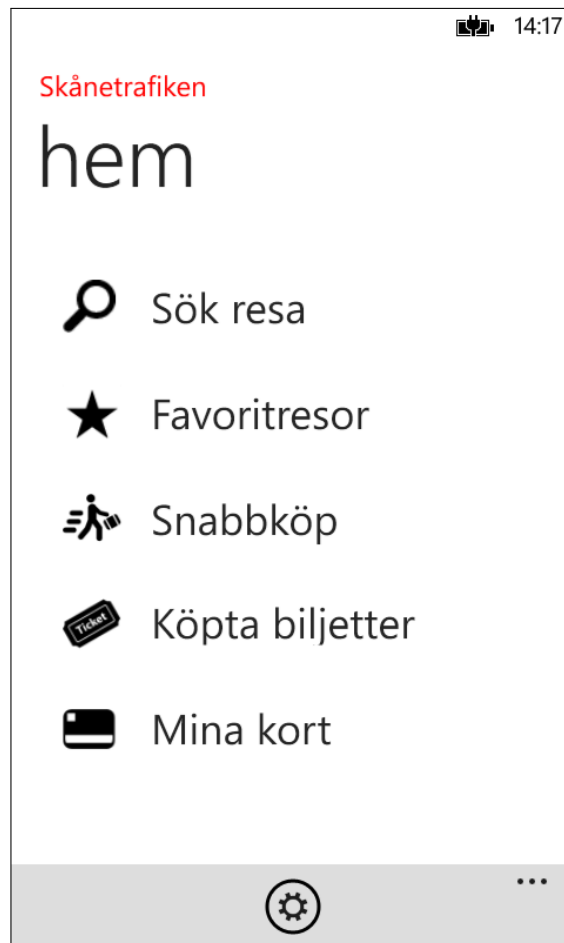
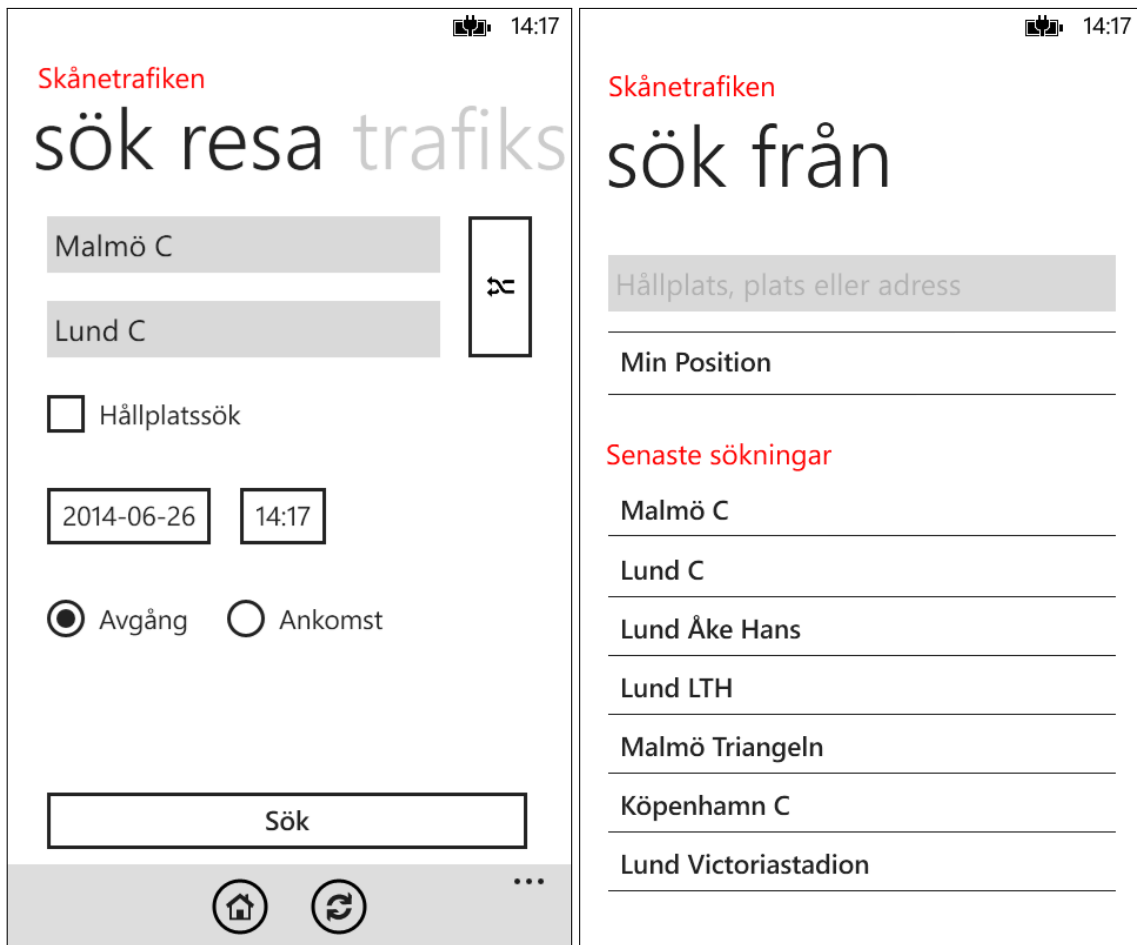


Figure 4.6: The home page.

As can be seen in figure 4.6 the final design is the list-design. This was decided upon the results from the usability tests.



(a) The page "Sök resa".

(b) The page "Sök från".

