

Faculdade de Engenharia da Universidade do Porto



**FEUP**

## Mobile Environmental Noise Protection System

Group 3A

VERSION 1.0

## Requirement Document

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## Version Control

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0.1	18/10/12	Rui Pinto	X	All of them	Creation of the document
1.0	30/10/12	Team	X	All of them	Completion of document and revision

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# List of Acronyms

CPU - Central Processing Unit

Gx - Team x

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

OS - Operating System

U.I. - User Interface

# 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 system to be developed has to cover the existing problems and provide a solution that allows the interaction between citizens, public authorities and city halls.

This report aims to clearly define the purpose and set of requirements of the Mobile Environmental Noise Protection System to develop, specifically focused on the crowd-sourcing and user interfaces section assigned to all groups 3. This document gives a detailed view of the user interface requirements, functionalities and restrictions of the system based on the users characteristics and their needs, defined by group 3A.

### 1.2. Document structure

This project requirement document is structured as follows:

- Introduction: brief explanation about the document and the project.
- System Overview: description of the project, its sub-systems, goals, features, potential users characteristics and main constraints;
- Use cases: description of the functionalities offered by the system from the point of view of its different types of users;
- System Requirements: definition of the user-oriented system requirements, both functional and non-functional.

# Chapter 2

## System Overview

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

It 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.

The M.E.N.P.S. 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 sub-systems, corresponding to the three groups presented in figure 1, with different responsibilities that will be explained next.

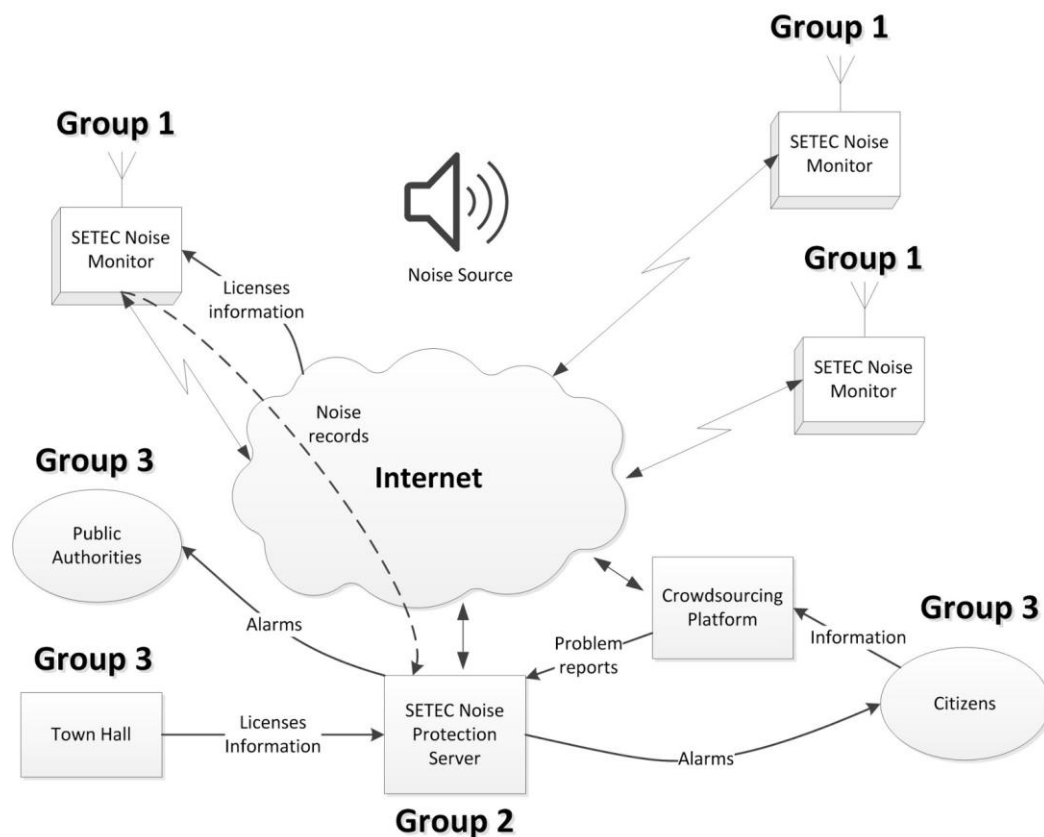


Figure 1 - Overall System Architecture



## G1 - Noise Monitor

- plan, design and build the “noise monitor” hardware, including the box, microphones for sound capturing, a smartphone to transfer data to the server (G2), a battery for long periods of autonomous work and an energy source;
- develop synch-scheme between multiple monitors;
- agree on interface with G2 (noise protection server);
- develop noise measuring application (local part on the smartphone):
  - receive “licenses information” from G2;
  - automatically configure this sub-system (according to license, location, etc.);
  - perform standard measurements (includes influences from temperature, humidity, etc.);
  - cyclically forward data to the server (G2);
  - generate alarms when noise permits are exceeded;
- execute calibration with a reference device.

