

Faculdade de Engenharia da Universidade do Porto



Mobile Environmental Noise Protection System

Group 3A

VERSION 1.1

Final Report

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Version Control

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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

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List of Acronyms

Gx - 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;
- Technologies Used: identification of the technologies used to develop the project.
- Android Application: description of the Android application functionalities.

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.

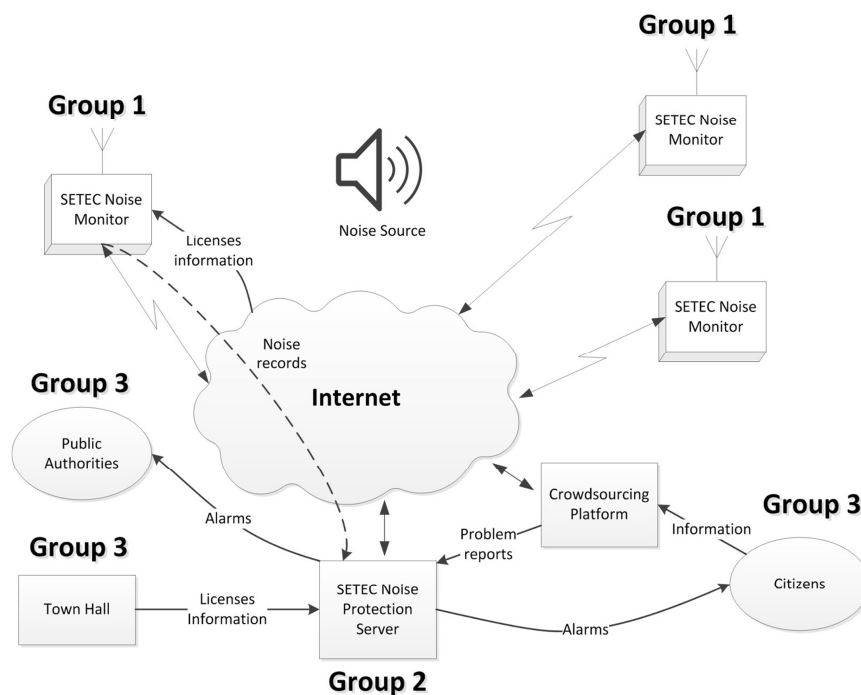


Figure 1. Overall System Architecture

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. Citizens

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.

2.2.2.2. Law Enforcement

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.

2.2.2.3. City Hall

Once authenticated, the City Hall can not only view noise heat maps and every incident reported but also submit licenses and request noise measurements.

2.2.2.4. 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.

3.1. 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.

