Plataforma de gestão de tráfego e segurança rodoviária para a infraestrutura Aveiro Tech City Living Lab

Milestone 2 – Elaboration Phase

Projeto em Informática
14th March 2023
Group 7

Table of Contents

01. Requirements Gathering

- Meeting with advisors.
- Brainstorming sessions.
- Analysis of similar projects.

02. Context

AVEIRO OPEN LAB

https://aveiro-living-lab.it.pt

02. Context

- Generate events based on real-time sensor data from ACTLL (Aveiro City Tech Living Lab), statistics and previous behaviours in a given area.
- Integrate with events from external mobility applications (HERE, Waze).
- Analyse uncommon periods in the city by correlating traffic flow, events, weather and road conditions.
- Train machine learning models with historic data to detect and predict events.

02. Context

Tasks	Deadline	Done By
Define the architecture and frameworks to be used.	14/03/2023 Milestone 2	All
Start the development of the API and the required backend for the platform. Integrate with data from the ACTLL (Aveiro City Tech Living Lab) sensors. Integrate with data from mobility applications (HERE, Waze).	28/03/2023	All
Combine all data to generate events. Develop the interface for the analysis platform.	11/04/2023	All
Prototype, mid-term presentation.	11/04/2023 Milestone3	All
Implement machine learning to analyze unusual periods in the city.	02/05/2023	All
Connect the entire system to the ACTLL infrastructure. Write the documentation.	23/05/2023	All
Submit technical report (final version). Demo and poster for students@deti & video.	30/05/2023	All
Final Project presentation.	06/06/2023 Milestone 4	All

02. State-of-Art

Genetec – Traffic Sensor Management

- Uses different types of sensors to capture real-time traffic data.
- Uses dashboards to create detailed visual reports.
- Sets the data to generate automated alerts.
- The goals of the project:
  - Track area occupancy.
  - Monitor traffic flow.
  - Detect developing incidents.
  - Manage parking areas.

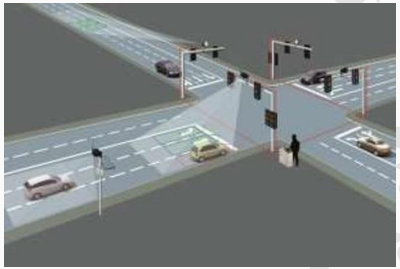
Similar to our project data collection and goals

https://www.genetec.com/products/unified-security/security-center/traffic-sensor

02. State-of-Art

Adaptive-Traffic-Signal-Control-System
Solve Traffic Congestion

- Uses computer vision and machine learning to have the characteristics of the traffic flow at a signalized road intersection:
  - Waiting time per vehicle.
  - Queue density.
- Based on that data:
  - Control the traffic lights, allowing the maximum number of vehicles to pass safely with minimum waiting time.



Similar to our project: Uses YOLO (You Only Look Once) and bounding boxes – Object detection

