Faculdade de Engenharia da Universidade do Porto

FEUP

Mobile Environmental Noise Protection System

Group 3A

VERSION 1.2

Final Report

Ana Orvalho – ee08175
João Pinho – ee07241
Rui Costa – ee05185
Rui Pinto – ee07186
Vítor Araújo – ee07206

February 17th 2013

Version Control

Version	Date	Author(s)	Approved by the Documentation Manager	Modified Sections	Changes
0.1	22/01/13	Rui Pinto		All of them	Creation of document
1.0	26/01/13	Rui Pinto		Chapter 4,5,6	Fill in the Use Cases, Database Specifications and Technologies Used
1.1	16/02/13	All team members	X	All of them	Rework all previously created chapters. Finalization and revision of the document
1.2	17/02/13	Vítor Araújo	X	Chapter 5, 6, 7	Added Android application screenshots and more implemented use cases

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List of Acronyms

G*x* – Team *x*

M.E.N.P.S. - Mobile Environmental Noise Protection System

Chapter 1

Introduction

1.1. Presentation

Environmental noise can be defined as "all unwanted or harmful outdoor sound created by human activities". Nowadays, this is a serious issue in all nations throughout the world. As such, there are some issues regarding lack of information and non-transparent situations that need solving.

The *Mobile Environmental Noise Protection System* is a distributed smartphone based system to protect citizens from illegal noise emissions.

The initial project includes a set of inexpensive and easy to use monitoring boxes that fulfill the legal requirements imposed to noise measuring equipment. These boxes send data to a server that stores and analyses it and the results are displayed to the users through a web page and an Android compatible application.

Our team is responsible for the development of the web page and the Android application.

1.2. Document structure

This document is structured as follows:

- Introduction: brief explanation about the project, the document and his structure;
- Project General Description: explanation about the project;
- Implemented Project Requirements: definition of the user-oriented system requirements;
- Database Specifications: description of the database using an entity-relationship model;
- Use cases implementation: description of the website and Android application structure and implemented use cases;
- Android Application: description of the Android application functionalities;
- Technologies Used: identification of the technologies used to develop the project.

Chapter 2

The Project

2.1. Project General Description

The *Mobile Environmental Noise Protection System* aims to provide a fast interface between city halls that publish licenses for noisy activities, citizens that consult this information and occasionally may want to report noise related incidents, and public authorities that must ensure that legal noise limits are being met. This integrated solution optimizes the response time of authorities to the requests and reports of the population.

The system is divided in three subsystems, corresponding to the three groups presented in figure 1.

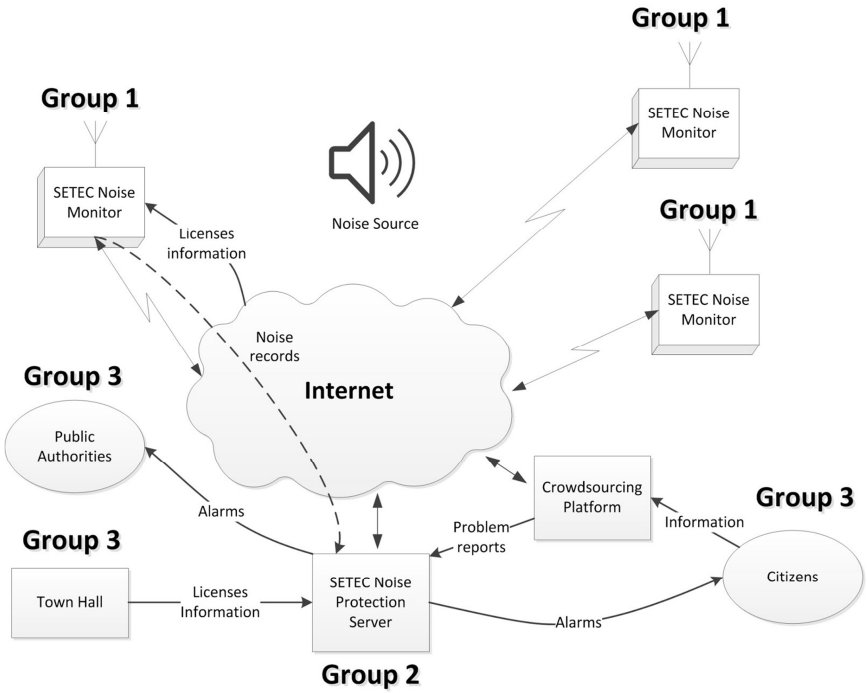

Figure 1. Overall System Architecture

In this figure a schematic view of the entire system can be shown, enabling a quick understanding of all the system's players - from the measuring boxes to the user interfaces.

2.2. G3 - Crowdsourcing and User Interfaces

2.2.1. Tasks

- Design and implement all user interfaces:
  - Citizens;
  - City Hall;
  - Authorities;
  - Administrator.
- Implement an integrated crowdsourcing platform:
  - Geotag incident reports from users;
  - Give feedback to users;
  - Produce incident listings.

2.2.2. User Descriptions and Needs

2.2.2.1. Visitor

Visitors are non-signed in users that have the lowest access level as they can only view the reports map and the noise heat map.

2.2.2.2. Citizen

This is the most common type of user. Once registered, the general population can report incidents of disturbance in the noise levels via either the system's webpage or the Android application. Citizens can also view and edit their own incident reports and consult the feedback associated, consult the map of noise measurements and permits.

2.2.2.3. Authority

Once authenticated, law enforcement is able to create new reports, view all the reports from other users and check the measurements taken by the boxes, in order to keep public order. Law enforcement is also notified whenever a box registers a noise level that is considered illegal according to the law.

2.2.2.4. City Hall

Once authenticated, the City Hall can not only view noise heat maps and every incident reported but also submit permits and request noise measurements. City Hall users are responsible for managing the status of the reports.

2.2.2.5. Admin

Only the Admin can create and delete high-level accounts for Authority and City Hall users. He can also choose and change the G2 server in use.

Chapter 3

Implemented Project Requirements

3.1. Marketing Requirements

This section presents a list of user-oriented requirements or, in other words, a list of users' needs satisfied by the *M.E.N.P.S.*

3.1.1. Functional Marketing Requirements

FM01 - The system must allow the registration of different types of users.

FM02 - The system must allow user authentication.

FM03 - The system should allow the consult of a generic noise heat map.

FM04 - The system must allow the consult of reported incidents.

FM05 - The system must allow incident reports.

FM06 - The system must provide feedback to the incident reports published whenever a measurement is done.

FM07 - The system must allow the input and consultation of licenses for planned noisy activities.

FM08 - The system must allow noise measurement requests.

3.2. Engineering Requirements

Engineering Requirements	Justification
The system will sanitize the user input	To protect the server from text input attacks and SQL injections
The system must automatically manage user permissions according to their type and login	To guarantee data confidentiality and access control
The system should use encryption for the most sensitive data	To be secure
The system should use appropriate colors and contrast	To promote user inclusion
The programming should be organized in well-defined classes	To allow the system to be easily updatable

Table 1. Engineering requirements

Chapter 4

Database Specifications

4.1 Database Technology

The system's database was implemented in MySQL, and contains all the information provided by and displayed to the users (excluding permit information, which is stored by G2). It also stores the noise measurements received from G2.

The following diagram represents the architecture and connections that exist between the database's tables. The tables are named after the main entities: user types, reports, measurements and server choices.

