
SOFTWARE REQUIREMENTS SPECIFICATION

for

AirWatcher

Version 1.0 approved

Prepared by Adrien Jaillet, William Jean, Matheus de
Barros Silva, Jade Prévôt, Brandon da Silva Alves

INSA Lyon, Group B3204 - B3025

April 5, 2021

Contents

1	Introduction	7
1.1	Purpose	7
1.2	Document Conventions	7
1.3	Intended Audience and Reading Suggestions	7
1.4	Project Scope	7
1.5	References	8
2	Overall Description	9
2.1	Product Perspective	9
2.2	Product Functions	9
2.3	User Classes and Characteristics	9
2.4	Operating Environment	10
2.5	Design and Implementation Constraints	10
2.6	User Documentation	10
2.7	Assumptions and Dependencies	10
3	External Interface Requirements	11
3.1	User Interfaces	11
3.2	Hardware Interfaces	13
3.3	Software Interfaces	13
3.4	Communications Interfaces	13
4	System Features	14
4.1	User Features	15
4.1.1	UC-1: Log In	15
4.1.2	UC-2: Calculate Mean of Air Quality at a specified circular area	15
4.1.3	UC-3: Log Out	16
4.1.4	UC-4: Compare and rank all sensors with a specific one.	16
4.1.5	UC-5: Analyse air quality at specific position and specified time.	17
4.1.6	UC-6: Analyse AirCleaner efficiency	18
4.2	Government Agency Features	19
4.2.1	UC-7: Analyse data of specific sensor	19
4.2.2	UC-8: Exclude malfunctioning sensors.	19
4.3	Private Individual Features	20
4.4	Administrator Features	20
4.4.1	UC-9: Create Account	20
4.4.2	UC-10: Add new sensor	20

5	Other Nonfunctional Requirements	21
5.1	Performance Requirements	21
5.2	Safety Requirements	21
5.3	Security Requirements	21
5.4	Software Quality Attributes	21
5.4.1	Adaptability	21
5.4.2	Availability	21
5.4.3	Correctness	21
5.5	Business Rules	21
6	Other Requirements	22
6.1	Appendix A: Glossary	22
6.2	Appendix B: Analysis Models	22
6.3	Appendix C: To Be Determined List	22

List of Figures

3.1	GUI - Login / Signin Menu	12
3.2	GUI - Private Individual Menu	12
4.1	Use Case Diagram	14

List of Tables

4.1	UC-1 Functional Requirements	15
4.2	UC-2 Functional Requirements	16
4.3	UC-3 Functional Requirements	16
4.4	UC-4 Functional Requirements	17
4.5	UC-5 Functional Requirements	18
4.6	UC-6 Functional Requirements	18
4.7	UC-7 Functional Requirements	19
4.8	UC-8 Functional Requirements	19
4.9	UC-9 Functional Requirements	20
4.10	UC-10 Functional Requirements	20

Version History

Version	Date	Authors	Description
0.1	2021-04-03	Adrien Jaillet, William Jean, Matheus de Barros Silva, Jade Prévôt, Brandon da Silva Alves	<ul style="list-style-type: none">• Document creation from template that respect IEEE standard.• Add of <i>Introduction</i> and <i>Overall Description</i> sections.• Draft of <i>External Interface Requirements</i> and <i>System Features</i> sections.

Chapter 1

Introduction

1.1 Purpose

The purpose of the document is to collect and analyze all assorted ideas that have come up to define the system, its requirements with respect to consumers. Also, we shall predict and sort out how we hope this product will be used in order to gain a better understanding of the project, outline concepts that may be developed later, and document ideas that are being considered, but may be discarded as the product develops.

In short, the purpose of this SRS document is to provide a detailed overview of our software product, its parameters and goals. This document describes the project's target audience and its user interface, hardware and software requirements. It defines how our client, team and audience see the product and its functionalities. Nonetheless, it helps any designer and developer to assist in software delivery lifecycle (SDLC) processes.

1.2 Document Conventions

1.3 Intended Audience and Reading Suggestions

This SRS is addressed to all stakeholders of the software: the governmental agency which need to monitor the air quality, the air cleaner providers which want to observe the impact of the cleaners on air quality and private individuals who participate in air quality data generation by installing fixed sensors at their homes. It is also addressed to developers who will develop the application and administrators responsible for software maintenance. The project manager can also follow the progress of the software specifications by reading this document.

