European Project Semester

PROJECT OUTLINE

Project dates: September – December 2026

Title: Fabrication and control of Collaborative Mobile-Manipulator Robot in industry 5.0

Project activity areas: Integration of robots, Control, communication, Robotics Operation System (ROS)

Keywords: Mobile robotic platform, Human-Robot collaboration, ROS, Industry 5.0

Tutor's name and coordinates

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Project origin

UTTOP - LGP

Project technical background:

The collaborative robotic consist in the fact that robots are able to share safely the same space and interact physically with humans. It is an important field for the future industry, but also for the medical and assisted-robotics training. Mainly, these robots are a manipulator arms that have the capabilities to detect the external forces of human and react in consequences.

However, the manipulator arms have a fixed base, which limits the space of interaction with the human. In this case, one usually fixes a manipulator arms robot on mobile robot platform that can move freely in a larger space and thus enlarge the collaboration space. This combination, called mobile-manipulator collaborative robot, is illustrated by the figure 1, where the while robot is the manipulator and black lower part is the mobile structure. This collaborative robotic structure may be used for different applications such as assisting human in carrying a load.

Fig. 1 : illustration of mobile-manipulator collaborative robot

The purpose of the current project is to make one whole mobile-manipulator robotic system and make a common control from two different robotic system available in our laboratory the Production Engineering Laboratory (LGP).

The two robotic systems are the mobile-platform Ridgeback of Clearpath (Fig. 2-left, https://clearpathrobotics.com/ridgeback-indoor-robot-platform/) and the collaborative manipulator-arm robot Kinova Gen3 (Fig. 2-right, https://www.kinovarobotics.com/product/gen3-robots). Indeed, each robot is independent from the other, with its own system and embedded computer.

Fig. 2: Two available robots: The Mobile robot (left) and the collaborative one (right)

Therefore, this project is about continuing two previous EPS project, that makes developments in simulation and implementation on real robots using ROS. The purpose of the current project is to go further to have a whole controlled system validated experimentally. This presents several challenges to be addressed:

1- Integrate mechanically the two robots (based on previous developed design).

2- Ensure a common communication and energy management (using previous development)

3- Adapt classical control technics for a joint control of mobile and manipulator robot

4- Tests a typical task that highlights common actions between the two robots

This mobile-manipulator collaborative platform is a part of bigger and important project, called ECOSYSPRO, which aims to create a complete platform of industry 5.0, at our University of Technology Tarbes Occitanie Pyrénées (UTTOP).

To achieve the project objectives, several documentations are available about the two robots and about the previous developments, that the student will have at the beginning of the project.

Studied topics:

- Definition of requirements and technical specifications with the client
- Analysis of each robot specifications from the exiting systems and the previous developments,
- Integrate mechanically the two robots using existing design,
- Integrate the informatics communication and common energy between the two robots,
- Apply a common control of the whole mobile-manipulator collaborative robot
- Make a typical use-case and experimental test of the whole robot in collaboration with a human to carrying an object.