

Dynamic Adjustable Prosthetic Socket CDR

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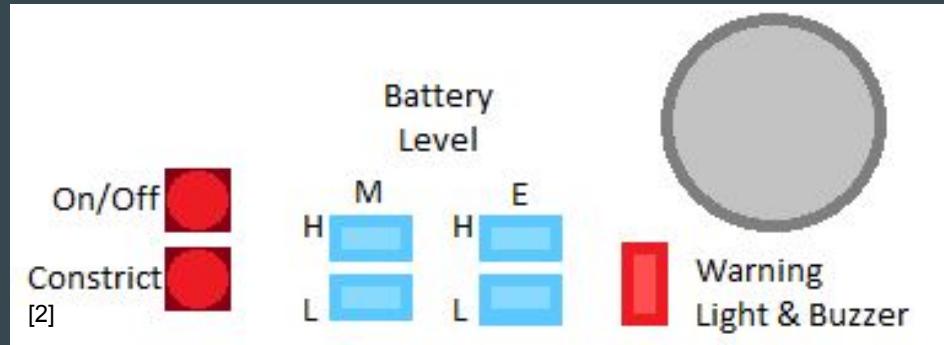
Our Project

- Create a responsive and supportive socket
- Inspired by CRS socket
- Support is provided by hydraulic bladders
- Use EMG sensors to determine movement



Changes from PDR

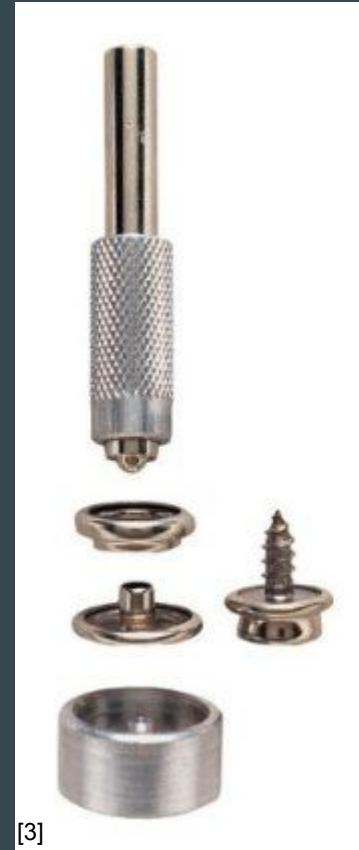
- Mechanical
 - 2 motor system vs 4 motor system
- Electrical
 - User interface



Progress Made

Bladders

- Vinyl
- PUL Pockets
- Prototype attachment of pockets
 - Screw snaps
 - Buckles/Straps



