ITRACT

Improving Transport and
Accessibility through new
Communication Technologies

ITRACT
Smart Map
User Experience Survey

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List of abbreviations

PT – public transportation
ICT – information and communication technologies
Q – question
FB – FaceBook
VOC – voice of customer

Introduction

Enormously fast pace of modern life results in the fact that travelling and especially commuting has become not just a daily routine, but rather an integral part of peoples lives. It is especially true when it comes to big cities. However, for connecting remote parts of countries smooth public transportation facilities are needed too. People always search for smooth and easy transport alternatives, which subsequently poses a lot of requirements to public transportation systems.

These requirements are concerned not only with such features of transportation vehicles as comfort, high-speed, availability and price, but also with accessibility and convenience of accessing arrival and departure times, transfer information, optimal routes, etc.

The aim of the current report is to actually learn about user experiences of managing trips using a cloud based real-time smart map developed within ITRACT project. The tested smart map was developed to serve primary as a test application for the Itract backend, the cloud based trip-planning solution. As a consequence, it was merely developed to demonstrate the capabilities and features of the backend and was not intended to serve as a product type trip planner. As a consequence, the focus of the smart map was not on the usability of the app, it was rather to demonstrate the functionality of the backend.

The report will be based on the results obtained from running a user experience survey. The survey will help to understand if the online tool performs well its' function of providing accurate information on the public transport schedules and routes. Also, it will help to identify 'killer features' and benefits of the tool, reveal its

imitations (if any) and highlight users' preferences towards trip planning applications as such. The outcome of this study will provide insights about the service usefulness and highlight lessons learned from piloting such service in different cities, which might be of a great use for further development.

Background information

Importance of public transportation in big cities

Transport is a kind of link that tightly binds many various constituents of society together, enabling us to connect with people and organizations, to get an access to goods and services, to catch opportunities and reach our goals. Since the world's population is constantly increasing together with the economic and social prosperity the requirements to the transport develop respectively. The density of roads is growing, as well as the types and number of means of transportations available. However, different countries are at different stages of the development of their transportation systems: big differences can be observed even in different cities within the same country. Nevertheless, the main challenge they all face is to make sure their transportation systems are efficient, serve people's needs and wants at best and of course at the bigger scale contribute to the supporting and improving society (Lyons, 2015).

A Professor of Transport and Society Glenn Lyones in his 'The future of transport. Initial Perspective, Future Agenda' expressed a notion that due to economic and social proximity, coming from urbanization and virtual mobility, meaning increased consumption of information and communication technologies among the worlds' population, a car as such is threatened to become 'a background functional technology in society'. Even if it is not totally correct the tendency of switching and massive use of public transportation is beyond dispute.

Another tendency worth consideration is the role of the vehicle ownership and transport service providing that is changing over years. Currently information movement is becoming an alternative to the actual people movement as we proceed further into the digital era. Hiring and sharing transport is becoming a new trend, replacing ownership. Lately numerous transport sharing services appeared on the market combining some features of both – owning and sharing. Uber (https://www.uber.com) – a ride sharing service – could serve as a good example of such a hybridized service. Launched in 2000, the current value of the company worldwide is around 18 billion USD. The service is available in 200 cities around the world, where every person having a smartphone can download an Uber application. The main idea – is to connect a passenger and a driver, in order to get a quick ride for a reasonable price (Lyons, 2015).

Lately a so-called landscape of transportation resulting in traffic has changed a lot. Previously transport activity was positively correlated with the economic activity, meaning the higher Gross Domestic Product produced by the country the more intense road traffic. It seemed logical that a unit of the economic output requires more traffic. However, in recent years this tendency has changed, resulting in a decrease of the traffic in developed economies. The reasons have not been understood and examined, however the notion is that globalization, urbanization, shift from manufacturing to services, advances in ICT, digital connectivity through world wide web could be among the reasons.

All the trends and tendencies mentioned above result in a fundamentally different approach to transport, which suggests addressing the future of the access to transport, rather then the future of the transport as such. Current level of the information technologies development facilitates digital connectivity and information sharing which could be a good start to bring the transport access to a principally new level.

Internet penetration

Internet is becoming a tremendously important tool used for numerous purposes in peoples' daily lives. Internet penetration provides significant advantages including: cost savings, users convenience, accessibility, high speed and volume of information communication, worldwide coverage and others.

Last years the use of information technologies namely the Internet has shown a very rapid growth practically in all the countries worldwide along with increased computer and smartphone ownership. People go online on a daily basis at work, at home, while commuting in transport or sitting in a class. Purpose wise the use of the Internet is almost unlimited and differ from person to person depending on a lifestyle - from sending and receiving e-mails at work, researching and navigating, to playing on-line games, downloading music and movies. The Internet has changed greatly peoples lives and continue to do so with an enormously fast pace. It is also true when it comes

to the business landscape: many companies and whole industries are going on-line in order to get a reach of their target audiences.

Transport in general and public transportation industry in particular nowadays experiences this shift resulting in advent of various applications and on-line services, that are basically aimed at serving commuters in a more efficient way by providing real time information on service's conditions.

Nevertheless, the Internet penetration is not equal around the world, since some segments remain skeptical and do not trust modern technologies to a large extent. In addition, many countries still lack a proper fast-speed Internet access and computer and smartphone ownership is not that common. These factors along with the variety of languages spoken world-wide and difference in the users habits pose a lot of challenges for the on-line services aiming to cover a broad cross countries audience.

According to Internet Usage Statistics available on the June 30-th 2014, the Internet penetration is distributed among different regions in the world as follows (Table 1).

WORLD INTERNET USAGE AND POPULATION STATISTICS JUNE 30, 2014 - Mid-Year Update						
World Regions	Population (2014 Est.)	Internet Users Dec. 31, 2000	Internet Users Latest Data	Penetration (% Population)	Growth 2000-2014	Users % of Table
Africa	1,125,721,038	4,514,400	297,885,898	26.5 %	6,498.6 %	9.8 %
Asia	3,996,408,007	114,304,000	1,386,188,112	34.7 %	1,112.7 %	45.7 %
Europe	825,824,883	105,096,093	582,441,059	70.5 %	454.2 %	19.2 %
Middle East	231,588,580	3,284,800	111,809,510	48.3 %	3,303.8 %	3.7 %
North America	353,860,227	108,096,800	310,322,257	87.7 %	187.1 %	10.2 %
Latin America / Caribbean	612,279,181	18,068,919	320,312,562	52.3 %	1,672.7 %	10.5 %
Oceania / Australia	36,724,649	7,620,480	26,789,942	72.9 %	251.6 %	0.9 %
WORLD TOTAL	7,182,406,565	360,985,492	3,035,749,340	42.3 %	741.0 %	100.0 %

Table 1. Internet penetration in world regions.
Source: http://www.internetworldstats.com/stats.htm).

Based on the information we can conclude that Internet penetration rate in Europe is reasonably high accounting for 70,5% and this rate is increasing rapidly year by year. It means that people are likely to use Internet for different purposes. It is hard to find an accurate data on the purposes of the Internet usage, but to in order to have a big picture and rather as a starting point the following was taken.

