



SETA

Deliverable 5.3

First evaluation of Visual Analytics and Decision Support system

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Authors

Vitaveska Lanfranchi
Tudor Sirbu
Suvodeep Mazumdar
Daniele Albertin
Sonia Floris

vita@k-now.co.uk
tudor@k-now.co.uk
s.mazumdar@sheffield.ac.uk
daniele.albertin@aizoongroup.com
sonia.floris@aizoon.it

Internal Reviewer(s)

Ravinder Bains
Matthew Hawes

Ravinder.bains@birmingham.gov.uk
m.hawes@sheffield.ac.uk

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1 Summary

Deliverable D5.3 presents the evaluation of the Methodologies and Technologies for Visual Analytics, Data Exploration and Decision Support System developed in Work Package 5. The document presents how the technologies were evaluated following a user-centred design paradigm and the approach presented in D1.2.1, D1.2.2 and D1.2.3. The document is concluded with a brief overview for the next phases of activities within Work Package 5.

2 Glossary of Terms

<i>DoW</i>	<i>Description of Work</i>
<i>D</i>	<i>Deliverable</i>
<i>DSS</i>	<i>Decision Support System</i>
<i>UI</i>	<i>User Interface</i>
<i>VA</i>	<i>Visual Analytics</i>
<i>WP</i>	<i>Work Package</i>
<i>USFD</i>	<i>University of Sheffield</i>
<i>Fabric</i>	<i>Crash reporting solution</i>

3 Introduction

The SETA project aims at developing and deploying methodologies and technologies to monitor, plan and evaluate mobility in urban areas, with the final goal of supporting a mobility shift towards more sustainable means.

To establish and maintain the monitoring and evaluation of mobility it is fundamental to have technologies that can support individuals as well as decision makers in making conscious, informed choices about transport.

To this extent, in WP5 partners worked to design and develop technologies for:

- supporting citizens' awareness of personal mobility through a system that is centered on personal mobility monitoring;
- supporting decision-making by using the acquired and manipulated data to provide evidence for decisions;
- providing visualisation of distributed, high variety, high velocity and high volume data, through intuitive exploration mechanisms.

The SETA project is now in the middle of its duration, and accordingly to the user-centred design paradigm adopted, has carried out an evaluation of the preliminary technologies to ensure:

- they are technically functioning
- they respect the requirements identified in D5.1
- they are usable
- that any early feedback can be incorporated in the final version of the technologies.

This deliverable presents the Simulation Exercise (SE) and the short-term evaluations carried out to understand the technical viability and the users satisfaction of the technologies before their release to a wider audience (the outcome of which will be reported in D1.4, D1.5 and D1.6). The SE was conducted over two days (6th and 7th of July 2017) in Santander, under the coordination of The University of Sheffield (WP5 coordinator) and of Santander City Council and The University of Cantabria (local organisers and project partners).

4 Pre-Simulation Exercise

The Seta app was developed over the first phase of the project, combining various modules developed by USFD and K-Now. The development stage involved multiple iterations with several stages of testing within the modules. Once integrated, several testing iterations were also conducted. Following these test phases, it was necessary to understand how the simulation exercise will be conducted and as a result, there was a need to conduct a dry-run of the simulation exercise.

The pre-simulation exercise (PSE) was a similarly structured one, designed to replicate the features/steps of the SE. For the sake of simplicity and practicality, this was conducted in Sheffield over a few hours. This exercise was the first time a structured activity was to be incorporated within the scope of the app and the citizens observatories framework. As a

result, it was important to understand any issues/concerns arising out of this exercise.

The tasks in PSE were very generic and high level, giving the flexibility of users to try out different routes and activities. The PSE involved ten researchers from USFD, distributed into four types of users (walkers, public transport users, vehicle commuters, and bicycle users). The four types of users had a set of tasks that were made available to them as printed copies as follows:

Type A: Walker

1. Walk from meeting venue for 7-10 minutes while keeping the phone in use. Send two observations via the app.
2. Switch off the screen and keep the phone in pocket/bag while walking for another 7-10 minutes
3. Turn around and start walking back for 5 minutes with phone still locked and housed within either pocket or bag
4. Take rest for 7 minutes while using the phone to send two observations and images via the app (at least one issue regarding road surface).
5. Walk back to meeting venue.

Type B: Public Transport User

1. (two users to carry WiFi/BT sensors in bag) Walk from meeting venue to nearest bus stop and wait for bus.
2. Take a bus for at least 20 minutes, recording observations by hand
3. While travelling on bus, using the report button, send at least one observation via the app (bus full / empty)
4. Get off the bus after 5 stops and walk to the bus stop on the other side to wait for the returning bus.
5. Take the bus to return to meeting venue. While travelling back, send at least one observation (report an issue regarding bus times)

Type C: Vehicle Commuter

1. Walk to car park or taxi stand
2. Send observations via app (report an issue)
3. Take vehicle for 10-minute ride
4. Stop for 10 minutes
5. Send at least two observations
6. Return to the meeting venue

Type D: Bicycle

1. Walk to the nearest cycle parking
2. Send an observation to report on the cycle parking space (attach an image, if available)
3. Ride the bicycle for 15 minutes and stop.
4. Send another observation on the quality of the road

5. Start riding the bicycle and return to the meeting venue
6. Park the cycle and send another observation to report on the cycle parking space

Prior to the exercise, the participants were requested to try the app for five minutes in a quick walk around a building. Once participants were satisfied with the app recording their activities, the exercise followed. Participants were given the option to choose their activities - while most participants chose to try the walking task (Type A), there were one participant for each of the other tasks.

The exercise took about an hour to set up, which involved briefing the participants, installing the app on their phones, providing instructions and print-outs for them to start the exercise. The setup process also involved them walking outside the building to ensure the activities were being recorded.

In addition to trialling the script for the SE and ensuring a practice run of the exercise, the pre-simulation exercise also identified several minor issues and potential improvements. Some examples of these improvements are showing a waiting icon while submitting reports, providing some feedback after reports being submitted and some cosmetic changes. Once completed, it was also realised that the SE would need more precise instructions (such as map routes and precise locations for stops etc.) and given the exercise would involve project partners, would need a set of interesting locations to visit, at a convenient distance.

5 Simulation Exercise

Following the pre-simulation exercise, a teleconference was carried out with Santander City Council and The University of Cantabria to organise the event in Santander, covering topics such as: best routes to carry out a complete evaluation of the features, how to rent bicycles etc. At the same time, it was suggested that an ideal location to travel to would be the Botin Centre Museum and participants could choose their means of travel. The location was chosen as it was a central point in the city, at a location which would be convenient for walking, cycling, driving as well as taking the public transport.

In addition to the varied forms of travel, the city of Santander also provided us the opportunity to test the app with various other means of transport during walking such as escalators, travellers and lifts (Figure 1).



Figure 1: Escalators/stairs used by participants to travel to their destinations

The scope of the SE was to test the following aspects:

- Installation and use of the SETA Mobile App
- Accuracy of the tracking mechanisms (reported in D2.3) and of its display back to users
- Accuracy of the WiFi, Bluetooth Monitoring Sensors for public transport (reported in D2.3)
- Accuracy of the citizens observatory reporting feature (reported in D2.3) and of its display
- Technical functioning of the app
- Technical functioning and usability of the Decision Support Systems (Citizens Observatories, Origin-Destinations, Graph and Sensor Visualisation)
- Identify further needs and requirements for Phase2

5.1 Methodology

The SE was conducted over two days (6th and 7th of July 2017) in Santander, under the coordination of The University of Sheffield (WP5 coordinator) and of Santander City Council and The University of Cantabria (local organisers and project partners).

The SE was carried out by a total of 17 participants plus the coordination team, formed by technical personnel. Each participant was expected to carry out one out of three tasks accordingly to the role he had been assigned.

All the participants took part to the evaluation of the mobile app whilst for the evaluation of the decision-makers interfaces only participants with real life roles of city council decision makers were chosen. To corroborate the results, 2 more evaluations of the decision makers interfaces were carried out after the event in the form of workshops with a higher number of decision-makers (In Birmingham and Turin, the other two partner cities).

A SE guide was distributed to all participants, including a consent form (available in Appendix A), the descriptions of the tasks, maps and practical details (see in Figure 2 participants using the SE guide whilst carrying out a task).



Figure 2: Participants using the Seta app during the Simulation Exercise

After the tasks the users were asked to fill in a questionnaire.

The methods used to evaluate were:

- logs of user actions during the execution of the tasks
- questionnaire distributed to all participants after the task (available in Appendix B)
- individual interviews with participants during debriefing
- a workshop with decision makers from Santander (on the 7th of July) to evaluate the insights from the mobility tracking and the citizens observatory visualisations.

- follow-up workshops with decision makers from Birmingham (on the 20th of July 2017) and Turin (on the 17th July 2017) to evaluate the insights from the mobility tracking and the citizens observatory visualisations.

While the participants were on ground, the coordination team monitored how the exercise was running by observing different criteria through various means:

- Checking the real-time dashboard for decision makers
- Monitoring the performance of the applications on Google Firebase
- Bug tracking using Fabric

The agenda of the simulation exercise is as follows:

DAY 1

Time	Item	Location	Lead
09:00 - 10:00	Introduction to the SE	University Cantabria meeting venue	USFD
10:00 - 11:00	App download and setup	Uni Cantabria meeting venue	USFD+ KNOW
11:00 - 14:00	Participants to follow a set of instructions, from a printed list of tasks	Around Santander	Cantabria / Santander
14:00 - 15:00	Re-assemble in meeting venue, fill-in evaluation sheets	Uni Cantabria meeting venue	USFD
15:00-17:00	Debriefing and individual interviews	Uni Cantabria meeting venue	USFD

DAY 2

Time	Item	Location	Lead
9:00 - 10:00	Presentation of questionnaire feedback	Uni Cantabria meeting venue	USFD
10:00 - 13:00	Decision-Makers workshop	Uni Cantabria	USFD, AIZ

		meeting venue	
13:00 - 14:00	Fill-in evaluation sheets	Uni Cantabria meeting venue	USFD

5.2 Scenario and Tasks for Mobile App

You are a commuter living in Santander and you are using the SETA app to monitor your journeys and to understand how you travel, how long you spend which each means of transport, how many calories you burn. Today you will have to choose from the following means of transport and carry out the tasks requested.

5.2.1 Walking

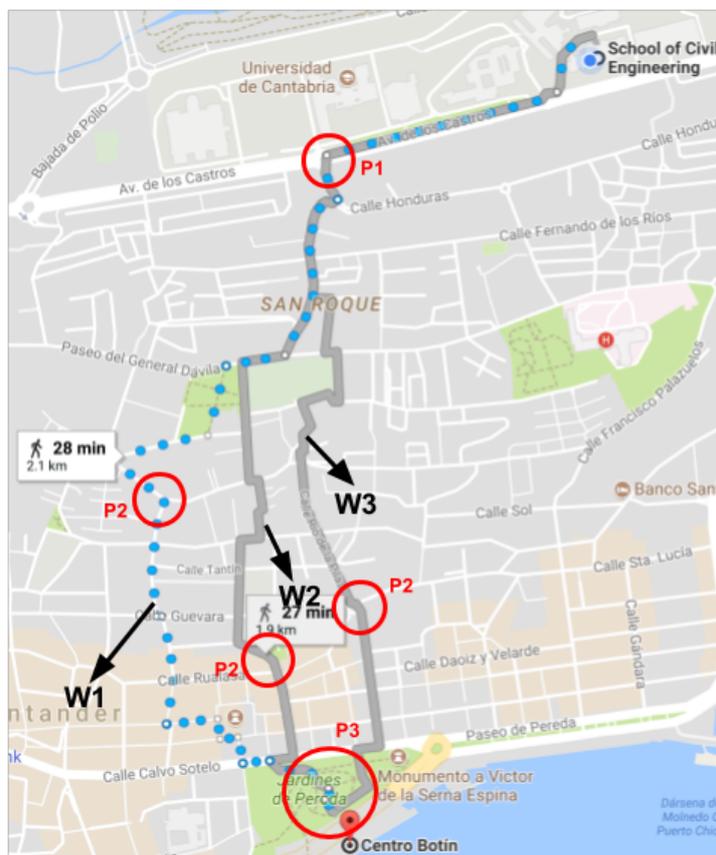


Figure 3: Simulation Exercise Walking Tasks

Summary: About 25-minute-long trip and there are some sections with pedestrians facilities such as moving walkways, escalators, and lifts.

