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Hand Prosthesis

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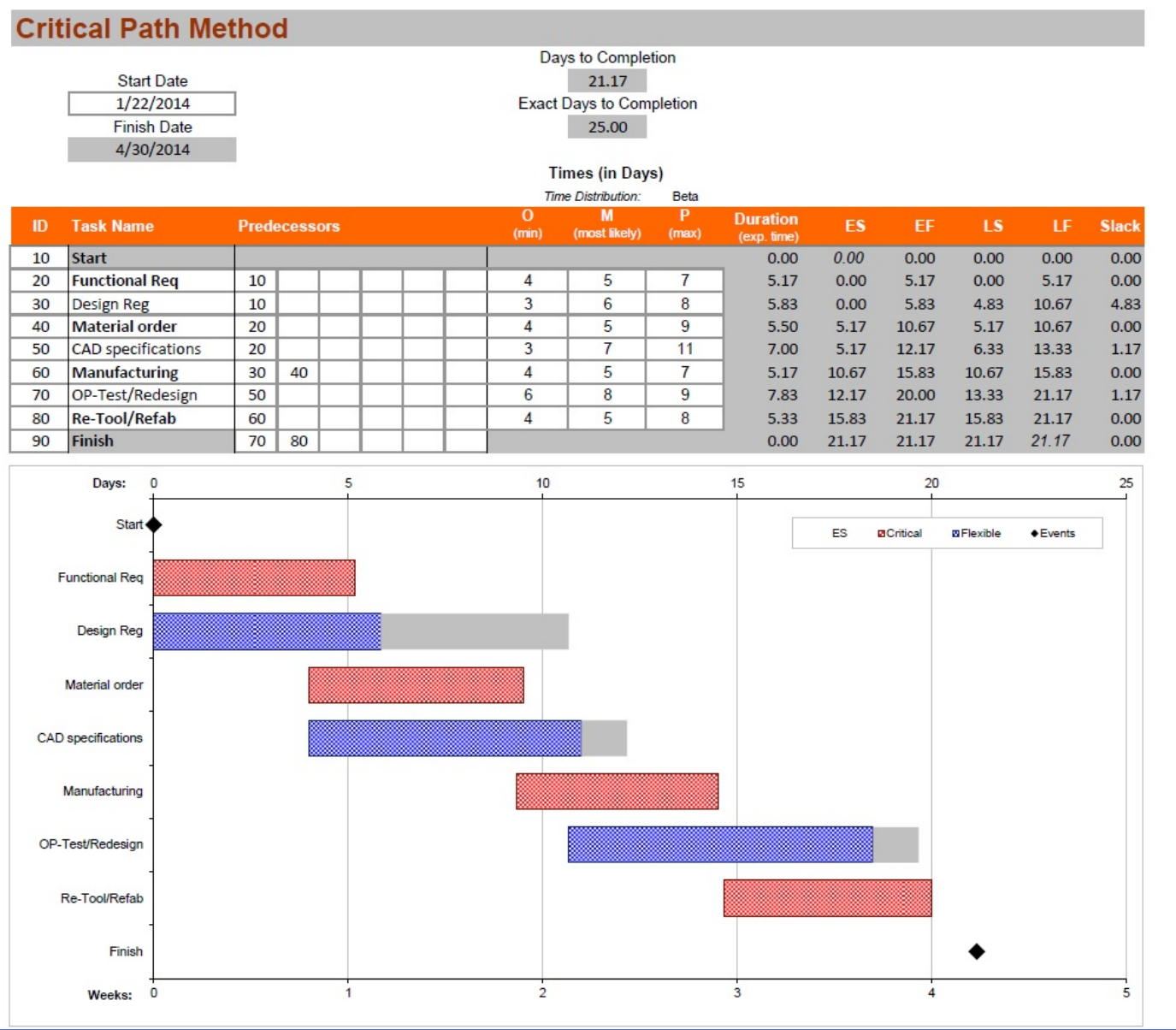
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Hand Prosthesis