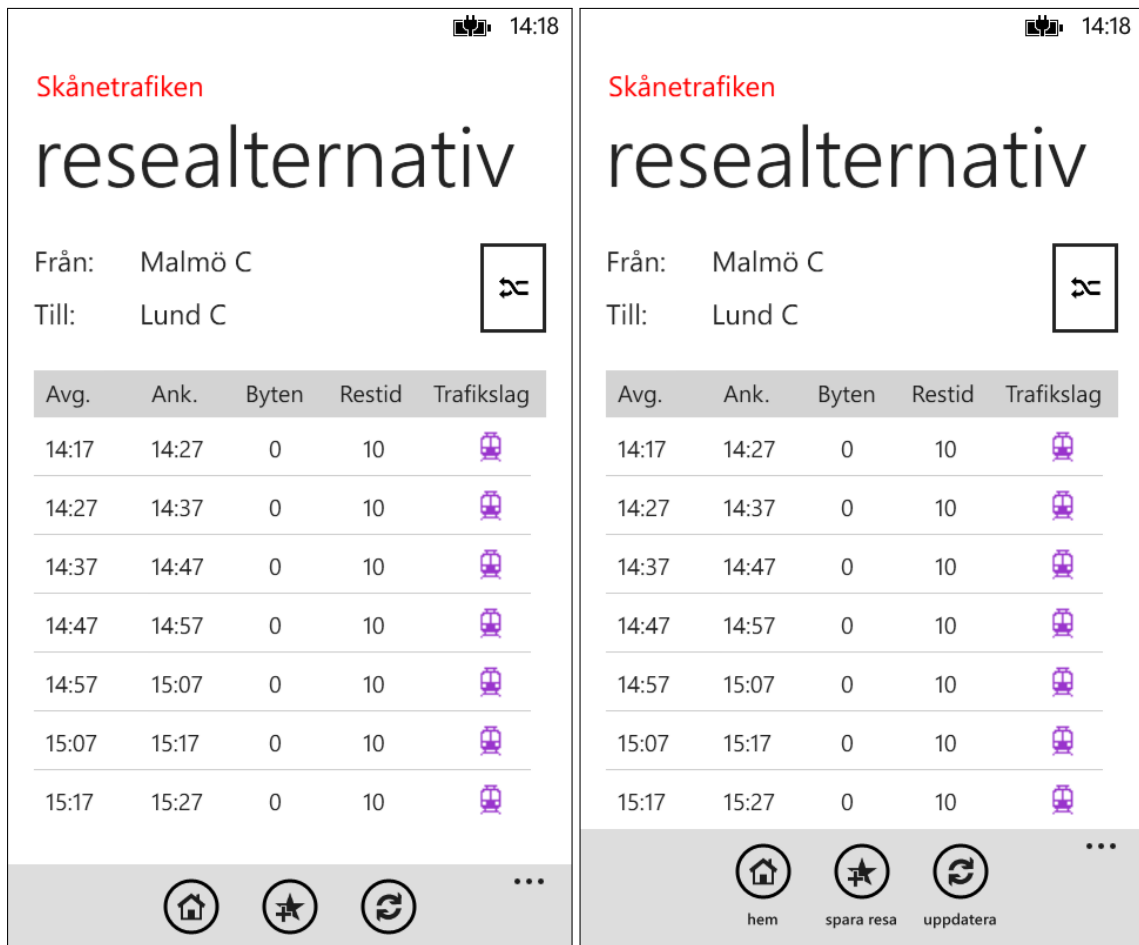
Figure 4.7: Pages for choosing where and when to travel.

In our final prototype we changed the design and decided to use a pivot pattern to navigate between 'sök resa' and trafikslag. The reason for this is because we got the result from the usability tests that it improved the user experience for our test persons. It was more appealing to swipe between pages on the mobile phone instead of pushing a button. Another reason was because we wanted to be more consistent throughout the application and use well known Windows Phone standards.

As can be seen in figure 4.7 everything is aligned and grouped and the confirmation button "Sök" is larger and placed at the bottom of the page. Because a user starts to read a mobile page at the top and then navigates down, and pressing the button "Sök" is the last thing a user does on this page, this is the most natural placement of the button.

Figure 4.7 also shows that the application keeps the latest search the user made and fills in the fields for start- and end-destination. Current date and time are set as default in the final prototype.

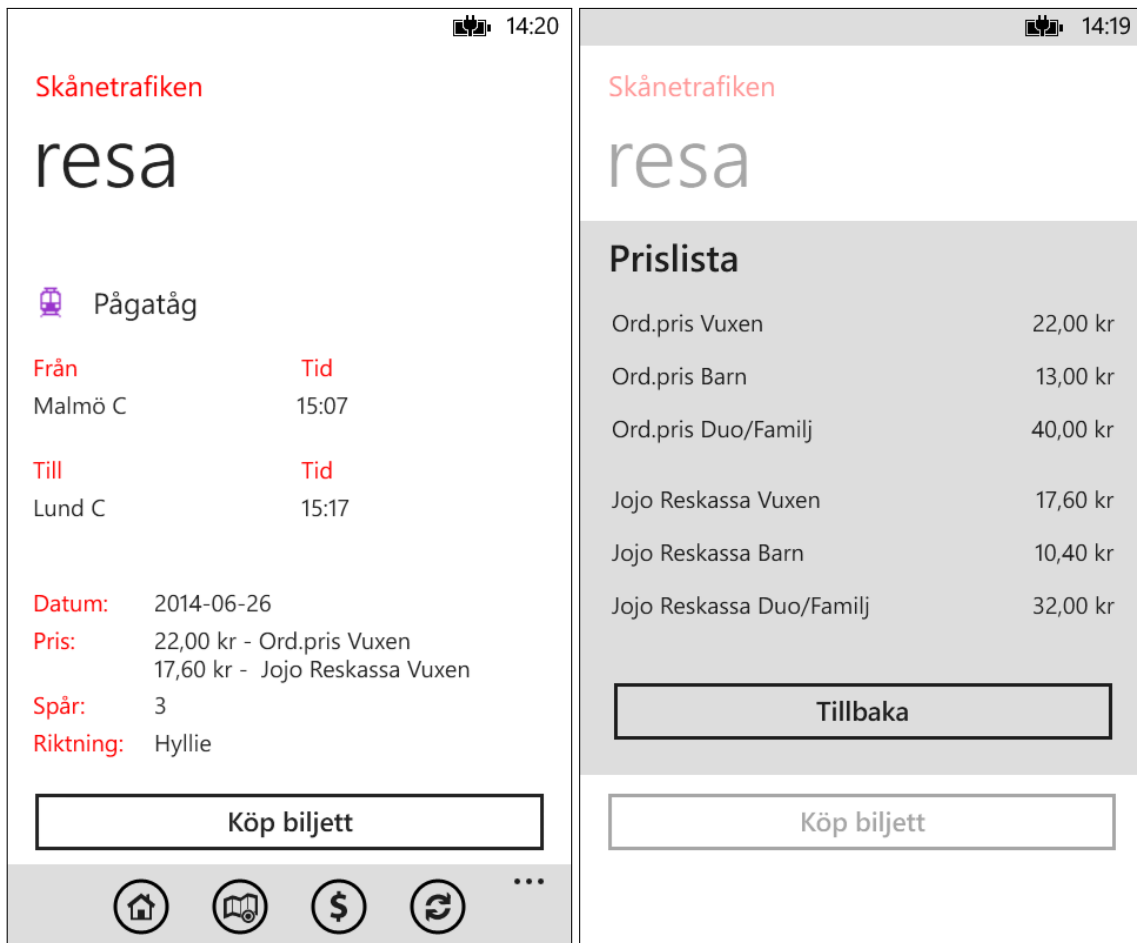
We decided to not make the application bar fully visible as default. Instead we decided to give the application a "memory" which memorizes the last state the application bar was in. It gives the users the option to have the application in the way that suits them the best.



(a) "Resealternativ" with default application bar. (b) "Resealternativ" with visible application bar.

Figure 4.8: The page "Resealternativ".

This page is the same as in the Hi-Fi prototype because it was perceived as good in the usability tests and it is quite similar to the same page in the current Skånetrafiken applications. The figure 4.8 shows the same page but with the two different options on the application bar.



(a) The page "Resa".

(b) Pricelist of tickets for a certain route.