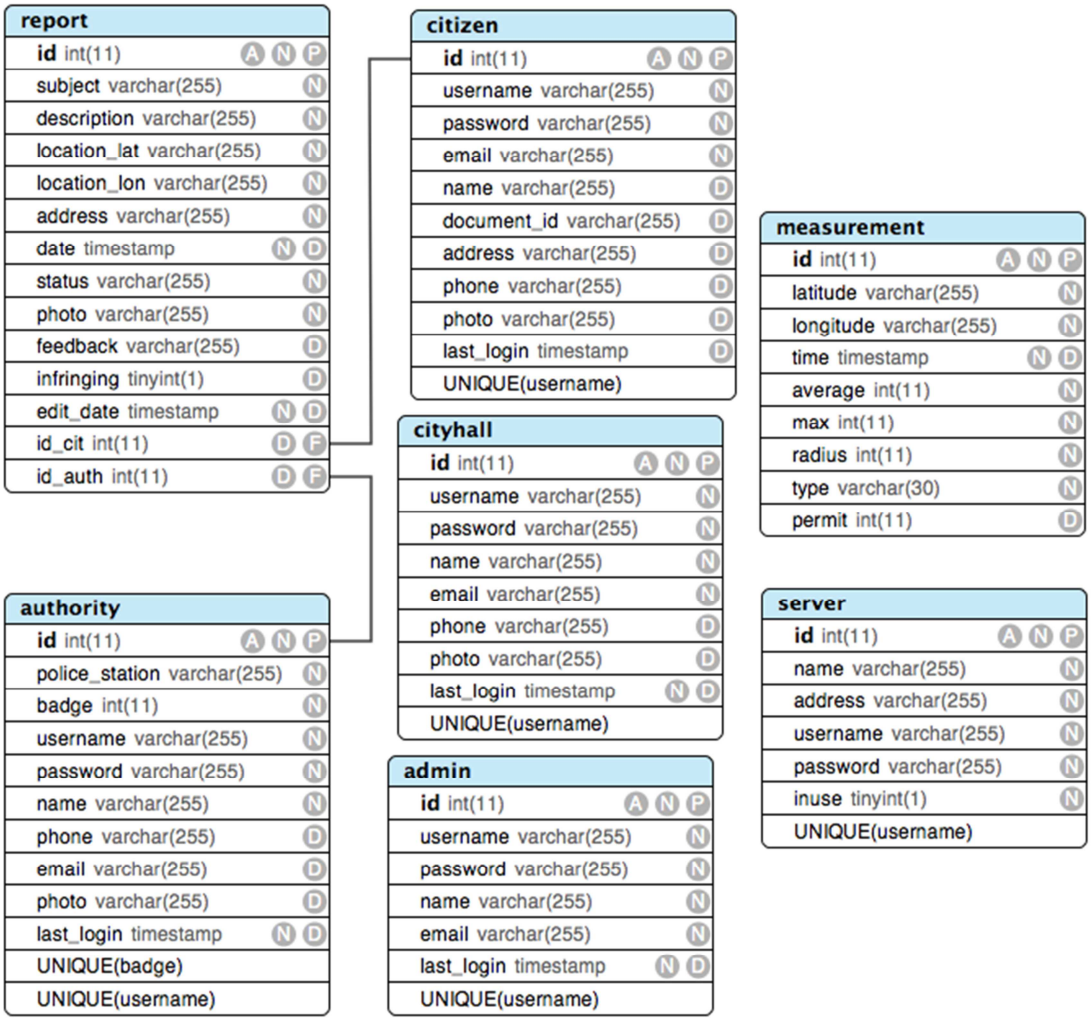

Figure 2. Database Entity-Relationship Model

Chapter 5

Use Cases Implementation

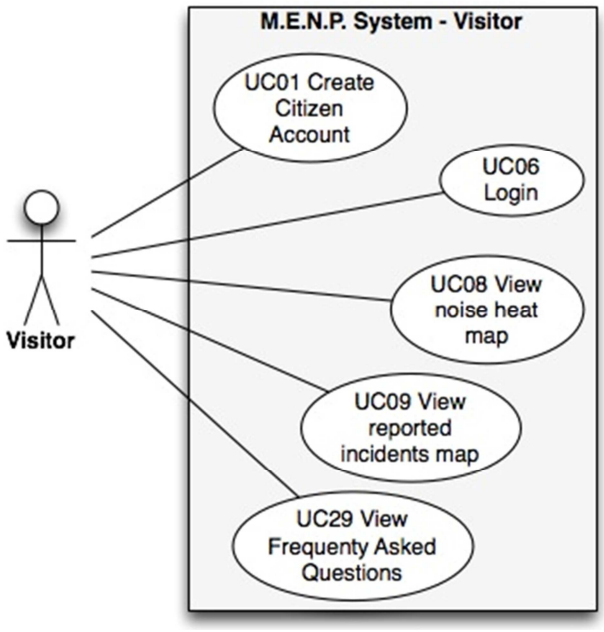

Figure 3. Visitor Use Cases

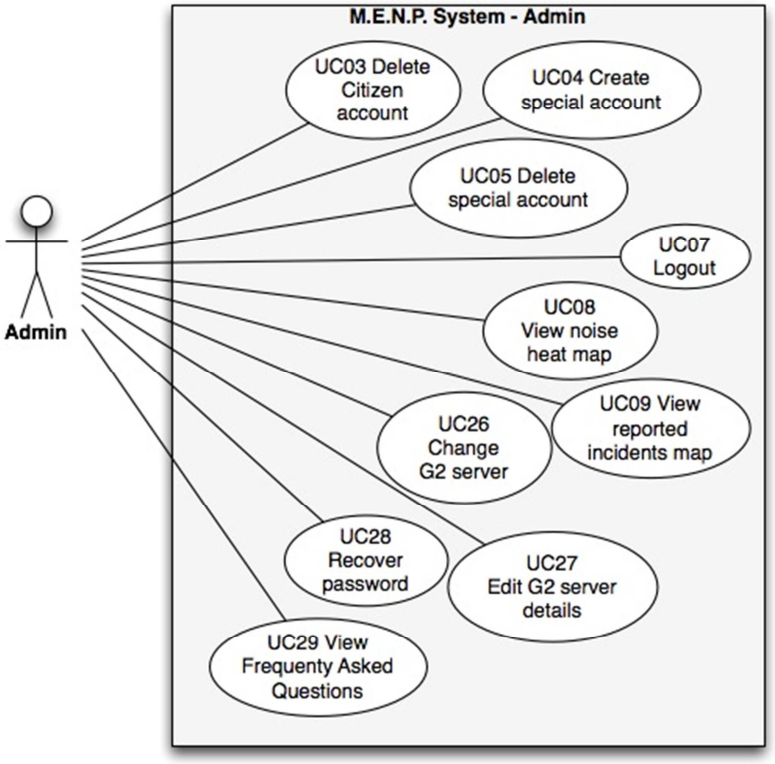

Figure 4. Administrator Use Cases

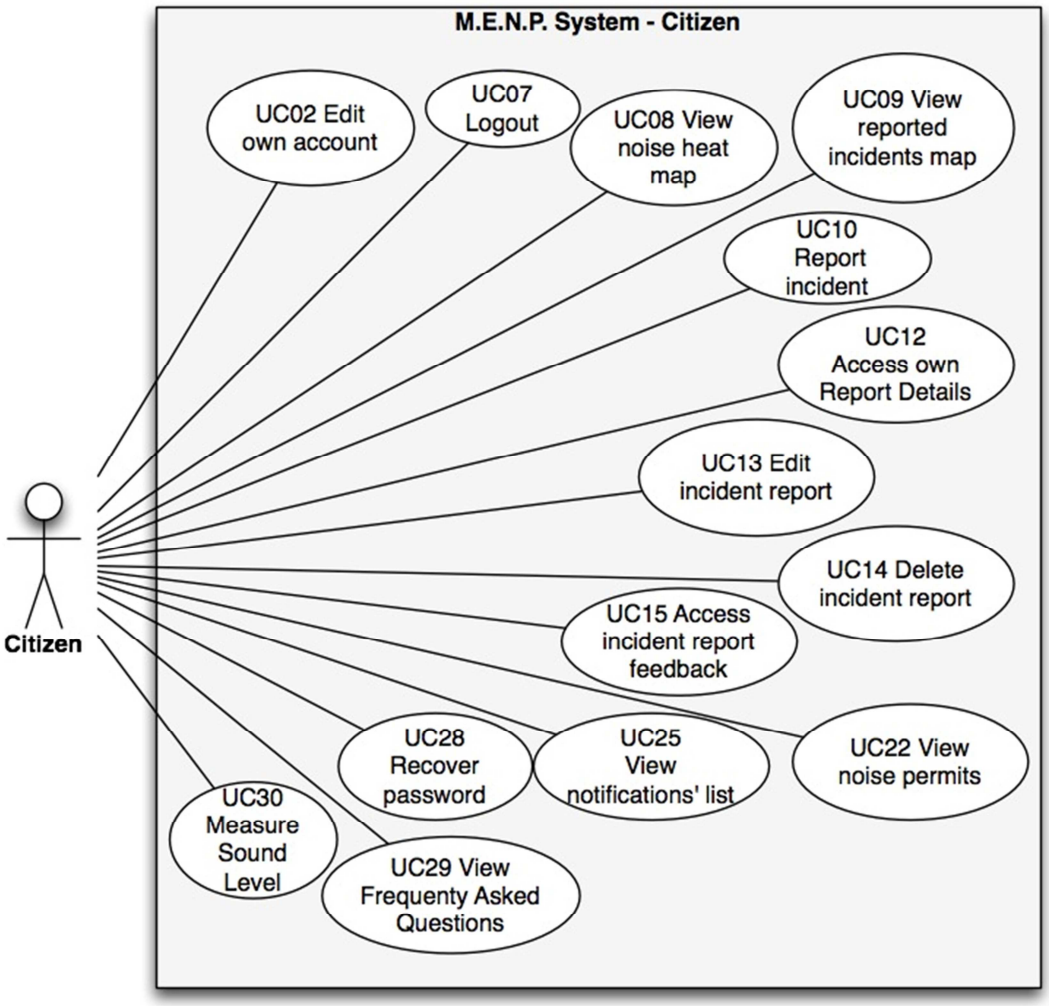

Figure 5. Citizen Use Cases

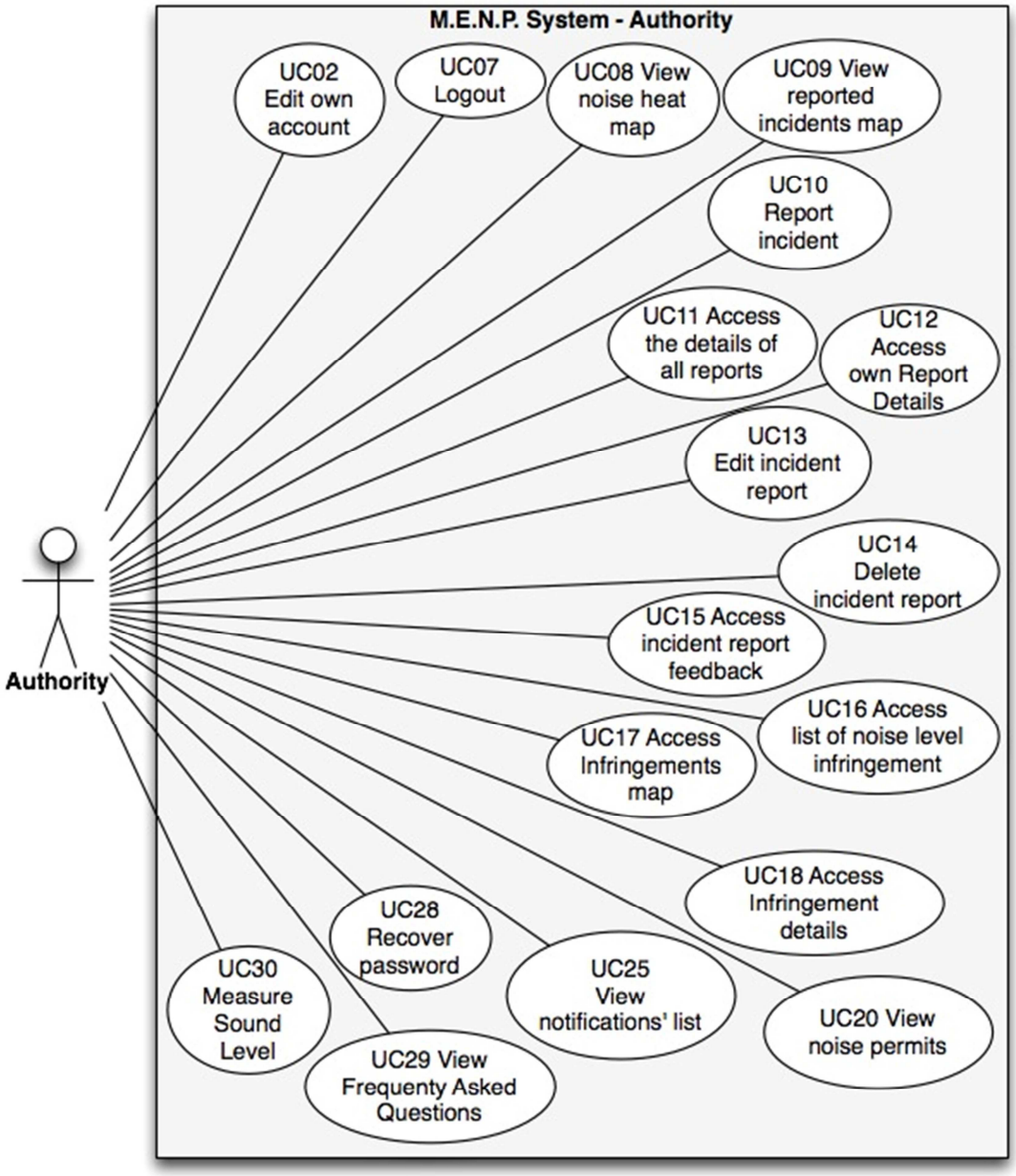

Figure 6. Authority Use Cases

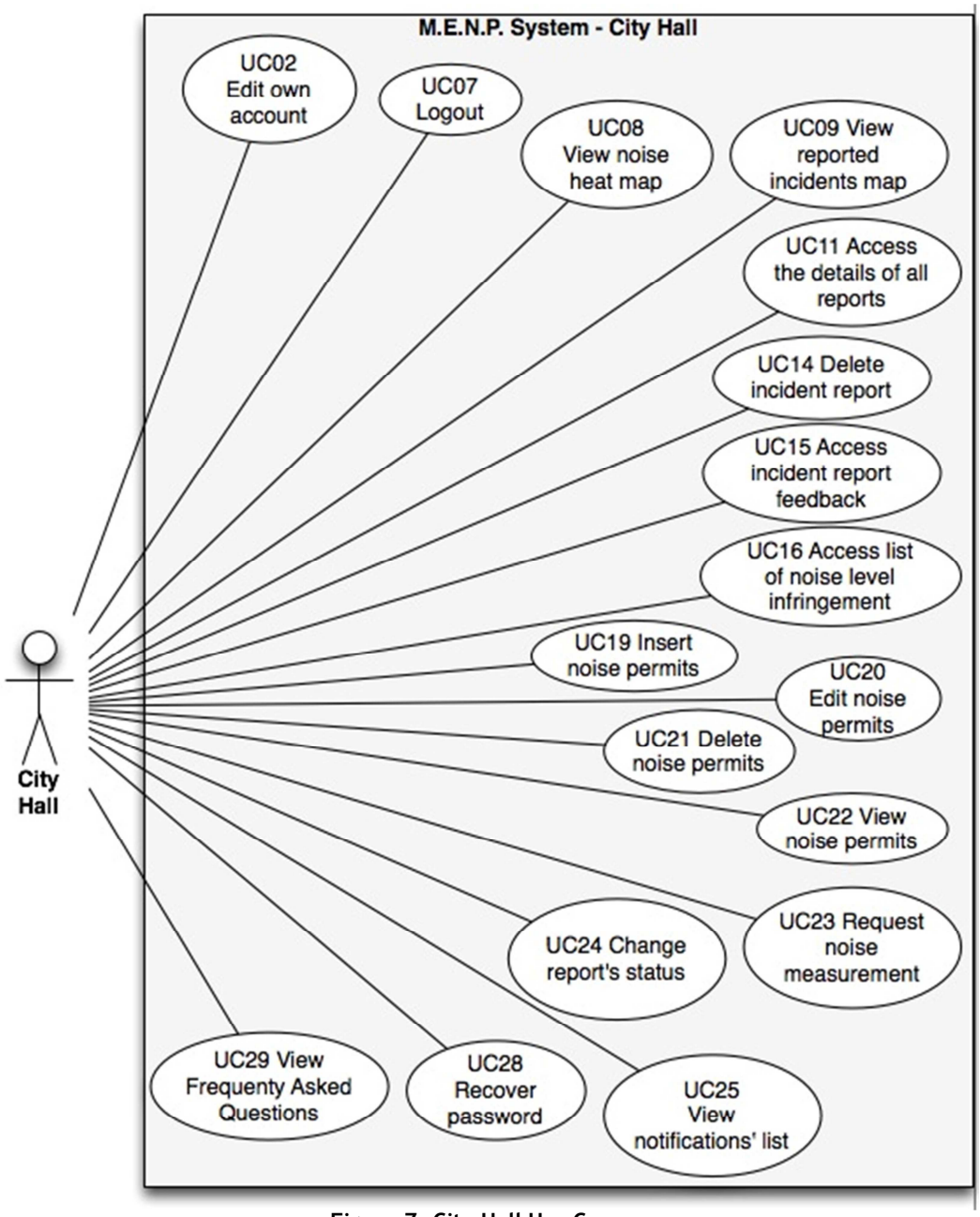

Figure 7. City Hall Use Cases

5.1 Technical implementation

UC01 - Create Citizen Account

When creating a new account, all information inserted by the user is validated on input using JavaScript. The username is unique in all the database and cannot be used by any other type o user. The password must have at least 6 characters and is encrypted with sha512, which is much more secure than MD5. The email must be in the format user@server.TLD. The telephone number is validated using current standards. The user can also upload a profile picture or, if he chooses not to, a default picture will be used.

