

## Air Watcher – Specification Document

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## I. System Specifications

### I.1. External interface requirements

#### *I.1.a. Data acquisition*

**ID: IDAT1**

TITLE: Application data acquisition

DESC: The sensors, users, providers, air cleaners, sensor measurements and attributes data will be delivered at regular intervals and stored on a central server, on which this application will be hosted. It will consist of 4 files in CSV format, sensors.csv, users.csv, providers.csv, cleaners.csv, measurements.csv and attributes.csv.

RAT: In order to acquire external data required for the application

DEP: None

### I.2. Functional requirements

#### *I.2.a. User Class 1 - Private user*

##### Functional requirement 1.1

**ID: FR1**

TITLE: Launch the command-line interface

DESC: A user should be able to access the command-line interface on the host server. It will consist in launching an executable.

RAT: In order for a user to access the application

DEP: None (except the user should have access to the server)

##### Functional requirement 1.2

**ID: FR2**

TITLE: Log into the application

DESC: Given that a user has a registered account [= is registered in the userinfo.csv file, which means it hosts at least one sensor], they should be able to log into their account to be able to use all the application's functionalities they're allowed to

RAT: In order for a user to log into the application

DEP: FR1

##### Functional requirement 1.3

**ID: FR3**

TITLE: Access sensors list

DESC: Users should be able to list all sensors registered in the application. Position criteria based on latitude and longitude can also be specified.

RAT: In order for a user to list all sensors

DEP: FR2

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#### Functional requirement 1.4

**ID: FR4**

TITLE: Retrieve specific sensor measurements

DESC: Users should be able to access the list of measurements of a specified sensor. Additionally, criteria of date, type of measurement and value threshold can be applied.

RAT: In order for a user to acquire information on a sensor

DEP: FR2

#### Functional requirement 1.5

**ID: FR5**

TITLE: Run malfunctioning sensor detection analysis

DESC: All users can run the malfunctioning sensor detection algorithm. It then provides a score which indicates if the sensor can be trusted or not. Marking a sensor as unreliable is reserved to government agents however.

RAT: In order for a user to check the reliability of a sensor

DEP: FR2

#### Functional requirement 1.6

**ID: FR6**

TITLE: Retrieve mean quality of air in a specified area

DESC: Users should be able to retrieve the mean quality of air in a circle of specified radius, centered on any point for a specified period of time. The algorithm will compute the quality of air using the sensors contained in that circle.

RAT: In order for a user to retrieve the mean quality of air in a specific area

DEP: FR2

#### Functional requirement 1.7

**ID: FR7**

TITLE: Compare similarity between sensors

DESC: Users should be able to retrieve the level of similarity between one specified sensor and all the others. The level of similarity is based on the measurements of the sensors during a specified period of time.

RAT: In order for a user to find similar sensors

DEP: FR2

#### Functional requirement 1.8

**ID: FR8**

TITLE: Retrieve quality of air at a given position and time

DESC: Users should be able to retrieve the quality of air at any latitude and longitude, at any specified time. The quality will be computed using the neighborings sensors.

RAT: In order for a user to retrieve the quality of air at a given position and time

DEP: FR2

## Functional requirement 1.9

**ID: FR9**

TITLE: Consult awarded points

DESC: Individual users should be able to consult the points awarded for their contributions to the application.

RAT: In order for a user to consult its points

DEP: FR2

### ***1.2.b. User Class 2 - Provider user***

All functionalities of User Class 1 can be used by User Class 2, except FR9 which is individual user-specific.

## Functional requirement 2.1

**ID: FR10**

TITLE: Log into the application

DESC: Given that a provider has a registered account [= is registered in the providers.csv file], they should be able to log into their account to be able to use all the application's functionalities they're allowed to

RAT: In order for a provider to log into the application

DEP: FR1

## Functional requirement 2.2

**ID: FR11**

TITLE: Access list of owned air cleaners

DESC: Providers should be able to access the list of their registered cleaners. The list contains information about each cleaner, notably its position (latitude, longitude) and its start and stop dates.

