technische universität dortmund

computer science 12

Bachelor/Master Thesis

Multi-Robot Scenario Coordinator for ROS2

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Basic navigation methods for autonomous robots have been developed and tested over recent years. These methods provide safe and reliable navigation for unknown environments, and even include navigation when dynamic obstacles are present. Such methods have been developed using ROS2, with the Nav2 navigation stack being a widely used example of such solutions. These navigation methods can be evaluated and tested using robot simulators such as Gazebo, which provide a physics engine and a graphical interface for realistic behavior simulation. In addition, frameworks such as AuNa [1] provide a method for multi-robot simulation using ROS2, Gazebo, and Nav2.

While Nav2 provides many individual components for robot navigation, robots still need manual configuration for each scenario. In addition, multi-robot scenarios are not covered, as each robot can only achieve a goal for and by itself. To solve this issue, a coordination tool for multi-robot scenarios is necessary, which tracks the state of all robots and coordinates them.

In this thesis, the student develops a tool that coordinates multiple robots to create a scenario. This scenario includes multiple phases and transitions between each phase, and guarantee that both the phases and the transitions are executed safely. The student should use ROS2, Gazebo, and Nav2 to implement the scenario coordinator and provide a graphical user interface that shows the current state of the scenario. In addition, the scenario may also be controlled by the user to trigger certain actions.

The student is required to have the following skills and knowledge:

- Proficiency in C++ and Python
- Basic knowledge about ROS, robot navigation, and simulation using Gazebo
- Ability to develop software that coordinates multiple autonomous robots
- Familiarity with the Navigation2 software stack and AuNa framework

References:

[1] Teper et al., "AuNa: Modularly Integrated Simulation Framework for Cooperative Autonomous Navigation", 2022