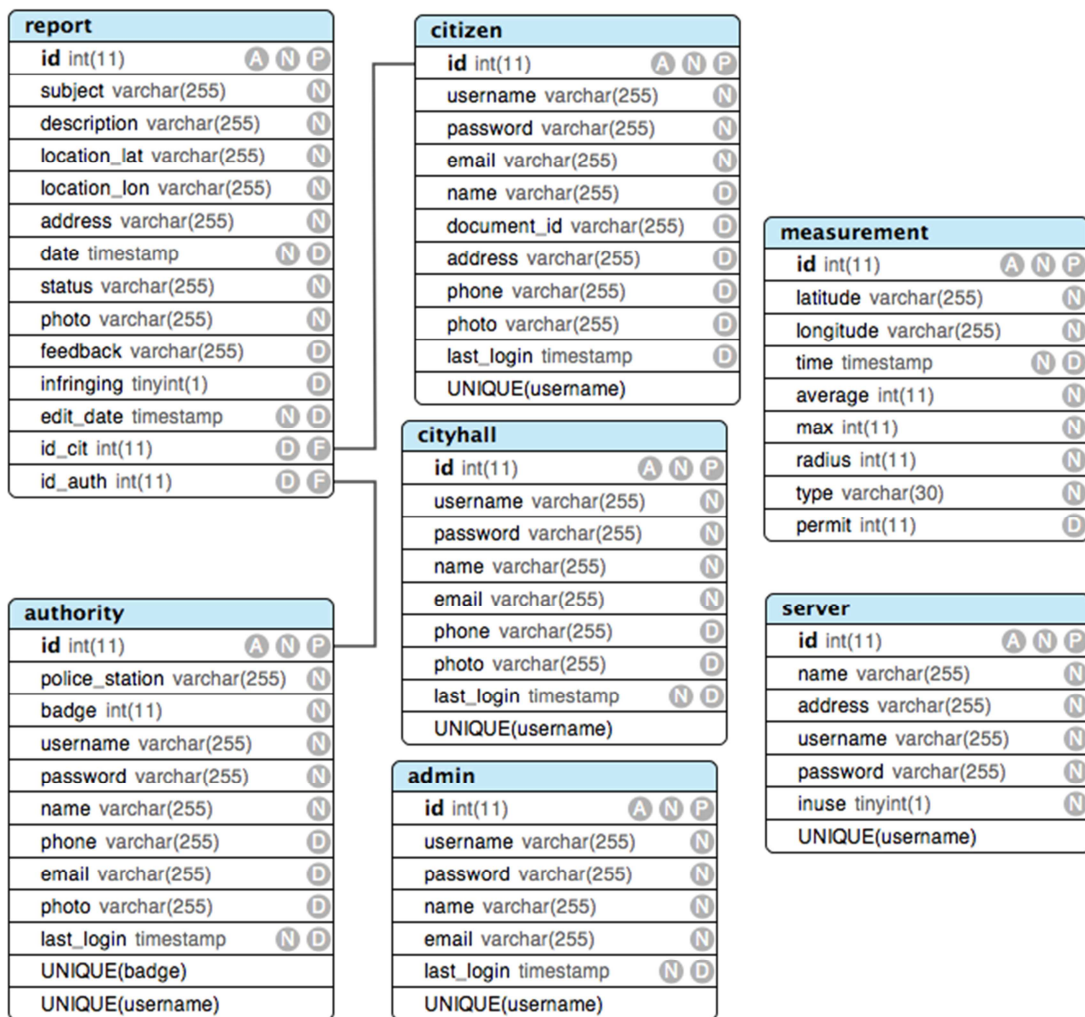


Figure 2. Database Entity-Relationship Model

Chapter 5

Use Cases Implementation

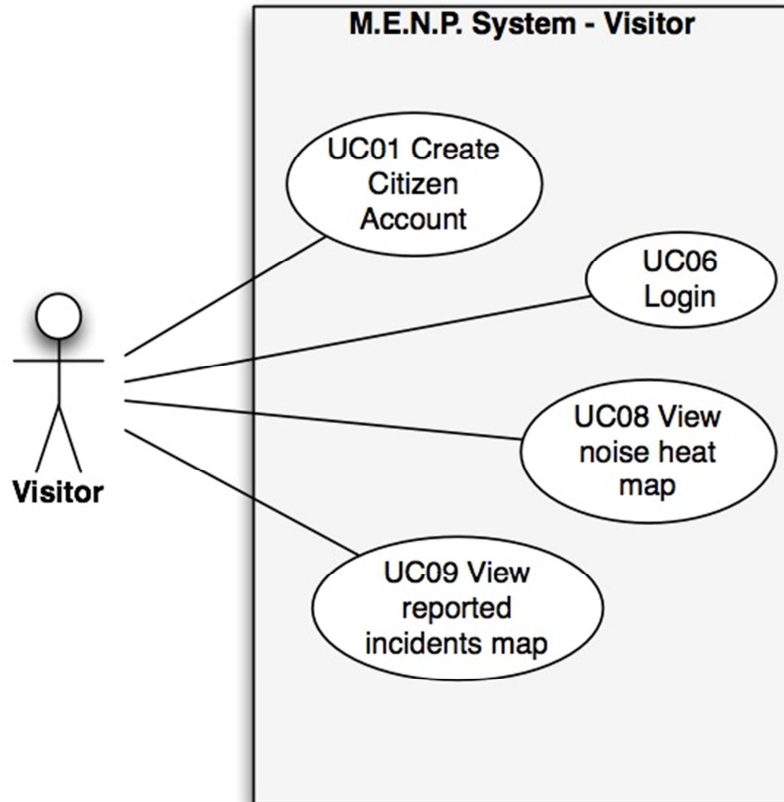


Figure 3. Visitor Use Cases

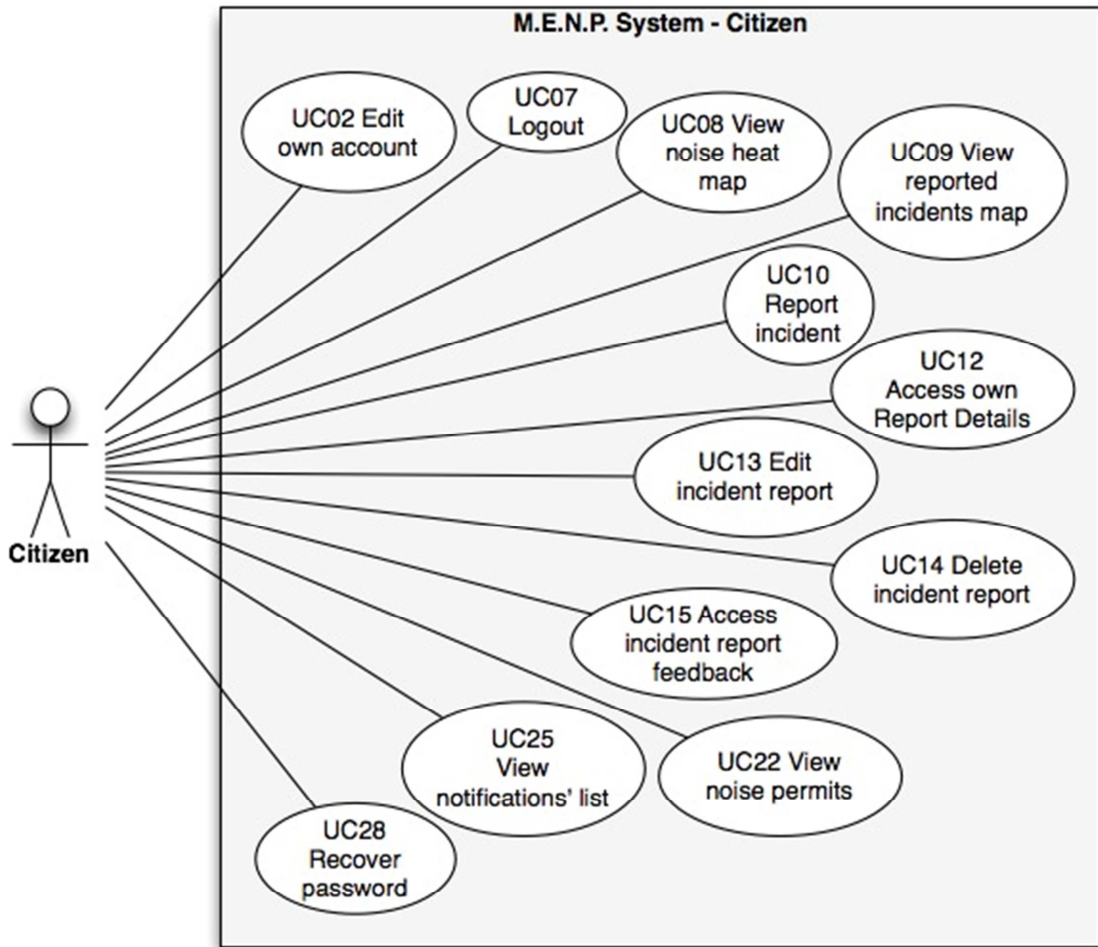


Figure 4. Citizen Use Cases

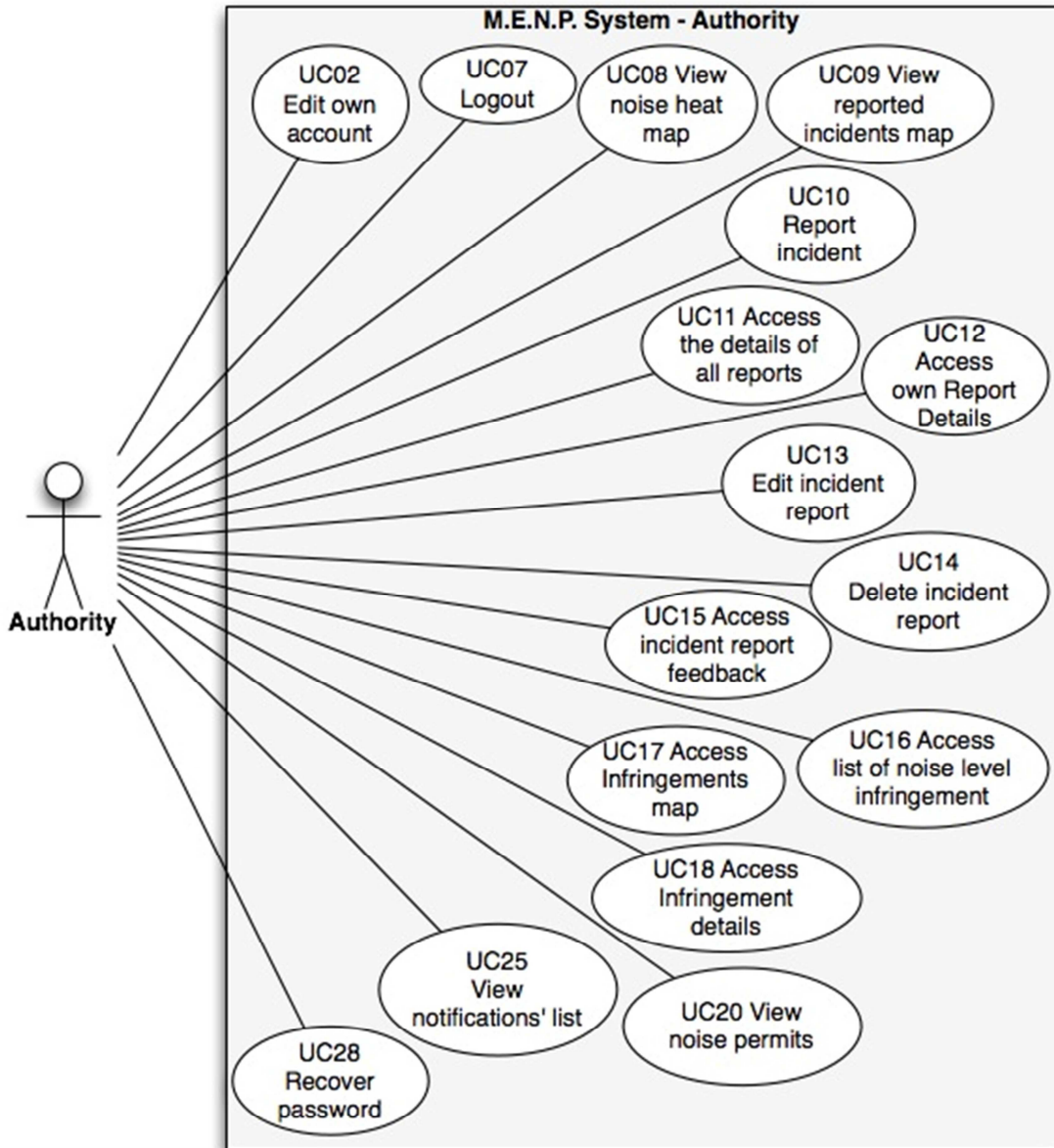


Figure 5. Authority Use Cases

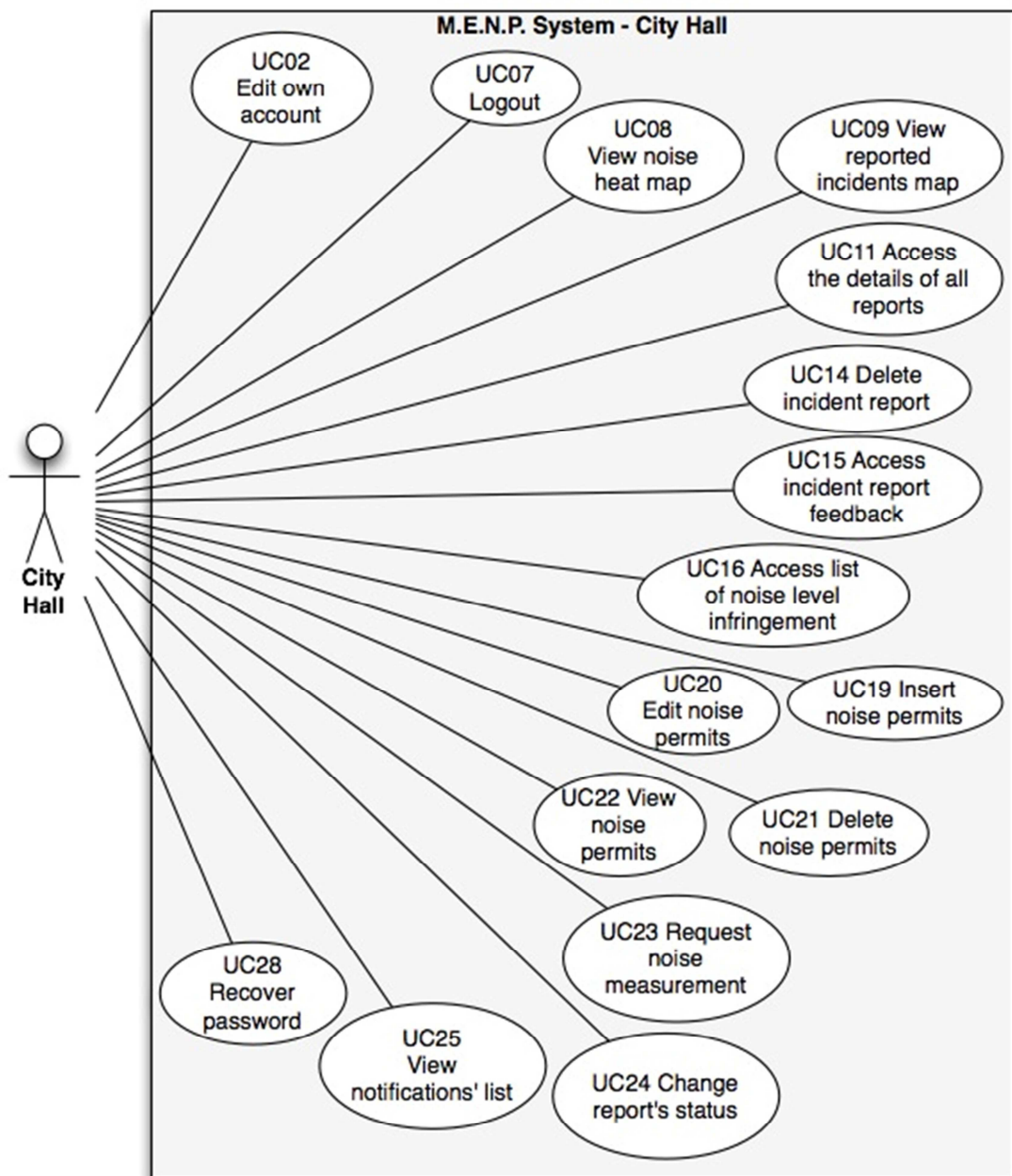


Figure 6. City Hall Use Cases