Technologies, application

The general adoption and increased functionality of various mobile devices, the evolution of mobile phones to smartphones and unlimited Internet access possibilities has broadened a range of fields where mobile devices can be used. According to smartphone statistic ownerships the percentage of the population owing smartphones

is growing fast and currently European countries taking a lead with Sweden and Spain being at the top of the list, accounting for 65% and 60% respectively (Table 2). The widespread reality penetrated numerous industries including public transportation.

Unique smartphone ownership statistics by country and as % of population		
Country	Unique Smartphone Owners (mln ppl)	As % of Total Population
France	26.6	42%
Germany	35.3	43%
Italy	27.4	46%
Netherlands	9.2	55%
Norway	2.9	59%
Spain	27.4	60%
Sweden	6.0	65%
World total	1,591	22%

Table 2. Smartphone ownership. Source: Tomi Ahonen Consulting Analysis 21 August 2014.

Due to emerge and accessibility of the Information and Communication Technologies users all around the world are becoming more experienced and demanding when it comes to online services. Moreover, the advent of modern technologies transforms users into co-producers of value, which means that users should be involved in the development process of both applications and services. Long ago Alvin Toffler (1980), in his book 'The Third Wave' claimed that consumers are a phenomenon of the industrial age and as society shifts to post-industrial era, the consumers are being replaced by so called "prosumers". By prosumers he meant people who actually participate in production of their own goods and services. Kotler took the Toffler's prosumer thesis and developed it further, predicting and giving reasoning to the fact that people will want to play a larger role in producing/designing goods and services they will consume (Kotler 1986). Basically it is what can be seen now: a lot of companies (both goods and services providers) actively involve customers and users into the production and designing process in order to make sure that the final product will reflect all the features demanded.

Mobile applications are one of the examples of how customers can be involved into production and basically tailor their own products and services.

Easy to download user friendly online solutions are necessary to provide real-time viable services helping to manage trips. Since demand always triggers supply – nowadays a lot of smartphones applications offer this kind of services, however all of them have limitations. For example, Google maps (https://www.google.se/maps/) gives general guidelines and instructions how to get from point A to point B using different means of transportations, but it doesn't provide an accurate real-time schedule. Res I Stockholm (mobile application, available for free) for example, provides real-time schedule, but it covers only one city - Stockholm. KarlstadsBuss (http://karlstad.se/karlstadsbuss/) has a real-time schedule which shows accurate arrivals and departures times, but only for buses and does not provide transfer and connections solutions to travel beyond Karlstad city. That is why in theory a smart map showing public transport from multiple locations across the world could become a unique solution, providing all the information for quick fix of the trips where a couple of means of public transportations are involved.

Customers needs and wants

Today's society, being characterized by high mobility, growing individuality and comfort requirements, shows a need for real-time information and services that make people's life even faster and easier at the same time. In public transportation, such data is vital for improving travelling experiences. It can be observed that the number of smartphone applications helping to plan and manage trips, buy and validate tickets, etc. has grown substantially, but not much attention is paid to the actual quality of experiences (Viera 2011).

Users satisfaction with applications and on-line services has a great influence on their large-scale adoption (Osman et al. 2014). To get insights into users experiences, they have to be assessed at different points in time since citizens' expectations are changing permanently. Also it is very important that all the suggestions are collected, analyzed and measures are taken in order to improve existing services (Verdegem and Verleye, 2009). Even though users' satisfaction is proved to be an essential element in the sustainability and viability of on-line services, little research has been performed on understanding it. Due to the lack of the secondary data available on the topic, it was decided to run a user survey in order to collect primary data.

An application that is to be tested in the current survey is ITRACT smart map. This online-based smart map is a web page based on the detailed open street map project, providing real time transit information for planning trips and monitoring real time events. The traffic information available includes arrival and departure times, routes, optimal solution, schedules, etc. for different types of transportations. A smart map Android application is also available for smartphones.

Survey design

Theory suggests that as a guideline to identify the information needed and in order to build a study framework a general research objective should be used. Taking into consideration the specificity of the topic, it was decided that current study would include only primary data collection from the actual users (Czinkota and Ronkainen, 2007).

Some secondary data gathered in the Background section of the current paper was concerned with the following topics: Internet penetration, Internet usage and smartphones ownership. Those fields were chosen in order to get some background information serving as premise to define a target audience and narrow it down to a number of cities. The information obtained from secondary data is of a great help for understanding basic trends in the area researched.

The goal of the current survey was to learn about user experiences of managing trips using a cloud based real-time smart map and also to analyze the usability of the on-line tool (application), identify major problems/limitations of the service (if any) and potential improvements. The next section describes the evaluation procedure that was used.

Real commuters conducted the survey in real environment, during their normal use of public transport services in the different European cities (both big and small). Recruitment and selection of the participants was made mostly via social medias. Participants were approached through FaceBook and personal emails.

Developing the sample plan

Since the on-line tool tested is in its early pilot stage, the actual real time information was available in the limited number of cities, so based on this, the survey sample was narrowed and pre-defined. In order to have a big picture and be able to compare trends, it was decided to narrow down the segment and approach participants in the following cities: Stockholm, Barcelona, Oslo, Riga, Milano, Madrid, Berlin. However, since the data was available also for some small cities predominantly in Sweden, a number of participants were chosen in Karlstad area.

The sample size was set to be around 50 respondents from different countries. This number was considered as sufficient due to the fact that not quantitative but rather qualitative information is of a bigger interest in the current survey. In addition a time scope of the project pose some limitations on a duration of the test period available.

In order to get as much heterogeneity as possible in terms of various demographic factors (gender, age, occupation, location, etc), around 80 travellers were selected, from which 53 actually participated in the tests. However, there were some basic

prerequisites that the participants had to fulfill in order to participate in the survey: being a user of public transport, having access to the Internet either through computer or mobile phone, actual presence in the city where smart map is to be tested.

Users were asked to test the on-line tool while trying to plan a trip to some destination they have been to already. It was made on purpose in order to be able to estimate how accurate the tool defines the route and arrival/departure points and also if it shows the most optimal route. There were no any limitations on the length of the trip, kinds of public transportation used and their number.

Procedure

The experiments were divided in three phases: pre-test phase, test phase and post-test phase.