https://github.com/VedantKhairnar/Adaptive-Traffic-Signal-Control-System

02. State-of-Art (Last Year Project)

Safe Roads: an Integration between Twitter and City Sensing

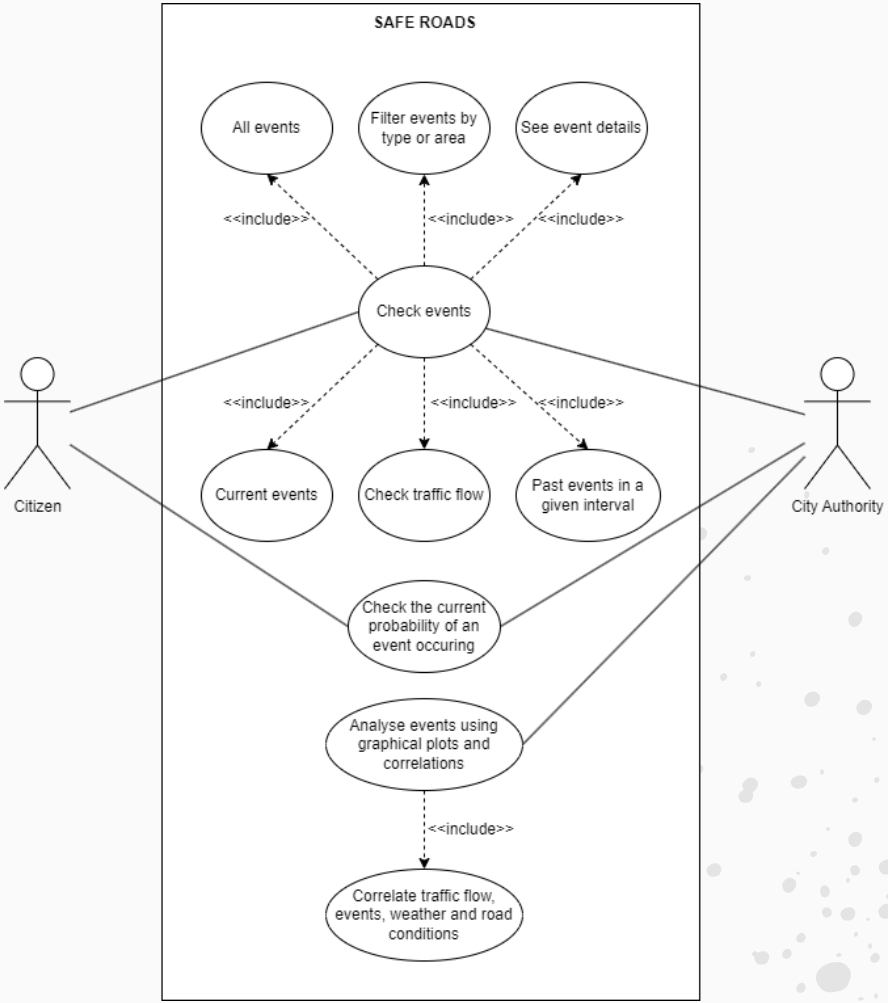
- Platform that generates alerts based on sensor information and relevant tweets.
- Twitter Bot:
  - Publishes alerts generated by the security platform.
  - Analyzes tweets of possible traffic jams and reported accidents.

Similar to our project:
Uses machine learning to filter the receiving data;
Generates alerts for every event;
Analyzes data form the ATCLL structure

03. Actors

- **Citizen**
  - Check traffic events in Aveiro.
  - Avoid traffic congestions, accidents and restricted roads.
  - Know the probability of an accident happening.
- **City Authority**
  - Check traffic events and traffic behaviour in Aveiro.
  - Analyse influence of events (e.g., accidents), weather (e.g., rain) and road conditions (e.g., holes) on traffic flow.
  - Access to an history of past events.
  - Know the probability of certain events happening in a certain area of the city, reduce the risk.

03. Use Cases


SAFE ROADS
All events
Filter events by type or area
See event details
<<include>>
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<<include>>
Check events
<<include>>
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<<include>>
Current events
Check traffic flow
Past events in a given interval
Citizen
City Authority
Check the current probability of an event occuring
Analyse events using graphical plots and correlations
<<include>>
Correlate traffic flow, events, weather and road conditions

04. Functional Requirements

Visualize the events

- Show a map of Aveiro.
- Display traffic congestion.
- Display the events and allow filtering.
- Display the details of an event.
- Provide origin of the event and its type.

Analyze and correlate events

- Provide a graphic plot to visualize traffic flow.
- Allow a correlation analysis between traffic flow, events, weather and road conditions.
- Predict the probability of events occurring based on historic data and current conditions.

- Comply with ATCLL, HERE, Waze and OpenWeather politics and regulations.

