1   Introduction

In the initial phase of our project, we conducted all development and testing activities within the **Gazebo simulator** due to the delayed delivery of the physical car. This virtual environment allowed us to simulate and validate our system's functionality.

To enable object detection capabilities, we implemented and trained a **YOLO convolutional neural network** using machine learning techniques. We trained the YOLO convolutional neural network on datasets consisting of images of road signs generated within the simulation environment, enabling the model to accurately detect and classify road signs in a controlled and realistic virtual setting. While the current performance of the YOLO convolutional neural network is limited due to its training on simulated road sign datasets, we plan to enhance its accuracy by retraining it in the future using real-world images of road signs.

2   Planned activities

1) **Kristina Jerkić** - Kristina with the help of Lazar and Ognjen set up the simulation environment by installing Ubuntu, ROS1, and Gazebo, successfully configuring and running the simulation. ENVIRONMENT PREPARATION **(TASK 1)**
2) **Lazar Zec** – Lazar with the help of Kristina and Ognjen set up the simulation environment by installing Ubuntu, ROS1, and Gazebo, successfully configuring and running the simulation. ENVIRONMENT PREPARATION **(TASK 1)**
3) **Ognjen Perić** - Ognjen with the help of Kristina and Lazar set up the simulation environment by installing Ubuntu, ROS1, and Gazebo, successfully configuring and running the simulation. ENVIRONMENT PREPARATION **(TASK 1)**
4) **Maja Popović –** Maja took the lead in training our network using the YOLO framework, ensuring its initial functionality for detecting and classifying road signs. DEVELOPMENT **(TASK 3)**
5) **Andrej Dušanić -** Andrej classified the images obtained from the simulation, providing a well-structured dataset that Maja used to train the YOLO model effectively. DEVELOPMENT **(TASK 2)**

3   Status of planned activities

Description of the planned activities, progress, research results, etc.

TASK 1: Set up the simulation and drive car around the simulation with only track, road signs and a car in a simulation.
   Status: completed;
   Difficulties: medium.

TASK 2: From the recording in TASK 1 make dataset with photos of road signs.
   Status: completed;
   Difficulties: easy.

TASK 3: Use YOLO v8 and train the network based on dataset we obtained in TASK 2.
   Status: completed;
   Difficulties: medium.

Bosch Future
Mobility Challenge

4 General status of the project

Up until this point, we have successfully implemented a moving car within the simulator. We have also demonstrated the ability to train a neural network based on a dataset of road signs and shown how to extract datasets both from the simulation and from real-world scenarios. Once the real car arrives—expected in the next 2–3 days—we will begin implementing road sign detection on the physical vehicle.

5 Upcoming activities

For the upcoming phase, we plan to start working with the real car. Initially, we will focus on driving it using a remote control and enabling it to respond to road signs. Following that, we will implement lane-following functionality to enhance the car's autonomous capabilities.