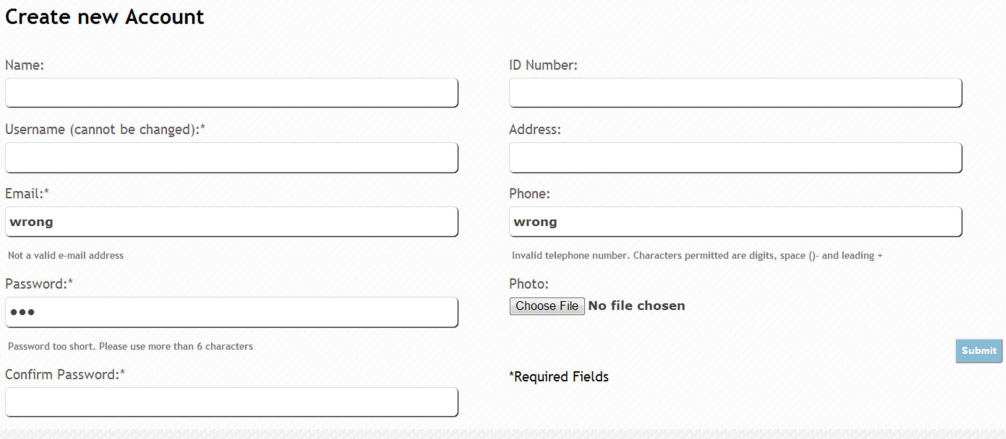

Figure 8. Create Citizen Account

UC02 - Edit own Account

All registered users can edit their own account by clicking their name on the top of each page.

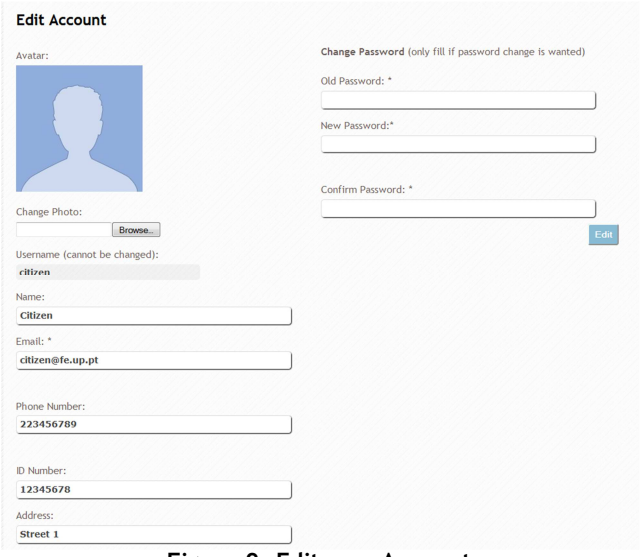

Figure 9. Edit own Account

UC04 - Create Special Account

Only the Admin can create City Hall and Authority accounts. The special account creation page provides the same input validation methods described in UC01.

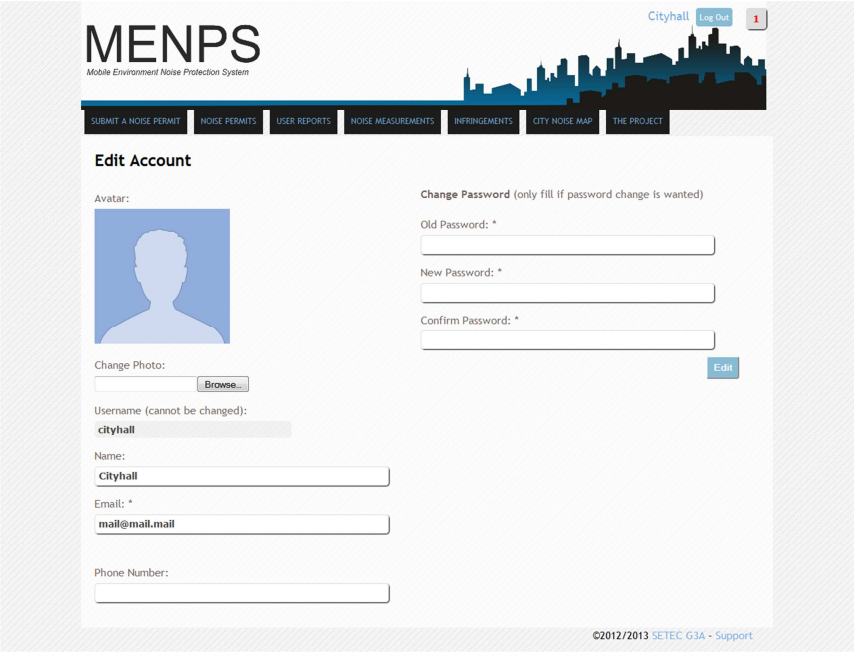

Figure 10. Create Special Account

UC08 - View noise heat map

All users can view a noise heat map of the city. This map is created from the triangulated noise measurements provided by G2. For colorblind users, a difference color scheme can be viewed by pressing a single button.

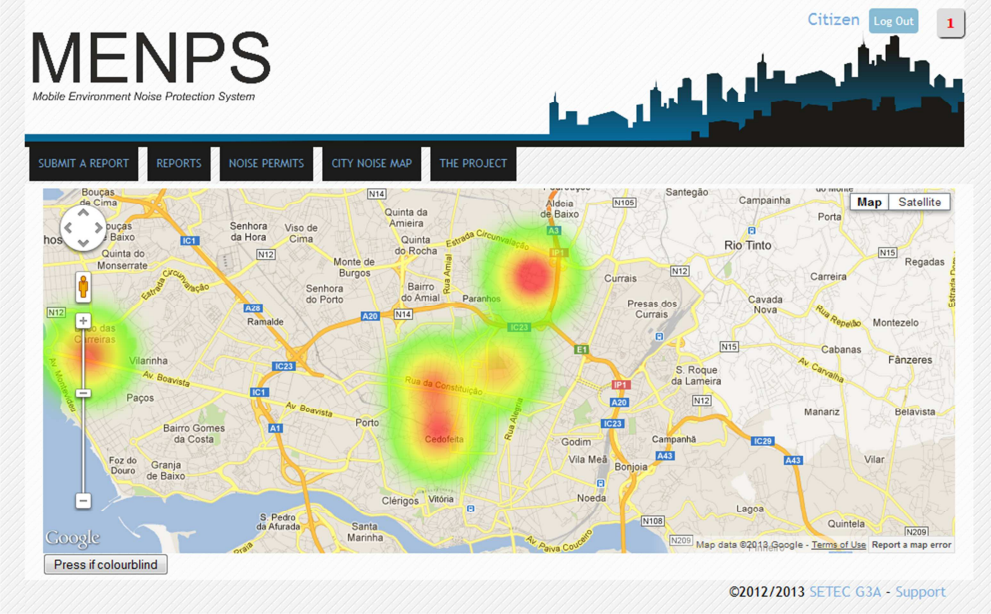

Figure 11. View noise heat map

UC09 - View reported incidents map

All users can see the location and basic description of reported incidents. This map distinguishes from the own user reports (in green) and all other users' (in red). The user can also access the full details of their own reports via a link.

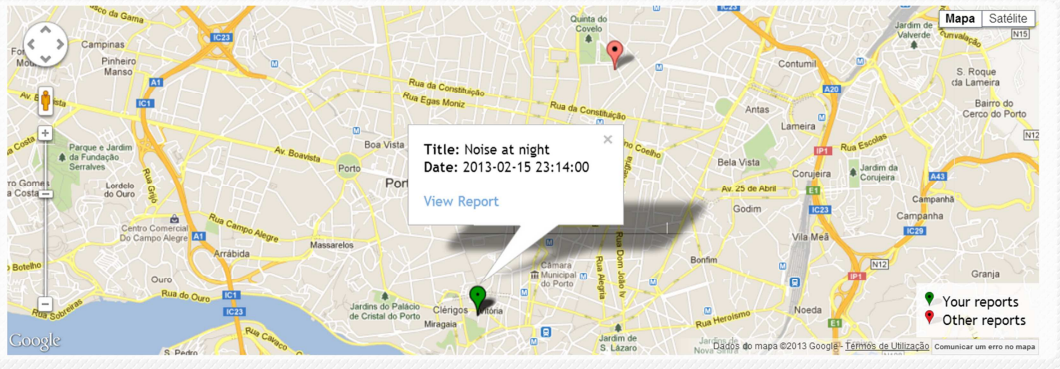

Figure 12. View reported incidents map

UC10 - Report incident

To report an incident, the user should provide a basic title and description. The current date and time are automatically provided by the system, but can be changed. The location can be obtained by searching for a specific address or city, by dragging the marker or choosing to use its own location, which is obtained via the HTML5 Geolocation feature. The location selected on the map is translated into a street address, for reference. A photo of the incident can also be uploaded.