1. Walk from meeting venue to Point **P1**, keeping the mobile screen on. When at P1, send a TEXT observation as **a generic observation** about the road traffic condition. **(Do not upload any image)**
2. Switch off the screen, lock the phone and walk to **P2**. When at P2, send another TEXT observation as **a generic observation** about the road traffic condition. **(Do not upload any image)**
3. Walk to the final destination at **P3, (Botin Centre Museum)**. When at P3, send a **generic observation** on the road traffic condition. **(Do not upload any image)**
4. Walk back to the meeting venue via points **P2** and **P1**. When you arrive at P2 and P2, please submit **a generic observation** on traffic condition. **(Do not upload any image)**
5. Upon reaching the meeting venue, send **a generic observation** and **upload an image**

*** Please note: the image upload may take a long time**

5.2.2 Public Transport (Bus Journeys)

Summary: 25 minute long trip; Line 7c1 serves the origin - destination. There's a bus stop in front of the faculty and a bus stop near of the museum (we are talking with the public transport operator in order to assign vehicles equipped with beacons to this line in order to carry out some quality of service surveys)

1. Walk from meeting venue to the bus stop in front of the faculty.
2. Take the **Line 7c1 bus** to the Museum (**Paseo de Pereda**)
3. While travelling on bus, using the report button in the app to send at least two observations by clicking on the **bus occupancy button**. **(Do not upload any image)**
4. Get off the bus at the Museum stop (**Botin Centre Museum**). Upon arrival, send one observation as a **general observation** of the road traffic. **(Do not upload any image)**
5. Take the return bus to the meeting venue (**Line 7c2 bus**). The bus stop is **Jardines de Pereda**
6. On your way back, send at least one observation regarding the bus occupancy (like step 3)
7. Upon reaching the meeting venue, send **a generic observation** and **upload an image**

Note: For users with WiFi/BT sensors, after each bus stop manually note the number of passengers in the bus and the observation time.

*** Please note: the image upload may take a long time**

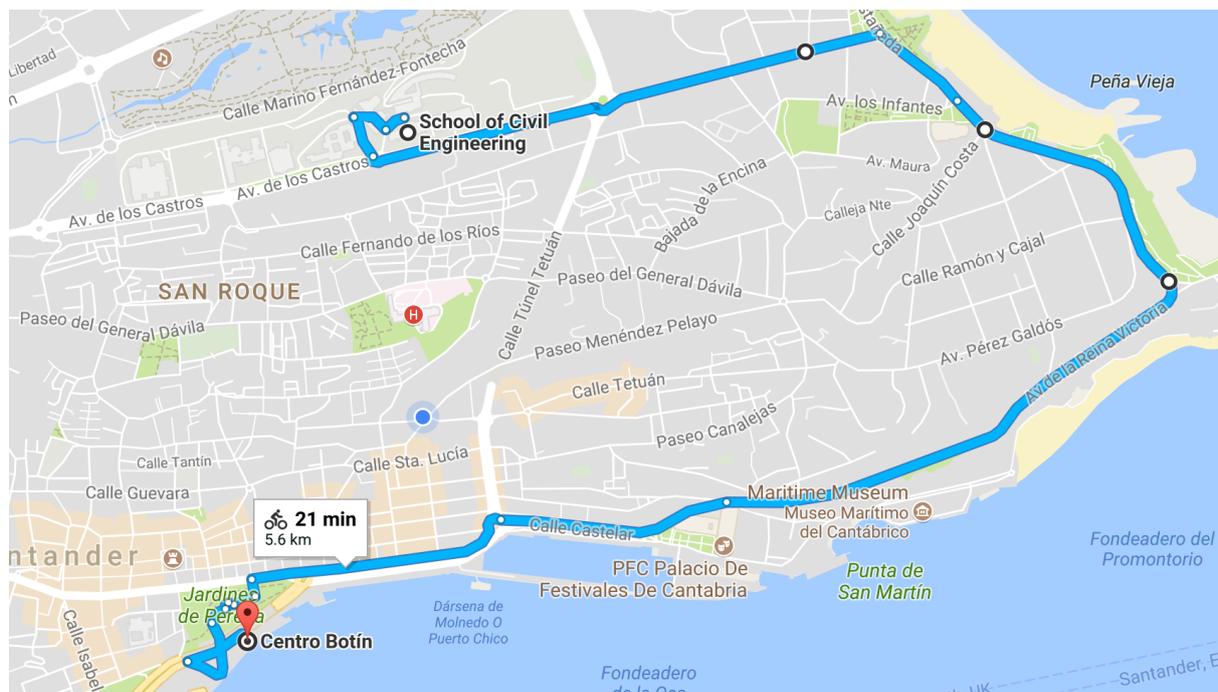
5.2.3 Vehicle Commuting

Summary: 10-minute-long trip. There's a parking area in front of the museum.

1. Walk to car park or taxi stand
2. Send **a general observation** via app upon reaching the car park/taxi stand regarding observed conditions on the road. **(Do not upload any image)**
3. Take the vehicle to the final destination **(Botin Centre Museum car park)**.
4. Stop for 10 minutes. While stopped, send at least two observations on the traffic conditions of the road (send at least one **generic observation** and one **traffic delay**). **(Do not upload any image)**
5. Return to the meeting venue.
6. Upon reaching the meeting venue, send **a generic observation** and **upload an image**

*** Please note: the image upload may take a long time**

5.2.4 Bicycle Commuting



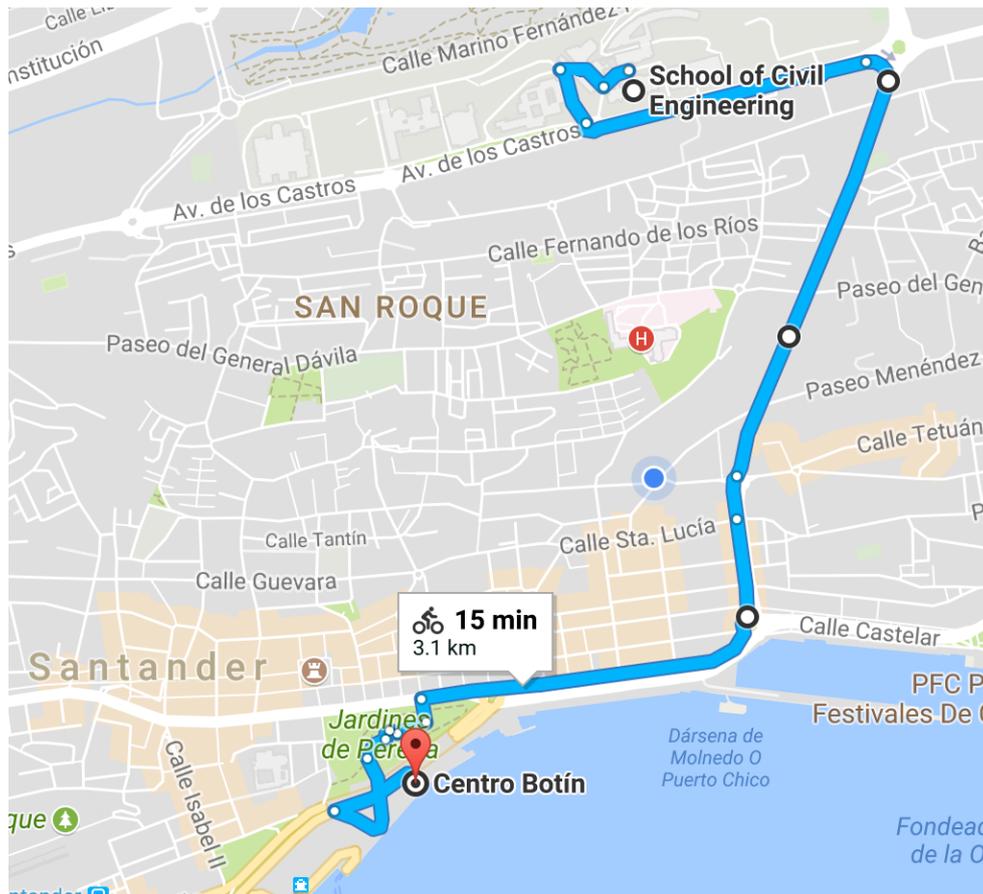


Figure 4: Bicycling tasks during Seta Simulation Exercise

Summary: 2 feasible paths: the red one (15 minutes) goes by the tunnel and is more polluted. The blue one is the same as the bus route and is longer (30 minutes).

1. Walk to the nearest cycle parking
2. Send an observation to report on the **bicycle parking space (also attach an image)**
3. Ride the bicycle till the final destination (**Botin Centre Museum**). Take either C1 or C2 route
4. Send a **generic observation** on the road traffic condition.
5. Start riding the bicycle and return to the meeting venue
6. Park the cycle and send another observation to report on the **bicycle parking space (also attach an image)**
7. Upon reaching the meeting venue, send a **generic observation** and **upload an image**

*** Please note: the image upload may take a long time**

5.3 Scenario and Tasks for Decision-Makers Interface

Prior to the Simulated Exercise, three instances of the Decision Makers' Origin Destination interface were made available via secured connections, deployed at USFD's servers. This was designed to protect highly secured personal data being collected by the mobile applications. The three instances were focussed on Sheffield (being deployed via the MoveMore application), Birmingham and Santander. The installation focussing on Turin will be deployed when the app is made available via the city of Turin. Figure 5 shows the three Origin-Destination interfaces for the three cities:

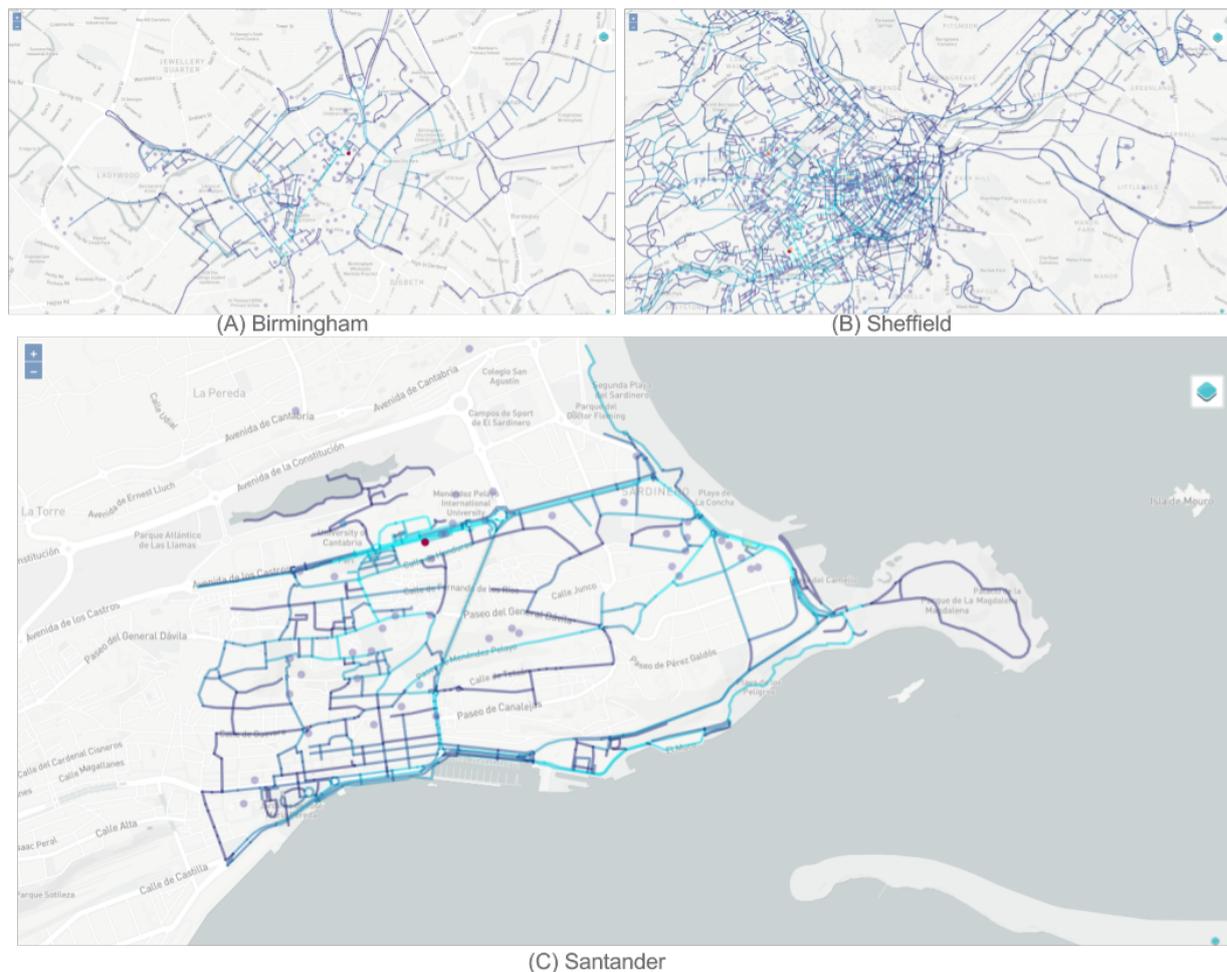


Figure 5: Decision Makers' OD Interface deployed in Birmingham, Sheffield and Santander city

The mobile application tested during Day 1 by the participants, upon completion of the tasks submitted the data to the USFD data repositories. The data collected by the mobile applications was then processed using various processes within the Decision Makers'

processing pipeline as follows (discussed in more details in D5.2). The locations and activities of the users are captured asynchronously, resulting in activity records and locations which are not matched exact to the timestamp. This requires a process of temporal alignment. A majority of this process is currently done within the app at the end of the day where the entire day's activities are analysed and collected within segments. The segments summarise individual journeys made by the users, which are then reported as a final summary of the day. Once the summaries are made available, the locations that are collected asynchronously are aligned to the activity segments based on the start and end times of the segments. The locations collected by the app is also queried via an internal process to provide the nearest postcode. The segments, summarising the type of journey and the start and end postcode of the journeys essentially create the Origin-Destination matrix. Postcodes are used as the primary interaction points, querying via origins and destinations. Finally, by selecting an origin and a respective destination, a color-coded map-matched route is provided to the decision maker to present the routes that are taken by the users.

Using the mobile applications citizen observatory data has also been collected through participatory input. Users captured data related to mobility in Santander for various categories of issues: road blocks, road closures, delays, public transport (whether they could see any free seats or not) and bike parking availability. Any issues which did not fall under any of these categories (e.g. missing or broken road signs, littering on public pathways) were qualified as generic. Along with descriptions, categories and answers to predefined questions (for bike parking and bus seats availability), users could also categorise their reports into positive or negative feedback.

The mobile applications also recorded in the background the user's location when they were reporting an issue. The location comprised of their latitude and longitude coordinates but also the city they were currently in. These were used to plot reports on a map in the decision makers' platform. With the exception of bus seat availability reporting, users were also able to attach or take a picture where they felt it was necessary (not available for buses due to privacy concerns).

The collected data was available to two categories of users: decision makers, in the platform dedicated to them, and mobile application users in the notifications page of the application. Collected data was transmitted and processed in real time, in a secure manner - using AES encryption.



Figure 6: Walking (top-left), Vehicle (top-right) and Cycling (bottom) journeys taken by participants on Day 1

The Day 2 of the Simulation Exercise began with an initial final submission of the app data. Given the participants were project partners with internet connections from external providers, the participants were requested to force submit the app data. Following this submission, the data was processed again to ensure all data was submitted. It is important to note that typically, data is submitted asynchronously when all users are connected to the Internet as a part of the app design. However, in this scenario, it was important to force data collection so that the Day 2 simulation exercise can proceed. Following the data submission, the app questionnaire feedback from Day 1 was discussed with the participants, presenting the results of the app evaluation. This was conducted as an informal focus group (with about 25 participants), aimed at collecting further information that the questionnaire could not capture.

Following the discussions and focus group, the decision makers' interfaces were presented to all the participants with various trajectories of the previous day being visualised (Figure 6). The participants were shown various routes of their activities the previous day, showing summaries of all the activities captured. Following the presentation, the workshop was

concluded. Three participants from the workshop were local to Santander and were expert in decision making systems or a decision maker. They were also well-versed with various routes that were chosen in the previous day.

The participants were asked to use the two systems:

- Citizens Observatory Web interface
- Origin-Destination Analysis

During the usage they were encouraged to talk aloud about their experience. One member of the coordination team was available to reply to any questions and to take note of their comments. The workshop was semi-structured, with some guidance questions (reported in Table 1).

Observing Data in Citizens Observatories (CO)	Origin-Destination (OD)
<ol style="list-style-type: none"> 1. Visually observe the data generated in the Citizens Observatory platform via the App <i>(leading question: what kind of information does the app provide to you?)</i> 2. Make a note of where are most of the observations coming from 3. Set a filter on road issues - can you observe any data submitted regarding issues on the road? <i>(leading question: how many observations do you find?)</i> 4. Observe the images being submitted by citizens regarding bicycle parking 5. Look for complaints / issues from citizens <i>(leading question: what kind of complaints/issues do you find most citizens concerned about?)</i> 	<ol style="list-style-type: none"> 1. Where (which postcodes, areas etc.) are most journeys originating/ending? <i>(leading question: why do you think they are the areas with the highest originating and ending journeys)</i> 2. Which roads are being used the most in the city ? 3. How many walking journeys are recorded in the city? 4. List some of the most common journeys 5. Select one of the areas by clicking on a postcode of interest - how many walking journeys are recorded? What is the average duration of all the journeys ? 6. List a few other postcodes and the number of journeys to and from the selected postcode 7. Select a postcode of interest and name the road which is a part of a high number of journeys

Table 1: Decision Makers Tasks for the two interfaces, providing a guided set of actions

This was important as it would firstly introduce a structure to the activities. The guidance questions for both Observing data and Origin-Destination analysis comprised of two types: Exploratory and Fact-finding. The exploratory questions are aimed at exploiting the visual

representations provided by the interfaces. They may be at times open to interpretation, biased by prior knowledge or the area of interest. As a result, exploratory questions do not necessarily aim to identify how well a decision maker can precisely answer a question, but rather aims at understanding how well a decision maker can exploit the visualisations and interface in addressing a question of interest. Fact-Finding questions are, on the other hand aimed at answering precise facts that can be checked for correctness such as 'how many journeys occur between postcodes A and B'. Examples of fact finding tasks in CO were '*how many observations do you find? (following selecting road issues)*', while in OD, some examples were 'Select a postcode of interest and name the road which is a part of a high number of journeys'. Examples of exploratory questions in CO were '*What kind of information does the app provide to you?*' and '*why do you think they are the areas with the highest originating and ending journeys*' in OD.

5.4 Decision Makers' Interface Results with Local Experts

Given the need for expert knowledge and experience, the Decision Makers' Interfaces were evaluated in two scenarios. The initial scenario for evaluation was as described, set within the city of Santander, using the data generated by the participants for the simulation exercise. This involved three participants, all of whom are decision makers or experts in traffic and transport simulation and based in Santander. This helped gather a unique insight into the different regions in the city. For example, it was observed that only the more affluent areas of the city had some usage of the Seta app (although there was a bias in the users who had access to the app). Participants were also highly engaged when they observed the routes they travelled and activities they had performed during the simulation exercise. Overall, the impression of the participants of the Decision Makers' interfaces was highly positive. The evaluation started with a brief recap of the two Decision Makers' interfaces, providing a brief demonstration of the interfaces. The reduced expertise time resulted in conducting a group evaluation, where one participant could drive the tasks while a discussion would help facilitate the process and highlight several aspects of the interface. The three participants, upon completing their tasks were invited to providing their feedback by filling an online evaluation sheet, developed on Google Forms¹.

The results of the evaluation feedback were highly positive. As can be observed, the questionnaire combined the two Decision Makers interfaces to ensure participants can provide their responses quickly. The low number of participants are not sufficient to provide any statistically significant insights into the quantitative assessments capturing feedback as Likert Scale questions. More interesting for the context of this discussion however, is the subjective feedback from three primary questions:

- *What are the things that you like about the system?;*
- *What are the things that you dislike about the system?;*
- *Would you consider this system for your job ? How useful would it be?;*
- *What additional insights can you derive from this system that you currently do not have access to?;*

¹ Questionnaire was made available at <https://goo.gl/forms/po9aepPx6qjeYjIW2>

- *Are there any other comments you would like to make about your experience?*

Overall, most participants agreed that the two interfaces are both very useful and will certainly be helpful in providing additional support to Decision Makers. In addition to the Santander evaluations with three decision makers, a follow up evaluation was organised by the Birmingham City Council to evaluate the two Decision Makers' Interfaces. Eight Decision Makers, with a wide range of expertise and roles from Data Scientists and analysts (for technical feedback) to Managers (for feedback from a higher level perspective) were initially presented the two different interfaces for Decision Makers in the form of a demonstration-driven discussion. The participants, during this presentation were also invited to ask further clarifications or questions. At the same time, participants were also use case owners in the Birmingham case study, and hence several other discussion points arose regarding how the systems will be deployed within the next phase as well as how the mobile application will be further adapted to suit additional needs of the different communities. Furthermore, discussions also involved a summary of the data being collected as well as how it was being processed to enable the two Decision Makers' platforms. Following the introductory session, the participants were divided into two groups - the first comprising managers and use case owners having a higher level overview of the needs of Birmingham City Council as well as specific requirements for the case study. The second group consisted of technical participants with considerable expertise in analysing data relevant to the Birmingham area.

Both groups were again presented the two systems with a detailed discussion on the simulation exercise in Santander. The data collected in Santander was then presented via the two interfaces. Following this, a walkthrough of the Decision Makers tasks was performed, which included demonstrating how the answers would be achieved. The evaluation was particularly designed this way to maximise limited time availability as well as make an interactive and engaging session to encourage a more discussion-based focus group. The Birmingham evaluation was highly interactive, presenting the datasets for the different cities to provide complimentary visualisations: Birmingham city to present a familiar region (but less data), Sheffield city to provide a larger volume of data (six months of data collected in the MoveMore campaign in 2016), and Santander (to provide a view of the simulation exercise). Following these demonstrations, the participants were invited to provide their feedback on the two decision makers interfaces. Two participants could not provide their responses, and as a result, only six participant responses are analysed. We believe that though the number of participants are low, the significant expertise, experience and knowledge of the participants were extremely important to provide us formative evaluations of the two interfaces. The two interfaces were evaluated separately, via two different evaluation sheets².