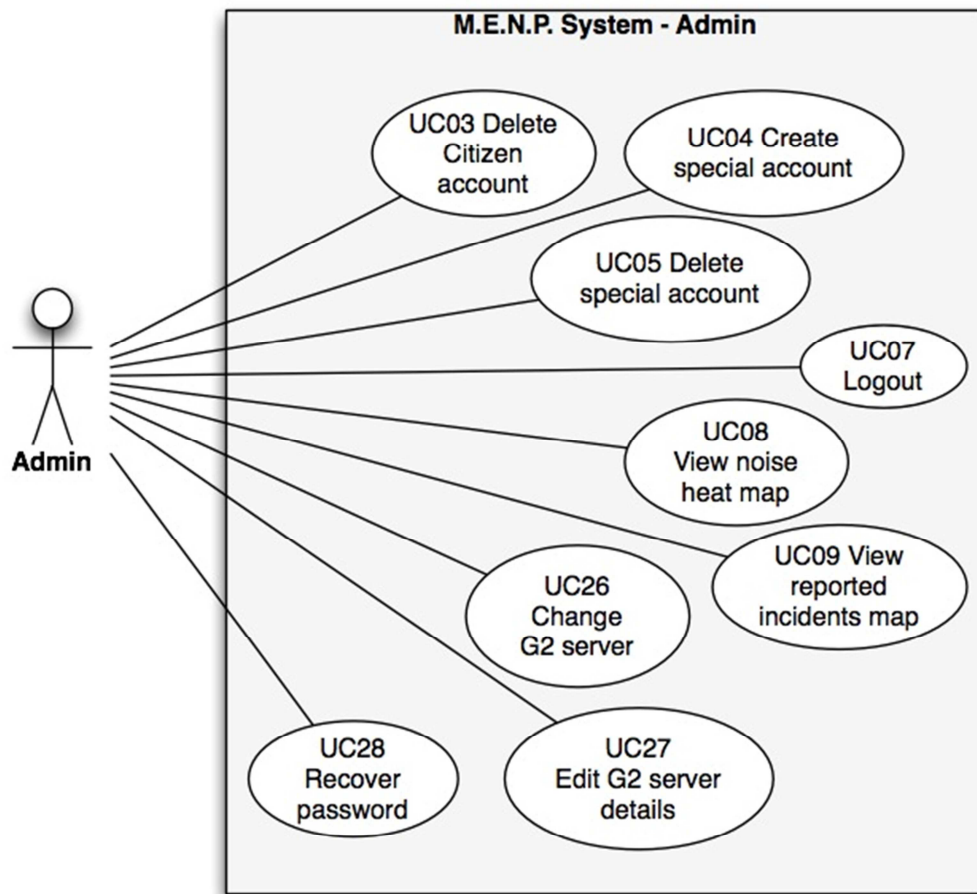


Figure 7. Administrator Use Cases

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 of 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.

The screenshot shows a web form titled "Create new Account". It contains several input fields and validation messages:

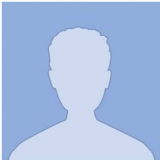
- Name:** An empty text input field.
- ID Number:** An empty text input field.
- Username (cannot be changed):*** An empty text input field.
- Address:** An empty text input field.
- Email:*** A text input field containing the word "wrong". Below it is the message "Not a valid e-mail address".
- Phone:** A text input field containing the word "wrong". Below it is the message "Invalid telephone number. Characters permitted are digits, space (-) and leading +".
- Password:*** A text input field with three dots (•••) visible. Below it is the message "Password too short. Please use more than 6 characters".
- Photo:** A file upload area with a "Choose File" button and the text "No file chosen".
- Confirm Password:*** An empty text input field.
- A blue "Submit" button is located at the bottom right of the form.
- A legend at the bottom indicates that fields marked with an asterisk (*) are required.

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.