Pre-test

During the pre-test phase a group in FaceBook was created (https://www.facebook.com/groups/863742777024035/), which served as a platform for sharing all the relevant information about the survey
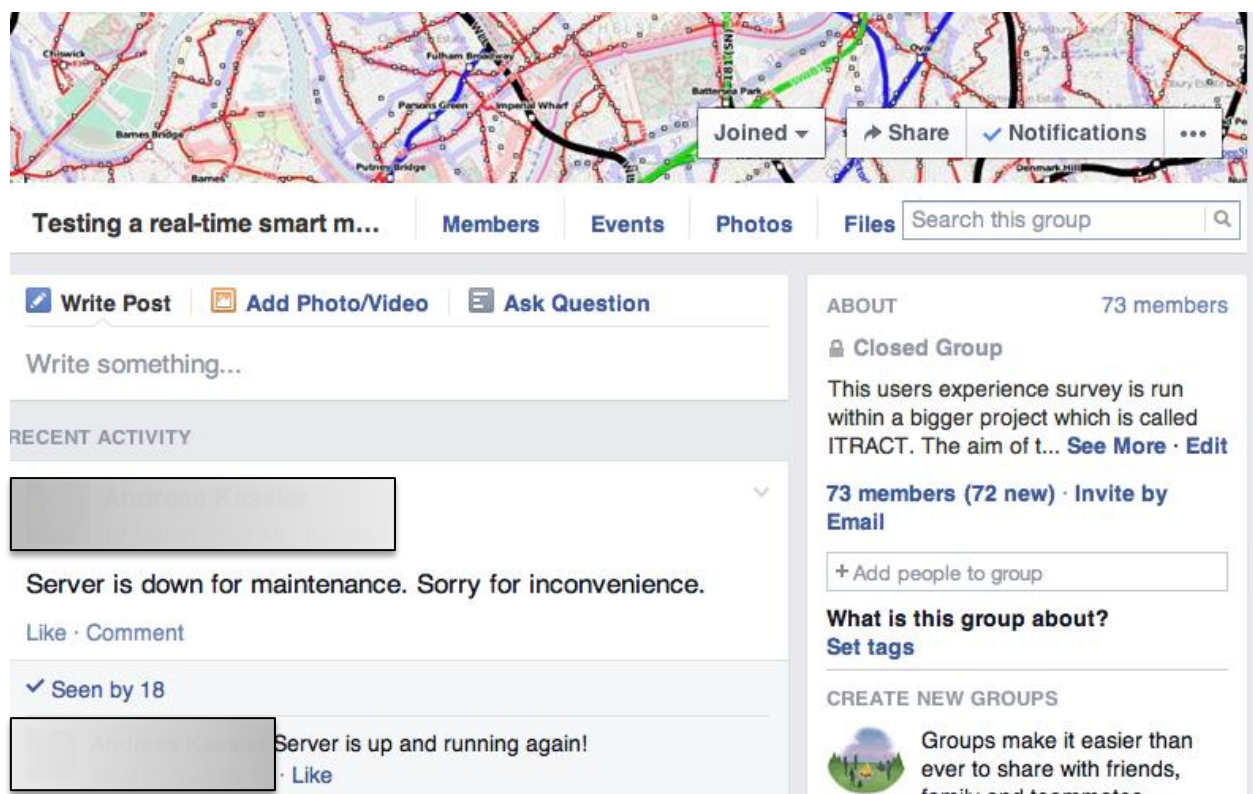
In the FaceBook group ITRACT project description was given, a purpose of the survey and procedure were explained, a link to the on-line smart map together with a user manual obtained from the KAU were provided. After that all the participants were invited to the group and asked to go through the explanatory parts. All the

participants were informed that they need to try out the smart map in order to plan their trips within their city and afterwards they need to reflect on their experiences in the survey questionnaire. Some of the participants that are not Facebook users got all the information and links in personal emails.

Test phase
During this phase a link to the actual on-line based survey questionnaire in the Facebook group was posted (http://www.surveygizmo.com/s3/2024378/Feedback-on-using-a-real-time-smart-map-for-public-transportation) and also private emails sent to the people not included in the FB group. The questionnaire can be found in the Appendix I of the current report. Users tested the service in real environment and shared their experiences in the questionnaire. During this phase users were also accompanied by a FaceBook group, where they could ask questions, report on the problems or communicate with the group administrator. In addition, some developers of the application were invited to the group and asked to participate in the group communications and also to take care of the questions regarding technical issues. The administrator of the group was taking care of the rest of the questions, providing additional explanations and assisting participants with the smart map using and filling in survey.

This method proofed to be a success, since it allowed users to report immediately and in real time about their challenges, experiences and improvement suggestions. It also allowed developers to correct, in real time, information problems, bugs they reported and make quick fixes to improve experiences. For example, the trip planning tool required to right click destination addresses on the map. Some users were not familiar how to right click on Mac devices, so developers helped to figure it out and to change settings.

Post-test phase.
All the participants were welcomed to share experiences and opinions in FaceBook group or by private messages even after the survey was completed. It allowed to collect some extra opinions.

Elaboration of the questionnaire

A self-completion questionnaire was selected as a primary data collection tool based on the following advantages: distribution convenience (it is especially important when the target audience dispersed all over the Europe), avoidance of an interviewer effect and variability, minimized costs in administration and time saving (Bryman & Bell 2007).

Tools

Numerous tools are available for inscription and survey running, that are range from basic simplistic to professional market research ones. A prior research was made, comparing a couple of tools including SurveyGizmo, SurveyMonkey and Wufoo.

After the examination a decision was made in favor of SurveyGizmo (http://www.surveygizmo.com) which provided an access to a greater functionality for including routing, logic and reporting functionality. A monthly usage rights were purchased in order to be able to complete the survey and use the automatically generated data reports.

Questions design

The questionnaire included 23 questions in total, grouped into 4 sections: Travel experiences, Product satisfaction, Product features and Demographics. Most of the questions are obligatory and require answers, only couple is optional. It was made on purpose, to make sure that all the information needed will be obtained. The selection of optional questions was made based on the common logic and also prioritizing the importance of insights every question will bring.

In order to make this survey user-friendlier and engaging a casual language, short sentences and clear wording were used. It is especially important when a survey is run across countries where English is not a first language. In addition, in order to minimize the time spent for filling in, unnecessary copying of words was avoided and at the same time numerous answer options where provided.

Feedback on using a real-time smart map for public transportation

Section 1. Travel experiences

Travel experiences section included 8 questions aimed at providing information regarding travel experiences while using a web-based smart map. This information is imperative to get a big picture on the trips details including: means of transportation used, length of the trips, number of changes, etc. (questions 1 to 3).

In question 4 a radio button greed was used. In order to rate 4 statements a Likert-type scale based on the level of agreement with the statement ranging from Strongly disagree to Strongly agree (including 2 negative options, two positive and 1 neutral) was chosen to measure this question. This question provides important insights about the customers' experiences on using the on-line tool.

Questions 5 and 6 are important for a technical side of the on-line smart map, since they provide information on the web browser used and the way of using the tool (web based or application). The results obtained will help to spot limitations (if any) for different solutions and based on that tailor technical aspects of the tool (f.e. resolution for different browsers, applications modification, etc.)

Questions 7 and 8 are bind together in some way. Question 7 – is a simple question that asks participants basically to self report their own perception of the on-line tool effectiveness in helping complete their tasks, meaning to plan their trip. Users are

expected to reflect on how well the smart map is performing when it comes to delivering the result. This questioned is followed by the next one - Question 8, which presuppose an open text - voice of customer (VOC) as an answer. Here we give users a chance to talk and reflect on the challenges they faced in own voice without limiting them to any options spectrum. Analysis for this question is to be done by categorizing the responses into groups by similar themes and then rating the percentage of times each theme occurs in the answers of those users who were not able to complete their task. The answers can be taken as suggestions for improvements or even a to-do list of the problems needed to be fixed in order to improve user experiences.

