Enhancing Intersection Traffic Management Through V2V Communication

RSA Project Presentation

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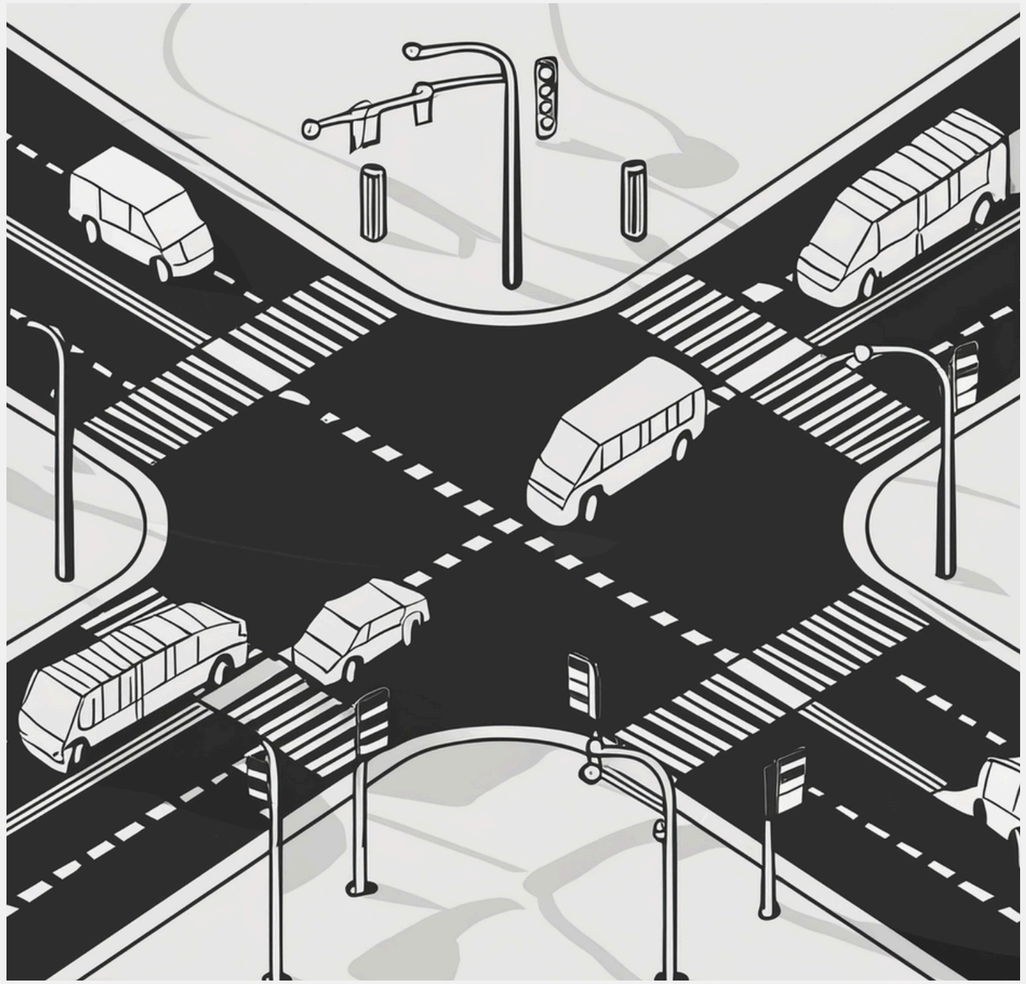