End users must focus their reading on *System Features* while developpers and administrators should also pay attention to *External Interface Requirements* and *Other Nonfunctional Requirements*.

1.4 Project Scope

The *AirWatcher* application is a console-based application that helps its users monitor the air quality as well as the quality of the data provided by the sensors used for data collection. This application is designed to improve air quality analysis by providing efficient algorithms for calculating indicators as well as checking the data reliability.

More specifically, the application provide, on demand metrics for a circular area specified by the user. Besides, the AirWatcher will continuously analyse data in order to identify malfunctioning sensors as well as wether the defect is willingly made or naturally caused.

Moreover, the application will also be responsible for managing the Governments's points system, which attributes a point to a private sensor owner each time their sensors's data are requested in a query for analysis. On the other hand, if the application identifies that the user is willingly distorting their sensors data, AirWatcher will mark the user as non-applicable for being awarded points.

By doing so, the application will allow the government agency to really monitor the air quality in order to taking the right measures for maintaining or improving air quality and as a consequence, the quality of life.

1.5 References

Chapter 2

Overall Description

2.1 Product Perspective

The application is part of a more global project. The project consists of a client server application. The end users, which are sensors, send their data to the server where AirWatcher is running. The data collection is out of scope of AirWatcher and is supposed to be fully operational. AirWatcher is a response to a governmental need. Indeed government agencies want to be able to monitor the air quality of specific areas so they could be able to take decisions (for example, install air cleaners in polluted zones) to improve the quality of life.

The data collection application and AirWatcher do not have to interface together. The only constraint is that the data collection, which will imply dataset updates, and AirWatcher should not run at the same moment.

2.2 Product Functions

The AirWatcher application will allow analysis of the data generated by a sensor to make sure that it is functioning correctly and otherwise identify and maintain malfunctioning sensors. The application will aggregate the collected information to produce statistics such as the calculation of the mean of the quality of air in a specific area specified by the user. The mean of the quality of air can be calculated for a given moment as well as for a specified period of time. The application will also enable selecting one sensor and then scoring and ranking all other sensors in terms of similarity to the selected sensor. The similarity will be based on the data generated by the sensors during a specified period of time. The purpose of this functionality is to identify areas with similar air quality. The Application must produce the value of air quality at a precise geographical position in the territory at a given moment. The agency and the providers could use AirWatcher to observe the impact of the cleaners on air quality, for example, the radius of the cleaned zone, the level of improvement in air quality, etc... Finally, the application will provide a console based user interface to its different users.

2.3 User Classes and Characteristics

There are four types of users that interact with the system: the government agency, the providers of "air cleaners", the private individuals who participate in air quality data generation by installing fixed sensors at their homes and administrators. Each of these four types of users has different use of the system so each of them has their own requirements.

The government agency is able to analyse the data generated by a sensor to make sure that it is functioning correctly. Then it will be able to identify and maintain malfunctioning sensors. There is only one government

agency but we can suppose it will use the software relatively frequently. This user can use all the functionalities associated with statistics. This is the most important user of our application.

The providers use AirWatcher to observe the impact of the cleaners on air quality, for example, the radius of the cleaned zone, the level of improvement in air quality, etc... There is less than 100 such kind of users. This user can also use all the functionalities associated with statistics with an relatively high frequency.

The private individuals participate in air quality data generation by installing fixed sensors at their homes. These types of users are very numerous but most of them does not use the software frequently. This user also have access to all the the functionalities associated with statistics.

Each user can manage its account. They all have a username and password.

here, tell about actor attributes

2.4 Operating Environment

The AirWatcher application operates in any modern operating system without any particular restrictions. It uses a client-server architecture. The software runs on the server while end users send their data. The server needs a *10.2.0+ g++* version. It may work with an older version but it has not been tested.

2.5 Design and Implementation Constraints

The project must be developed in *C++*. The application must not modify the data files. The algorithms used to analyse the data must be efficient. Therefore, the performance of the algorithms must be measurable. The metric of performance will be the duration of execution of an algorithm, measured in milliseconds.

The application should be developed following the layered architecture pattern. The different layers are: the user interface layer, the authentication layer and the statistic functionalities layer.

2.6 User Documentation

The application provides a user manual which consists of a basic description of the user interface. This user manual follows the *Linux man-pages* format.