Section 2. Product satisfaction

Product satisfaction section comprises of 4 questions bringing insights to the users satisfaction of the using the tool for managing their trips. Two different types of questions were used here: Likert-scale rating and open-end types.

Question 9 is quite straight forward, asking about users satisfactions with the tool and providing answers ranging from Not satisfied to Completely satisfied, presupposing two positive, two negative and one neutral answer. This question is followed by the Question 10, which is actually optional and required the answer only unless a respondent answered 'completely satisfied' in the previous question. This question is open text (voice of customer) and asking what would make a user more satisfied with the smart map as a trip-planning tool. The information obtained is expected to reveal users expectations towards such an on-line tool.

Question 11 is another way to find out what users' opinion about the tool tested. After all, someone is unlikely to recommend to their friends something that is not rated high by them. This question uses a Likert scale ranging from I will not recommend to I will recommend and requires an answer.

Question 12 is designed in a way to capture perceptions of the smart map tool tested. Users allowed entering their own words and reflecting once again on their experiences/satisfaction, but from a slightly different angle. Combination of those four different questions using different formats and approaches should provide a more comprehensive picture of the users satisfaction. To analyze this question a theme based word cloud created by TagCrowd (http://tagcrowd.com) – an on-line based service – will be used.

Section 3. Product features

Question 13 consists of two parts, which are basically cover two important aspects of the user experiences – likes and dislikes when it comes to features.
The first part of the question, when users are asked to list the most useful feature, will indicate what currently works really well. After all, it is important to know what users

like, to make sure this feature is not changed or removed at all. In addition, this is a good question to spot a 'killer feature' (or features) of the smart map.

The second part of the question is aimed at investigating the least useful features. According to Fried at all (2006) when talking about selection of the features to be included to the web application, they suggest, "More isn't the answer. Sometimes the biggest favor you can do for customers is to leave something out". Meaning that it could be a better strategy to focus on the useful, so to say 'killer' features rather than trying to cover as many as possible. This question will have to find out what features might be taken out from the on-line tool.

Question 14 is an optional one. By asking what features are missed we investigate major frustrations and pains of the users. This question will make users to think about and identify what is really important to them.

Question 15 is a typical open-end question where users are welcomed to share their opinions regarding the interface of the tool. This question is a kind of invitation for a dialog and participation in the web tool development. Apart from the general user feedback we expect to get feature ideas and suggestions.

Question 16 could serve as one of the ways to identify the strengths and weaknesses of a smart cloud map in comparison with similar applications available for managing trips.

Question 17 is seen as a complimentary to the previous one, the idea behind is to make users to think about the performance of the smart map in comparison with other tools and then actually name them in the next question. However, this question is optional, since some people might not use any similar applications at all.

Section 4. Demographics

As many sources suggest, the demographic questions were placed at the end of the survey. This section is aimed at identifying a portrait of a typical user of such application and determining what factors may influence a respondent's answers. Also it helps to identify some correlations between users demographic characteristics and their experiences and preferences toward on-line tools managing trips.

The demographic section comprises five questions that are typical for all the surveys. Questions 18 and 19 are concerned about gender and age. Gender question helps to reveal disparities in opinions. Age question is fundamental, since segmentation by age is important to nearly every survey. In our case, it is important to understand if there any specific to age challenges in using a smart map or preferences towards functions to be included or the look of the interface, etc.

Question 20 will contribute to profiling the users of a smart map and might be able to indicate about purposes of their commuting and thus using a smart map.

Question 21 is asking about the users location is important in order to identify the content quality, accuracy of routes and timetables in different countries. Knowing the country where issues occurs will help to fix them on the spot. In addition, this question might reveal some tendencies based on cross-cultural differences, which also might result in the willingness of localization the tool for certain markets. Since the data for a smart cloud web is available in a limited number of cities, all of them were defined and placed as options.

Question 22 is asking users to identify if they consider themselves early adopters of new technologies. The answer will help to reveal more techy people and also can be used when analyzing data to divide customers to subgroups as more and less tacky people and take a look and pains both encounter.

Question 23 is the one revealing users behavior when it comes to the usage of public transportation. It is an important question for statistics and general trends.

Results

Data handling and analysis

Apart from using reporting functions from SurveyGizmo, all the data collected during the survey was transferred into a spreadsheet tool (Microsoft Office Excel) for the additional quantitative analysis, storage and retrieval purpose.

The survey results consist of two types of data – quantitative and qualitative. To present the quantitative side of the results descriptive statistics was used. Using descriptive statistics the survey summary about the sample and about the observations will be made. For analyzing qualitative data obtained from the open-ended questions a thematic analysis process will be applied. Later on the qualitative data will serve as a source for the formulation of suggestions on how the on-line tool can be further improved.

The full report on all the survey questions can be found in the Appendix II of the current paper.

Sample characteristics

The total number of the respondents who took part in the survey is 53 people, 30 from them are males and 23 females, accounting for 56,6% and 43,4% respectively. When it comes to the age (Figure 1), it varies, though it is clearly seen that the most of the respondents who actually tried out the on-line smart map and filled in the survey are young people, majority or 62% aging from 26 to 35 years with the average of 28.

It can be explained by the fact that web based on-line services are more likely to be used to a higher extent by young people who are actually seen as yearly adopters of new technologies and applications. 75,5 % of respondent are employed, 15, 1% students and the rest are unemployed and not specified (Figure 2).
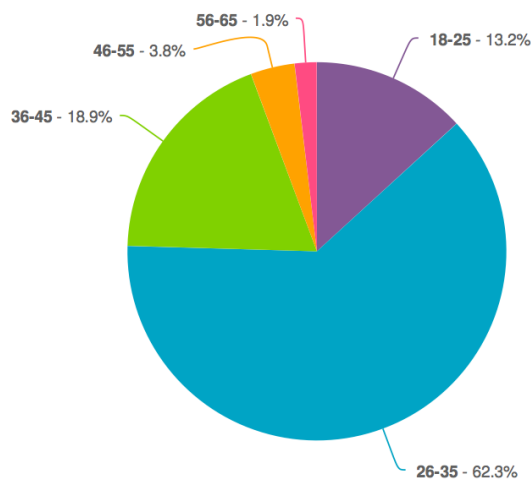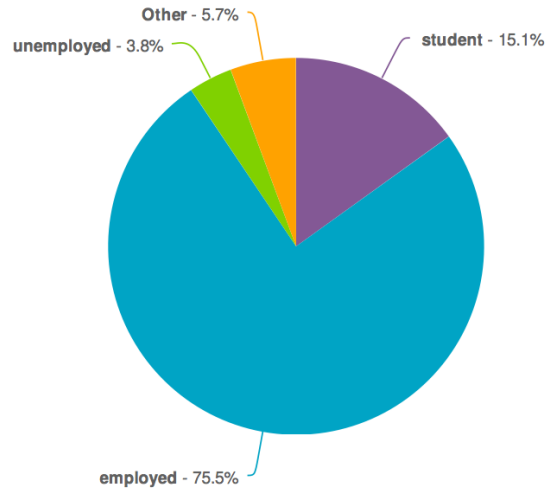
Figure 1. Respondents' age split