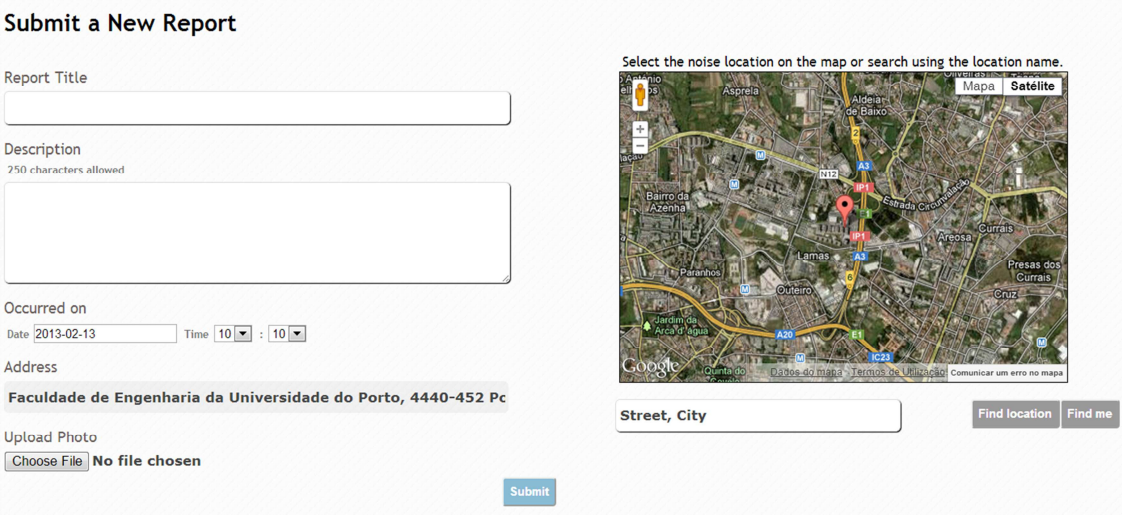

Figure 13. Report incident

UC12 - Access own report details

According to the information available in the database, the report feedback and infringing are automatically changed.

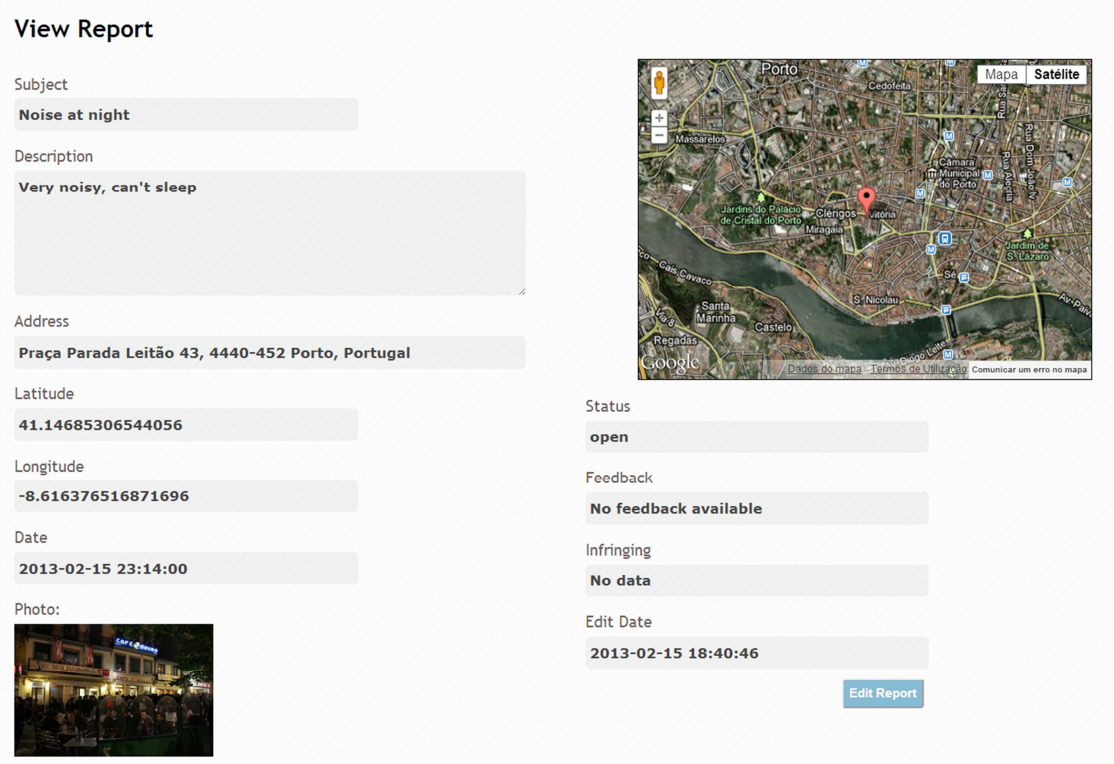

Figure 14. Access own report details

UC15 - Access incident report feedback

All measurements within 1000m from a reported incident, it is provided as feedback for that report. A graph for each measurement is also provided, with recorded maximum and average sound levels for that box.

Figure 15. Access incident report feedback

UC17 - Access infringements map

Infringements information can be viewed on a table and also on a map.
Within this map, users can click each marker to get basic infringement information, like radius and maximum noise level, as well as a link to the full details. By clicking the marker, a red circle appears, denoting the noise influence area of that infringement.

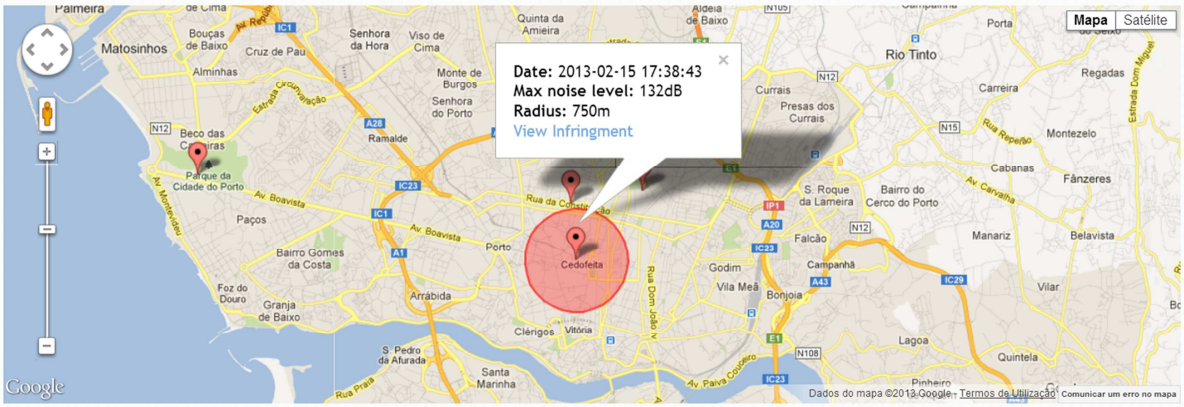

Figure 16. Access infringements map

UC19 - Insert noise permits

To insert a noise permit, the City Hall user must select the type of permit, maximum noise allowed, date range of the permit and at which time noise is allowed. The permit area is provided by drawing a rectangle on a map. This feature is provided by Google Maps API. The permit information is stored on G2 server.

