

Project Status 2

Team PSIML

January 2025

1 Overview

During this period, the project has made steady progress, successfully reaching key milestones outlined in the initial planning phase. The team has calibrated and configured the core sensors, established both physical and simulated testing environments, and completed foundational work on lane detection. The next steps involve designing and testing more advanced maneuvers, such as intersection navigation and sign recognition, as well as developing control algorithms for vehicle operation and decision-making logic. With these achievements, the project remains on schedule and is well-prepared to address the more complex features in the upcoming phases.

2 Planned activities

At this phase of the project, our team focused on tasks such as:

- Configure and prepare the car for operation
- Develop a new app for manual driving
- Set up the physical testing environment
- Process camera images for lane detection
- Process camera images for intersection detection
- Define the method for processing and applying steering commands

3 Status of planned activities

• Configure and prepare the car for operation

We encountered some difficulties while setting up the car, particularly with errors on our Raspberry Pi 5. This led us to reinstall the Raspberry Pi OS, and ultimately, we switched to a different SSD card and a new version of Raspberry Pi OS. Since making these adjustments, we haven't faced any further technical issues.

• Develop a new app for manual driving

To enhance the car's functionality, we developed a custom application, as the original software did not meet our requirements. The new application supports both keyboard controls and compatibility with a gaming steering wheel, offering a more immersive, realistic, and enjoyable driving experience, as demonstrated in the first video. Next, we implemented a line detection algorithm and integrated it with the control application to assess its performance, as shown in the second video. Lastly, we created a local application for real-time image streaming, enabling us to test and refine the line detection algorithm without relying on the physical car.

• Set up the physical testing environment

To save time and space, and avoid difficulties with using the real map, we created our own testing environment using poster papers, carefully following the dimensions of the Bosch map.

• Process camera images for lane detection

We used standard techniques such as Canny edge detection and Hough transformation for lane detection. We slightly tilted the camera downwards on our car and defined a region of interest (ROI) for the detection of the lanes.

• Process camera images for intersection detection

It hasn't been started yet.

• Define the method for processing and applying steering commands

We decided to develop a PID controller for lane keeping, which will adjust the steering commands based on the detected lane position to maintain the car's course.

4 General status of the project

Several essential tasks have been completed, such as the creation of a custom application for manual driving, the setup of a physical testing environment, and the implementation of lane detection algorithms. The team has also defined the method for processing and applying steering commands, with the decision to develop a PID controller for lane keeping. Overall, the project is progressing well and remains on schedule, with the team well-prepared to tackle more complex features in the upcoming phases.

5 Upcoming activities

The next steps include implementing more advanced maneuvers, such as intersection detection, and refining the steering control system, by using PID controller. We have observed that the detected lane lines can be noisy or inconsistent, likely due to factors such as lighting conditions or camera vibrations. To address this, we are considering the use of a Kalman filter to smooth the lane detections.

Additionally, we plan to explore the implementation of a neural network for sign recognition and will define a region of interest (ROI) for this task. The decision-making logic is yet to be developed, and we are considering implementing it in the form of a state machine. These steps will further enhance the system's performance and bring us closer to achieving more complex functionalities.