**Development of an intelligent platform for obtaining environmental data**

**Introduction.**

Currently, urban areas usually harbor a large amount of pollutants that seriously protect the health of human beings, these pollutants come from different emission sources such as lead, hydrocarbons, solid waste, among others, which are generated from vehicles. , people, homes and industries. For this reason, cities today must have measures that harm the environment, in order to establish metrics and decisions that improve their quality of life and prevent environmental damage.

A monitoring system helps make informed decisions that help improve the situation in the affected area, it is important to determine the source and type of pollutant that affects the population where the contamination is analyzed.

For this work, the development of a system for monitoring defined geographical areas for the collection of environmental variables and polluting elements is proposed, for their visualization and study through a web platform.

The purpose of the web platform is to be the means by which the environmental monitoring data of various IoT nodes are displayed, to make the information understandable for the daily user, to allow the environmental study of a previously monitored defined geographical area and to study its evolution.

The web platform will have only two roles Administrator and User, the user being able to consult the information of the IoT node, environmental information and generate historical reports no older than one year.

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| **Type of roles** | **Description** | **Privileges** | **Technical background** | **Frequency** |
| Administrator | User who has administrator permissions. The administrator manages the IoT nodes by allowing you to register, delete, and modify the IoT nodes. | Access to all system functionalities. | advanced. Basic system administration skills with significant application knowledge are required. | whenever required |
| User | User accessing the system can apply filters to the data. | Visualize the information of the IoT nodes. In addition, you have privileges to apply filters to the information. | Half. It is requested that you have experience to access the system and manage the filtering tools. | whenever required |

**Functional Requirements**

1. User: Select geographic monitoring area
2. User: Select the IoT node
3. User: Consult characteristics of the IoT node
4. User: Historical report of the IoT node
5. User: Generate graph of the historical record of the IoT node
6. User: Reset password
7. Admin: Delete IoT node
8. Admin: Register IoT node
9. Admin: Modify IoT node
10. Admin: Consult IoT node
11. Admin: Delete User
12. Admin: Consult User
13. Admin: Modify User
14. Admin: Register User
15. Admin: Query Location
16. Admin: Delete Location
17. Admin: Modify Location
18. Admin: Register Location
19. System: Show the network status of the IoT node
20. System: Notify disconnection
21. System: System access (login)
22. Admin: Access the administrator panel

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| Functional Requirements Specification | | | | |
| Code | Name | | degree of need | |
| RF-01 | Select geographical area of monitoring | | High | |
| Description | The user will be able to select a geographical area to be able to view the IoT nodes available in the selected area | | | |
| Tickets | Fountain | Departures | | restrictions |
| + locality | User. | * Show the IoT nodes available in the selected area to select | | * The location must exist in the database. * The locality must have IoT nodes. |
| Process | The user must select from a list the desired geographical area among the available areas so that it can display the available IoT nodes in the selected area. | | | |

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| Functional Requirements Specification | | | | |
| Code | Name | | degree of need | |
| RF-02 | Select the IoT node | | High | |
| Description | The user will be able to select an available IoT node | | | |
| Tickets | Fountain | Departures | | restrictions |
| + node  + locality | User. | * The most up-to-date information of the lot node is displayed in the main panel. | | * The IoT node must exist in the system. * You must select the   location previously.   * Node must have monitoring data |
| Process | The user after selecting the location, selects an IoT node and the system displays the most current monitoring data associated with the IoT node. | | | |

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| Functional Requirements Specification | | | | |
| Code | Name | | degree of need | |
| RF-03 | Consult characteristics of the IoT node | | High | |
| Description | The user will be able to consult the characteristics of the IoT node | | | |
| Tickets | Fountain | Departures | | restrictions |
| + button description | User. | * All the data of the selected IoT node will be displayed on the screen. | | * The IoT node must exist in the database. * You must select the location previously. |
| Process | The user clicks the description button and the system will display the information of the IoT node in the system | | | |

