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FALL PROJECT

What is the most natural way to get information about bus schedules?

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Abstract

What is the most natural way to get information about bus schedules? During this project some users research are being conducted and documented. The results have been used to develop a mobile application for bus schedule retrieval in Sør-Trøndelag, Norway.

Contents

1	Introduction	4
1.1	Motivation	4
1.2	Goal	5
2	Method	6
2.1	User survey	6
2.2	Application	7
3	Result	8
3.1	User Survey	8
3.1.1	Waiting Time	8
3.1.2	Application Feedback	9
3.1.3	Result	9
4	Discussion	10
A	User Survey	11

List of Tables

3.1	Waiting in Trondheim	8
3.2	Reasons for missing the bus in Trondheim	9
A.1	Introductory and Buss Usage Questions	14
A.2	Waiting on the bus	18
A.3	App Questions	24

List of Figures

A.1	Question 1	12
A.2	Question 2 and 3	12
A.3	Question 4 and 5	13
A.4	Question 6 and 7	16
A.5	Question 8, 9 and 10	17
A.6	Question 11 and 12	22
A.7	Question 13 and 14	23

Chapter 1

Introduction

This project report denotes the work of creating a mobile application extending the functionality of the existing BussTUC project which is part of the FURIOUS¹ projects.

BussTUC is an ongoing project for several years, and started off in 1997. In general it is a service for bus schedule querying. This means that users can ask questions about bus schedules in plain text into a search field, and get the result printed to them correctly. This can be tested at NTNU's web page².

During our work with this project the tasks included user research, developing the application, and extending the BussTUC system with the functionality we thought could make it better. The tasks also included finding the best way to implement the functionality to the mobile application. It might not be the best way to make it integrated with the BussTUC services, but rather an individual tab for exactly this functionality for better recognition by the users. This report will show our research and results.

1.1 Motivation

A lot of time and effort has gone into various FURIOUS projects, but there has been little user testing of the products developed. It was uncertain how BussTUC, AtB's real-time tracking³, and applications utilizing these services, has impacted the wait time and daily commute of passengers. Similar tests in Seattle [?], show that commuters using real-time applications wait almost 2 minutes less than users of traditional information.

After AtB opened up their real-time API numerous applications for Android, iPhone and web has begun utilizing it in various ways. Many of these applications combine AtB's real-time tracking with the BussTUC oracle. One example of these applications, busskartet (The Bus Map)⁴, is a bus map calculating current bus locations from the time tables and showing all the buses. This map does not utilize the real-time tracking from AtB, as the developers found it too unreliable at the time. With continuous improvement to AtB's real-time systems, it might now be able to support such a map view. Nettbuss has already started showing all their regional buses in a simple map view on their site⁵.

¹the Future Ultimate Intelligent Route-Organizing System

²<http://busstuc.idi.ntnu.no/>

³<https://www.atb.no/aapne-data/category419.html>

⁴<http://www.busskartet.no/>

⁵<http://www.nettbuss.no/sanntid>

1.2 Goal

Our ultimate goal was to create an application that the traveling users of AtB wanted to use. It was supposed to be easy to use, beautiful to look at, and of course functional to give the users a reason to use the application. Since there are some competitors to this application out there already, we needed to make this a priority.

The functionality we wanted to add was a way for the users to find the bus's approximate location at the time, to see how far away it is. This information is given to us by AtB, the company that handles the public transportation in Trondheim and Sør-Trøndelag. This is open information, and therefore easy to get access to. This functionality should be as precise as possible to make it usable by the travelers, which is in the hands of AtB and their supplier of the data, Swarco Norge. This means that the application is relying on their data being correct.

Either way, our goal was to make this application as good as possible from our position.

Chapter 2

Method

2.1 User survey

In order to gather user information, a web survey was created, and shared with users in many different cities, but mostly Trondheim. This method was chosen as it gave people more time to answer the questions than a personal interview would, and in addition it would open up the survey to people in other cities and people that would be impossible to reach otherwise.

10 questions were asked, with 5 follow up questions if the interviewee's primary way of gathering route information was through a phone application. Most of these questions was multiple choice, but also contained a 'other' alternative where the users could input their own special cases. The only exception being question 10e where the user was asked to input their personal experiences with the application.

