Mitacs Internship Progress Report

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Introduction

This report documents my progress and experiences during the Mitacs internship in which I have engaged in various tasks that have helped me get into robotics, control systems, and simulation environments.

Initial Setup and Introduction to Robotics

My first primary focus was on setting up an Actuonix PQ12-30-12-P linear actuator with an Almond Board. The goal was to tune its PID controller, which is a crucial component in robotics for precise control of movements. This initial task served as an introduction to the fundamentals of PID tuning, ROS and robotics in general.

Working with Dynamixel Motors

In the subsequent weeks, I attempted to set up two Dynamixel joint motors using the `dynamixel_controllers` library.Not mush success was achieved due to the library being outdated with a lack of support for ROS 1 and had compatibility issues with motors. Because of that I switched to the `dynamixel_workbench` library but compatibility issues persisted. Even with not much success I learned a lot about ROS workspaces and the insides of the Dynamixel libraries.

Transition to the Gripper Robot

After that we decided to shift our focus to a gripper robot comprising four joint motors and two tactile sensors. My initial task was to set up the gripper robot and ensure its proper functionality. Once operational, I began tuning the PID controllers for each joint with the goal of enhancing the accuracy and responsiveness of the robot's movements.

Extensive work was conducted on the physical robot and after finding some problems with real life limitations as gravity, we transitioned to computer simulations to further refine the PID tuning. The simulations yielded promising results but the same performance was not found when the same PID was applied

on the physical robot and then more tuning was required to achieve satisfactory results.

Tactile Sensor

My first task was to set up the RViz (which is a 3d visualization tool for ROS) model of the robot to better represent the sensors. After that I worked on aligning the sensors to address a dragging issue, but success was not achieved in this aspect.

Conclusion

Towards the ending of the internship I focused on compiling my final reports detailing my work and how to replicate it so that Professor Fonseca can use it as a a basis for future interns.

Throughout the Mitacs internship, I have gained significant experience in robotics, particularly in PID tuning and motor control. Despite encountering several challenges, each task provided valuable learning opportunities and contributed to my overall growth as a researcher.