Bachelor/Master’s Thesis

Cooperative Overtake Maneuver for Platoons

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 (ITSs) 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.

Since forming such a convoy of vehicles requires complex cooperative maneuvers which usually is non-negligible effort, existing platoons should not be destroyed easily. On a freeway, which is the prime use-case for platooning, vehicles are driving with different speeds. A slower driving vehicle in front of a platoon could however tremendously decrease its beneficiary effects. Therefore, the entire platoon should instead perform a cooperative maneuver \(^1\), \(^2\) to overtake to slower driving vehicle.

**Goals of the Thesis**

The goal of the project is to design a cooperative overtake maneuver based on V2X-messages that are exchanged between all members of the platoon. The algorithm should determine when it is necessary (and also safe) to overtake a slower driving vehicle and perform the overtake maneuver of the entire platoon without destroying it. To order to implement and test the algorithm we will use Plexe\(^1\) as simulation framework.

To successfully complete this thesis, you need to do the following:

- Design an (or multiple) algorithm(s) to fulfil the task described above and implement it within the simulation environment.
- Evaluate the performance of the algorithm(s) using well-stabled metrics for networking, safety, and platoon benefits.
- Use these metrics to compare the algorithm to the (non V2X-based) overtake maneuver that is already integrated into Plexe.

**Required Knowledge**

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

**Keywords**

Cooperative Driving, Platooning, Cooperative Maneuvers, Vehicular Networking, Network Simulation