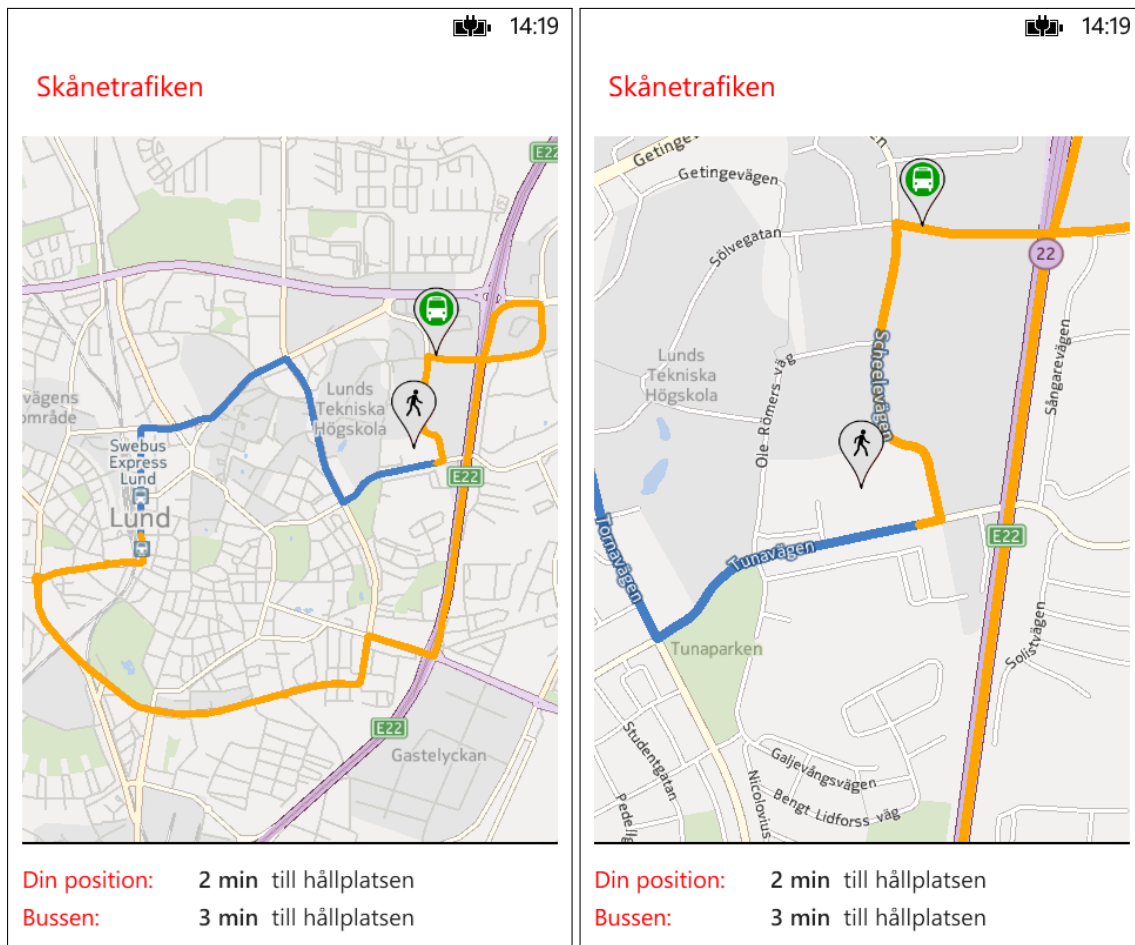
Figure 4.9: Screens of the page "Resa".

In figure 4.9 the page for "Resa" is shown as well as the pop-up window showing the different prices for the chosen route.

This page has been modified and improved after the usability tests. The information regarding the chosen route have been re-ordered so the most relevant information for the user is shown first when a user reads the page. We also added information about the adult price for the chosen route when it is purchased with a jojo-card, as seen in a), because this was something the users wanted to be displayed on this page.

In this prototype we changed the concept of the triangle shaped indicators for when the transport is in time, delayed or cancelled. Our solution only shows a red triangle when the transport is delayed or cancelled so we have removed the green and blue indicator. Along with the red indicator the new time for arrival is displayed if the transport is delayed, otherwise if it is cancelled, it displays "Inställt" instead of a new time. When a transport is in time, nothing else is displayed except the time for departure and arrival. If the triangles are present they will be visible next to the time in image a).

Information about the price for the chosen route can be seen when pushing the dollar sign in the application bar. This pop-up window displays the price for the different ticket types. We grouped the information so the regular price for the types are grouped together and the prices when purchasing with a jojo-card are grouped together, as seen in image b).



(a) "Resväg" - normal zoom.

(b) "Resväg" - zoomed in.

Figure 4.10: Images from the page "Resväg".

"Resväg" is a completely new feature we decided to develop and use in our prototype. Figure 4.10 shows what the feature displays, both in default mode but also when it is zoomed. "Resväg" shows the users position as well as the position for the bus. The complete route for the bus is marked with yellow and the searched route the user has made is highlighted with a blue line. The feature gives the user the chance to see where the bus is, in real-time. It uses gps-tracking for the users position as well as for the bus. It also displays the estimated time it takes for the user to walk to the bus stop as well as how much time it is until the bus reaches the same bus stop.



(a) Buy ticket between different cities.

(b) Buy ticket within a city.

Figure 4.11: Images of the page "Köpa biljetter".

Figure 4.11 shows the images for the ticket purchasing page for both a standard travel search and a city ticket. The text style for the destinations are bold to make it more visible for the user that they are purchasing a ticket for that specific route. When purchasing a city ticket the name of the city is highlighted and there is no end-destination because the ticket is valid in the whole city.

The first time a user purchases a ticket with the application, one adult ticket is set as default because it is the most purchased ticket type. To make our application more user-centered and personal, the application will remember the most purchased ticket type for each user and then set that type as default. This to reduce number of "clicks" as well as make it easier and faster for the user to purchase a ticket.

