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FACULTY OF ENGINEERING

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The Robo-RAD:
A Bluetooth Controlled Rear Anti-tip Device for Wheelchairs

Introduction

The necessity of this project stems from the lack of adjustability in existing rear anti-tip devices currently on the market. Most wheelchairs come equipped with the standard tipper bars that are not very adjustable. This leads to most users removing them after 6 months of use, because they are more of a hinderance than help. This unfortunately leaves these users with no method of backwards fall arrest.

Our goal is to create a wirelessly adjustable, easy to use rear anti-tip device. This allows the user to adjust the arm to the necessary position to enter a wheelie position, descend curbs, and transition from sloped to flat surfaces without getting stuck in a position where the push wheels end up suspended in the air.

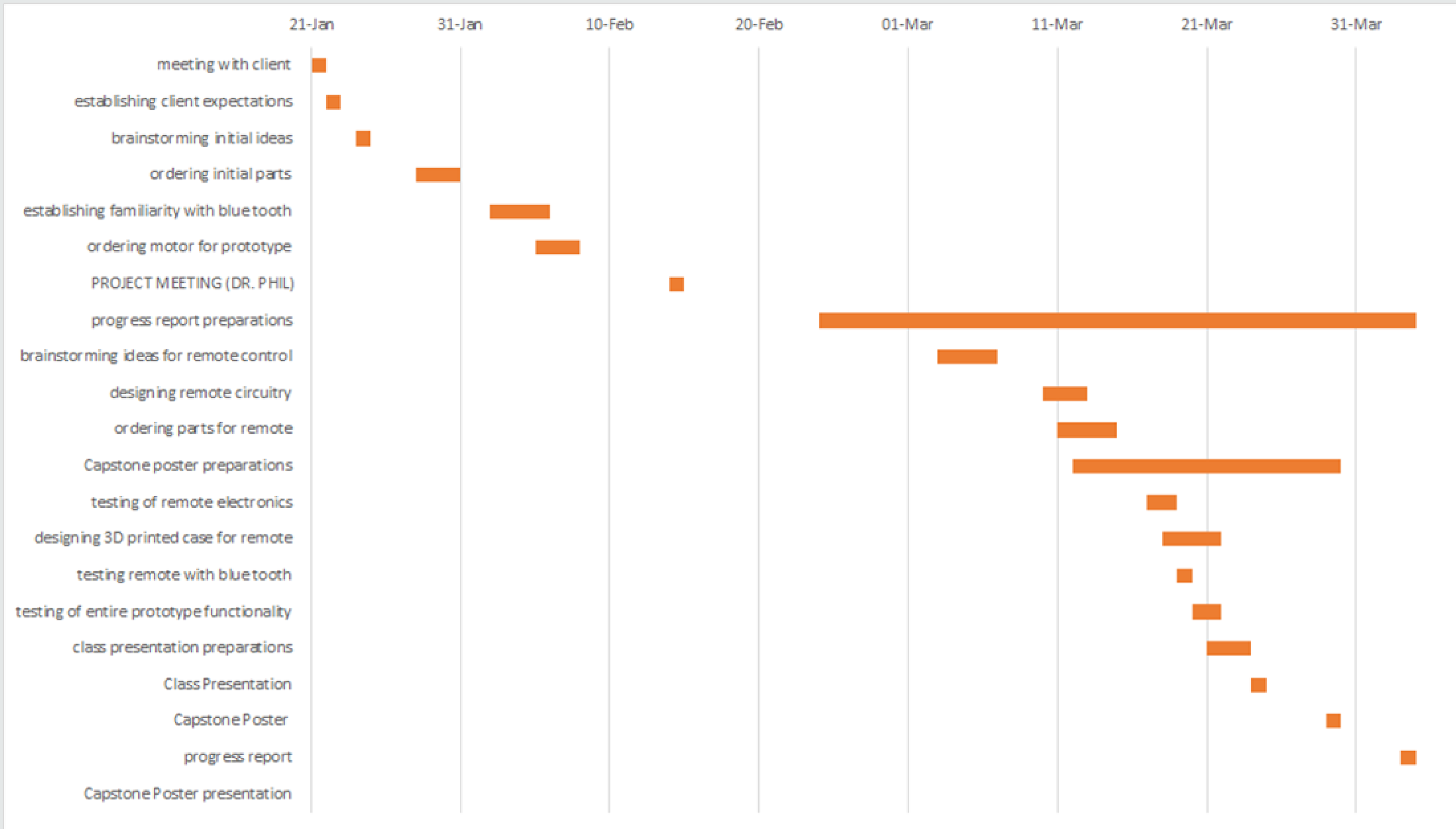
This project stems from an idea presented in 1994, that is that if users had adjustability in their anti-tippers, they would be less likely to remove these safety devices from their wheelchairs. This project is the second attempt at developing an electrical solution to this issue.

