Universidade de Aveiro

DETI

Projeto em Engenharia Informática

Mobility platform in Aveiro Tech City Living Lab Infrastructure

Milestone 2

Grupo 3

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1 Summary

This report is a compilation of the outputs of the project's Elaboration phase. In this document the elements that were already shown in class are presented as well as the deployment diagram and domain model of the system.

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2 State of the art

- *Survey of public transport routes using Wi-Fi*
  - Goal: gather data regarding the use of transportation to provide accurate OD matrices and to improve public transport efficiency
- *A Case Study of Wi-Fi Sniffing Performance Evaluation*
  - Goal: identify the possible factors including channel settings and access point configurations that affect sniffing behaviours and performances
- *Crowd Mobility Analysis using Wifi Sniffers*
  - Presented a system for crowd behaviour analysis using non-invasive Wi-Fi probes
- *ViFi-MobiScanner: Observe Human Mobility via Vehicular Internet Service*
  - Goal: Understand human mobility using the passengers Wi-Fi mobile stations (e.g. Smartphones) connected to the VIS and GPS data
- *Heptasense*
  - Platform that provides intelligence about the behaviour of people and vehicles to improve operations
  - Helps prevent incidents and assures safety as well as gives you a chance to see and analyze the patterns of pedestrian habits
- *Parquery*
  - Parquery's AI technology detects vehicles and any kind of object in images from any camera
  - Smart parking solution: efficiently and effectively manages parking spaces

3 Requirements Gathering

- Important data to capture in Cais da Fonte Nova:
  - Number of people on the sidewalk
  - Number of moliceiros passing by
  - Number of people inside the moliceiros
- How to obtain the data: to increase the accuracy of the data we will use both wifi sniffing and object detection from the feedback of the camera
- Processing the data: Comparing the data acquired from both methods, the variations of the flow of people and moliceiros will be calculated
- Showing the data on the dashboard:
  - Use of graphics to show the data in a more visually appealing way
  - The shown data can be filtered to allow the visualization of the variation of traffic in certain days and/or hours and other relevant information
  - Live data will be available
- Who are the target users:
  - All the economic businesses in the area may use the data to improve their advertisement efficacy
  - The tourism branch (shops related to tourism, restaurants, bars, specialities products shops, etc)
  - Aveiro's Town Hall (specially requested this information to use, for example, on the planning of certain activities)

4 Actors and Use Cases

After analysing what are the requirements of our project, we stipulated that our system has the following actors:

Actor	**Role**
Users	Can access the web application to obtain data. For example, event organizers, Aveiro's city hall, emergency services, nearby stores, tourism companies, etc.
Administrator	Has access to all data, modifies the web application and fixes bugs
Sensors	Capture and send all the data to the broker in real-time. This englobes the monitoring Wi-Fi interface, cameras and APU/Jetson Nano
Broker	Stores all the data collected by the sensors and provides it to the subscribed clients in real time

Table 1: Actors and its roles

The following subsection presents our project's Use Cases, which are divided into two different diagrams: one relative to the API and one relative to the Web App.

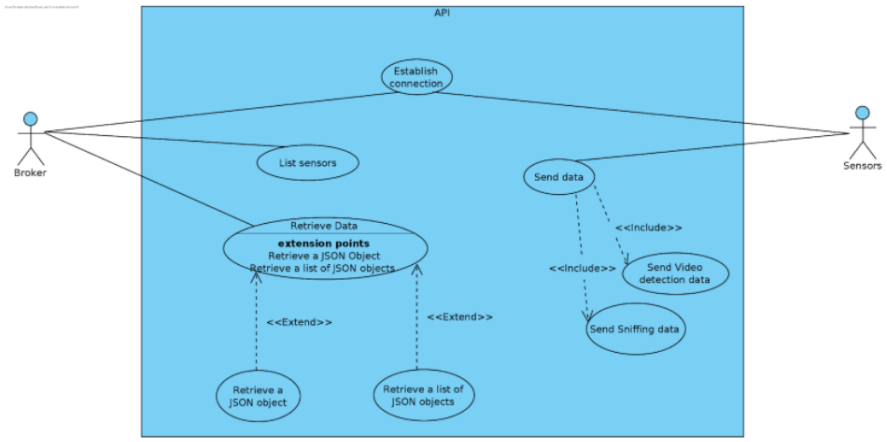

Figure 1: API - Use Case Diagram

Figure 2: Web App - Use Case Diagram

5 Functional Requirements

In this section there are presented some functional requirements that our system must perform.