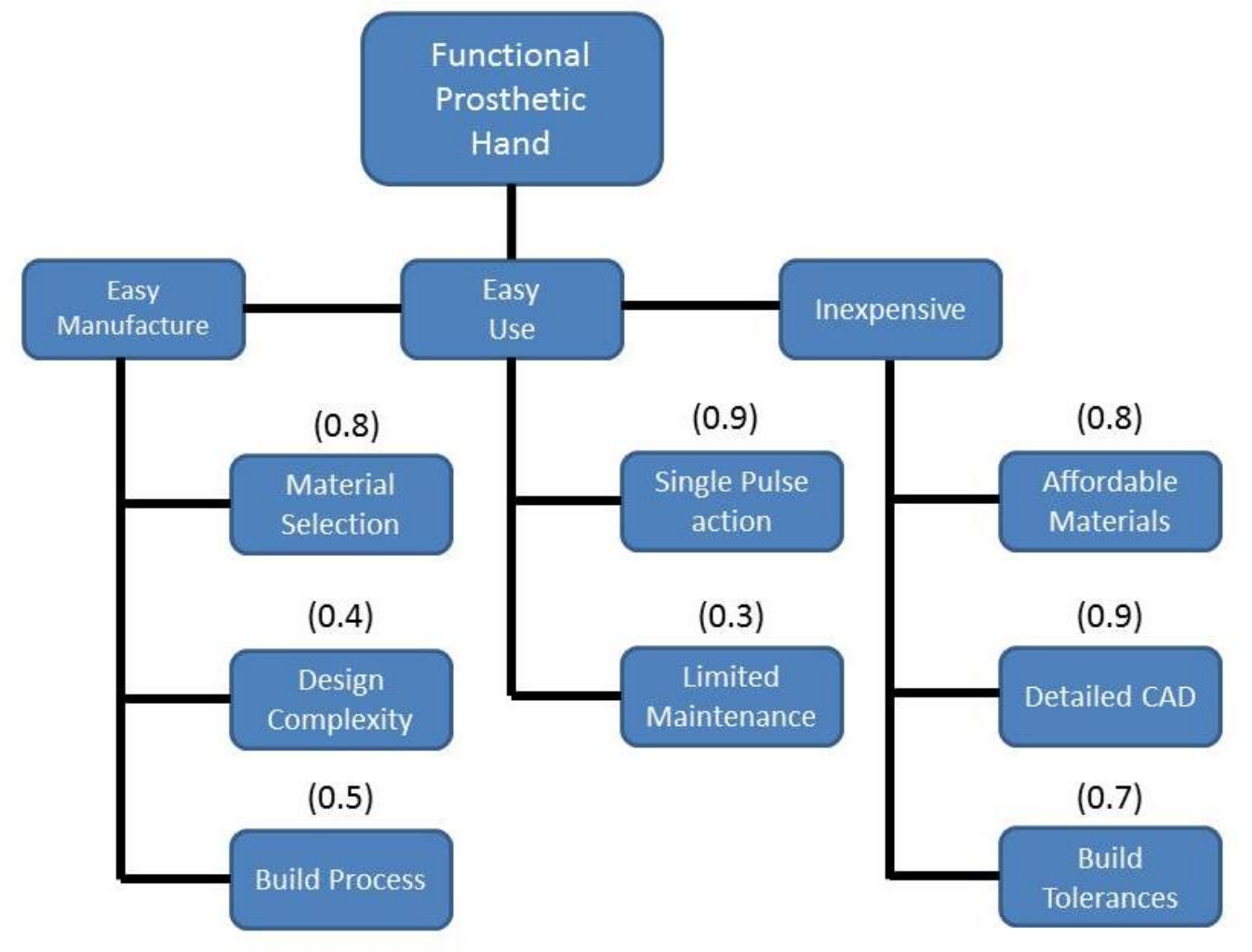
Abstract

This project deals with engineering students’ prosthetic hand design, submitted to the University of Southern Maine’s engineering department. The primary goal of the prosthetic hand design is to allow an impaired individual to grasp and hold everyday objects ranging from a toothbrush to a jug of milk. The project consists of three teams each designing their respective portion of the prosthetic device. The teams will deal with three specific design areas; computer aided design of the mechanism, electronic integration, and manufacturing implementation. The design team turns notebook doodles into virtual models in SolidWorks. The electronics team will control a battery powered micro linear actuator with an Arduino Uno micro-controller. The manufacturing team will bring the SolidWorks model to life with a CNC machine and assemble the aluminum and electronics into a fully functional proof-of-concept model. The functional requirements will be the driving force behind the design specification for the prosthetic hand and will be annotated in the “house of quality” excel spreadsheet. A Gantt chart will set timeline goals and critical paths that the teams will adhere to. The final outcome of this project will not only be a physical device but also consist of a process in manufacturing from design to build.

