1 Introduction

This report summarizes the progress of Team SPARK during January 2025. The team worked on testing the car, improving object and lane detection, setting up the simulation environment with race tracks and traffic signs, and integrating the camera node for real-time detection. Despite some challenges, such as hardware issues, we successfully resolved them and made significant progress in both software development and simulation preparation. The project remains on track as we prepare for the next phase.

2 Planned activities

Activity	Members	Type of Activity
1. Test start-up code on physical car	All	Development & Testing
2. Complete race track and traffic signs (simulation)	Nhi	Preparation & Construction
3. Object detection (traffic signs)	Tai, Nhi	Research & Development
4. Lane detection	Ha	Development
5. Set up camera node for detection	Tai, Hieu, Long	Development
6. Vehicle control via .py script using serial communication	Long, Hieu	Development
7. Lane following using lane detection	Tai	Development
8. Document progress and record video	All	Reporting

3 Status of planned activities

Activity	Status	Implementation	Difficulties
1. Test start-up code on physical car	Completed	Successfully ran the dashboard on the RPi and used PuTTY to control the motors.	The initial failure of the power board caused delays, but it was replaced with a voltage regulator circuit, allowing the car to run again.

2. Complete race track and traffic signs order (simulation)	Completed	Traffic signs and track layout adjusted.	None.
3. Object detection (traffic signs)	Completed	Trained YOLOv8 model; generated and verified best.pt for inference.	Training required extra computational resources and preparation of datasets.
4. Lane detection	Completed	Lane detection works well on straight and curve paths.	None.
5. Set up camera node for detection	Completed	Can recognize traffic signs directly through RPi camera.	None.
6. Vehicle control via .py script using serial communication	Ongoing	Creating a .py script to send serial commands for motor control.	Delayed due to the death of the power board.
7. Lane following using lane detection	Ongoing	Using the camera to detect lanes and control the steering to follow the detected path, including turning based on the lane.	Yet to be tested on physical track, requiring validation

4 General status of the project

The team has achieved significant progress in developing core functionalities:

Accomplishments:

- Successfully tested the start-up code on the car. Initially, the car ran smoothly, but the power board failed during the later phase. A temporary solution using a voltage regulator circuit allowed the car to operate again.
- Trained a YOLOv8 model for traffic sign detection, achieving reliable inference results.
- Integrated the camera node on the Raspberry Pi to detect traffic signs in real-time.
- Developed and tested lane following functionality.
- Adjusted the race track and finalized traffic sign placement in the simulation environment.

Challenges:

- The power board failure required quick troubleshooting and replacement. Though it was resolved effectively, it still caused delays in the project timeline.
- Lane following functionality has not yet been tested on the physical track, which may present issues during real-world implementation.

Despite these challenges, the team remains on track and is focused on refining algorithms and integrating functionalities for the next phase of testing.

5 Upcoming activities

- Improve lane detection and test lane following on physical track.
- Connect simulator with brain.
- (Maybe) Replace Raspberry Pi with Jetson.
- Create a custom interface for the vehicle control.
- Implement behavior control from object detection.