1. How many times a week do you commute by bus?
2. What is your work status? (Voluntary)
3. How old are you? (Voluntary)
4. In which city do you utilize bus the most?
5. In what context do you commute by bus?
6. How long do you usually wait for the bus?
7. Do you think knowing the exact location of the bus would be helpful to reduce the time spent waiting for the bus?
8. On a scale from 1 to 10 (10 being extremely frustrated), how infuriated do you become by waiting for the bus?
9. If you arrive late for your bus, what is the reason?
10. What service do you primarily use to find route information? If the answer was phone application, a new set of questions were asked in addition
 - (a) Which phone do you use?
 - (b) Which application do you primarily use?

- (c) On a scale from 1 to 10 (10 being super happy), how satisfied are you with the application of your choice
- (d) How did you hear about the applicaton?
- (e) Please elaborate on your experiences with the application (Voluntary)

2.2 Application

The application took basis in BusTUC, but includes AtB's real-time tracking system. By using the survey results (2.1), the application attempts to create a better user experience for passengers than other apps.

Chapter 3

Result

This chapter includes all the results from our work in chronological order. Starting off with the user survey earlier mentioned, and finishing with the application.

3.1 User Survey

Most of the data gathered was generated through a web based survey created using Google Forms, and distributed on Facebook. We also talked to four people on the street before deciding our time was too limited for a face-to-face type of survey. However, information gathered from these four people were considered when conducting this project.

3.1.1 Waiting Time

The overall picture shows that most of the people answering the survey, 81%, thought that having the opportunity to see where the bus's location was would help them spend less time waiting [A.4]. This was really important in the beginning of the project. If it were the other way around, the project would seem meaningless since this is the main functionality focused on.

Table 3.1: Waiting in Trondheim

Time	Count
Do not know	0
0 - 2 minutes	3
3 - 4 minutes	9
5 - 6 minutes	12
7 - 8 minutes	5
9 - 10 minutes	4
11 - 14 minutes	1
15 +	0

Of the people traveling with bus in Trondheim, 65% thought they waited more than 5 minutes for the bus to arrive (numbers in table 3.1). People missing the bus also leads to more waiting. One of the questions where why people got too late to the bus. The result in Trondheim is described in table 3.2. Even though the reasons are varying, the one that sticks out is that people have a hard time calculating how far it is to the bus stop. This made it reasonable for

the development to take this into account. For instance making it possible for people to get a notification when it is time to go to the bus stop.

Table 3.2: Reasons for missing the bus in Trondheim

Reason	Count
I am never too late	3
The bus was ahead of schedule	2
Got wrong rout information from the app minutes	5
Real-time was inaccurate and showed the wrong time minutes	5
Miscalculation of walking time to the bus stop	12
Did not use the rout information	3
The bus goes so often that I do not care if I'm one minute late	3
Other	1

3.1.2 Application Feedback

The section about application usage gave some feedback on people's application habits, likes and dislikes. This gave us some inspiration making our own application.

Of all the participants in this survey, 25 people answered that they mostly used applications to find the rout information (question 12, figure A.6). The most popular applications are Bartebuss in Trondheim and RuterReise in Oslo. These are two really great and different applications with different highlights and great features. By combining the best features from these two, we believe that our application will have a fair chance to compete.

In addition some people wrote a little comment on what feature they liked about the application, or what they missed. About RuterReise, people commend that the application needed the ability to show the whole travel in a map, that it is a great application everybody should have and that the application just shows the when the next bus will pass, and not the rout from A to B. By the looks of the feedback on Bartebuss, the application tend to not update the time of arrival correctly so that the buss suddenly arrives before the real-time suggested. Another person commented that it is hard to find the timetable for a given bus route. It should be possible to click on the bus rout one wants, and not just the stops.

3.1.3 Result

As a result of this user survey, we got a lot of input and feedback we can use in the development.

Chapter 4

Discussion

What was good? What was bad? Future work

Appendix A

User Survey

This part of the appendix contains the results from the user survey conducted. The data are visualized through pie diagrams displaying the percentage each answer got, sorted by questions. The questions were asked in the order the pie charts appear in. Not all participants answered all the questions. This depended on how they answered their questions. For instance, people who do not take the bus are immediately sent to the ‘finished’ page. The survey consisted of three pages: the introductory page consisting of only one question, the page about bus usage, the page about waiting and finally the page about mobile application. To get to the last page, the participants had to answer ‘App’ on how they found the bus schedule.

The actual analysis on this survey is in section 3.1. This appendix just contains the number of answers for each question displayed in pie diagrams.