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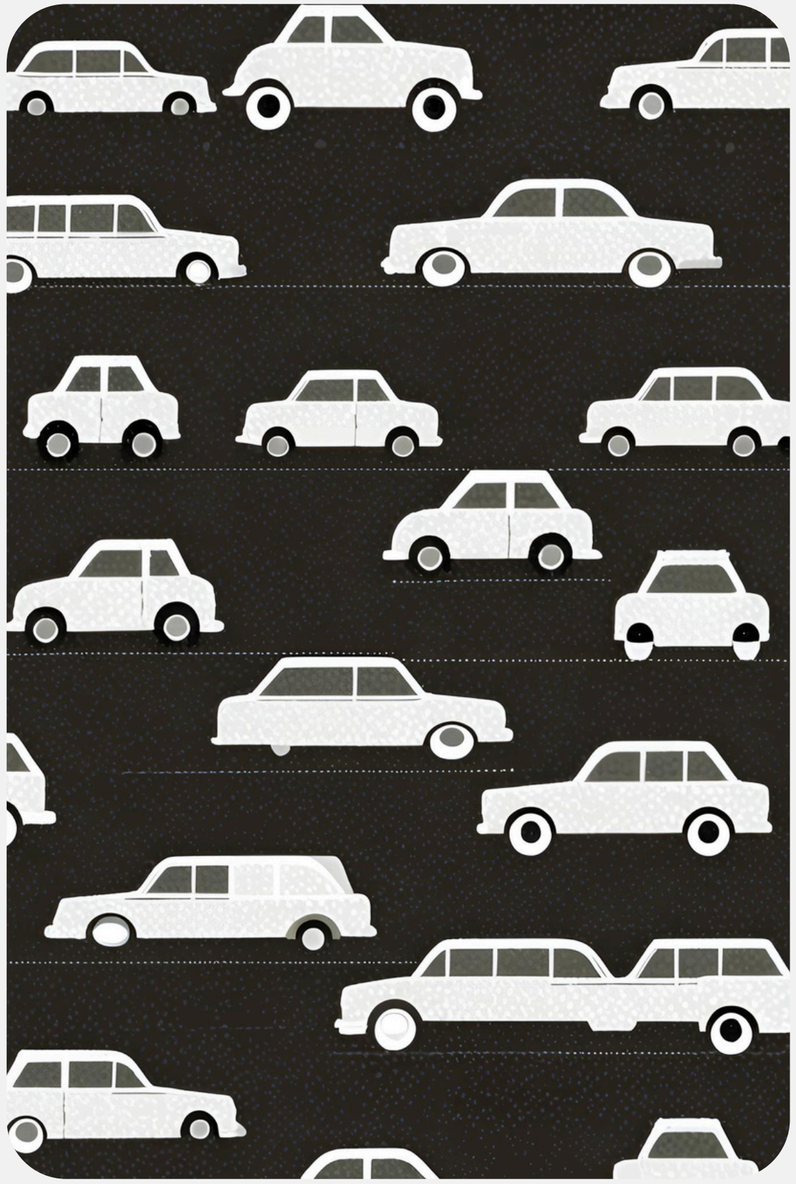
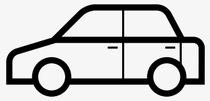
Overview

Nowadays, cars use communication systems to improve traffic flow at intersections. By enabling vehicles to communicate with each other and roadside units, traffic is better organized, reducing stops, minimizing congestion, and enhancing safety.



Objectives



V2V Communication

Install an OBU in the automobile and use the CAM to relay critical information about the vehicle to other OBUs and RSUs. Such as, location,speed, etc.

