Traffic Management Platform

Project developed by:

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Context

Road safety is the main goal behind Intelligent Transport Systems and vehicular network communications, since a large number of the current accidents and deaths could be avoided if the vehicles had the capacity to trade information between them, with the road infrastructure and other road users.

In this context, the PASMO project, Plataforma Aberta para o desenvolvimento e experimentação de Soluções para a Mobilidade, developed by the Instituto de Telecomunicações, installed a set of equipments at Costa Nova and Barra beaches, as well as the Barra bridge and the A25. One of the use cases of the project is the classification of the traffic at both beaches.

Objectives

The goals of this project are to improve the classification of the traffic at Barra and Costa Nova beaches, by merging data from traffic classification radares and video cameras. The traffic radars are capable of identify, although with significant errors, various object classes, such as light vehicles, heavy vehicles, bikes and persons. It is intended to use the footage from the cameras, with the same viewfield of the radares, tho improve classification results, recurring to image processing techniques to detect objects in real time, such as YOLO or equivalent. The data from four radares and four cameras are available in real time to be processed.

Besides vehicle classification, it shall be created a front-end that allows the visualization of the data, either by the public, that will have access to generic data, or by public entities, que will be allowed to consult statistics and other aggregates.

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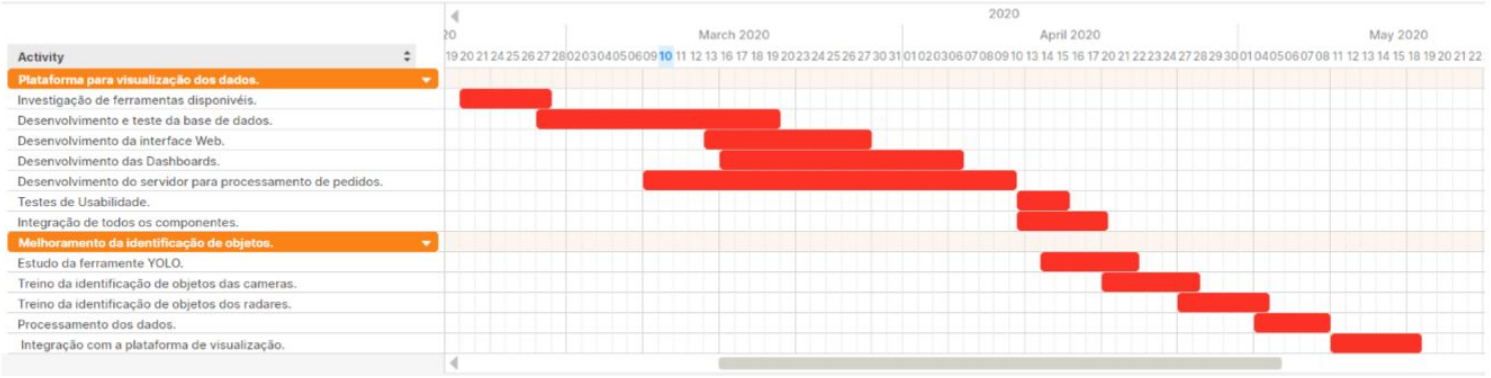
Calendar and task division



Responsibilities in the first module:

- Database: Leandro Soares and João Soares.
- Graphic Interface: David Rocha and Cristiano Santos.
- Data processment: Francisco Morgado and Cristiano Santos.
- Website: Leandro Cardoso and Francisco Morgado.
- Documentation: David Rocha and João Soares.

Responsibilities in the second module:

- Remote Control: Leandro Soares and João Soares.
- Camera Object Identification: David Rocha and Cristiano Santos.
- Radar Object Identification: Francisco Morgado and Cristiano Santos.
- Sensorial Fusion: David Rocha and João Soares.

Functional Requirements:

High priority:

- Chart visualisation.
- In/out traffic flux in real time.
- Information should be efficiently.
- Refreshed zon/device selection should be done with the minimap.