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| Functional Requirements Specification | | | | |
| Code | Name | | degree of need | |
| RF-04 | Historical report of the IoT node | | High | |
| Description | The user will be able to generate a historical report of a nodelot by applying filters. | | | |
| Tickets | Fountain | Departures | | restrictions |
| + report button  + locality  + nodeLoT  + pollutants | User. | * file with historical monitoring information. | | * The IoT node must exist in the database. * You must select the location previously. * Time range must be selected. * Contaminants must be selected. * Iotnode must have monitoring information |
| Process | The user enters the report section, selects the location and the node to be analyzed, marks the pollutants that we want the report to include and clicks on the report button so that it generates a file with the historical monitoring information. | | | |

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| Functional Requirements Specification | | | | |
| Code | Name | | degree of need | |
| RF-05 | Generate IoT node historical log graph | | High | |
| Description | The user will be able to generate graphs of the history of the IoT nodes by applying filters | | | |
| Tickets | Fountain | Departures | | restrictions |
| + date  + locality  + IoT node  + Button to generate graph | User. | * Graph that will show the user the history of the IoT node and the selected filters | | * The user must be registered in the system. * The locality and the IoT node must be registered. * It is not possible to list future dates. |
| Process | On the history screen, the user will have several comboboxes in which they must select the location, the node as well as the date and a set of checkboxes, one for each data to select the data we want in the graph. After the selection, the user will click the button to generate the | | | |

graph and the user will be able to see the graph on the screen.

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| Functional Requirements Specification | | | | |
| Code | Name | | degree of need | |
| RF-06 | Restore password | | low | |
| Description | The user may reset his password in the event of loss of this password. | | | |
| Tickets | Fountain | Departures | | restrictions |
| + button for restore password.  + Field for enter the direction of email.  + send button  direction of | System user. | * Message indicating that a password reset code has been sent to your email address. * An email with a code. | | \* The user must be registered in the system. |
| mail to the system |  |  | |  |
| Process | On the login screen, the user must select the "forgot my password" link, this will be redirected to another screen in which the user must enter the email address with which he was registered in the system. | | | |

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| xp Functional Requirements Specification | | | | |
| Code | Name | | degree of need | |
| RF-07 | Delete IoT node | | High | |
| Description | The administrator will be able to remove an IoT node from the system | | | |
| Tickets | Fountain | Departures | | restrictions |
| + delete button  + IoT nodes | Administrator. | * A message confirming the removal of the node will be displayed on the screen and the sensor will be removed from the database | | \* The IoT node must exist in the database.  . |
| Process | The administrator consults the IoT nodes and among the options of the IoT node, the administrator must click the delete button, a confirmation will be displayed and if accepted, it is deleted from the database. | | | |

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| Functional Requirements Specification | | | | |
| Code | Name | | degree of need | |
| RF-08 | Register IoT node | | High | |
| Description | The administrator will be able to Register an IoT node of the system | | | |
| Tickets | Fountain | Departures | | restrictions |
| + Data from  Conection  + locality  + location  + IoT nodes | Administrator. | * A form will be displayed on the screen to fill out and after registering, the registration must be confirmed and a new record must be created in the database | | * The IoT node must be connected to the network. * The location must be   previously registered.   * All the information on the form must be filled out. |
| Process | The Administrator will be able to enter a form in which the necessary data for the connection is filled out, after confirming the connection, the town and location must be registered. When registering correctly, a confirmation message will be displayed and the record will be created in the database | | | |

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| Functional Requirements Specification | | | | |
| Code | Name | | degree of need | |
| RF-09 | Modify IoT node | | High | |
| Description | The administrator will be able to modify the data of an IoT node | | | |
| Tickets | Fountain | Departures | | restrictions |
| + update button  + Data from  Conection  + locality  + location  + IoT nodes | Administrator. | * The data of the IoT node is modified either for the connection or to change its geographical position. | | * The IoT node must exist in the database. * You must select the location previously. * You should not leave empty fields. |
| Process | The Administrator must consult the existing IoT nodes and select the update option, a form will be displayed with the existing data within the inputs and the administrator will only have to change the text, after changing all the necessary data, he must press the update button, a confirming message will be displayed the update and the record in the database will be updated. | | | |

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| Functional Requirements Specification | | | | |
| Code | Name | | degree of need | |
| RF-10 | Consult IoT node | | High | |
| Description | The administrator will be able to consult the IoT nodes of the system | | | |
| Tickets | Fountain | Departures | | restrictions |
| + locality  + name node  + IoT nodes | Administrator. | * All IoT nodes that meet the filters will be displayed on the screen | | * The IoT node must exist in the database. * At least one parameter must be searched. |
| Process | The administrator will be able to consult the information of the nodes, applying the locality filter and the name filter, showing on the screen all the nodes that comply with the filters. | | | |