Design Process

- The first thing we did was analyze the previous attempt at an electrical solution and determine what worked and what did not.
- After determining what the client wanted and what we could reuse from the previous project we developed our design.
- Because the Robo-RAD must be wireless we decided to use a Bluetooth remote. The client initially asked about a smartphone app, but as a group we decided that a remote would be more accessible and would not cost any more to develop than a smartphone app would.
- We then split up the tasks and each group member started researching the best way of accomplishing each aspect.
- Colin will be handling the remote's design and construction.
- Cameron will be handling all things motor related.
- Stephanie will be handling the Bluetooth communication and software.

Details of Design

- We are at the halfway point in our project at this point. We stayed on track according to our Gantt chart and fortunately Covid-19 did not impact us too much, because we are all still able to work on our individual parts.



- Cameron has built a prototype using a worm gear motor and c-clamps. He also built a testbench to test the prototype. Figure 1 shows the testbench set up, highlighted is the motor, the drive shaft, the c-clamps and test flag used to conduct some preliminary tests.

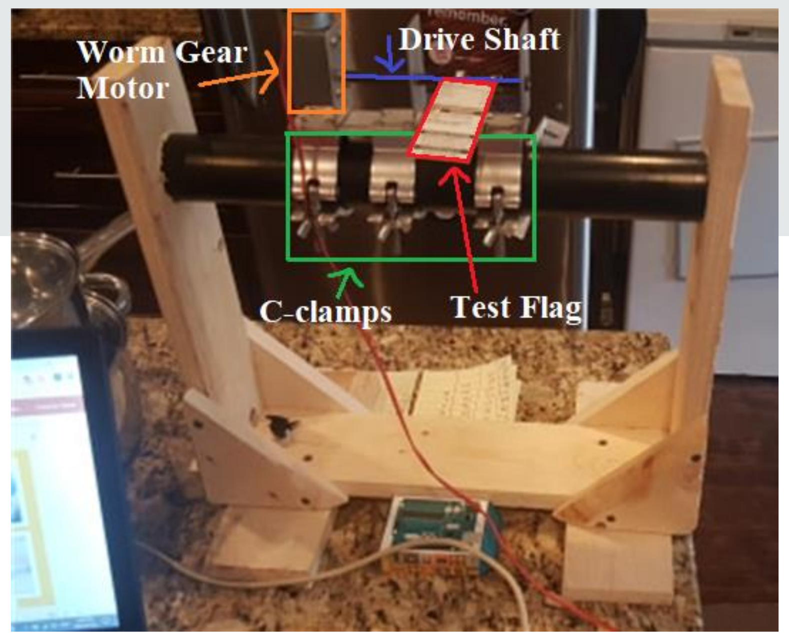


Figure 1

Motor Test Results:

Max current draw (shaft lock test) = ~800 mA
Max power draw = ~10 Watts
Max torque able to be resisted from worm gear: 276 Mpa
Calculated torque for a 300lb person: ~259MPa
Time to move 90° : ~200ms

