Waterproof Hearing Aid

GNG2101 - Progress Report

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Introduction - Problem Statement

We are team A4 presenting for the class GNG 2101, our goal today is to outline our progress in the development of a product to help our client Abigail. She is a Carleton University student who lost her sense of hearing through one ear about one year ago. As a student and recreational swimmer she is concerned about the durability of her hearing aid. Our mission is to develop a product that can ease her concerns and ensure her hearing aid can keep up with her active lifestyle.

Client Needs

Earpiece produces a clear audible sound.

The battery holds a significant charge

Earpieces are small enough to be both comfortable and secure for long periods of time.

Battery level indicator.

Bluetooth connectivity.

Hearing aid can easily be powered on or off.

Metrics And Target Specs

Metric #	Metric	Unit	Marginal Value	Ideal Value
1	Duration of Battery	Hours (hr)	>6	10
2	Sounds level	Decibels (dB)	>15	60
3	Amount of time to power off	Seconds(s)	<10	3
4	Length of earbud sleeve in ear canal	Centimeters(mm)	<7	4
5	Weight	Ounces(oz)	<0.14	0.8
6	Length of Over ear hook	Centimeters(cm)	<5	3
7	Length of earbud frame	Centimeters(cm)	6	2

Benchmarking

Specifications	1	2	3	4
Company	JINGHAO	Life Changing Products	IQbuds MAX	GNG2101 Team
Material	SIlicone and Iron	Plastic	Silicone	Silicone Gore-Tex
Price	CAD$ 169.99	USD$ 74.20	CAD$ 499.99	Material Cost
Estimated Battery Life	long	35 hours	-	N/A
Water Resistant	Yes	Not mentioned	Yes	Yes
Dimension	0.8 x 1.3 x 4 cm;	12 × 6 × 8 cm	9 mm	= To Current
Power Source	Battery	Rechargeable	Rechargeable	N/A
Weight	3 grams	4 grams	Not mentioned	Varies with model
Noise Cancellation	not mentioned	Not mentioned	Hybrid ANC	N/A
Color	Nude	Grey	Black	Variable

Concept generation

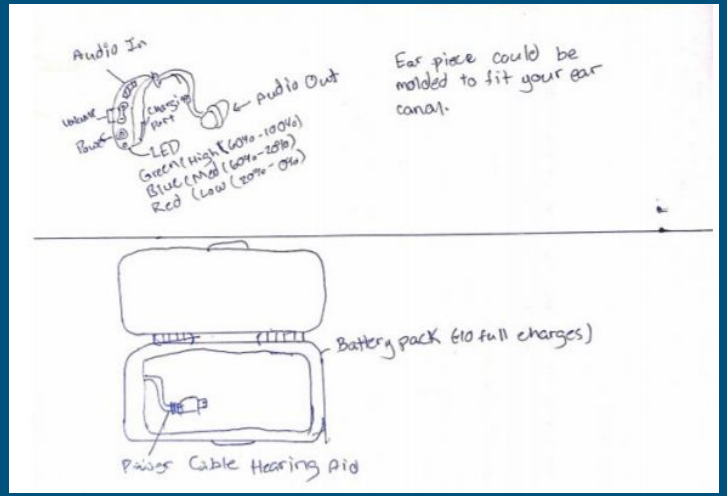
Most team generated concepts touched on the idea of reading the battery level, bluetooth and waterproofing

Feasibility Study 1 showed our current plan was flawed
1. We were only able to make hearing aid water resistant, not waterproof

