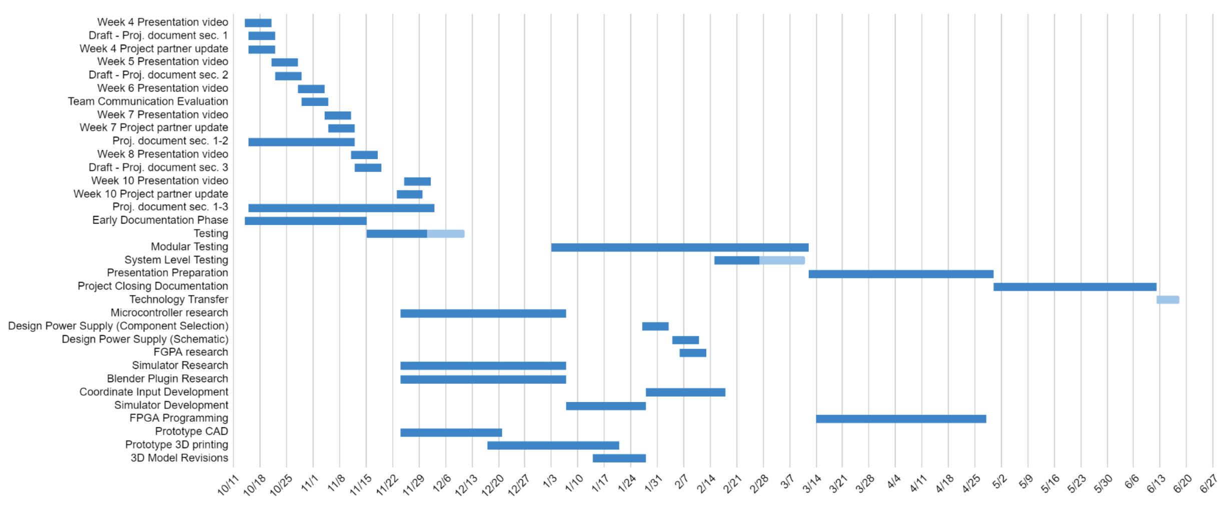
Group 26

Executive Summary

Robotic arms can provide utility to users in a wide-variety of situations, however; many current options are simply too expensive for hobbyists or average consumers. Our design aims to solve this problem by creating an affordable, accessible tentacle arm with inexpensive electronics and 3D printed parts.

When first tasked with creating the arm, we explored many existing robotic arm designs and compared the strengths and weaknesses of each approach. We wanted to optimize for cost and prototyping speed, as anything too expensive would be out of our budget, and anything that took too long to prototype would make testing and revising our design much more difficult. Eventually we decided on a pulley-based system, with nine motors mounted on a baseplate that could pull strings. These strings run through the arm and attach to specific points; therefore, by pulling the strings the arm is articulated. For electronics, a PCB buck converter was designed to receive power from a rechargeable 12V battery, and output this to the encoders and motor drivers that take 5V and 12V respectively. An ATMega128 microcontroller, and a DE-10 Lite FPGA were used to interface the computer application with the various devices in the arm. The ATMega128 does the bulk of the communication and data parsing, while the FPGA is used as a ‘glue-block’ and register extender. One feature that we wanted from the beginning was a simulation of the arm’s movement, as it would allow us to test out our positioning math. We considered creating one from scratch using OpenGL, but because we already had a model of the arm that could be rigged and posed in Blender (open-source 3D modeling and animation software), we decided to instead write a plug-in for Blender.



Our team learned a lot of valuable lessons throughout the project. From a collaboration standpoint, we ended up contributing to most tasks as a group, but meeting in-person more frequently would have helped us make progress quicker. Clarifying exactly how each module is meant to communicate is very important, as misconceptions with how smaller parts work can lead to difficulties during integration. Our team members will keep these in mind as we enter the professional world, and work on increasingly complex team efforts. Overall, we enjoyed working on this project a lot, and were able to learn a lot about interdisciplinary teamwork.