Figure 2. Respondents' occupation split

The split of the respondents country-wise can be seen on the Figure 3. The majority of the respondents coming from Sweden, which can be explained first of all by the ease of reach, but also from the secondary data presented in the Chapter 1 we can see that Sweden is one of the leading countries in Internet usage and the smartphone ownership rate. 11% of the respondents who answered 'Other', probably live in suburbs of big cities, so they did not choose actually the name of the closest big city, but rather preferred not to specify.
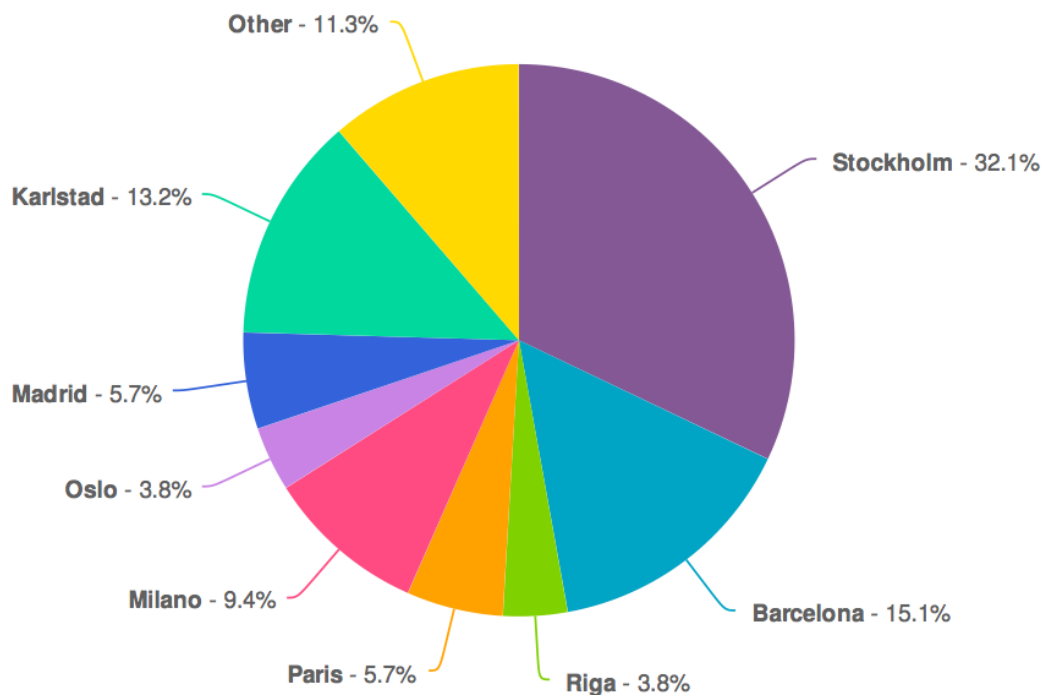
Figure 3. Split of the respondents by location

33 respondents accounting for 62,3% consider themselves early adopters when it comes to the technology. When it comes to the transportation usage (Table 3), most of the audience – 26 people or 49,1% uses public transportation several times a day. However, the second place by the number of answers is shared between those who use PT several times a week and less than several times a month. Probably, the latest are private cars owners. Nevertheless, 49,1 % is a big number, meaning that there is a potential in the market for the planning trips applications.

Value	Per cent	Count
several times a day	49.1%	26
once a day	5.7%	3
several times a week	17.0%	9
once a week	5.7%	3
several times a month	5.7%	3
less than several times a month	17.0%	9
Total		53

Table 3. Frequency of public transportation usage by respondents

Survey findings

All the survey findings will be presented in three thematic groups reflecting themes of the sections in the questionnaire, except the fourth – demographics – that is presented in the Sample characteristic chapter.

Travel experiences

Most of the respondents' trips took under 20 min – 45,3%; 32,1% of people were travelling for 21-40 min, the overall average is 28 min (Table 4). From this question we can assume that such an on-line tool is likely to be used for short trips, that is why alive timetable is one of the advantages that is highly appreciated by these users.

Value	Percent	Count
under 20 min	45.3%	24
21-40 min	32.1%	17
41-60 min	17.0%	9
more than 60 min	5.7%	3
Total		53

Table 4. Time spent on commuting

Figure 4 shows that 62, 3 % of respondents used one type of public transportation during their trips and 32,1% - two, which means that the tool can be used for trips where transfers are required. The most popular means of transportations used are: buses by 36 people and metro by 24.
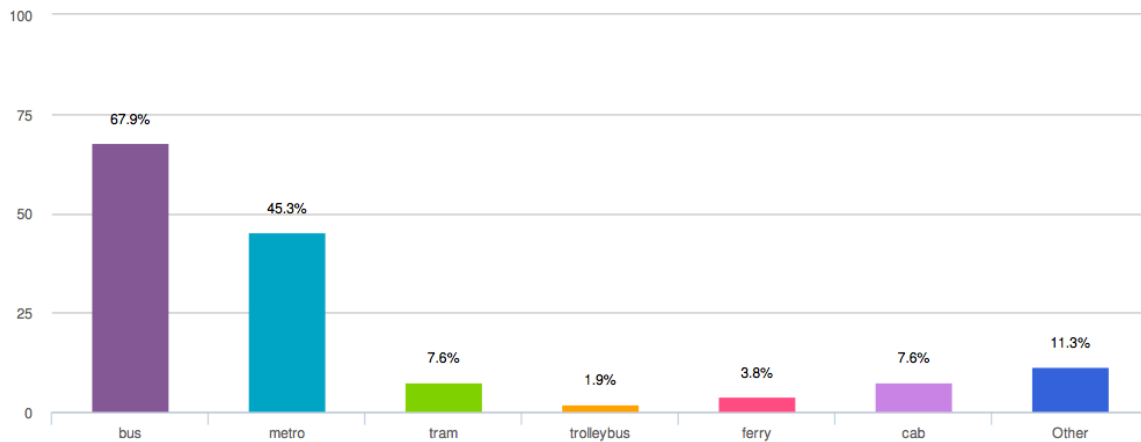

Figure 4. Number of types of PT used

When the respondents were asked to reflect on their experiences of using the smart map (Table 5), the majority of answers is on the positive side for all the statements. The answers split is more or less the same except the third statement (indicating accurate time-table) which is agreed by the most of the people.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Responses
it was easy to navigate and find needed places on the map	5 9.4%	6 11.3%	12 22.6%	19 35.8%	11 20.8%	53
it showed the best possible route	3 5.7%	8 15.1%	14 26.4%	17 32.1%	11 20.8%	53
it showed accurate time-table	3 5.7%	7 13.2%	7 13.2%	28 52.8%	8 15.1%	53
it has a friendly interface	4 7.5%	8 15.1%	12 22.6%	17 32.1%	12 22.6%	53

Table 5. Experiences of using the smart map solution

Majority of the respondents – 34 person or 64, 2% used on-line web solution for the smart map. However, still 20,8% preferred Android app (Figure 5). When it comes to web browsers, Chrome is revealed to be the most popular one with 54,7% users (29 people), followed by Safari with 22,6% (12 people).

