Specific Targeted Research Projects (STReP)

SOCIOTAL
Creating a socially aware citizen-centric Internet of Things

FP7 Contract Number: 609112

D6.5 Community feedback (M33)

Deliverable report

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0.1	10.05.2016	Table of content proposed	DNET
0.2	10.06.2016	Hackathon details added	DNET
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0.6	24.06.2016	Introduction, conclusion and smaller revisions of different sections	DNET
1.0	30.06.2016	Final version for submission	DNET

Table of content

Section 1 - Introduction

The key goal of the WP6 is to create an environment that encourages citizen participation in an IoT. A deep understanding of citizens and their respective concerns and needs can was achieved in cooperation with the end-users during different workshops, meetups and similar events. The dialogue and engagement with different communities throughout the project life time was done engaging target end-user ecosystem.

WP6 delivers input to WP1 in terms of use cases and requirements from different communities, namely citizens and service developers. This encompasses the capturing of user insights, explicit use case ideas and requirements as well as an overall validation of the requirements developed in WP1. At later stages of the project the evaluation of the project results becomes more important as the results are available to the end-users. The evaluation itself was taken as an action in WP1 as a preliminary API evaluation; and further carried on in WP6 to evaluate the beta platform release.

This report provides an evaluation on the usability of the developed SocIoTal tools and enablers by both user's (citizens) and developer's communities. It also shows the outcomes of the Hackathon competition with two user focus groups: developers and non-developers. Developers are professional users who will work with the SocIoTal tools to make commercial or non-commercial applications with the added value of the Privacy by co-design in 'bubbles' (specific combinations of people, things and services). Non-developers are interested citizens who will use the SocIoTal User Environment (or SocIoTal Personal Dashboard). The evaluation is done by IoT makers, developers community and citizens to provide sufficient sample and feedback about the platform usability for different focus groups.

The document is structured as follows. In Section 2 methodologies in software usability evaluation are presented. Community feedback from meetups that provided evaluation about the project and project results is given in Section 3. The Hackathon as a main vehicle for evaluation of the project platform is presented in Section 4, providing details about the organization of the event, its goal and the outcomes of the competition, as well as analysis of the usability evaluation. The document is concluded with Section 5.

Section 2 - Methodologies in software usability evaluation

In this section methodologies for evaluation of the software usability are presented. The final set of methodology is depicted to evaluate the usability of the SocIoTal platform, which results are presented in the Section 4.3. In the section a survey on methodology presents Question-asking protocol, Coaching, Performance measurement, Congnitive Walkthrough, Pluralistic Walkthrough

2.1 Question-asking Protocol

One of the methods for evaluating software usability is to set predefined questions wherein participants answers direct questions about the interface. The goal of such questioning is to enable the tester to get an even better understanding of the participant's mental model of the system" [1].

2.2 Coaching Method

A coaching or mentoring allows participants to ask any system-related questions of an expert coach during usability testing. Usually, the tester acts as the expert coach, but it is possible to have a separate tester serving as a coach. The latter approach may allow the tester to gain additional usability insight through observing the interaction between the participant and coach. In cases where an expert user serves as the coach, this also enables the tester to analyze the expert user's mental model of the system. The main goal of this method is to determine the information needs of users to provide better training and documentation in addition to possibly redesigning the interface to eliminate the need for questions in the first place. It is also possible for the tester to control the answers given to questions during testing to discover what types of answers help users the most [1].

During the Hackathon, mentors were assigned to teams with a goal to lead the participants through their tasks. Also, the mentors were evaluating the questions about the platform and the participant's ability to perform the task.

2.3 Performance Measurement

The goal of this testing method is to capture quantitative data about participants' performance when they complete tasks. As such, there is usually no interaction between the tester and participant during the test. Evaluators usually conduct such testing in a usability lab to facilitate accurate data collection and to minimize interference. Sometimes this method is combined with other techniques to capture qualitative data as well, such as retrospective testing [1].

2.4 Cognitive Walkthrough and Pluralistic Walkthrough

Cognitive walkthrough uses a more explicitly detailed procedure to simulate a user's problem solving process at each step through the dialogue, checking if the simulated user's goals and memory content can be assumed to lead to the next correct action [2].
This is a variation of the cognitive walkthrough inspection method wherein representative users, evaluators, and developers inspect the interface as a group. The goal of this method

is to step through usage scenarios and discuss usability issues that arise in the scenario steps.
The pluralistic usability walkthrough adapted the traditional usability walkthrough to incorporate representative users, product developers, members of the product team, and usability experts in the process.
In the process evaluation of the SocIoTal platform using Pluralistic Walkthrough, the participants of the Hackathon were given a task (the task to realize their idea as a service), and with questionnaire about the experience while doing the task, data was captured with questionnaire. The Pluralistic Walkthrough must meet the following requirements: inclusion of representative users, product developers, and human factors professionals and all participants must assume the role of the user [3][4][5]. The inclusion is met with the organisation structure of the Hackathon which enables end-users with different background to participate in the event.

2.5 Questionnaires

A questionnaire is a measurement tool designed to assess a user's subjective satisfaction with an interface. It is a list of questions that are distributed to users for responses. Responses on a questionnaire are usually quantitative (e.g., ratings on a 5-point scale). [1]. The questionnaires have been used in SocIoTal as a method for evaluation.

Section 3 - Community feedback from meetups

Each innovation is risky in terms of its success and there are attempts trying to indirectly tackle uncertainties that may arise around innovation itself. One strategy is Responsible research and innovation (RRI), which as a main driver fosters involvement of society from the beginning to the end in the innovation process [x1][x2]. According to Stahl et al, core features of the RRI in ICT are product, process, purpose and people; where the focus in on the purpose of the development needs as well as on the people involved in the innovation, i.e. co-creation of the product. In that term, workshops are used as a method for involving the end-users into the

3.1 Workshop in Grenoble

3.1.1 Grenoble IoT Makers community feedback

Grenoble meetup organizes periodically talks on the IoT domain. Speakers from the ecosystem of IoT (firms, university, professor…) are invited to present their product or the view of the domain. The community is composed of 242 members in June 2016, two years following its creation. The feedback is very good and the evaluation of the quality of the talks is from 4 to 5 stars, the maximum!