Medium priority:

- Direct comparison between zones.
- Direct comparison between different time periods
- In/Out traffic flux of different time periods.
- One or more selected radar/zone to analyse data.

Low priority:

- Statistic visualisation related to meteorological data.

Non Functional Requirements:

High priority:

- Distinction between users on the information they can access.
- Java implementation.
- Dashboards with Graph.js.
- Database implemented in SQL.
- Database should update every 15 minutes.
- Use of YOLO to identify vehicles.
- 10% increase in the success ratio on identifying vehicles.

Medium priority:

- Database security, especially against SQLInjection.
- Create extensive documentation.
- Database should update every 10 minutes.
- 15% increase in the success ratio on identifying vehicles.

Low priority:

- Database should update every 5 minutes.
- 20% increase in the success ratio on identifying vehicles.

Personas and motivations

Users:

Maria Assunção:

Maria is 65 years old, and retired. During her free time, she likes to travel, but doesn't enjoy traffic. To plan her trips, and to know the best roads and time periods to drive, she would like to have an easy and efficient ways do check seasons with the biggest affluence, as well as the most congested roads, to be able to avoid them.

Paulo Rodrigues:

Paulo is 32, and is the president of Cascavais. He believes that having a constant motorisation and a precise register of traffic related data in that area, allowing him to control and reinforce the areas with the biggest affluence, as well as having statistics of different time periods, to be able to pick the best places to advertising and public constructions would benefit Cascavais.

Alberto Sousa:

Alberto is 42 and is the traffic manager of Cascavais. It would make is job easier if he had access to a platform where every data related to road traffic, past and present, was available, so that he could plan with more efficiency every change that would benefit the region, such as police reinforcement in areas with constant traffic jam, and the addition of road signs in areas with a high number of accidents.

Administrators:

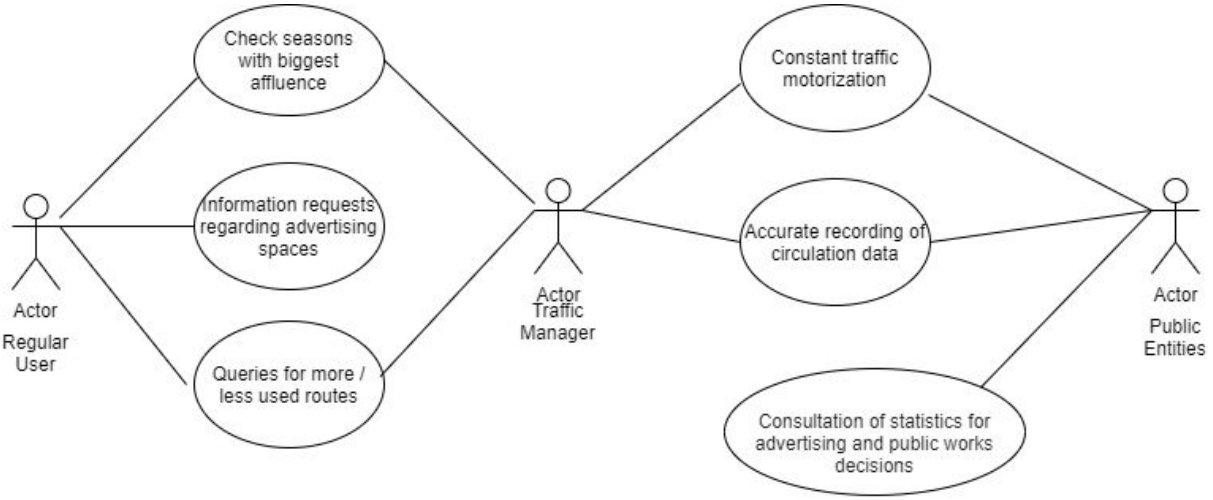
Lara Silva:

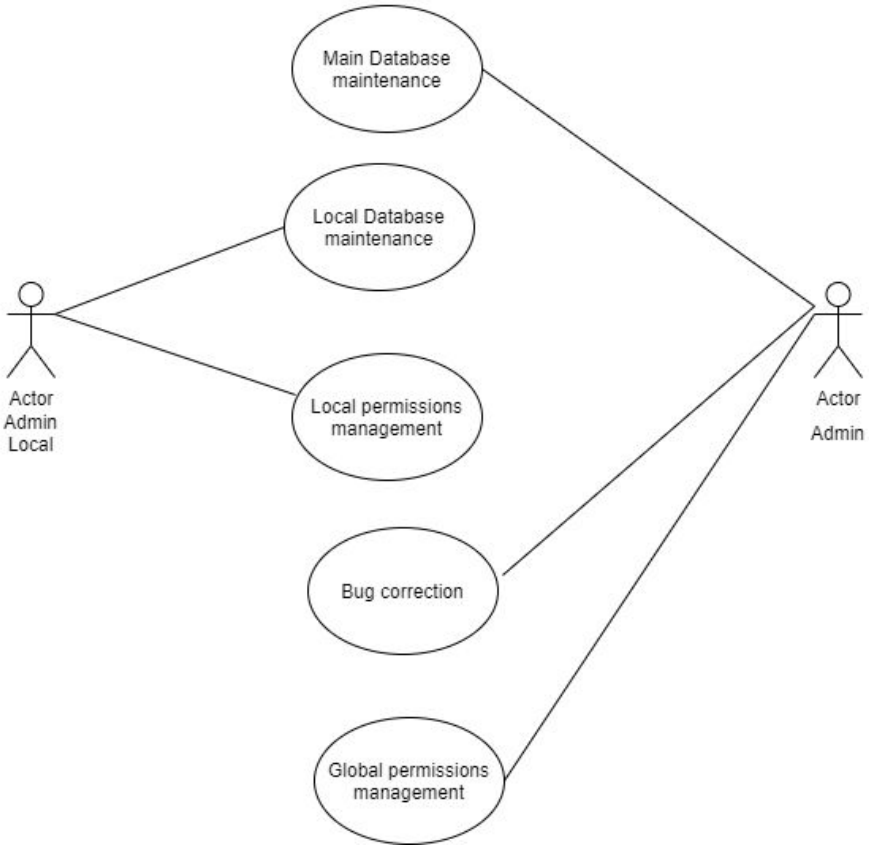
Lara is a local administrator of the implemented system. It is part of her work to maintain the local database, as well as manage permissions of access of data by other areas, after permissions from the owners of the service.

Mário Santos:

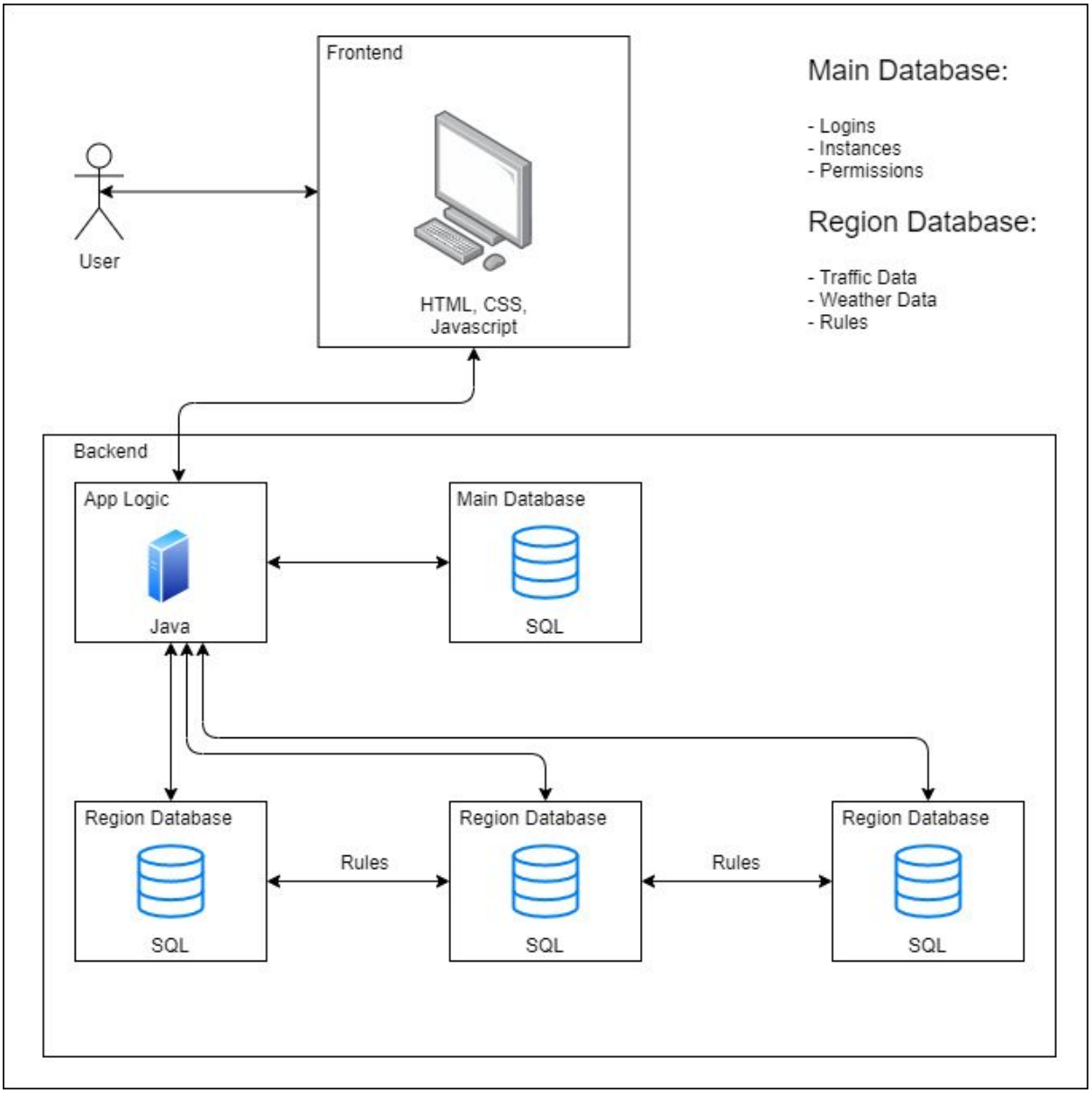
Mário is the administrator of the platform, and it is part of his work to maintain the mais database, as well as correct some bugs that could appear, in addition to make some improvements to increase the quality of the service to the platform users.

Use Cases


Check seasons with biggest affluence
Information requests regarding advertising spaces
Queries for more / less used routes
Actor Regular User
Actor Traffic Manager
Constant traffic motorization
Accurate recording of circulation data
Consultation of statistics for advertising and public works decisions
Actor Public Entities