RAT: In order for a provider to see its air cleaners

DEP: FR2bis

## Functional requirement 2.3

**ID: FR12**

TITLE: Consult owned cleaners statistics

DESC: Providers should be able to access the statistics of their cleaners. Statistics include the radius of the cleaned zone, and the level of improvement of air quality.

RAT: In order for a provider to get statistics about its air cleaners

DEP: FR2bis

### ***1.2.c. User Class 3 - Government user***

All functionalities of User Class 1 can be used by User Class 3, except FR9 which is individual user-specific.

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### Functional requirement 3.1

**ID: FR13**

TITLE: Log into the application

DESC: Given that a government user has a register account, they should be able to log into their account to be able to use all the application's functionalities

RAT: In order for a government agent to log into the application

DEP: FR1

### Functional requirement 3.2

**ID: FR14**

TITLE: Mark specific sensors as reliable / unreliable

DESC: Government agents have the right to mark a sensor as unreliable. Measurements from these sensors are excluded from computations, and if the sensors are owned by a private user, the user will not earn any more points from these. When a sensor seems reliable again, a government agent can remove the unreliable status.

RAT: In order for a government agent to mark sensors as unreliable (or reliable)

DEP: FR13

### Functional requirement 1.13

**ID: FR15**

TITLE: List individual users

DESC: Government agents can see the list of all private users, with their sensors and earned points.

RAT: In order for a government agent to list all individual users

DEP: FR13

### Functional requirement 1.14

**ID: FR16**

TITLE: List all cleaner providers

And their cleaners

DESC: Government agents should be able to list all cleaner providers, along with the cleaners (sorted by "active" and "not active")

RAT: In order for a government agent to list all air cleaner providers

DEP: FR13

### Functional requirement 1.15

**ID: FR17**

TITLE: Access the list of all air cleaners

DESC: Government agents should be able to list all the air cleaners, sorting them by proximity to specific coordinates, start and stop dates...

RAT: In order for a government agent to access the list of all air cleaners

DEP: FR13

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## Functional requirement 1.16

**ID: FR18**

TITLE: Consult any cleaner's statistics

DESC: Government agents should be able to access the statistics of the air cleaners. Statistics include the radius of the cleaned zone, and the level of improvement of air quality.

RAT: In order for a government agent to access any air cleaner's statistics

DEP: FR13

## I.3. Performance requirements

### Algorithm performance measurements

**ID: PR1**

TITLE: Measurable algorithm performance

DESC: The application should provide measurements of the execution time of algorithms like malfunctioning sensor detection, sensor comparison, mean quality of air, or quality of air at a specified position, in milliseconds.

RAT: In order to estimate the performance of algorithms

DEP: None

## I.4. Design constraints

### Application hosting and access

**ID: DSC1**

TITLE: Hosting and access

DESC: The application will be hosted on the servers storing the collected data. This application will be used only locally on this server, through a terminal.

RAT: In order to understand the application's scale

DEP: None

## I.5. Development constraints

**ID: DVC1**

TITLE: Programming language

DESC: The application will be programmed using the C++20 language standard.

RAT:

DEP: None

**ID: DVC2**

TITLE: Development environment

DESC: The application will be developed using CLion IDE from JetBrains

RAT: In order to produce code efficiently

DEP: None

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**ID: DVC3**

**TITLE:** Delivery strategy

**DESC:** The application will be developed following the continuous integration principles. Functionalities will be delivered one at a time.

**RAT:** In order to follow agile principles and provide faster returns to the client

**DEP:** None

## **II. Analysis of Security Risks**

### Software Engineering - Security by design

#### **II.1. General description**

Security is a valuable component of quality for applications supposed to be used as a tool and support for decision making and impartial evaluation. The AirWatcher application falls into that category, being designed to serve as a tool for a government agency for environmental protection. On the first hand, the application is responsible for collecting data from various sensors. The application must provide qualitative information as well as being a tool that helps the government agency to identify and maintain malfunctioning sensors.