Here are some comments from members that come regularly. Peter Hirt, a passionate of the domain wrote: “very good level related to the variety of professionals, researchers and industry computer and electronics”. Izaro who came for the first time wrote: “Superb initiative, I would follow the upcoming events.” After the meetup on LoRA, Izaro bought devices from LoRA technology to discover its capabilities. He wrote: “Very illustrative and clear, with many details on the capabilities and constraints, I hope soon to receive a pair of antennae and I would like to completely discover all the capabilities of LoRA”.

Grenoble meetup achieves more and more success. The last session welcomed 55 people and it was necessary to find a larger room. CEA, the organizor, is now looking for an larger space to manage the growing success and the increasing number of members present.

3.2 Workshop in Cagliari

3.2.1 Organization

CRS4 organized two meetings in Cagliari hosted by the University of Cagliari and in collaboration with the "Need for Nerd" team (www.needfornerd.com) a community (of about 3000 people/developers from Italy and the rest of the Europe) targeted to developers mentoring (Figure 1).
CRS4 had the opportunity to disseminate the project, to let people experiment with the user environment and to test the platform APIs (User Environment APIs in particular). These meetings were targeted at users (as citizens), the first day and to developers, the second day. Participants were 30, in total and each participant filled an evaluation card.

Figure 1 NeedForNerd event call for SocIoTal Citizens and developers

3.2.2 Technology, Tools and Hardware

The technology provided for "non-developers" (citizens) included the SocIoTal web and mobile user environment and a live installation of two Hardware IoT devices directly connected to the SocIoTal Context Manager:

- A NetAtmo Weather station device
- An Arduino YUN device with a light sensor

Users and developers were introduced to the SocIoTal project, by the CRS4 team, showing them the main functionalities of the platform: the signup process, how to register a physical devices to the context manager, how to associate a device to a personal channel and how to create trigger action events with the data received from a subscribed device.
These tools and devices were also provided for the developers plus an introduction to the SocIoTal APIs.

Figure 2 SocIoTal User Environment introduction

Citizens had two hours to go through the platform with the support of the CRS4 team. They found the dashboard well designed and they could connect easily their Android smartphones to receive notification from a trigger action event.

Figure 3 Citizens testing the platform with the CRS4 support

The day after the developers had two hours to do some experiments with SocIoTal. They started to use the web user environment and they tried to connect some devices using API. Some developers brought personal devices to the event and connected them to the context manager and the user environment.

Figure 4 Developers testing the APIs with the CRS4 support

3.2.1 Developers and citizens community feedback

Generally, the feedback from citizens was good and they considered the platform handy and useful to easily manage personal IoT devices and connect them to other Internet services. They found the graphic and the usability of the user environment pretty nice and were also happy to easily share personal device data with other people.
The privacy aspect was considered crucial and even if they were worried about the storage of the personal device data, they appreciated the concept of the community to share their devices with trusted people.
Users gave some suggestions to improve the usability of the platform: for example, they considered that it was good to improve the notification system, they suggested to translate the user environment into more languages, they suggested a notification system with audio and images and they recommended to expand the combination of the trigger action events.

The developer's feedback was also good. They found the SocIoTal APIs well-structured and they liked the use of the REST standard. Sometimes they found some bug and generally they wanted a more exhaustive documentation with more examples.

Section 4 - Hackathon

The Hackathon was held during the IoT Week 2016 in Belgrade, covering 3 days in total of development and preparation for the presentation of the services made using the provided technology. The event was organized by ICT research project SocIoTal, RERUM, ClouT, ALMANAC and TagItSmart; and it was supported by a local Microsoft department in Belgrade. The goal of the Hackathon was to evaluate the set of APIs, tools and enablers from the project using software evaluation methodologies presented in section 2.

4.1 Organisation and structure of the event

4.1.1 Organisation

The call of the Hackathon was announced one month before the event to allow collecting users' idea, preparing required hardware and to coordinate mentoring of the teams. Mentoring included support for the developers for different technology enablers and utilization of the provided APIs. For "non-developers", mentors were brainstorming with teams to help with their idea realization by teaching them how to use SocIoTal user environment tools.

The text of the call is provided below:

Do you want to make your neighborhood or your city a better place? Did you ever face a problem in your community that could be solved using technology? This is your chance! Develop an application or service or build it using SocIoTal tools and technology from various ICT projects and you will be able to won significant prizes! SocIoTal is all about that, bringing power of the IoT to the citizens.

Rules are simple: Either you are a developer hacker or an ordinary guy (or a girl:) submit your idea and your team in one of 3 categories. We will select the best ideas that will be a part of Hackathon event. No ideas? Check at the end of these page application examples from the SenZations Summer School running on SocIoTal and Azure platform.

Categories:

- *Best developer service/app*
  - *Innovation aspect*
  - *Business/commercial aspect*
  - *Idea and motivation (answer the real-world problem in community, municipality or neighborhood)*
- *Best non-developer service/app*
  - *only tools used, e.g. webEnv and mobEnv, F2F enabler and Gait, + hardware*
  - *Idea and motivation (answer the real-world problem in community, municipality or neighborhood)*

The second goal of the event was to involve other ICT research projects that were provided their technology, namely these project are RERUM, Almanac, ClouT and Microsoft as an industry partner and IoT Week sponsor.

4.1.2 Technology, Tools and Hardware

The technology provided to the participants from the SocIoTal project for “non-developers” (citizens) included SocIoTal user tools and for the developers both – user environment and the SocIoTal APIs. The hardware list was formed in front to cover most of the usual set of potential use cases, as well as based on the participants’ ideas submitted.