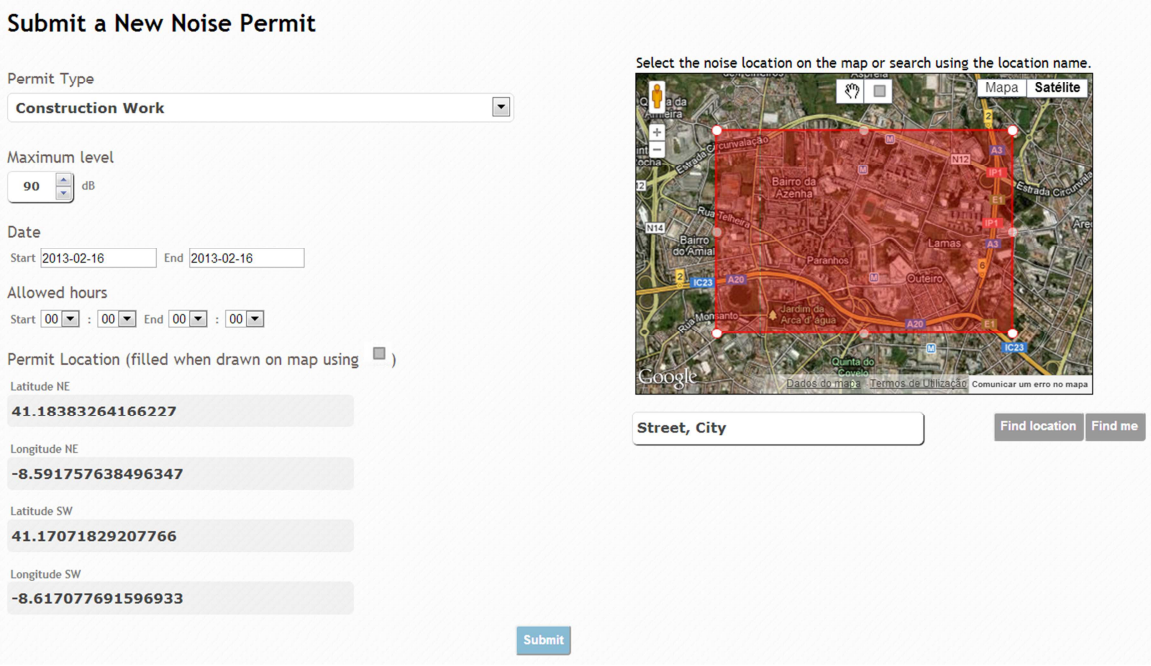

Figure 17. Insert noise permits

UC23 - Request noise measurement

By filling out a noise measurement request, a email is sent. Since this feature was considered low level and thus not implemented, the email is sent to our own group account and is never used. If this functionality was to be developed, a proper communication could easily be set up using REST, as with the permits creation.

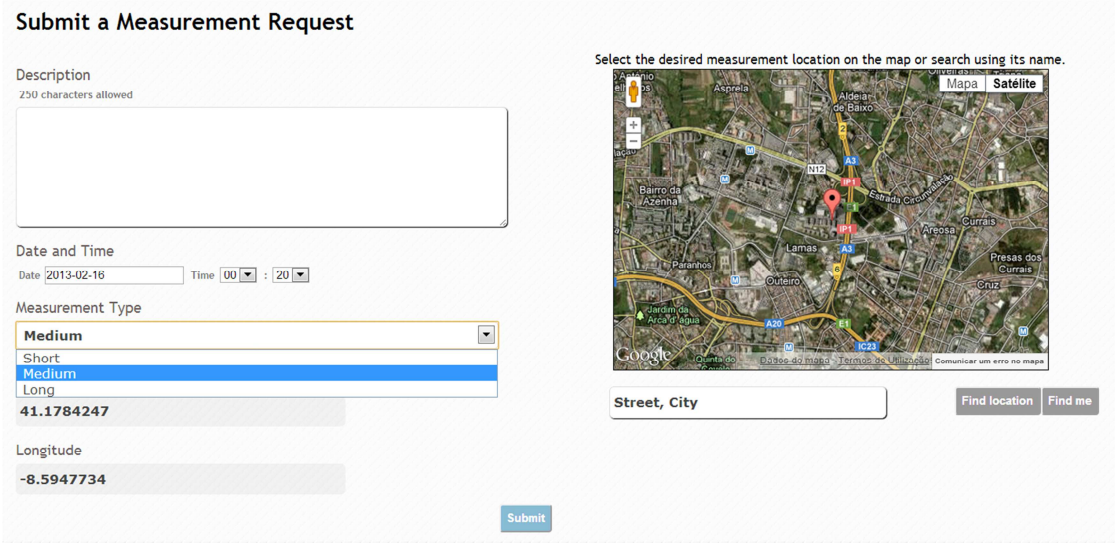

Figure 18. Request noise measurement

UC24 - Change report status

City Hall users can change status of reports in batch, by selecting multiple reports and choosing the desired action.

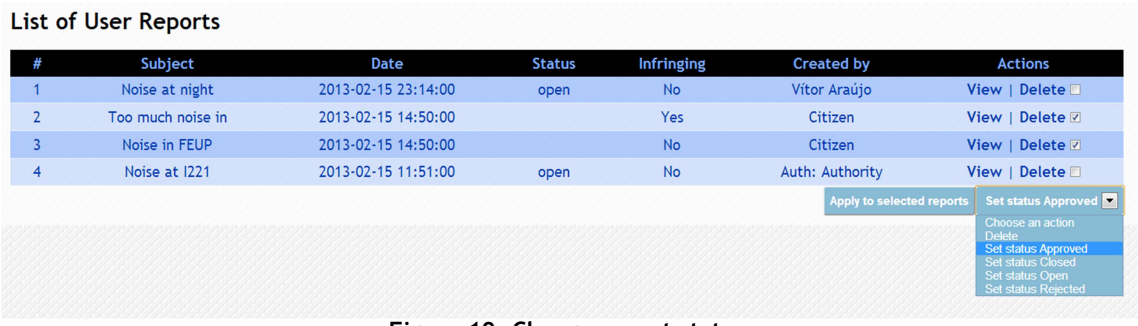

Figure 19. Change report status

UC25 – View notifications' list

Located on top of each page there is a box that shows the number of current notifications (in the figure below, the number represents the amount of new infringements for an Authority type user). By clicking the box, a list also provides other useful system information and direct links to the notification subjects (in the figure, the user can immediately click the link to see details on infringement number 177). The notifications are updated with every page change, to assure their relevance.

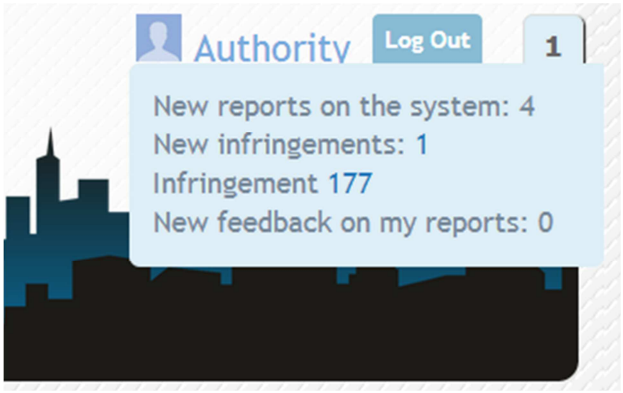

Figure 20. Notification list

UC26 – Change G2 server

The Admin can easily change the G2 server from which information is retrieved. Nevertheless, permits are always uploaded to both servers.

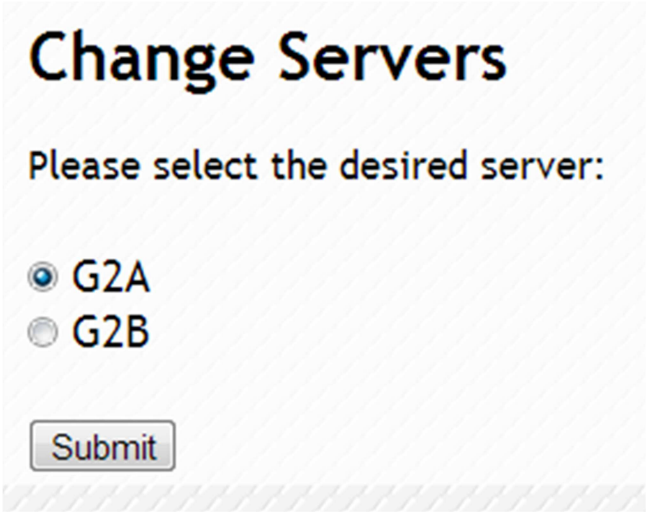

Figure 21. Change G2 server

UC28 – Recover password

If any users forgets its password, he can provide his username and a new randomly generated password will be emailed to him. The old password cannot be recovered, due to the secure hashing method used (sha512). The username is enough to be used as identification, because its uniqueness is garanteed in the registration process. The new password is encrypted and changed in the database, and the user is advised to change it as soon as possible.