The application is used by the agency as well as air cleaner providers. Hence the application must be impartial and objective.

The application is responsible for the quality of the analysis it provides. To fulfill this mission, the application relies on sensors under the control of the government agency. To improve precision, the application also incentivises private individuals to connect their own captors to the app by sending them rewards.

Hence the main issues that can affect the overall quality of the application turn around data collection, analysis and storage. The data must be considered as the core of the application.

The following document discusses security risks regarding the AirWatcher application. It covers all major aspects of security, with an emphasis on data integrity.

#### **II.2. Availability**

##### **Application uptime**

The application has no specified availability requirements. Since it is not a security or health critical application, there is no need for an expensive datacenter server. The application is mostly designed to be used by the government agency which typically operated between 8 a.m and 6 p.m. This represents a 10h/24h = 42% uptime requirement on workdays,  $(10 \times 5) / 24 \times 7 = 30\%$  for any weekday.

A server in any [tier 1 Data Center](#) in the country of the government agency would be perfectly suited for the task, if not overkill. However, it is not recommended to select a non-professional data center. According to the American [Uptime Institute](#), to be defined as Data Center Tier 1, a data center must adhere to the following:

No more than 28.8 hours of downtime per annum. These facilities are allowed the highest amount of downtime of any level. Zero redundancy. This level of a facility does not have redundancy on any part of its operations. Facilities do not have any redundancy guarantees within its power and cooling certification process. 99.671 % uptime per annum. This is the lowest amount of uptime that a facility graded by the Uptime Institute can produce.

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Hence, 99.671 % uptime per annum is more than necessary. This allows for air cleaner providers to access data on a broader schedule.

### Data backup

Data being the most critical aspect of the application, a dedicated cold storage server in a different location is a requirement. Backup can be done automatically on a daily or weekly schedule depending on the amount of new data to store.

NB: Backups should be fully encrypted to ensure no data leak.

## II.3. Reliability

This describes the characteristic of the system expressed by the probability that it will deliver the expected service for a specified period.

Since the application is not deployed yet, there is no way to evaluate it. The number of failures should remain as low as possible.

## II.4. Maintainability

This characterizes the ability of the system to be repaired when it is faulty, or to evolve. Similarly, to the previous section, there is no way to evaluate it before the application deployment. However, the application of “security by design” concepts should enhance the application maintainability.

The application is designed to be deployed on a single server, with a moderate number of simultaneous users. Its maintainability depends on 3 principal factors:

- **Connectivity:** Only the system administrators have access to server critical rights, hence limiting the risks.
- **Extensibility:** The service is not built to be extensible by external entities and will not allow it.
- **Complexity:** There is no data access policy for the users. They do not access it. The code complexity stays low on a security access point of view, hence limiting the risks.

Hence, security by design principles apply to different extents to the application code and design, however the small size of the application means there is no need to over complexify the code with such things as compartmentalisation or defence in depth. Limiting code complexity is also a way to limit unexpected bugs.

## II.5. Safety

Safety characterizes the ability of the system not to incur catastrophic failures. For the AirWatcher application, this is strongly linked to quality coding, error handling and extensive testing.

There is a dedicated section about test plan and testing further in this document.

Safety is also ensured by the system administrators of the application, so as to set up rights properly, perform system updates and set up firewalls and automatic logging.

## II.6. Security

The application security characterizes the ability of the application to protect against unauthorized access or manipulation (viruses, attacks, etc.). This regroups central issues since data is the core of the application:



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## **Major data requirements: Confidentiality, Availability, Integrity**

Data are not to be modified after insertion. There is no access policy for users. Any user can access data through application functionalities and statistical analysis. Hence, the major requirement for data is integrity and reliability.

Automatic data processing and statistical analysis allow the application to detect at any time if newly added data are erroneous. The application should also be able to detect if some specify sensor data are statistically erroneous. This is discussed further in the following sections.