5.1 Sensor modules

Reference	Functional Requirements
RFS-1	It should be possible to count the number of devices emitting Wi-Fi requests in the surroundings
RFS-2	It should be possible to estimate how many people are in the surroundings
RFS-3	It should be possible to send the sensorial data to the broker
RFS-4	It must be possible to estimate how many moliceiros pass in that area

Table 2: Functional Requirements - Sensor modules

5.2 API

Reference	Functional Requirements
RFA-1	It should be possible to obtain information when there are changes in the data (atual value, average of values, list of values)
RFA-2	The sensors of Wi-fi sniffing should provide the data in real-time
RFA-3	The cameras should provide new data in real-time
RFA-4	It should be possible to list and visualize the types of sensors used and their location

Table 3: Functional Requirements - API

5.3 Front-End

Reference	Functional Requirements
RFF-1	It must be possible to visualize the geographical places where the data is being collected
RFF-2	It must be possible to check the occupation in terms of people and and the traffic of moliceiros in the area
RFF-3	Statistical analysis of the data from the sensors must be presented
RFF-4	Historical data must be presented
RFF-5	t must be possible to manage and to see details of the data collected by the sensors
RFF-6	It must be possible to perform the user authentication in the platform
RFF-7	It must be offered the possibility of sending notifications to the users when there are changes in the data

Table 4: Functional Requirements - Front-End

6 Non Functional Requirements

In this section there are introduced the non functional requirements that must be fulfilled by the system.

6.1 Performance

Reference	Non Functional Requirements
RD-1	The application must present the data in real-time with the least amount of delay possible
RD-2	The web application must be responsive and able to adapt to any device where it is being accessed
RD-3	The web application load time should not be more than one second for users

Table 5: Non Functional Requirements - Performance

6.2 Usability

Reference	Non Functional Requirements
RU-1	The website's interface has to be user optimized and easy to interact with
RU-2	The solution must be versatile so that future sensors can be added or future functionalities to the API
RU-3	The Web Application must allow to view information in Portuguese as well as in English

Table 6: Non Functional Requirements - Usability

6.3 Security

Reference	Non Functional Requirements
RS-1	The data received must not have private information of the devices and respective users before being sent to the broker
RS-2	Only administrators can manage the sensors
RS-3	The access to the sensor data must be managed by the system
RS-4	Only the admin can access and change the sensors information

Table 7: Non Functional Requirements - Security

7 Domain Model

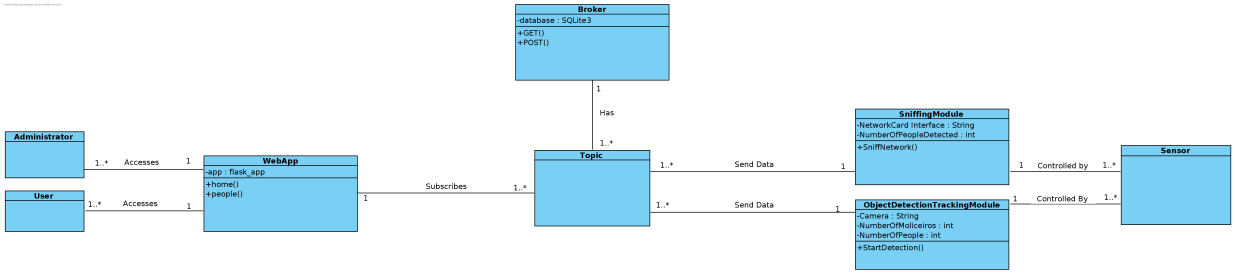

Figure 3: Domain diagram

The domain model of the project (Figure 3) represents the real-world conceptual classes of the system, their attributes and how they are associated.