Bladders

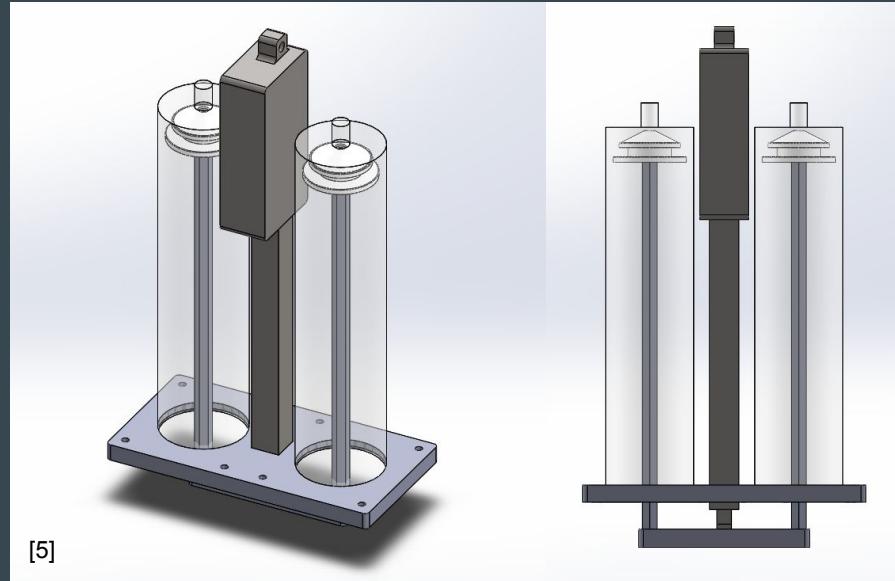
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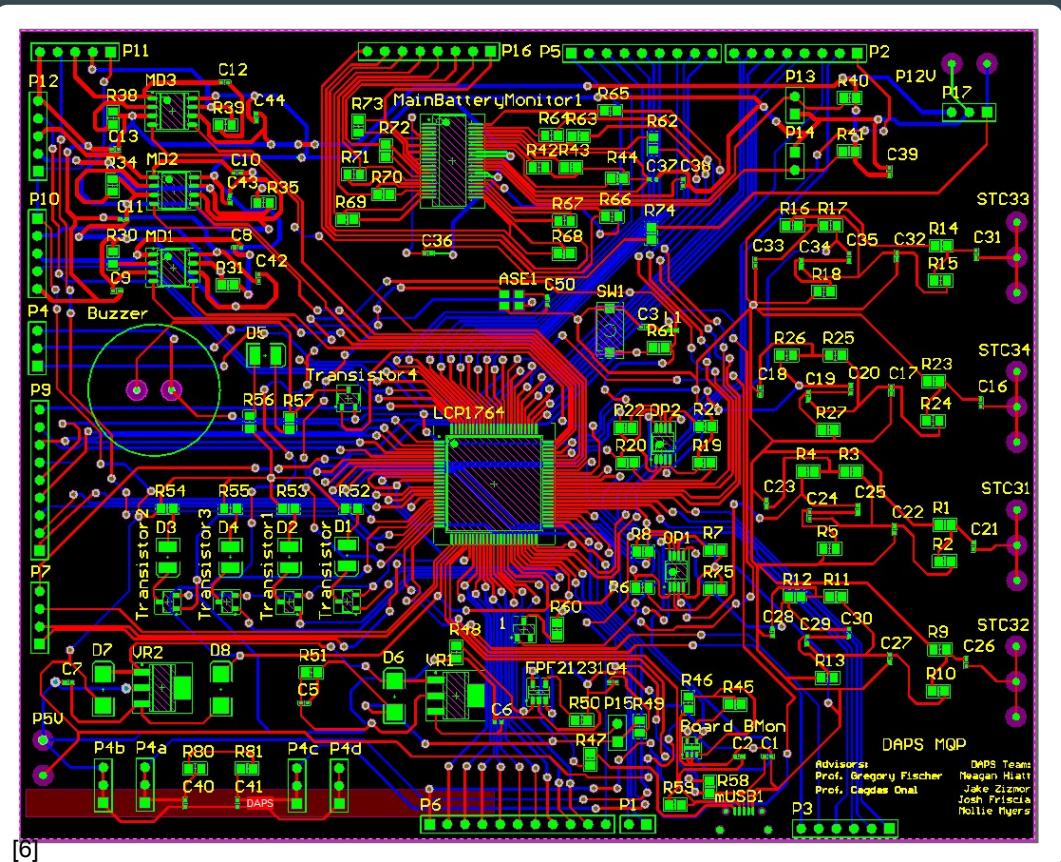
Mechanical

- Hydraulic testing rig
 - Prototyped
 - Final
- Motors
 - Firgelli P16 Linear Actuators
 - One motor to two syringes



Electrical

- PCB
 - Chose parts for board
 - Batteries
 - 4 Cell 5200mAh motor battery
 - 1 Cell 750mAh electrical battery