SocIoTal user tools list provided was as follows:

- Mobile Environment (Android app – add device to workspace by QR code scanning)
- SocIoTal Web Environment (web platform – manage devices from user’s workspace)
- F2F enabler Android application for the recognition of the social context based on distance between two persons;
- Gait recognition Android application for recognition of user that utilize device based on walk pattern;
- SocIoTal Idm Issuer
- SocIoTal Capability Manager
- SocIoTal Policy Decision Point
- SocIoTal Policy Administration Points
- SocIoTal Context Manager (pub/sub component with storage capability)
- SensiNact Gateway (access to Santander, Genova, Fujisawa and Mitaka real-time data)

From other projects there were additional tools list provided:

- RERUM Gateway (pre-connected RE-Mote devices)
- Microsoft Azure (Dockerized components)
- ALMANAC Data Fusion Manager (Dockerized agent for mining and discovery; forecast more complex situations based on learnt model)
- ALMANAC LinkSmart GlobalConnect (connect local IoT and enable discovery and sharing)
- ALMANAC Smart City Resource Adaptation Layer SCRAL (REST interface with access to physical devices, networks and services for monitoring and actuating)

Hardware for the Hackathon was mostly based on Raspberry Pi with the possibility for developers to bring their own devices. Next sensors were provided to the developers and “non-developers”:

- RPi 3 with various sensor kits (PIR, light, temperature, Camera, GPS, Alcohol, Air quality, Hear-rate, Fire sensor, Rain and humidity, MQ-2 Gas, Buzzer, Sound, etc.)
- WiFi module ESP8266
- Zolertia RE-Mote, Contiki OS, various sensors XBee, enOcean devices (contact detector, temperature sensor, remote commander, switch, smart plug) + several Zolertia devices with CoAP + 1 or 2 Philips Hue devices + 1 TV with KODI connectivity)
- LoRa gateway and modules

4.1.3 Focus Groups

There were 3 target user groups for the evaluation, based on which the categories of the Hackathon were formed.

4.2 Competition categories

In this section outcomes from the developers and non-developers idea competition are presented. In total, six developers presentations are given, including two developers winning ideas: Multifunctional gadget for disabled persons, noise pollution monitoring; and four non-developers: Air quality monitoring, Alcohol breath analyser, green area monitoring and fire monitoring in the building.

4.2.1 Developer presentations

The developer's ideas for two teams participating in the Hackathon are presented in this section. First service was Multifunctional gadget for disabled persons that help persons with disabilities to detect objects around them. The other Noise pollution monitoring is service that monitors noise in the city around targets of interests. Both teams have used API from SocIoTal to build part of functionalities that their service requires.

4.2.1.1 Multifunctional gadget for disabled persons

IoT Week Belgrade
May 31st-June 2nd 2016

Discovering new dimensions of IoT

Purpose of the project

- For disabled persons:
  - invalids
  - old people
  - people suffering from
    - vision problems
    - distortion of spatial perception, etc.
- To help them to solve the problems of face recognition, spatial orientation, and others
- To help their relatives to know about their health and the state of their homes
- As a result, the daily life can become more secure for disable people, and more calm and relaxed - for their families and relatives

IoT Week Belgrade
May 31st-June 2nd 2016

Discovering new dimensions of IoT

Proposed solution

The solution is based on the Intel Edison platform:

- Compact, powerful and inexpensive computing platform with built-in communications capabilities(Wi-Fi, Bluetooth)
- Complex and extensive data processing can be done directly on the Intel Edison
- Multifunctional solution: camera, range finder, different sensors (temperature, humidity, gas, etc.) can be connected
- All data can be transmitted to mobile phones and computers of the dispatch service, relatives, or other close people

IoT Week Belgrade
May 31st–June 2nd 2016

Discovering new dimensions of IoT

Customizing the design

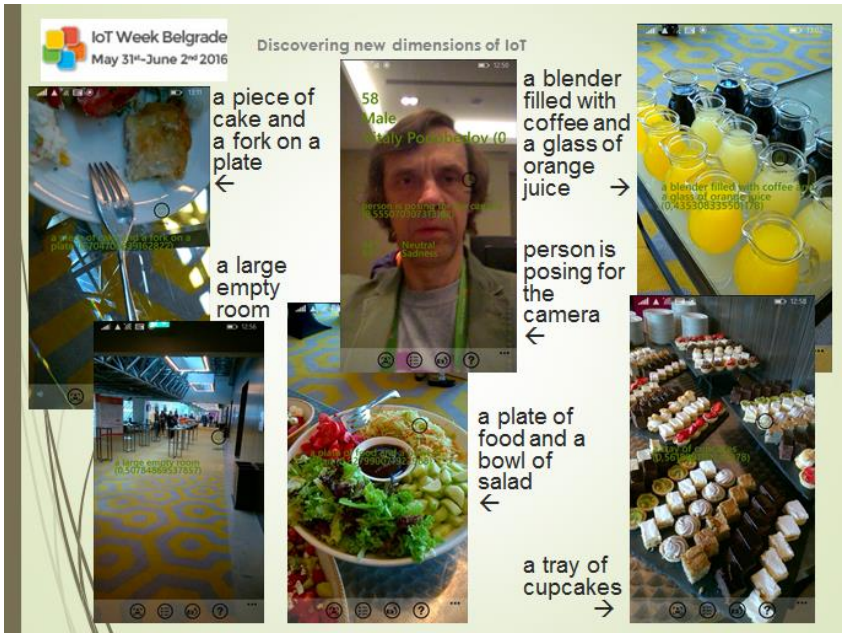
- A line of different functionalities can be provided through the expansion modules (can be added inside the device or wirelessly)
- Modular principle should ensure an optimal combination of price / performance for a wide range of people
- Customer can select only the necessary sensors and devices, thereby reducing the overall cost of the gadget:
  - ***Module with the camera*** - face recognition, emotions
  - ***Module-bracelet*** - temperature and heart rate (pulse)
  - ***Audio-Image Module*** - change of tone and height of audio-signal will allow to quickly identify the obstacles
  - ***GPS / GSM module*** - alarm button and emergency communications with relatives or dispatch services. Chance to know the current location and history of the routes

