Mobility platform in Aveiro Tech City Living Lab Infrastructure

Milestone 2, Elaboration

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State of the art (I)

- *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

State of the art (II)

- Heptasense - Pedestrian Detector

  - 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

Requirements Gathering (I)

- 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

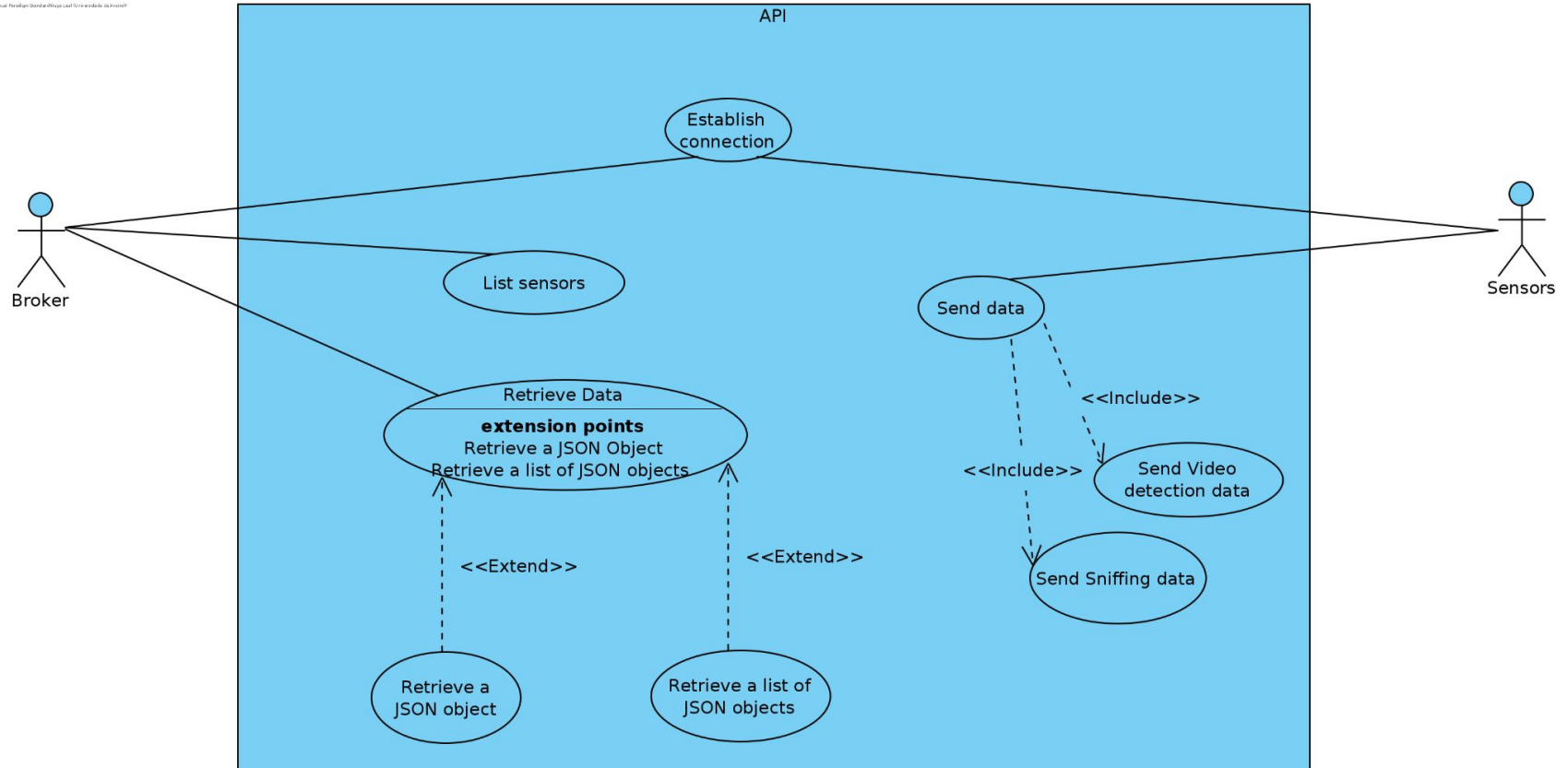# Requirements Gathering (II)

