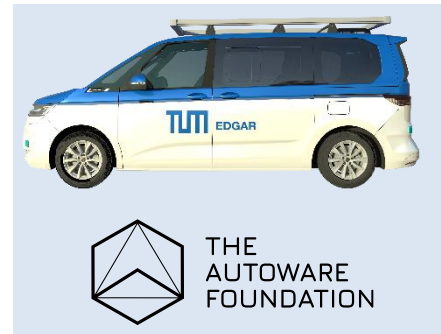


Term paper/ IDP

Integration of the TUM FTM Teleoperation Concepts into Autoware

Motivation

Autonomous vehicles (AVs) are confronted with a multitude of challenges in the form of unusual and unforeseeable scenarios, known as edge cases, which can include changing weather conditions, unconventional road layouts, and unanticipated obstacles. Due to the vast number of potential edge cases and their inherent complexity, it is unlikely that all of them can be accounted for during the development of AVs. As a result, it is inevitable that AVs will encounter edge cases during their operation on public roads. To address edge cases during the operation of AVs, teleoperation can provide a mission fallback solution by enabling a human operator to control or assist the AV remotely.



Project description

In this project, we aim to enhance the teleoperation capabilities of Autoware, a widely used open-source autonomous driving stack, by integrating our in-house developed teleoperation software stack. The project begins with a thorough familiarization with Autoware and our teleoperation software, focusing on understanding Autoware's state machine and the interaction between the two software stacks.

Following this, we define interfaces and requirements to facilitate the integration of the teleoperation software, while using Autoware's existing features. In the implementation phase, we realize the integration concept by implementing the defined interfaces and customize Autoware's state machine. To assess the implementation against the specified requirements and showcase a seamless interaction, the integration of one of our teleoperation concepts is thoroughly tested in simulation and on our test vehicle, EDGAR.

The following **work packages** comprise the student research project:

- Familiarization with Autoware and the TUM FTM Teleoperation Software
- Analysis of the interactions between Autoware and our teleoperation software
- Analysis of Autoware's state-machine
- Definition of an integration concept including interfaces and requirements
- Implementation of the concept
- Evaluation of the concept using one of our teleoperation concepts
- Documentation and Discussion of the obtained result

Prerequisites

- Intrinsically motivated and interested in the topic of autonomous driving
- Creativity as well as independent and accurate working style
- Prior experience with Autoware is advantageous
- Programming experience, ideally with C++, ROS 2, Python
- Experience with Git

Contact

If you are interested in this or another project, you can also send me an unsolicited application. Just send an email with a short motivation, your CV and current transcript of records to:

Tobias Kerbl | tobias.kerbl@tum.de | +49 89 289 15780

Institute of Automotive Technology | Prof. Dr. Markus Lienkamp