## **Main security issues: Data collecting and treatment**

The Application is responsible for collecting and aggregating data from multiple sensors of various locations and designs. They can be administered directly by the government or by private individuals. Any captor can become malfunctioning and provide unreliable data. Notably, a private individual can deliberately alter the data of its sensors. Any malfunctioning or malicious captor can be detected by the application so as to classify its source as unreliable and its data as false. For private individuals, this means that their data won't be used for further queries hence they won't receive rewards.

## **Problems: Interception, Interruption, Modification, Fabrication**

Data interception is not a real problem since out of context incoming data to the application are of limited interest. However, sensor data streams should never be interrupted, and their data never modified, for instance by a man in the middle attack, since it could compromise the quality of the application. This should not be possible using sensor private key delivered by the application and encryption. Hence, the only remaining problem concerns data fabrications from those sensors and the issues discussed precedingly. These are solved by statistical analysis and incentivising private individuals to act honestly by rewarding them.

## **A typical data compromise scenario**

A sensor which has never been detected as malfunctioning/malicious suddenly sends erroneous data. This is detected by the application from statistical analysis. The new data are automatically considered false and not included in queries. If the sensor is at charge of the government, the government agency users can do the necessary to repair the sensor. If it is administered by a private individual, the sensor is just considered erroneous, and all its entire data will be marked as false.

## **Discussion around multi-sensor attack**

An "attack" of many sensors becoming malicious is unlikely, especially since data from the government sensors acts as neutral validators that would allow the application to detect such an attack. Besides, such an attack would be complex, spread around several locations, and its overall cost being very likely to exceed the gains, it makes it very unlikely.

An air cleaner company could have the incentive to launch such an attack on a located area, however, for the reasons expressed above, it is risky for the company that could lose its contract with the government as well as being sued.

## **II.7. Conclusion on analysis of security risks**

The core of the application being the data, several measures ensure their quality in time. The application remains straightforward and simple hence reliable.

### III. Test Plan

#### III.1. Unitary Tests

Unitary tests allow us to test if a method provides the good results. Here is a list of the methods we should test during the application's development. To validate these tests, we will use pre-computed values for the following functionalities:

- **Air quality index** computation at a **given location and time**.
- **Air quality index's mean** computation on a **given circular surface and for a specific period**.
- **Level of air quality improvement** computation for a **given air cleaner**.
- **Surface of the cleaned zone** computation for a **given air cleaner**
- Calculation of the **average difference** between **the measurements of a given sensor and nearby sensors**.
- **Government agent's login** method using a **given id and password**: it would return the functionalities' menu available to the government agency or an error if the user is not in the database.
- **Provider's login** method using a **given id and password**: it would return the functionalities' menu available to the providers or an error if the user is not in the database
- **Individual user's login** method using a **given id and password**: it would return the functionalities' menu available to the individual users or an error if the user is not in the database.

#### III.2. Functional Tests

To test the different functionalities of our application we need to define what happens at each step of the scenario.

##### 1 - Login fail

Step	Description	Actions	Results
1	The user has to login	Enter an id and a password. One of them or both are not in the database	You don't have access to the application. Please enter a good id or password.

##### 2 - Access sensors list

Step	Description	Actions	Results
1	The user has to login	Enter his id and his password	You are connected.  (Display of the menu: all the functionalities provided to the government agency/individual user/provider)  Which functionality do you want to use?
2	He then has to choose a functionality	Enter the command "consult sensors"	Display a list of the sensors available as well as their localization: Name : Sensor0 Longitude: 44 Latitude: -1 ...