- Showing the data on the dashboard:

  - Use of graphics to show the data in a more visually appealing way

  - This 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)

Actors

- 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

Use cases (I)

Visual Paradigm Standard(Hugo Leal (Universidade de Aveiro))

```
                                    API

                              Establish
                              connection

Broker                                                    Sensors

              List sensors              Send data

          Retrieve Data                        <<Include>>

           extension points                      Send Video
          Retrieve a JSON Object                 detection data
          Retrieve a list of JSON objects
                                    <<Include>>

                                                 Send Sniffing data

      <<Extend>>            <<Extend>>

    Retrieve a          Retrieve a list of
    JSON object         JSON objects
```

Use cases (II)

Functional requirements (I)

- 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

Functional requirements (II)

- 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

Functional requirements (III)

- 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	It 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

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Non functional requirements (I)

- 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

Non functional requirements (II)

- 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

Non functional requirements (III)

- 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

Non functional requirements (IV)

- Documentation:

Reference	Non functional requirements
RD-1	The documentation produced should be easy to understand
RD-2	The web application should have a description of functionalities and a user manual
RD-3	Should document the places defined for the study, as the sensors present on the location
RD-4	The endpoints and API functionalities should be documented
RD-5	Should document the obtained data, the architecture, functionalities and information of the used sensors

