

Localization and Navigation for an Autonomous Construction Vehicle



Technical University of Munich



TUM School of Computation,
Information and Technology
(CIT)

Chair of Robotics, Artificial
Intelligence and Real-time
Systems

Background

The shortage of skilled workers, stagnating productivity, lack of digitalization, and worker safety concerns put pressure on the construction industry to adopt autonomous systems [1][2]. These systems are exposed to the harsh outside environment and need to be resilient to a variety of challenging interferences. The [CoCoRo](#) project is a cooperation between the [FML](#) and [AIR](#) chairs with the goal of developing collaborating robots on construction sites. Our partners at the FML chair have a dumper with GNSS, Ultrasonic Sensors, IMUs, a Stereo Camera, and the Jetson Orin as the main compute unit. To make the dumper a reliable and responsive mobile robot, stable localization and reactive navigation needs to be implemented while considering the special requirements that construction sites pose.



Autonomous dumper prototype of the FML chair [3]

Tasks and Objectives

In this project you will get your hands on real hardware. If you are not afraid of having to read sensor handbooks or deal with confusing error statements on the fly, you will gain valuable insight into robot development outside of simulations. You should have a good tolerance for dealing with hardware peculiarities while striving for a resilient implementation. Depending on the type of the thesis, completion of all the following objectives is not expected.

- Localization
 - Integrating two [u-blox F9P](#) GNSS sensors
 - Configuring Visual Odometry for the [zed2i](#) stereo camera
 - [EKF](#) parameterization
- Configuring [Nav2](#)
 - Updating the costmap with USS and pointcloud data
 - Controller tuning for adequate trajectory following with latencies
 - Collision Monitor

Supervisor:

Prof. Dr.-Ing. Alois Knoll

Advisor:

Lukas Oehler, M.Sc.

Research project:

CoCoRo

Type:

Bachelor/Semester/Master
Thesis

Research area:

Mobile Robotics, Autonomous
Driving, Uncertainty-Aware
Control

Programming language:

C++, Python

Required skills:

comfortable with ROS2,
comprehensive knowledge of
mobile robotics, self motivated

Language:

Englisch/German

Date of submission:

30. September 2025

Start date:

November 2025

For more information please contact us:

Phone:

E-Mail: lukas.oehler@tum.de

Internet: www.ce.cit.tum.de/air

References

- [1] R. Berbner et al. *The construction industry in times of crisis: progress on ESG, standstill on digital transformation*. Study. PwC, 2024.
- [2] C. Liang et al. “Human-Robot Collaboration in Construction: Classification and Research Trends”. In: *Journal of Construction Engineering and Management* (2021), 147(10).
- [3] Korbinian Zöls et al. *Autonomer Schüttguttransport*. TUM FML. 2025. URL: https://www.youtube.com/watch?v=mpbWQbk18_g#t=20m15s.



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