##### 3 - Retrieve sensor's measurements

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Step	Description	Actions	Results
1	The user has to login	Enter his id and his password	You are connected.  (Display of the menu: all the functionalities provided to the government agency/individual user/provider)  Which functionality do you want to use?
2	He then has to choose a functionality	Enter the command "use sensor <0>"	Display the name and the location of the sensor:  Name: Sensor0 Longitude: 44 Latitude: -1  You will then have different options proposed in a menu
3	He then has to choose an option in the new menu	Enter the command "consult measurements"	Display the sensor's measurements (10 lines): date, O3, So2, No2 and Pm10  Date: 01/01/2019, O3: 50,25, SO2: 74.5, NO2: 41.5, Pm10: 44.75 ...  (The options are once again displayed)

#### 4 - Retrieve sensor's measurements at a special date

Step	Description	Actions	Results
1	The user has to login	Enter his id and his password	You are connected.  (Display of the menu: all the functionalities provided to the government agency/individual user/provider)  Which functionality do you want to use?
2	He then has to choose a functionality	Enter the command "use sensor <0>"	Display the name and the location of the sensor:  Name: Sensor0 Longitude: 44 Latitude: -1  You will then have different options proposed in a menu
3	He then has to choose an option in the new menu	Enter the command "consult measurements [01/01/2019]"	Display the sensor's measurements (10 lines): date, O3, So2, No2 and Pm10 Date: 01/01/2019, O3: 50,25, SO2: 74.5, NO2: 41.5, Pm10: 44.75 ...  (The options are once again displayed)

#### 5 - Run malfunctioning sensor detection analysis

Step	Description	Actions	Results
1	The user has to login	Enter his id and his password	You are connected.  (Display of the menu: all the functionalities provided to the government agency/individual user/provider)  Which functionality do you want to use?
2	He then has to choose a functionality	Enter the command "use sensor <0>"	Display the name and the location of the sensor:  Name: Sensor0 Longitude: 44 Latitude: -1  You will then have different options proposed in a menu
3	He then has to choose an option in the new menu	Enter the command "evaluate"	Display the sensor's status: malfunctioning or working correctly:  Malfunctioning  (The options are once again displayed)

#### 6 - Mark specific sensor as unreliable (Only for the government agency)

Step	Description	Actions	Results
1	A government agent has to login	Enter his id and his password	You are connected.  (Display of the menu: all the functionalities provided to the government agency)  Which functionality do you want to use?
2	He then has to choose a functionality	Enter the command "use sensor <0>"	Display the name and the location of the sensor:  Name: Sensor0 Longitude: 44 Latitude: -1  You will then have different options proposed in a menu
3	He then has to choose an option in the new menu	Enter the command "disable"	Mark the selected sensor as unreliable. If the sensor belongs to an individual user, the last will not be able to gain points anymore:  Sensor0 has been disabled.  (The options are once again displayed)

Similar test but for the functionality: Mark specific sensor as reliable. The command is now enabled, and the result should be displayed: Sensor0 has been enabled

#### 7 - Compare the similarity between the other sensors

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Step	Description	Actions	Results
1	The user has to login	Enter his id and his password	You are connected.  (Display of the menu: all the functionalities provided to the government agency/individual user/provider)  Which functionality do you want to use?
2	He then has to choose a functionality	Enter the command "use sensor <0>"	Display the name and the location of the sensor:  Name: Sensor0 Longitude: 44 Latitude: -1  You will then have different options proposed in a menu
3	He then has to choose an option in the new menu	Enter the command "compare"	Display a similarity ranking of the other sensors compare to the selected one along with the score used to rank them.  (The options are once again displayed)

## 8 - Go back to menu

Step	Description	Actions	Results
1	The user has to login	Enter his id and his password	You are connected.  (Display of the menu: all the functionalities provided to the government agency/individual user/provider)  Which functionality do you want to use?
2	He then has to choose a functionality	Enter the command "use sensor <0>"	Display the name and the location of the sensor:  Name: Sensor0 Longitude: 44 Latitude: -1  You will then have different options proposed in a menu
3	He then has to choose an option in the new menu	Enter the command "menu"	Display of the menu: all the functionalities provided to the government agency/individual user/provider  Which functionality do you want to use?

## 9 - Consult a sensor: failed attempt

Step	Description	Actions	Results
1	The user has to login	Enter his id and his password	You are connected.