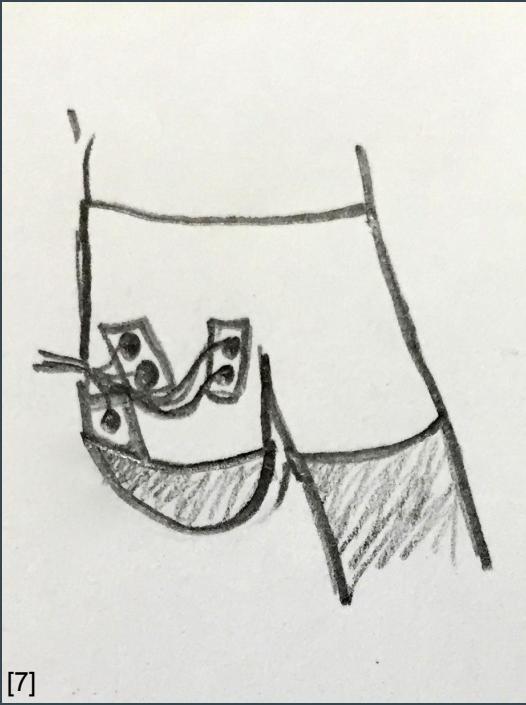


EMG

- Attachment Prototypes

| Idea | Cause no irritation | Prevents Rotation of EMGs | Reusable | Easy to make | Inexpensive to make |
|---------------------------------|---------------------|---------------------------|----------|--------------|---------------------|
| Hip Brace | X | X | X | 3 | |
| Compression shorts | X | X | X | 2 | X |
| Blood pressure cuff | X | | X | 2 | X |
| Residual limb sock/socket liner | X | | X | 3 | |
| Velcro strap | | | X | 2 | X |
| Kinesio tape | X | X | | 2 | X |

Compression Shorts



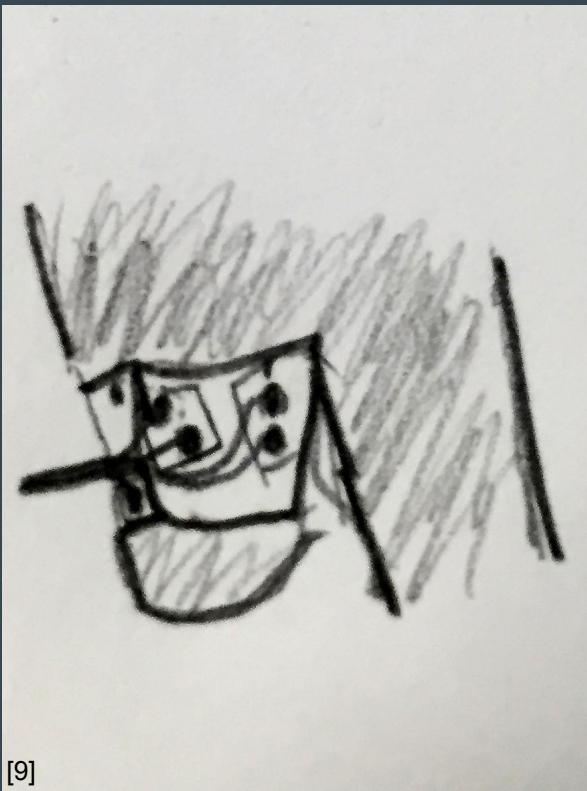
[7]



