Bachelor Thesis

Manual Controller for Model-scale Vehicles in Mixed Traffic

Problem Statement

The project GROKO-Plan aims at developing a graph-based trajectory planning method for networked vehicles. A challenge for autonomous vehicles is to interact with human-controlled vehicles.

The CPM Lab is an open-source, model-scale experiment platform for networked and autonomous vehicles. It currently allows to directly control a vehicle's actuators with a gamepad. With this method of controlling the vehicle, many users struggle to stay on the road shown in Figure 1, let alone participate in traffic. A user-friendly way of controlling a vehicle in the CPM Lab is required.

Human-controlled vehicles are not able to communicate trajectory plans, which are typically required for networked trajectory planning. The networked vehicles can cope with the uncertainty of future trajectories by reachability analysis to plan fail-safe trajectories [1]. The need to plan conservative, fail-safe trajectories should be relaxed by assumptions on human vehicle behavior based on traffic rules and conventions.

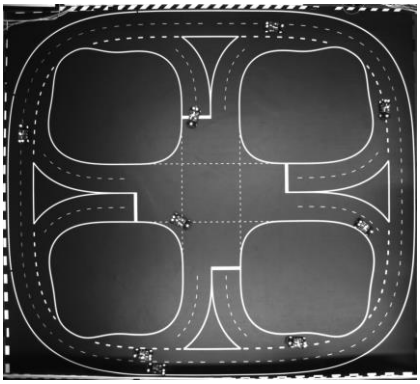

FIGURE 1 ROAD NETWORK IN THE CPM LAB WITH MODEL-SCALE VEHICLES.

Task

- Develop a user-friendly method of controlling a model-scale vehicle on the road network in the CPM Lab. Assist the user so that they can easily stay on the road by abstracting the input for vehicles.
- Expand the existing trajectory planner for networked and autonomous vehicles to enable mixed traffic. Implement assumptions on human vehicle behavior based on traffic rules and conventions to improve the trajectory prediction of manually controlled vehicles.
- Demonstrate the controller in the CPM Lab.

Qualifications

- Knowledge of MATLAB and/or C++
- Affinity to mathematics
- Student of Automation Engineering, Computer Science, Mechanical Engineering or a similar study program

Contact

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Please include in your application: transcript of records, CV and certificates.

[1] Pek, Christian, and Matthias Althoff. 2021. "Fail-Safe Motion Planning for Online Verification of Autonomous Vehicles Using Convex Optimization." IEEE Transactions on Robotics 37