Citizen Observatories

The Citizens Observatories Decision Makers' Interface presented in D5.2 was evaluated with five decision makers. The data being presented was from the simulation exercise at Santander. Figure 7 presents an overview of the quantitative questions for the evaluation.

² Citizens Observatories evaluation form available at <https://goo.gl/forms/iEIAJEmB041NkqFD2> and Origin-Destination evaluation form available at <https://goo.gl/forms/w7nlcsiCQJfjDdtA2>

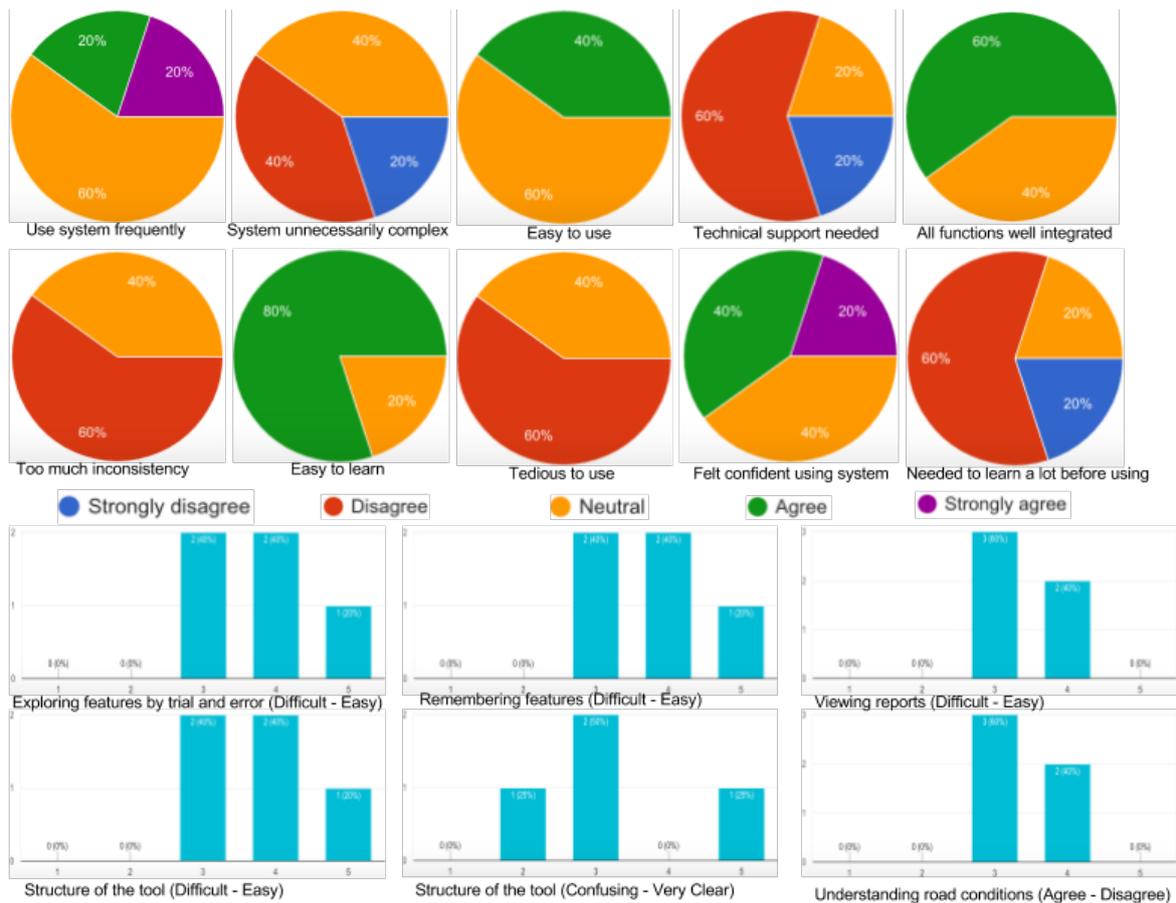


Figure 7: Objective feedback responses from questionnaire on Citizens Observatories.

The subjective questions were aimed at collecting feedback on things in the system that the participants appreciated as well as elements that would need improvements on. Among the positives of the Citizens Observatories interface, participants liked the layout and the ease of use. They also appreciated that citizens have the ability to report on incidents as well as provide images of the traffic. Participants highlighted that the reports could be better presented on the map as well as list views. For example, different colours could be used to represent different types of reports such as road-work, blocks, traffic etc. All participants also agreed they find the system helpful for their jobs, while one participant also suggested to connect such datasets with existing systems: *‘useful to show case patterns of incidents and behaviours to then look in how these reporting incidents are linked to current main systems of reporting’*. Another participant also mentioned using such data to make decisions on where new infrastructure can be provided. Participants also highlighted that such systems would be helpful to understand *‘public views on the routes like if there is a traffic issue’*.

Origin Destination Analysis

The Origin Destination Interface presented in D5.2 was evaluated with five decision makers. The data being presented was from the simulation exercise at Santander, in addition to Sheffield and Birmingham data. Figure 8 presents an overview of the quantitative questions

for the evaluation.

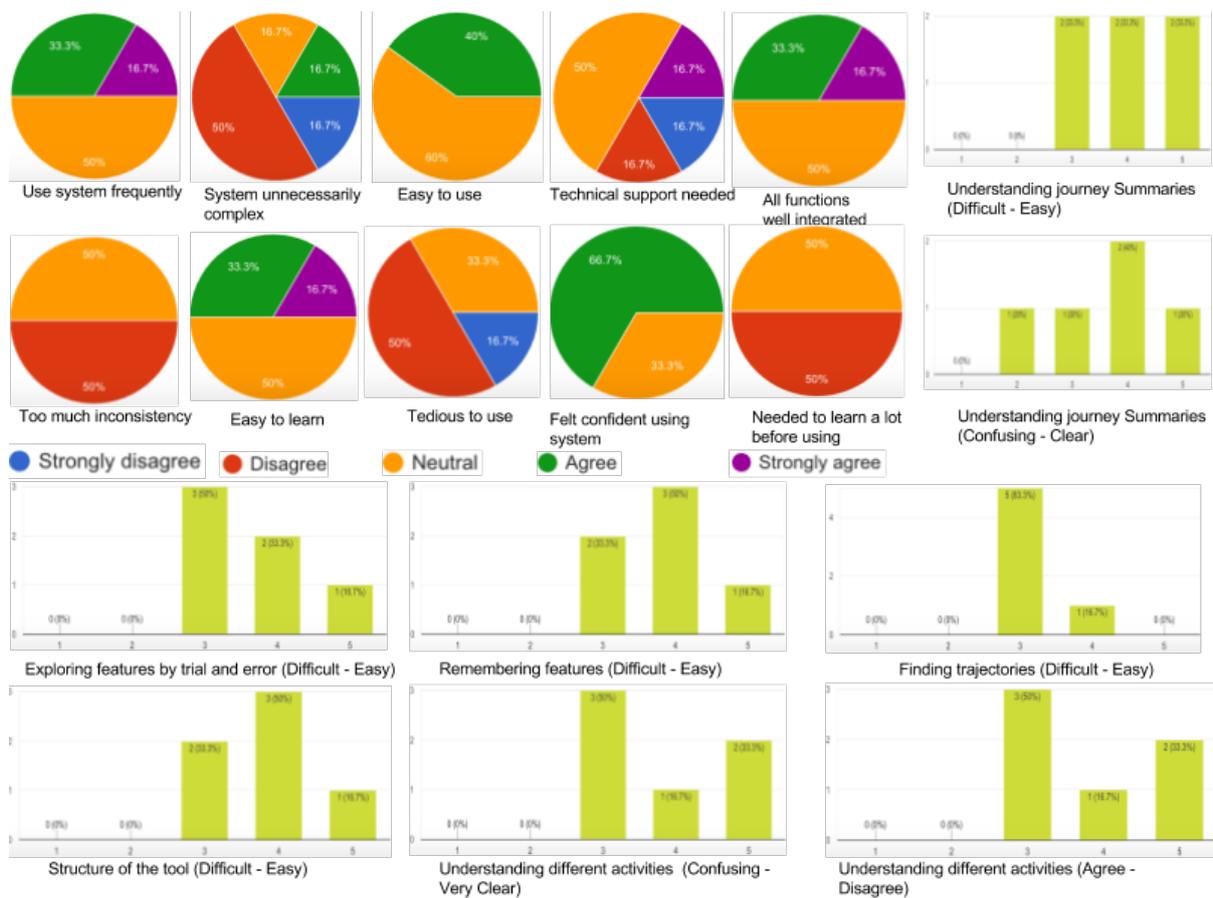


Figure 8: Objective feedback responses from questionnaire on Origin Destination Interface.

As for Citizens Observatories, several subjective questions were also asked to the decision makers on their impressions of the systems. Participants appreciated the idea of understanding the routes citizens take and the way of using ‘postcodes to track a route and what kind of travel method was used’. They also appreciated the overall look and feel of the system as well as the ease of use. One participant noted when asked what they liked about the system: ‘The ability to look at real journeys and mode of transport, and use this insight to inform and drive our decisions.’. On being asked how the system can be improved, noted that the use of legends would be very helpful at helping users understand routes and number of journeys much better. The participants noted that they find the system very helpful as ‘it could help get data on the city about travel/traffic flow and what routes are more used and by what means i.e by car or bikes etc.’ and ‘might be useful for gaining insights into soft modes’. At the same time, one participant mentioned that the visual approach employed by the system is ‘very useful to visualise data for decision makers’. In addition to using existing approaches, it was observed that the system would be very helpful in providing complementary insights. For example, understanding transport behaviour across the city as well as gaining insights into soft modes. One participant mentioned that such data is currently unavailable to decision makers and hence will help them gather a better

The participants carried their own personal mobile devices, split as follows (Figure 10) in terms of Operating Systems.

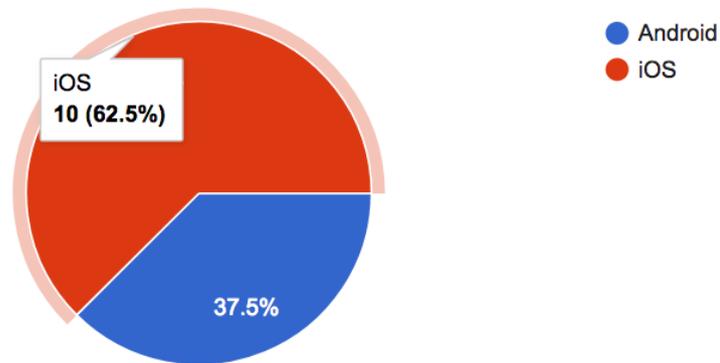


Figure 10: App version used by Simulation Exercise users

Regarding the ease of use of the app, almost all participants found the app easy to use (76% would agree or strongly agree the app was easy to use (Figure 11) and felt confident whilst using it (Figure 12).