Introductory Page

The introductory page only consisted of one question to weed out the ones that did not ride the bus.

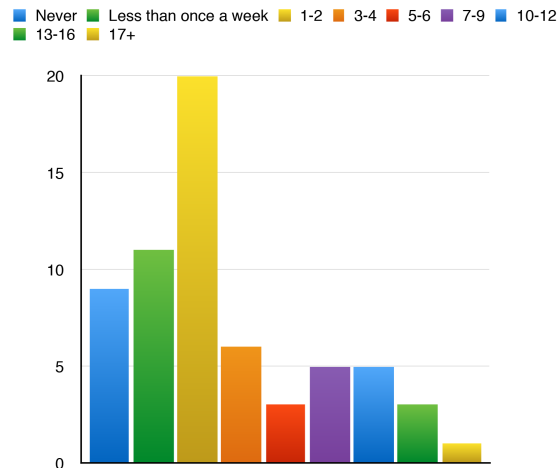


Figure A.1: Question 1
How many times a week do you ride the bus?

Bus Usage

This page focused on the specific bus habits of the users and consisted of six questions.

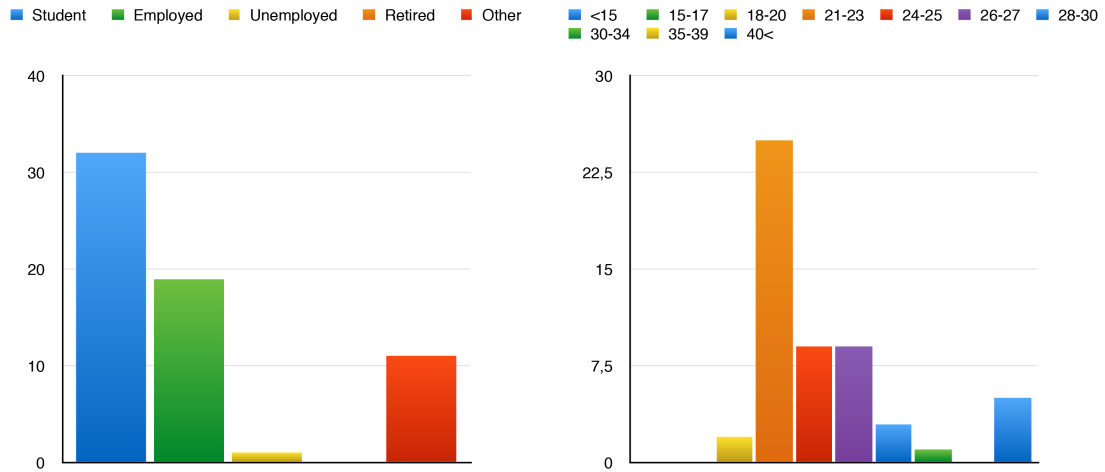


Figure A.2: Question 2 and 3
1) What is your working status? 2) What is your age?

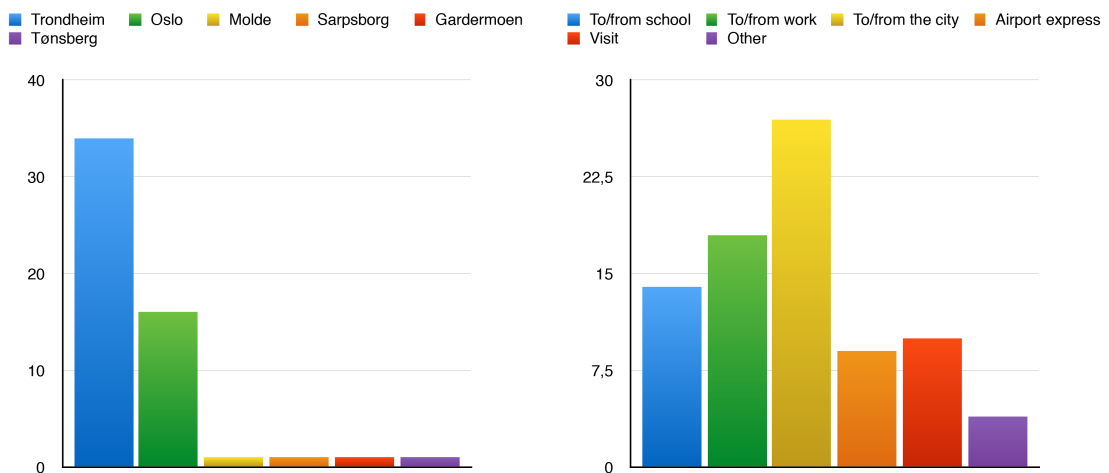


Figure A.3: Question 4 and 5
1) In what city do you ride the bus? 2) In what context do you take the bus?

