Perception System for a Formula SAE Driverless Car

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Abstract

Perception and sensor fusion are important areas for robotics, and especially for self-driving (autonomous) vehicles. The Formula SAE competition has recently introduced a new driverless aspect to the competition. In this event, the boundaries of the race course are delineated by yellow and blue traffic cones. The goal of this project was to create a perception system for a Formula SAE driverless car. A combination of LiDAR and visual camera was used to map the course and localize the vehicle. Several LiDAR-based SLAM methods were explored. The visual camera was used to detect individual cones and determine the course boundaries. Template matching methodologies as well as color segmentation and contour detection were used on the visual data. Physical data collection was conducted on campus at OSU, as well as at a test track in Wilsonville, OR. Further testing and data collection was conducted in ROS and Gazebo. Finally, the expected camera view was simulated using the Unity game engine, and the resulting image compared to the real camera feed. This simulation is used to optimize the predicted locations of the boundary cones.

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