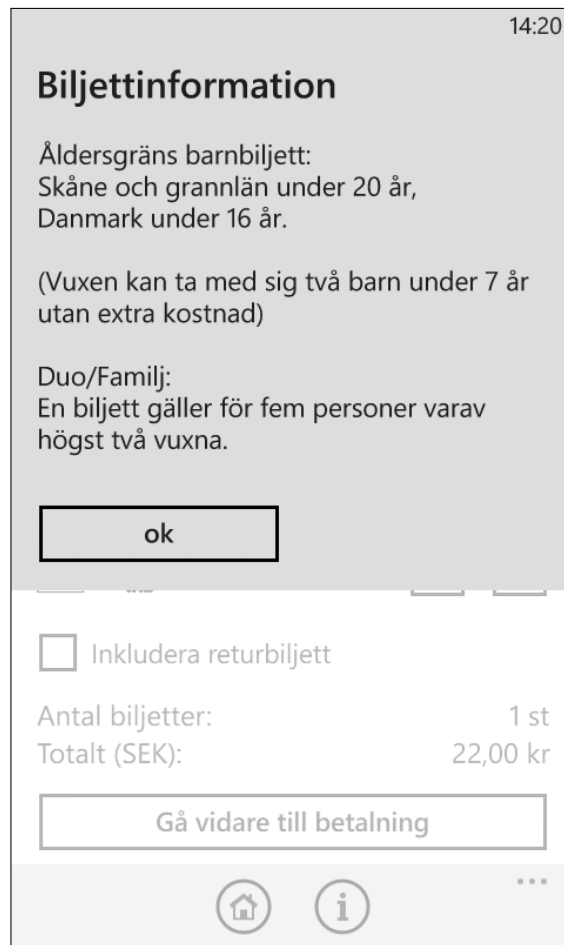
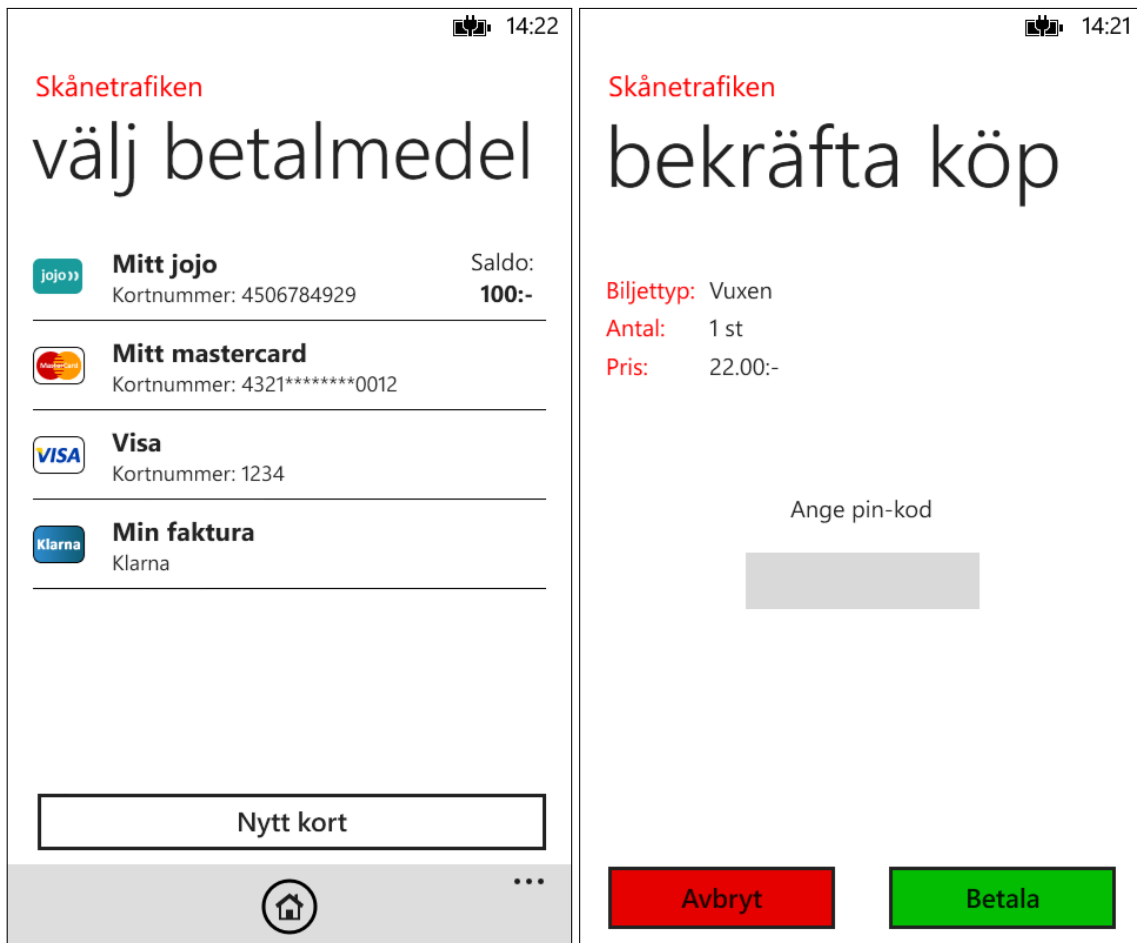


Figure 4.12: Pop-up showing ticket information.

Figure 4.12 shows the pop-up window with information about the ticket types. The icon is a typical information icon which is recognized by most users and the button is placed in the application bar. The different segments are also placed in groups for a better view.



(a) The page "Välj betalmedel".

(b) The page "Bekräfta köp".

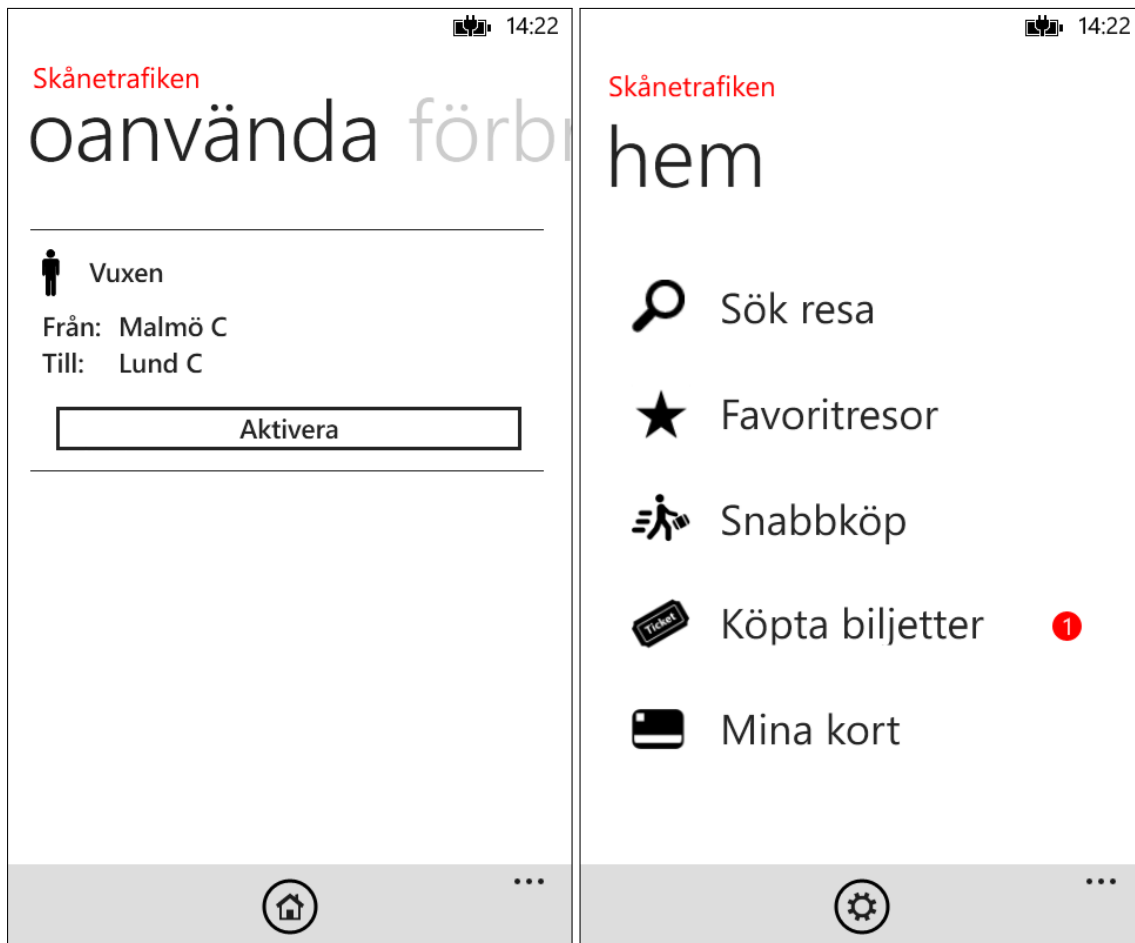
Figure 4.13: Images showing the steps for paying a ticket.