The following table (A.1) contains the replies for both the introductory question and the bus usage questions.

Table A.1: Introductory and Buss Usage Questions

Answer nr	How many times a week do you ride the bus?	What is your current working status?	How old are you?	In which city do you most often take the bus?	In what context do you most often take the bus?
1	1-2	Student	18-20	Trondheim	To/from school, To/from the city, Visit
2	3-4	Student	21-23	Trondheim	To/from school
3	3-4	Student	21-23	Trondheim	To/from the city
4	1-2	Student	21-23	Trondheim	To/from the city, Airport express, Visit
5	1-2	Student	26-27	Trondheim	To/from school
6	3-4	Unemployed	21-23	Trondheim	To/from the city
7	7-9	Student	24-25	Trondheim	To/from school, To/from work, To/from the city
8	1-2	Employed	21-23	Oslo	To/from work
9	1-2	Student	24-25	Trondheim	To/from the city, Airport express
10	1-2	Student	21-23	Oslo	To/from school, To/from work, Visit
11	1-2	Student	21-23	Oslo	To/from the city
12	3-4	Student	21-23	Trondheim	To/from school, To/from work, To/from the city
13	5-6	Employed	24-25	Oslo	To/from work, To/from the city
14	1-2	Student	21-23	Trondheim	To/from the city, Airport express, Visit
15	1-2	Student	18-20	oslo	To/from school
16	1-2	Employed	28-30	Oslo	To/from work
17	7-9	Employed	40j	Oslo	To/from work
18	1-2	Running a business	40j	Oslo	To/from the city
19	1-2	Student	24-25	Trondheim	To/from the city, Airport express
20	1-2	Student	26-27	Trondheim	To/from the city
21	10-12	Student	21-23	Tønsberg	To/from school, To/from the city
22	13-16	Student	21-23	Oslo	To/from school
23	7-9	Employed	26-27	Oslo	To/from work, To/from the city, Airport express, Visit
24	10-12	Employed	40j	oslo	To/from work
25	7-9	Student	21-23	Trondheim	To/from school, To/from the city
26	3-4	Student + part time job	24-25	Trondheim	To/from work, To/from the city, Airport express
27	1-2	Student	21-23	Trondheim	Airport express
28	Less than once a week	Student	26-27	Oslo	To/from work

29	1-2	Student	24-25	trondheim	Visit
30	10-12	Employed	24-25	Oslo	To/from work
31	10-12	Employed	24-25	Oslo	To/from work, To/from the city, Visit
32	1-2	Student	21-23	Trondheim	To/from the city
33	10-12	Student	21-23	Trondheim	To/from school
34	Less than once a week	Student	21-23	Trondheim	To/from the city, Visit
35	17+	Employed	40j	oslo	To/from work
36	Less than once a week	Student	24-25	Trondheim	To/from the city
37	1-2	Student	21-23	Trondheim	To/from the city, Airport express
38	5-6	Employed	26-27	Trondheim	To/from work, Visit
39	Less than once a week	Student	21-23	Oslo	Home to parents every other week
40	1-2	Student	21-23	Trondheim	Workout
41	Less than once a week	Employed	28-30	Trondheim	To/from the city
42	5-6	Student	21-23	Sarpsborg	To/from school, To/from the city
43	Less than once a week	Employed	30-34	Trondheim	To/from the city
44	13-16	Employed	26-27	Trondheim	To/from work
45	Less than once a week	Student	21-23	Trondheim	To/from the city
46	1-2	Employed	26-27	Trondheim	To/from the city
47	13-16	Student	26-27	Trondheim	To/from school
48	3-4	Employed	26-27	Trondheim	To/from work
49	Less than once a week	Employed	28-30	Gardermoen	Airport - Hotel
50	1-2	Student	21-23	Trondheim	Workout
51	Less than once a week	Employed	21-23	Trondheim	Visit
52	7-9	Student	21-23	Trondheim	To/from school
53	Less than once a week	Employed	21-23	Trondheim	Airport express
54	Less than once a week	Employed	40j	Molde	To/from work
55	Less than once a week	Employed	18-20	Trondheim	Airport express

Waiting on the Bus

This page focused on the waiting. Since we want to solve, or improve peoples waiting time, the survey had five questions that focused on this.

