Autonomous Racing Car

Student

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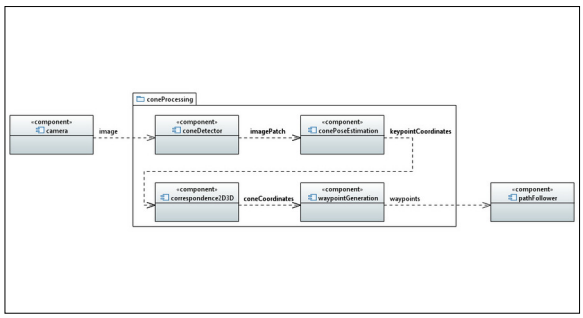
Introduction: The goal of this semester thesis is to build an autonomous system for a ground vehicle, that is able to navigate a track defined by traffic cones.

Approach: The autonomous system uses a monocular camera, YOLOv8, for object detection and pose estimation, pose estimation of the traffic cones and waypoint generation based on the cone position. The system is realised as a Robot Operating System (ROS) node, allowing deployment on any system that supports ROS. The node uses two YOLOv8 models, which are exported to Open Neural Network Exchange (ONNX) and executed with the ONNX Runtime. The JetRacer ROS AI Kit is used as target platform to deploy the node, it uses a Jetson Nano as computing platform.
Besides the hardware platform, a Gazebo simulation, which uses a model of the JetRacer platform, is set up for testing the system. This thesis focuses on setting up the necessary development environment for the host and also the packages for the JetRacer.

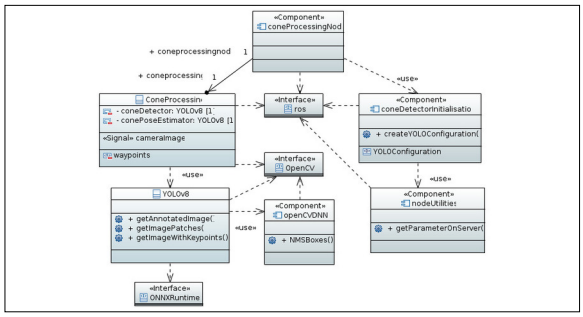
Conclusion: By the end of this project, there will be a ROS node that detects cones, which run on the Jetson Nano and the host with Gazebo. A development environment was set up to train YOLOv8, create ROS nodes, annotate images, and use the ONNX Runtime to execute neural networks. As no annotated data was found for the cone pose estimation, the remaining parts of the ROS node were not implemented. The annotation process was started, but so far, not nearly enough data is available for training.

JetRacer
Waveshare

System overview
Own presentment



ROS node implementation of the cone processing
Own presentment



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Subject Area
Mechatronics and Automation, Software and Systems