In figure 4.13 are the images of "Välj betalmedel" and "Bekräfta köp" which is the next two steps when purchasing a ticket.

On the page "Välj betalmedel" the user can see the cards that the user has registered in the application. If the user has a registered jojo-card the balance is displayed as well. Another payment choice is to pay using "Klarna". This is possible only when a user has an account with "Klarna". This is then also displayed on "Välj betalmedel". On this page we also decided to have the feature of registering a new payment card.

"Bekräfta köp" shows the page of the last step when buying a ticket, which is to confirm the purchase. A pin-code is required to be entered here for security reasons. As can be seen in the image, information about ticket type, number of tickets and total price is displayed.

We decided to color code the buttons on this page. The color green is associated with confirmation and the red color was chosen because it is associated with stop or cancel. To help prevent that users make an error in this crucial step we also decided to put the buttons beside each other with a big gap between instead of having the buttons on top of each other.



(a) Unused tickets.

(b) Red notification of unused tickets.

Figure 4.14: Images showing the page and information for "Köpta biljetter"

In figure 4.14 are the images that show how the application looks like when a user has purchased a ticket which is unused. The left image shows the page where the user is redirected after the purchase is confirmed. Every unused ticket will be placed in "Oanvända" and the most important ticket information is available directly to the user. The activation button is large to draw attention to the user that it is with that button you activate the ticket.

In the right image the home page is shown. In the final prototype we added a red item to notify the user that a new unused ticket is available in "Köpta biljetter".



(a) Active tickets.

(b) A purchased ticket.

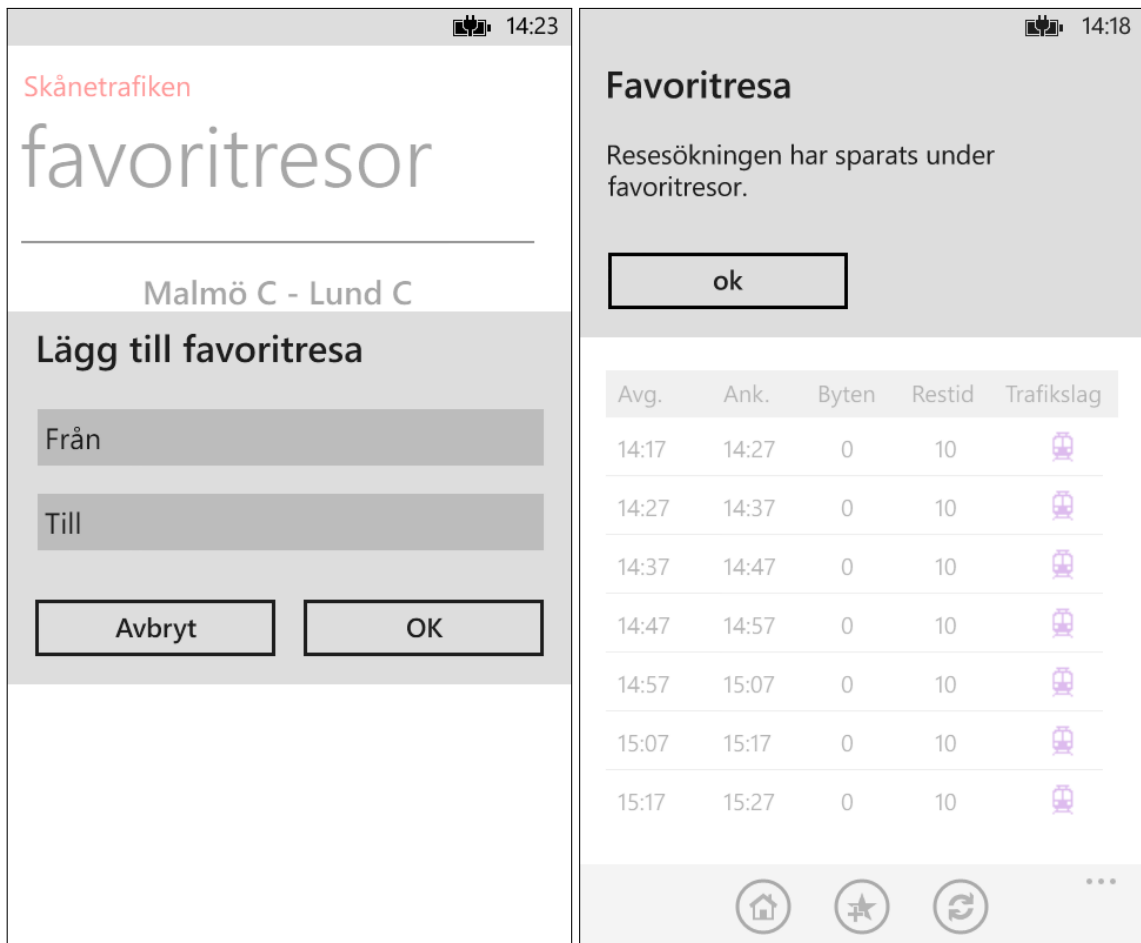
Figure 4.15: Images showing an active ticket.

Figure 4.15 shows the step when a ticket has been activated. In the left image is the page where every active ticket is shown. The right image shows the ticket in full-screen mode.



Figure 4.16: The page "Favoritresor".

In figure 4.16 the page for "Favoritresor" is shown. After feedback from the usability tests we changed the design from just being a button from which you can search for departures and arrivals to have a separate title with two buttons "Sök resa" and "Köp biljett". The functionality of "Sök resa" is the same as the button in the Hi-Fi but when clicking on "Köp biljett" the user can directly buy a ticket for the chosen travel.



(a) Add a favorite travel from "Favoritresor". (b) Add a favorite travel from "Resealternativ".

