1 Introduction

This is the qualification report of team ATROTON for the Bosch Future Mobility Challenge 2025. In this report we are going to cover the activities that were prepared during the last month and what we are looking to accomplish till the next report.

2 Planned activities

In this part of the report, we are going to enumerate all of the planned activities for this period and specify the members for each activity.

Vehicle Perception & Control:

- Intersection Detection
- Lane Detection/Following
- Traffic Signs Detection
- Traffic Lights Detection
- Path planning
- Parking
- Finite State Machine Diagram

External activities:

- Track Setup

3 Status of planned activities

Intersection Detection
Status: Ongoing
Implementation: We're planning to use the Harris algorithm to identify the opposite side of the intersection and apply the RANSAC method to fit a line that helps maintain a straight path. To detect corners, we'll utilize OpenCV.
Difficulties: Haven't figured out how to take the turn.

Lane Detection/Following
Status: Complete
Implementation: The car can stay in lane and take turns. Bought a new wide angle camera and improved the behavior of the vehicle.
Difficulties: The tests for the algorithms are tested on the temporary track. The camera used before was not the wide angle pi camera.

Traffic Lights & Signs Detection
Status: Complete
Implementation: Both traffic lights and signs are being detected by our model that we trained with YOLO8 using ultralytics, and then we optimized the model converted it into a openvino model for better performance . With the signs printed our model successfully recognizes them in real time.
Difficulties: Haven't obtained traffic lights yet, thus they can't be tested in real time.

Path planning
Status: Ongoing
Implementation: We have written code using Dijkstra's algorithm and simulated its behavior in a small application. Our next step is implementing it on the car.
Difficulties: Needs a better test track to be tested properly.
Parking
Status: Ongoing
Implementation: We are working to make a static approach to parking when detecting the parking sign.
Difficulties: The speed of the raspberry pi is slow and has trouble running the code. Lost precious implementation time because of the wrong camera use.
Track Setup
Status: Ongoing
Implementation: As a temporary solution we used black foam floor tiles, with white electrical tape for the lines.
Difficulties: The pool liner material is costly and can't be used. In communication with the printing company for alternative material.
Finite State Machine Diagram
Status: Complete
Implementation: The vehicle is able to detect most signs (stop, no entry, parking, crossing) and behave accordingly.
Difficulties: No major difficulties on this part.
Localization
Status: Ongoing
Implementation: We are working on utilizing the imu to extract the vehicle coordinates and researching ways to fuse the gps coordinates with the imu coordinates, to compensate for the imu drift.
Difficulties: No difficulties yet.
Pid controllers
Status: Ongoing
Implementation: we are working on a pid controller for the steering and the speed for a smooth ride.
Difficulties: No difficulties yet

4 General status of the project

So far, we have completed the lane following, the sign detection and the finite state machine diagram and we are working on parking and the path planning. Also we are looking into the parking.

5 Upcoming activities

The next steps are finishing the tasks that are still ongoing from this report and then moving forward on working on the upcoming activities that will be assigned according the previous ones to each member. For starters, the most important is setting the track and then the rest.

Perception:

- Intersection Detection & Navigation improvement
- Parking improvement
- Localization

Vehicle Control

- PID Controllers