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| Functional Requirements Specification | | | | |
| Code | Name | | degree of need | |
| RF-11 | delete user | | High | |
| Description | The administrator can remove users from the system | | | |
| Tickets | Fountain | Departures | | restrictions |
| + delete button  + user | Administrator. | * A deletion confirmation message will be displayed on the screen. * The user is removed from the system | | * The IoT node must exist in the database. * The user must be consulted previously |
| Process | The administrator consults the available users and selects the delete option. Before definitively deleting, he must confirm again and if the user is accepted, he will be permanently deleted from the system. | | | |

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| Functional Requirements Specification | | | | |
| Code | Name | | degree of need | |
| RF-12 | Consult User | | High | |
| Description | The administrator will be able to consult the existing users | | | |
| Tickets | Fountain | Departures | | restrictions |
| + mail  + name  + search button  + IoT nodes | Administrator | * All the data from the user records that match the search filters will be displayed | | * Some filter must be applied. * The user must be previously registered. |
| Process | The administrator accesses the user panel in which he can search for users by name or email, by pressing the search button, all the records that match the search will be displayed on the screen. | | | |

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| Functional Requirements Specification | | | | |
| Code | Name | | degree of need | |
| RF-13 | Modify User | | High | |
| Description | The administrator can modify user data | | | |
| Tickets | Fountain | Departures | | restrictions |
| + update button  + user | Administrator. | * A user update confirmation message will be displayed and the changes will be made to the modified user's record. | | * The user must be previously registered. * The user must be consulted previously   . |
| Process | The administrator must access the user panel, consult the desired user and press the update button, this will display a form with the user's data which can be changed and finally the administrator must press update, displaying a message confirming the update. | | | |

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| Functional Requirements Specification | | | | |
| Code | Name | | degree of need | |
| RF-14 | register user | | High | |
| Description | The administrator will be able to register users. | | | |
| Tickets | Fountain | Departures | | restrictions |
| + mail  + name  + password  create button  user | Administrator. | * A new user will be created | | \* All fields must be filled out. |
| Process | The administrator accesses the user panel and selects the option to create a new user, the administrator must fill in the name, password and email fields, to later confirm the creation of the user and create the respective record in the database. | | | |

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| Functional Requirements Specification | | | | |
| Code | Name | | degree of need | |
| RF-15 | Query Location | | High | |
| Description | The administrator will be able to consult the locations | | | |
| Tickets | Fountain | Departures | | restrictions |
| + location | Administrator. | * All locations matching the search criteria will be displayed on the screen. | | \* The location must be previously registered |
| Process | The administrator accesses the locations panel and through the name field, entering the name partially or completely, all the locations where the name matches are displayed on the screen. | | | |

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| Functional Requirements Specification | | | | |
| Code | Name | | degree of need | |
| RF-16 | Delete Location | | High | |
| Description | The administrator will be able to delete locations | | | |
| Tickets | Fountain | Departures | | restrictions |
| + delete button  + location | Administrator. | * The location deletion is confirmed and the record is deleted from the database | | * The location must exist in the database. * The location must be consulted previously. |
| Process | The Administrator accesses the locations panel, will consult the location and select delete, a confirmation will be made to make sure the deletion and if accepted, the deletion will be confirmed and the record will be deleted. | | | |

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| Functional Requirements Specification | | | | |
| Code | Name | | degree of need | |
| RF-17 | Modify Location | | High | |
| Description | The administrator will be able to update the locations | | | |
| Tickets | Fountain | Departures | | restrictions |
| + update button  + location | Administrator. | * The data of the selected location will be updated with respect to the changes made by the administrator. | | * The location must exist in the database. * The location must be consulted previously. |
| Process | The administrator accesses the locations panel, will consult the desired location and presses the update option, which will display a form with the location data for modification. When the desired changes are made, the administrator must confirm the update and the location will be updated with about the new changes. | | | |