Algorithm Street Priority

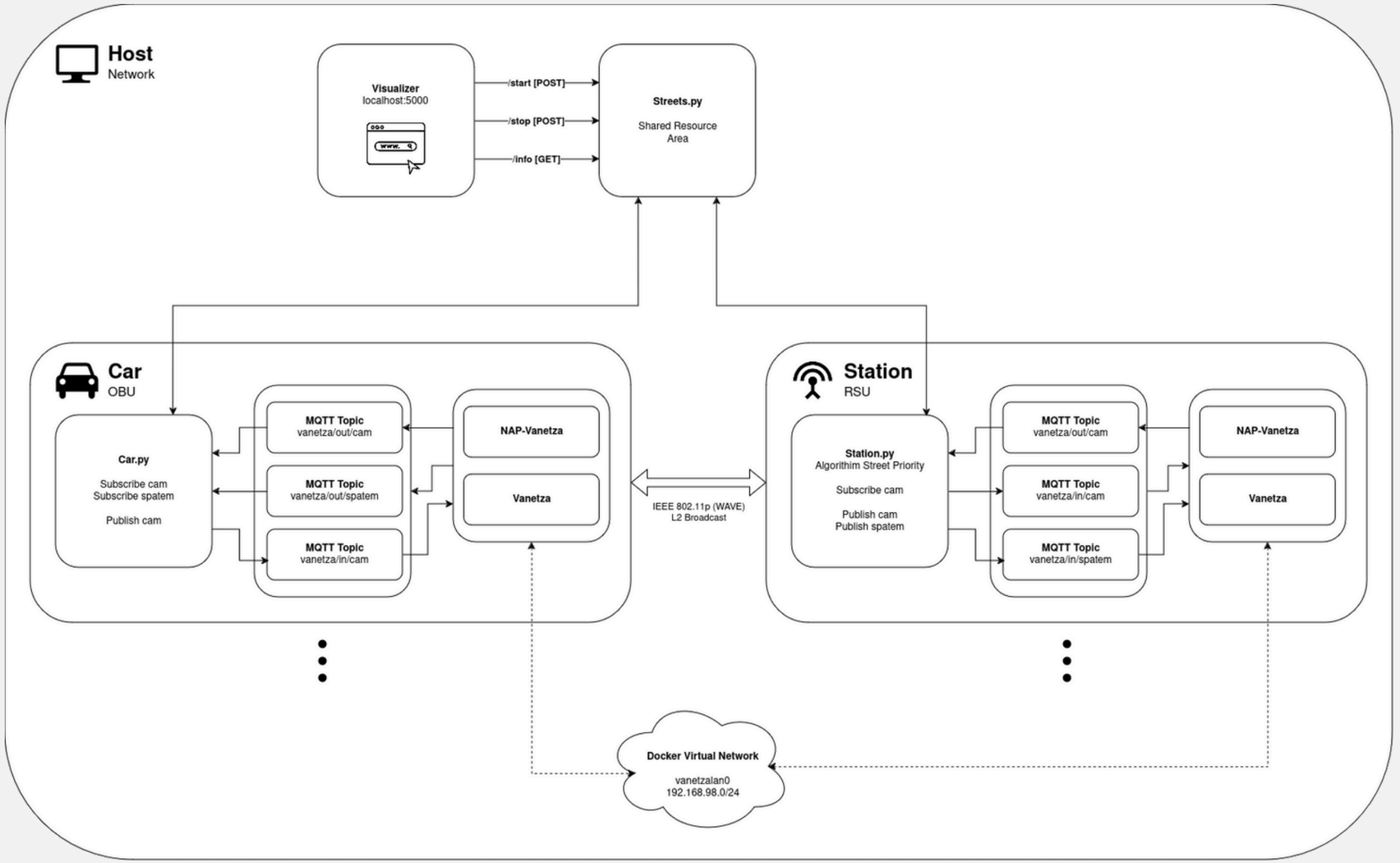
Develop an algorithm that uses CAM messages from nearby OBUs to decide which vehicles within a street should stop, slow down, or continue moving based on proximity and other relevant factors.

Exchange Messages

OBUs and RSUs use CAMs and SPaT messages to exchange information. CAMs provide car and station data, while SPaT messages relay traffic light status, helping vehicles decide whether to stop, slow down, or proceed.