2.7 Assumptions and Dependencies

We assume that the data the application needs (on sensors, providers, users, cleaners, etc...) is present and precisely located on the server. We also assume that those files are correct plain text documents in csv format. The software is not responsible for the data collection. We therefore suppose that the data is collected beforehand. We also take for granted that the data will not be modified while the software is running.

The software does not rely on any dependency.

Chapter 3

External Interface Requirements

3.1 User Interfaces

There is one command line user interface. Once the program is running, the user is prompted to inform his username and password. If the credentials are recognized by the application the access is granted and the menu appears. If not, the credentials are asked again.

The menu of government agency and air cleaner provider consists of 8 options:

1. get statistics at a specific time
2. get statistics in a time interval
3. rank sensors in function of similarity
4. get the value of air at a specified position
5. get cleaners impact on the air quality
6. modify my account
7. logout
8. shutdown

The menu of private individuals consists of 9 options:

1. get statistics at a specific time
2. get statistics in a time interval
3. rank sensor in function of similarity
4. get the value of air at a specified position
5. get cleaners impact on the air quality
6. modify my account
7. Get my personnal score
8. logout
9. shutdown

```
sevla@dell:~/Test[]$ ./airwatcher
*****
AirWatcher - Air Quality Monitor
*****
<1> Sign in
<2> Sign up
-> █
```

Figure 3.1: GUI - Login / Signin Menu

```
sevla@dell:~/Test[]$ ./airwatcher
*****
AirWatcher - Air Quality Monitor
*****
<1> Get statistics at specific time
<2> Get statistics in time interval
<3> Rank sensors
<4> Get mean of air quality at a specific position
<5> Get cleaners impact on the air quality
<6> Update account
<7> Ger personal score
<8> Sign out
<9> Quit
-> █
```

Figure 3.2: GUI - Private Individual Menu

3.2 Hardware Interfaces

3.3 Software Interfaces

The application will load data from csv files locally.