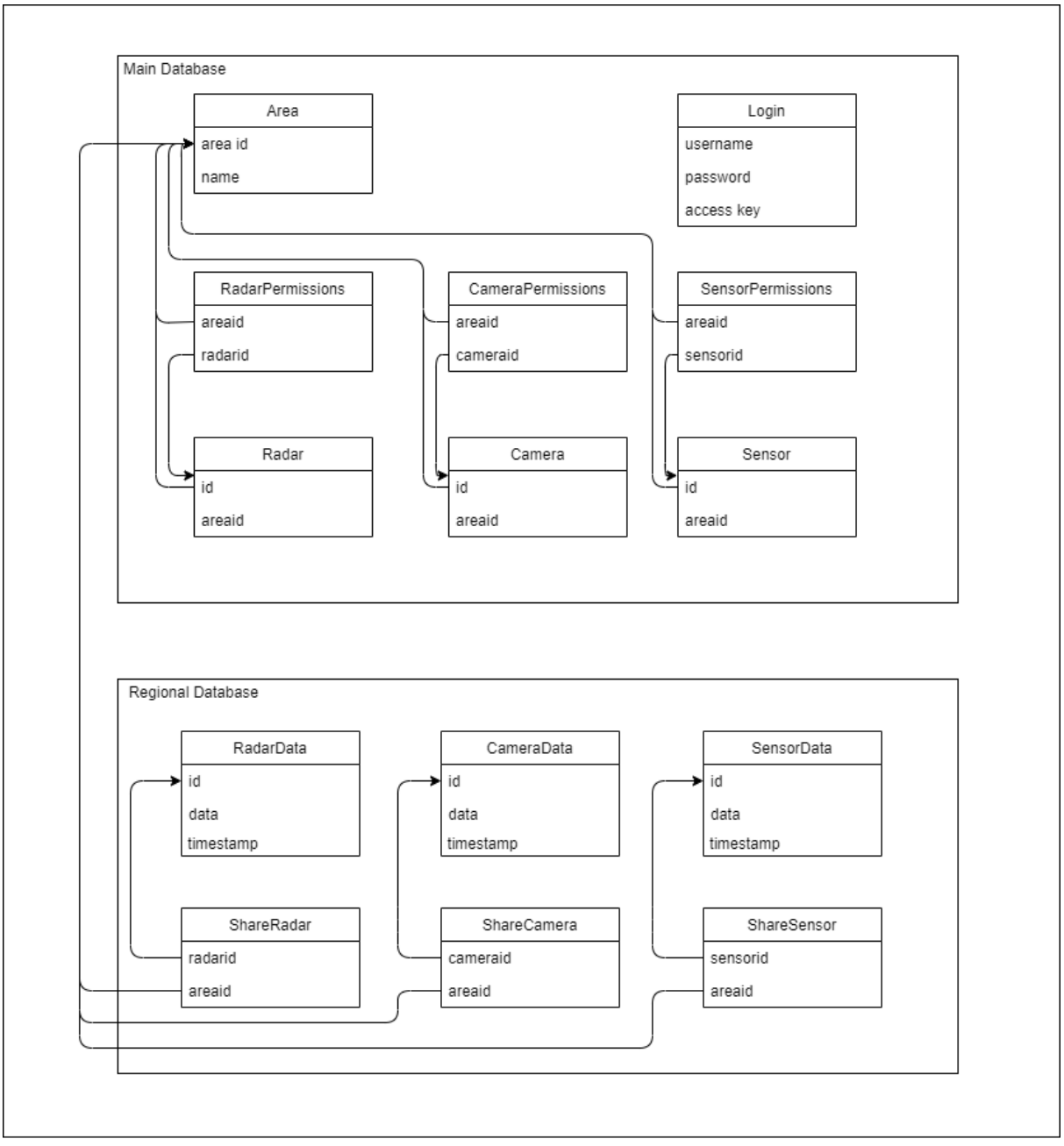

Main Database maintenance
Local Database maintenance
Local permissions management
Bug correction
Global permissions management
Actor Admin Local
Actor Admin

Architecture



The chosen architecture is multi tenant, which means that every public entity is responsible to manage their database, so that we only provide the model to the regional database, in order to make it communicate with the central one. It is a web app, where all the front end is developed in HTML, CSS and JavaScript. In the backend, it will be used Java to obtain data from the PASMO API, and MYSQL to create the database.

Database - UML Diagram



In the main database, it will be stored user login data and permissions, equipment ids, as well as the regions where they're installed.

The region databases will store specific data the user pretends, and permissions, to provide capacity to trade information with other radars from other areas, if the user allows it.

SWOT Analysis