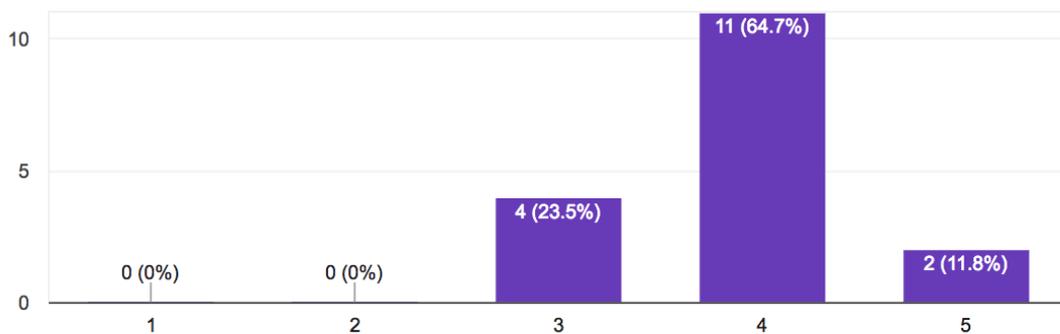


Figure 11: App evaluation questionnaire response for ease of use

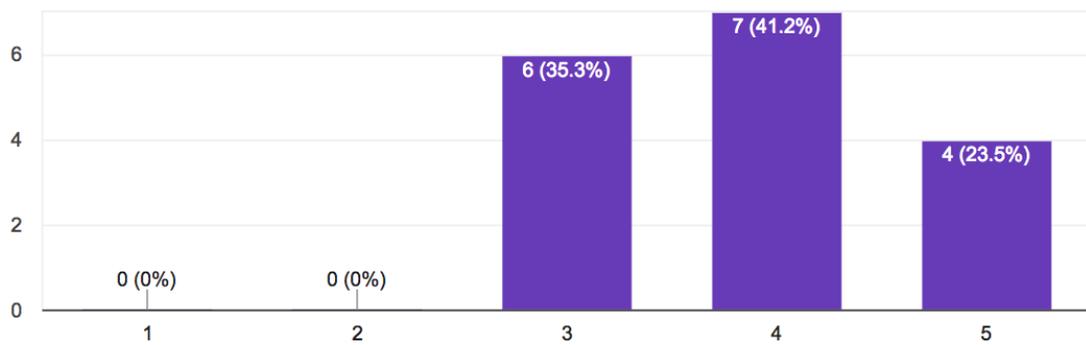


Figure 12: App evaluation questionnaire response on confidence in using the App

Users also rated highly the fact that the app functionalities are easy to remember (see Figure 13)

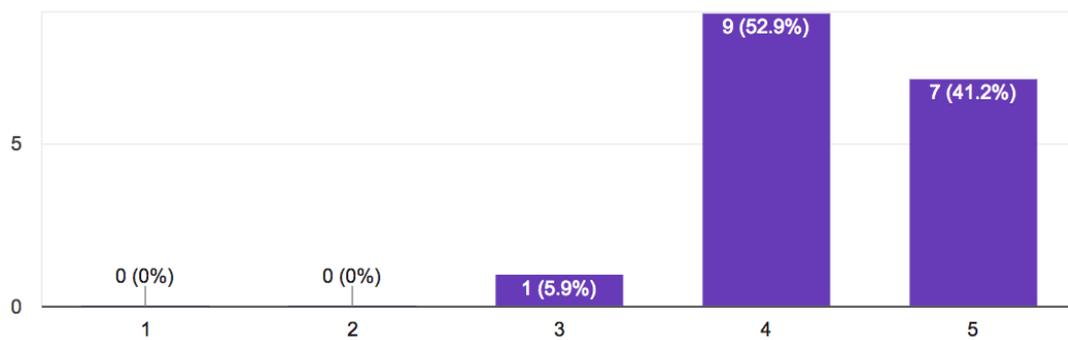


Figure 13: App evaluation questionnaire response for easy to remember

And the design (see Figure 14)

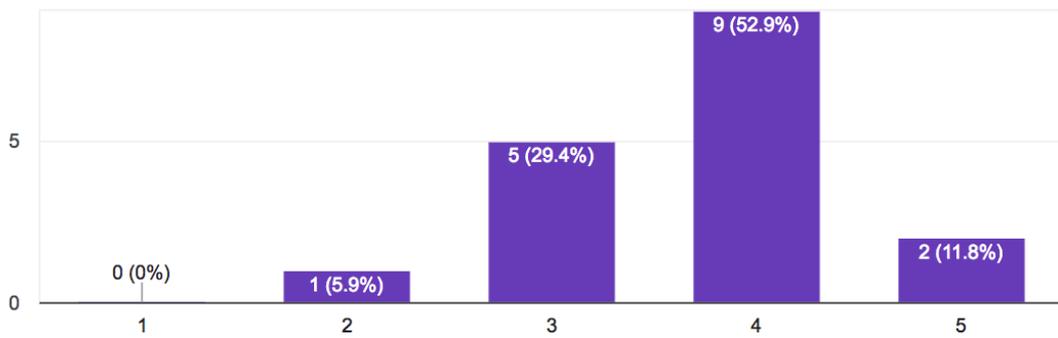


Figure 14: App evaluation questionnaire response for the design of the App

The result was corroborated by impressions collected using the questionnaires and during interviews:

- *“nice and clear display - not complicated”*
- *“Easy to use, worked as intended”*
- *“I liked the simplicity”*
- *“Easy of use, look and simple styling”*

Whilst the different functionalities of the app were appreciated by the users, the integration was rated not optimal, with 47% of users disagreeing or mildly disagreeing, and only 53% of users considering the functionalities well integrated.

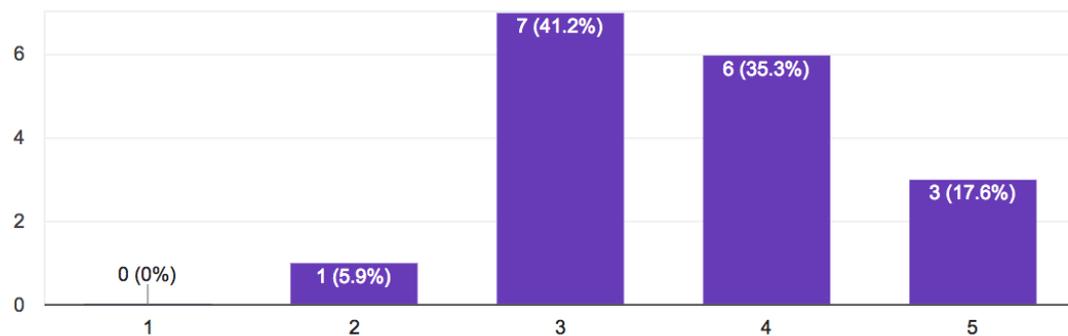


Figure 15: App evaluation questionnaire response on Integration of all the features

Looking at the comments and the interviews, this theme emerges again:

- *“Did not understand how to save personal details, and did not understand the function of bus trip:*
- *“When I've finished sending feedback it should return me back to the dashboard.”*
- *“The flow could be made easier”*

Overall the participant appreciated mostly the features that the app was offering, with several participants commenting how they enjoyed being aware of the calories they consumed and of *“the fact that it automatically detects the modality of transport”*.

The accuracy of tracking, whilst being one of the most appreciated features, it is also the one that attracted more criticism, due to the complicated nature of tracking and recognising movements.

In the questionnaire the accuracy, 47% disagreed or strongly disagreed that the app was accurate, whilst 23.5% were neutral and 29.4% rated it accurate. Analysing the data by OS did not highlight significant differences between perceived accuracy in iOS and Android.

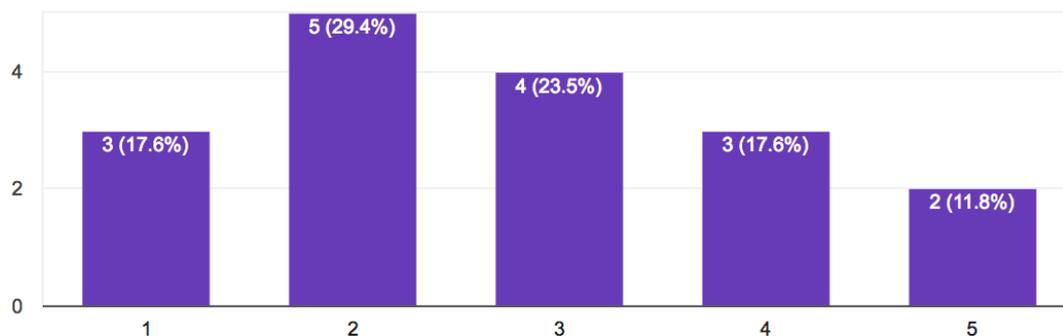


Figure 16: App evaluation questionnaire response for Activity Recognition

Looking at the comments and interviews, participants appreciated that:

- *“It records activity in the background without any intervention”*
- *“recognises different transport types, bus, walking”*

They however commented critically on the accuracy of the tracking in difficult situations (*“tracking through tunnel not good - jumps around”*), on the transport recognition (*“All my cycling was recognised as walking. It incorrectly says I took one bus journey.”*) and on the exactness of the GPS points (*“The exact journeys were not accurate as I did not go down that exact route”*).

Other criticisms were focused on the way the information about tracking is displayed (*“Journey lengths in time don't match the start and end times”*, *“The timing of the app seemed off.”*) and on battery consumption (*“the app consume too much battery”*, *“Need to understand information on battery and data consumption”*).

6 Logistics App Evaluation

6.1 Methodology

Couriers need a way to search quickly through free bay area and book fast the nearest. They are working tight schedules and don't need obstacles that get in their way. The goal of the app design was to create a streamlined and simple experience to help them work better.

Accordingly to the user-centred design paradigm adopted, an evaluation of the preliminary technologies has been carried out to ensure:

- they are technically functional;
- they respect the requirements identified in D5.2;
- they are usable;
- that any early feedback can be incorporated in the final version of the technologies.

To obtain such a feedback from early adopters, feedback about the app usage has been surveyed to collect suggestions and criticism about the Logistic App and its features.

6.2 Data collection

The questions presented in the survey related to the Logistic App where the following:

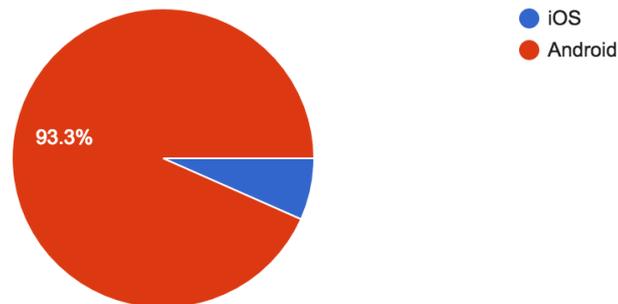
- App version (iOS, Android);
- Is the app easy to use? (1-5);
- Are you comfortable using the app? (1-5);
- Do you think app functions are easy to remember? (1-5);
- Is the app graphically nice? (1-5);
- Is the location service precise? (1-5);
- Do you think the app saves your time? (1-4);
- Is the app useful to find a load/unload bay near your destination? (yes/no);
- Do you find the check-in/out process easy? (1-4);
- Do you find the virtual "parking disk" useful? (1-5);
- Are you comfortable with park abuse reporting function? (yes/no);
- Do you know that reporting has not legal validity? (yes/no).

In addition to those questions, there is a free compilation data field to accept suggestion from early adopters.