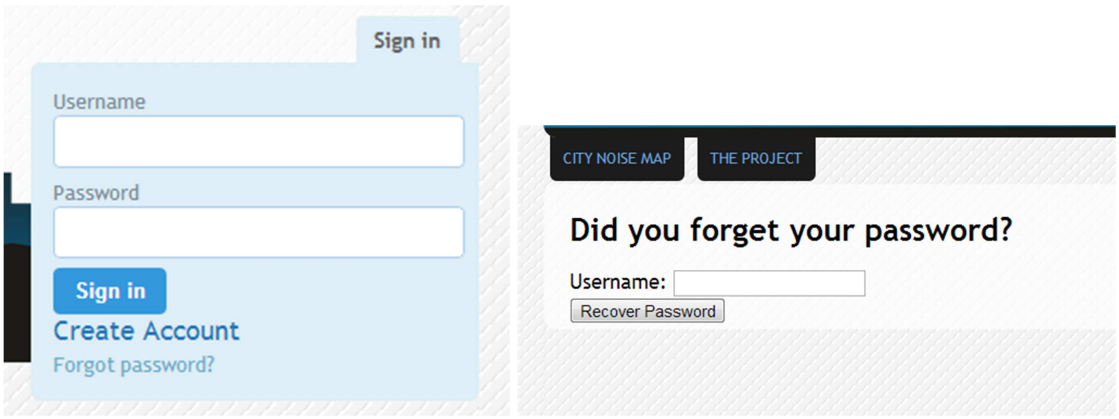

Figure 22. Recover password

UC29 – View Frequently Asked Questions

All users can access a page with instructions on how to perform basic actions on the website.

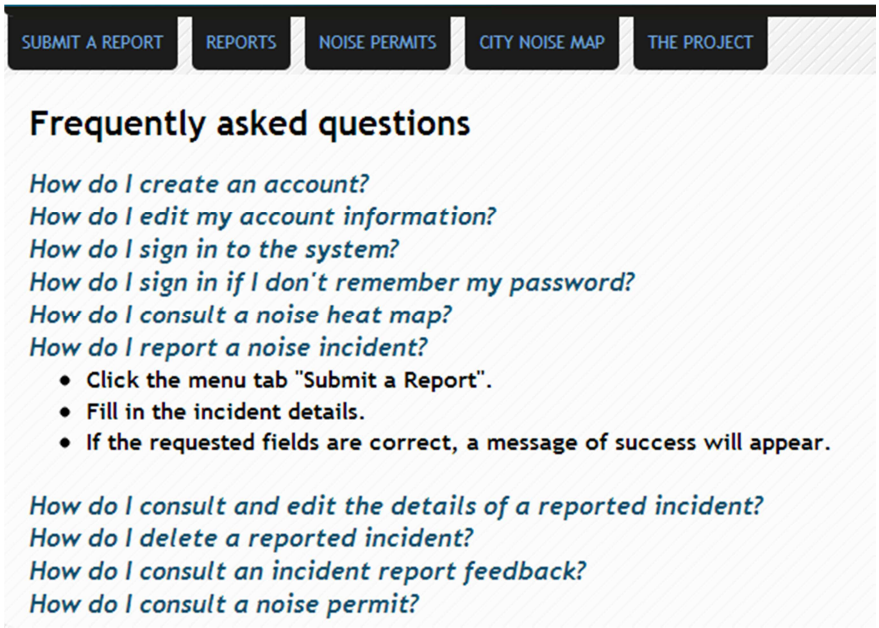

Figure 23. Frequently asked questions

Chapter 6

Android Application

The Android application provides interfaces for Citizen and Authority and its workflow is similar to the website. It uses Google Maps Android API 2.0 and its interfaces were created according to Android design guidelines, providing a familiar environment to this operating system's users.

The application also features a noise level meter, which gives the user an estimation of the noise level around him.