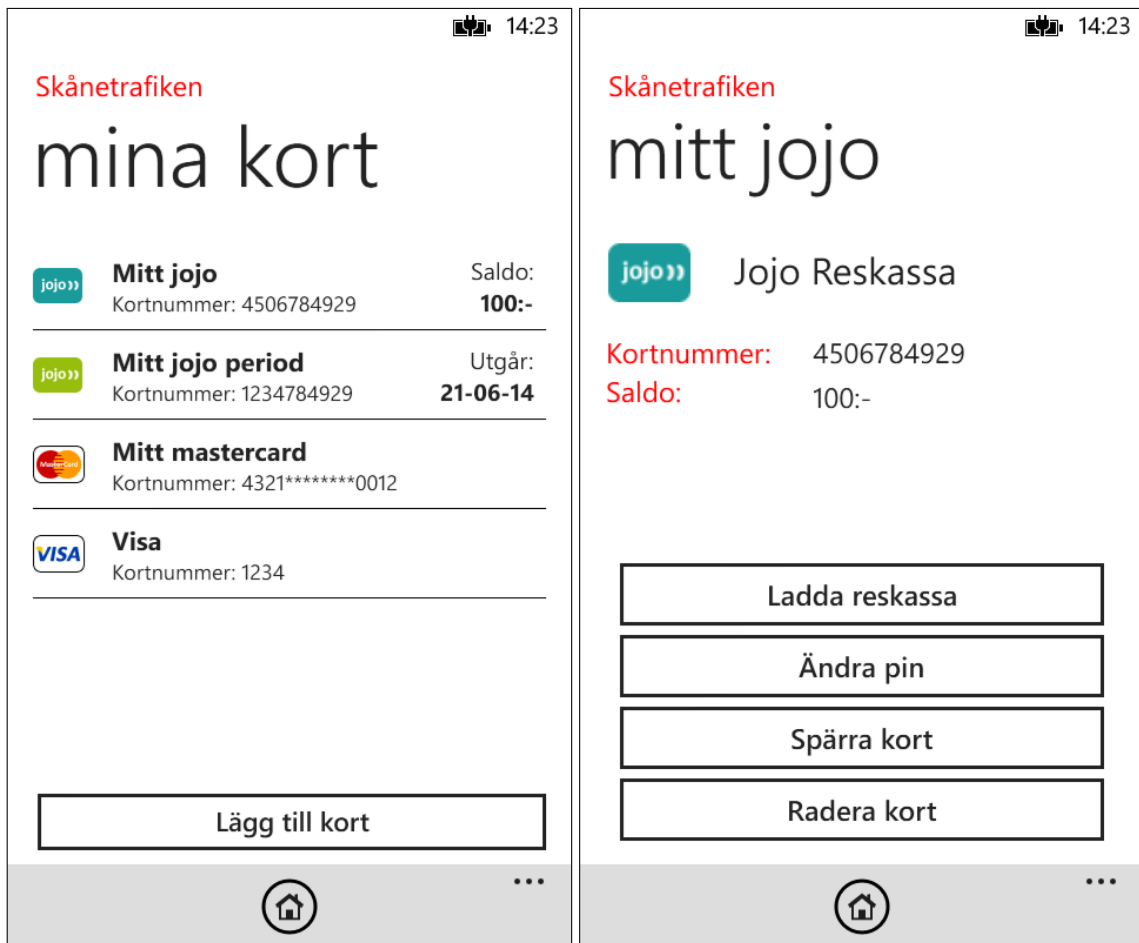
Figure 4.17: Images showing how to add a favorite travel.

A favorite travel can be added directly from "Favoritresor" as in the left image in figure 4.17 or from the application bar on the page "Resealternativ" as shown in the right image. The fact the users can add a favorite travel on both of those pages was something the users liked. They thought it was especially good that it could be added from the page "Resealternativ" so they did not have to go back to the home menu, to the page "Favoritresor" and add it from there when they had a departure search showing.



Figure 4.18: The page "Snabbköp".

During the usability tests some users complained about the "Snabbköp" page being unstructured and hard to understand. For the final prototype some changes were made to make it easier for the users to understand. As can be seen in figure 4.18 we made it clearer what the users options are, you can buy a city ticket within the city you are located, at the top of the page, and travels to other destinations are beneath it. From the beginning the destinations from a location are the most common ones across all travelers, but after some usage it adapts to show the most used destinations for the user itself. This behaviour is something the users wished for during the usability tests, before this, in the Hi-Fi, the destinations shown were the same as the ones shown in Skånetrafiken's ticket dispensers.

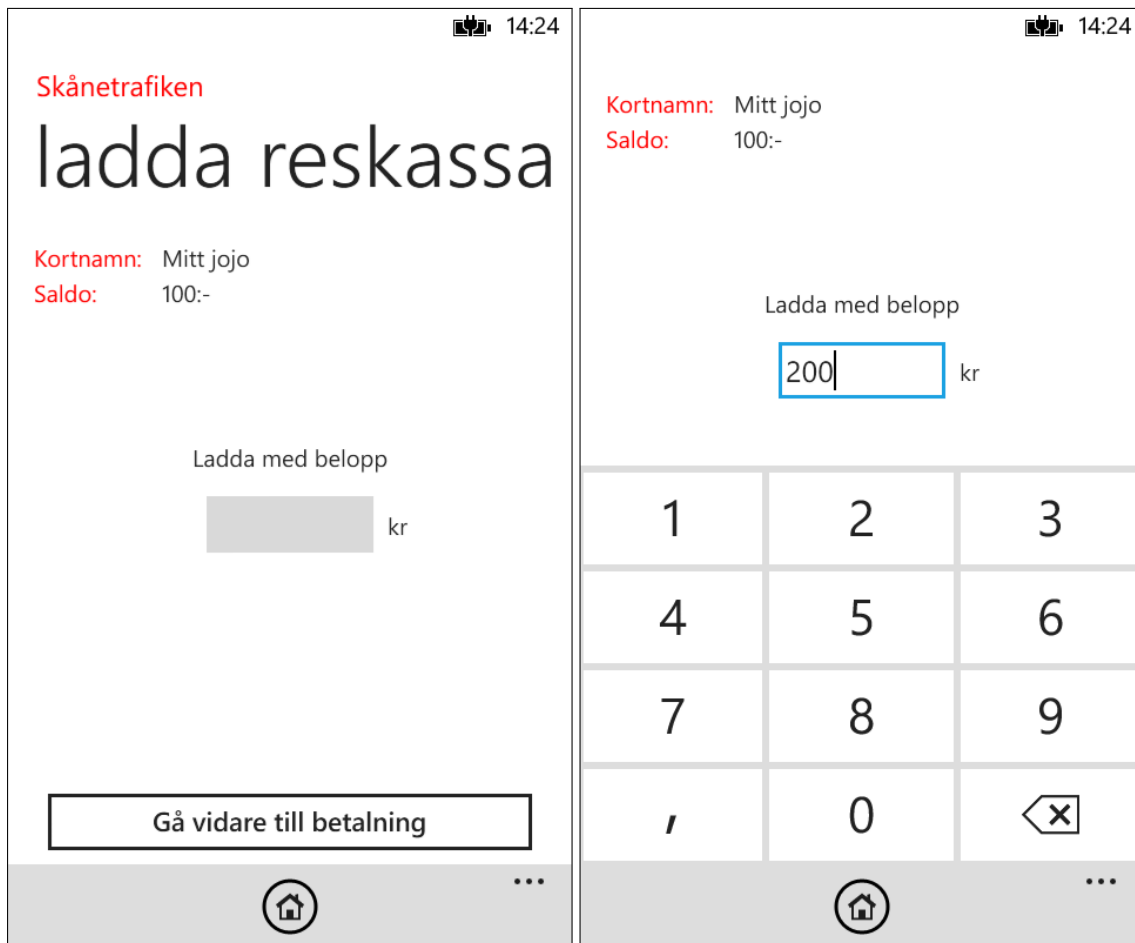


(a) The page "Mina kort".

(b) Information and options for a jojo-card.

Figure 4.19: Images showing the users payment cards.

The page showing the users payment cards, "Mina kort", is shown in the left image in figure 4.19. No users had any specific complains about this page during the usability tests except they wanted the expiration date for the "Jojo Period"-card to be shown on the main page for the payment cards. Except the expiration date, the balance for the "Jojo Reskassa"-card is also shown on the main page. The cards are sorted to show all jojo-cards first and all other payment cards beneath. From the main page for "Mina kort" the user can chose to add a new card or click on an existing card to show options like in the right image in the figure. This page have not changed very much from the Hi-Fi neither. The titles, card number and balance are now following the red color scheme and a button to block a card if it is lost has been added.