8 Architecture Diagram

In this section the architecture of the project is presented (Figure 4). The data relative to the number of people detected by Wi-Fi sniffing and object detection and the number of moliceiros detected by object detection is captured by the respective modules in the sensors and this data is sent to the broker through a MQTT connection. The broker saves the data in a database and also sends it to the Web service (Flask). The web server (Gunicorn) interacts with the Web service and communicates with the Reverse Proxy Server (Nginx) through a Unix socket. The Reverse Proxy Server manages the load balance of requests. The user visualizes the web application in his device, sending and receiving HTTPS requests and responses.

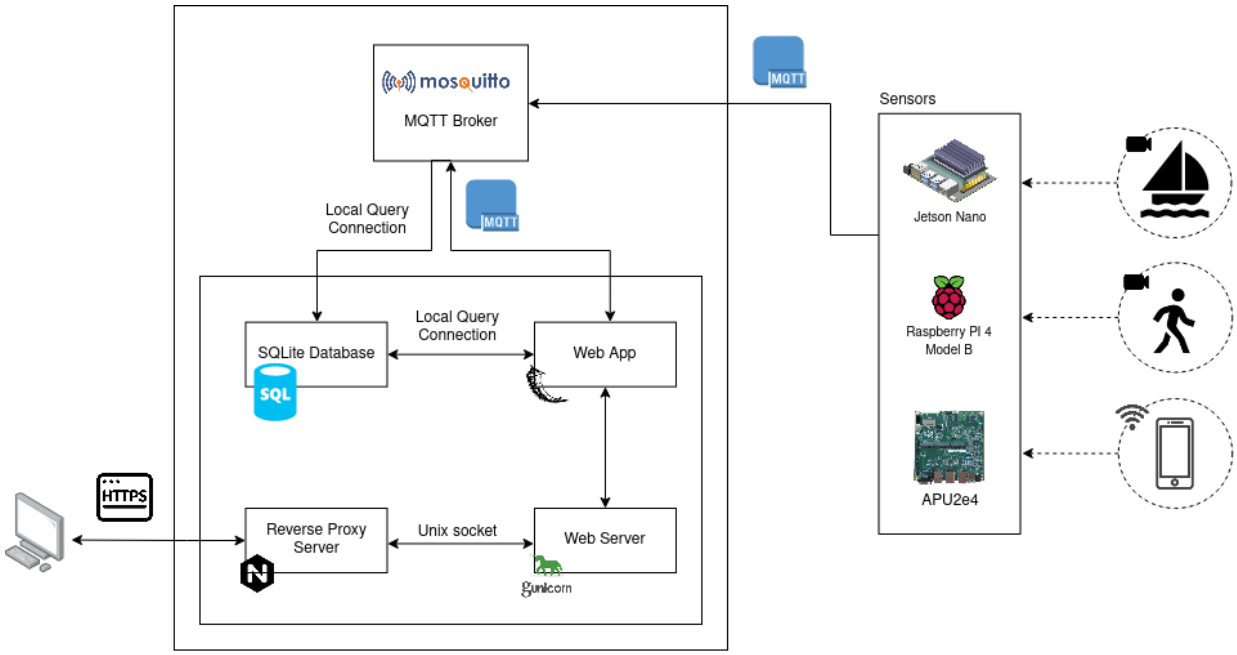

Figure 4: Architecture diagram

9 Deployment Diagram

This section shows the deployment diagram of the project (Figure 5). In the diagram it is possible to view the several components of the system and how they interact between them.

