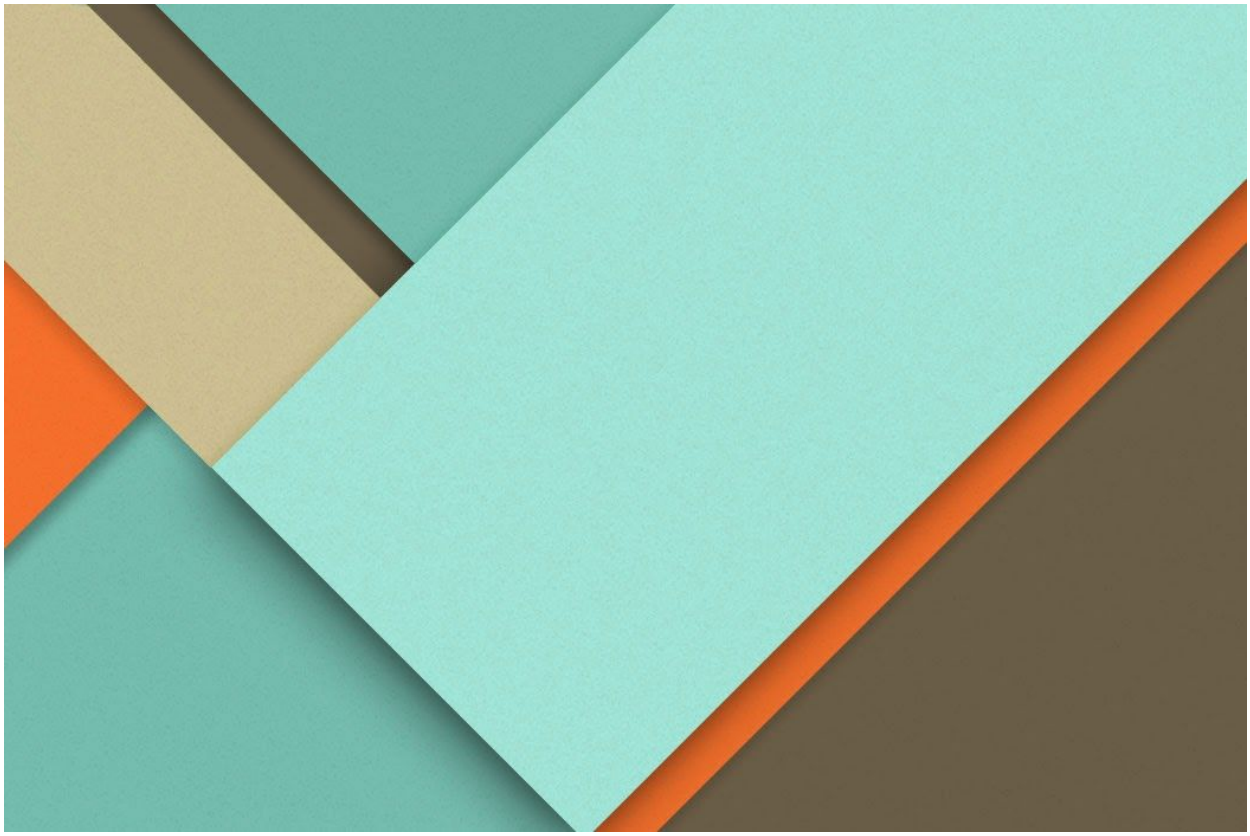

Project Deliverable G

GNG2101

Professor: Dr. Anis

The HearShield Protective Device Project

Team A6

Nicholas Anderson	300078674
Evan Charkowy	300126081
Sofia Ershova	300114465
Liam Genik	300052849
Evan Schonfeldt	300111231

Table of Contents

Overview

The first prototype of the protective device was a low fidelity, focused prototype made to test the weight and size of the product. Through testing of the first prototype the team was able to conclude that this design concept was indeed a viable option. The prototype was brought to the client and feedback was obtained. Luckily, our team was able to test the first prototype with the client as well as with the team members. From the feedback and results from the tests, the team was able to come up with some areas for improvement and ideas for progression of the design. With these in mind, the team created a second prototype focused on materials and manufacturing.