Architecture of the project
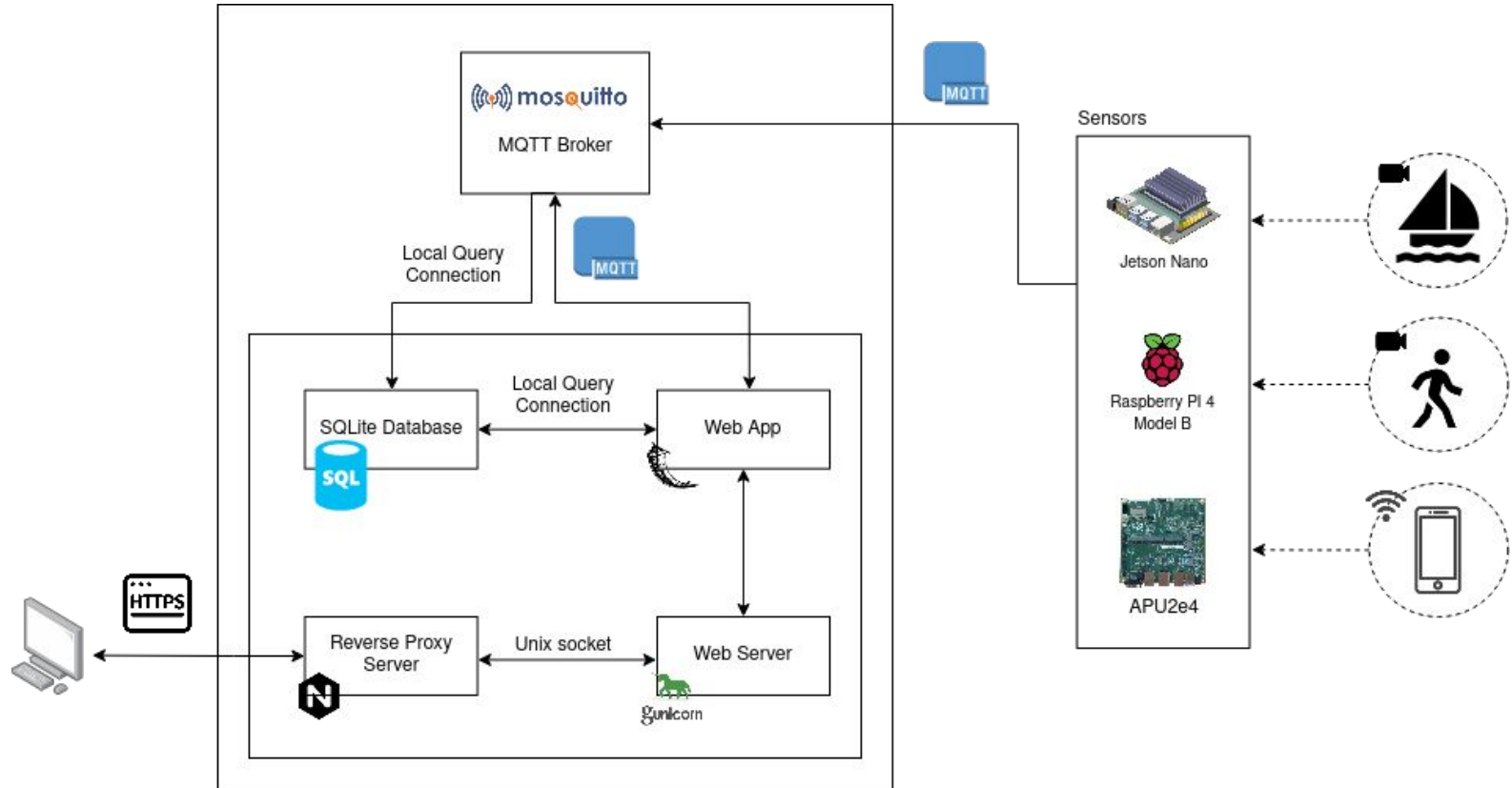
User interaction (I) - Full Page View
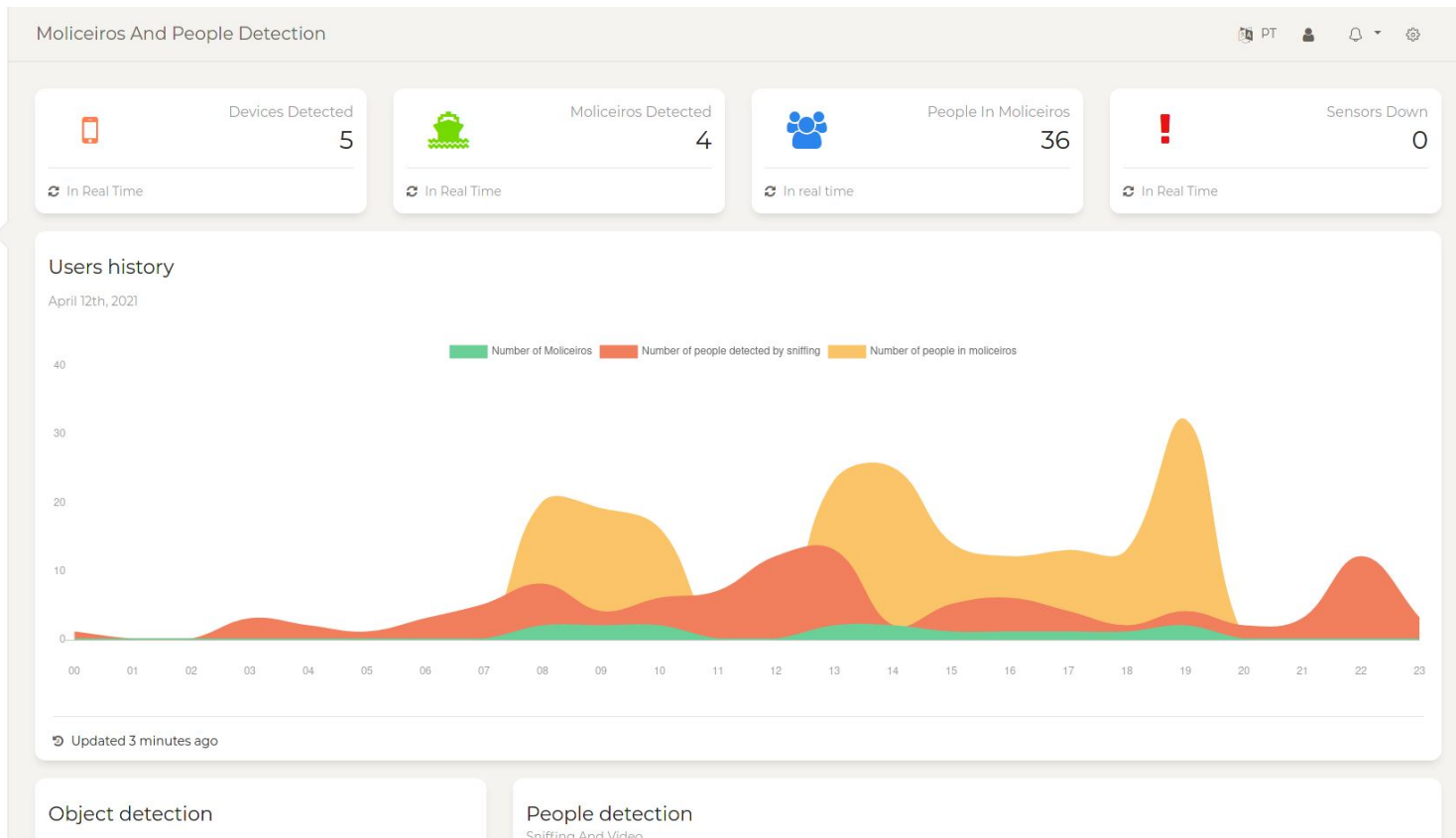