Edit Account

Avatar:


Change Photo:

Username (cannot be changed):
citizen

Name:

Email: *

Phone Number:

ID Number:

Address:

Change Password (only fill if password change is wanted)

Old Password: *

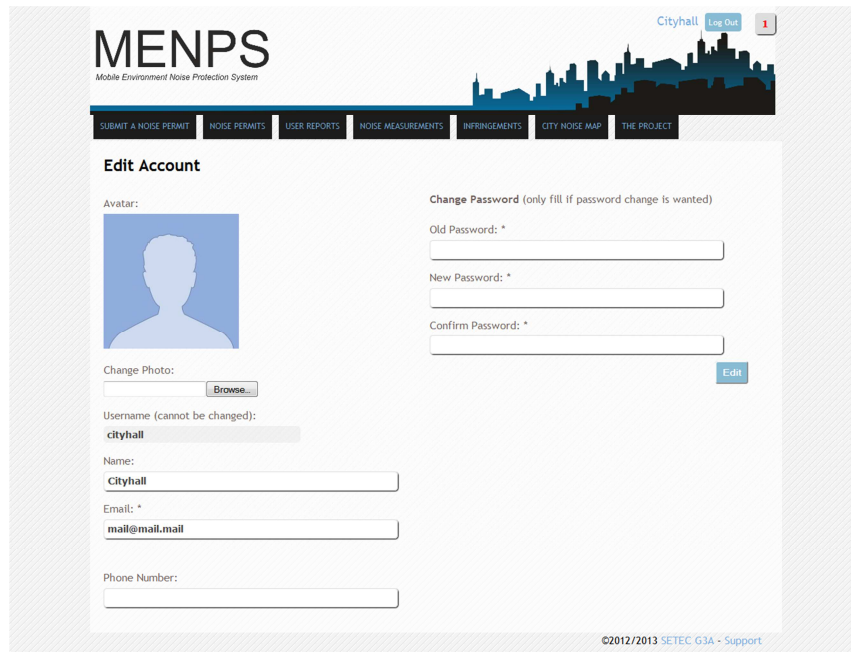
New Password: *

Confirm Password: *

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.



The screenshot shows the 'Edit Account' page for a user named 'Cityhall'. The page has a header with the 'MENPS' logo and navigation tabs: 'SUBMIT A NOISE PERMIT', 'NOISE PERMITS', 'USER REPORTS', 'NOISE MEASUREMENTS', 'INFRINGEMENTS', 'CITY NOISE MAP', and 'THE PROJECT'. The user is logged in as 'Cityhall'. The form includes fields for 'Avatar' (with a 'Change Photo' button), 'Change Password' (with 'Old Password', 'New Password', and 'Confirm Password' fields), 'Username' (locked to 'cityhall'), 'Name' (set to 'Cityhall'), 'Email' (set to 'mail@mail.mail'), and 'Phone Number'. An 'Edit' button is at the bottom right. The footer contains the copyright notice '©2012/2013 SETEC G3A - Support'.

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.

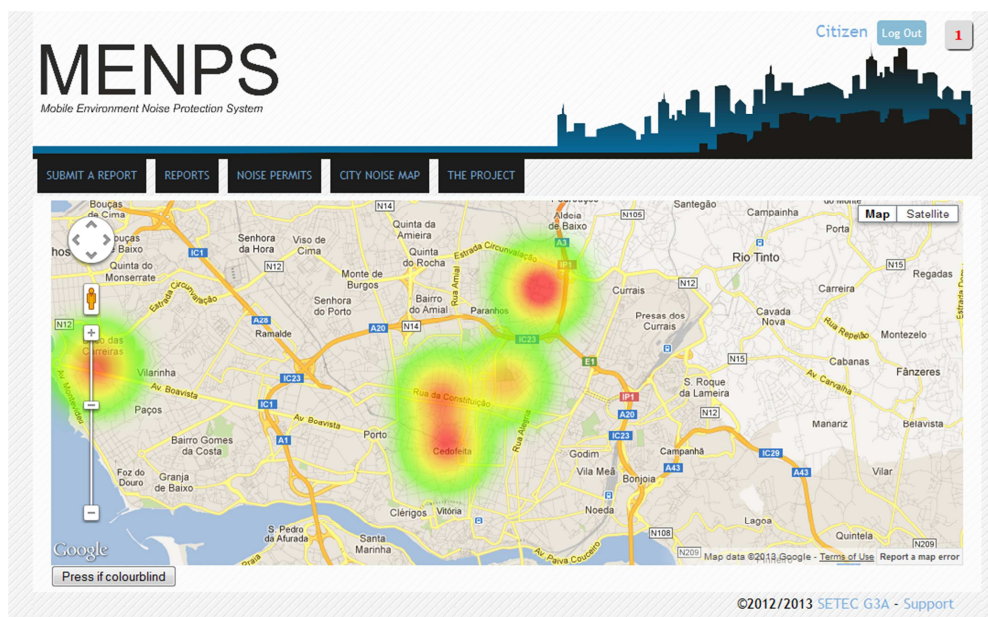


Figure 11. View noise heat map

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.