Client Feedback

The client feedback was overall positive. The client was impressed with how well thought out the design was. She particularly liked that the design gave both her and [redacted] options with how to wear it and what colour it would be . The client was fully on board with moving forward with the design. She expressed that she was excited to see the finished product. As this was a low fidelity prototype it did not give the client a full idea of what to expect so there was some uncertainty in that area. The client was concerned about the device just being loose in the case. We explained that the device would have a mold that the device would fit into to avoid rattling. The client expressed that this would be a crucial part of the design as she feared it would distract [redacted] and possibly cause damage to the device. As

this was already part of our design concept, research of how to complete this aspect now has higher priority. One goal for the next prototype is to have a more clear picture of the finished product for the client. This will include incorporating more of the materials that will be used for the final product into the next prototype.

As the user is a small child who cannot fully express her likes and dislikes in words, the main form of feedback is observing how the user interacts with the product. With help from the clients, the team developed a set of criteria for how the interaction should occur (the main goal being that it did not distract or hurt her in any way and would allow her to move without issue). During and after the client meeting, the first prototype was clipped to [redacted]. She was then allowed to continue to move as she usually would. [redacted] was not concerned by the prototype being clipped on although she was curious about the product at first. Once the prototype was fastened to the back of her shirt she forgot about it altogether and continued on without hindrance. She was observed moving about in her daily activities wearing the product. It did not pull on her clothes or distract her in any way. This is exactly what the team was going for when designing this product.

[redacted] expressed that her favourite colour was yellow when asked during the meeting. This is the colour that the team hopes to make the silicon exterior case.

Goals of Prototype II

1. To test the manufacturing procedure and observe the quality of the product.
2. To test durability of the hard case material.
3. To test audio pass through in our chosen waterproof material (cuben fiber).
4. To test the waterproof quality of the material.

Prototype II

The goal of this prototype was originally to simply 3d print a relatively high fidelity model of the case and test the durability of the product through various tests relating to real life scenarios. The case was designed in AutoCad using the dimensions gathered from deliverable D and consists of three components, the base, the lid, and the pin, as shown in the figures below. However, it should be noted that the makerspace's printers are only available once a week and unfortunately our print failed due to unclear reasons resulting in

us having to wait until next week to attempt another print. Having printed most of the case successfully we were still able to have the goal of the prototype be testing durability, albeit with a lower fidelity product. We also decided to broaden the goals of this deliverable and revolve this deliverable around testing our waterproof material, cuben fiber, for how well sound passes through it in order to determine whether or not it is a suitable waterproof cover for microphones of the Nucleus 7.

