

# Master / Bachelor Thesis

## Using dynamic priority assignment to increase feasibility in priority-based networked control

### Problem Statement

The project GROKO-Plan aims at developing a graph-based planning method for optimal cooperative trajectories for interacting vehicles. In a broad sense, the goal of trajectory planning is to find a sequence of control inputs that take a vehicle from a starting position to an end position.

The optimal solution of the trajectory planning problem for a system consisting of multiple agents can be obtained when formulating the centralized control problem that considers all agents. If a solution to the problem exists, it can be obtained in the centralized formulation, at the cost of high computational load. The computational load can be reduced by a distribution of the control problem among the agents. Whether the distributed control problem is feasible depends highly on the priority assignment. Consider the situation in Figure 1 where three vehicles follow a straight reference trajectory and encounter an obstacle.

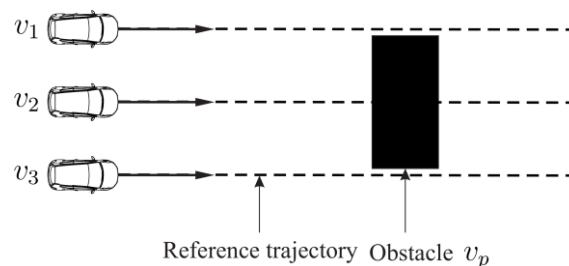


FIGURE 1 PRIORITY ASSIGNMENT PROBLEM OF THREE VEHICLES DRIVING IN FORMATION.

Assume that the vehicles drive with constant velocity and can only use steering as a control input. Given a priority order of 1, 2, and 3, there are six possibilities for priority assignment. Four of them are valid, but if  $v_2$  has the lowest priority, the vehicle cannot find a feasible solution to its control problem.

### Task

- ▶ Analyze existing strategies for priority distribution
- ▶ Develop strategies for priority distribution with the goal of increasing feasibility of the distributed control problem
- ▶ Apply the developed strategies for priority distribution to trajectory planning for ground vehicles in an urban scenario
- ▶ Evaluate the developed strategies with 20 model-scale vehicles in the [CPM Lab](#)

### Qualifications

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

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