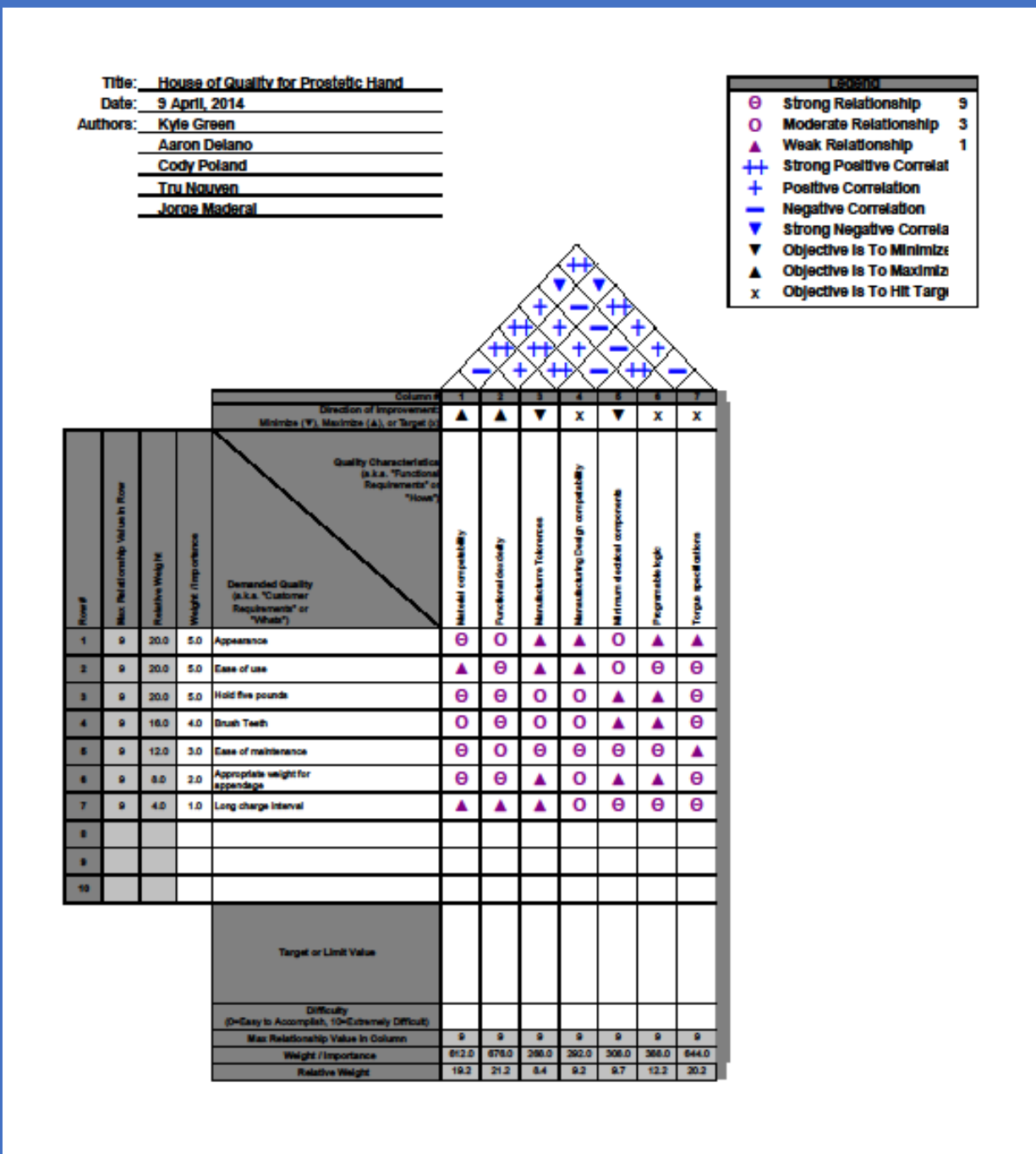


GANTT CHART

Prosthetic Hand Objective Tree



OBJECTIVE TREE



HOUSE OF QUALITY



Figure 1a

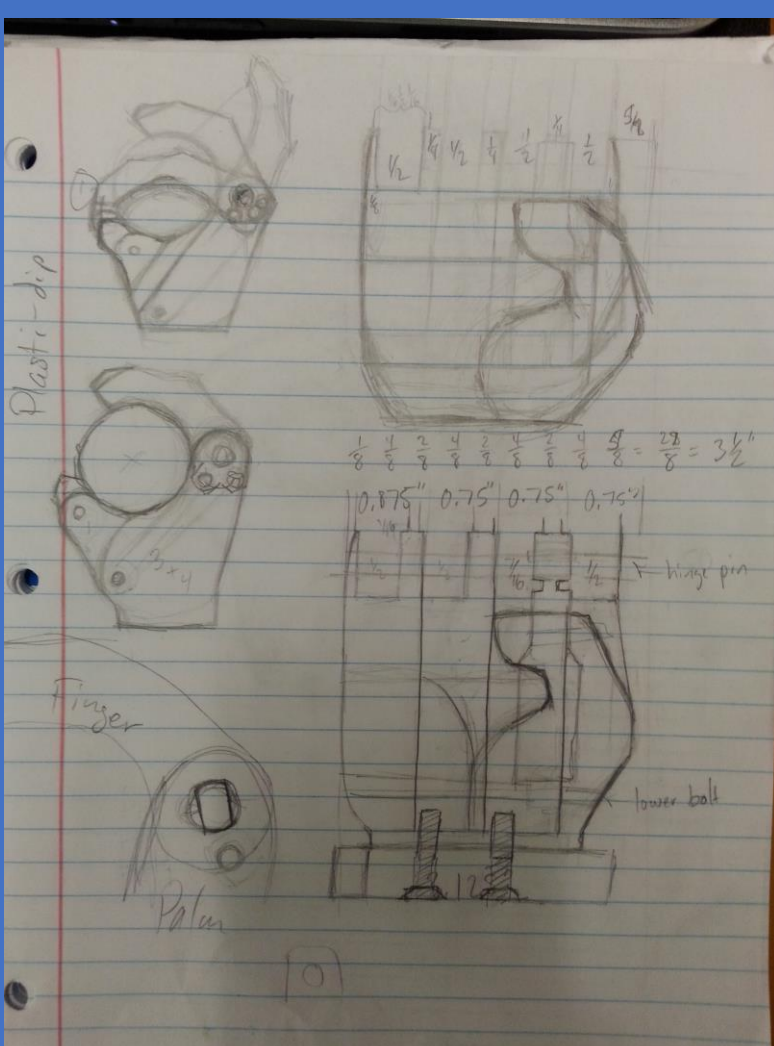


Figure 1b

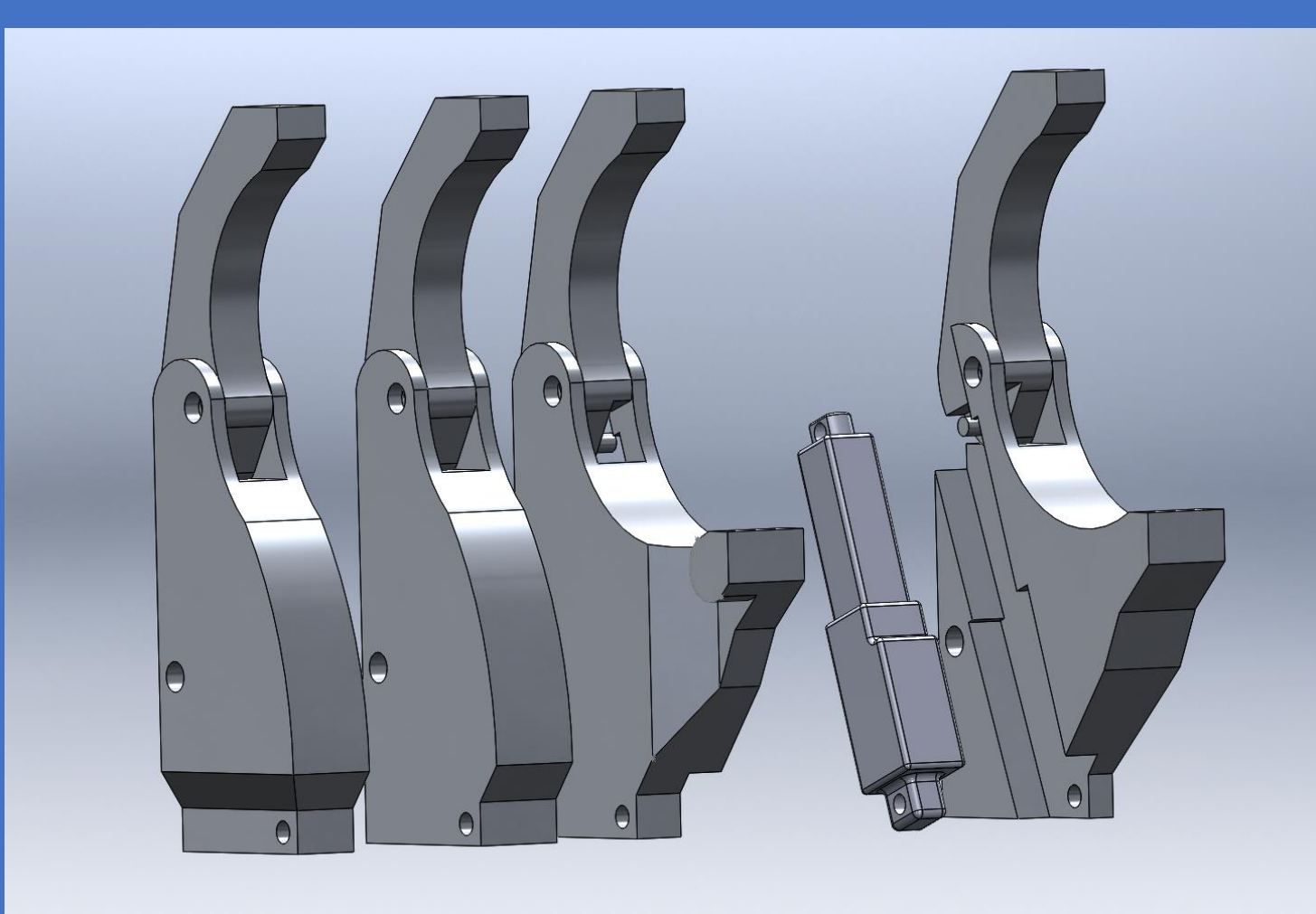


Figure 1c