## G2 - Noise Protection Server

- implement the different noise measurement aspects as defined by the law:
  - implement various measurement algorithms;
  - consider special noise permit rules;
  - automatically configure the system according to location of noise monitors;
  - document incidents;
  - produce life and past event noise maps and visualizations;
- agree with G1 (noise monitors) on an interface;
- agree with G3 (crowdsourcing and user interfaces) on interfaces.

## G3 - Crowdsourcing and User Interfaces

- design and implement all user interfaces:
  - citizens (report incidents, information, etc.);

- town-hall (report planned incidents, information from citizens, alarms);
- public authorities e.g. Police (information from citizens, information related to licenses, noise alarms, etc.) for PC and smartphones;
- implement an integrated crowdsourcing platform:
  - geotag incident reports from citizens;
  - give feedback to citizens;
  - produce incident blogs.

## 2.1. System Breakdown Structure

SBS v1.0  
October 30th 2012

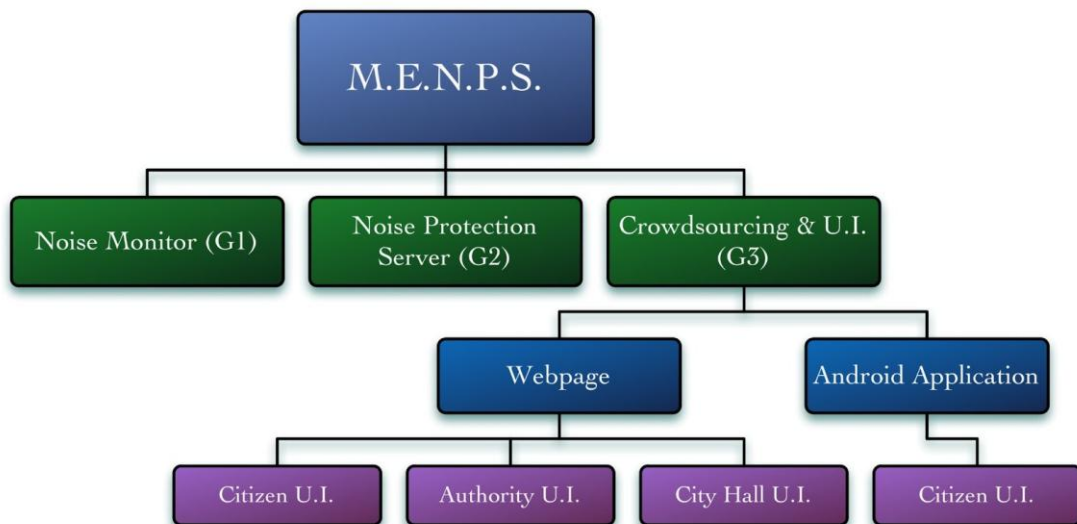


Figure 2 - System Breakdown Structure

From this point forward, the focus will be placed on the Crowdsourcing & U.I. modules, i.e., Group 3's work.

### 2.1.1. Goals

The goals which the final system should achieve are:

- Be a cheaper solution than what exists in the market
- Give voice to the population while making sure reports are trustworthy
- Serve as a fast and safe way to inform law enforcement
- Be easy to use, implement and install
- Be well organized and logical

- Be the most automatic and autonomous possible
- Be information-wise transparent

## 2.1.2. Features

The system must present the following features:

1. Web interface: the major functionalities of the system can be used through a web page that works as main interface between the different users specified in the next section;
2. Android compatibility: in addition to the web page, the system will be accessible through an Android application, specially oriented to citizens;
3. External Microphones: to collect the environmental noise, the system will be able to connect to a set of boxes that contain external microphones, allowing the user to check the levels of noise.
4. Crowdsourcing: this type of model will allow citizens inform the authorities of high levels of noise in a certain place and create maps of reported incidents across the city.
5. Noise Maps: the environmental noise collected by the boxes allows the construction of noise maps of the cities and analyze critical areas of noise pollution.

## 2.2. User Characteristics

The M.E.N.P. System will be used by the common citizen, law enforcement and city hall. All these types of users have different characteristics:

### 2.2.1. Citizen

This is the most common type of user. Citizens can have a general perception of the city's noise levels via a noise heat map. Once registered, the general population can report incidents of disturbance in the noise levels via either the system's web-page or the Android application. Citizens can also view the status of their own incident reports.