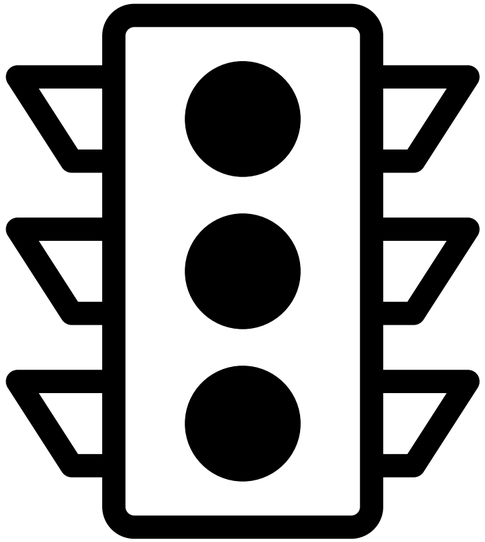
Architecture

- The system includes N cars (OBUs) and M stations (RSUs) interconnected through a Docker virtual network.
  - The demo features 5 OBUs and 4 RSUs.
- A shared resource area allows car and station threads to exchange information.
- Additionally, a visualizer displays the interactions between cars and stations.



Implementation

What was implemented?



Simulated Connection between RSUs and OBUs

- Range between OBUs and RSUs is simulated.
  - The Shared Regions, Streets, check which cars are within the Stations range and block or unblock their communication.

Announcements of entities

- Each car and station will announce itself through CAMs messages, where they send in CAMs relevant information so others can decide how to interact.