04. Non-Functional Requirements

Performance

Usability

Compatibility

Maintainability

04. Assumptions and Dependencies

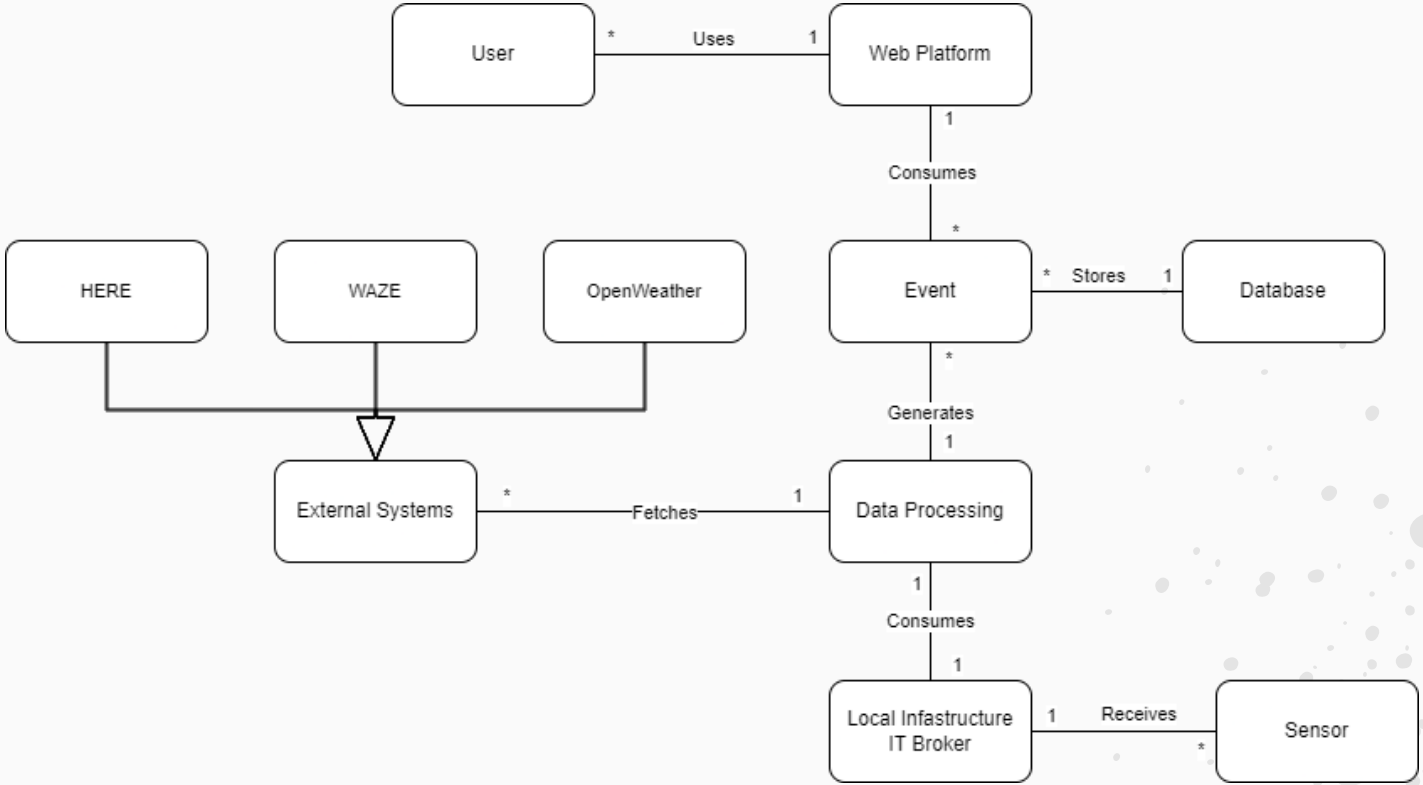
Assumptions

- The ACTLL, HERE, Waze and OpenWeather are always available.
- The users can fully interact with the platform without any help.
- The system doesn’t experience performance bottlenecks.
- The events from external systems are always correct.
- All devices can access the platform.

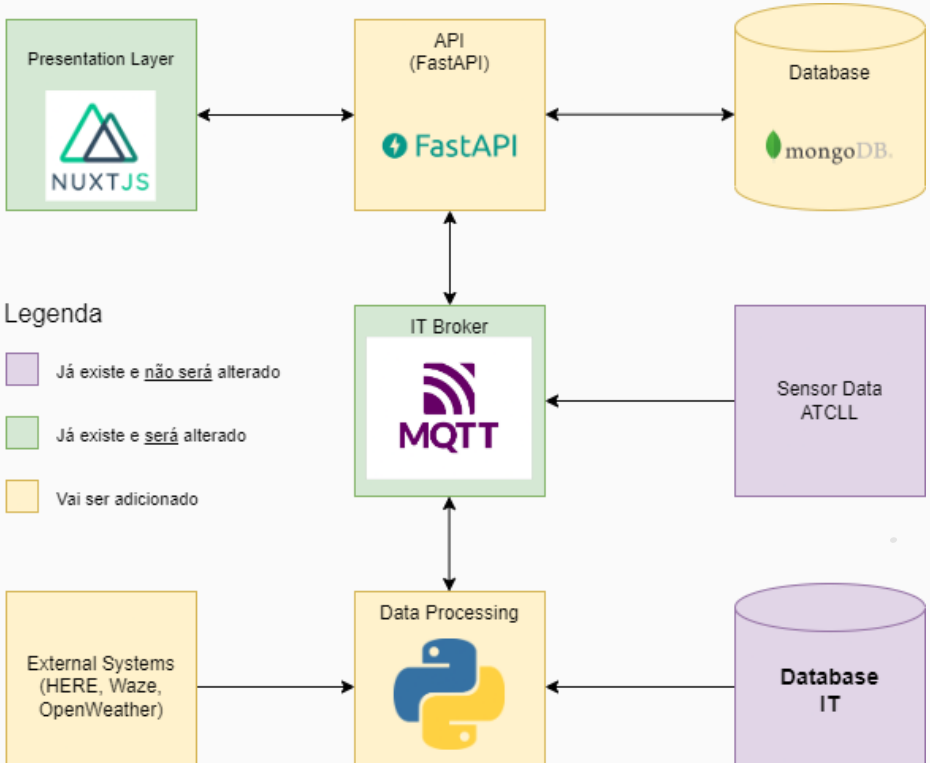
Dependencies

- The partnership with Waze needs to be accepted for accessing their data.
- The data that is provided by HERE, Waze and OpenWeather.