Figure 1: Base

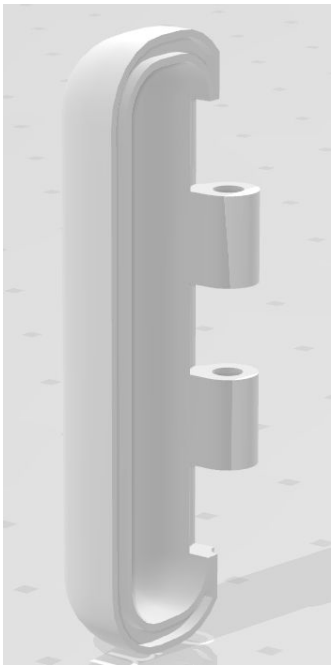

Figure 2: Lid

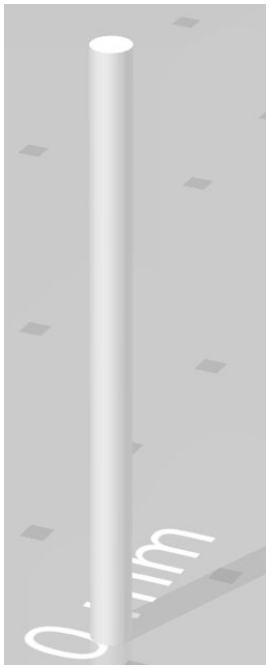

Figure: Pin

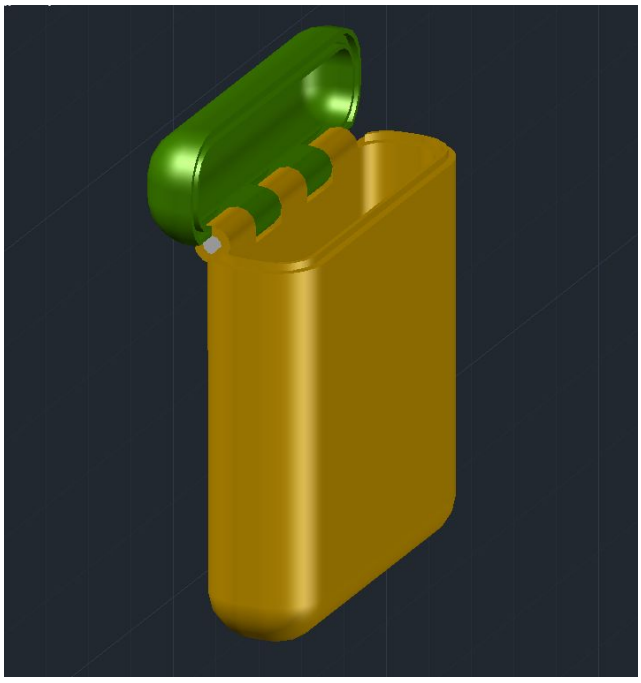

Figure 4: Assembled Case

Figure 5: The failed print of the case

Testing

The focus of this deliverable that was tackled first was to test the ability of sound to pass through the material chosen to act as a impermeable membrane for waterproofing our case, being cuban fiber. In order to accomplish this task, we downloaded an application to our phone which has the purpose of recording the intensity of decibels coming into the device's microphones. The materials involved in this experiment were two phones (one with the audio application running, and one emitting audio), the cuben fiber, a tupperware and its lid. It should be noted that the audio emitted from the second device was "pink noise" and thus the volume level was basically constant. In addition the phone emitting the audio was at the same distance from the audio receiving phone in all tests. To begin, a control test was performed by placing the audio receiving phone in the tupperware without a lid and playing audio from the second phone at a set distance. The phone running the application recorded the audio intensity it was picking up and created a graph (Figure 5) using this data. Next, an almost identical test was conducted with the difference being that the lid of the tupperware was on and in between the two phones resulting in the graph depicted in Figure 6. Lastly, the third test saw the cuben fiber covering the opening of the tupperware which resulted in the application creating the graph seen in Figure 7.

When analyzing the graphs it should be noted that any abrupt dips or rises in dB intensity recorded near the beginning of the recording or the end should be ignored as this was a product of having to start the recording and then place the fiber on the tupperware or the lid. Figure 5, being the graph of the control test, showcases an average audio intensity of 84dB being picked up by the microphones, thus setting the bar for our cuben fiber test. Figure 6 showcases the data from the second test, being that with a closed lid, which features an average audio intensity "heard" by the microphones of around 78dB, which, as expected is lower than the intensity picked up by the control test. Lastly, Figure 9 corresponds to the third test, being the audio recorded through our chosen fabric, cuben fiber. It should be noted that the average audio intensity picked up for the cuben fiber test was approximately 83dB which is extremely close to the value of the control test of 84dB. Therefore, these three tests allowed for the conclusion that cuben fiber is a great waterproof material for our product as it allows for sound to pass through it with ease.

