1 Introduction

In the initial phase of the project, our team has focused on establishing the foundational hardware and software architecture for the vehicle. This structural planning is essential for ensuring that all components communicate effectively once the automation logic is implemented. Parallel to this design work, I have conducted the measurement and calibration of the sensor suite. These steps were necessary to ensure data reliability, as accurate sensor input is the prerequisite for any autonomous functionality.

The team spirit remains steady and focused. We are currently in a phase of technical alignment, where open communication between the hardware and software sub-groups has been vital for solving early integration hurdles.

2 Planned activities

The project began with a focus on defining the vehicle's core architecture through four specialized workstreams. Our Hardware lead is currently focusing on sensor calibration to ensure input data accuracy. Simultaneously, the embedded specialist is researching to resolve Data Acquisition (DAQ) challenges, ensuring stable communication between components.

Regarding software and automation, our control lead is focused on environment preparation (simulation on Gazebo), specifically configuring ROS1 Noetic and the vehicle's primary localisation problems. At the same time, the perception lead is in the development stage, focusing on camera calibration and the vision pipeline.

3 Status of planned activities

Hardware lead: (Châu)

Status: Ongoing (70%)

Implementation: Testing and calibrating sensors on the vehicle. We have tested and calibrated most sensors to ensure they provide accurate input information.

Difficulties: The current challenge is designing a solution to mount the encoders on the wheels to get the wheel speed information.

Perception lead: (Lộc)

Status: Ongoing (30%)

Implementation: Collecting a dataset of objects specific to the BFMC environment, identifying the optimal YOLO model version compatible with the team's hardware, and performing transfer learning.

Difficulties: Data collection is challenging because the competition objects are significantly smaller in scale compared to real-world counterparts.

Environment preparation: (Thanh)

Status: Ongoing (50%)

Implementation: Setting up the ROS1 Noetic environment and Gazebo simulation. We have developed localisation algorithms designed to fuse sensor data, providing an accurate pose of the robot on the map within the simulated environment.

Difficulties: The current challenge is fine-tuning the noise models in Gazebo to match expected real-world sensor behavior.

4 General status of the project

Completed: Sensors calibration, ROS1 Noetic environment setup, and Localization algorithm development (Simulation).
In Progress: Finalizing the PCB layout and resolving DAQ communication bottlenecks.
Current Limitation: Real-vehicle testing is being held until the DAQ and hardware power systems are fully verified.

5 Upcoming activities

DAQ Implementation: Deploy the researched data acquisition solutions to ensure stable, real-time communication between the embedded system and the controller.
Hardware Validation: Transition the localization algorithms from Gazebo to the physical vehicle to verify pose accuracy in a real-world environment.
Control: Research and implement MPC for controlling the car.
Perception Refinement: Start developing the vision pipeline for lane and object detection using the calibrated camera feed.
Power Testing: Conduct stress tests to ensure the power system remains stable during motor acceleration and sensor processing