3.4 Communications Interfaces

System Features

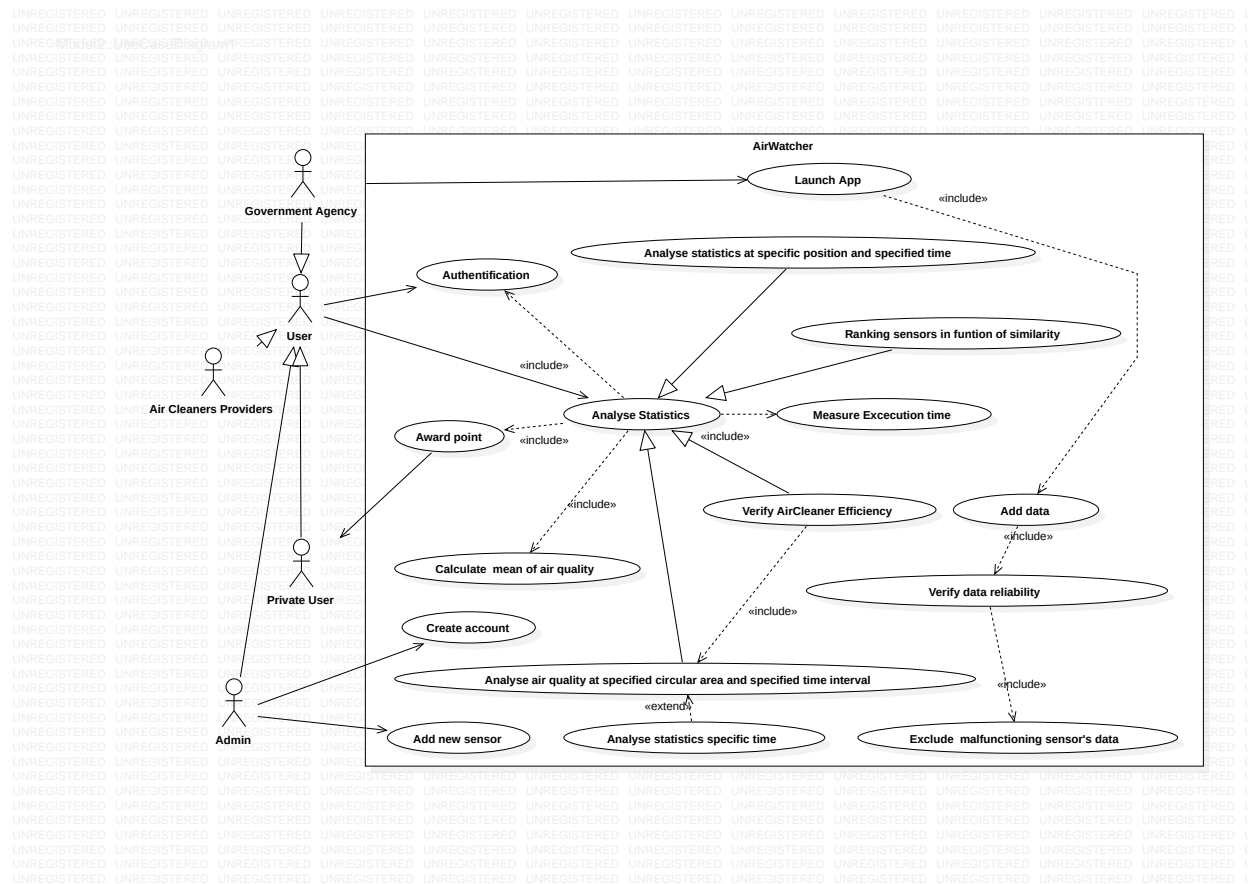


Figure 4.1: Use Case Diagram

4.1 User Features

4.1.1 UC-1: Log In

Description and Priority

This feature allows a user to authenticate himself. It has a low priority level.

Stimulus/Response Sequences

1. The system asks for the login of the user;
2. The user refers its login;
3. The system asks for the password of the user;
4. The user refers its password;
5. The system login the user.

Functional Requirements REQ-1

Use Case	Log in
Description	Allow a user to log in
Inputs	login, password
Precondition	Nobody is log in
Postcondition	User logged in
Output	User

Table 4.1: UC-1 Functional Requirements

4.1.2 UC-2: Calculate Mean of Air Quality at a specified circular area

Description and Priority

This feature permits to show the mean of air quality at a specified circular area. It has a high priority level.

Stimulus/Response Sequences

1. The system shows the different options of the menu;
2. The user choose the option 4;
3. The system ask for a circular area;
4. The user enters a specific area;
5. The system shows the mean of air quality at this position.

Functional Requirements REQ-2

Use Case	Calculate mean of air quality
Description	This functionality will returns the mean of air quality in terms of inputs
Inputs	longitude, latitude, radius, begin, end
Precondition	user logged
Postcondition	
Output	The mean of air quality in the circle defined by a point (longitude and latitude) at a certain moment (between begin and end).

Table 4.2: UC-2 Functional Requirements

4.1.3 UC-3: Log Out

Description and Priority

This feature permits to logout the user. It has a low priority level.

Stimulus/Response Sequences

1. The system shows the different options of the menu;
2. The user choose the option 9;
3. The system logout the user.

Functional Requirements REQ-3

Use Case	Log out
Description	Allow a user to log out
Inputs	
Precondition	User logged in
Postcondition	
Output	

Table 4.3: UC-3 Functional Requirements

4.1.4 UC-4: Compare and rank all sensors with a specific one.

Description and Priority

This feature permits to rank sensors compared to a selected one. It has a high level of priority.

Stimulus/Response Sequences

1. The system asks for a SensorId;
2. The user refers a SensorId;

3. The system compare all sensors to this one;
4. The system ranks all sensors. The sensor which is the closest to the refered is on top of the list. The farthest is the last one of the list;
5. The system print the list to the user.

Functional Requirements REQ-4

Use Case	Compare and rank all sensors with a specific one.
Description	Allow a user to compare and rank every sensor with a specific one. This feature permitt to identify areas with a similar air quality.
Inputs	SensorID
Precondition	User logged in. The selected sensor must not be malfunctioning
Postcondition	
Output	A rank of sensors compared to the selected one.

Table 4.4: UC-4 Functional Requirements

4.1.5 UC-5: Analyse air quality at specific position and specified time.

Description and Priority

This feature permitt to get the air quality at specific position and specified time. It has a high level of priority.

Stimulus/Response Sequences

1. The system asks for a Longitude;
2. The user refers a longitude;
3. The system asks for a latitude;
4. The user refers a latitude;
5. The system asks for a begin timestamp;
6. The user refers a begin timestamp;
7. The system asks for a end timestamp;
8. The user refers a end timestamp;
9. The system calcul the air quality at the specified position and the specified time;
10. The system print the value.