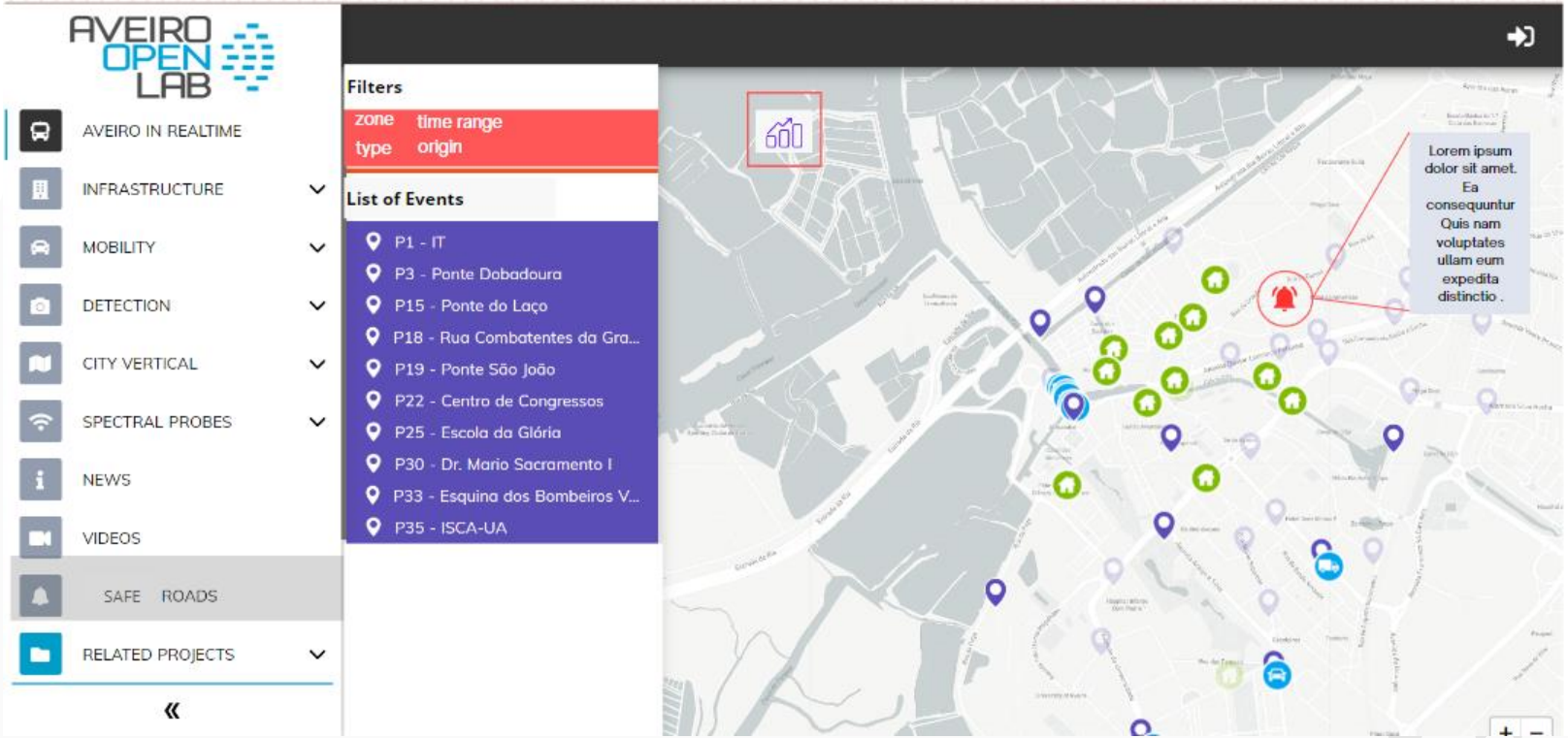
05. Domain Model



05. Architecture Diagram



06. Mock-up


AVEIRO OPEN LAB
AVEIRO IN REALTIME
INFRASTRUCTURE
MOBILITY
DETECTION
CITY VERTICAL
SPECTRAL PROBES
NEWS
VIDEOS
SAFE ROADS
RELATED PROJECTS
Filters
zone time range
type origin
List of Events
P1 - IT
P3 - Ponte Dobadoura
P15 - Ponte do Laço
P18 - Rua Combatentes da Gra...
P19 - Ponte São João
P22 - Centro de Congressos
P25 - Escola da Glória
