AUTONOMOUS DRIVING ROBOT

PROJECT OUTLINE

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Project Description

Increasingly cars are becoming more autonomous, giving warnings for speed limit signs and controlling the speed of the vehicle. Meanwhile, fully autonomous cars are being developed and tested on the roads in a variety of situations. There are many problems surrounding autonomous cars, and this project will start to explore some of those complexities.

The goal of this project will be developing a ROS based program to work with Turtlebot3, a relatively simple robot, inside a simulated environment (Gazebo) but with the potential for it to be transferred to a physical robot. The project aims to tackle such issues as lane following, and the recognition of road signs then adjusting the robot's behaviour accordingly.

I will be implementing computer vision processing techniques to achieve the stated goals. The end-goal of the project will be the development of a robot that can autonomously navigate a simulated road environment while obeying UK traffic laws.

Proposed Tasks

- Define a road simulation inside Gazebo.
    - Creation of a 3D simulated environment to test the robot inside of.
- Research computer vision techniques and learn how to implement them.
    - Finding the best possible approach that fits the project needs.
- Develop a lane following behaviour.
    - Implement the above mentioned best possible approach for lane following.
- Research various potential approaches for road sign recognition (e.g. computer vision vs neural networks).
    - Finding the best possible approach that fits the project needs.
- Develop road sign recognition.
    - Implement the above mentioned best possible approach for sign recognition.
- Define an architecture for controlling the robot behaviour in response to detected road markings/signs.
    - Implement both the lane following and sign recognition behaviours into a single program.

Project Deliverables

- Investigation report into computer vision techniques.
    - Includes the results of my research into computer vision approaches for lane following behaviour.
- Functioning lane following behaviour.
    - A finished and functioning behaviour that can successfully navigate lanes within the simulated environment.
- Investigation report into various road sign recognition techniques.
    - Includes the results from my research into various road sign recognition approaches.
- Functioning road sign recognition behaviour.
    - A finished and functioning behaviour that can successfully detect and recognise road signs as the robot passes them.
- Functioning autonomous driving robot program based off developed behaviours.
    - The finished, final program to control the robot. This will include the above mentioned lane following and sign recognition behaviours.

Initial Annotated Bibliography

Blender Foundation (2019). *blender.org - Home of the Blender project - Free and Open 3D Creation Software*. [online] blender.org. Available at: https://www.blender.org/ [Accessed 10 Feb. 2022]. The 3D modelling program that will be needed to create the objects used inside the environment simulation.

OpenCV (2019). *OpenCV library*. [online] Opencv.org. Available at: https://opencv.org/ [Accessed 10 Feb. 2022]. The OpenCV API will be used to develop the computer vision portion of the project.

OSRF (2019). *Gazebo*. [online] Gazebosim.org. Available at: http://gazebosim.org/ [Accessed 10 Feb. 2022]. Gazebo will be used to provide the 3D simulated environment for the project.

ROS (2020). *ROS.org | Powering the world's robots*. [online] Ros.org. Available at: https://www.ros.org/ [Accessed 10 Feb. 2022]. The robot of choice is powered by ROS and the project will be developed using ROS Noetic running on a Ubuntu Linux machine.

TurtleBot (2019). *TurtleBot*. [online] www.turtlebot.com. Available at: https://www.turtlebot.com/ The project will make use of the TurtleBot3 Waffle Pi robot.

TurtleBot3 (2019). *ROBOTIS e-Manual*. [online] ROBOTIS e-Manual. Available at: https://emanual.robotis.com/docs/en/platform/turtlebot3/overview/#overview [Accessed 10 Feb. 2022]. E-Manual for the TurtleBot3.