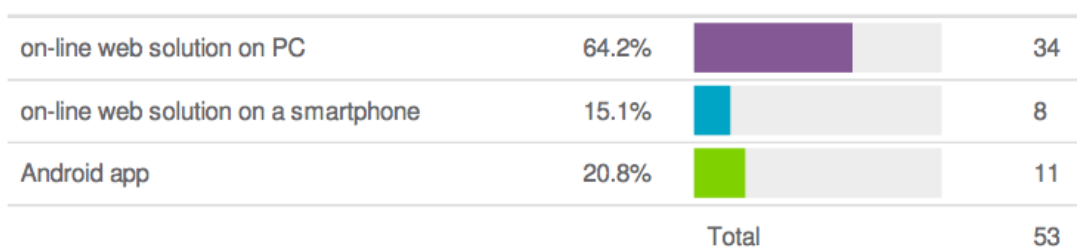|			
on-line web solution on PC	64.2%		34
on-line web solution on a smartphone	15.1%		8
Android app	20.8%		11
		Total	53

Figure 5. Solutions used for running a smart map test

39,6% of the users (21 person) were not able to complete their task from the first try – meaning to plan a trip using the smart map service. All the challenges they encountered could be grouped by similar issues:

- quality of the information (f.e. some stations and streets were not indicated on the map);
- choose of buttons (right click) was a challenge, causing problems with selecting a starting point and destinations;
- map does not work outside the city;
- graphics of the web application is not appealing;
- technical problems with the tool (f.e. it crushed a couple of times);
- speed of the proceeding information was slow in a couple of cases.

* A detailed list with all the comments can be found in the appendix.

Product satisfaction

When it comes to the satisfaction level, most of the responses – 39,6% or 21 people - indicated a neutral level (3). Overall the responses are slightly more on the positive side with the average of 3,2 (Figure 6).

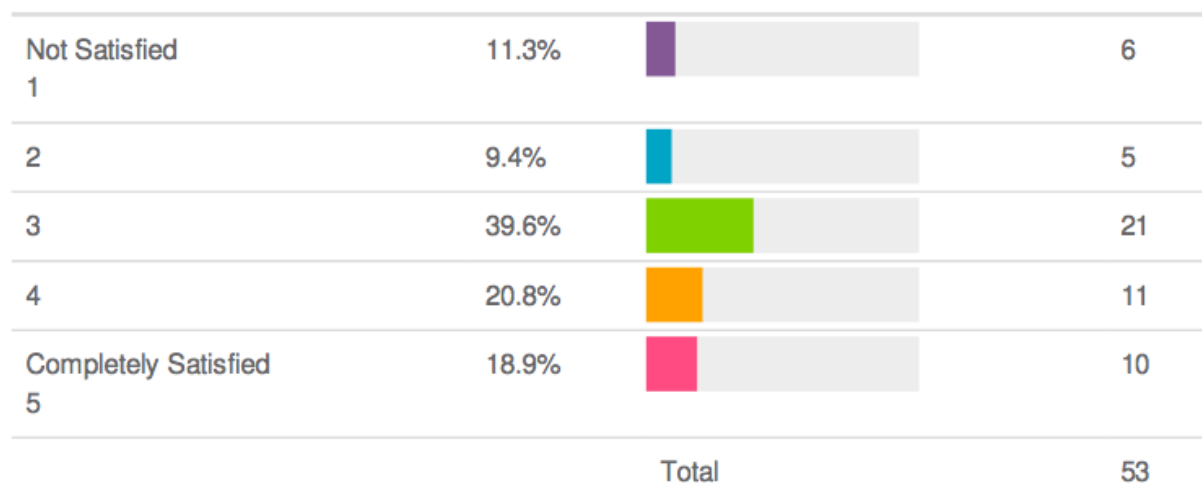|			
Not Satisfied 1	11.3%		6
2	9.4%		5
3	39.6%		21
4	20.8%		11
Completely Satisfied 5	18.9%		10
		Total	53

Figure 6. Respondents' satisfaction level

Completely satisfied were only 10 people or 18,9%, the rest listed some reasons why they are not satisfied with the on-line smart map. All the reasons are grouped by the theme and listed below in the Table 7.

Theme group	Reasons of a lower satisfaction rate named by responses (every new bullet point is a separate answer entered by a respondent)
Functionality	- adding the ability to type and search the address - it would be better if you could type in the destination, not search for it; - possibility to enter location manually;

	- it would be better if you just type the departure and destination in a separate browser; - the map is not very clear; the results are not very clear; - two entries. one for departing from and the other for destination; - I expected to see the public transportation option, the word TRANSIT confused me. Sometimes I want to choose the means of Public Transportation too: like go only by t-banna or only by bus; - if you could change between different transfers and if you could have the same search function as in Hitta.se; '1. I would add a exchange button like: Karlstad <-> Stockholm in order to exchange destination by source and the other way around. 2. Depending on the starting point in the same city the information changes. You can verify as following: Try Karlstad University -> Stockholm and then Karlstad -> Stockholm. In the first case, only appears buses to Karlskoga and in the second case appears some SJ trains which of course, the second case is much better. 3. I would introduce information about the Transport company such as: SJ Destination Oslo (If Oslo is the last train stop). Thus, it is easy to know which train, in this case, you must take. 4. I would introduce kind of icons in the route description such as: "Train icon-bus icon" 1.25 pm - route null - 2h 48m. In this way it is easy to see how many public transports you should take in that trip; 'It seems only possible to check one stop each without saving it for complex journey. So, only use step-by-step, right? Saving function may be of added value. Unless a complete stranger to the environment travelling is intended in, the "need" may be a bit extravaganza. Building dependency without real need has a news or nerdish value. To pay for the service is hardly attractive. Which other added values, functions could be integrated in the app? Construct a menu of such information options, enable saving of search parameters, and voila you have a schedule where an end destination may provide good hints about entertainment, circle of friends in neighborhood etc. If "air-connectivity" breaks down, user is helpless; - It would be good if there was predictive text for locations. I typed in 'Stockholm' and nothing came up to select, so I was not sure if it was a valid destination. It is a bit confusing on the app as to how you generate the journey. Where do you click? It could be improved by showing future journeys, not just the earliest possible trip. It helps to see how often buses and trains go, not just when the next one is;
Interface Design	- graphic impact; - interface is not good; - there are many green and yellow H-icons over the map, it looks overloaded when the zoom is out; - it is showing all the metro stations icons all the time. For Paris - there are to many of them, the icons are too big and they cover all the visible surface. The description text of the route is too small, and plain, giving no quick clues for the user; - the interface could be more user friendly. Also there should be some instruction on the web on how to use it.It would be nice if one can