(a) Image showing the page "Ladda reskassa".

(b) Image showing a deposit amount.

Figure 4.20: Images of the steps of making a deposit to a Jojo-card.

A feature for refilling a "Jojo Reskassa"-card is a feature almost all users, throughout our research, wanted in an application. This can be done by clicking on the button "Ladda reskassa" as seen in the right image in figure 4.19. When choosing the option to refill a card, the user is taken to the page shown in the left image in figure 4.20. Here we have chosen to also view the cards balance, which was not shown on this page in the Hi-Fi prototype. When clicking on the text field for choosing a sum to add to the balance a numerical keyboard is shown as in the right image in the figure to make it easy and fast for the user to enter a number, in comparison to a standard keyboard. When clicking the button to pay, as seen in the left image, the user is taken to the same payment page as when buying a ticket, seen in figure 4.13, except the user cannot pay with a jojo-card.

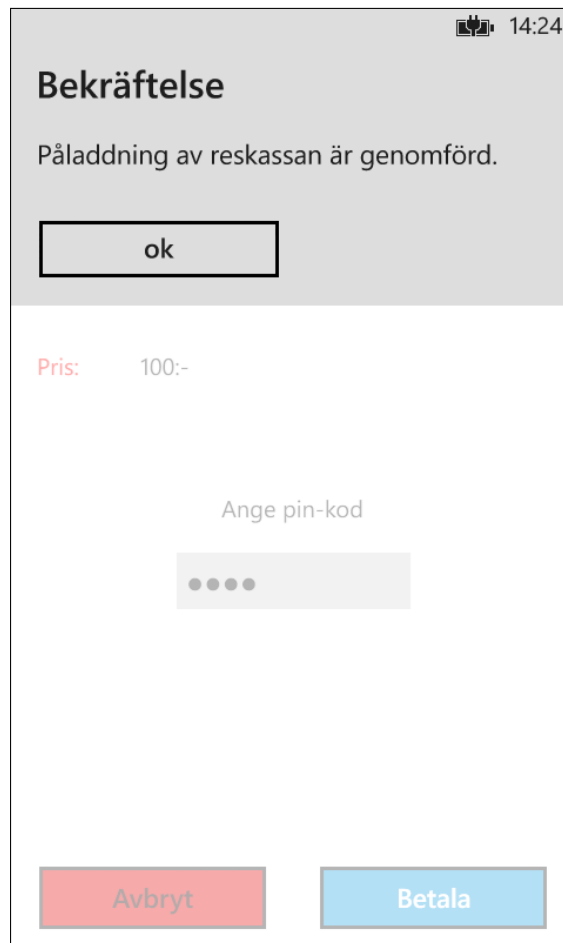


Figure 4.21: Image showing a deposit confirmation.

After the payment in the Hi-Fi no notification of a completed, or uncompleted, payment was shown which is something we added to the final prototype, shown in figure 4.21, after input from the users.



Figure 4.22: Image showing the pop-up when deleting a card.

When the user chose to delete a card through "Radera kort" a security notification is shown like in figure 4.22 to prevent the user from accidentally deleting a card.

Skånetrafiken
lägg till kort

Mastercard

Kortnummer

Giltig månad 1 Giltigt år 2014

CVV/CVC

Avbryt Nästa

Skånetrafiken
lägg till kort

Namnge ditt kort

Ange personlig pin-kod

Bekräfta personlig pin-kod

Avbryt Spara

(a) The first page of "Lägg till kort".

(b) The second page of "Lägg till kort".

Figure 4.23: Images showing the steps of adding a payment card.

To add a new card the user can choose to do so from "Mina kort" as shown in the left image in figure 4.19 or from the page "Välj betalmedel" as shown in the left image in figure 4.13. The users wanted the opportunity to add a new card when buying a ticket but they also wanted to be able to do it in advance to be able to buy a ticket faster when they first use the application. To add a new card the user fills in a standard form for adding a payment card as seen in the left image in figure 4.23 and then the user chooses a name for the card and a personal pin code, as seen in the right image in the figure, to use when paying with the card.

4.4.1 Usage of design principles

When designing the Lo-Fi- and Hi-Fi-prototypes we always considered the different rules, principles and guidelines for designing a user interface and strived at using them in our design process. This can be seen in different ways in our prototype.

The home screen in figure 4.6 gives the user a better visibility over what can be done in the system, by having all the main features shown here. Throughout the whole application and design process we strived for consistency in the sense that the layout, colours, positioning of confirmation buttons and the navigation is the same throughout the prototype. This is very important and one of the eight golden rules when designing a user interface.

Early on in the design process, in the stage of evaluating the existing applications, we discovered the lack of informative feedback in the applications. We therefore decided to use the principle of offering informative feedback in our prototypes in terms of i.e. pop-ups with information of what has been done. This gives the user some control and certainty that the action has been made and is therefore important. This can be seen in i.e. figure 4.21 when a user has made a deposit to the jojo-card. Feedback is also shown graphically whenever a button is pressed, the button then changes color.

We have in our system used the design principle of constraints when using the feature "Hållplatssök". When marking the checkbox for this feature as can be seen in figure 4.7, the input field for an end destination disappears. This because the feature only supports a search from a start destination and shows every bus from that bus stop with several different end destinations. By setting a constraint the user is not able to pick an end destination, which prevents the user from making an error when using this feature.

The golden rule of permitting easy reversal of actions is also used in several ways in our application. One example is when adding a favorite travel or purchasing a ticket. The user then always has the option of cancelling the action using the button "Avbryt".

The feature "Snabbköp" is created to reduce the number of steps a user has to make when purchasing a ticket. The feature reduces the short-term memory load and makes it easier for the user to perform the task.

Chapter 5

Discussion

5.1 Developing for Windows Phone

Application development for Windows Phone was totally new for both of us but we had some experience in development for mobile platforms like Android. It was quite easy to set up the environment, we chose to work in Microsoft Visual Studio for Windows Phone, which Microsoft recommended. This version of Visual Studio was developed especially for Windows Phone and had the Windows Phone SDK already installed along with software for parallel development. The main programming language for Windows Phone is C#, this language has a lot in common with Java which we both have good experience in. Later in the project when focusing more on the design of the Hi-Fi prototype we discovered that the built in component library was very poor and lacked some components often used when developing mobile applications. Fortunately this library could be extended with commonly used components by downloading an external library often used by Windows Phone developers. Another thing, which probably has to do with Windows Phone being younger and not as popular as Android and iOS, is the lack of information on both Microsoft's web page and on forums. The overall experience of development to Windows Phone is good, but it probably need a couple of more years before being a platform competing with Android and iOS.

