Deliverable G: Prototype 2

Group C-5

Liam Wilks

Gregory Bry

Liam Bruce Christo

Jordan Hilko

Aditya Nair

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Introduction:

This deveriable focuses on the design and creation of a second prototype. The first prototype focused on general shape and positioning of the motors. The second prototype will focus on the construction of the motors and the coding of the apps to control those motors. Once this prototype is done being constructed it will be tested for two major specifications: its functionality (how well the motors work) and the strength of the motors or how strong the motors vibrate. The app will be tested as well however it is not a major target for this prototype as it will be the component of our design that will be subject to change the most. Once the testing is done we will decide on what can be achieved for our third prototype and what we hope to present on design day. This deveriable will focus on testing the second prototype and determining what our final prototype objectives are depending on prototype 2 test result

Client Feedback:

During the third client meeting, the group met with both Rollie and Irene. The group presented Rollie with prototype 1, but since contact with Irene is limited to phone calls, the prototype was described to her. When discussing the two options that the project could take, either the insole or the ankle method, Irene said that the insole design would work better for her then the ankle mounted method. When having the prototype and design plans described to her, Irene said that the design “sounds promising”. Irene seems to be satisfied with the progress and the direction of the prototype.

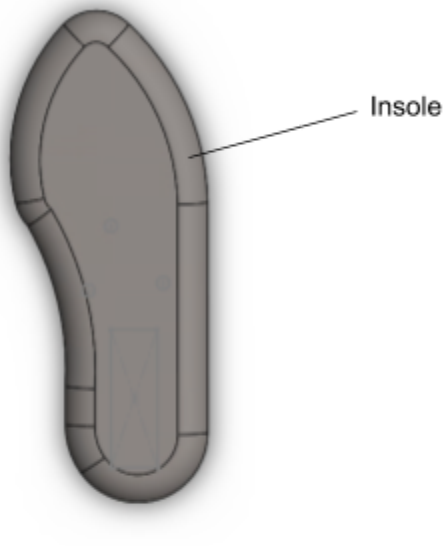
During the meeting, Irene stated her shoe size was an 8-8.5 womens. The prototype 1 test used motor placements determined by a mens 11 size shoe, so the placement of motors in future

prototypes must be changed in accordance with the new information on shoe size. Additionally, Irene stated that she does not use orthotics, so the design will not need any changes with respect to that.

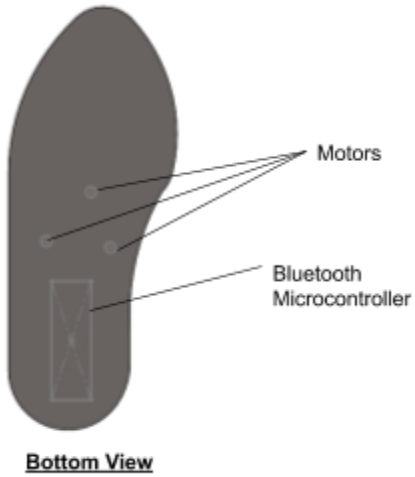
During the meeting, Irene said that she will possibly be making a trip to Ottawa, and may be around during design day. If she is here during design day, the group may be able to find some time to perform tests with her to analyse the final prototype.

Solidworks Model:

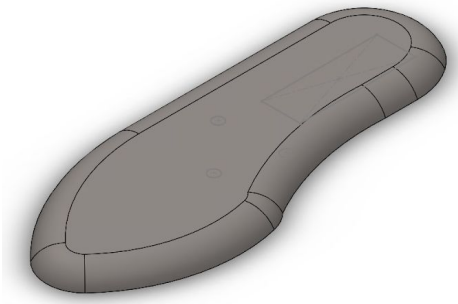
The first part of prototype 2 is an analytical prototype, a Solidworks model depicting the placement of parts on a shoe insole. Using the dimensions of size womens 8.5 shoe, a template was created, and given a sample width. The parts were then sized, and their placement was determined based on previous tests. While this is a simpler prototype, it serves as an effective guide for the placements of parts, and makes future work easier.