IoT Week Belgrade
May 31st–June 2nd 2016

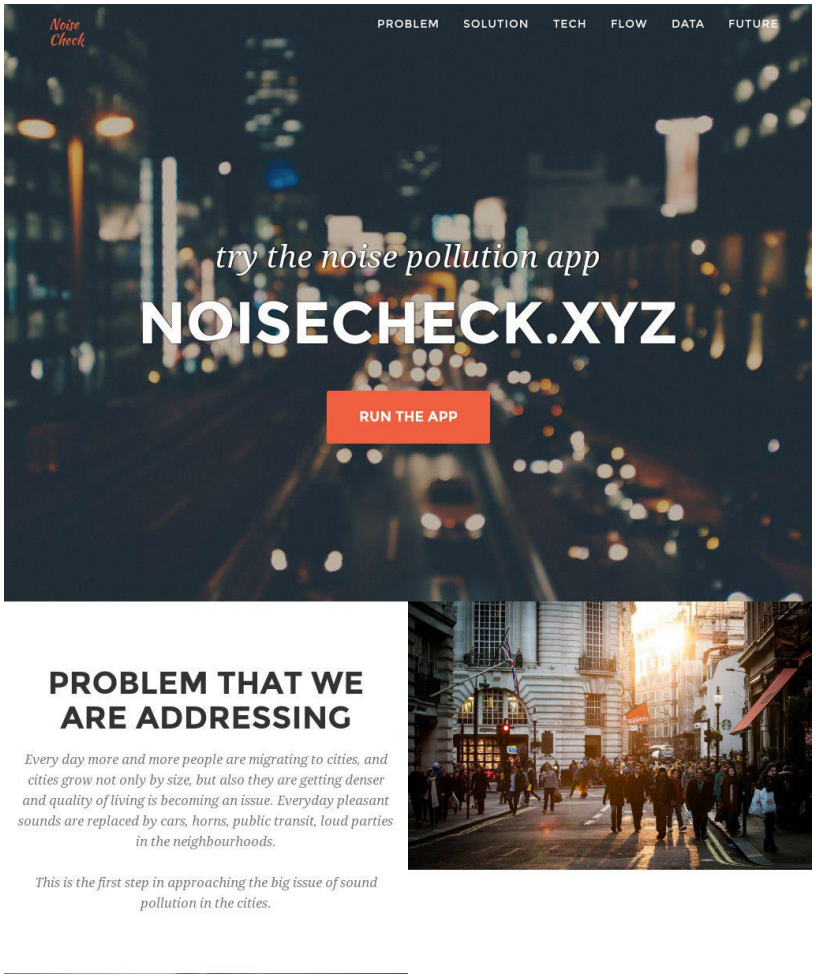
Discovering new dimensions of IoT

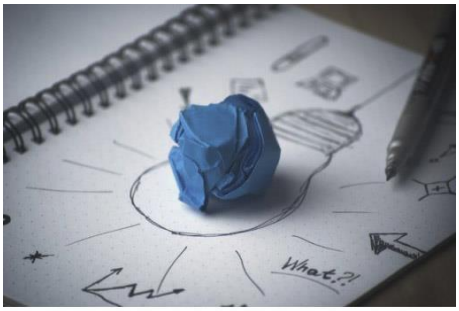
What was done during Hackathon?

- Understanding of the project as a whole and principle of modular construction were formed
- Transfer and storage of the sensor data into cloud was realized for the aim of their historical storage, as well as for dissemination to the interested parties (relatives, friends, doctors)
- The face recognition functionality was completed, including the addition of new persons and their descriptions
- The image recognition functionality was added and tested (on the next page)


IoT Week Belgrade
May 31st–June 2nd 2016
Discovering new dimensions of IoT
a piece of cake and a fork on a plate
a large empty room
a blender filled with coffee and a glass of orange juice
person is posing for the camera
a plate of food and a bowl of salad
a tray of cupcakes

4.2.1.2 Noise pollution monitoring





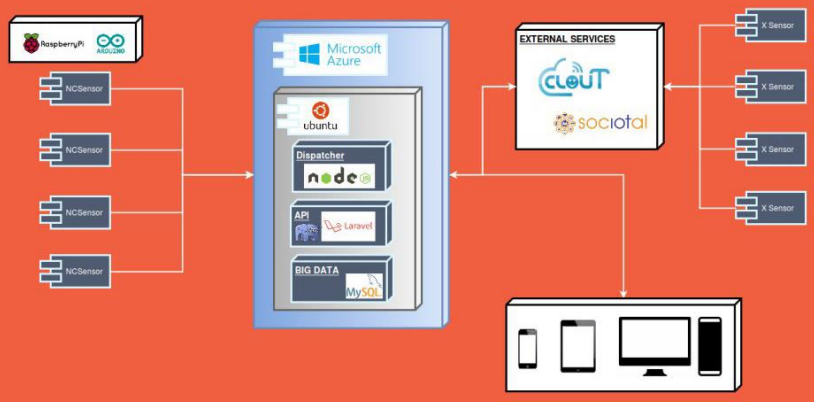
THE IDEA

We are creating a system that can monitor the noise pollution sources and notify the authorities to intervene and prevent further noise pollution in city areas.

This would be an automated system for gathering the data, processing it and sending the notifications to city infrastructure system internet connected end-points.

TECHNOLOGY BEHIND THE IDEA

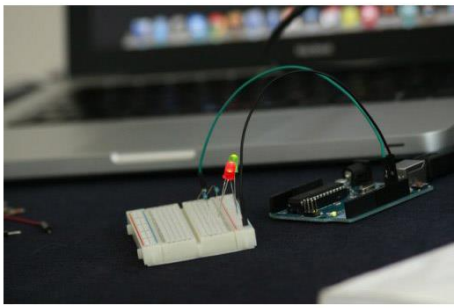
We took approach to use IoT based environment. Raspberry Pi as a cost effective solution for gathering the info is an ideal platform for quick and easy setup, and powerful extensibility. Server side is based in the Azure cloud platform, where data would be stored and processed. Third part of the solution is a web server that serves the data to connected systems and end users for a public access.



ARDUINO Microsoft Azure node RaspberryPi

DATA FLOW

Our idea is to create a system that monitors the sound pollution levels in any point of the city, after that we are gathering all the information on the cloud storage. Using the cloud computing power we are crunching the data and making the statistics of the noise and mapping the noisiest hours of the week by location.