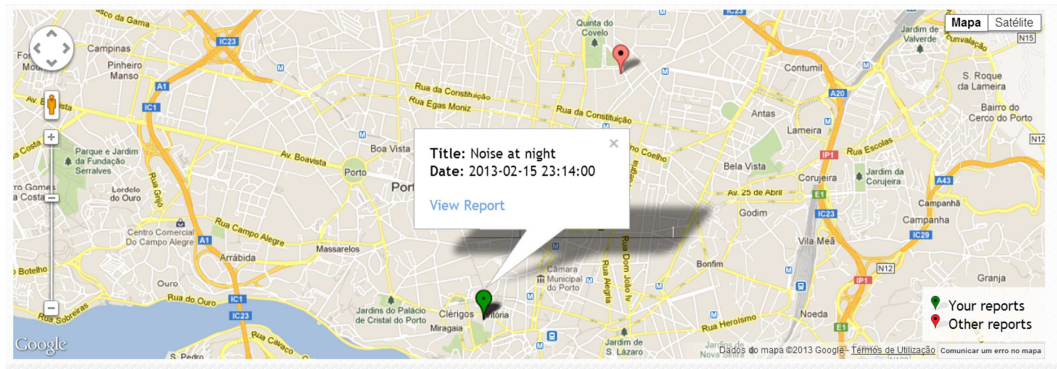


Figure 12. View reported incidents map

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.

Submit a New Report

Report Title

Description
250 characters allowed

Occurred on
Date: 2013-02-13 Time: 10 : 10

Address
Faculdade de Engenharia da Universidade do Porto, 4440-452 Pc

Upload Photo
 No file chosen

Select the noise location on the map or search using the location name.

Street, City

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.

View Report

Subject
Noise at night


Description
Very noisy, can't sleep

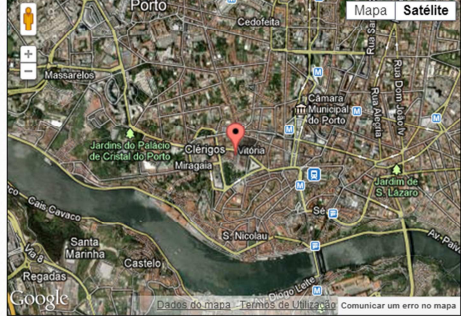
Address
Praça Parada Leitão 43, 4440-452 Porto, Portugal

Latitude
41.14685306544056

Longitude
-8.616376516871696

Date
2013-02-15 23:14:00

Photo:




Status
open

Feedback
No feedback available

Infringing
No data

Edit Date
2013-02-15 18:40:46

[Edit Report](#)

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.

Feedback

Click one of the yellow markers to view more information.





Time	Max	Average
2013-02-16 10:10:00	82	82
2013-02-16 10:15:00	86	80
2013-02-16 10:20:00	86	80
2013-02-16 10:25:00	86	86
2013-02-16 10:30:00	82	80
2013-02-16 10:35:00	86	82
2013-02-16 10:40:00	82	80
2013-02-16 10:45:00	82	80
2013-02-16 10:50:00	82	80
2013-02-16 10:55:00	82	79

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.

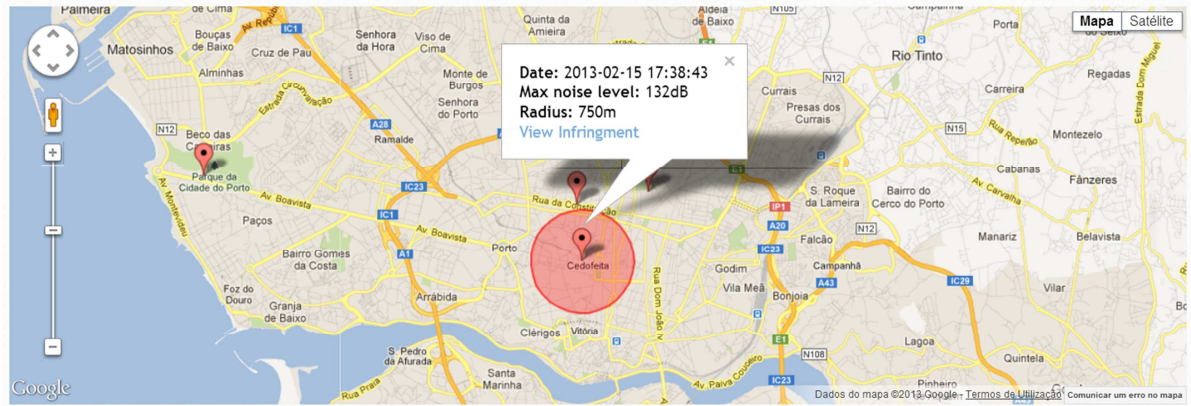


Figure 16. Access infringements map

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 both G2 servers.

Submit a New Noise Permit

Permit Type

Maximum level
 dB

Date
Start End

Allowed hours
Start : End :

Permit Location (filled when drawn on map using)

Latitude NE

Longitude NE

Latitude SW

Longitude SW

Select the noise location on the map or search using the location name.

Street, City

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.