Functional Requirements REQ-5

Use Case	Analyse air quality at specific position and specified time.
Description	Allow a user to analyse air quality at specific position and specified time. The application must return a value even if there is no sensor at the specified location.
Inputs	longitude, latitude, date
Precondition	
Postcondition	
Output	The air quality at the specified location and date.

Table 4.5: UC-5 Functional Requirements

4.1.6 UC-6: Analyse AirCleaner efficiency

Description and Priority

This feature allows the user to get stats about the air Cleaner efficiency such as the radius of AirCleaner impact. It has a high level of priority.

Stimulus/Response Sequences

1. The system asks for a CleanerId;
2. The user refers a CleanerId;
3. The system calculates the size of area impacted by the airCleaner. It use cleaner's property to get begin timestamp and end timestamp.
4. The system print the radius of the AirCleaner Impact;

Functional Requirements REQ-6

Use Case	Analyse AirCleaner efficiency.
Description	Allow a user to analyse AirCleaner efficiency. The application analyse data at the begining and at the end of AirCleaner operation.
Inputs	CleanerId
Precondition	
Postcondition	
Output	The radius of AirCleaner impact.

Table 4.6: UC-6 Functional Requirements

4.2 Government Agency Features

4.2.1 UC-7: Analyse data of specific sensor

Description and Priority

TBD

Stimulus/Response Sequences

TBD

Functional Requirements REQ-7

Use Case	Analyse data of specific sensor
Description	Allow a user to analyse data of a specific sensor. If the user is a private user he can only analyse data of his own sensor.
Inputs	SensorID
Precondition	User logged in. If it's a private user, the sensor must be his.
Postcondition	
Output	If the sensor is malfunctioning.

Table 4.7: UC-7 Functional Requirements

4.2.2 UC-8: Exclude malfunctioning sensors.

Description and Priority

TBD

Stimulus/Response Sequences

TBD

Functional Requirements REQ-8

Use Case	Exclude malfunctioning sensors.
Description	The governmental agency can exclude a malfunctioning sensor. Then they wouldn't be considered anymore for stats.
Inputs	SensorID
Precondition	Sensor is not soon considered as malfunctioning
Postcondition	Sensor is considered as malfunctioning
Output	

Table 4.8: UC-8 Functional Requirements

4.3 Private Individual Features

4.4 Administrator Features

4.4.1 UC-9: Create Account

Description and Priority

TBD

Stimulus/Response Sequences

TBD

Functional Requirements REQ-9

Fonctionnality 3	Create account
Description	Allow an admin user to create an account
Inputs	login, password, role
Precondition	No account with this login and password already exists
Postcondition	Account created
Output	login, password, role

Table 4.9: UC-9 Functional Requirements

4.4.2 UC-10: Add new sensor

Description and Priority

TBD

Stimulus/Response Sequences

TBD

Functional Requirements REQ-10

Fonctionnality F4	Add new sensor
Description	Allow a user to
Inputs	Sensor
Precondition	The sensor doesn't exist
Postcondition	The sensor exists
Output	Sensor

Table 4.10: UC-10 Functional Requirements

Chapter 5

Other Nonfunctional Requirements

5.1 Performance Requirements

The government agency would like the algorithms (analyzing a sensor, calculating mean, comparison of sensors, etc) of AirWatcher to be efficient. They must be performant. The application must be able to measure their performance, through the duration of execution of an algorithm measured in milliseconds.

5.2 Safety Requirements

There is the possibility that a private individual may act maliciously and corrupt their sensor in order to provide false data. Therefore, the AirWatcher application will allow the government agency to analyze the data provided by a private individual's sensor and classify its behavior as reliable or unreliable. If a private individual is detected to provide unreliable data, their entire data will be marked as false and will be excluded from all further queries on the application. This will prevent the user from gaining any further points.

5.3 Security Requirements

The application must allow the government to be able to thwart individuals who corrupt their sensor, to remedy it and thus guard against this type of behavior.

5.4 Software Quality Attributes

5.4.1 Adaptability

5.4.2 Availability

5.4.3 Correctness

5.5 Business Rules

Chapter 6

Other Requirements

6.1 Appendix A: Glossary

6.2 Appendix B: Analysis Models

6.3 Appendix C: To Be Determined List