Top View

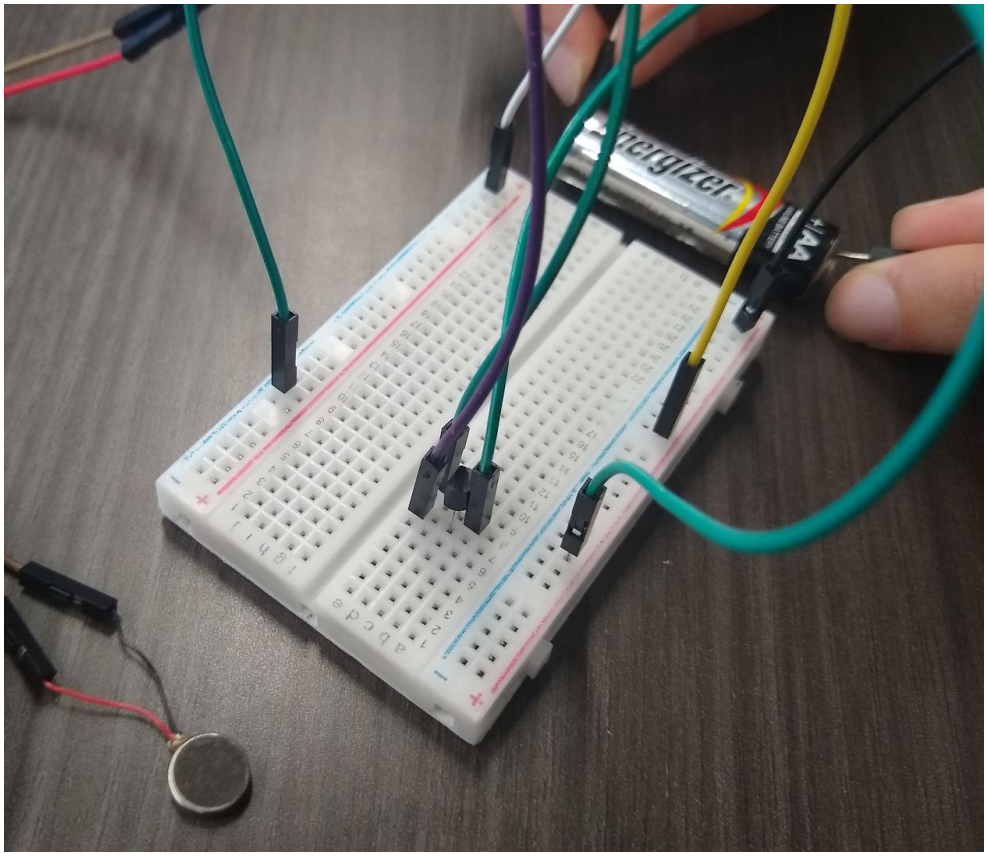


Bottom View



In addition to the CAD renderings of the design, the team constructed a simplified wiring setup to test the viability of transistor controlled vibrating motors. Due to limitations of materials, the group was unable to test a complete version of the design, but the design is not very complex, and a simplified version of the design is more than adequate to test the viability of the circuitry.

This test featured a single vibrating motor, powered by a single 1.5 Volt AA battery. The motor was then able to be turned on and off by a single transistor, which was also hooked up to the battery. With this test, our group was able to determine the proper setup that would be required to both power and control the final design.



In future prototypes, a number of small adjustments must be made. For example, due to a lack of materials, this test only used a single motor and a 1.5 volt battery. The final design will use a single, 3 Volt coin cell battery, and three motors. The motors will all be connected in parallel so that they will all work if one breaks. Additionally, a microcontroller will control the signal to the base of the transistor. Finally, all parts will be soldered together, rather than all being placed on a breadboard.

Prototype Testing:

	Wiring	Transistor Test	Vibration Test
Expected	- Motor is able to be controlled through a simple wiring. Can vary the strength based on if the load is connected in parallel or series.	- Motor action can be controlled using a transistor.	- Vibrations can be very easily felt when held in hand as well as when covered by fabric mimicking a sock and insole.
Actual	- Motor test was successful and acted 100% as expected	- Motor was successfully controlled using a transistor after a few trials. Worked as expected	- The vibrations were noticeably felt when held in a hand but were slightly less noticeable then expected when covered in a fabric. This is due to the incorrect voltage and current being supplied and will be improved on in the next prototype.

All three tests were determined to be successful in a sense that they provided the team with knowledge and insight into the basics of the wiring and transistor setup as well as providing

a general feeling for how strong the vibrating motors will be. This final test of vibration strength provided the most information as this test was able to tell the team that a battery needed to supply the vibrating motors will need to be the recommended 3V and as determined by the team the circuit will need approximately 1000mA to function at peak performance. The battery that will be ordered is expected to produce the 3V required as well as the 1000mA that was estimated to be required.

Target Specifications (From Deliverable B):

	Metric	Units	Marginal value	Ideal value
1	Volume of the device	cm^3	<100	<36.87
2	Time it takes for the user to start walking once device is activated	s	<10	<7
3	Weight of the device	g	<300	<200
4	Time it takes the user to put on the device	min	<15	<10
5	Strength of parts	J	<4.4145	<2.943
6	Material cost	CDN$	<100	<60
7	Efficiency over time	Scale 1-5	5	4

The tests conducted on this prototype showed a general idea of how the final prototype will work. The volume of the prototype was observed and estimated to be within the marginal value of <100cm^3. As most parts needed for the final prototype were not present the final size is only an estimation and will need further testing to be fully determined. The weight of the device was also estimated to be less than <300g which will fall within the marginal values. Once again this is just an estimate based on the few parts available. Lastly the strength of the parts was

determined through this test. A force test was not conducted so exact values are not known but upon inspection of parts the strength of the vibrating motor, which will experience the most force, was determined to be medium to high meaning that the weight of the client will not cause the product to fail. The other metrics were unable to be tested at this time and will be reported on further in later reports.

Design Day Plans:

Design day is the day where all groups will present their products to the judges and viewers who then will pick the best implementation of the the project that was initially assigned to each group. Amongst many groups we must stand out while presenting our product so we plan on presenting our products by showing facts about Parkinson's and any device that aid people who experience this disease. There aren't many recognized companies who develop products that aid patients with Parkinson's and even if there are it doesn't aid them on a daily basis but our product aids the patient and also helps them on a daily basis. By presenting facts about Parkinson's disease the amount of work that's been going on in aiding the patients. As far as verifying if our solution works really well, we plan on checking on our client once a month to see if it really does aid them in their daily activities and before presenting we hope to meet our client once again during March and allow our client to use it. Based on their feedback we may improve our product based on their requirement of their satisfaction.

Conclusion:

During the development of our second prototype, we explored the design and functioning of the product and made some decisions on how to implement the second prototype faster and efficiently. This process involved creating a CAD design that highlights the placement of the motors and microcontroller. After this we tested our mini vibrating motor with a 1.5V battery to check its functioning and to see if its viable for our product. Later on, we compared our prototype testing with our target specification and they were fairly accurate. Then we planned our way of presenting our product and how to verify if the solution works well so it stands out. All in all we have a well designed plan on how we'll construct our prototype 3 and we realize what we should improve on and soon we confidently approach on building our final product.