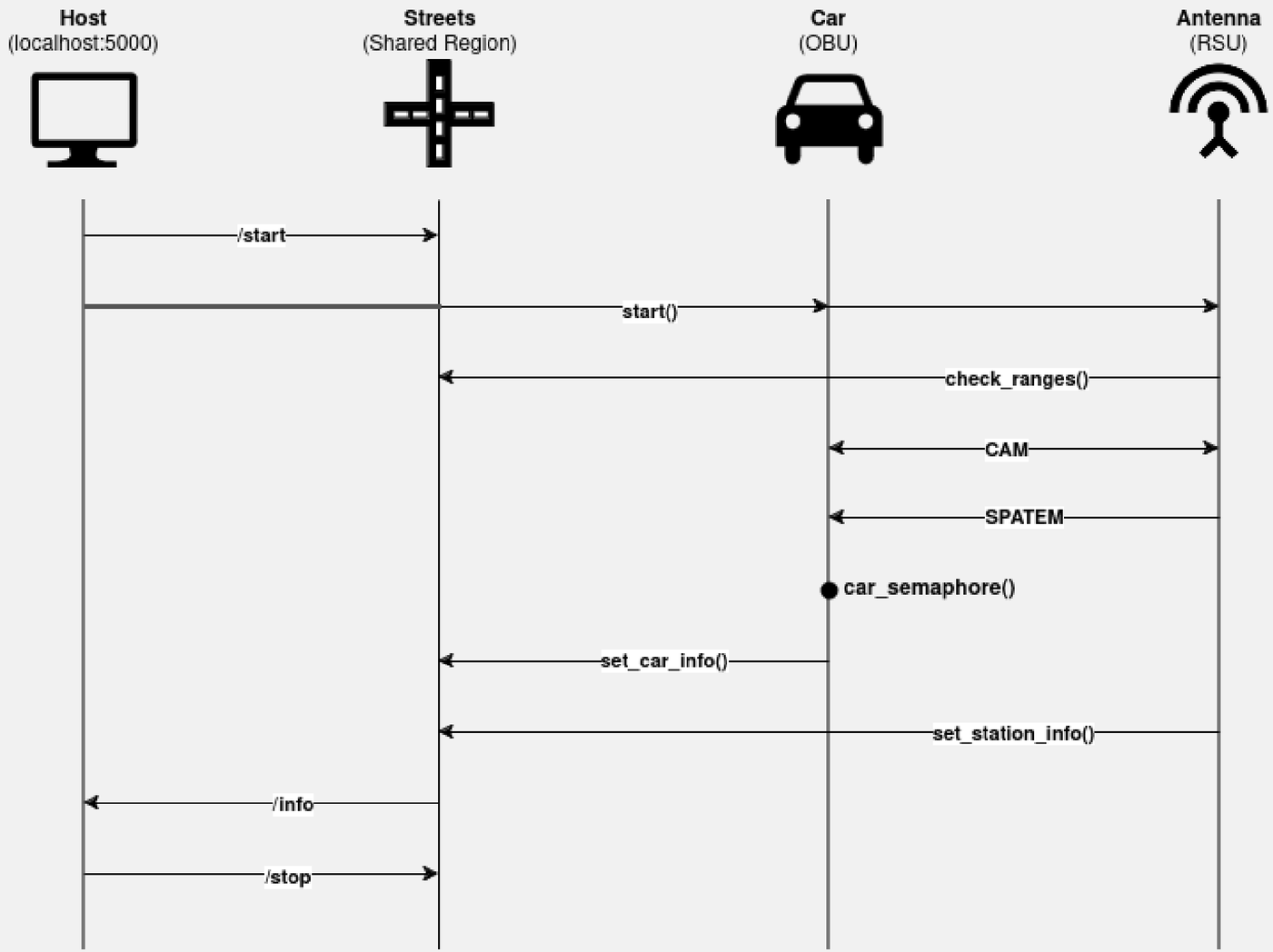
Street Priority Decision and Spreading

- It gathered data, including their location and speed, by utilizing the CAMs message that was received from the cars.
- The vehicles that are closest to the intersection are given priority by this algorithm, while those that are farther away will slow down or stop.
- The corresponding semaphore will turn yellow or red to indicate that vehicles on the street are required to halt and slow down.
- Cars use SPaT, which allows RSUs to disseminate information on the condition of each street, to determine whether they are in a zone where they need to slow down.

Message Timeline

Timeline

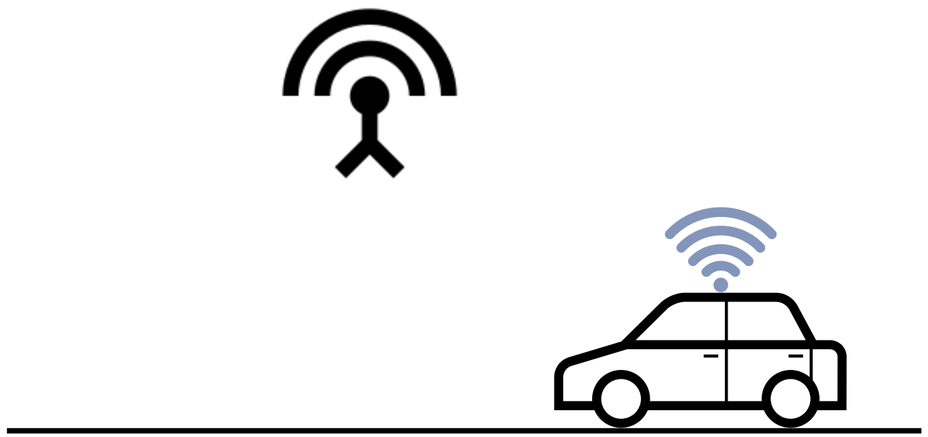
1. Simulation starts with the host.
    a. A Shared Street Area is established.
    b. Threads for cars and stations are made
2. Streets monitor the station's range for cars and either block or allow communication between their OBU and RSU.
3. Vehicles and stations communicate using CAM messages to report and gather data regarding their current conditions.
4. When two cars approach an intersection at roughly the same distance, RSU determines which is the preferable approach, modifies the semaphore for the intersection's streets, and broadcasts the SPaT message.
5. Once a car receives the SPaT message, it will either slow down, halt, or continue driving based on the semaphore assigned to the street.