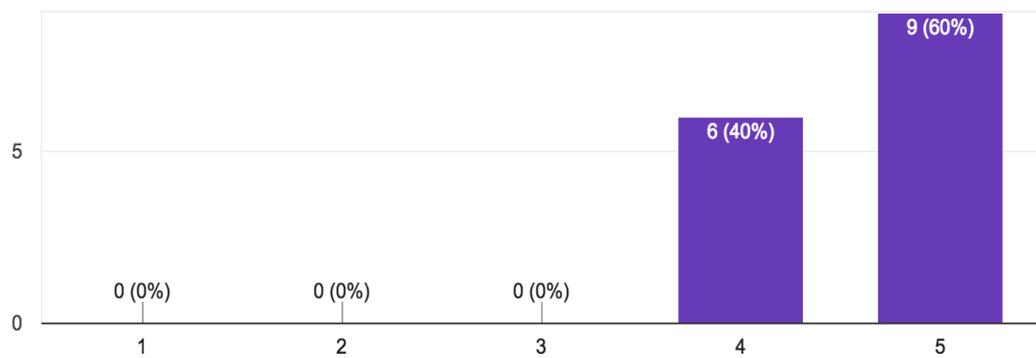
6.3 Results

The results of the survey were calculated on the responses of 15 people, below the results for each question:

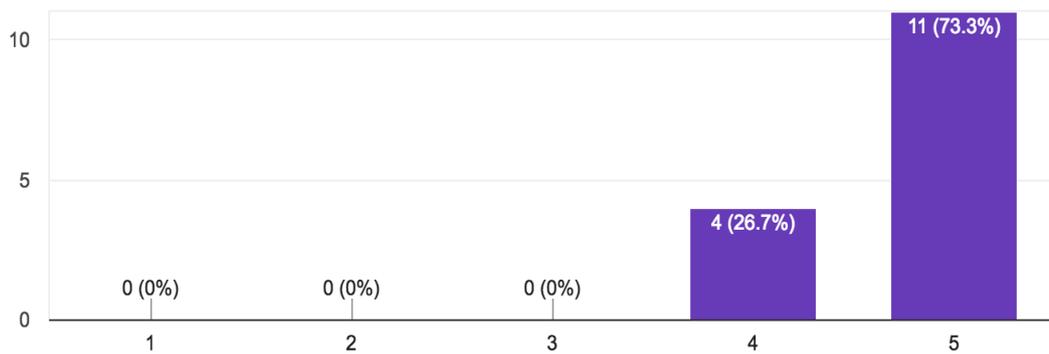
1. App version:



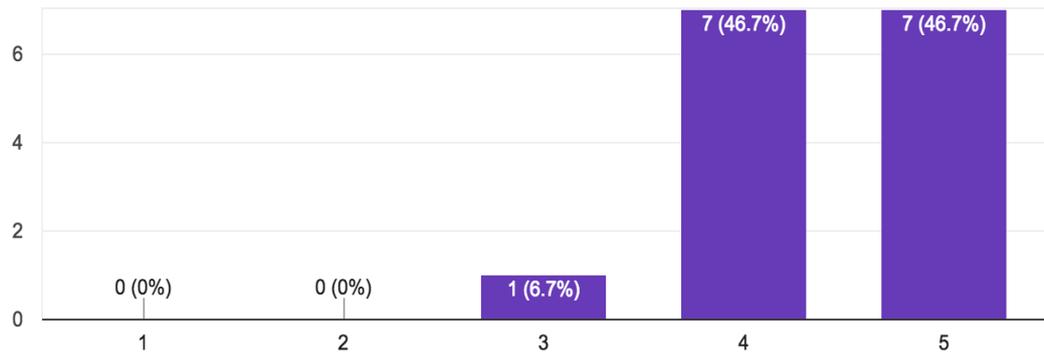
2. Is the app easy to use? (1 very complex - 5 very simple):



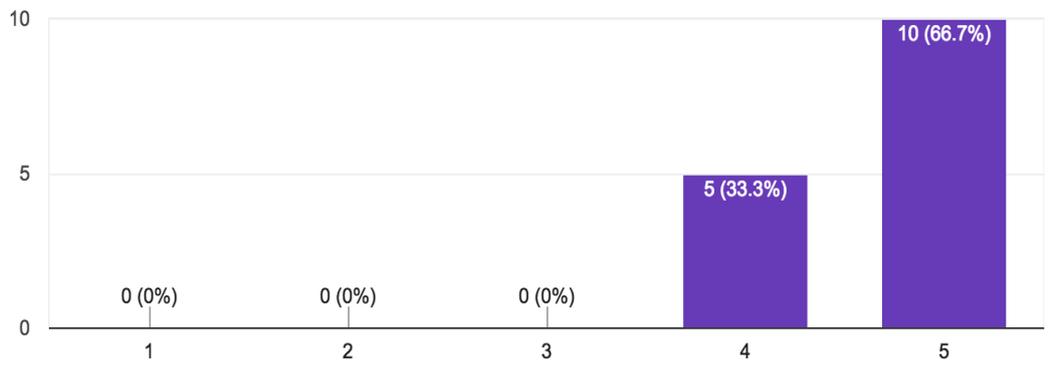
3. Are you comfortable using the app? (1 very little - 5 very much):



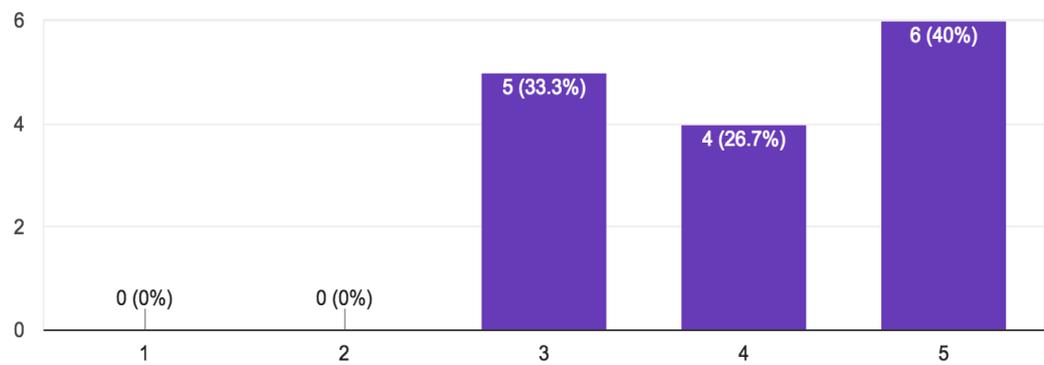
4. Do you think app functions are easy to remember? (1 very little - 5 very much):



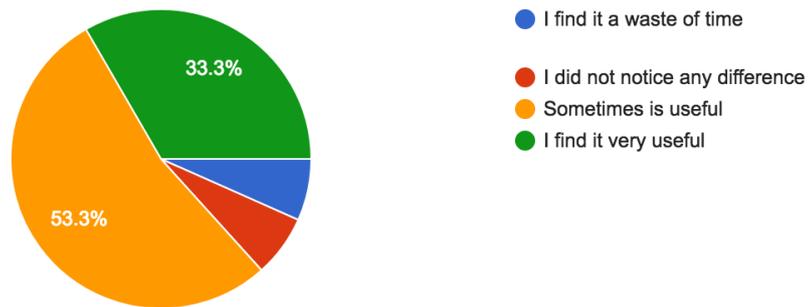
5. Is the app graphically nice? (1 very little - 5 very much):



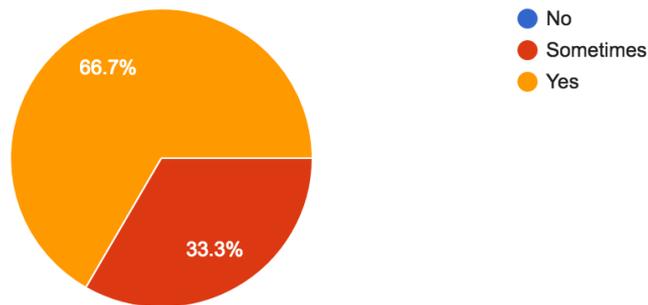
6. Is the location service precise? (1 very little - 5 very much):



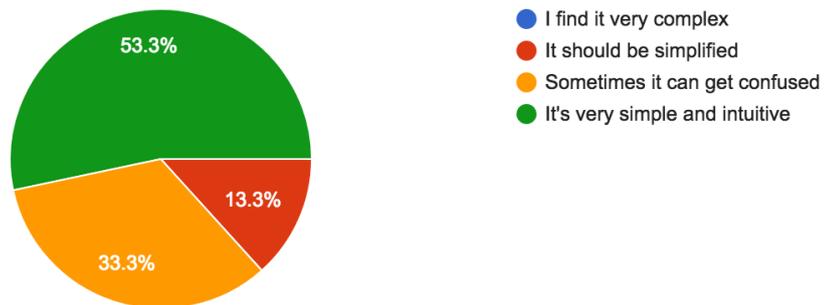
7. Do you think the app saves your time?



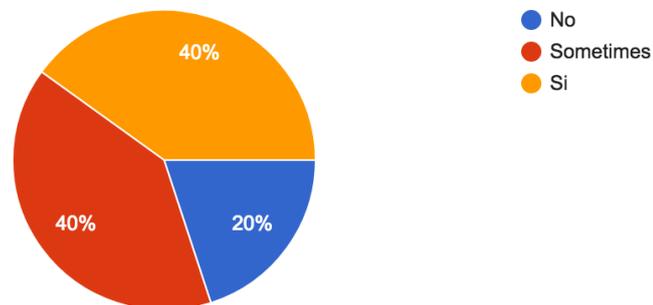
8. Is the app useful to find a load/unload bay near your destination?



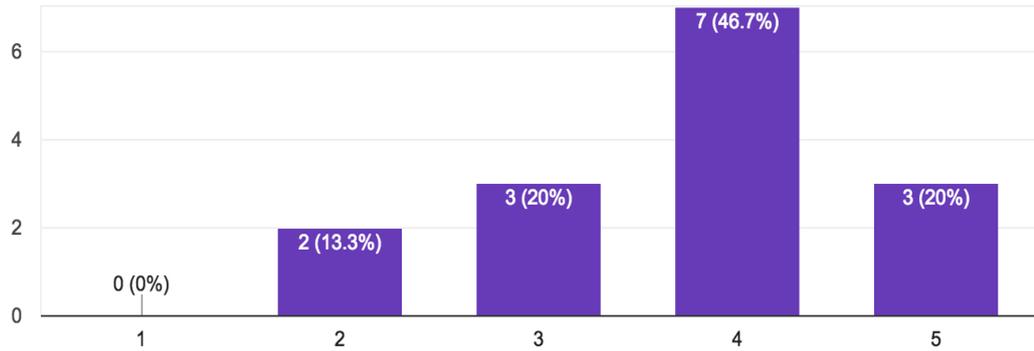
9. Do you find the check-in/out process easy?:



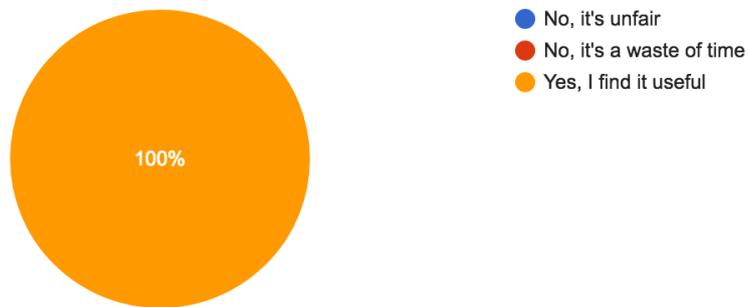
10. Do you find it useful to explicitly say that you leave a parking lot and/or you have no intention of using it?