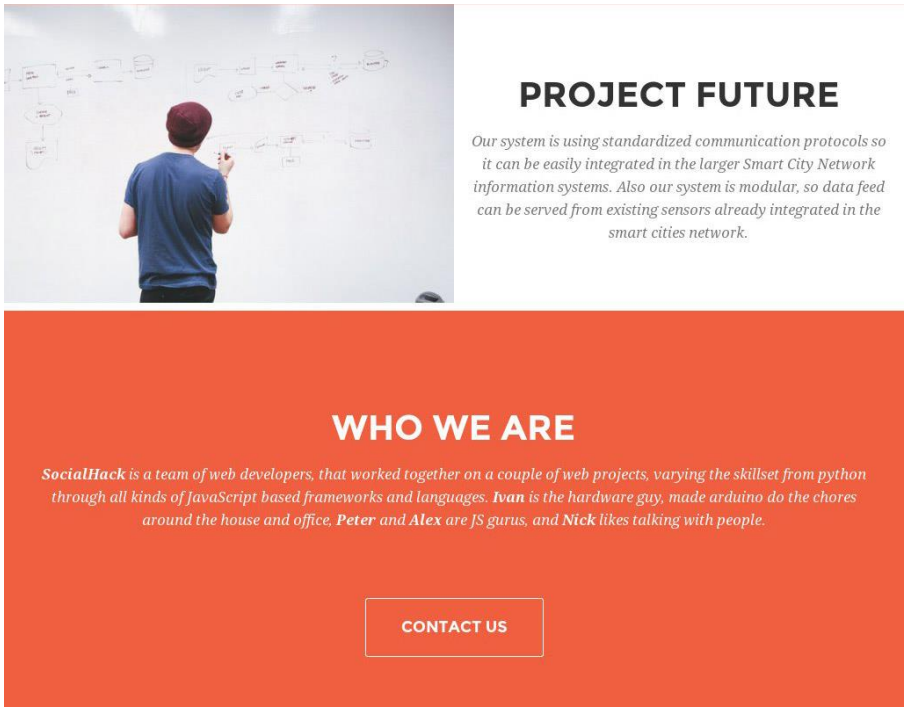
DATA RESULTS

This statistic data can be used as an information for choosing the neighborhood to live in when the end user is looking for apartment to rent.

On a commercial level we can use the data to examine the noise of the vehicles and to determine the quality of the street road and should it be repaired.

Some cities like Belgrade have combined commercial and residential areas so there are coffee shops, restaurants and pubs inside the residential areas which can cause a disturbance in the neighborhood when having late-night parties and we can monitor and control the situation using the noise level data.

Monitoring and reporting the noise levels in working environment inside commercial production areas is also vital to the workers health and work protection.



4.2.2 Non-developers presentations

The non-developers realized services for the community selected to be a part of the Hackathon ordered from best to the last position were: Alcohol breath analyser, Fire monitoring in the building, Air quality monitoring, Green area monitoring.

4.2.2.1 Air quality monitoring

AIR QUALITY SENSORS

Indoor air quality

The level of air pollution in the city is increasing with every passing year!!!

This can be scary for the city residents.

Can we make a difference with the indoor air quality?

- It is important to be at the service of citizens, in the form of health preservation, preservation of life and

AIR QUALITY

Sensors for measuring air quality

- O_2
- CO_2
- CO
- DUST PARTICLES

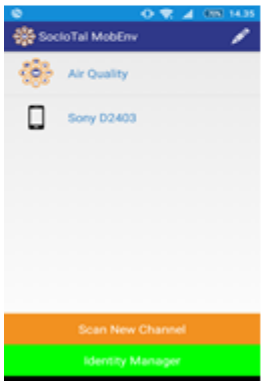
- For economy reasons and practically we can unify all sensors in one device.
- Master sensor

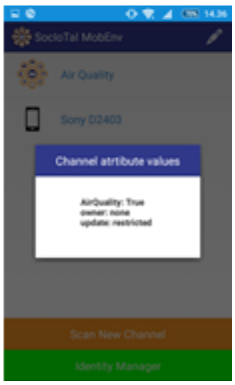
ALL SENSORS ARE CONNECTED WITH USERS AND THE COMPANY WHO IS IN CHARGE OF MAINTENANCE OF AIR QUALITY

- WE HAVE A SMART CIRCLE!

Implementation

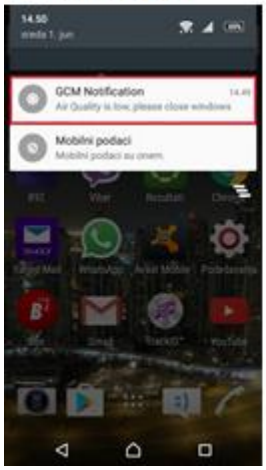
- Sensors have two levels
  - NORMAL
  - LOW





ECONOMY ASPECTS

- Price : 50-350e
- Example



- In cases where the values are exceeded, the information is automatically sent, through the APP, to the user and the companies for maintenance.

