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Team D – CuBi
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Individual progress

For CuBi, the two biggest things I focused on was controlling the dynamixel motors, defining the Spring semester validation experiments, and keeping track of timelines. I worked with Nithin, Bobby, and Paulo in the dynamixel portion of the assignment.

CuBi Technical

We were having difficulties detecting the Dynamixel motors when using the Arbotix board. To solve this issue, we purchased a Dynamixel U2D2 to control the motors from our computer and a 6 port AX/MX power hub to power all the motors.

Once Nithin and I were able to detect the motors, we used Mixcell to configure the Dynamixels. We set all the IDs, so that there were no conflicts. This ensured that we could control all of them independently when all four motors were chained together. We changed all the motors to have a baudrate of 57600. When the baudrate was set to 9600, ROS was unable to detect the motors.

We then followed the ROS tutorial to set up all the launch files to be able to control all the of the Dynamixels independently. We ensured that each motor would be found consistently. Then we made sure that we could subscribe to each Dynamixel motor topic to be able to read their state information and publish new motor positions and velocities through the command line.

I wrote code to subscribe to a topic where a desired set of joint angle positions and velocities were sent. This node would then publish to the Dynamixel motor topics to control the motors. I then worked with Bobby to determine the angles at which the gripper fingers were opened and closed, and the angles at which the tray was on the ground and in the air. I tuned PID gains with Nithin. The goal was to have very slow controlled movements initially. In the future we will increase our proportional gains to allow for quicker movements of the joints.

CuBi Project Management

We were two weeks behind schedule, so I outlined every task that was left for us to catch up. We then worked as a team to divide up the work. Now, we are less than a week behind schedule!

I also designed the Spring Validation Demonstration experiments. There is only 5 weeks left until this day and it is very important for us to know exactly what we will be demonstrating. In this way, we can focus most of our energy in tasks that bring us closer to meeting our goals. Laavanye and Nithin helped refine these experiments. We also worked on re-writing the Fall Validation Demonstrations.

We did miscellaneous work to organize our desk, as it was hindering our development. We also organized all our previous 3D printed assemblies, so that we can refer back to them in the future.

Challenges

Technical

We had issues with detecting the Dynamixel motors when they were set at different baudrates. The lowest buadrate recommended in the specifications of each of the motors was 8000. Initially we decided to set them to 9600, but we were only able to detect the motors sometimes. When we changed the baudrate to 57600, we were able to consistently detect and control the motors through ROS.

Another big issue that we are facing is that we are not checking whether the joint configurations that we receive result in valid trajectories. Our finger grippers are larger than half the size of the tray. If we try to close them simultaneously, they get stuck. This results in a current overload error which does not allow us to control them anymore. Currently, this requires us to turn off the power to the motors to reset them, but we are looking for ways to reset them programmatically. To solve the problem of getting the gripper stuck, we do not close the fingers at the same time. We first close the right finger than we close the right one.

Team Work

Nithin: Has worked directly with me to control the Dynamixel actuators. We began performing initial experiments in different scenarios to determine the ability of our gripper system to pick up objects in different scenarios.

Paulo: Manipulator was re-designed and the motors were integrated to actuate the grippers. He 3D printed all the parts and assembled them. He worked with Nithin and I to ensure that electronic assembly was possible.

Laavanye: Improved the segmentation algorithm. I worked Paulo and him to determine the height of place the Intel RealSense camera to be able to see in front of cubi, but also what is on the gripper.

Bobby: Nithin and I worked closely with Bobby. He created a ROS script which would subscribe to commands sent from the remote-controller. These commands would then be mapped to desired joint angle configurations. The code I wrote with Nithin would then move the motors to the desired joint configurations.

Plans

In the future, I will be working on making the Dynamixel system more robust. It will need to validate that correct angle configurations are received and that the robot can move to these joint configurations without collision. Special attention will be placed on the two gripper fingers

I will also transition into working more on the vision side. I will be setting up the Intel RealSense on my computer. Laavanye is using classical vision techniques to determine which objects are

pickable. I will be using Deep Learning to classify the most common objects in classrooms (desks, chairs, etc…), as well as potential toys we can find in day cares. I will need to create a process to gather data.