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Blood Pressure Cuff

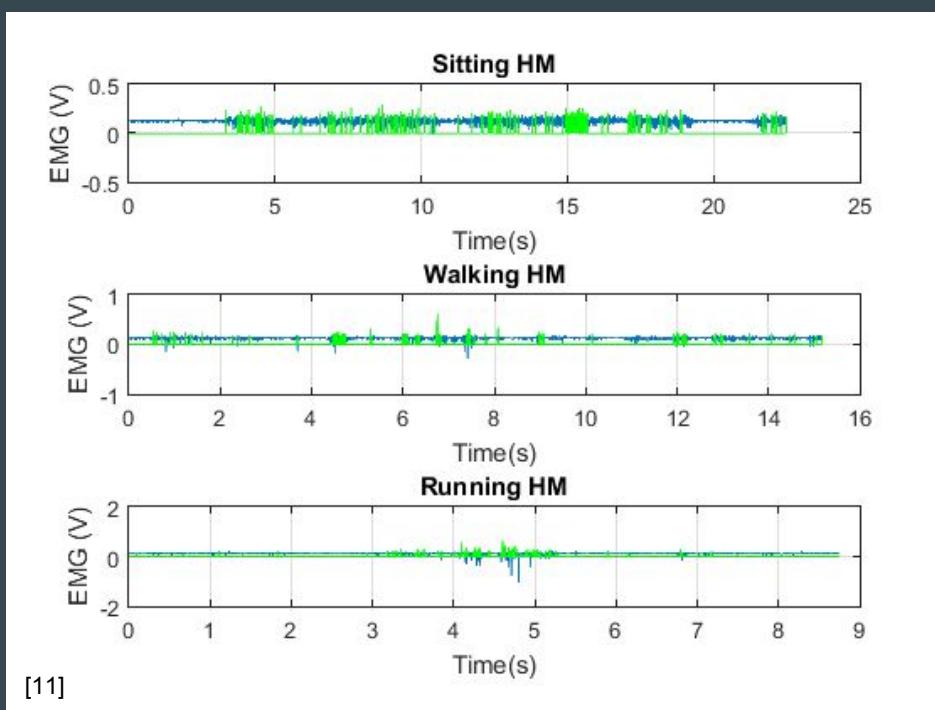


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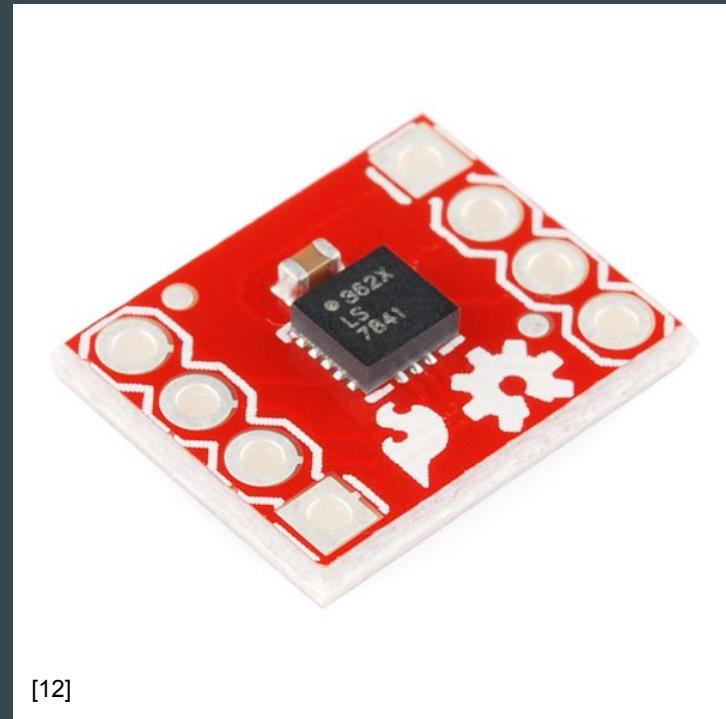
Detection Algorithm

- Unfiltered EMG testing
- Initial spike to detect the beginning of motion
- Amplitude to determine state
 - Standing
 - Walking