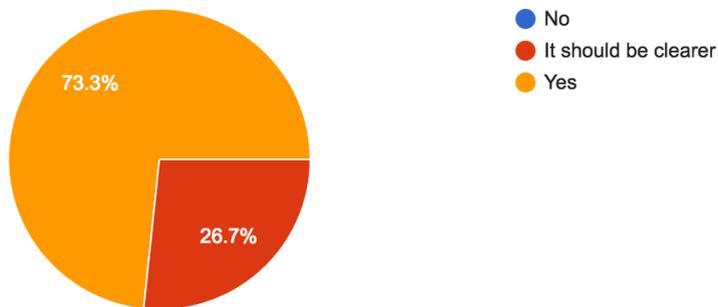
11. Do you find the virtual “parking disk” useful? (1 very little - 5 very much)



12. Are you comfortable with park abuse reporting function?



13. Do you know that reporting has not legal validity?



The overall judgment of the application was quite positive. The mobile app proved to be quite simple and comfortable to use, the main purpose of the app was well valued. The mobile app received some useful feedbacks in order to improve the user experience and to improve communication of the functionalities. Two of the most critical point is related to the precision of the location service, and the virtual “parking disk” even if those are not the main tasks of the app, we will analyze in deep the points in order to improve it.

7 Routing Engine Evaluation

7.1 Methodology

Decision makers need a complete application that allows traffic and mobility data analysis, combining multiple dimensions. The interface must be easy to use and has to offer a double approach: a simple interface to quickly glance at pre tailored data sets, and a complete, yet easy to configure, tool to customise all collected data in every possible way.

Accordingly to the user-centred design paradigm adopted, an evaluation of the preliminary technologies has been carried out to ensure:

- they are technically functional;
- they respect the requirements identified in D5.2;
- they are usable;
- that any early feedback can be incorporated in the final version of the technologies.

To obtain such a feedback from early adopters, feedback about the app usage has been surveyed to collect suggestions and criticism about the Decision Maker Dashboard and its features.

7.2 Data collection

The questions presented in the survey related to the Logistic App were the following:

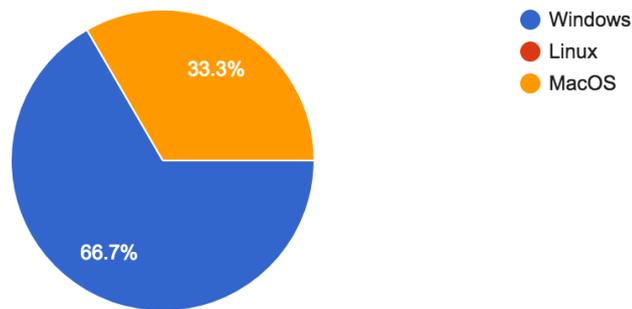
- Operating system
- Browser type
- Browser version
- Do you find the app easy to use? (1-5)
- Are you comfortable using the app? (1-5)
- Are the app functions easy to remember? (1-5)
- Is the app graphically nice? (yes/no)
- Is the sidebar intuitive? (1-5)
- Is the suggested route feature useful to find alternatives to your usual routes? (yes/no)
- Is the sensors grouping and their graphic rendering easy to read? (yes/no)
- Is the sensors' details visualisation clear to understand (stats and measurements)? (yes/no)
- Is the 3D map rotation useful? (yes/no)
- Do you find the route 3D rendering useful? (yes/no)

In addition to those questions, there is a free compilation data field to accept suggestion from early adopters.

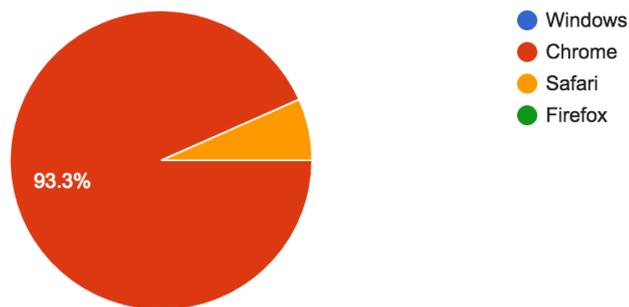
7.3 Results

The results of the survey were calculated on the responses of 15 people, below the results for each question:

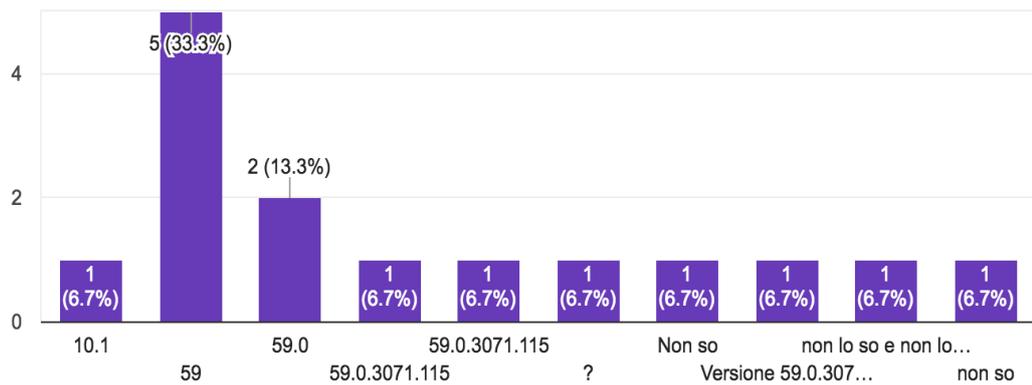
1. Operating system



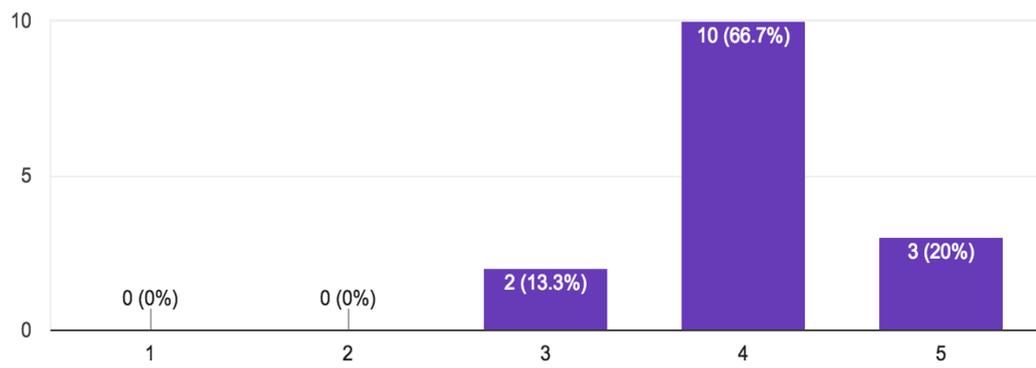
2. Browser type



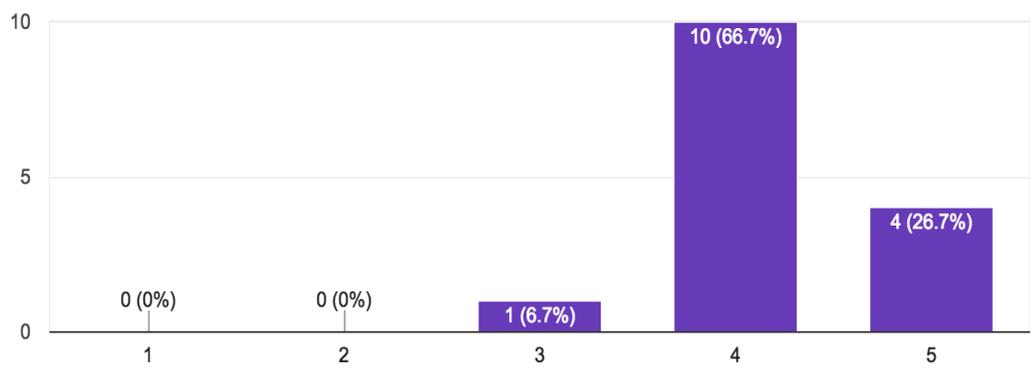
3. Browser version



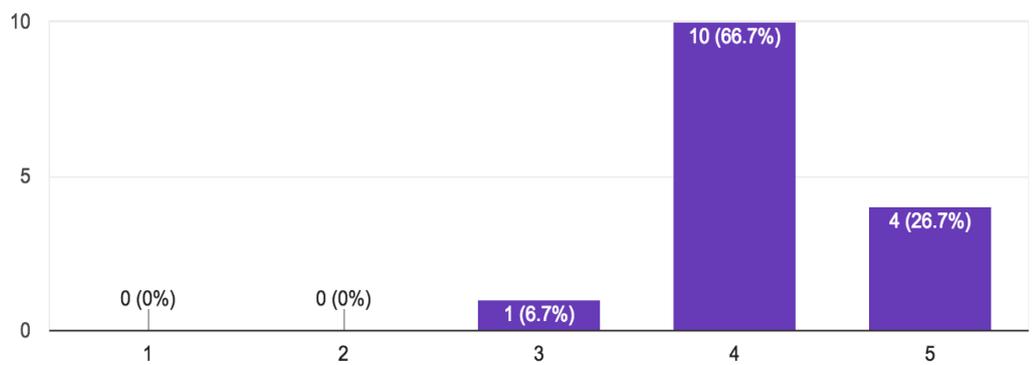
4. Do you find the app easy to use? (1 very little - 5 very much)



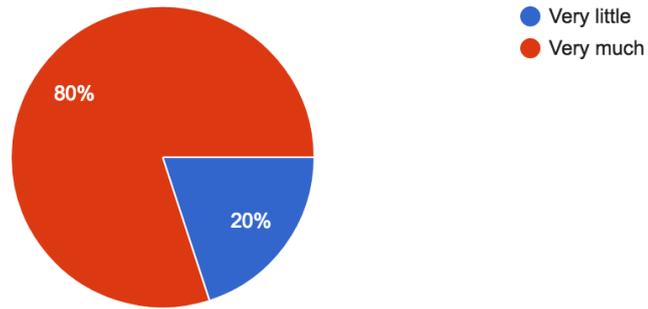
5. Are you comfortable using the app? (1 very little - 5 very much)



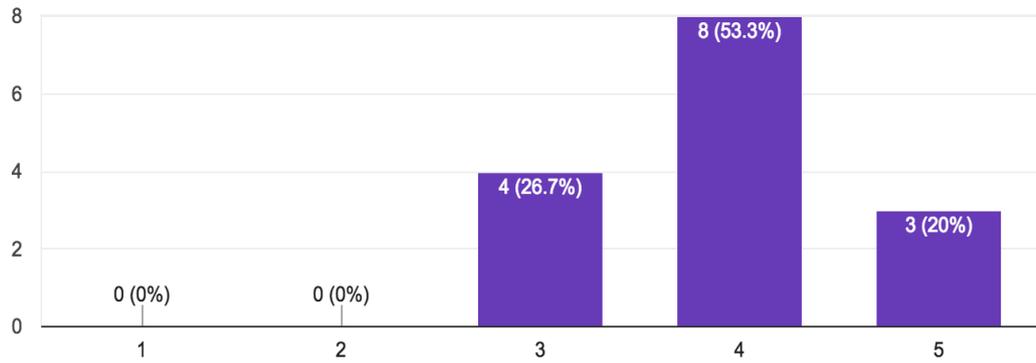
6. Are the app functions easy to remember?(1 very little - 5 very much)



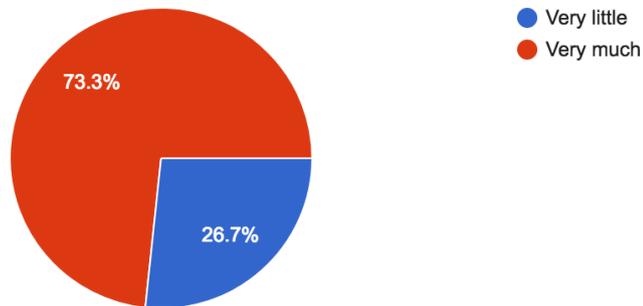
7. Is the app graphically nice?



