TUHH

Technische Universität Hamburg | W6 | 21079 Hamburg

Asan Adamanov
E-Mail: a.adamanov@tuhh.de

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Thesis/project work at the Institute of Technical Logistics

Title: Enhancing Motion Planning Algorithms for Task-Constrained Robotic Manipulation: A Study on Open Liquid Container Transport in Limited Workspaces

Motion planning is a vital component of robotic manipulation, enabling robots to perform tasks such as pick and place efficiently. While existing open-source framework, such as Moveit, have made significant progress in standard motion planning scenarios, challenges arise when additional constraints are imposed on the robot's arm. This thesis aims to investigate and validate various motion planning algorithms, specifically addressing the complexities of transporting an open liquid container while ensuring its upright orientation to prevent spillage within a physically constrained operation space. The research will include the creation of a simulation environment, the study of a task-constrained motion planner, and the implementation and validation of multiple algorithms using the Ufactory xArm 6 DOF robot arm.

Task description:

1. Creating a gazebo simulation environment that accurately models the challenges of transporting an open liquid container within a confined operational space.
2. Developing a task-constrained motion planner that can handle the delicate task of moving the container with a fixed end-effector orientation to prevent spillage.
3. Implementing and evaluating various trajectory planning algorithms to optimize the robot's motion for efficient container transport and avoiding collisions within the limited workspace.
4. Validating the performance of the developed motion planning algorithms using the Ufactory xArm 6 DOF robot arm, which serves as the experimental testbed.

Requirements:

- Student of engineering (e.g., mechatronics, mechanical or computer science)
- Interest in manipulator robots and trajectory planning
- Confident with programming languages, e.g., Python or C++
- Experience in working with robots, especially Robot Operating System (ROS)
- Independent and meticulous way of working

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