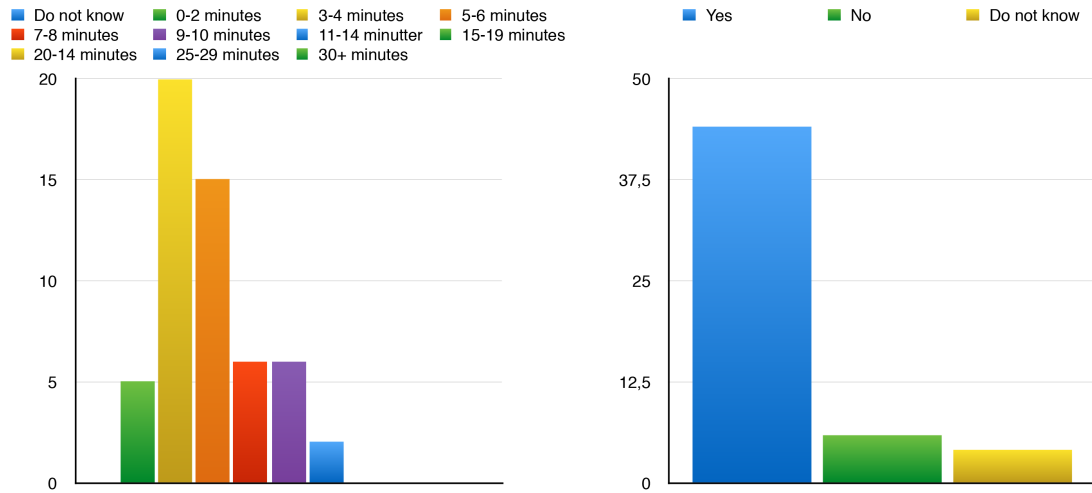


Figure A.4: Question 6 and 7

- 1) How long to do you wait for the bus, on average? 2) Do you think knowing where the bus is located will help you accomplish shorter waiting time?

