

Development of Scenarios for Benchmarking in Networked and Automated Driving

(Master Thesis)



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Motivation

Networked and automated driving has the potential to reduce traffic, accidents and improve the efficiency of transportation systems, making it an important as well as current research topic. However, owning and maintaining a fleet of vehicles is a costly and time-consuming process not all research can afford. To address this problem, the chair of embedded software at RWTH Aachen University has launched the Cyber Physical Mobility (CPM)-Remote project and makes its in-house CPM lab available to researchers from other organizations.

A limited number of examples are provided by the chair, which, however, offer little added value for current research topics and thus hardly invite to use CPM-Remote.

State of the Art

In late 2021, the chair of embedded software will host its own competition focused on networked automated driving with up to twenty ego-vehicles. This challenge will focus on the coordination and communication between those vehicles. Therefore, there will be no perception part in the challenge. The position of all vehicles and obstacles will be provided at runtime by an indoor positioning system.

After initial research, there are no publicly available scenarios that could be used for the purposes of the competition. However, there are several other labs that follow a similar approach as the CPM lab.

Objective

In this thesis, scenarios for the upcoming competition are developed and integrated into the existing infrastructure. In order to enable an efficient evaluation, the requirements for the scenario generation must be elaborated first. Afterwards different methods for the generation of the scenarios will be examined and the most suitable one will be selected. Once the method for generating scenarios has been completed, a selection of scenarios will be developed, with particular attention to the traffic diversity during the scenarios.

After all scenarios have been completed, a set of evaluation metrics is composed, which evaluate the performance of the algorithm within the scenario and thus enable a ranking in the competition. For this purpose, different metrics should be compared and at least one metric must be selected per scenario.

Planned Approach

After an initial requirements analysis, generic programming is used during development to enable later extensions of both scenarios and evaluation metrics. A dataset such as roundD¹ or inD² is used as the basis for the scenarios. This has the advantage that the reference solution is already given by the trajectory driven by humans. In addition, the traffic volume and the behavior of the participants is realistic. Finally, the entire system is tested with real users.

¹www.round-dataset.com, ²www.ind-dataset.com