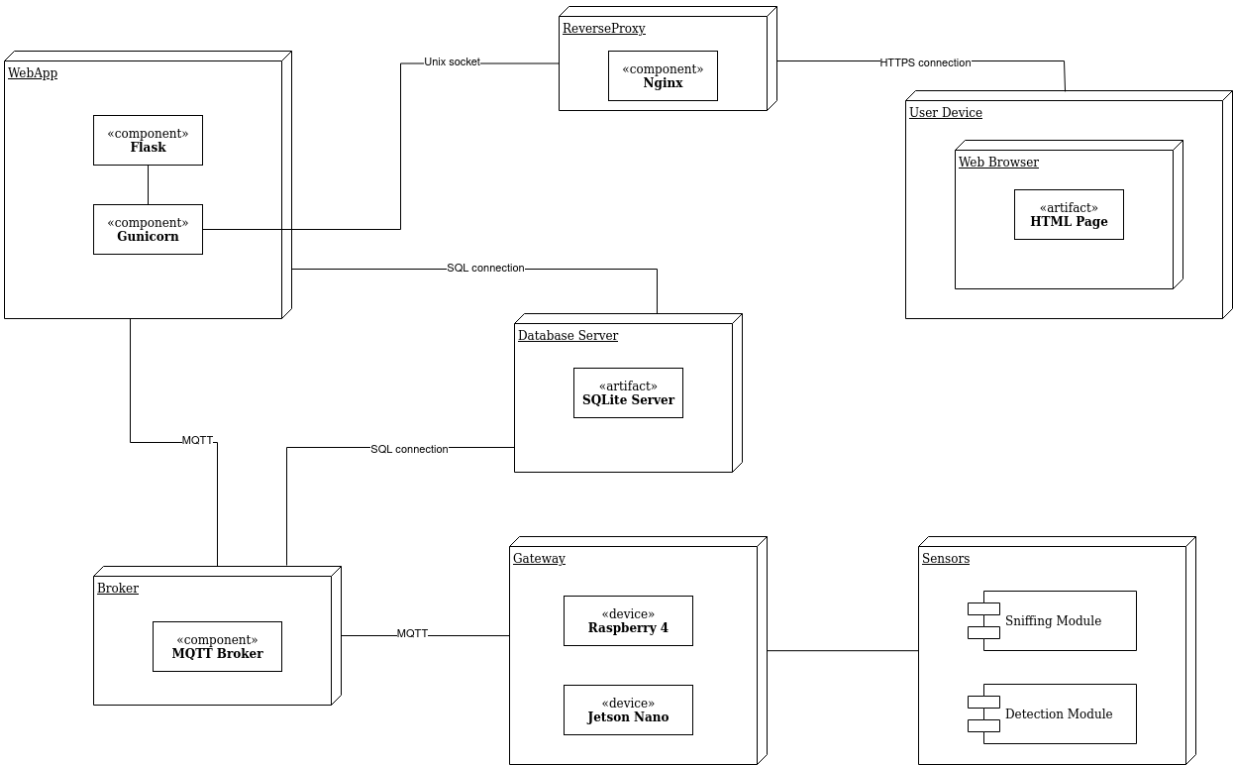

Figure 5: Deployment diagram

10 User Interaction Mock-Ups

This section presents several design mock-ups of how the front-end of our system will look like. Throughout the development of the project these may be altered depending on how to present the data in a clear and understanding way. However, these mock-ups will serve as a base to build a functional prototype.

In figure 6 we can see the web application in full perspective and how the objects are placed on the interface.