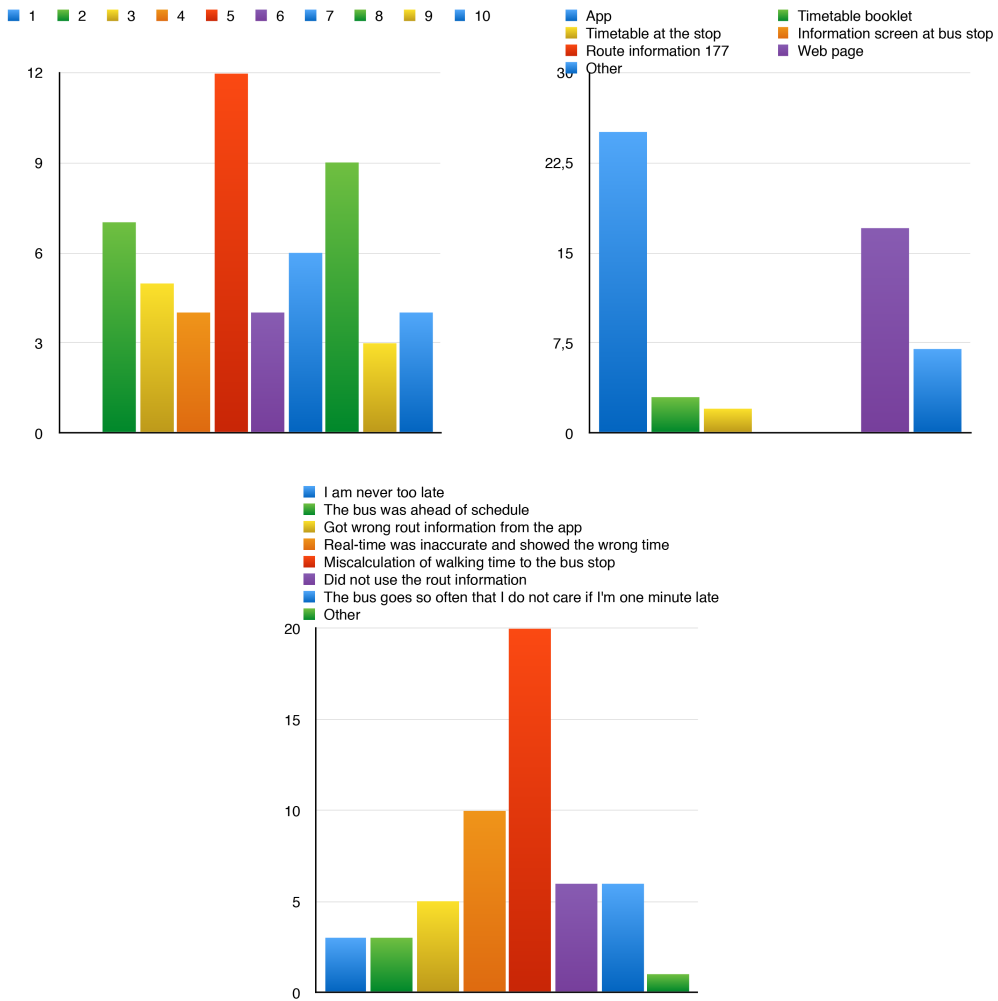


Figure A.5: Question 8, 9 and 10

1) On a scale from 1-10, where 10 is super annoyed, how annoyed does you get waiting on the bus? 2) How do you retrieve the bus schedule? 3) If you are too late for the bus, what is the reason?

The following table (A.2) shows what the participants answered on these questions.

Table A.2: Waiting on the bus

Answer nr	How long do you tend, on average, to wait for the bus?	Do you think information on where the bus is located, can help you achieving shorter waiting time?	On a scale of 1 to 10, where 10 is very irritated, how annoyed are you of waiting for the bus?	Which service do you use primarily to find your bus route?	If you are late for the bus, what is the reason?
1	5-6 minutes	Yes	6	App	Got wrong rout information from the app
2	0-2 minutes	Yes	8	Rout map at stop	The bus departs so often that I do not care if I'm one minute late
3	3-4 minutes	Yes	7	App	I am never too late
4	7-8 minutes	Yes	9	App	Miscalculation of walking time to the bus stop
5	5-6 minutes	Yes	8	App	Real-time was inaccurate and showed the wrong time
6	5-6 minutes	Yes	3	Rout map at stop	Did not use the rout information
7	5-6 minutes	Do not know	5	App	Miscalculation of walking time to the bus stop
8	3-4 minutes	No	2	Information screen at stop	The bus departs so often that I do not care if I'm one minute late
9	9-10 minutes	Yes	3	Information screen at stop	Did not use the rout information
10	5-6 minutes	Yes	10	App	Real-time was inaccurate and showed the wrong time
11	3-4 minutes	Yes	4	App	Real-time was inaccurate and showed the wrong time
12	3-4 minutes	Yes	5	App	Miscalculation of walking time to the bus stop
13	3-4 minutes	Yes	5	App	Real-time was inaccurate and showed the wrong time
14	7-8 minutes	Yes	4	App	Got wrong rout information from the app

15	3-4 minutes	Yes	2	Web page	Real-time was inaccurate and showed the wrong time
16	3-4 minutes	Yes	2	App	Miscalculation of walking time to the bus stop
17	5-6 minutes	No	2	App	Miscalculation of walking time to the bus stop
18	9-10 minutes	Yes	8	App	Real-time was inaccurate and showed the wrong time
19	3-4 minutes	Yes	2	Web page	The bus departs so often that I do not care if I'm one minute late
20	9-10 minutes	Yes	8	Web page	Real-time was inaccurate and showed the wrong time
21	7-8 minutes	Do not know	5	App	Did not use the rout information
22	3-4 minutes	Yes	3	Web page	Did not use the rout information
23	3-4 minutes	Yes	8	Web page	Miscalculation of walking time to the bus stop
24	0-2 minutes	Yes	5	App	The bus departs so often that I do not care if I'm one minute late
25	3-4 minutes	Yes	5	App	Got wrong rout information from the app
26	7-8 minutes	Yes	8	App	Got wrong rout information from the app
27	7-8 minutes	Yes	7	App	The bus was ahead of schedule
28	0-2 minutes	No	3	Web page	The bus departs so often that I do not care if I'm one minute late
29	5-6 minutes	Yes	7	Web page	Miscalculation of walking time to the bus stop
30	3-4 minutes	Yes	5	App	Miscalculation of walking time to the bus stop
31	3-4 minutes	Yes	4	App	Miscalculation of walking time to the bus stop
32	5-6 minutes	Yes	7	App	Real-time was inaccurate and showed the wrong time