P30 - Dr. Mario Sacramento I
P33 - Esquina dos Bombeiros V...
P35 - ISCA-UA
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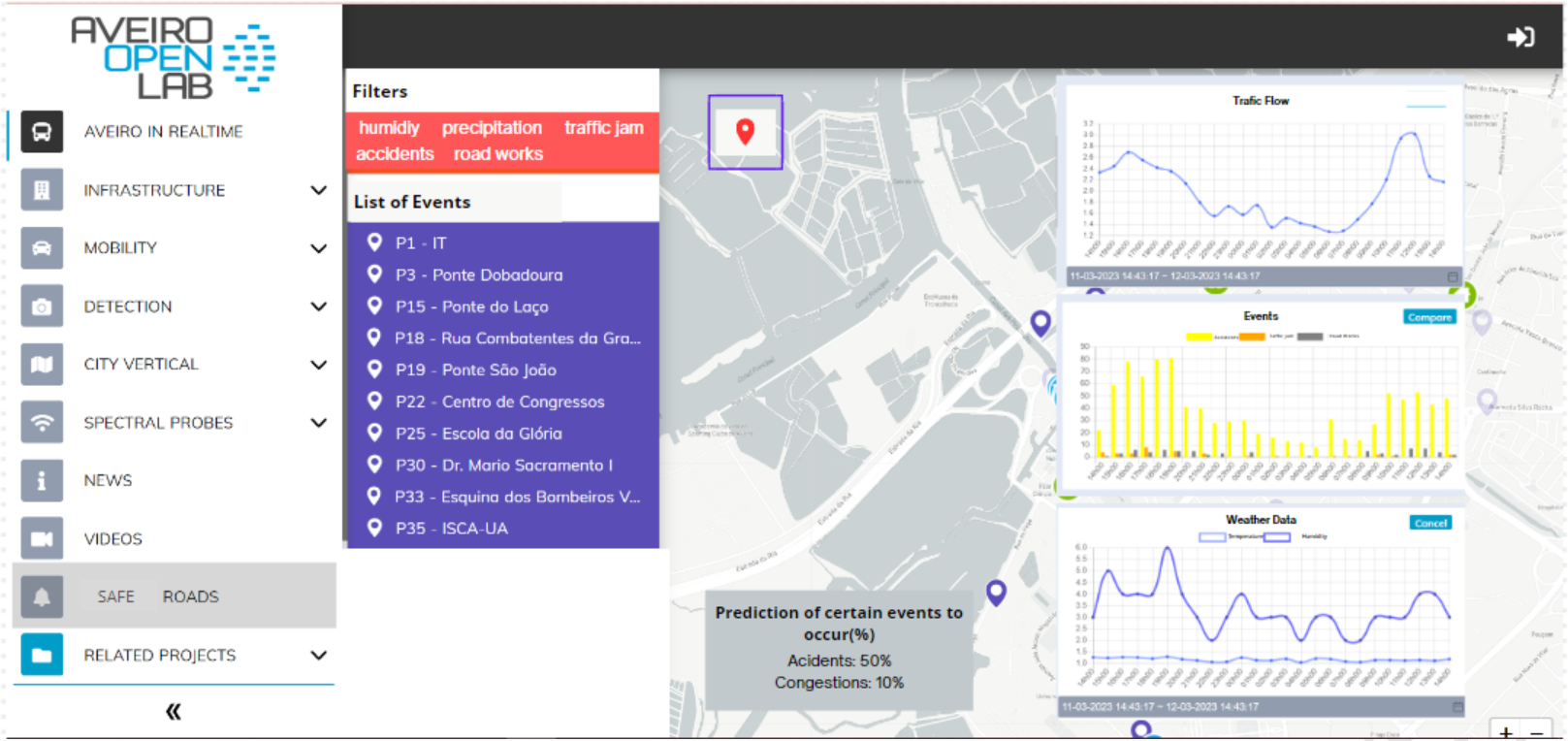
06. Mock-up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humidiy precipitation traffic jam
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Trafic Flow
Events
Compare
Weather Data
Cancel
Prediction of certain events to occur(%)
Acidents: 50%
Congestions: 10%

06. Mock-up (Graphs)