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| Functional Requirements Specification | | | | |
| Code | Name | | degree of need | |
| RF-18 | register location | | High | |
| Description | The administrator will be able to register locations | | | |
| Tickets | Fountain | Departures | | restrictions |
| + add button location  + name  + status  + country | Administrator. | * A new location will be registered. | | \* All fields must be filled. |
| Process | The administrator accesses the locations panel and selects the option to create a new location, this will display a form where the name of the location, state, and country will be requested. When all the fields are filled in and pressing create, a new location will be registered and The registration will be confirmed to the user. | | | |

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| Functional Requirements Specification | | | | |
| Code | Name | | degree of need | |
| RF-19 | Show the network status of the IoT node | | High | |
| Description | The system will show on the screen the nodes that are connected/disconnected | | | |
| Tickets | Fountain | Departures | | restrictions |
| + IoT node status  + IoT nodes | System. | * The system will show a small message next to the node that shows if it is online or offline | | * The IoT node must exist in the database. * You must select the location previously. |
| Process | When accessing the main panel, the user selects the desired location and when viewing the available IoT nodes, it will be shown next to them if they are online or offline. | | | |

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| Functional Requirements Specification | | | | |
| Code | Name | | degree of need | |
| RF-20 | notify disconnection | | High | |
| Description | The system will notify the administrator of the disconnection of IoT nodes | | | |
| Tickets | Fountain | Departures | | restrictions |
| + IoT node status  + IoT nodes | System. | * The system will notify the administrator through messages of the disconnection of the IoT node | | * The IoT node must exist in the database. * The administrator must access the system |
| Process | The administrator will receive notifications through the system about the disconnection of the IoT nodes, specifying which node has the problem in search of solving the problem. | | | |

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| Functional Requirements Specification | | | | |
| Code | Name | | degree of need | |
| RF-21 | Access to the system (login) | | High | |
| Description | The user will be able to enter the system through their credentials. | | | |
| Tickets | Fountain | Departures | | restrictions |
| + password  + mail | System. | * The user will enter the system with their username | | \* The user must exist in the database with the password and email provided. |
| Process | The user provides his email and password, if the data is correct, being those that are linked to his user, the system must allow him to enter. | | | |

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| Functional Requirements Specification | | | | |
| Code | Name | | degree of need | |
| RF-22 | Access the administrator panel | | High | |
| Description | Login to the administrator panel | | | |
| Tickets | Fountain | Departures | | restrictions |
| + mail  + password | Administrator. | * After providing the credentials associated with an admin role the system should direct the admin to the admin panel | | \* The administrator must exist in the database with the password and email provided. |
| Process | The administrator provides his email and password, if the data is correct, being those that are linked to his account, the system must allow him to enter the administrator panel. | | | |

**non-functional requirements**

1. The system is a web platform developed with js, html, css and php
2. The history and the main panel will be on different pages
3. The system must have a load time of no more than 50 milliseconds
4. Navigation through the page will use the 3-click rule
5. The system must be functional at least for Windows, Linux, Android and IOS
6. The system must be responsive to the dimensions of the screen (Monitors)
7. The system must be responsive to the screen dimensions where it will be displayed (Tablets and IT)
8. The system must be compatible with most commercial browsers such as chrome, firefox, edge and safari

**Glossary**

**Arduino**

It is a motherboard based on an ATMEL microcontroller, which aims to be low cost and function as a microcomputer that can be programmed in different ways to use a wide range of accessories.

**pollutants**

Pollutants are elements that are harmful to health and the environment, which are generated by human activities.

**Internet of Things (IoT)**

The Internet of things is a process that allows the connection of various electronic devices of daily life, to share data between them and achieve a common goal.

**Environment**

The environment is the set of elements of chemical, biological and physical origin defined in a geographical area in which living beings coexist. It is also defined as natural and artificial elements that interact with living beings.

**Web page**

A web page is a set of files which contain information, which is used to display or perform an action that involves a user, which is contained on the Internet.

**NodeIoT**

Embedded device, composed of a series of sensors to monitor environmental variables, based on a Raspberry Pi and an arduino nano, using IoT technology.

**RaspBerry Pi**

A Raspberry is a microcomputer that can be programmed to perform different tasks and to which other components can be connected. a raspberry enables communication and data processing as one of the main tasks over the internet.

**Geographical area**

A geographic zone is a considerable extension of land which has defined limits.

**Resources. HR, Budget, Time.**