## **2.2.2. Law Enforcement**

Once authenticated, law enforcement is able to access a detailed city noise heat map with every incident reported. Law enforcement is also notified whenever a box registers a noise level that is considered illegal according to the law.

## **2.2.3. City Hall**

The Environmental Department or equivalent department within the City Hall, once authenticated on the M.E.N.P.S.'s website, can not only view noise heat maps and every incident reported but also submit licenses and request noise measurements.

# **2.3. Constraints**

## **2.3.1. Interoperability**

This project's making is divided by three types of teams:

1. Noise Measuring Box Hardware and Software;
2. Server side;
3. User interface.

There are several teams of each type making similar work. The final work must be interoperable between the teams.

## **2.3.2. Time**

A system prototype must be delivered by December 10, 2012.

The final project will be delivered by January 21, 2013.

## **2.3.3. Android Compatibility**

The system must be compatible with the Android OS for the user interface regarding the citizens.

# Chapter 3

## System Requirements

### 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 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 must automatically manage user permissions according to their type.

FM04 - The system must allow the consult of a generic noise heat map.

FM05 - The system must allow the consult of a map marking the location of reported incidents.

FM06 - The system must allow incident reports.

FM07 - The system must provide feedback to the incident reports published whenever a measurement is done.

FM08 - The system must allow the input of licenses for planned noisy activities.

FM09 - The system must allow noise measurement requests.

FM10 - the system should give feedback whenever a requested measurement is done.

FM11 - The interface must include a help menu.

#### 3.2 Non-functional Marketing Requirements

##### 3.2.1. Performance Requirements

NF01 - The system should not consume excessive resources (CPU, battery, memory, etc.).

### **3.2.2. Reliability Requirements**

NF02 - The system should always present accurate information and when in doubt no information is better than producing inaccurate one.

NF03 - All data input should be validated by the system.

NF04 - Recovery time in case of failure should be the shortest possible.

NF05 - The system should have the minimum down-time possible.

### **3.2.3. Security Requirements**

NF06 - The system should be able to authenticate different types of users through their credentials.

NF07 - If no action is performed by the user in a long period of time (30 minutes for example) the system should log the user out.

NF08 - Data should be maintained confidential and respect the predetermined boundaries.

### **3.2.4. Usability Requirements**

NF09 - The system should be easy to use.

NF10 - Context help should be provided in every operation.

NF11 - Error messages should be in a clear and constructive language.

NF12 - Every operation done by the user should have system feedback.

NF13 - The user interface should be intuitive, simple, straightforward and alike throughout.

### **3.2.5. Maintenance Requirements**

NF14 - The system should be easy to install.

NF15 - All necessary documentation should accompany the software.

NF16 - The system should be easily updated and/or modified.

# Chapter 4

## Use Cases

The software developed by group 3A must satisfy all the requirements listed in the previous section, providing interfaces for the three types of users already explained. As such, the use cases presented in figure 3 were identified and detailed below. Note that use cases that are common to multiple actors are only explained once.



Figure 3 - M.E.N.P.S. Use Cases

## 4.1. Visitor

Use Case	Description
Register as citizen	The visitor can only register himself as a citizen (other types of users have different registration processes) by introducing a set of personal information (name, address, ID, email, desired password, etc.).
Log in	A registered user can authenticate itself by introducing the username and password defined at the time of registration.
Access the noise heat map	A non-authenticated user can access a general noise heat map that marks the noisier and quieter areas through a variation of colors.

## 4.2. Citizen

Use Case	Description
Report incident	After being validated, the user can submit situations of high noise levels and their location to the authorities, by sending the information of its position.
Consult reported incident feedback	The user has access to their report information and their current state.
Access the reported incidents map	The user has access to a map of all incidents reported by citizens, including available ongoing or previous measurement in certain places.
Consult the licenses	The user will be able to access and read all the licenses added by the city hall that correspond to their report location.
Log out	The registered user can become a visitor by pressing the log out option.



### 4.3. Authority

Use Case	Description
Access the reported incidents map	The authority has access to a map of all incidents reported by citizens, including available ongoing or previous measurement in certain places.
Receive measurement request	The authority has access to all ongoing or previous measurement requested by the city hall.
Consult all reported incidents	A list of all the citizens' reports will be present to be consulted by the authorities.
Consult all reported incidents feedback	The authority has access to the state of all incidents reported.
Consult the licenses	All licenses are added by city hall, the authorities will be able to access them.

### 4.4. City Hall

Use Case	Description
Request measurement	The city hall will have access to a page that allow submit requests for noise measurements. The location, data time and metrics to be used must be defined.
Submit license	The city hall will have access to a page that allow submit licenses. The location, data, time and sound limits must be defined.

# References

- [1] AZEVEDO, Américo - Requirements, v1.0, October 30th 2011