 - Moving
- Lack of movement in accelerometer to detect end of motion



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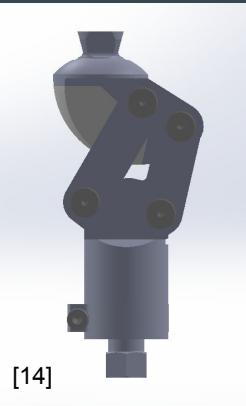
Going Forward

Putting it all together

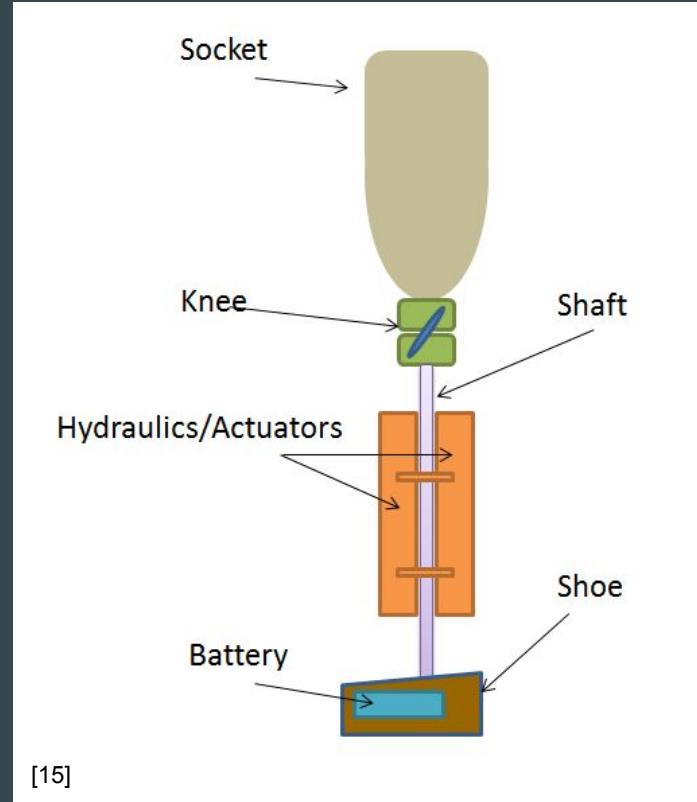
- Knee model to test around
- Placement
 - Hydraulics/Tubing
 - Electronics/Wiring/Batteries
 - EMGs