			(Display of the menu: all the functionalities provided to the government agency/individual user/provider)  Which functionality do you want to use?
2	He then has to choose a functionality	Enter the command "use sensor <102>"	No sensor found  You will then have different options proposed in a menu

#### 10 - Retrieve mean quality of air on a specified area

Step	Description	Actions	Results
1	The user has to login	Enter his id and his password	You are connected.  (Display of the menu: all the functionalities provided to the government agency/individual user/provider)  Which functionality do you want to use?
2	He then has to choose a functionality	Enter the command "airQ <latitude> <longitude> <start_date><end_date>"	Display the mean quality of air in a specified area and at a given period  (Display of the menu: all the functionalities provided to the government agency/individual user/provider)  Which functionality do you want to use?

Similar test but with an error in the dates, the latitude or the longitude.  
Result: "Error in the input, please try again"

#### 11 - Retrieve quality of air at a given position and time

Step	Description	Actions	Results
1	The user has to login	Enter his id and his password	You are connected.  (Display of the menu: all the functionalities provided to the government agency/individual user/provider)  Which functionality do you want to use?
2	He then has to choose a functionality	Enter the command "airQ <latitude> <longitude> <date>"	Display the quality of air in a specified location and at a given time  (Display of the menu: all the functionalities provided to the government agency/individual user/provider)  Which functionality do you want to use?

Similar test but with an error in the date, the latitude or the longitude.  
Result : "Error in the input, please try again".

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## **12 – Access the list of owned air cleaners (Only for providers)**

Step	Description	Actions	Results
1	The Provider has to login	Enter his id and his password	You are connected.  (Display of the menu: all the functionalities provided to the provider)  Which functionality do you want to use?
2	He then has to choose a functionality	Enter the command "consult cleaners"	Display the cleaners owned by the provider.  (Display of the menu: all the functionalities provided to the government agency/individual user/provider)  Which functionality do you want to use?

Similar test but for the functionality: Consult owned air cleaners statistics. The command is now use cleaner <num> and the result should display the name of the cleaner selected owned by the provider as well as its statistics: the radius of the cleaned zone, and the level of improvement of air quality

## **13 - Access individual users list (Only for the government agency)**

Step	Description	Actions	Results
1	The Government agent has to login	Enter his id and his password	You are connected.  (Display of the menu: all the functionalities provided to the government agency)  Which functionality do you want to use?
2	He then has to choose a functionality	Enter the command "consult users"	Display the name of the users as well as the name of their sensors.  (Display of the menu: all the functionalities provided to the government agency/individual user/provider)  Which functionality do you want to use?

## **14 - Access all air cleaners providers list (Only for the government agency)**

Step	Description	Actions	Results
1	The Government agent has to login	Enter his id and his password	You are connected.

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			(Display of the menu: all the functionalities provided to the government agency)  Which functionality do you want to use?
2	He then has to choose a functionality	Enter the command "consult providers"	Display the name of the providers as well as the name of their cleaners, sorted by "active" or "not active".  (Display of the menu: all the functionalities provided to the government agency/individual user/provider)  Which functionality do you want to use?

### 15 - Access air cleaners' statistics (*Only for the government agency*)

Step	Description	Actions	Results
1	The Government agent has to login	Enter his id and his password	You are connected.  (Display of the menu: all the functionalities provided to the government agency)  Which functionality do you want to use?
2	He then has to choose a functionality	Enter the command "use cleaner <num>"	Display the name of the air cleaner selected, as well as its statistics: the radius of the cleaned zone, and the level of improvement of air quality  (Display of the menu: all the functionalities provided to the government agency/individual user/provider)  Which functionality do you want to use?

### 16 - Access air cleaners' statistics (*Only for the government agency*): Failed Attempt

Step	Description	Actions	Results
1	The Government agent has to login	Enter his id and his password	You are connected.  (Display of the menu: all the functionalities provided to the government agency)  Which functionality do you want to use?
2	He then has to choose a functionality	Enter the command "use cleaner <20>"	Air cleaner not found  (Display of the menu: all the functionalities provided to the government agency/individual user/provider)  Which functionality do you want to use?