USEFUL

4.2.2.1 Alcohol breath analyzer

Alcohol breath analyzer

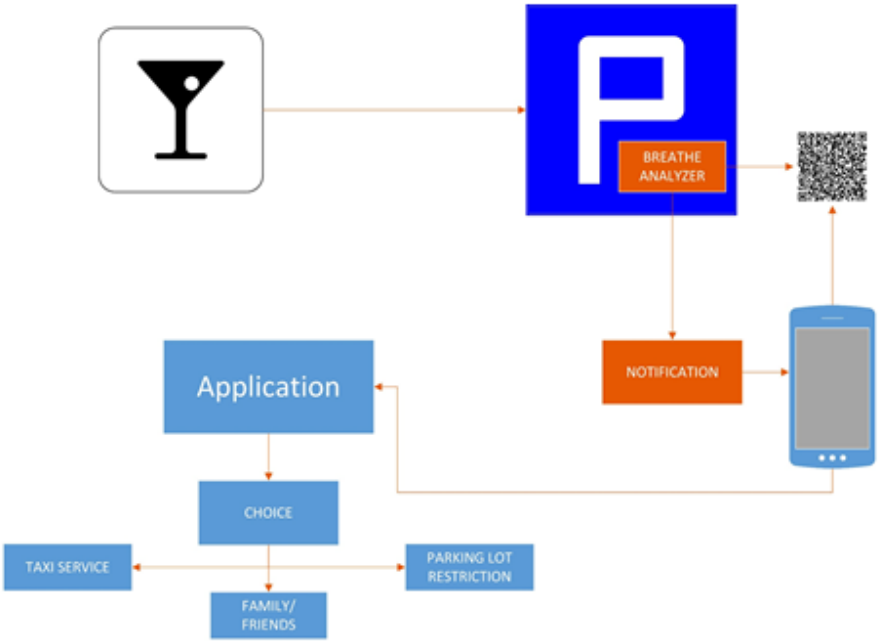
Social awareness and responsibility

One of main issues is participation of drunk drivers in traffic

It's simple – don't drink and drive

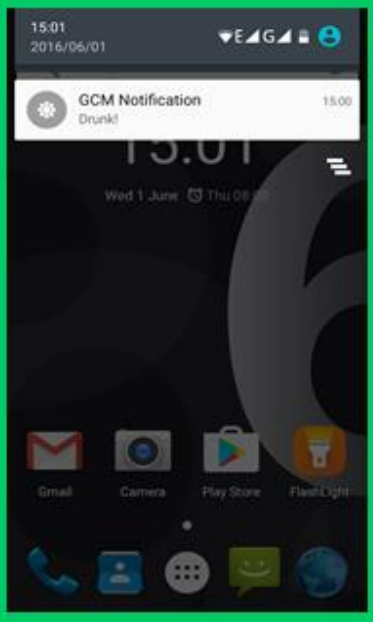
Drinking is common social habit

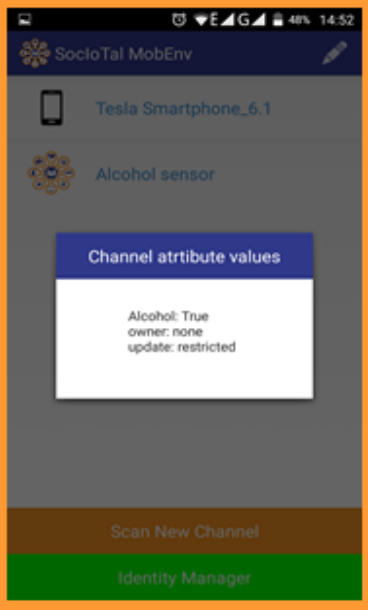
It connects people, but it also can lead to many hazards



- Approach breath analyzer
- Scan QR Code
- Mobile device is connected with sensor

- Blow to sensor
- Sensor detects value and triggers the notification
- Notification arrives on mobile device





- Enter application and read values
- Sensor returns value "true" if there is alcohol presence in breath

Advanced version of application could be:

- Chose between Taxi services, maybe phone book (for calling friend or so) or ignoring
- If ignoring, possible outcome could be notifying family member of choice – feeling of guilt

Possible funding

- City (public interest)
- Taxi service (profit)
- Kickstarter? (community interest and involvement)
- Insurance?

THANK YOU FOR YOUR TIME!

4.2.2.2 Green area monitoring

RAIN-HUMIDITY DETECTING DEVICE

- ✓ CLIMATE CHANGES NOTIFICATIONS
- ✓ AUTOMATIC CONTROL BY SMARTPHONE APP
- ✓ COLLECTING WEATHER DATA FROM OFFICIAL SERVERS

- ✓ MAINTAINING ENVIRONMENT HEALTHY
- ✓ PREVENTING FROM SOIL DESERTIFICATION
- ✓ HIGH ACCURACY AND PERFORMANCES

SMARTPHONE APPLICATION

- ✓ REAL TIME ACCURACY
- ✓ PUSH NOTIFICATIONS
- ✓ WEB STORAGE OF PREVIOUS ACTIONS
- ✓ FAMILY SHARING
- ✓ EASY TO CONFIGURE
- ✓ HIGH LEVEL APP SECURITY

➢ TYPE OF WARNING:

" It's raining outside, no need for watering, the sprinkles will now automatically turn off for water saving. Smart window is now closed, you should consider closing the rest and prevent from moisture damage. "

BUSINESS PLAN

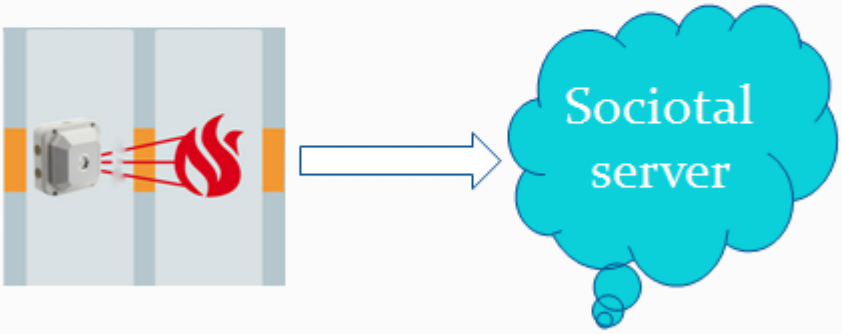
- AGREEMENT WITH HOME COUNCIL
- HIGH LEVEL OF CUSTOMER SUPPORT
- INCENTIVES: BILL REDUCTION
- EFFECTIVENESS AND EFFICIENCY IN AGRICULTURE
- INVEST IN ADVERTISEMENT THROUGH SOCIAL NETWORKS