User interaction (II) - Real Time Detections / Notifications
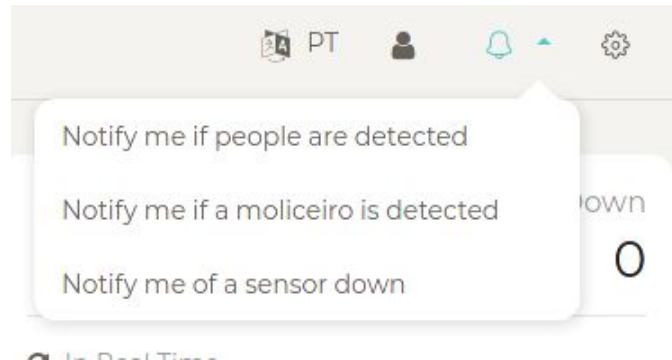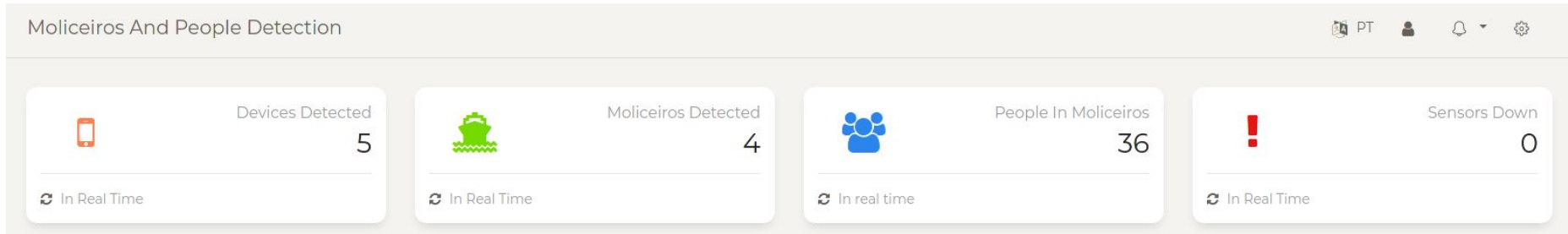
User interaction (III) - Traffic in a selected Date

