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Team D – CuBi

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ILR03

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Individual progress

For CuBi, the two biggest things I focused on was controlling the dynamixel motors and improving our ability to track everyone's tasks. I worked with Nithin, and Bobby on the dynamixel portion of the assignment.

CuBi Technical

In our last progress review, we were able to control one of the AX-12 Dynamixel motors through a GUI. However, we were unable to do so using ROS or through some tutorial scripts provided by robotis. The problem was that we were not able to detect the Dynamixel motors. Our goal for this progress review was to be able to control all the motors through ROS.

As mentioned in the previous ILR, we used the Arbotix-M robocontroller to power the Dynamixels and the USB2Dynamixel to control it. To allow for two people to test at once, we picked up another USB2Dynamixel connector from the inventory and I soldered cables that would connect the Dynamixel to a DC power supply. In this way, one person could test using the board to power the system and another person could directly use the power supply.

Our next goal was to understand why different wiring configurations would lead to the Dynamixel not being found by the GUI. First we wanted to confirm that there were no wiring issues. We used the multimeter to determine which pins of each Dynamixel were connected together and found that all Vins, Gnds, and V++ pins of each Dynamixel were connected together. Therefore, there was no apparent problem with wiring. After testing multiple wiring configurations, we realized that if we connected the USB2Dynamixel to the Arobtix-M board to the motor, then we were unable to find the motor when it had a Baudrate above 57142. We also found out that several motors had conflicting IDs and fixed them. Finally, we learned that after updating the configuration of the motors, we had to unplug the Arbotix-M controller for the changes to be applied correctly. After all this process, we were able to connect all the motors in series and control them through the GUI. We reflashed their firmware, updated the baudrate, and chose IDs for each motor.

Bobby then tried to control the motors via ROS while Nithin and I were following the Robotis tutorial. We were still unable to find any motors. Nevertheless, Bobby was able to control the angle of the motors. We found a GUI for linux to control the motors and since we used it, we have been unable to find them anymore. We tried using ROS, the tutorial, the Windows GUI which had always previously worked, Linux GUI, and we used several computers to test each.

CuBi Project Management

We were good at tracking very high-level schedule and our goals for the two-weeks ahead of us. Without a deep understanding of the mid-time objectives it was very difficult to prioritize our weekly tasks. We also had a lot of difficulty knowing how much work everyone was doing and be able to track we were on track. To avoid this, we created an excel were we could mark off what we are doing every week and can get a sense of what needs to be done in the mid-term future.

Feature	Tasks	Subtask	Expected Date Complet	Status	Owner	No
Grippers				☑		
	Trade studies (E.g. payload, DoF, size, cost)		1/14/2019	☑		
Actuation Mechanism (arms and fingers)				☑		
	Conceptualize mechanism		2/1/2019	☑		
	Trade studies motors and controller		2/2/2019	☑		
	Identify off the shelf hardware		2/13/2019	☑		
	Drawing mechanism		2/20/2019	☑		
	Acquire necessary hardware		2/28/2019	☑		
	3D print parts		3/1/2019	☑		
	Mechanism Assembly		3/2/2019	☑		
	Mechanisms Actuation		3/3/2019	☐		
		Move All Dynamixels in series	3/3/2019	☐		
	Integrate it with Grippers		3/10/2019	☐		
	Validate whole assembly on actual toys		3/20/2019	☐		
		Can we pick up all three toys in manual control (no assembly)	3/13/2019	☐		
		Can we pick up all three toys in manual control (assembled to robot)	3/20/2019	☐		

Figure 1. Manipulator Grasping Schedule.

Challenges

Project

By the end of the progress review, we were unable to detect any of the motors, so I decided to try to control the directly with the Arbotix-M motorcontroller. We found an FTDI to USB cable and changed the jumper so the board was powered via USB. This board can be controlled via Arduino IDE, but they require old Arduino IDEs, ones which did not come bundled with Java. Because of this, we had to figure out how to install a Java Runtime Environment to run the IDE. Again, despite trying it with several OS (OSX, Ubuntu 16, and Windows) and different machines, we were unable to upload any script to the board. There are known open issues regarding these uploading problems.

Team Work

Nithin & Bobby: Have worked directly with me to control the Dynamixel actuators. All the work above was work we did collaboratively. We had worked with Paulo to determine the current requirements with the motors when picking up heavy toys.
Paulo: Manipulator was re-designed after discussing with Nithin and I, so that the cables could reach each other.
Laavanye: Improved the segmentation algorithm and sped it up by 3x. We worked together, to decide on initial potential mounting positions based on the results the algorithm was giving.

Plans

In 2-weeks, the robot will be completely assembled and actuated. We should be able to detect objects which fit on the tray based on size, actuate the grippers to grasp the objects, and ensure that the objects are carried in a horizontal position.

The immediate steps are to reach out to Robotis asking for ideas on how to debug the problems we are experiencing with Dynamixel. We will also try to get the Arbotix-M board found on the computer, so that we can try to control the motors directly. Once we do this, we will attempt to pick up objects.

As a group we will have discussions on the final layout of CuBi: determine where the power system will go, which motors are connected to which board, etc… We will also begin the transition of Bobby, Nithin, and I onto the perception team.