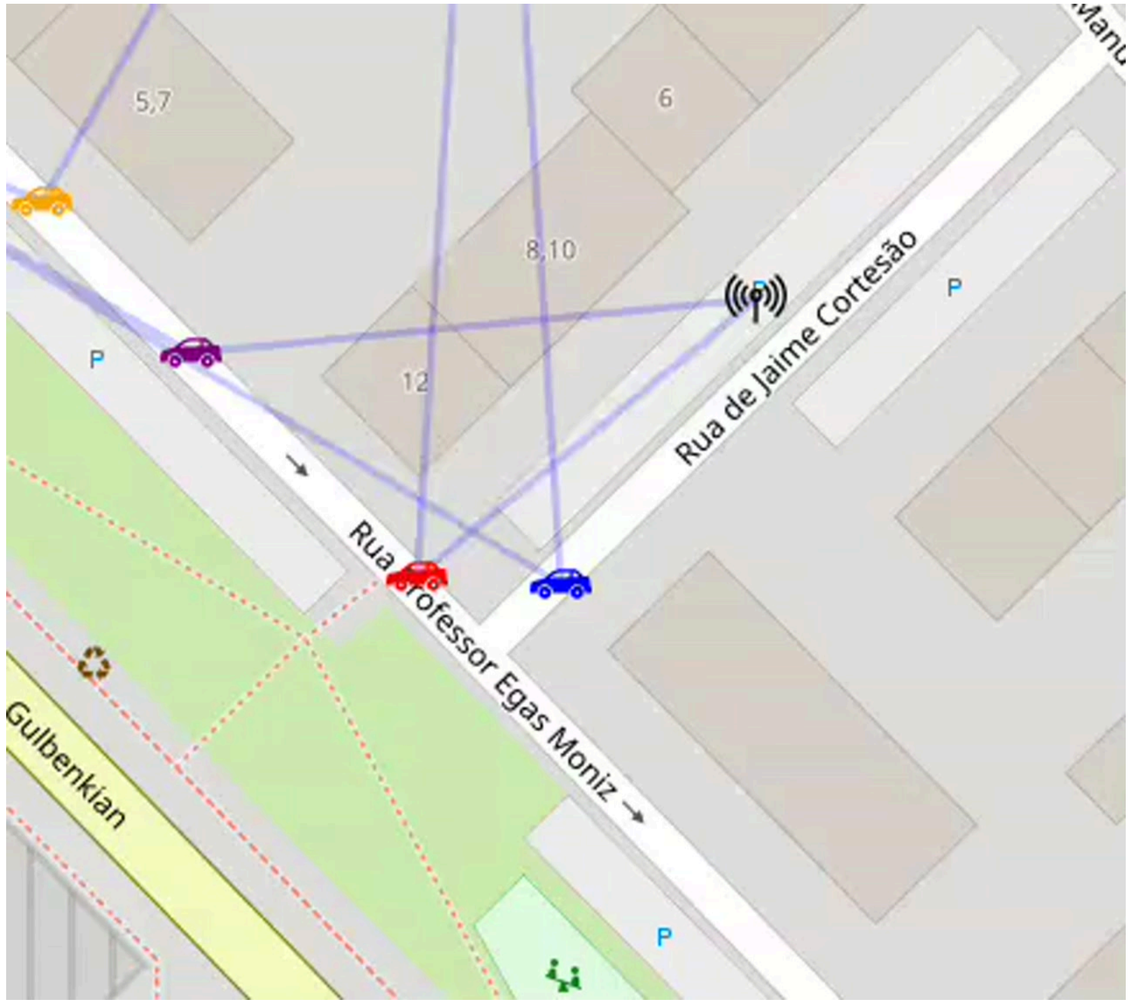


CAM exchange between OBU and RSU

OBU and RSU exchanging CAMs

- When exchanging CAM messages the RSU will recognize that is connected to the OBUs in the Cars.