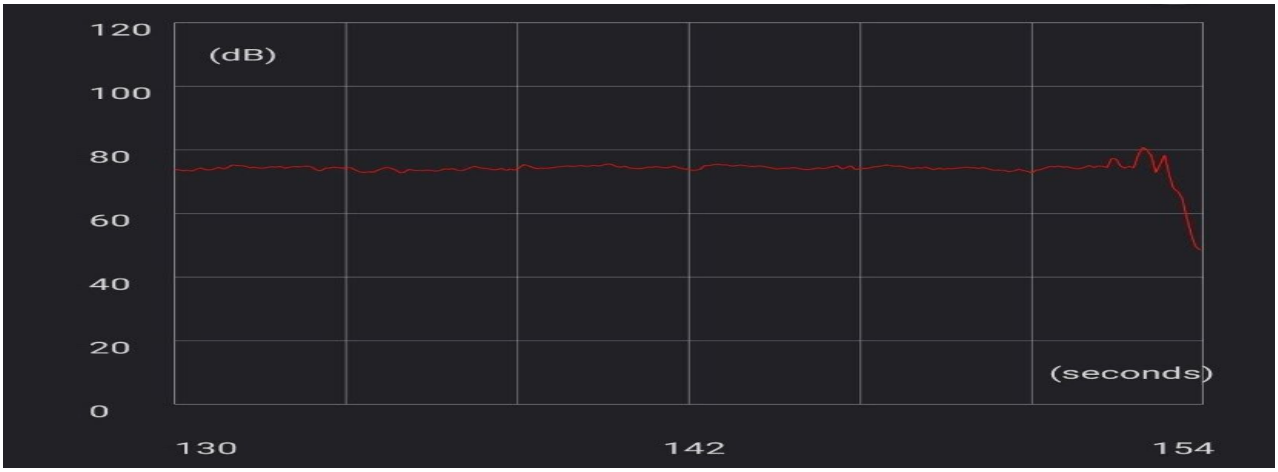

Figure 5: Plastic Container with a Plastic Lid

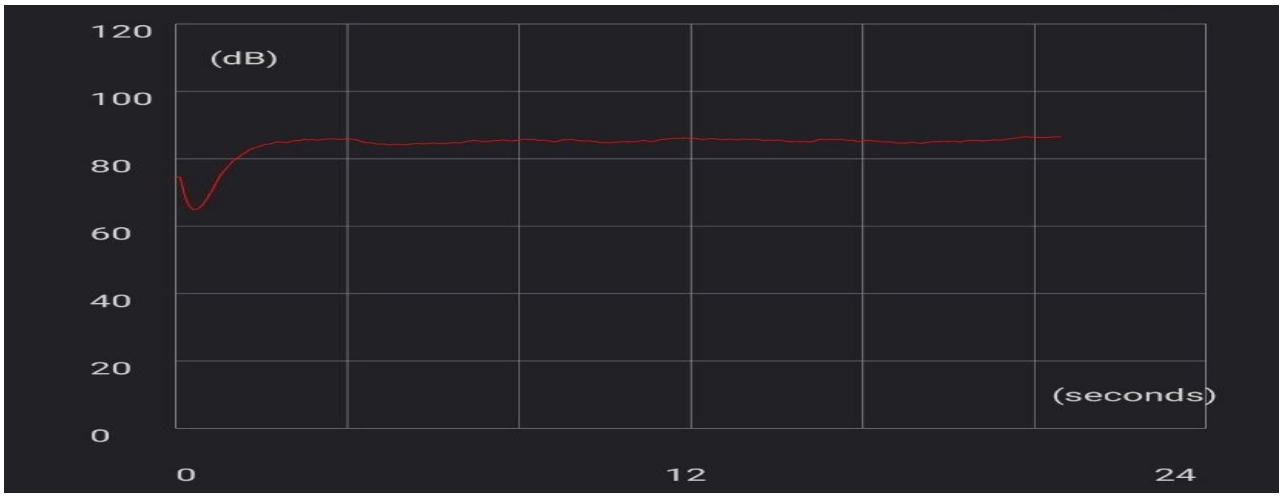

Figure 6: Plastic Container Without Any Lid

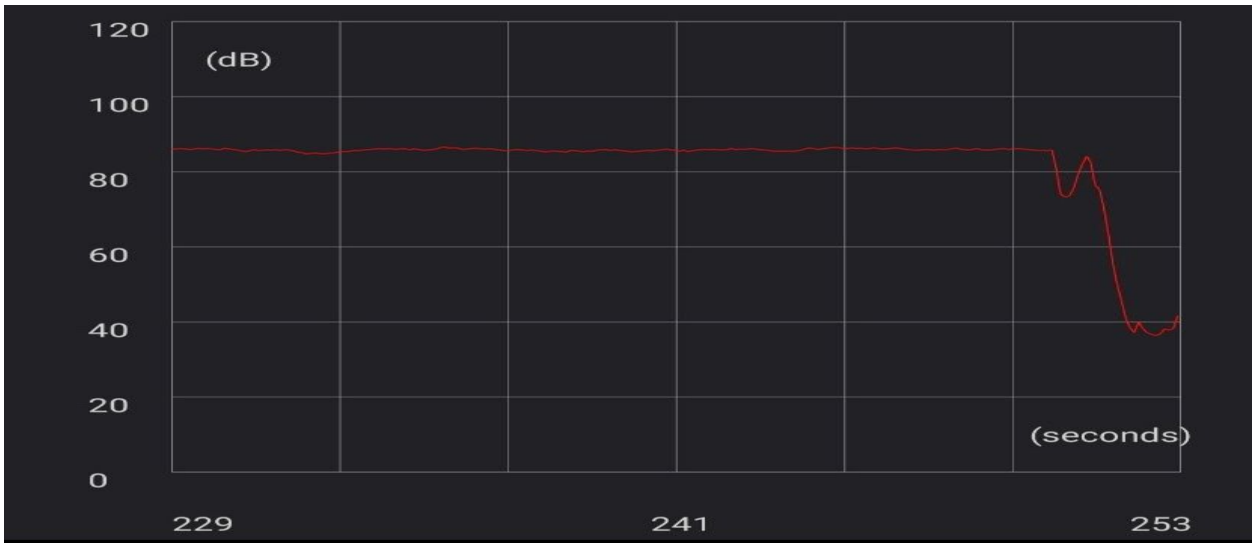

Figure 7: Plastic Lid with a Cuben Fibre Top

Figure 8: Test 2: Cuber Fiber Cover

The second aspect of our testing was the waterproof testing for the chosen material. It is very important for the case to be completely waterproof as [redacted] hearing aid is both expensive and important for her everyday life and water could damage it. We tested the waterproof qualities of the material by securing the sheet of material to the plastic container by rubber bands (as seen above in figure 8). Water was then allowed to rest for a certain period of time on the material. The interior of the container was then checked to see if any water was allowed in. The results of this test show us that the material is sufficiently waterproof as no water made it into the container.

Childproof/Durability Test: ABS Plastic

The first function of testing the ABS plastic case was to test its durability and to see how well it would hold up when left in the hands and curiosity of a child. Unfortunately the lid was the only available part, so the overall size cannot be accounted for when testing. However the lid was dropped from several heights, from 1-3 meters. This material was not even remotely damaged by the impact of the floor. There were no scratches to be seen. Next was the throwing test, taking the lid and throwing it at several materials, drywall, metal, brick, and a door. After throwing it as hard as possible against the materials it was inspected and had no damage whatsoever The material also cannot be snapped in half with the current thickness. Despite being plastic it held up quite well against more than even a child could throw, snap or drop it. Proceeding forward the material was cleaned well and was bitten down on with teeth to test whether or not it would be safe if a child accidentally put it in their mouths. The material was able to withstand an adult bite using molars, however it is to be noted if this was bitten down on at full force it would break someones teeth. The plastic managed to stay intact however a few indents were made to the plastic. With this final test it can be concluded that the material has proven to be childproof, and extremely durable (as long as you're not trying to break it with tools).