5.2 Analysis

When analysing the statistics to determine the target group we decided to analyse which age group that travels most frequently with public transportation. This was the basis for determining the target group. One other approach that could have been used is to analyse which age group that uses the travel application from Skånetrafiken the most and then to complement that statistics with an analysis of which age segment that uses Windows Phone

the most. We decided to use the first approach because that gave us a good insight on the people that travels often and therefor potentially would use our application as often. One other reason behind our choice is that we wanted to focus more on what an overall user would want in an application of this type rather than to be as specific and limit it to what a Windows Phone user would want. We made this project on the platform for Windows Phone but our results can easily be used to release new versions for Android as well as for iOS.

After our first usability evaluation session we noticed that the structure of the test was not optimal. We decided to do a task-oriented part first and then follow up with interview questions. This was changed to the test session on the Hi-Fi prototype and with more knowledge and experience now, we should have done the first session like we did the last where we asked the questions during the task-oriented part.

With more time we would have wanted to test our prototype on more people with a wider age spread but due to the time restrictions we had, we instead focused on the main target group when selecting test persons. We could also have done usability tests on our Lo-Fi prototypes to get opinions earlier on our application design. Even though this could have affected the final design, it can not be said with certainty, and could therefore also be a waste of time.

An important aspect to consider is the design choices made for the Hi-Fi prototypes. When designing the two different Hi-Fi prototypes we chose two different designs, as mentioned earlier, one with focus on a list layout and one with a grid layout. We also chose to have one with a white color theme, the list layout, and one with a black color theme, the grid layout. When doing the user tests on the prototypes we asked the users which layout design and which color theme they preferred. What we did not have in mind at that moment were the possibility that one of the aspects may have affected the other. Some of the users may have liked the grid layout more if the color theme was changed and vice versa. This is something we probably would have done differently if we could do it over again. We would instead present both layouts with the same color themes.

5.3 Application comparison

The main goal of this master thesis was centered around designing and creating an application with the end user in focus. After our initial usability evaluation and especially the survey and interviews, we got a lot of criticism against the existing applications, pointing to a none-user-focused design process. There did not seem to have been so many users involved in the process, or maybe no one at all. This was especially clear in the survey where the second, fourth and fifth most requested features were connected to the jojo-card, which is completely left out in the existing applications. After analyzing the GUI and doing some observations and interviews with users in the target group we could also conclude that the users were not completely satisfied with the design and some helpful design patterns and principles like feedback and visibility had been poorly used or completely ignored.

In comparison to the existing applications, the application we created and the design process we used had a large focus on the end user. By involving users from the target group as early as possible we got important information on pros and cons with the existing applications and which features the users thought were important. With expert reviews,

interviews and observations we then got information about the GUI and how the users interacted with the system, which helped us locate which parts in the application the users had difficulties with and which they did not. In the end this design process and focus on the end users probably led to the creation of a travel application which is both better and easier to use than the existing ones.

5.4 Future work

The first thing to do is to use the prototype as a shell and do a full implementation of the application and use the API provided by Skånetrafiken. This is something we wanted to do in this master thesis but due to the fact that it would take months to develop a new, fully functional application, we decided to instead do a complete design and mock the functionality.

The error-handling can be improved. There are certain parts that lacks error prevention as well as feedback to the user. This can easily be done with i.e. pop-up windows.

With more time, we would have wanted to do a more extensive testing session on the Hi-Fi prototype as well as one more design-iteration after developing the final Hi-Fi prototype. This would give more accurate points on improvements in the application.

One very important improvement that has to be made and need further development is the update to the application on time for departure/arrival. This is crucial, especially because our new feature "Resväg", needs to update the position of the transport much faster, if not in real-time. This is also something that almost every one in our tests marked as a huge problem.

Another feature that can be developed in the future is to integrate the application with the native function called NFC (Near Field Communication) which would allow the user to purchase a ticket by putting the mobile phone near a NFC-reader just like users do with their jojo-cards today. There are restrictions today which makes it impossible for this feature to exist as of now. One restriction is that not all mobile devices has NFC. Another is that Skånetrafiken would have to change all their readers because they, as of now, does not support NFC.

Chapter 6

Conclusions

The goal of this thesis was to come up with an overall solution for a travel planner to Windows Phone in the form of a prototype application. Because there already existed travel applications for the intended company, Skånetrafiken, on the mobile platforms Android and iOS we wanted to include these in the development process of our application. We also wanted the design of the application to focus on what the travelers wanted from a travel application.

After working with Windows Phone we could conclude that this mobile platform has all you need to develop a complete travel application.

From our initial usability tests, performed mainly on the existing applications from Skånetrafiken and through surveys, we came to the conclusion that the travelers were not very pleased with the existing applications. The applications lacked useful features and it took too long to buy tickets were two of the most common reasons for the negative criticism. This is something we have focused on when developing the application. After coming up with a Hi-Fi prototype in the form of a testable Windows Phone application we once again did usability tests to see what the travelers thought of the new design and features. From the usability tests we could conclude that the users were very pleased with our prototype and all of them preferred this application over the ones that exist for Android and iOS.

Chapter 7

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Appendices

Appendix A

Expert review form

Användbarhetsutvärdering av Reseplaneraren

Design

1. Hur bedömer du applikationens design?

Android

	Mycket dålig	Dålig	Neutral	Bra	Mycket bra
Färgsättning	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>
Layout	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Typsnitt	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>
Ikoner	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Terminologi	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>
Kontinuitet	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

iOS

	Mycket dålig	Dålig	Neutral	Bra	Mycket bra
Färgsättning	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>
Layout	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Typsnitt	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>
Ikoner	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Terminologi	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>
Kontinuitet	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

2. Hur upplever du det grafiska helhetsintrycket?

	Mycket dåligt	Dåligt	Neutralt	Bra	Mycket bra
Android	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>
iOS	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Kognitiva aspekter

3. Hur väl följer applikationen de kognitiva aspekterna?

Android

	Mycket dålig	Dålig	Neutral	Bra	Mycket bra
Mapping	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>
Affordance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Synlighet	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>
Feedback	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Constraints	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>

iOS

	Mycket dålig	Dålig	Neutral	Bra	Mycket bra
Mapping	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>
Affordance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Synlighet	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>
Feedback	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Constraints	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>

Navigering

4. Det är lätt att navigera i applikationen.

	Instäm. inte alls	Instäm. inte	Neutral	Instäm.	Instäm. helt
Android	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>
iOS	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

5. Det krävs för många "klick" för att utföra följande:

Android

	Instäm. inte alls	Instäm. inte	Neutral	Instäm.	Instäm. helt
Köpa biljett	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>
Lägga till favoritresa	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lägga till bevakning	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>
Visa ankomst- och avgångstider	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lägga till tidtabell	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>
Visa biljetter	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Registrera kontokort	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>

iOS

	Instäm. inte alls	Instäm. inte	Neutral	Instäm.	Instäm. helt
Köpa biljett	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>
Lägga till favoritresa	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lägga till bevakning	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>
Visa ankomst- och avgångstider	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lägga till tidtabell	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>
Visa biljetter	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Registrera kontokort	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>

Övrigt

6. Hur bedömer du applikationens design?

	Mycket dåligt	Dåligt	Neutralt	Bra	Mycket bra
Android	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>
iOS	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

7. Vad skulle du vilja ändra/förbättra i applikationen?

8. Hur kan vi göra applikationen lättare att använda?