Local Velocity Field based approach to mobile manipulation

Level: Exam project, Bachelor thesis, Master thesis, or an internship
Duration: 2 to 6 months
Start: By agreement
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Institution: ETF Robotics

Overview and Technology: This project investigates a locally defined velocity field control strategy for a nonholonomic mobile base coupled with a collaborative manipulator. The method relies solely on proprioceptive information from the manipulator and computes linear and angular velocities for the base based on signed distances and angle thresholds. Such strategies enable kinesthetic interaction, retreat/forward motions, and base rotation that preserve the reachable workspace of the end-effector without requiring global sensing. The underlying approach is well-positioned for mobile manipulation scenarios requiring close human–robot collaboration and reactive workspace extension.

Platforms / hardware	**Software & tools**
• RB-KAIROS mobile base with Franka Emika Panda 7-DoF cobot • PC workstation	• Linux + ROS (ROS1/ROS2) • Python, C++ • MoveIt for motion planning • Navigation stack (move_base)
Project options (projects can be modified based on student interests**)** • Implement the retreat/forward and rotational threshold–based region definitions for a mobile manipulator • Implement a local velocity field controller that outputs wheeled-base commands from manipulator proprioception	
Expected outcomes	**Recommended background**
• ROS implementation of a local velocity field controller for a nonholonomic base • Demonstration in simulation (and optionally on hardware) of human-guided kinesthetic manipulation	• ROS basics (topics, services, TF, MoveIt) • Fundamentals of control (impedance/velocity control concepts)
Literature • Local velocity field control for nonholonomic base mobile manipulators • ROS Tutorials	