1 Introduction

This report outlines the progress and outcomes of the initial tasks undertaken during this phase of the autonomous vehicle project. It focuses on defining the foundation for the vehicle's functionality, selecting technologies, and creating essential documentation. These efforts aim to establish a robust framework for future development

2 Planned activities

Project Management and Planning

- **Read and understand the given documentation**: Review and organize all documentation provided by BOSCH to support development. Responsibilities: Agustin, Cristan, Dylan, Emanuel, Matias. Type: Planning

- **Create project plan**: Develop a comprehensive project plan, including task allocation for team members. Responsibilities: Agustin, Cristan, Dylan, Emanuel, Matias. Type: Planning

- **Prepare virtual testing environment**: Define requirements, WSL setup, necessary commands, and code development for the simulator. Responsibilities: Agustin. Type: Environment Preparation.

Sensing and Input Working Package

- **Define other necessary sensors**: Identify and specify additional sensors required to align with the system's objectives and operational requirements. Responsibilities: Dylan, Matias. Type: Updates.

- **Camera handling, preprocessing, noise cancelling, ROIs definition**: Manage camera input, including image capture, preprocessing, noise reduction, and define regions of interest (ROIs) for relevant areas. Responsibilities: Cristian, Emanuel, Agustin. Type: Development.

Perception and Scene Understanding Working Package

- **Choose main languages and technologies**: Research and define the main programming language and necessary technologies for implementing various vehicle functionalities. Responsibilities: Agustin, Cristan, Dylan, Emanuel, Matias. Type: Research.

- **Lane detection**: Detect Lane boundaries using sensors and cameras to enable autonomous vehicle positioning within the lane. Responsibilities: Cristian. Type: Development

Behaviour and Motion Planning Working Package

- **PI5 code deployment and vehicle control:** Upload code to the Pi5 and control the vehicle through the dashboard. Responsibilities: Dylan, Matias. Type: Development and Testing

- **Define architecture and communication between packages**: Design software and hardware architecture for the autonomous vehicle. Responsibilities: Agustin, Cristan, Dylan, Emanuel, Matias. Type: Planning

- **Vehicle Control Working Package**: Lane following and speed control Implement lane-following algorithms and speed control mechanisms to ensure stability and safe lane detection. Responsibilities: Agustin, Dylan, Type: Development.

Miscellaneous

- **Prepare physical environment**: Set up the physical environment with necessary markers, boundaries, and sensor placement for testing lane-following and speed control. Responsibilities: Agustin, Cristian, Dylan, Matias, Emanuel. Type: Environment Preparation.
- **Hardware acquisition**: Analyse, purchase, and install necessary hardware to support the proposed architecture. Responsibilities: Agustin, Dylan, Emanuel, Matias. Type: Updates.
- **3D modelling**: Design mechanical structures for sensor mounting and bases to reorganize electronic boards. Responsibilities: Agustin, Dylan. Type: Development.

3 Status of planned activities

Project Management and Planning

- **Read and understand the given documentation(completed)**: All relevant documentation from BOSCH has been reviewed and organized for the team's use. We didn't have any issues with this task
- **Create project plan(completed)**: Finalized with clear task allocation. We didn't have any issues with this task
- **Virtual Testing Environment(completed)**: Successfully set up, resolving Ubuntu and GPU-related issues by adopting dual boot or WSL solutions. We found some difficulties with the Ubuntu distribution and GPU usage. After some research and testing we found that the best alternatives are dual boot or WSL.

Sensing and input working package

- **Define other necessary sensors(completed)**: Ultrasonic sensors were selected for efficiency and cost. We didn't have any issues with this task
- **Camera handling, preprocessing, noise cancelling, ROIs definition(on going)**: ROIs defined, and preprocessing steps planned. We are facing an issue with preprocessing and line detection. Currently, we are working together to resolve it.

Perception and scene understanding working package

- **Chose languages and technologies(completed)**: Python chosen for its library support, alongside Hough for line detection and YOLOv5 for object detection. We didn't have any issues with this task
- **Lane Detection (on going)**: Path detection functional, but preprocessing inconsistencies affect line stability. We are experiencing issues with the lane lines detected. While they are correctly identified, for some reason (located in the preprocessing step), the lines vary slightly, given a somewhat inconsistent view of the path. However, we know where the problem lies and are working to fix it.

Behaviour and motion plan working package

- **PI5 Code Deployment and vehicle control(completed)**: Successfully completed after replacing a malfunctioning SD card. The malfunctioning SD card caused delays, requiring a replacement to load the code properly.
- **Define project architecture and communication between packages (on going)**: Initial design adapted to team needs; minor adjustments expected as the project progresses. We didn't have any issues with this task.

Vehicle Control working packages

- **Lane Following and Speed Control (on going)**: Using Stanley control algorithm, early simulator tests started. Integration with lane detection pending; mock data used for testing. We didn't accomplish the integration with the lane detection module, so we are generating mock data to test the algorithm.

Miscellaneous

- **Prepare physical Environment (on going)**: we planned to plot a 6x6 test track to install in a classroom of our university, and a 2x3 early test track to test at Home. Although we already reserved the classroom to work with the track, the tracks are not ready yet, so we are working with a piece of cloth and some tape to test the lane detection with the car.

- **Hardware Acquisition (on going)**: HC-SR04 sensors integrated, debugging completed; additional hardware acquisitions delayed due to supplier negotiations. Initial debugging issues with the ultrasonic sensor tools were resolved, but delays in hardware acquisitions are due to ongoing negotiations with suppliers.

- **3D Modeling (on going)**: Initial sensor-mount designs printed; ongoing adjustments to dimensions and new parts development for added stability. The biggest difficulty was making minor corrections to the dimensions of the pieces.

4 General status of the project

The project is progressing well, with key groundwork completed, including documentation review, project planning, and initial architecture design. The vehicle can detect lanes, but preprocessing inconsistencies need resolution. Lane-following and speed control algorithms are in early testing, with further integration required.

The virtual testing environment is functional, while the physical environment is under development with temporary setups in use. Hardware acquisition is ongoing, with some delays due to supplier negotiations. Overall, the project is advancing steadily, with a focus on refining core functionalities and preparing for advanced testing.

5 Upcoming activities

- Find sponsors, promote our image on social media and organize weekly meetings
- Camera handling, preprocessing, noise cancelling, ROIs tuning
- Further improve lane detection
- Intersection detection
- Further improve project architecture and communication between packages
- Lane following and speed control
- Prepare physical testing environment
- Complete Hardware acquisition