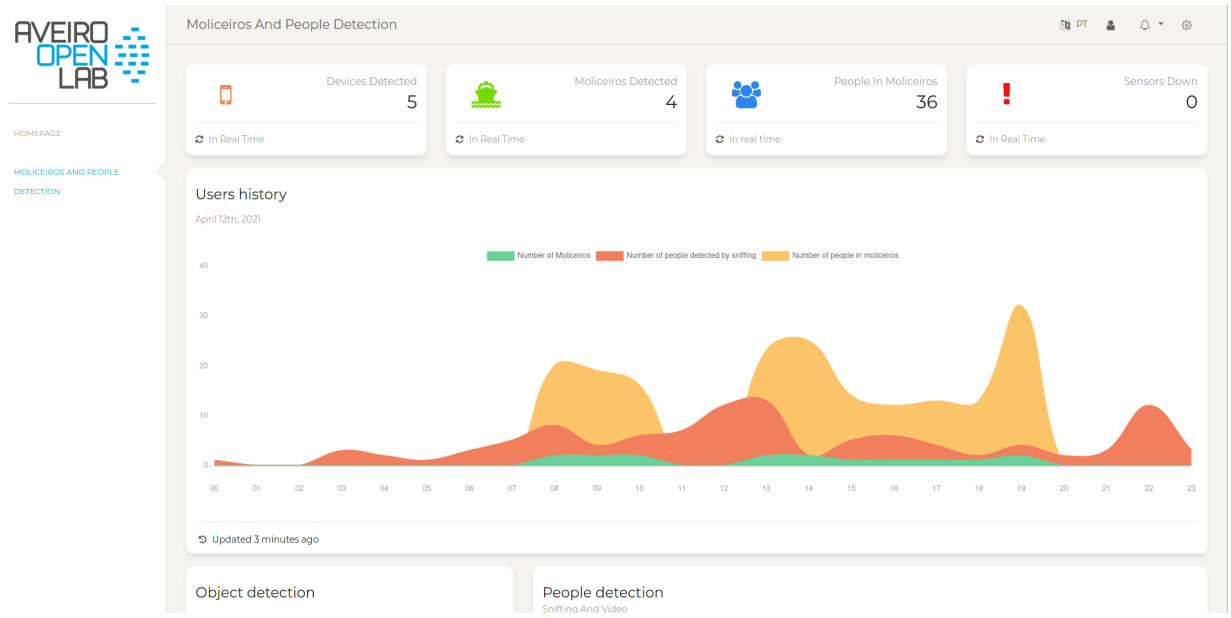

Figure 6: Image of the web application in full view

The web application will have full compatibility between devices and browsers. In figure 7 we can see the web application running on mobile and it's responsiveness. For instance, the menu bar also works on mobile.

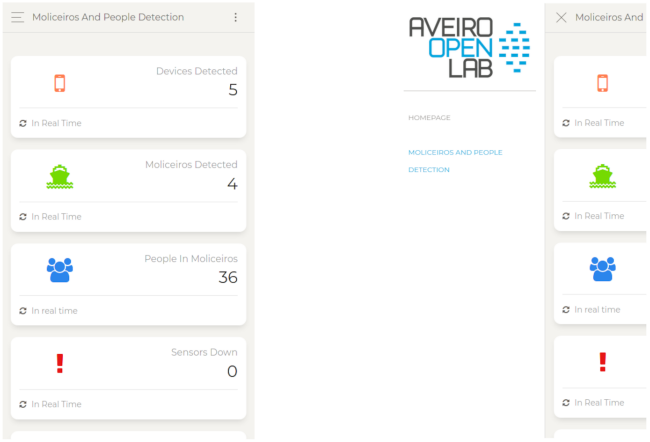

Figure 7: The web application on a mobile screen

On the top of the application page (figure 8) it is possible to see in real-time the detection of *moliceiros*, people and devices. It is also possible to see which sensors might be down.

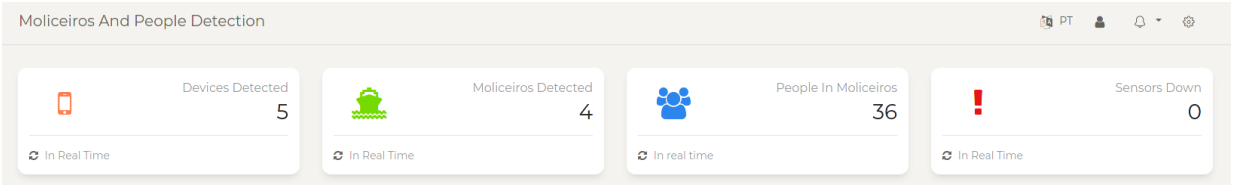

Figure 8: Real-time the detection information

Some of the features to be implemented (figure 9) are the interface language translation, user login, notifications.