	drag actually the dot of the location, better then just a click.
Instructions/guidelines	- easy of use. It is not clear how to use this application; - I had some initial troubles to understand how it works and from the computer map did not find my location accurately
Information missed	- include ALL transport networks. In Barcelona it was missing "Rodalies" and "FGC"; - it is not complete yet, then I couldn't find the route from my first search; - more solutions from nearby cities; - it does not show the number of the buses I have to take, just says "get on TMB BUS at 12:25" and the name of the bus stop It does not show more than one option of route
Not optimal solution	- the bus line number wasn't always correct and clear; - there was a closer bus stop that would have taken me to my destination that was ignored; - to show the accurate time; - it did not show the route
Navigation problems	- poor navigation; - it is difficult to navigate the map: I had to go like 10 times from zoom in to zoom out to put my pins on the map. I didn't manage to pin it exactly though. I tried to right click the map to the place where I am now, and then to type my destination, it didn't work either. I had to zoom out like 10 times again to find my destination, that is 25 km away and it is really not user-friendly
Other answers	- IPhone application is definitely missed; - I want the programme shall work quicker; - it was quite normal app like the one I use daily; - more information about the city; - no useful results; - the usability; - to completely start from scratch; - the good part about this map is that it is very visual tool but only if you know where you go. P.S. I usually use SL.se with inbuilt Google map option. And I am very satisfied with SL app.

Table 7. Reasons of a lower satisfaction rate

When the respondents were asked if they would recommend this application to their friends, 11 people (20,8%) admitted that they would recommend it, while 5 people would not do so. 15 respondents felt neutral about this question (Figure 7).
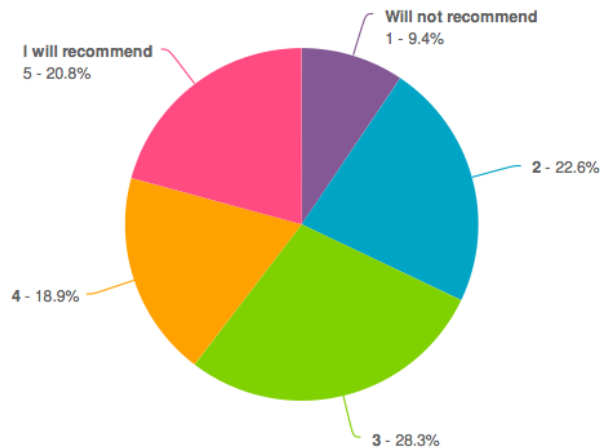
Figure 7. Recommendation rate listed by respondents

In order to analyze the following question, where the respondents were asked to describe this online tool with one or more words, a word cloud generator TagCrowd (http://tagcrowd.com/) was used (Figure 8). This word cloud shows what words were mentioned and how many times, highlighting the ones used more frequently. So we can see that the most frequently used words are useful – mentioned by five respondents, followed by cool, which got three answers and easy, fast, nice, simple, smart got two mentions each.

Figure 8. A word cloud by the tool description

Product features

When it comes to the list of the most useful features, by using the same TagCrowd word cloud generator tool (Figure 9), it can be concluded that a visual map is the most valued one, followed by timetable available, real-time navigation, zooming, details and easy clicks. However, five respondents in total did not find any features they consider as useful.
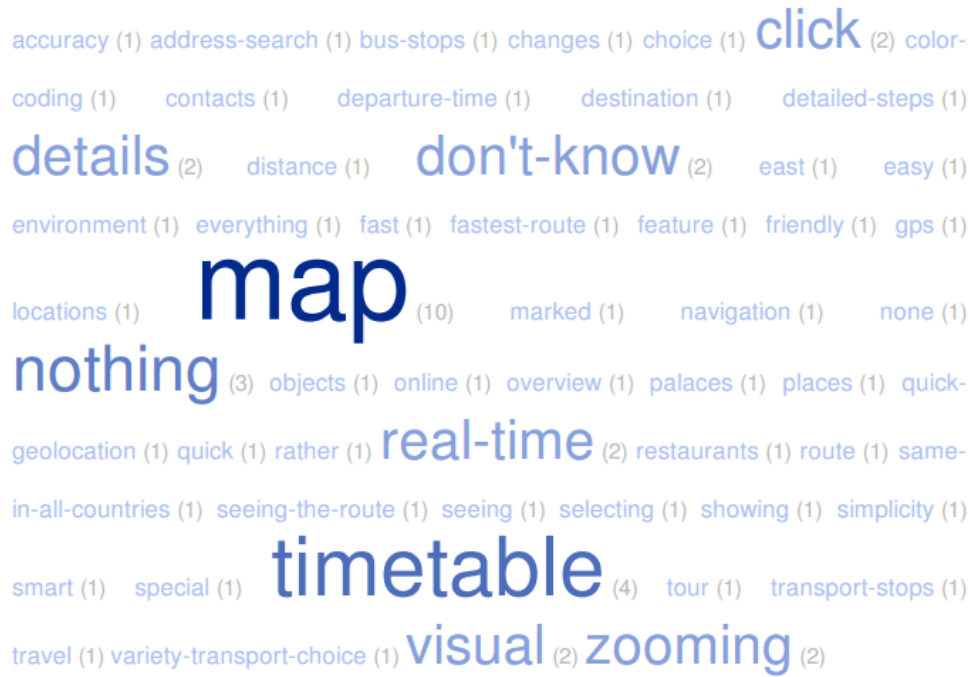
Figure 9. A word cloud by the most useful features

The question about the least useful features appeared to be quite tricky, since only a few of respondents entered actual features; otherwise general suggestions and things to be improved were mentioned (the blank fields, no, none, nothing and I do not know were referred as negative answers, meaning that all the features are useful). The least useful features that can be opted out by the respondents' opinions are as follows:

- Fewest transfers if it is not shown the number of transfers
- The second counting feature
- The travel time
- Too much info in the top left
- Walking itineraries
- Connections
- Internet connection
- Language
- Map
- Name in Swedish
- The journey planner
- The multiple choice car, walk, transit
- The trip type Safest
- Too much info

Features that are missed could be grouped by themes into following groups, the number n the brackets shows the number of respondents listed same/similar feature:

- a satellite view map (2);
- better navigation and geolocation (2);
- different marks for different types of transport stops (2);

- all the transportations means timetables;
- better routing;
- 'from' to 'fields', manual information entering (5);
- an option to enter day and time to be able to plan a trip for the future, not instant (3);
- memory board - an option to save favorite trips, favorite means of transportation, destinations, etc. (3);
- advanced search & pre-defined options (4);
- link to company public transportation update website;
- a guideline, how to use the tool (2).

The answers above could serve as a guideline for the product developers pointing out features that can be considered for adding to the tool in the future. The full list of all the features missed can be found in the Survey Report, attached in the appendix (Q18).

To analyze the last qualitative information question, where respondents were asked to share their opinions about the smart map interface and also to give their comments on how the interface could be improved, all the comments were grouped using a word cloud approach (Figure 10).

Figure 10. A word cloud by smart map interface improvements

When the respondents were asked to compare the smart map tool with other on-line solution they used before, 47,2% or 25 people admitted that it is more or less the same, 30,2% consider it is worth and 22,6% think it is better then other solutions available (Figure 11).

