

To: Dr. Sarah Oman
From: Team 19F13 Hip B
Due Date: December 6, 2019
Re: Final Prototype

Introduction

The following memo will discuss the prototype the biomechanics hip exoskeleton team (BHET) presented on December 4, 2019. Included will be pictures of the CAD design and constructed prototype along with a discussion of the design.

CAD Design in SolidWorks

To better accommodate construction of the prototype, portions the CAD model presented in the final report were modified. This was constrained mostly to the motor mount assembly. Shown below is the modified motor mount assembly in SolidWorks.

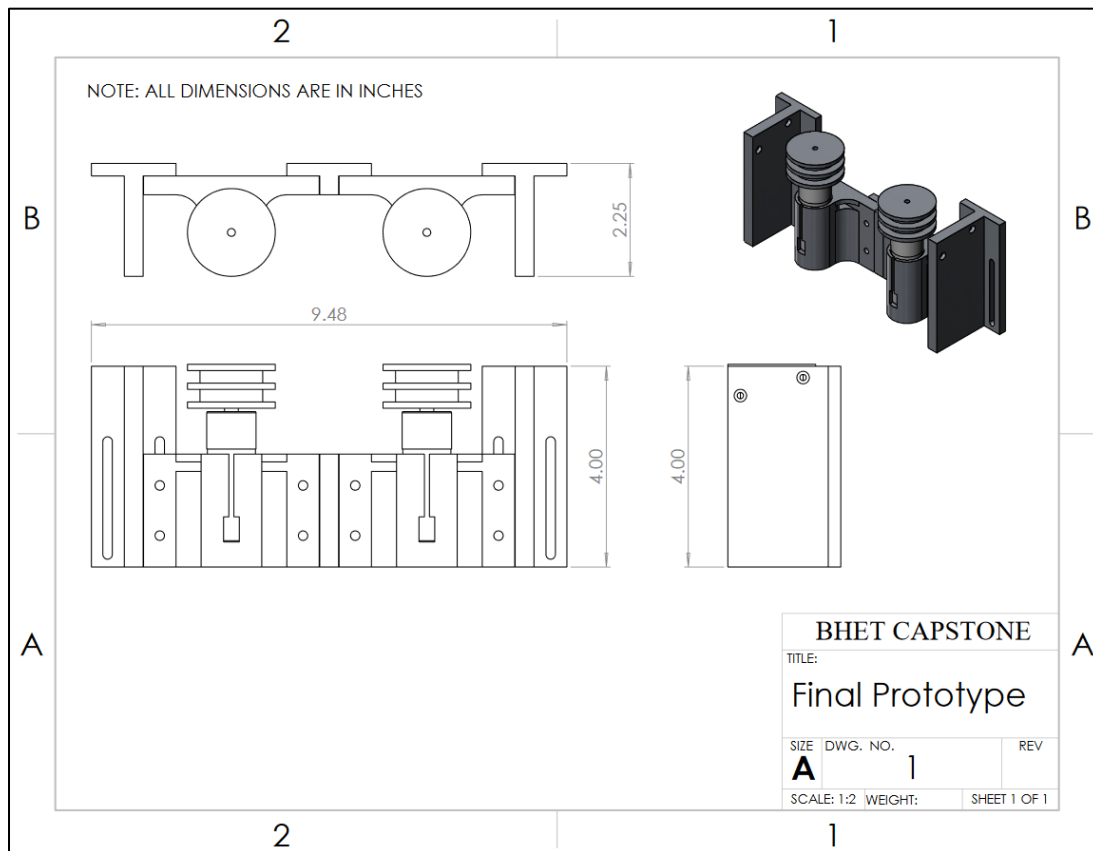


Figure 1: CAD design of motor mount for final prototype

This new design has a simplified geometry that will allow for ease of manufacturing for both machining and 3D printing. The assembly is comprised of two identical motor mounts, 2 identical cable boss plates at each end and a center bracket that connects the two sides of the assembly. This modularity in the design allows for parts to be replaced easily and reduces the amount of unique parts in order to simplify manufacturing.

Constructed Design

Our constructed design was made using the utility belt from our first prototype and an aluminum bar that was mounted on the belt using Velcro strips. The aluminum bar was cut into three sections, the back bar is where the motors are mounted, and there are two smaller bars which are where the casings for the tubing/cord are mounted on. These two bars are mounted near the front of the belt, so that the casing is in line with midline of the leg. The motor mount, pulley, guides, and casings were all 3D printed. They were also bolted to the aluminum frames. The cord we used was 550 cord, and it was threaded through plastic tubing. The knee brace from the first prototype was used to attach the cord to the knee. This was done with a simple knot.

We only constructed half of the system due to time constraints and other difficulties. A close-up picture of the prototype can be referenced in the below figure.



Figure 2: Close up View

The below image shows how the prototype looks relative to the whole body.



Figure 3: Full Body View of Prototype

Conclusion

Overall, the team was satisfied with how this prototype turned out. Though, there will definitely be changes when work on the final product begins. First, we have to change the knee brace into something more rigid so the force from the cord will be distributed better and won't cause the fabric to slip. The back-motor subsystem needs to be compressed because it took up more space than we expected on the back plating. Once we pick our motor the dimensions for the motor mounts will also need to be adjusted. Lastly, we may change the frame to utilize thermoplastic and foam to conform to the body better.