RDDL based global action planning for mobile manipulation

Level: Exam project, Bachelor thesis, Master thesis, or an internship

Duration: 2 to 6 months

Start: By agreement

Mentors: N. Ružić ; N. Knežević

Institution: ETF Robotics

Overview and Technology: This project focuses on verifying and experimentally evaluating RDDL-based planners for mobile manipulation tasks. The core idea is to treat the mobile manipulator (RB-KAIROS + manipulator) as an agent acting in an RDDL-defined domain (e.g., multi-location visiting, fruit harvesting, handover tasks). The student will analyze the RDDL domain and instance definitions, connect the planner outputs to ROS action servers / services, and design benchmarks to compare different planners and parameter configurations. The emphasis is on correctness (to see if robot behavior matches the abstract RDDL model), robustness (handling noise and failures), and performance (task completion time, number of actions, safety).

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) • rbkairos_etf_services repository with RDDL planner integration
Project options (projects can be modified based on student interests**)** • Static-domain verification: run RDDL planners in simulation for predefined maps and tasks, and check that the executed ROS behaviors follow the RDDL specification • Planner comparison: evaluate multiple RDDL planners or parameter settings (discount factors, horizon lengths, reward weights) on the same mobile manipulation scenarios • Robustness experiments: inject execution noise (pose uncertainty, failed grasps) and evaluate how well RDDL policies handle disturbances and recover	
Expected outcomes	**Recommended background**
• Clean ROS integration and test harness for running and logging RDDL-planned missions with a mobile manipulator • Quantitative evaluation (success rate, time-to-completion, number of actions, safety-related metrics) for at least one nontrivial RDDL domain • Final report in IEEE paper form	• Basics of ROS (services, action servers, navigation / manipulation pipelines) • Programming in Python and/or C++
Literature • RDDL language documentation and planner manuals • ROS Tutorials • https://github.com/etfrobotics/rbkairos_etf_services	