Hiking Powered Prosthetic Foot By Team Power Rangers

Sponsored By Quality of Life +

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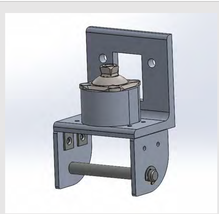
SAN DIEGO STATE UNIVERSITY

Project Overview

For our challenger, Caleb, we need a prosthetic that can keep up with his active lifestyle and that will allow him to do the hiking, camping, and backcountry hunts that he enjoys. This hiking prosthetic must be powered and be able to meet the energy demands of hiking in order to mimic the functionality of the human foot and give him the powered assistance to hike up and down hills regularly.

CAD Model

Model View



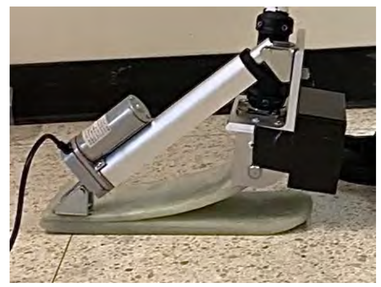
Ankle Pivot Subassembly w/ Universal Attachment

Fiberglass Flex Foot Subassembly

Prototyping

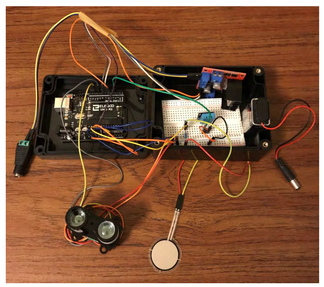
- Initial prototype made from all metal (not pictured)
- The first iteration of fiberglass molding when in vacuum (left)
- Made the bottom piece thicker and top flex piece more refined and assembled with Ankle Pivot Subassembly (middle)
- Final prototype fully assembled (right)

Final Product



Assembled System w/ Electronics Housing

Ankle Pivot Assembly with Pylon Attachment



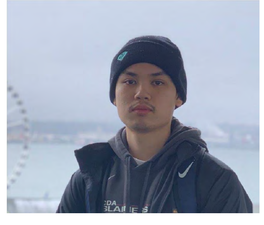
Electronics Housing w/ Electronics

*Pressure and Distance Sensor on Outside

Team Members

Lindsey Twomey
Team Lead

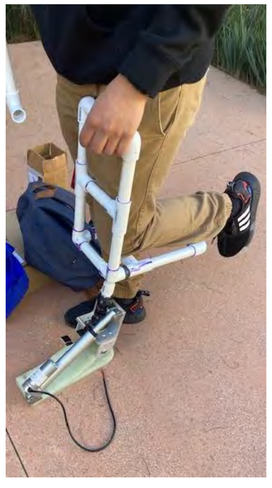
Cole Stewart
Design Engineer



Duy Tran
Controls Engineer

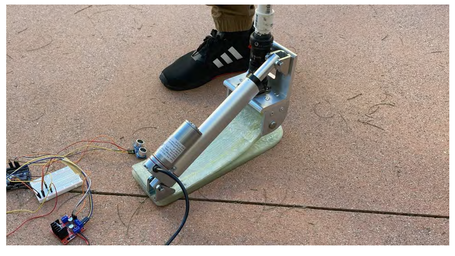
Andres Bahena
Manufacturing Engineer

Testing



Testing the system wearing a bypass looking at:

- Flexibility and energy return of fiberglass portion
- Actuator push off force and speed
- Fracture or deformation in fiberglass parts



```
Foot Down Time (ms): 995
User foot is down
User foot is up
Foot Down Time (ms): 1057
User foot is down
User foot is up
Foot Down Time (ms): 969
User foot is down
User foot is up
Foot Down Time (ms): 1011
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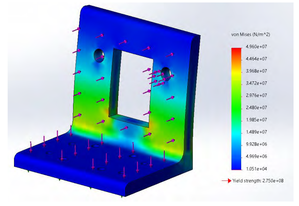
```
Distance: 10.80cm    Pressure Value: 46     Motor Speed: 244
Distance: 7.12cm     Pressure Value: 88     Motor Speed: 234
Distance: 4.95cm     Pressure Value: 107    Motor Speed: 230
Distance: 4.03cm     Pressure Value: 113    Motor Speed: 228
Distance: 3.88cm     Pressure Value: 105    Motor Speed: 230
Distance: 3.88cm     Pressure Value: 71     Motor Speed: 238
Distance: 4.39cm     Pressure Value: 12     Motor Speed: 253
Distance: 6.00cm     Pressure Value: 0      Motor Speed: 255
```

Sensor readings to track motor speeds and analyze walking speed of user using pressure and distance readings

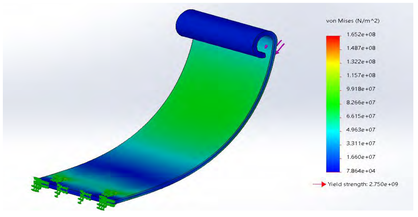
Design Analysis

Major structural parts simulated under 250 lbs. of loading to account for the weight of the user and any additional gear they may carry;
All were well under yield strength and showing no critical deformation

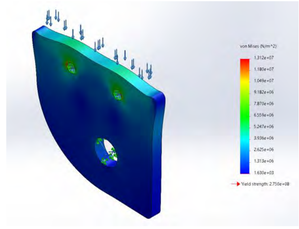
L-Bar Actuator Attachment



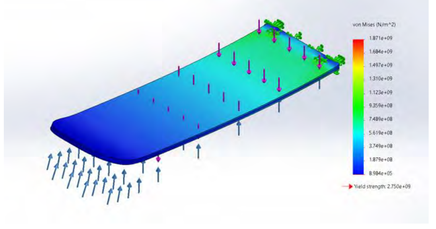
Flex Foot Top



Ankle Pivot Side



Base Foot



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