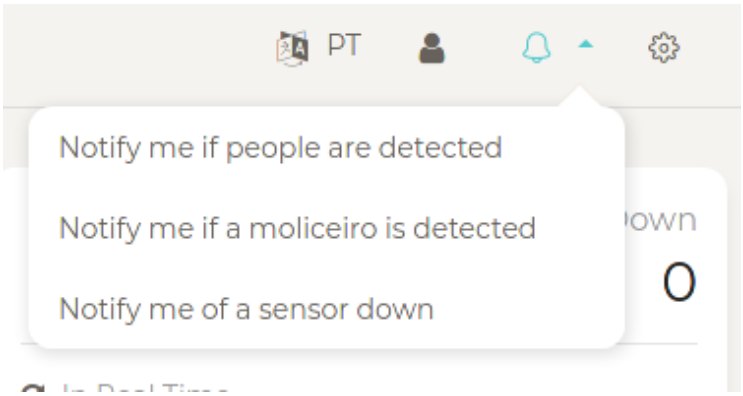

Figure 9: Notification feature

It is possible for the user to see the detection data of a full day (figure 10)

Figure 10: Detection data for a full day

In figure 11, we can see possible ways to show data. For example in the mock-up diagrams we can see the detection information of the last 7 days and the last year

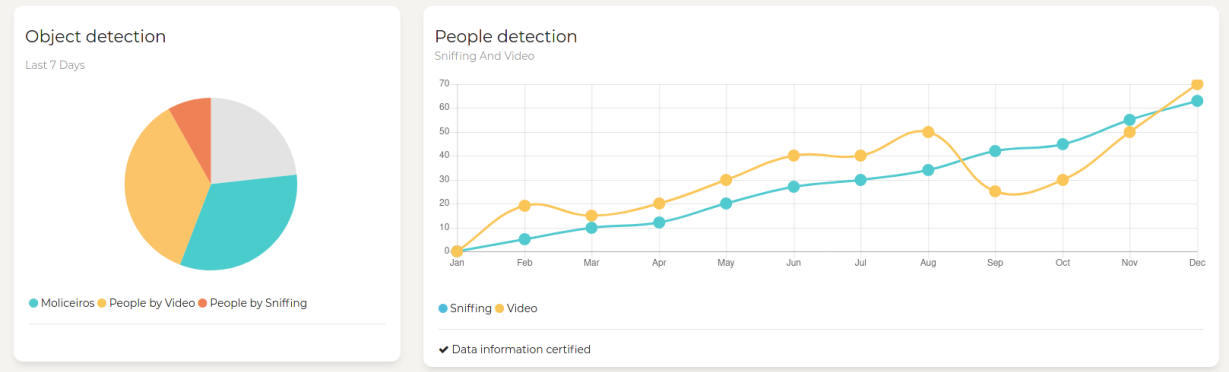

Figure 11: Possible ways to show past data on the application

The user will also be able to get data from a specific date and time. In figure 12 we can see a possible way of prompting the user for the date and time of the information

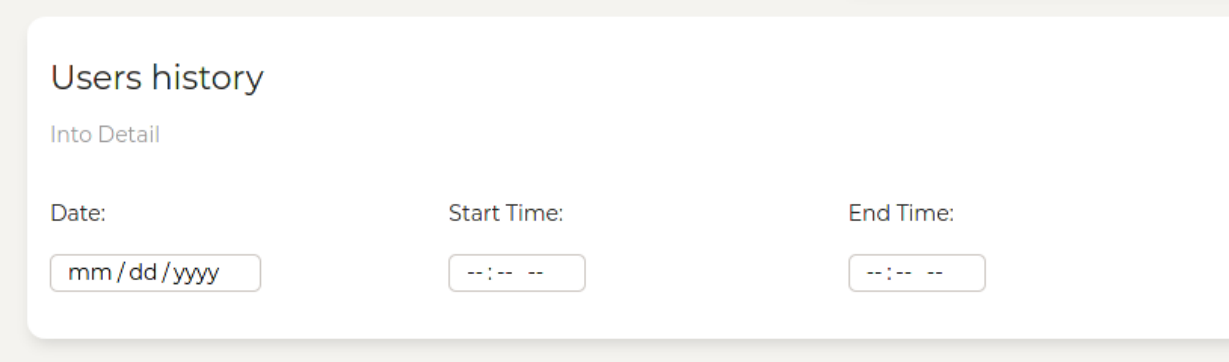

Figure 12: Image of the web application in full