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[14]



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Outputting information

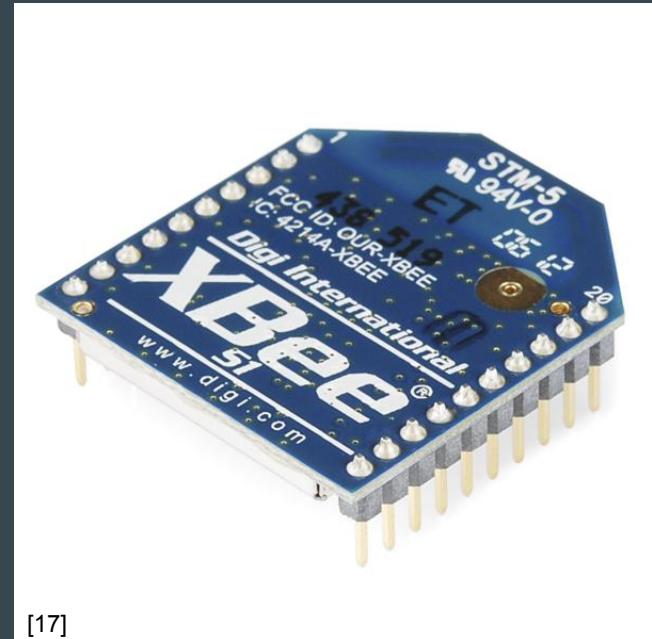
- USB cable
- xBee
- WiFi
 - ESP8266



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Outputting information

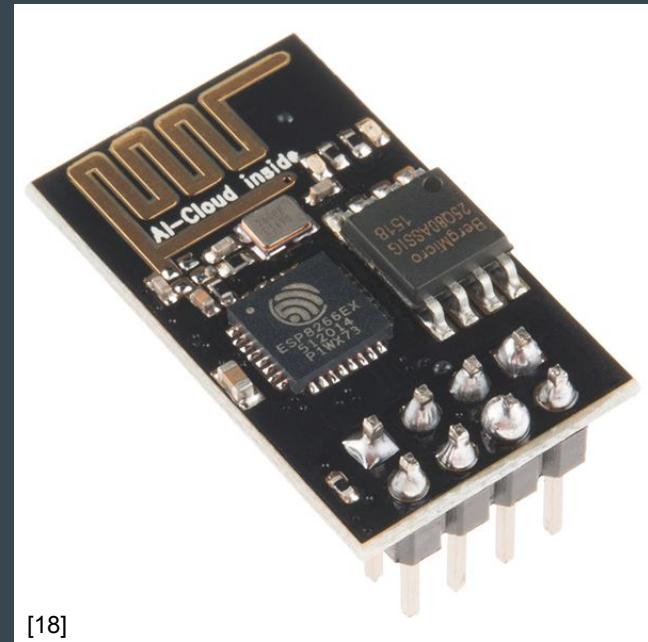
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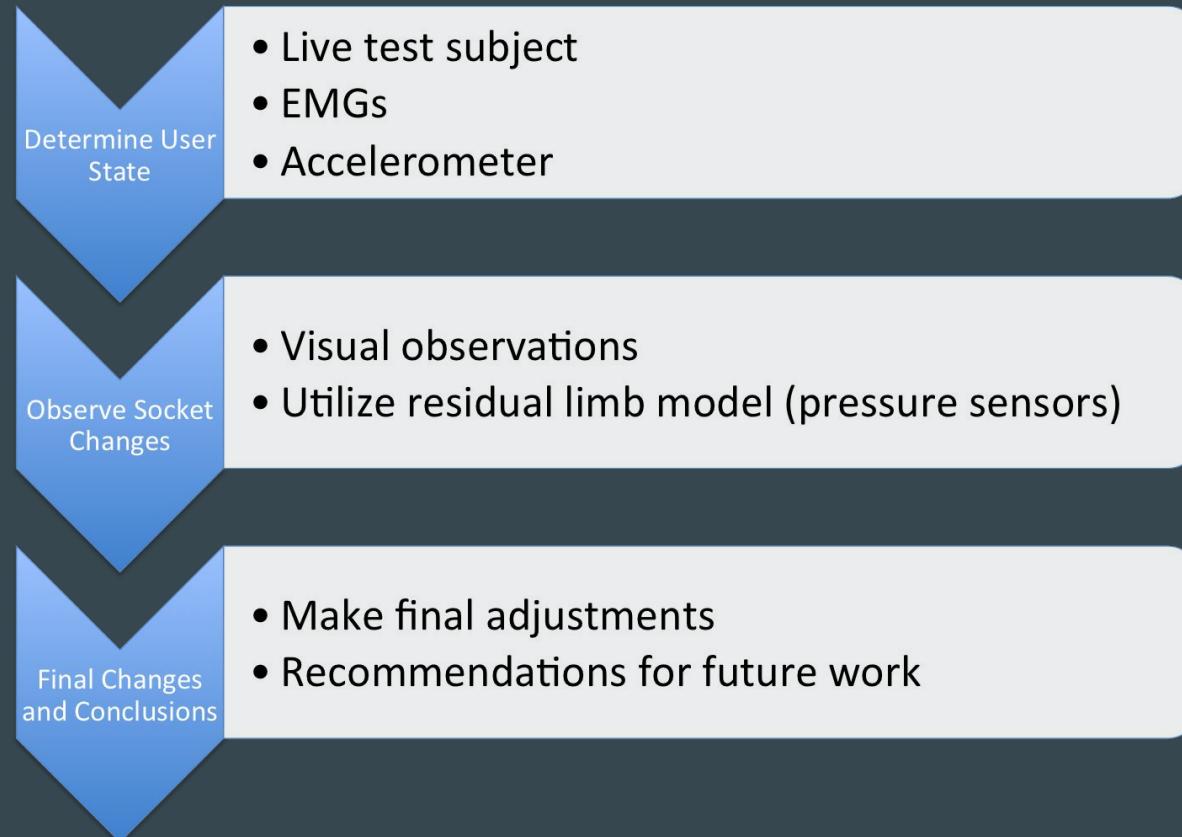
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Final Design Testing