## IV. User manual

### IV.1. Connection

Once the application launches, you will be asked to log in. You will need to enter your email and password. If the connection fails, you will be prompted again and so on.

### IV.2. Functionalities

Once the connection is granted, you will have access to different functionalities depending on your role in the application: **Government agency**, **Provider**, or **private user**. A menu will be displayed; you will then have to enter the following commands.

#### 1 - Go back to menu

**Command:** *menu*

**Description:** Display the menu. You will be asked which functionality you want to access.

#### 2 - Access sensors list

**Command:** *get\_sensors*

**Description:** Display a list of the sensors available as well as their localization

#### 3 - Access and modify a specific sensor

**Command:** *use\_sensor <num>*

**Description:** Display the name and the location of the sensor with the number num provided. You will then have different options proposed.

**Options:**

##### a) Retrieve sensor's measurements

**Command:** *measure*

**Description:** Display the sensor's measurements: date, O3, So2, No2 and Pm10

##### b) Retrieve sensor's measurements at a special date

**Command:** *measure <date>*

**Description:** Date format : dd/mm/yyyy. Display the sensor's measurements: date, O3, So2, No2 and Pm10

##### c) Run malfunctioning sensor detection analysis

**Command:** *evaluate*

**Description:** Display the sensor's status: malfunctioning or working correctly

##### d) Mark specific sensor as unreliable

**Command:** *disable*

**Description:** Mark the selected sensor as unreliable. If the sensor belongs to an individual user, the last will not be able to gain points anymore. [Warning] Only the government agency will have access to this functionality

##### e) Mark specific sensor as reliable

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**Command:** *enable*

**Description:** Mark the selected sensor as reliable. [Warning] Only the government agency will have access to this functionality.

**f) Compare the similarity between the other sensors**

**Command:** *compare*

**Description:** Display a similarity ranking of the other sensors compare to the selected one along with the score used to rank them.

**g) Go back to the menu**

**Command:** *menu*

**Description:** Return to the main menu

### 4 - Retrieve mean quality of air on a specified area

**Command:** *airQ <latitude> <longitude> <start\_date><end\_date>*

**Description:** Display the mean quality of air in a specified area and at a given period

### 5 - Retrieve quality of air at a given position and time

**Command:** *airQ <latitude> <longitude> <date>*

**Description:** Display the quality of air in a specified location and at a given time

### 6 - Access list of owned air cleaners

**Command:** *get\_cleaners*

**Description:** Display the cleaners owned by the provider. [WARNING] Only the providers will have access to this functionality

### 7 - Consult owned air cleaners' statistics

**Command:** *use\_cleaner <num>*

**Description:** Display the name of the cleaner selected owned by the provider as well as its statistics: the radius of the cleaned zone, and the level of improvement of air quality. [WARNING] Only the providers will have access to this functionality

### 8 - Access individual users list

**Command:** *get\_users*

**Description:** Display the name of the users as well as the name of their sensors. [WARNING] Only the government agency will have access to this functionality

### 9 - Access all air cleaners' providers list

**Command:** *get\_providers*

**Description:** Display the name of the providers as well as the name of their cleaners, sorted by "active" or "not active". [WARNING] Only the government agency will have access to this functionality

### 10 - Access air cleaners list

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**Command:** *get\_cleaners*

**Description:** Display the air cleaners, sorting them by proximity to specific coordinates, start and stop dates...  
[WARNING] Only the government agency will have access to this functionality

## 11 - Access air cleaners' statistics

**Command:** *use\_cleaner <num>*

**Description:** Display the name of the air cleaner selected as well as its statistics: the radius of the cleaned zone, and the level of improvement of air quality. [WARNING] Only the government agency will have access to this functionality

## IV.3. Customer Service

The AirGeeners team is at your disposal for any question related to AirWatchers. Feel free to contact us by email at: [contact@airgeeners.com](mailto:contact@airgeeners.com)

To report an issue, please join a copy of your datasets along with your report.

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