Submit a Measurement Request

Select the desired measurement location on the map or search using its name.

Description
290 characters allowed

Date and Time
Date: 2013-02-16 Time: 00 : 20

Measurement Type
Medium
Short
Medium
Long
41.1784247

Longitude
-8.5947734

Submit

Street, City Find location Find me

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.

List of User Reports

#	Subject	Date	Status	Infringing	Created by	Actions
1	Noise at night	2013-02-15 23:14:00	open	No	Vitor Araújo	View Delete <input type="checkbox"/>
2	Too much noise in	2013-02-15 14:50:00		Yes	Citizen	View Delete <input checked="" type="checkbox"/>
3	Noise in FEUP	2013-02-15 14:50:00		No	Citizen	View Delete <input checked="" type="checkbox"/>
4	Noise at I221	2013-02-15 11:51:00	open	No	Auth: Authority	View Delete <input type="checkbox"/>

Apply to selected reports Set status Approved

- Choose an action
- Delete
- Set status Approved
- Set status Closed
- Set status Open
- Set status Rejected

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.

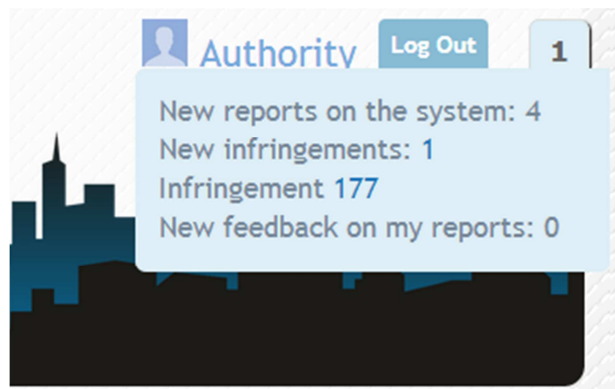


Figure 20. Notification list

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.

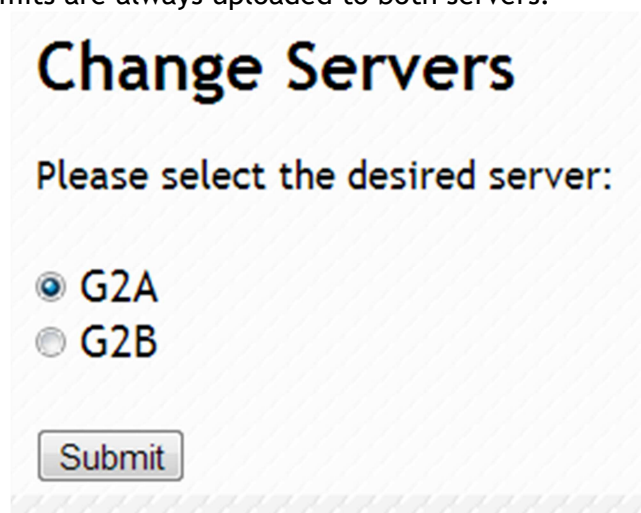


Figure 21. Change G2 server

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 guaranteed 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.

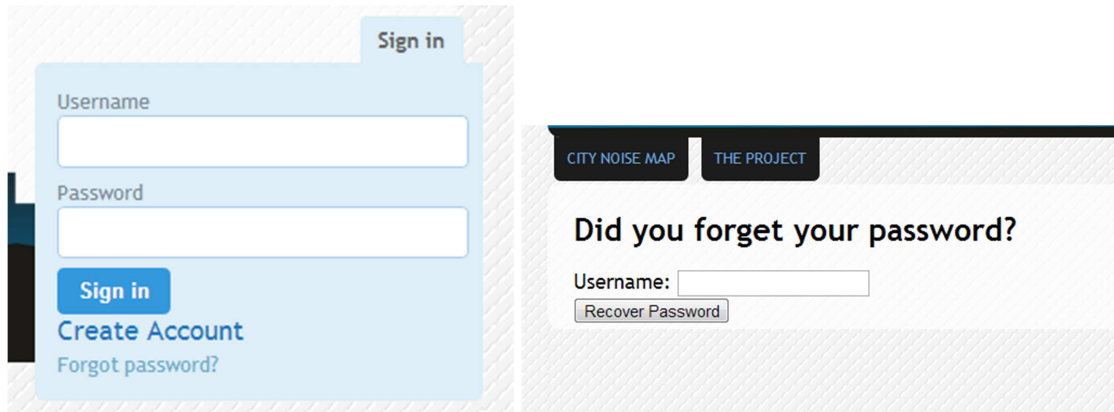


Figure 22. Recover password

Chapter 6

Technologies Used

6.1. 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.

6.2. 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.

6.3. Android Application

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

Chapter 7

Android Application

The Android application provides interfaces for Citizen and Authority and its workflow is similar to the website. Interfaces were created according to Android design guidelines and should provide 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.

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.