Cornell Cup

- GUI
 - recreate socket UI as a GUI on the Atom
 - Communicate using either the xBee or WiFi
- Analysis
 - Combine image analysis data with readout data
 - Determine accuracy and response rates



B Term Gantt

DAPS Gantt Chart

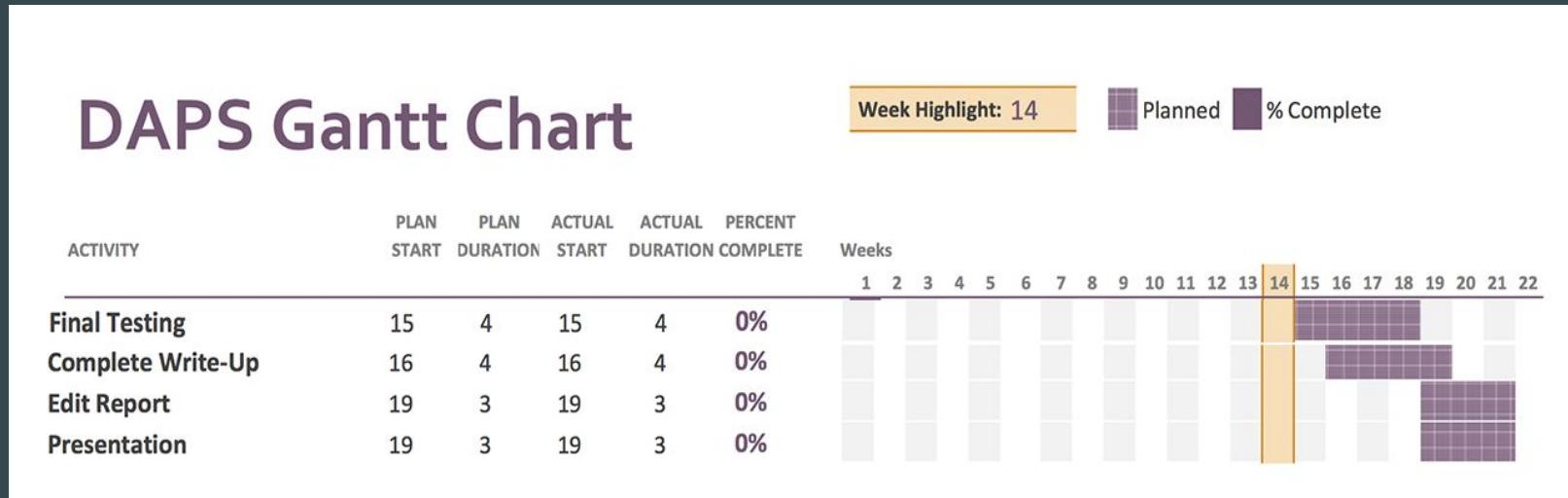
Week Highlight: 14

Planned % Complete

| ACTIVITY | PLAN | PLAN | ACTUAL | ACTUAL | PERCENT | Weeks |
|-----------------------------|-------|----------|--------|----------|----------|-------|
| | START | DURATION | START | DURATION | COMPLETE | |
| PCB Design | 4 | 2 | 4 | 8 | 100% | |
| Obtain Components | 5 | 3 | 5 | 7 | 100% | |
| Prioritize Code Functions | 7 | 1 | 7 | 1 | 100% | |
| Write Code | 8 | 5 | 8 | 6 | 100% | |
| Design Final Testing | 7 | 4 | 9 | 3 | 100% | |
| Build Bladders | 9 | 3 | 9 | 3 | 100% | |
| Build Hydraulics | 9 | 3 | 9 | 5 | 75% | |
| Test Sensors | 10 | 1 | 10 | 1 | 100% | |
| Test Pressure Systems | 10 | 1 | 10 | 1 | 100% | |
| Make Electrical Board | 9 | 5 | 12 | 5 | 25% | |
| Assemble Enclosure | 12 | 2 | 14 | 2 | 25% | |
| Test Enclosure | 13 | 1 | 14 | 1 | 0% | |
| Test EMGs with Enclosure | 13 | 2 | 14 | 2 | 0% | |
| Write Up Project Structure | 8 | 3 | 8 | 3 | 100% | |
| Write Up Alternative Design | 9 | 2 | 9 | 4 | 100% | |

The Gantt chart illustrates the progress of various tasks over a 22-week period. The tasks are listed on the left, and their scheduled and actual timelines are shown across the weeks. A vertical orange bar at week 14 indicates the current week. Most tasks have been completed by week 14, except for a few like 'Build Hydraulics' and 'Assemble Enclosure' which are still in progress.

C Term Gantt



Thank you

References

- [1] Photograph taken by J. Zizmor
- [2] Outline of User Interface, drawn by M. Hiatt
- [3] http://www.amazon.com/General-Tools-Instruments-1268-Fastener/dp/B00004T7VW/ref=sr_1_2?ie=UTF8&qid=1449512514&sr=8-2&keywords=screw+snap
- [4] http://www.amazon.com/BuckleGear-Molle-Accessory-Straps-Black/dp/B00NLNOZCM/ref=sr_1_1?ie=UTF8&qid=1449607066&sr=8-1&keywords=buckle+straps
- [5] SolidWorks Model - by J. Friscia
- [6] PCB board Design - by M. Hiatt
- [8] Diagram of EMG-modified Compression Shorts - by M. Myers
- [9] Photograph of EMG-modified Compression Shorts - by M. Myers
- [10] Diagram of EMG-modified Blood Pressure Cuff - by M. Myers
- [11] Diagram of EMG-modified Blood Pressure Cuff - by M. Myers
- [12] EMG Data - Collected by M. Myers & M. Hiatt
- [13] <http://cdn.medgadget.es/wp-content/uploads/2013/08/jaipur-knee.jpg>
- [14] <https://grabcad.com/library/prosthetic-knee-four-bar-linkage>
- [15] Drawn Diagram of Prosthetic - by J. Friscia
- [16] <https://www.sparkfun.com/products/11215>
- [17] <https://www.sparkfun.com/products/13678>
- [18] <https://www.sparkfun.com/products/13678>
- [19] Intel Cornell Cup <http://www.systemseng.cornell.edu/intel/>