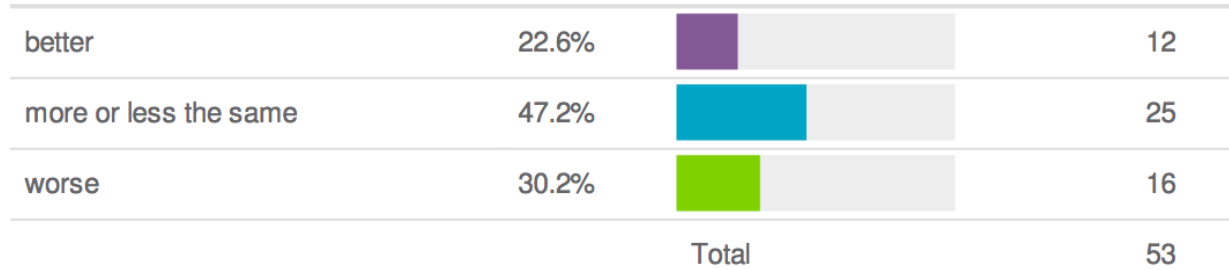|				
better	22.6%			12
more or less the same	47.2%			25
worse	30.2%			16
		Total		53

Figure 11. Comparison of the smart map with other similar solutions

The last question in this section was aimed at identifying similar solutions for managing trips that are available and being used by respondents. This question was not required, so the response rate is not that high. All the responses are grouped and presented in the Table 8.

Name of the application/tool	Number of responses
Google Maps	9
SL	5
Res i STHLM	4
Karlstads Bus	3
TMB	2
Waze	2
Ruter.no	2
Deutsche Bahn Navigator	1
Hitta.se	1
Trafi.lv	1

Table 8. Similar solutions to the smart map used by respondents.

In Sweden, the most popular solutions are local ones, like SL, Res I Sthlm and Karlstadsbuss. In the rest of the countries Google maps appears to be the most popular one and only a couple of respondents named other local solutions. The reason behind could be that first of all, the most of the respondents of this survey are from Sweden, and secondly Sweden has a well-developed pubic transportation system and a high rate of the smartphone ownership and Internet penetration that makes it possible to use on-line tools and smartphone applications for managing trips to a high extend.

Conclusions

Summing up secondary data provided in the Background information chapter it can be concluded that there is a huge potential in the market for such an application as a cloud based smart map for planning trips. The following tendencies in the modern

society bring up the need for a smart solution combining features of all the existing ones available on the market:

- switching from private cars to hiring, sharing and also massive use of public transportation;
- users become co-producers of the services; they are more demanding, seeking for comfort and better experiences with public transportations;
- rapidly increasing internet penetration rate;
- increasing rate of smartphones ownership together with constantly improving functionality of mobile devices.

Primary data collected during the user experience survey also supported some of the tendencies revealed in secondary data. For example, majority of the respondents do use public transportation a couple of times a day and also they do use a lot of different applications and services for managing trips. It is obvious that they are becoming more experienced and demanding in their seek for comfort in arranging trips; it can be seen from the number of comments on how the application should look like and what functionality it should have.

When it comes to the product satisfaction, the respondents were more neutral, many of them could not complete their tasks from the first try. From the challenges listed, the most common are: quality of the information, choose of buttons, limited functionality outside the city and slow speed of proceeding information. However, most of the challenges could occur due to the fact that the smart map service is on its pilot stage. The most common reasons of the lower service satisfaction can be categorized by themes in such groups as a tool design (functionality) and interface design. A lot of the respondents mentioned a missed function of typing in addresses of destination and search and also a memory panel where you can save intermediate search results and previous trips.

A word cloud approach for analyzing the most appealing product features revealed that a visual map is the most valued one, followed by timetable available, real-time navigation, zooming, details and easy clicks. Useful, cool, easy, fast, nice, simple and smart – these are the most frequently used words to describe smart map tool. The interface was described as fine, nice and ok, however a lot of respondents mentioned some improvements needed like: it would be better to have more simple and clear interface, better to use different colors, etc. However, the majority of the respondents stated that they would recommend this service to their friends

Limitations

Secondary and primary data collection was engaged with certain limitations. When it comes to the secondary data – limitations come with the dynamics of the ICT development. This data changes very fast and becomes obsolete, so it is hard to find theory and concepts reflecting the current state of its development. In addition, there

is no much research done on the user experiences of testing trips planning applications.

Another limitation is coming from the fact that smart map was developed to serve primary as a test application for the ITRACT backend, the cloud based trip planning solution. As a consequence, it was merely developed to demonstrate the capabilities and features of the backend and was not intended to serve as a product type trip planner. As a consequence, the focus of the smart map was not on the usability of the app, it was rather to demonstrate the functionality of the backend.

Limited time frame available and also limited number of cities participated in the project created some constraints during the primary data collection process. The participants had to be recruited from certain cities. A sample size was found too small for clamming any correlations between demographics and user experiences.

However, these limitations do not lessen the significance of the results obtained from the user experiences survey.

Suggestions

If the application is to be developed further a primary target audience should be young people, since they are more likely to use such an application as a smart map and they consider themselves as early adopters of new technologies and on-line based services. After service is properly tested and adopted by early users, it will spread to a larger audience.

Based on the survey results, it is seen that most of the trips managed by the tool were quite short (almost 80% under 40 minutes), with 1 or 2 means of transportation involved. It means that for short trips the most useful feature is an accurate timetable, and for the ones involving more then one type of transportation – accurate transfer information on connection trips for different transportations. So basically, these are two basic features that have to be really accurate and precise. Most of the respondents gave a positive feedback about these features, except minor problems with the quality of information in Spain and in Italy. When further developing this tool, comprehensive information should be available for all the locations.

A lot of the respondents mentioned a smart map interface design as a challenging and the least useful feature. A current location point could be marked in a more explicit way, for example it could be a red flag or a big dot. A green color for all the stations and stops could be replaced by different color options for different kinds of transport. In addition, icons are found too big, while description text for stops is too small.

Another thing which has to be added according to the survey results – is a clear instruction (a guideline) on how to use the tool, for example there could be a panel

on the left or write with a short description of every step and buttons, a short video guideline or similar.

Even though a lot of people used a web based solution of the service, it was mentioned by many (both while recruiting respondents and in the survey answers) that IPhone application is missed. This kind of service should have phone based applications both for Android & IPhone.

Many of the respondents listed as a missed feature an option to type manually both a current location and destination. It is something that people used to do in other tools like Google maps and it seems very intuitive for them. It would be a good add on to have this ability within the smart map service.

Another function that could be added is an option to enter day and time of the transfer in order to be able to plan a trip for the future, not instant. And also a memory option to be able to save it and come back later.

A general suggestion is that it is very important to involve actual users into co-creation process. To do so a focus group can be created in order to test the tool, to provide feedback, after it is implemented to test it again. Users are an available source of information on the performance of the existing solutions as well a source of innovative ideas for further improvements, which is should not be neglected.

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