Group 003-03

Project Summary
Robotic Arm

This project developed a two-axis SCARA robotic arm from the ground up. It aims to make a system capable of drawing lines on paper with a variety of writing utensils and quickly programmable using GCode commands.

As a team, we started by choosing the materials we wanted to use to make the arm. Our main concern was the system being sturdy enough to be reliable while still being strong enough to support its own weight. Based on these requirements, we chose to work with wood due to its strength and ease to work with. After choosing the material, we designed the structure using CAD (Onshape). This then allowed us to spec motors. After settling on a pair of DC motors and a servo for the writing utensils, we specced the rest of the electronics (amplifiers, H-bridges, etc.). Finally, we chose to use an MSP430 as our microcontroller.

The thorough CAD modeling we did of the structure meant the structure only underwent minor revisions. Furthermore, for our control systems, we thoroughly researched PID controllers and inverse kinematics which meant our code only needed minor modifications during integration. Some iterations we made on the structure were in making it more stable. We needed to adjust the guy wires to keep them directly above the axis of rotation and explored different methods of tying the guy wires to keep them taut. For our code, we needed to "tune" the PID controller, which meant adjusting certain constants in the algorithms which would make the motors able to accurately spin to a desired position.

Some key lessons we learned is that early and thorough design work pays off. We ended up not making any major changes to the robot later on. Many of the changes we made we had already anticipated and were not surprised when we had to make them.

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