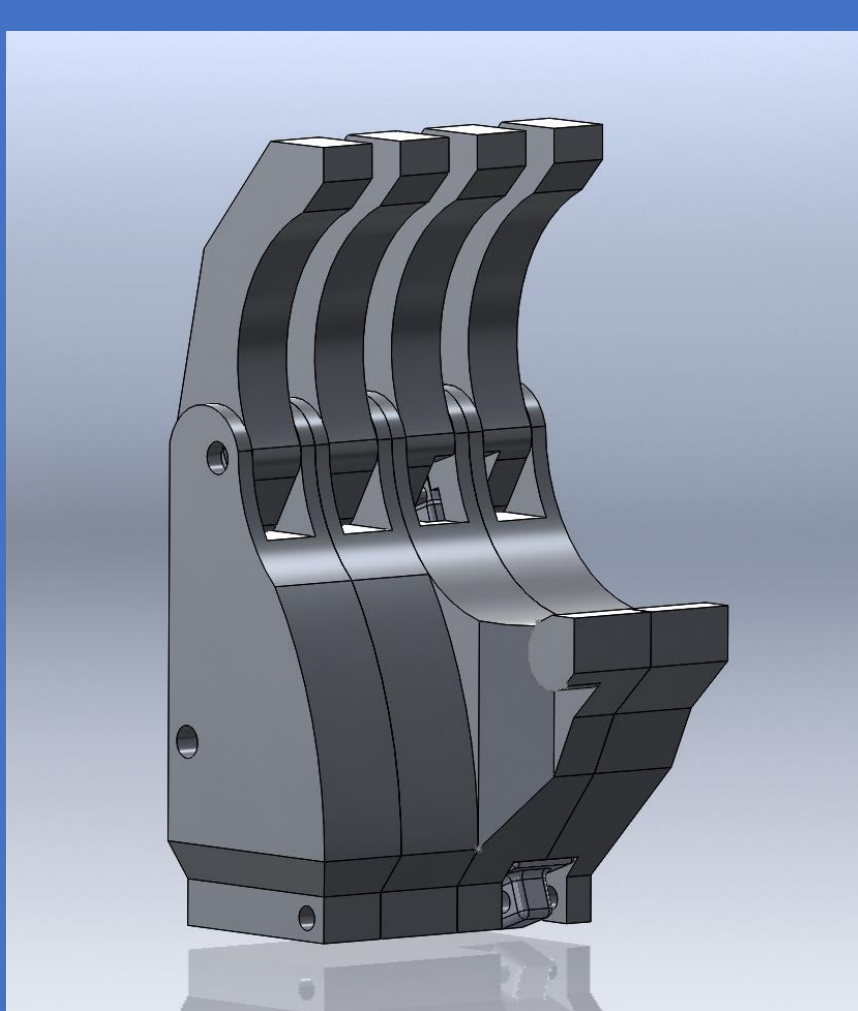


Figure 1d

We chose to do the aluminum “claw” design over a 3D-printed, fully articulating design for the following reasons:

- Both of USM’s 3D Printers are non-functioning.
- Aluminum bar is cheap, relatively lightweight, and easy to mill.
- The single moving part reduces the amount of programming we had to learn and reduces complexity of manufacturing.
- We have a very limited timeframe to learn the CAD and logic software and then mill and assemble the product.