4.2.2.3 Fire monitoring in buildings

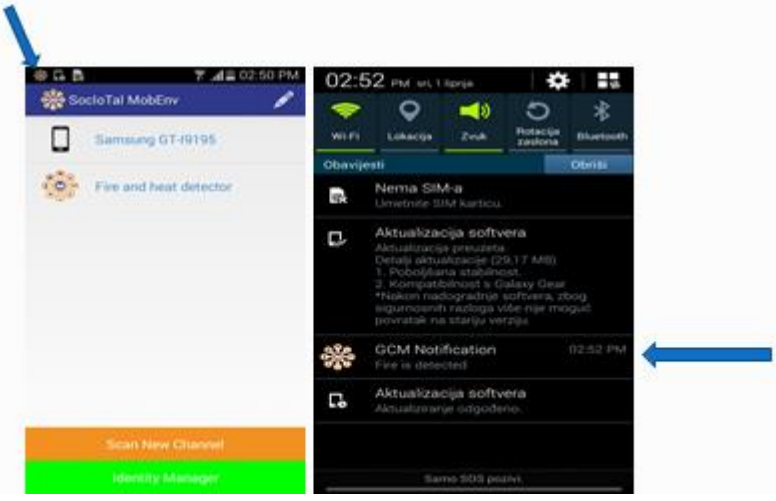
Fires threaten us at every step

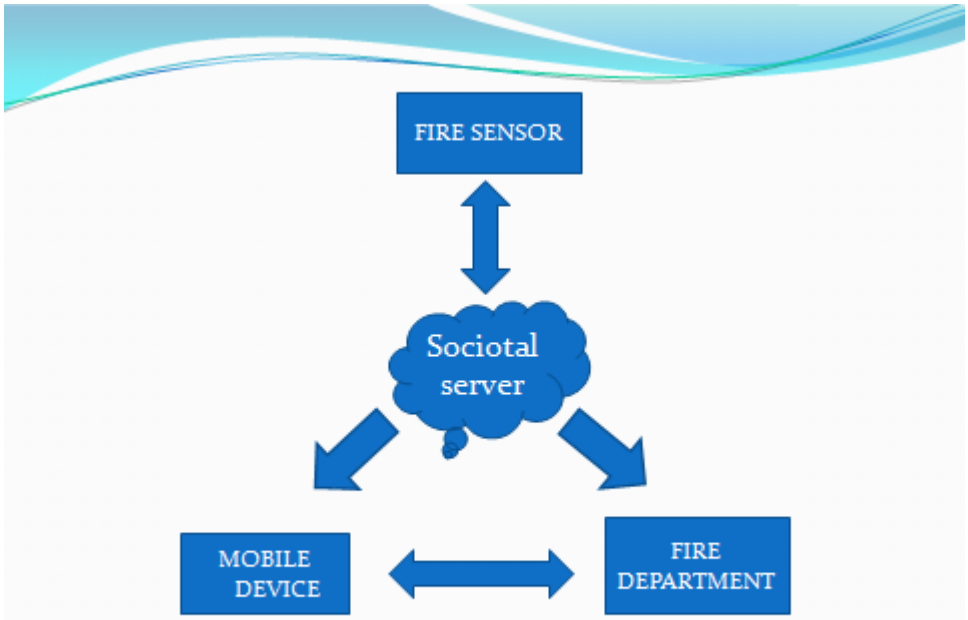
Most of fires are due to the old building infrastructures

Sensor is checking if there is fire on every 5 second's.
When sensor detect's fire it send's information to web.



Web server send's notification to the user's mobile device and it could be extended to send it to the fire department.




FIRE SENSOR
Sociotal server
MOBILE DEVICE
FIRE DEPARTMENT


"Sociotal fire detection"
Keeps your family and neighborhood safe

4.3 Hackathon results

The complete evaluation of the SocIoTal platform was done during the 3 days of the Hackathon in June 2016 as a part of the IoT Week Belgrade 2016 conference.

The participants could participate as non-developers and developers. Non-developers were using SocIoTal end-user tools Mobile and Web environment to deliver their services and applications. Their feedback is important as SocIoTal platform is designed to be used by different end-user profiles. Developers provided feedback about technical details about the platform usability, while using SocIoTal documentation and enablers API to deliver their service.
There were 22 contestants, with different background, education and age, so it can be concluded that this population is good for statistical measurements of the data.

4.3.1 Analysis of the SocIoTal platform usability

The results are based on three evaluation methods selected from the methodologies previously presented in Section 2:

- Pluralistic Walkthrough
- Performance Measurements
- Coaching Method

Pluralistic Walkthrough and Performance Measurements methods of evaluation are done through set of predefined questions, specially designed into two groups:

- Common questions
- API evaluation questions

Common questions are presented to both developers and non-developers. Example of this questionnaire is shown below (Table 1 and Table 2).

Table 1 Developers and non-developers questionnaire

Date	
Education	• High School • Collage • Post-Graduate • PhD
Current Job	• Engineer • Manager • Marketing • R&D • Other _____
Describe realization of task given in details (click of the mouse, space bar, enter…)	

Was it difficult to perform this task, and why?	• 5 • 4 • 3 • 2 • 1	Comment
Will the customer realistically be trying to do this task? (Your opinion)	• 5 • 4 • 3 • 2 • 1	Comment
Is the control for the action visible? (Is button you need to press visible, etc.?)	• 5 • 4 • 3 • 2 • 1	Comment
To what degree the process output (work product) conforms to requirements?	• 5 • 4 • 3 • 2 • 1	Comment
Is there a strong link between the control and the action? (Is every control followed with appropriate action)	• 5 • 4 • 3 • 2 • 1	Comment
Is feedback appropriate? (Is there enough information given to perform this task?)	• 5 • 4 • 3 • 2 • 1	Comment
In what degree performance was time-effective?	• 5 • 4 • 3 • 2 • 1	Comment
What were good things while you perform task?		

What are, in your opinion, unnecessary things you did while performing task?	
NOTES (How would you improve it etc.?)	

Do you think the application is useful for the citizens? Why?	
What is good about the concept of this application/service?	
What is bad about the concept of this application/service?	
Do you think this is an interesting application for the citizens from a societal perspective?	• no opinion • strongly disagree • disagree • neutral • agree • strongly agree

Do you think that this application might violate your privacy? Why?	
Do you think this is an interesting application for the citizens?	Yes, especially for institutions
From an economic perspective, e.g. saves costs?	no opinion/strongly disagree/disagree/neutral/agree/strongly agree
From a security perspective, e.g. That application may enhance user physical and/or virtual security?	no opinion/strongly disagree/disagree/neutral/agree/strongly agree
If you would change something about the application what will it be?	• It is well conceived • It is good but I would partially change it • Not good. I would change it completely
What do you think of the design/functionalities?	
What do you think about the concept?	• How does it look • Are you able to do the things you want to • How is it to navigate • What other features would you like the app to provide

Table 2 API developers' questionnaire

Date	
API Group	
API	
Good	
Bad	
Missing	
API usability (mark from 1 to 10)	
Number of API crashes during testing	
What would you do differently?	
What adjunctive API would you like to have?	
What adjunctive resources/tools/documentation would you like to have?	
NOTES	

4.3.2 Performance Measurement

The questionnaire captures the quantities data about the SocioTal platform and enables the Performance Measurements evaluations. The users are presented with set of question related to the:

- Effectiveness
- Efficiency
- Quality
- Timeliness
- Productivity
- Safety

Questions are in range from 1(bad) to 5(good). The goal of the question and average grade for the question is discussed and empirical conclusion is extrapolated from this statements.

There was 11.77% of the contestants hold high school diploma, 52.94% of the contestants hold the college diploma and 35.29% of the participants were at post-graduate studies (1). The background of participants was diverse, coming from all sorts of industries, starting from agriculture engineer to doctor of medicine (2). From (1) and (2) it can be concluded empirically that structure of contestants match the predicted users of the SocIoTal platform, the socially aware citizen regardless of education and age.

The first question "Was it difficult to perform the task?", was mainly formulated to see how non-developer or non-technical person find it difficulty in new and unfamiliar platform. The contestants could grade by numbers from 1 (it was not difficult) to the 5 (it was difficult).
The average of the survey is 2.35. As expected developers have graded lower result compared to the non-developers, and they average is 2.00, while non-developers had average of the 2.46. From information 3, 4 and 5, it can be concluded that non-technical participants did not find difficult to use SocIoTal platform compared to technical contestants.