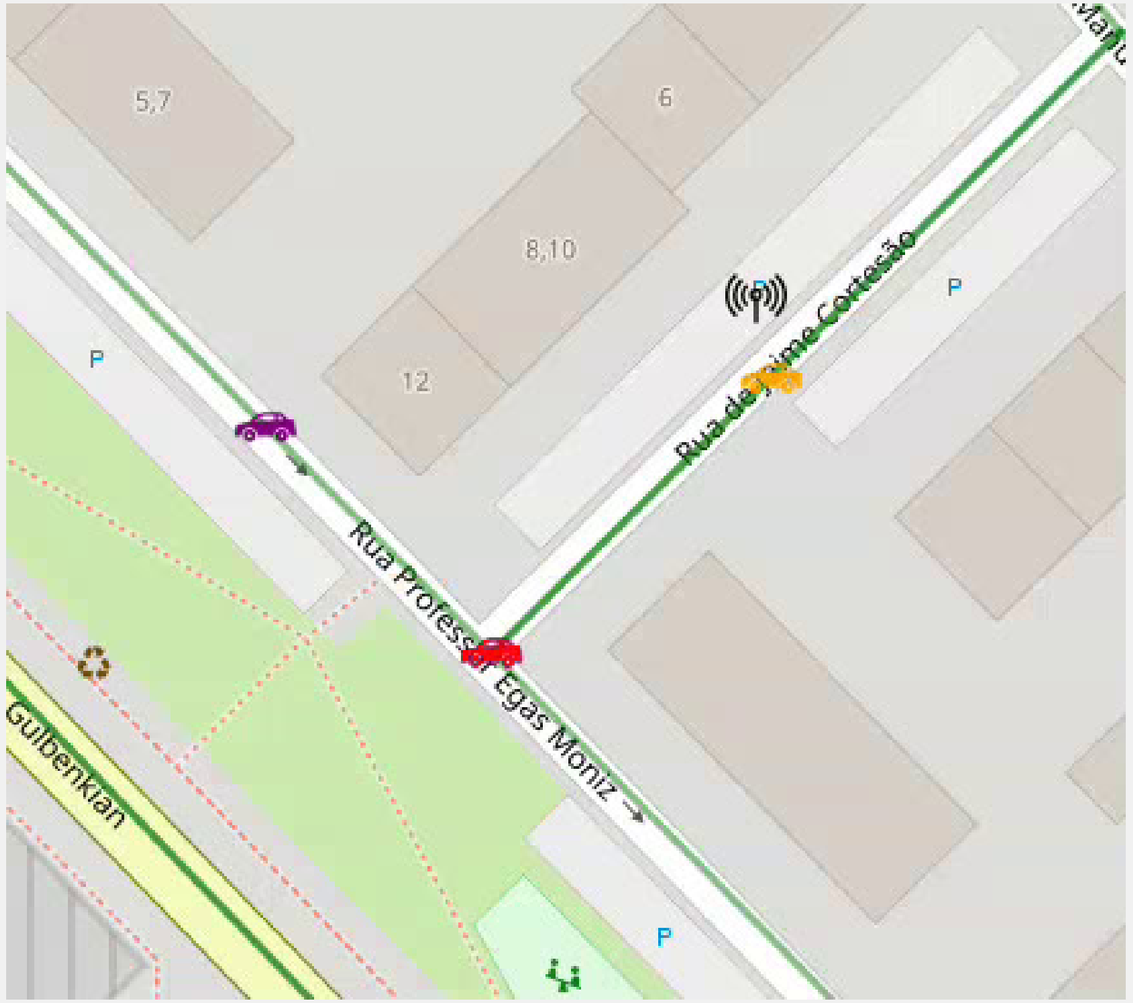




SPaT Broadcast to OBU from RSU

RSU Broadcast SPATEM to the OBU

- After RSU deciding which is the best approach when different veihicules are approaching to the intersection, it will broadcast through SPaT messages its decision.



DEMONSTRATION

Do you have any questions?