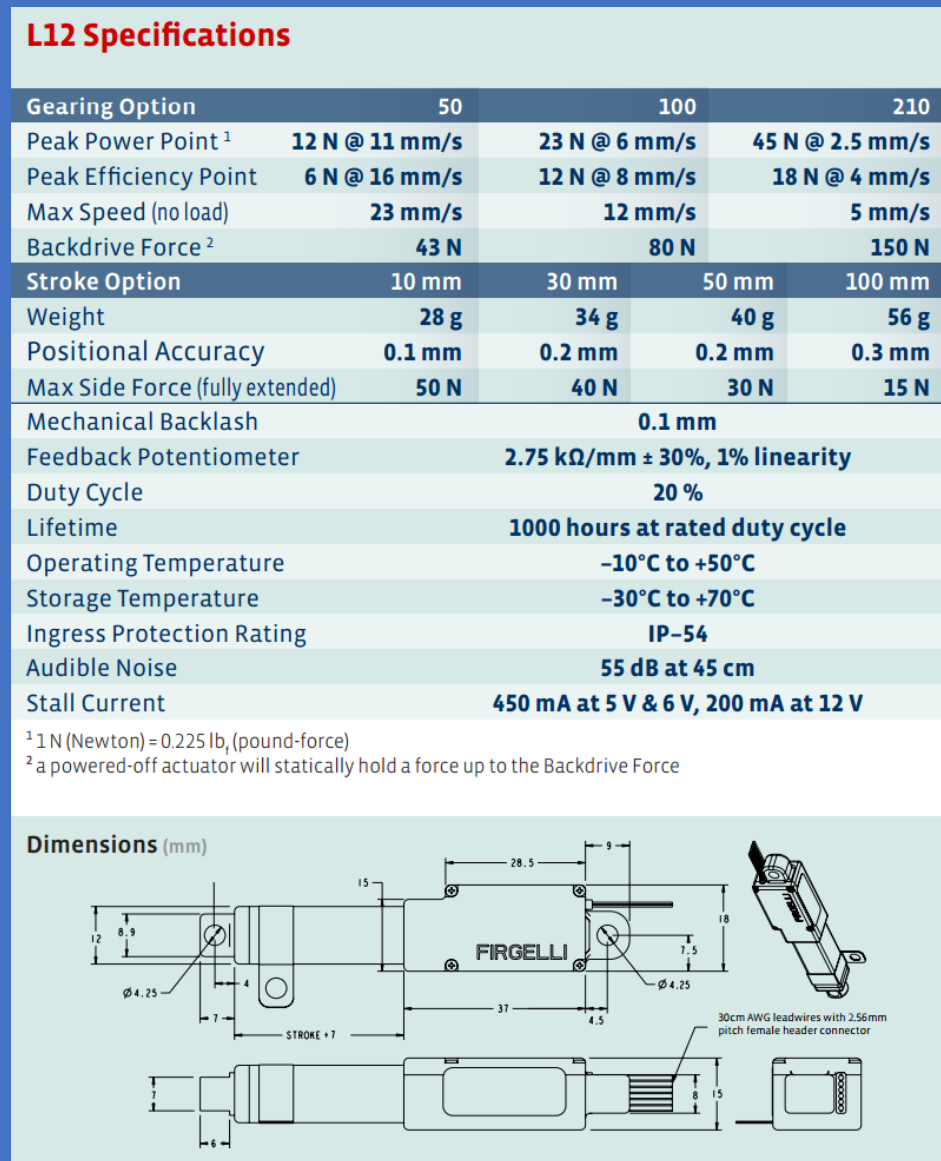


Figure 2a

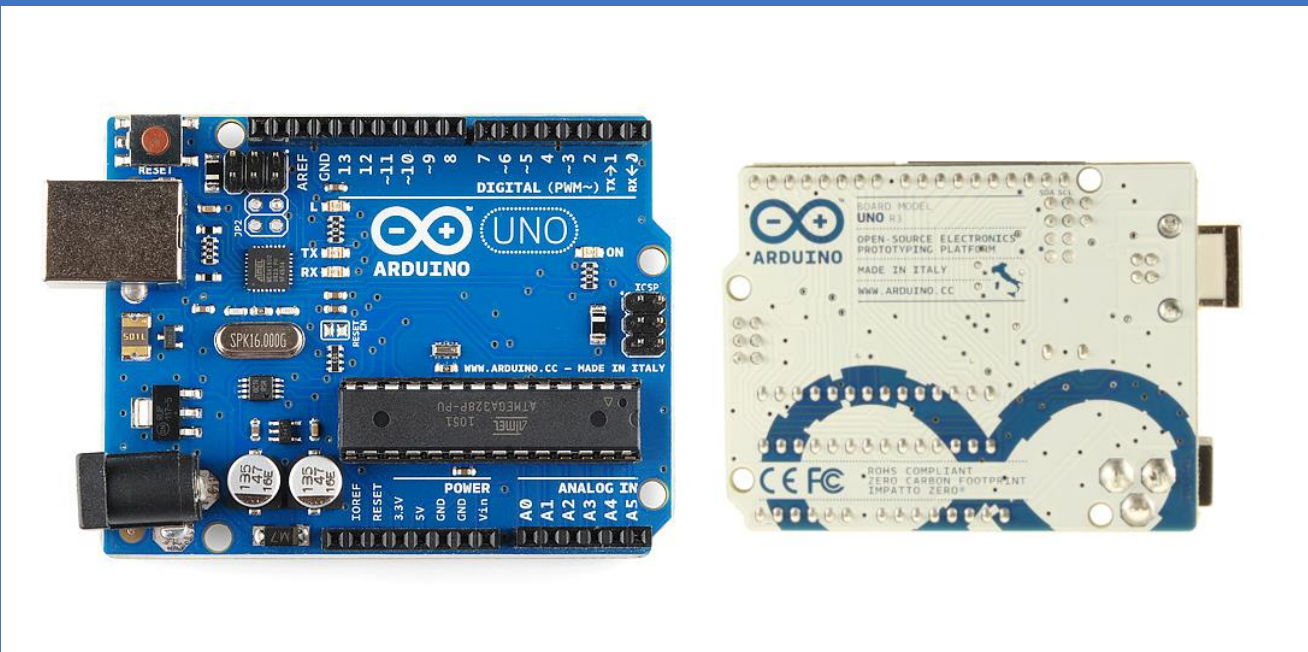


Figure 2b



Figure 2c

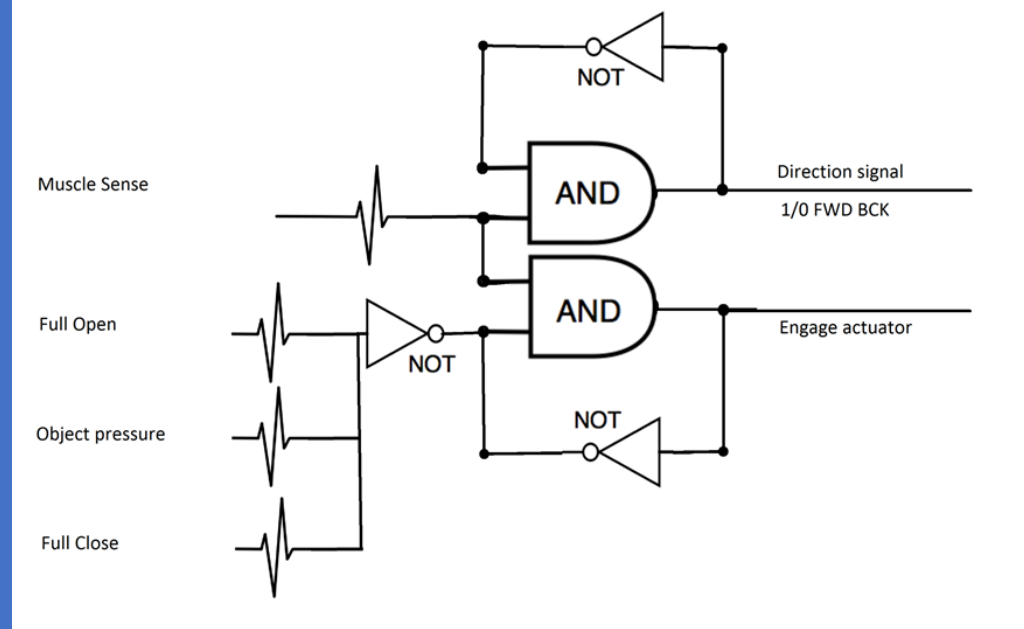


Figure 2d

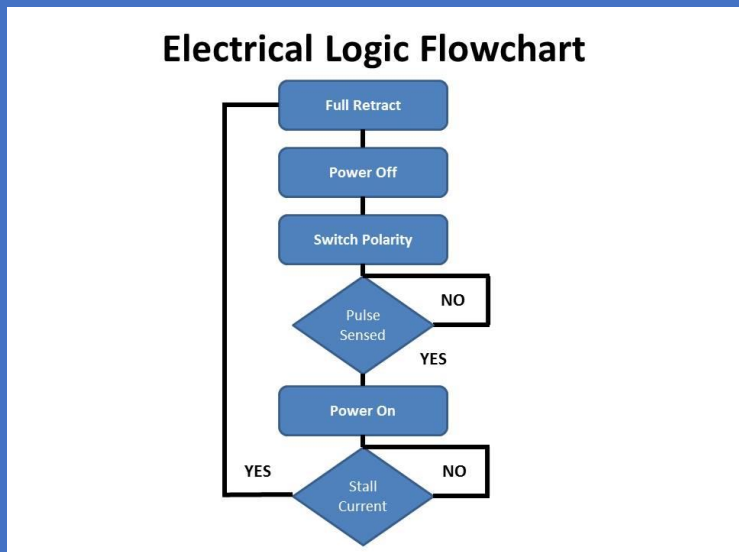


Figure 2e

Design

Figure 1a – Fully articulating prosthetic hands such as this “iLimb” served as inspiration for our design.

Figure 1b – After considering our facility’s manufacturing capabilities, we began sketching a manufacturable design.

Figure 1c – “Exploded” view of the final SolidWorks model.

Figure 1d – Final SolidWorks assembly.

Electronics

Figure 2a – Firgelli L12 micro linear actuator specification sheet.

Figure2b – Arduino UNO microcontroller board handles the logic.

Figure 2c – Advancer Technologies Muscle Sensor Kit V3 can be used to allow user control over grip.

Figure 2d – Simple logic schematic.

Figure 2e – Electrical logic flowchart.

Manufacturing

Figure 3a – SolidWorks assemblies had to be rearranged for manufacturability.

Figure 3b – “Plate 1” was a success.

Figure 3c – Leftover material from Plate 1.

Figure 3d – USM’s Bridgeport 3-axis CNC.