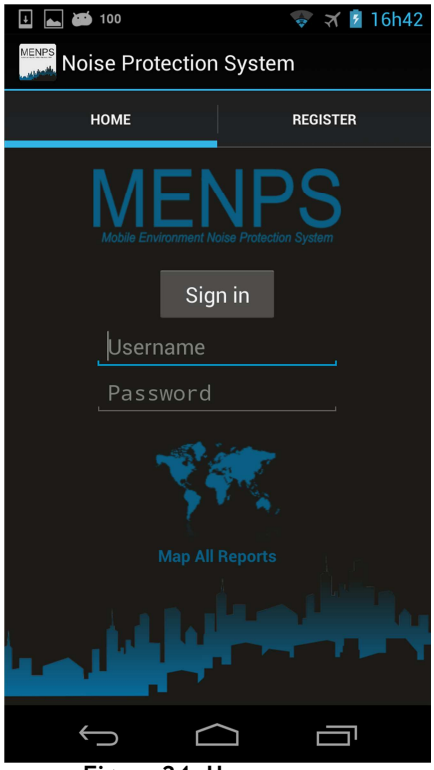

Figure 24. Home screen

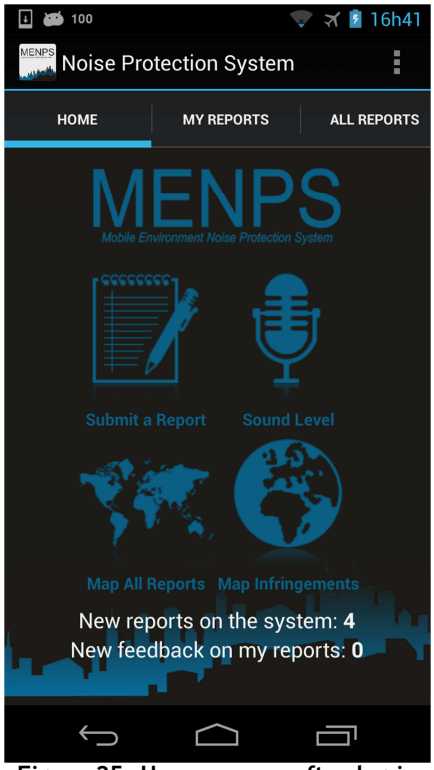

Figure 25. Home screen after log in

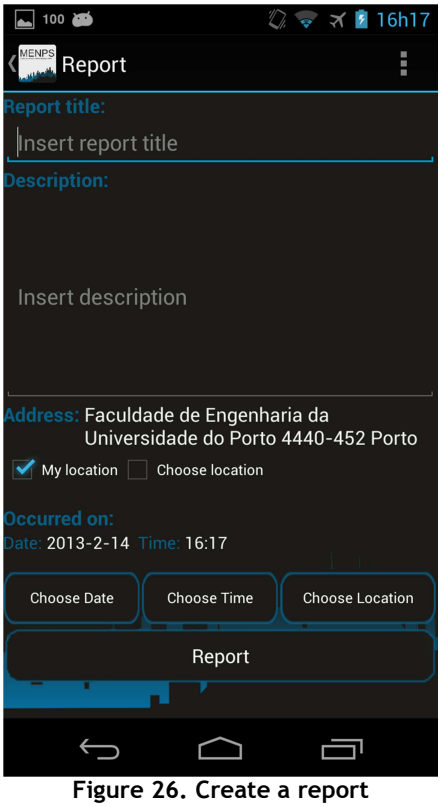

Figure 26. Create a report

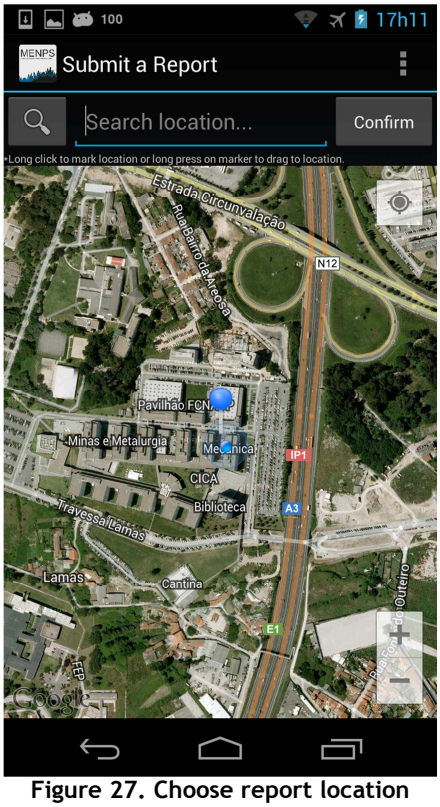

Figure 27. Choose report location

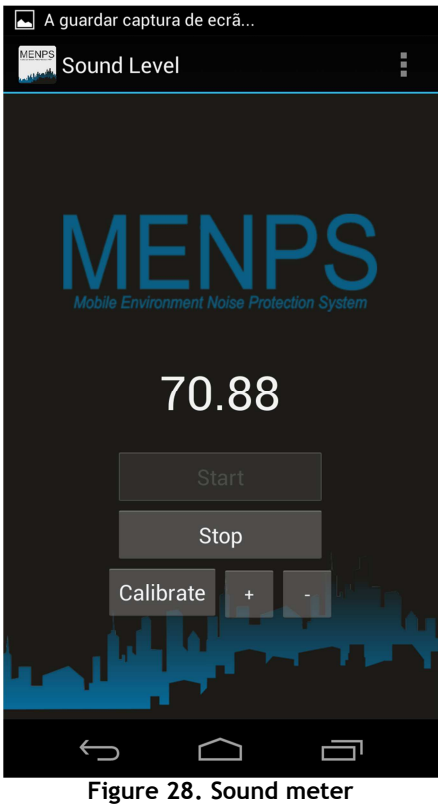

Figure 28. Sound meter

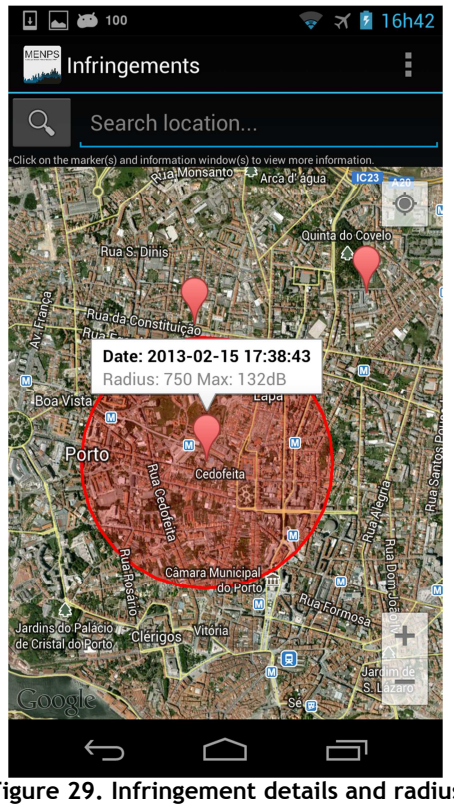

Figure 29. Infringement details and radius

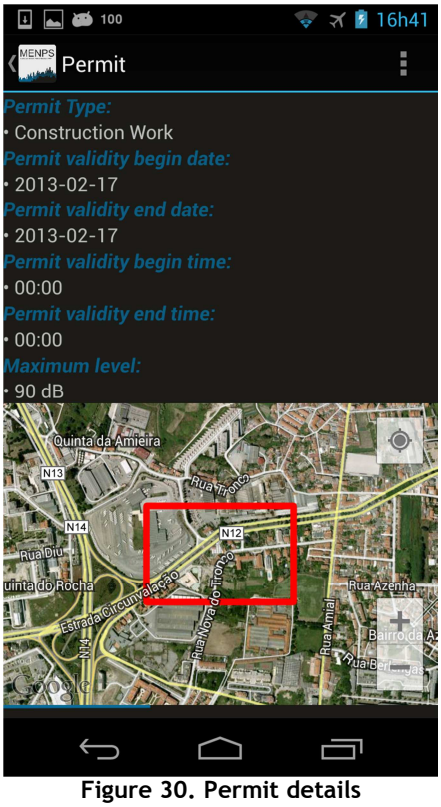

Figure 30. Permit details

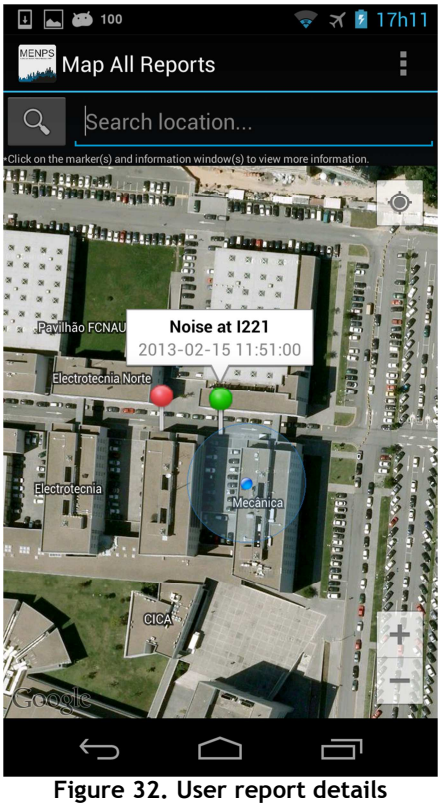

Figure 32. User report details

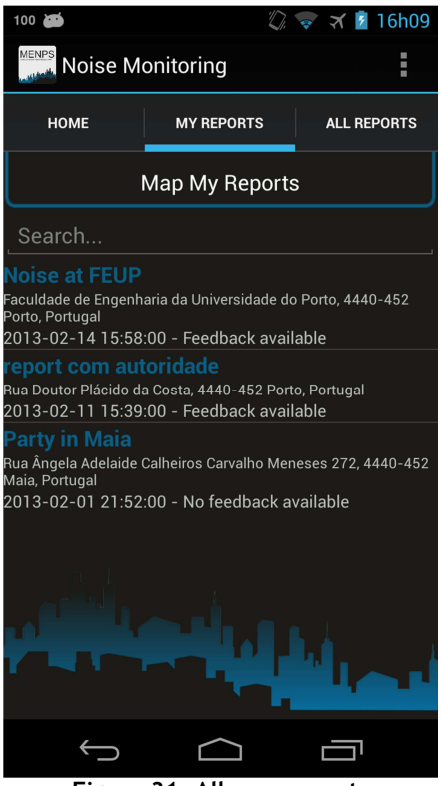

Figure 31. All user reports

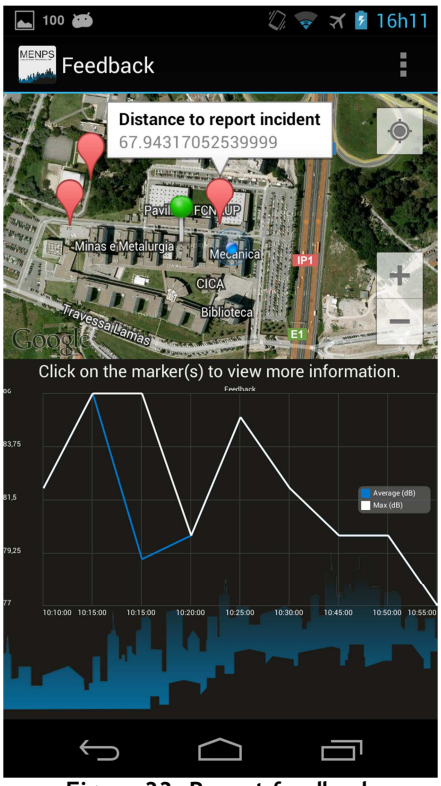

Figure 33. Report feedback

Chapter 7

Technologies Used

7.1. System-wide technologies

Communication with G2's server and between the Android Application and the Website is done using REpresentational State Transfer (REST), a scalable, low latency, readable and client-server based architecture language. With the purpose of easing HTTP communication protocols, cURL - a client-side library - was used. In order to show format diversity, both JSON and XML files were used, JSON for the measurements and XML for the permits. Our database was SQL based and was accessed using PHP's MySQLi extension.

7.2. Website

Based on PHP, the website was built in HTML5, JavaScript and CSS, creating a powerful synergy that resulted in a fast, easy-to-use platform. Both Maps and Chart Tools API by Google were used to display information in a beautiful and intuitive way.

7.3. Android Application

The Android Application was written in Java using the most recent Google Android API available.

Chapter 8

Conclusion

Big challenges offer a good possibility for growth. This project was, without a doubt, a big challenge. Working with people and integrating concepts acquired throughout an entire course was certainly not easy, several were the obstacles and roadblocks. This arduous path could not have been crossed without not only this team's but all teams' collaboration and effort.

Defining the project and each team's role in it took far more than the stipulated, delaying this complex project from the start. It was not until the middle of November that coding begun.

Deadline compliance was not this course's strength. Even though our work was fairly terminated by the end of the original deadline, it was not until the week leading to the new deadline that the remaining teams started to catch up, provoking integration issues.

All in all, SETEC allowed its students the acquisition of skills and know-how that will without a doubt help in the fast-approaching entrance to the real working environment.