

Joint master thesis proposals between LINKS and POLITO

Proposal 1: “Robot-Environment perception and task planning for multi-floor navigation”

Motivation

In the context of service robotics, where exists a growing trend of adoption of such systems in real-world scenarios with increasing complexities (e.g., hospitals, industrial buildings, train stations, etc.), autonomous mobile robots are required to unlock navigation capabilities such as moving within a multi-floor layout. Such capability requires the knowledge of structural elements, such as floors and connections among them (e.g., lifts or stairs). While humans show a natural ability to plan and move in such environments, this is still a challenge for autonomous robots.

Objectives

During the thesis period, the candidate will investigate existing navigation approaches (e.g., the ones included in ROS Navigation 2 stack) and will explore novel solutions to recognize and interact with the environment (e.g., with automated doors, furniture, and elevators) to enable navigation across floors in a building. In particular, the existing navigation planning approaches will be extended to include the concepts of floors and structural elements which connect floors of a building e.g., stairs and lifts. The student will have to develop initial prototypes leveraging a simulation environment but will be strongly encouraged to target for the final solution a real laboratory with actual robots.

More specifically:

- Extensions to the existing open-source ROS2 (Robot Operating Systems 2) libraries e.g., behavior-tree based behaviours and navigation planners/controllers, will be performed to support a continuous navigation across floors.
- The solution should exploit data coming from a lidar sensor or cameras for environment perception, and actionable IoT devices for the environment control.
- The implemented solution will be tested on real mobile robots (Turtlebot 3) and devices available in LINKS' laboratory.

Duration: 6-8 months.

Requirements

- Computer Science, Mechatronics, or similar background
- C++/Python programming languages
- Some knowledge in communication protocols and computer vision will be considered a plus
- Linux OS knowledge will be considered a plus
- ROS/ROS2 knowledge will be considered a plus
- Proactive mindset, problem-solving oriented

We consider the possibility to have 2 students collaboratively working on such topic.

For further info refer to:

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