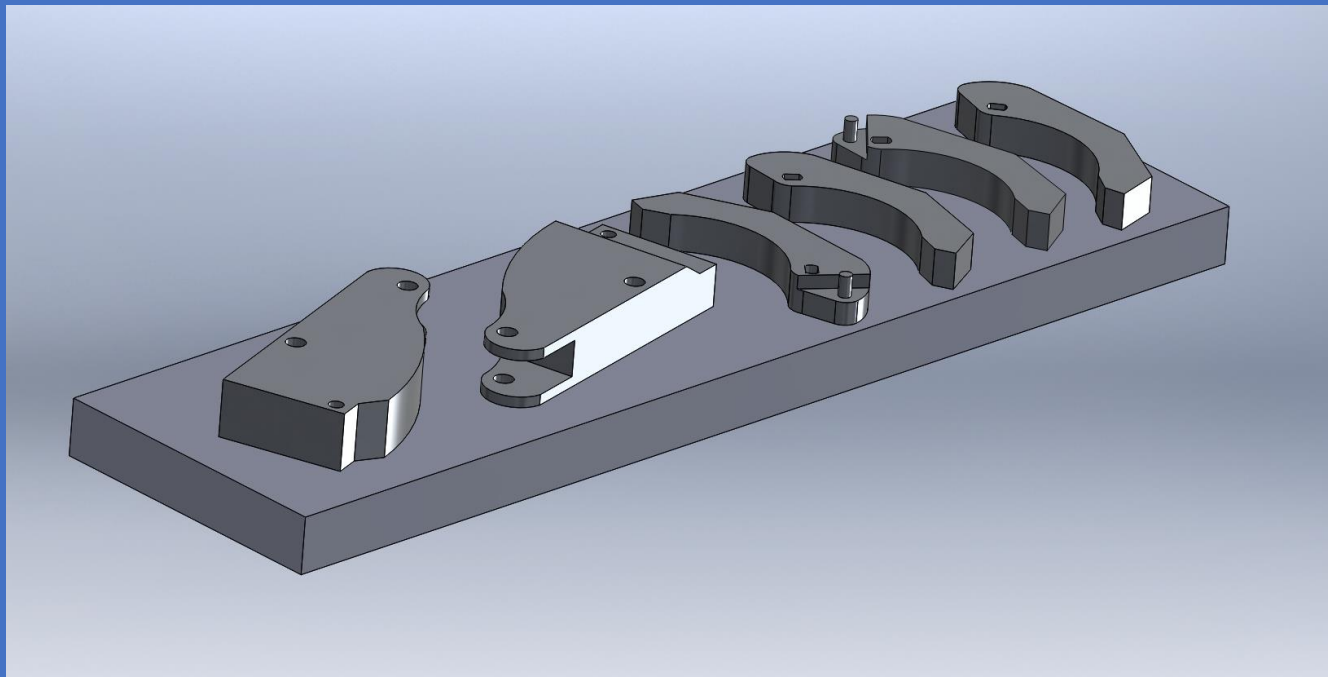


Figure 3a

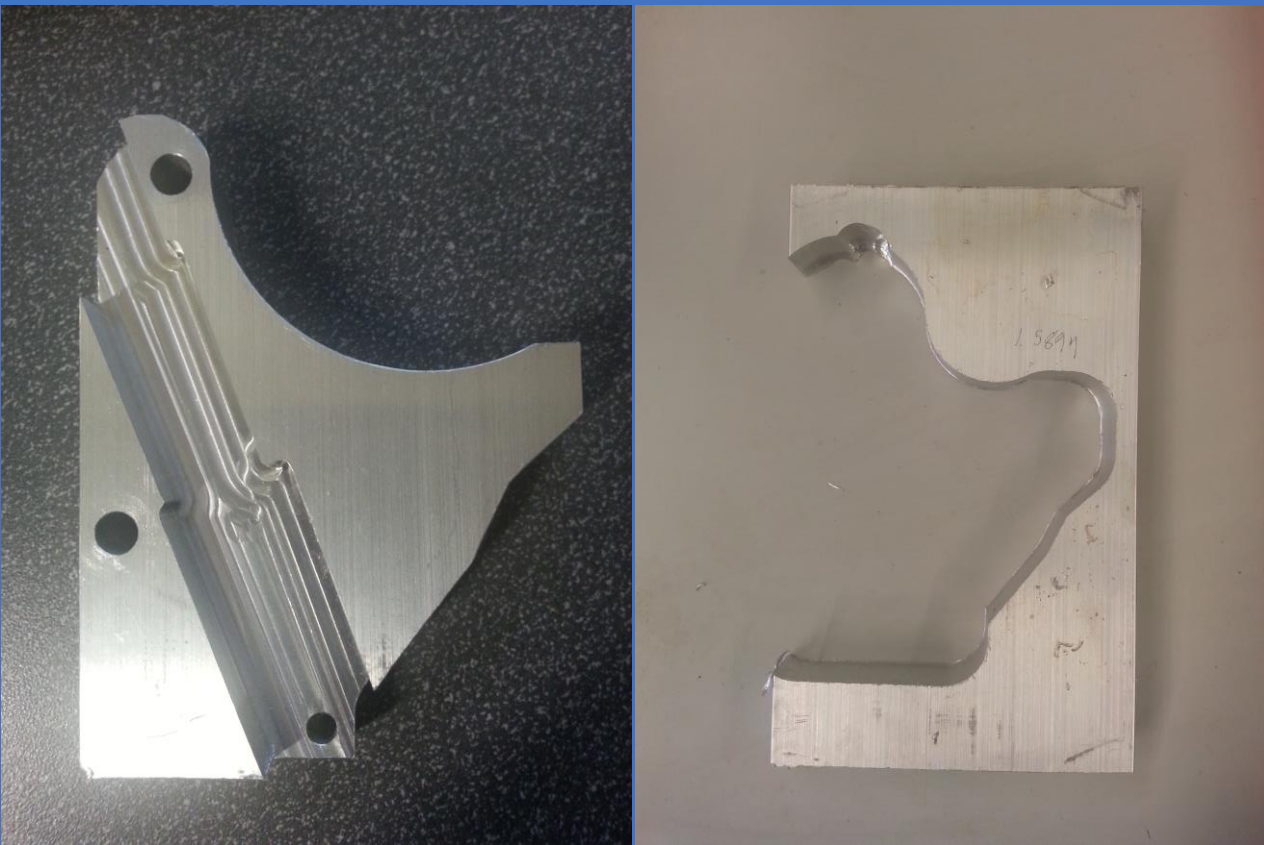


Figure 3b

Figure 3c



Figure 3d