

# CommonRoad Control: Empowering Autonomous Driving by Combining Control and Motion Planning



Technical University of Munich



School of Computation,  
Information and Technology

Professorship of  
Cyber-Physical-Systems

Join our pioneering CommonRoad<sup>1</sup> project at CPS where you'll develop an open-source Python toolbox that integrates cutting-edge control algorithms with state-of-the-art motion planning. Become part of the CommonRoad ecosystem—a renowned framework for autonomous driving.

## Overview

Autonomous driving systems require both robust motion planners [1, 2, 3] and reliable controllers [4]. Our chair has developed CommonRoad [5], a motion planning and benchmarking suite for several years, which has become a widely recognized and used framework over the years<sup>2</sup>.



Figure 2: Our research vehicle EDGAR.

We are now aiming to enrich CommonRoad with a toolbox that implements several controllers. While many solutions exist, few offer a comprehensive, closed-loop perspective between motion planning and control (e.g. [6]). In this project, you'll research, implement, tune and compare several advanced controllers and integrate them with our cutting-edge motion planners.

## Description

This thesis unites a deep knowledge in control with an interest in open-source software development. Good skills and theoretical understanding in control are prerequisites. With thesis, you have the chance to learn how to write code that can actually be released as a pip-package.

The general software architecture was already conceptualized in a previous work and a prototype is currently being implemented by two PhD-Students. However, as most of the controllers have yet to be implemented (and even selected), it may become necessary to improve the software architecture.

We are planning to release the toolbox at the end of the thesis (most likely after some code revision by the supervisor). You will then be part of the package authors.

## Tasks

- Familiarization with Motion Planning for Autonomous Driving
- Literature Deep Dive into Control for Autonomous Driving
- Selecting 4-6 appropriate controllers, implementing and tuning them
- Development of a closed-loop planner-controller simulation (work already in progress)
- Revision of the software architecture if necessary
- Selecting reasonable evaluation metrics for the combined planner-controller simulation (e.g. combination from control and planning metrics)
- Evaluation the controllers with different 2 different planners

<sup>1</sup><https://commonroad.in.tum.de/>

<sup>2</sup>For example, we won this year's Autoware Challenge and were the first to bring our code on EDGAR

### Supervisor:

Prof. Dr.-Ing. Matthias Althoff

### Advisor:

Tobias Mascetta, M.Sc.  
Lukas Schäfer, M.Sc.

### Research project:

CommonRoad

### Type:

MA

### Research area:

Control

### Programming language:

Python

### Required skills:

Experience in Control, Python

### Language:

English

### Date of submission:

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## References

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