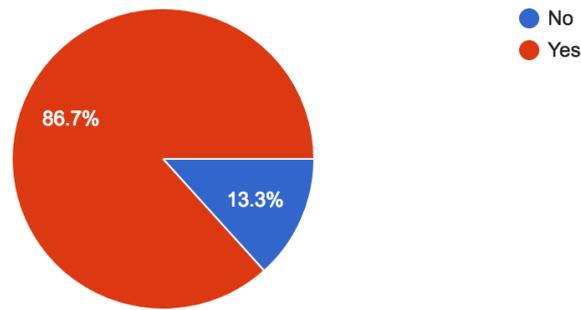
8. Is the sidebar intuitive? (1 very little - 5 very much)



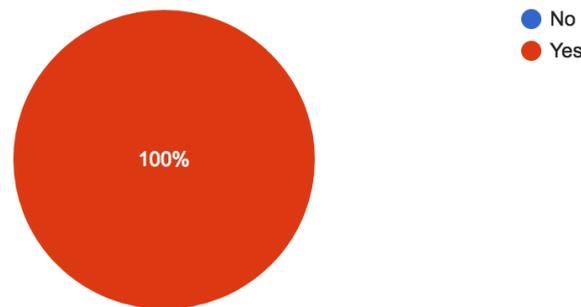
9. Is the suggested route feature useful to find alternatives to your usual routes?



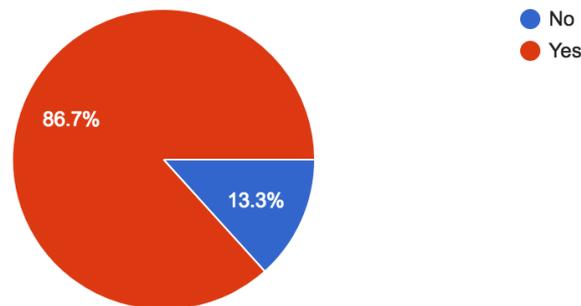
10. Is the sensors grouping and their graphic rendering easy to read?



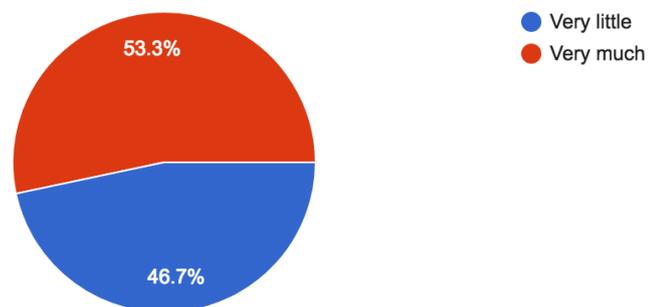
11. Is the sensors' details visualisation clear to understand (stats and measurements)?



12. Is the 3D map rotation useful?



13. Do you find the route 3D rendering useful?



The overall judgment of the application was quite positive. The web app proved to be simple and comfortable to use, the main purpose of the app was well valued. The web app received some useful feedbacks in order to improve the 3d visualization and to improve the data analytics views. Based on the answers the sidebars and the 3d visualization could be improved in order to best fit the user needs, and the users expected more data analytics aggregation.

8 Conclusions

The previous sections present the initial evaluations of the technologies and methodologies developed in SETA project for visual analytics and decision support. The technologies have been evaluated in simulated scenarios and the initial evaluation results presented show that the technologies achieved the expected performances. The systems will, in the next few weeks start to be deployed in larger scale to be evaluated in over long term.

In the phase two of development, the system for visual analytics and decision support will integrate the remaining requirements and the valuable feedback received during the first evaluation.

9 Appendix A: Consent Form

Title of Research Project: Seta Technologies Evaluation

Name of Researcher:

Participant Identification Number for this project:

Please initial box

1. I confirm that I have read and understand the information sheet/letter (delete as applicable) dated *[insert date]* explaining the above research project and I have had the opportunity to ask questions about the project.

2. I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason and without there being any negative consequences. In addition, should I not wish to answer any particular question or questions, I am free to decline. *Insert contact number here of lead researcher/member of research team (as appropriate).*

3. I understand that my responses will be kept strictly confidential (only if true).

I give permission for members of the research team to have access to my anonymised responses. I understand that my name will not be linked with the research materials, and I will not be identified or identifiable in the report or reports that result from the research.

4. I agree for the data collected from me to be used in future research

5. I agree to take part in the above research project.

Name of Participant
(or legal representative)

Date

Signature

Name of person taking consent
(if different from lead researcher)

Date

Signature

To be signed and dated in presence of the participant

_Suvodeep Mazumdar_____

Lead Researcher	Date	Signature
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10 Appendix B: Questionnaires

10.1 Mobile App Evaluation Questionnaire

The Seta mobile App evaluation was conducted via Google Forms, available at <https://goo.gl/forms/tbFLz7UITggHblf03>

The following screenshots present the questionnaire

SETA Mobile App Evaluation

Thanks for agreeing to participate in the Seta Phase 1 evaluation. The aim of this evaluation is to evaluate the first iteration of the technologies developed in the Seta project. For this evaluation, we will be focussing on testing various aspects of different technologies. In this evaluation, we will try to understand how the Seta Activity Tracking App performs under simulated conditions.

* Required

Email address *

Your email

Task performed - please enter the task details in brief

Your answer

Version of the app

Android

iOS

I would like to use the App frequently

1 2 3 4 5

Disagree Agree

I found the App unnecessarily complex

1 2 3 4 5

Disagree Agree

I thought the App was easy to use

1 2 3 4 5

Disagree Agree

I think I would need the support of a technical person to be able to use this App

1 2 3 4 5

Disagree Agree

I found the various functions in this App well integrated

1 2 3 4 5

Disagree Agree

I thought that there was too much inconsistency in the App

1 2 3 4 5

Disagree Agree

I would imagine that most people would learn to use this App quickly

1 2 3 4 5

Disagree Agree

I found the App very tedious/troublesome to use

1 2 3 4 5

Disagree Agree

I felt very confident using the App

1 2 3 4 5

Disagree Agree

I needed to learn a lot of things before I could get going with the App

1 2 3 4 5

Disagree Agree

I feel that the App is well designed

1 2 3 4 5

Disagree Agree

I feel that the structure of the App is well laid-out

1 2 3 4 5

Disagree Agree

Exploring new features by trial and error is

1 2 3 4 5

Difficult Easy

Remembering features and how to use them is

1 2 3 4 5

Difficult Easy

Understanding the structure of the App is

1 2 3 4 5

Difficult Easy

I found the process of submitting observations via the App (e.g. report on the availability of parking space, submitting issues/reports)

1 2 3 4 5

Difficult Easy

Understanding the different levels of activities and durations is

1 2 3 4 5

Difficult Easy

The recognition of activities in the app was accurate

1 2 3 4 5

Disagree Agree

What are the things that you like about the App ?

Your answer

What are the things that you dislike about the App?

Your answer

Are there any comments you would like to make about your experience?

Your answer

Never submit passwords through Google Forms.

10.2 Decision Maker Interface Evaluation Questionnaire: Citizens Observatories

The Seta Citizens Observatories Interface evaluation was conducted via Google Forms, available at <https://goo.gl/forms/1EUzoZswlOiGv1Z63>

Seta Decision Maker's Platform - Citizens Observatory

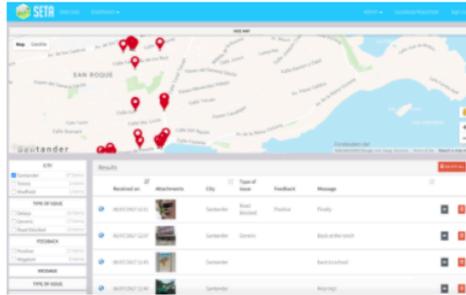
Thanks for agreeing to participate in the Seta Phase 1 evaluation. The aim of this evaluation is to evaluate the first iteration of the technologies developed in the Seta project. For this evaluation, we will be focussing on testing various aspects of different technologies. In this evaluation, we will try to understand how the Seta Decision Maker's platform focussed on Citizens Observatories performs under simulated conditions.

* Required

Email address *

Your email

SETA Citizens Observatories Platform



I think I would like to use the system frequently

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

I found the system unnecessarily complex

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

I thought that the system was easy to use

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

I think I would need the support of a technical person to be able to use the system

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

I found the various functions in the system were well integrated

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

I thought there was too much inconsistency in this system

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

I would imagine that most people would learn to use this system very quickly

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

I found the system very tedious/troublesome to use

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

I felt very confident using the system

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

I needed to learn a lot of things before I could get going with the system

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

Exploring new features by trial and error is

	1	2	3	4	5	
Difficult	<input type="radio"/>	Easy				

Remembering features and how to use them is

	1	2	3	4	5	
Difficult	<input type="radio"/>	Easy				

Understanding the structure of the tool is

	1	2	3	4	5	
Difficult	<input type="radio"/>	Easy				

	1	2	3	4	5	
Confusing	<input type="radio"/>	Very clear				

I found the process of viewing the reports in the Citizen Observatory Platform

	1	2	3	4	5	
Difficult	<input type="radio"/>	Easy				

I found it easy to understand the various conditions of road and issues while using the Citizen Observatory Platform

	1	2	3	4	5	
Strongly Agree	<input type="radio"/>	Strongly Disagree				

What are the things that you like about the system?

Your answer

What are the things that you dislike about the system?

Your answer

Would you consider this system for your job ? How useful would it be?

Your answer

What additional insights can you derive from this system that you currently do not have access to?

Your answer

Are there any other comments you would like to make about your experience?

Your answer

SUBMIT

Never submit passwords through Google Forms.

10.3 Decision Maker Interface Evaluation Questionnaire: Origin Destination Analysis

The Seta Origin Destination Analysis Interface evaluation was conducted via Google Forms, available at <https://goo.gl/forms/essLpRkSUEAoQrTJ2>

I found the system very tedious/troublesome to use

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

I felt very confident using the system

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

I needed to learn a lot of things before I could get going with the system

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

Exploring new features by trial and error is

	1	2	3	4	5	
Difficult	<input type="radio"/>	Easy				

Remembering features and how to use them is

	1	2	3	4	5	
Difficult	<input type="radio"/>	Easy				

Understanding the structure of the tool is

	1	2	3	4	5	
Difficult	<input type="radio"/>	Easy				

I found the process of understanding the different activities in the city

	1	2	3	4	5	
Difficult	<input type="radio"/>	Easy				

	1	2	3	4	5	
Confusing	<input type="radio"/>	Very clear				

I found the process of finding the trajectories between areas in the city

	1	2	3	4	5	
Confusing	<input type="radio"/>	Very clear				

	1	2	3	4	5	
Difficult	<input type="radio"/>	Easy				

	1	2	3	4	5	
Exhausting	<input type="radio"/>	Simple/Refreshing				

Understanding the summaries of the journeys was

	1	2	3	4	5	
Confusing	<input type="radio"/>	Very clear				

	1	2	3	4	5	
Difficult	<input type="radio"/>	Easy				

What are the things that you like about the system?

Your answer

What are the things that you dislike about the system?

Your answer

Would you consider this system for your job? How useful would it be?

Your answer

What additional insights can you derive from this system that you currently do not have access to?

Your answer

Are there any other comments you would like to make about your experience?

Your answer