Milestones and Project Planning

I. Project Planning

The project plan has been updated according to our recent setback. The plan is the same, however, due to the inconvenience, prototype two and three have been switched. All roles and responsibilities for the separate parts remain the same. As the project plan has not changed due to switching the prototypes, a breakdown of this week's activities have been recorded below instead of submitting a separate file as usual.

First, Liam and Nick are in charge of the development of the 3D model/ design of the prototype.

Following this, Sofia and Evan C are responsible for the physical manufacturing of the prototype.

After completing the following two dependencies in order, Evan S is in charge of the testing of the prototype and ordering of materials needed for the final product. Ordering the materials for the product is the first dependency for the following week when the final product will begin to be created.

These tasks are to be completed for the next prototype delivery date in order to move on with our project.

II. Milestones

As of this deliverable, the team has completed multiple deliverables and hit milestones such as completing prototype I and II precisely on schedule. The third prototype is an upcoming milestone that the team is working hard to complete. Strict scheduling and frequent meetings are taking place in order to ensure this will be met on time and that the best possible quality of work will continue to be delivered.

Conclusions and Plans for Moving Forward

In conclusion, although our team was unable to complete the prototype that was planned for, other equally important aspects of the design were able to be tested. Moving forward, the main goal is to select and order materials that will be used in the final product as well as reprint the hard case for the third prototype. Although the project has had some recent setbacks, the scheduling plans have been readjusted in order to continue with the design and complete the product in time for design day.