The goal of the question "Will the consumer realistically be trying to do this task?", is to evaluate the platforms possibility of gain versus the difficulty to perform the task and to determine consumers persistent to do task even if he/she encountered the problems. Overall grade was 4.41, so it can be concluded that the end users will try to do task even if they encounter difficulties.

The goal of the question "Is the control for the action visible?" is to evaluate the interface of the SocIoTal platform and to see if there is need for rearranging of the controls. Overall grade is 4.82, so it can be concluded that there is no need for major UI improvements/rearranging.

The question "To what degree the process output (work product) conforms to requirements?" is asked to evaluate expectation of the end users and in what degree these expectations are met. The overall grade was 4.17; accordingly it can be concluded that SocIoTal meets expectations of the end users.

The main focus of the question "Is there a strong link between the control and the action? (Is every control followed with appropriate action)" is to determine if every event is followed by appropriate action and to fix potential bugs. The overall score is 4.53, so it can be concluded that participants did not find any problem, and they did not specify bugs. It can be concluded that no major improvement is needed with regard to the functionalities in SocIoTal platform.

The goal of the question **"**Is feedback appropriate? (Is there enough information given to perform this task?) is to determine and evaluate the documentation about SocIoTal platform, its wiki page etc. The overall score was 4.41, accordingly participants were satisfied with availability and usefulness of the documentation.

The question “In what degree performance was time-effective?” is asked to determine if the time-cost is worthy the gain and benefit SocIoTal platform gives. The overall score was 4.41 so it can be concluded that the time-cost was justified by benefits gain.

The goal of the question “Do you think this is an interesting application for the citizens from a societal perspective?” is to determine overall subjective feeling of the Hackathon participants. Average grade is 4.76 , and it can be concluded that participants were satisfied with application and its potential to be widely used by citizens.

The goal of the question “From an economic perspective, e.g. saves costs?” is to determine if the SocIoTal platform is cost-effective, the mean was 4.41 so it can be concluded that participants see this platform as the cost-saving platform.

The goal of the question “From a security perspective, e.g. That application may enhance user physical and/or virtual security?“ is to evaluate the platform from security perspective. The participants did not have any special concern about platform security and it can be concluded that participants see this platform as secure.

Question	Mean
Was it difficult to perform the task?	2.4
Will the consumer realistically be trying to do this task?	4.4
Is the control for the action visible?	4.82
To what degree the process output (work product) conforms to requirements?	4.17
Is there a strong link between the control and the action? (Is every control followed with appropriate action)	4.53
Is feedback appropriate? (Is there enough information given to perform this task?)	4.41
In what degree performance was time-effective?	4.41
Do you think this is an interesting application for the citizens from a societal perspective?	4.76
From an economic perspective, e.g. saves costs?	4.41

Table 3 The Hackathon questions and mean values of the answers

4.3.3 Pluralistic Walkthrough

The group of non-developers who made Air Quality use case through the Pluralistic Walkthrough of the platform concluded that they learned new things and that platform was useful and that it can enhance the quality of life of the citizens. They concluded that the application is easy to use, space and budget friendly and that it has possibility of wide range of use, especially institutions. However, they stated that it could be more approachable for older people.
Moreover they do not see how the application would violate their or other people privacy. Also, they are satisfied about design, they stated that the platform is easy to manipulate with, but they made a comment that notification could be sent as alert and that there should be history about earlier values and type of pollution.

The non-developer group which made the use case about Fire detection stated that SocIoTal platform is very useful, that they managed to improve old system very efficiently and that

they managed to overcome traditional problems with the fire installations in the old buildings. Also they think that the platform is interesting, simple and easy to use. Moreover they did not give any negative feedback about the platform itself. Also they do not think the platform can violate the security of the citizens. However they stated that the platform could have more modern UI.

The team that designed the use case about the alcohol analyser in breath stated that they think that the platform is useful for citizens and it is easy to use. However they concluded that interface should be more modern and that there are too many steps for building their service. Also they concluded that they are stratified that they manage to evolve more people into their use case, and to improve quality of life for the user (drunk driver) and his/hers relatives.

The team which made the use case about Green area monitoring stated that there are no unnecessary things that they have done through the process of making the application, that they were able to make application using SocIoTal platform that could make neighbourhood and environment more “green”, pleasant for living and that they made their service easily without unnecessary steps. Also they stated that a good thing is that the concept has it business potential and that the platform has a bright future. Moreover they do not think that the application can violate the privacy of the citizens, although they made a comment that the interface of the application could be more modern.

The developers group that monitored the sound level in environment stated that platform could potentially provide the useful data to the citizens and the developers. Moreover they concluded that it is easy for anyone to add their sensor into the system and make data accessible to others. Also they stated they were able to connect many different clients into one, integrated network and provide flexible and secure endpoints for data manipulation and that API design and the functionalities, because it’s simple enough to quickly get a grasp on, yet offers a very flexible structure to accommodate a wide range of use cases. Moreover they think that the platform can enhance the security of the citizens and that the authentication subsystem is very comprehensive, so that an application could not violate the privacy of users. Also they think that the platform has a bright future due to the facts that anyone could use it, and that the platform follows latest IoT concepts. However they managed to crash the API because they flooded the server with data, and they proposed a solution in form that the API should limit number of message per IP. Although, they are satisfied with documentation they think it that it could be updated with more general information about the platform.

Section 5 - Conclusion

From all participants during different events held in Grenoble, Cagliari and Belgrade the feedback was very good and the evaluation of the usability showed 4 out of 5; where 5 is excellent. The usability evaluation provided by the Hackathon participants showed positive feedback about the SocIoTal platform APIs and Tools.

It can be concluded that the SocIoTal platform is easy to use, that can significantly save time and resources, enabling anyone to add their sensor into the system and make data accessible to the others; connecting many different stakeholders, integrating network and providing flexible and secure endpoints for data manipulation; with straightforward and documented API design and the functionalities; offering a very flexible structure to accommodate a wide range of use cases. The platform can enhance the security of the citizens and the authentication subsystem is very comprehensive – accordingly an application could not violate privacy of the users.
In addition, Hackathon participants concluded that they learned new things and that platform can be used to enhance the quality of life of the citizens.

Section 6 - References

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