33	0-2 minutes	No	8	App	Real-time was inaccurate and showed the wrong time
34	9-10 minutes	Yes	9	Web page	Got wrong rout information from the app
35	7-8 minutes	Yes	10	Timetable booklet	Miscalculation of walking time to the bus stop
36	3-4 minutes	Yes	6	App	I was slow out the door
37	5-6 minutes	Yes	4	App	Miscalculation of walking time to the bus stop
38	5-6 minutes	Yes	6	Information screen at stop	Miscalculation of walking time to the bus stop
39	11-14 minutes	No	9	Web page	Miscalculation of walking time to the bus stop
40	3-4 minutes	Do not know	6	Web page	The bus was ahead of schedule
41	11-14 minutes	Yes	5	Web page	I am never too late
42	9-10 minutes	Yes	10	Web page	The bus was ahead of schedule
43	5-6 minutes	Yes	8	Web page	Miscalculation of walking time to the bus stop
44	3-4 minutes	Yes	5	Information screen at stop	Miscalculation of walking time to the bus stop
45	3-4 minutes	Do not know	2	Web page	Did not use the rout information
46	5-6 minutes	Yes	7	Timetable booklet	Miscalculation of walking time to the bus stop
47	3-4 minutes	Yes	7	Information screen at stop	Real-time was inaccurate and showed the wrong time
48	9-10 minutes	Yes	10	App	I am never too late
49	5-6 minutes	Yes	5	Information screen at stop	Did not use the rout information
50	5-6 minutes	No	3	App	The bus departs so often that I do not care if I'm one minute late
51	5-6 minutes	Yes	2	Web page	Miscalculation of walking time to the bus stop
52	3-4 minutes	Yes	8	Timetable booklet	Miscalculation of walking time to the bus stop
53	0-2 minutes	Yes	5	Web page	Miscalculation of walking time to the bus stop

54	3-4 minutes	Yes	5	Web page	Miscalculation of walking time to the bus stop
55	Do not know	Yes	10	App	The bus was ahead of schedule

App Questions

If the user answered that he or she used mobile application to find the bus schedule, he or she had to answer this page as well. By making this questions we got a picture of how happy people were with the current situation and how the applications worked for them. With this information we may be able to create an application that is even better than the existing ones. As a finish, the users got the opportunity to write what else they thought of, if they had something more to contribute they felt did not come thorough during the survey.

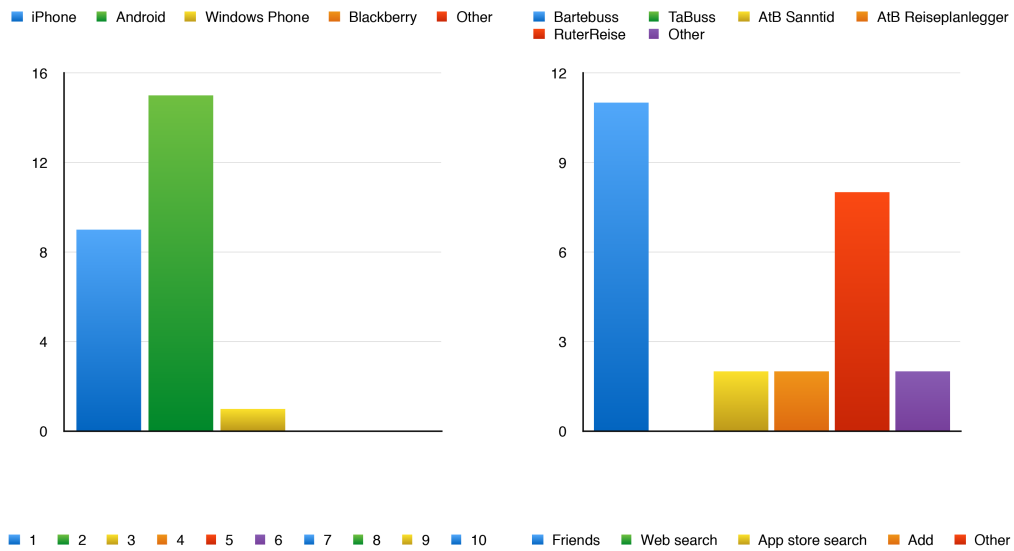


Figure A.6: Question 11 and 12
 1) What phone do you use? 2) What application do you use?

