

Safe Roads: Traffic management and road safety platform for the ATCLL infrastructure

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Abstract—The idea of having a modern inter-connected city is getting stronger with the growth of Wi-Fi connected devices and the evolution of IoT. Therefore, it was proposed the development of a traffic management and road safety platform, which could process and analyze real-time radar and camera data to generate traffic events around the city. Adding to the already existing congestion events, it was possible to detect potholes using a YOLOv8 model, and vehicles driving in the wrong way using a custom algorithm. Integration with data from HERE and OpenWeather enriched the data collection. There is a graph page to compare events with traffic flow and weather data, and includes results from correlations and predictions of traffic flow.

I. DATA GATHERING

The main source of data comes from the ATCLL sensors located around Aveiro. External APIs from HERE and OpenWeather enriched the data collection, providing traffic flow and events, and weather data respectively. The IT database provided historical data for creating correlations and training a deep learning model to predict traffic flow.

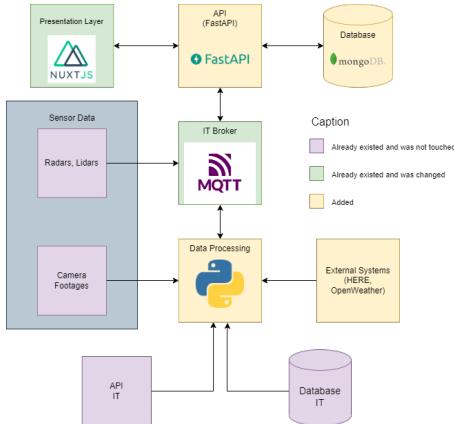


Fig. 1. Architecture Diagram.

II. EVENT DETECTION

A YOLOv8 model trained to detect potholes is used on camera footage, and pixel positions are converted to real-world

coordinates to display on the map. A custom algorithm to detect vehicles driving the wrong way uses radar positions. It works by using a line that separates both ways of traffic, determining if a shift in positions corresponds to the correct way of traffic. It was adapted to use two lines (one per way of traffic) to account for a large amount of false positives.



Fig. 2. Pothole detection visualization.



Fig. 3. Wrong way vehicle detection visualization.

III. WEB PLATFORM

Integrated in the existing ATCLL web platform, one is able to view and filter events, view their details, and check traffic flow. It's possible to compare events against traffic flow and weather data in a tab with graphs, which includes relevant static results from correlations. Prediction of traffic flow isn't

dynamic, since the model requires updated data to be accurate, which the IT database was unable to provide.

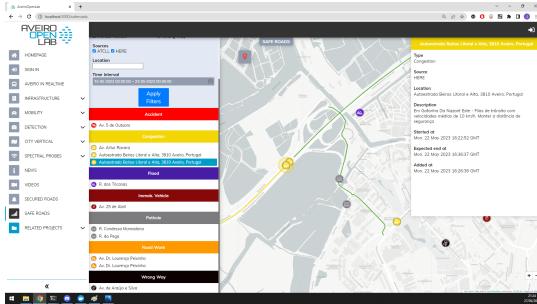


Fig. 4. Safe Roads map.

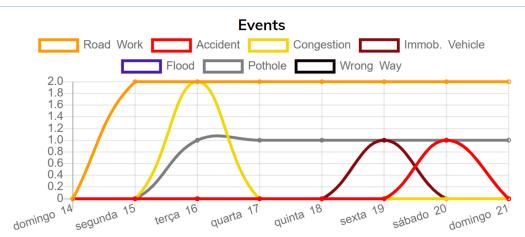


Fig. 5. Graph Events in ATCLL web platform.

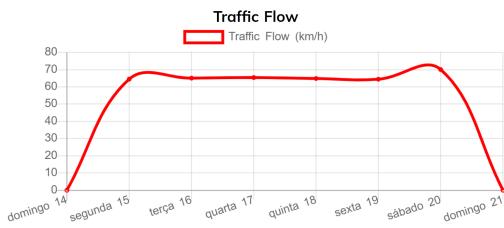


Fig. 6. Graph Flow in ATCLL web platform.

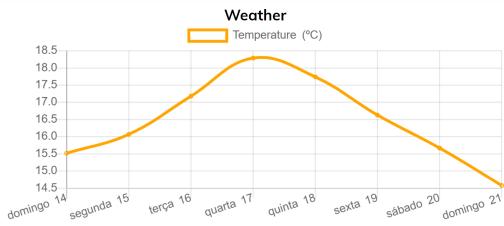


Fig. 7. Graph Weather temperature in ATCLL web platform.

IV. CORRELATIONS AND TRAFFIC FLOW PREDICTION

Traffic flow was correlated with aspects such as weather, school and days of the week. Results confirm higher traffic during bad weather, school periods and in weekdays. Traffic flow prediction uses a LSTM deep learning model, designed to learn from sequential data, being its performance satisfactory.

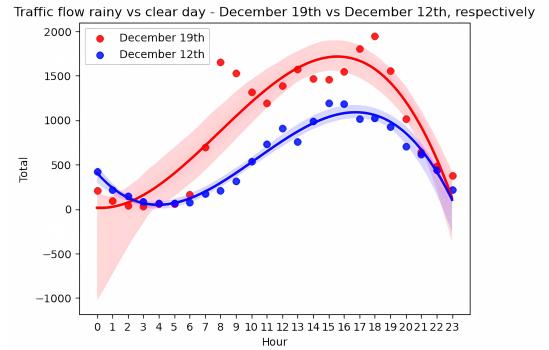


Fig. 8. Traffic flow rainy vs clear day.

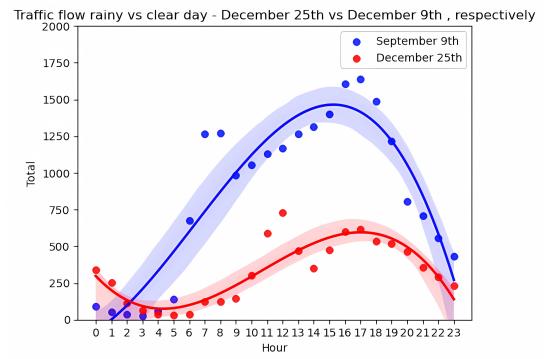


Fig. 9. Traffic flow rainy vs clear day.

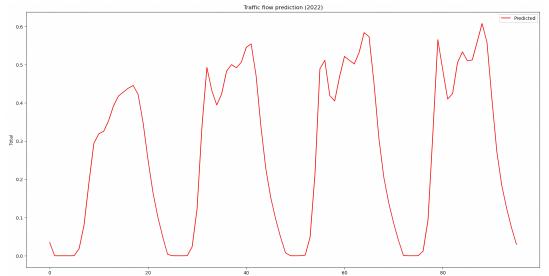


Fig. 10. Traffic Flow Prediction.