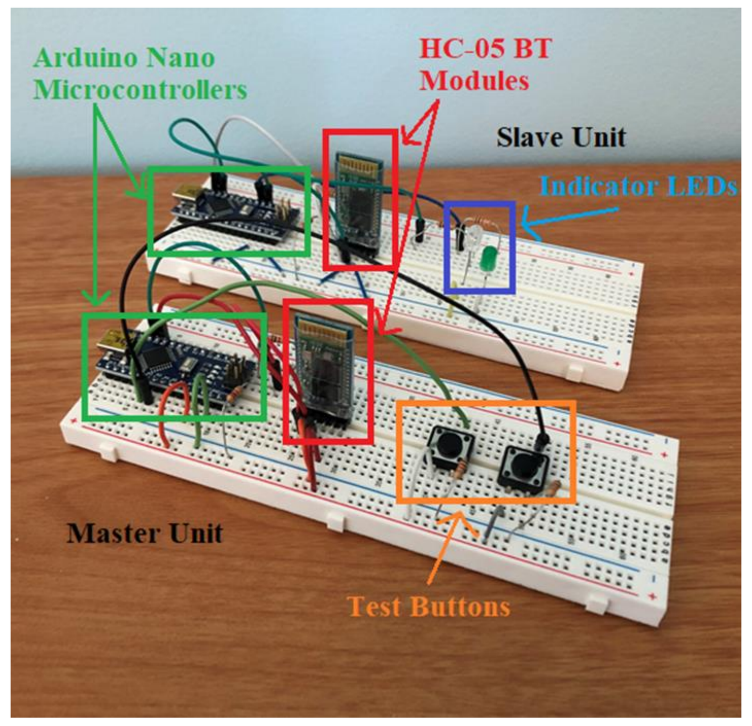
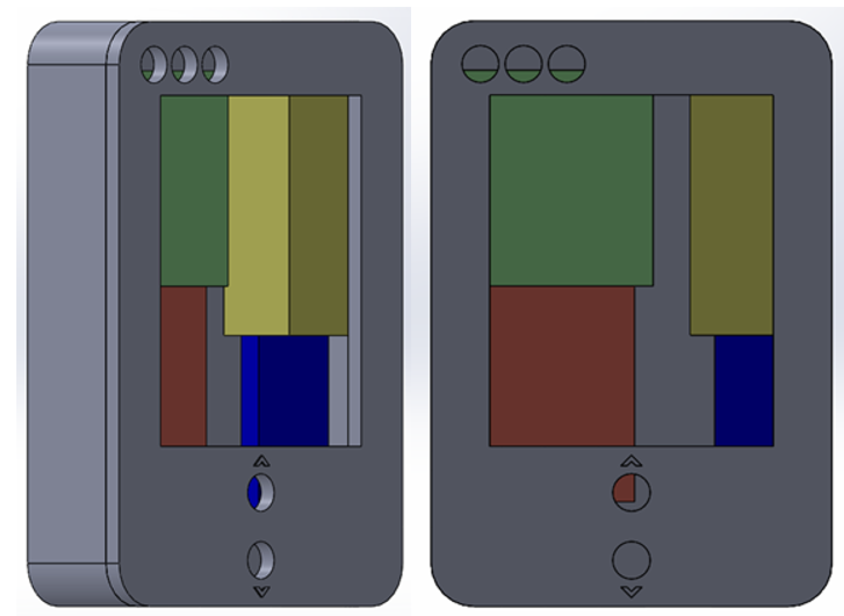


Figure 2

Stephanie has developed a master and slave Bluetooth testbench in Figure 2. This allows us to emulate the movement of the motor with the LED indicators (highlighted in blue) on the slave unit by pressing the test buttons (highlighted in orange) on the master unit.

Bluetooth Test Results:
Motor
Max Distance: 9-10m
Transmission time delay: 5-10ms
Interference: None



Colin has completed a preliminary design for the remote, we plan to 3D print it when the library opens back up in the fall.

Conclusion and Recommendations

In our opinion we should be able to complete the rest of this project in the time given between September and December 2020, so long as the university re-opens to in-person classes and meetings resume.

The prototype we have now will need to be tweaked, and more software needs to be developed for the features of the remote, including pre-sets, password authentication and changing of pre-sets.

At this point we have no recommendations to make as we are only partway done the project.

References

No online or print references were use in the preparation of this poster. All images and IP are original.