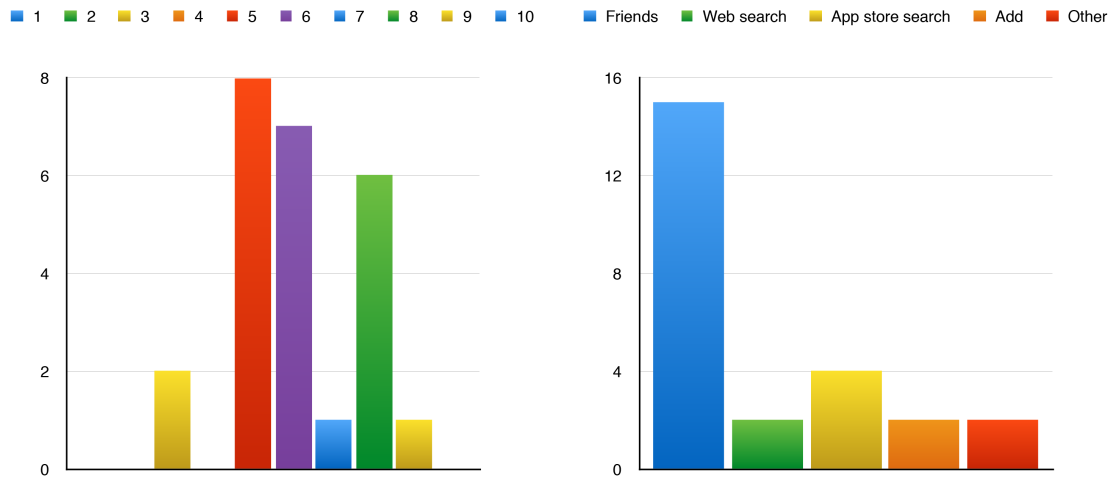


Figure A.7: Question 13 and 14

1) On a scale from 1-10, where 10 is super happy, how happy are you with the application? 2) How did you discover the application?

The following table (A.3) show how the participants, who answered they used the application the most, replied on the application questions.

Table A.3: App Questions

Answer nr	What phone do you have?	Which application do you use the most?	On a scale of 1 to 10, where 10 is super satisfied, how satisfied are you with the app?	How did you hear about the app?	(Optional) Describe your experience with the app
1	iPhone	Bartebuss	8	Friends	
3	iPhone	Bartebuss	5	Friends	
5	iPhone	Bartebuss	6	Friends	
7	iPhone	Bartebuss	6	Friends	
10	Android	RuterReise	7	Do not know	It needs a lot more features, such as being able to see the entire bus route (with stops) when you press a route.
11	iPhone	Bartebuss	3	Friends	
12	Android	Bartebuss	5	Friends	
13	iPhone	RuterReise	5	Appstore search	
14	Android	RuterReise	5	Friends	
16	Windows phone	Trine i farta	8	Friends	
17	Android	RuterReise	8	Friends	When you scale from 1 to 10, it should say what is worst, best, etc.. Such as the penultimate question. Eg. can it matter irritated well explained.
18	Android	RuterReise	5	Web search	
21	Android	VKT	6	Web search	
24	Android	RuterReise	9	Appstore search	Very good! Definitely a "must have" app.
25	Android	AtB sanntid	5	Add	
26	Android	Bartebuss	8	Friends	Very good experience with the app, particularly fond of the UI and the way information is displayed. could have been better at updating time when it comes to major delays, but expect that some of this lies with AtB's real tables ...

27	iPhone	Bartebuss	6	Friends	
30	Android	RuterReise	3	Appstore search	The way developers think I use the app is quite banal. For example cumbersome to find the bus from A to B, but easy to find when the next bus passes. When the next bus passes I do not care if I have to wait 20 minutes at the bus exchange.
31	iPhone	RuterReise	6	Add	
32	iPhone	Bartebuss	8	Friends	
33	Android	Bartebuss	8	Friends	The app frequently change the time the bus will arrive when it is approaching, so it comes sooner than you think. This makes it difficult to calculate when to go home.
36	Android	AtB reiseplanlegger	6	Appstore search	
37	Android	AtB reiseplanlegger	5	?	
48	Android	AtB sanntid	6	Friends	
50	Android	Bartebuss	5	Friends	Tungvint å finne fram til rutetidene for en enkelt buss, burde vært en funksjon for å velge den bussen du ønsker og ikke bare en meny for busstoppene du ønsker.
55	iPhone	Bartebuss	4	Friends	