Master’s Thesis

Platoon Formation using Swarm Intelligence

The ongoing growth of passenger transport leads to increased road traffic and pollution. Researchers and car manufacturers are trying to improve driving using Inter-Vehicle Communication (IVC), resulting in trends like Intelligent Transportation Systems (ITs) or cooperative driving. One application there is Cooperative Adaptive Cruise Control (CACC) or platooning, which promises to improve today’s driving a lot by increasing traffic, reducing fuel consumption, and improving safety. Before profiting from all of these improvements, vehicles have to get into a platoon. Thus, platoon formation is an important challenge in this field.

We studied platoon formation strategies from the perspective of individual cars by optimizing platoon assignments regarding individual capabilities and properties \([1]\). Simulations using simple heuristics already indicate that these, and the willingness to compromise, have a huge impact on the resulting assignments.

A different approach for forming platoons might be using swarm intelligence \([2]\), which lets multiple agents perform simple actions to achieve a greater goal. Concepts like distributed opinion building \([3]\) could be applicable for coming up with car-to-platoon assignments. Therefore, the feasibility of swarm intelligence concepts for platoon formation needs to be investigated.

This thesis is in cooperation with Prof. Dr.-Ing. Heiko Hamann\(^1\) from University of Lübeck.

Goals

In this thesis, the feasibility of platoon formation using swarm intelligence should be investigated. As an example, the concept of distributed opinion building \([3]\) should be used. In order to achieve the goal of this thesis, you have to (a) design a formation algorithm which uses swarm intelligence and considers the properties of the individual cars to build platoons and (b) evaluate its performance within a simulation study by comparing it to traditional formation approaches.

Requirements

You should have a basic understanding of Vehicular Networking, Network Simulation, and C++.

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\(^1\)https://www.iti.uni-luebeck.de/en/staff/hamann.html