Users history

April 12th, 2021

Number of Moliceiros Number of people detected by sniffing Number of people in moliceiros

40

30

20

10

0

00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23

↺ Updated 3 minutes ago
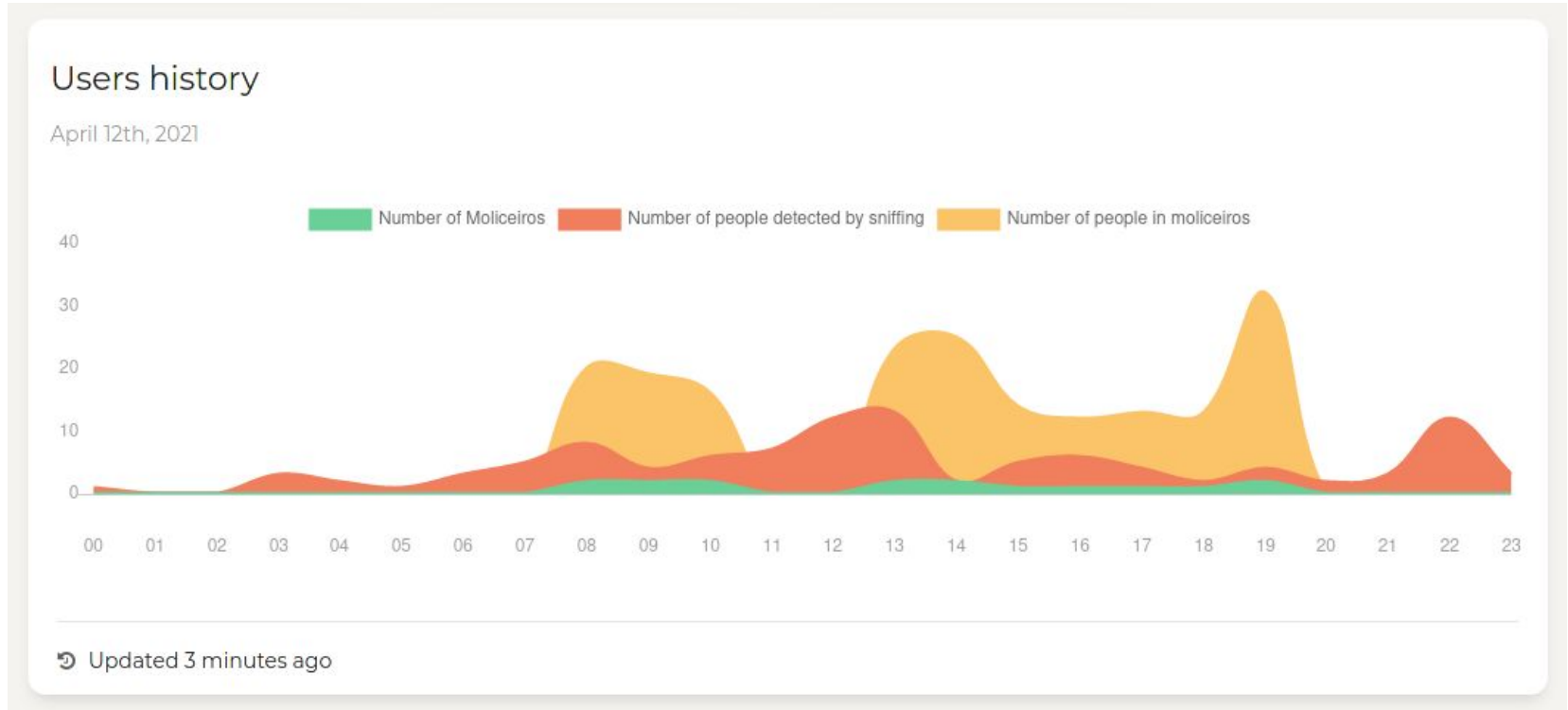
User interaction - Last 7 days / Year detection data

Object detection
Last 7 Days

- Moliceiros ● People by Video ● People by Sniffing

People detection
Sniffing And Video
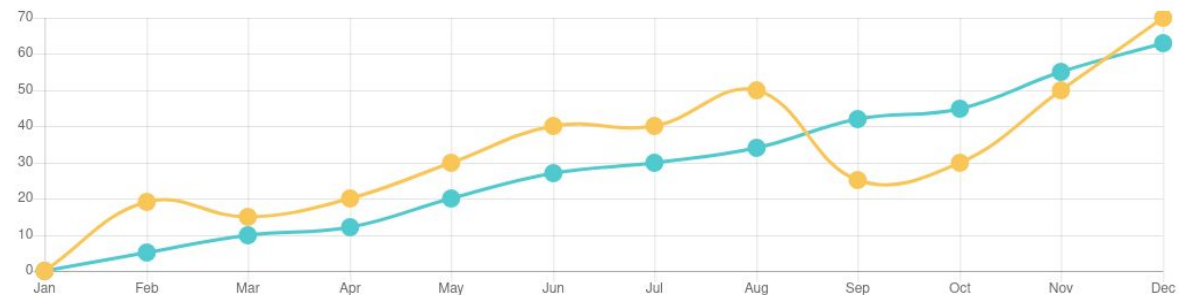
- Sniffing ● Video

✔ Data information certified

User interaction - Specific Time traffic data / Statistics

Users history

Into Detail

Date:

| mm / dd / yyyy |

Start Time:

| -- : -- -- |

End Time:

| -- : -- -- |

Adjustments to the project calendar