2. Keeping the hearing aid on while swimming would prove to be a real challenge

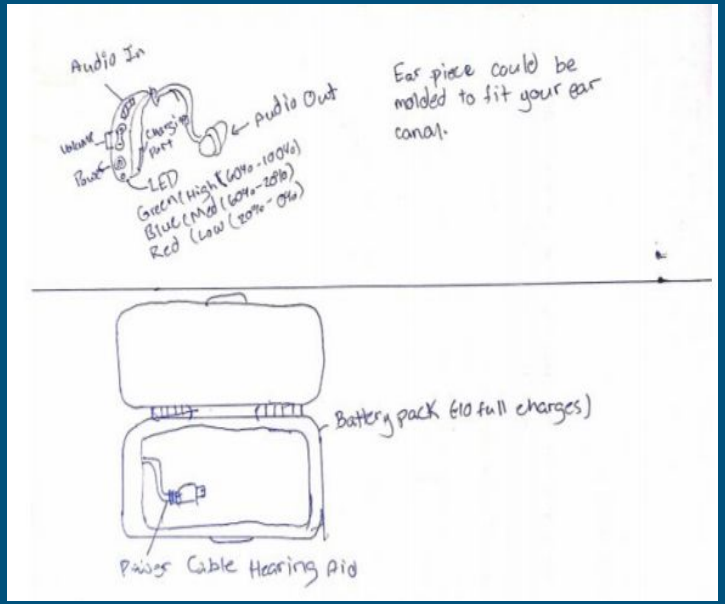
3. Long lasting battery and low budget did not mix well together.

4. Bluetooth does not work through water



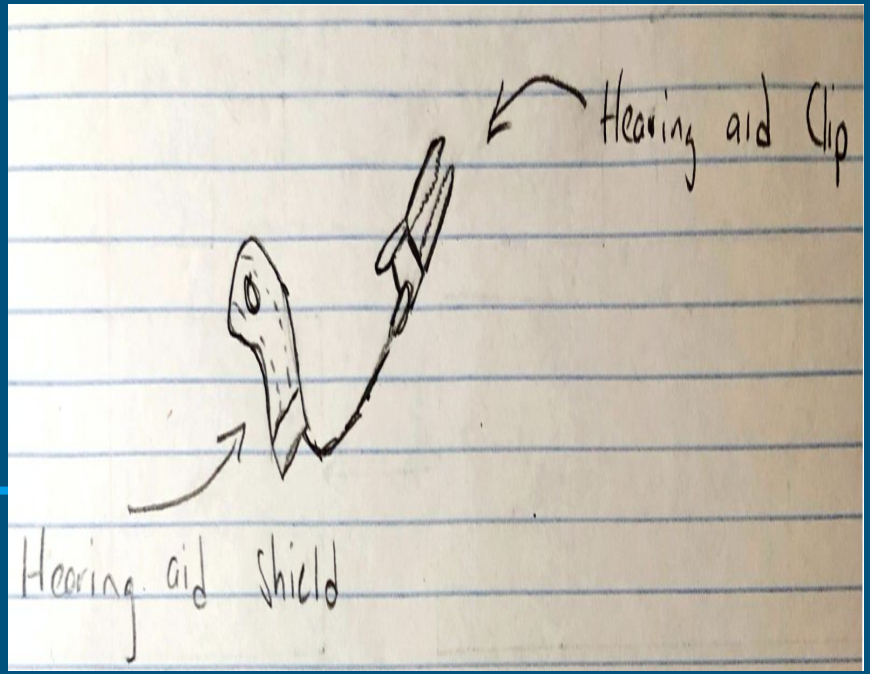
Proposal 1

The hearing aid itself will be a “behind the ear” style in which the external portion houses the microphone, the battery, audio/power controls and a battery indicator LED. The audio output portion of the hearing aid will be in the form of a the flanged earbud. Material selected for the exterior of the hearing aid will be a waterproof polymer, a hydrophobic mesh will cover areas where sound must enter or exit the hearing aid. The carrying case will be a simple plastic case housing a battery with two LED power indicators on the outside, one showing the power of the case, the other showing the power of the hearing aid.



Proposal 2

It is a protective shield for our clients current hearing aid. We will find all the necessary dimensions of the hearing aid and design a case that will be used specifically to repel water. The client will have the option to take off and put on the case accordingly. This may be the best proposal since the user will not need to carry multiple hearing aids for different occasions, therefore this would be a very convenient design.



Final Concept

- The final concept is a reduced feature case which will resist water and measure the client's existing hearing aid battery levels.
- It's to be made of the same material that 3D printers use as their ink (ABS), as it's already been demonstrated to be water resistant.
- It also needs the client's existing hearing aid model as a base for the build specification and proportions of the case.
- The ability to measure the battery level of the hearing aid is still a WIP.

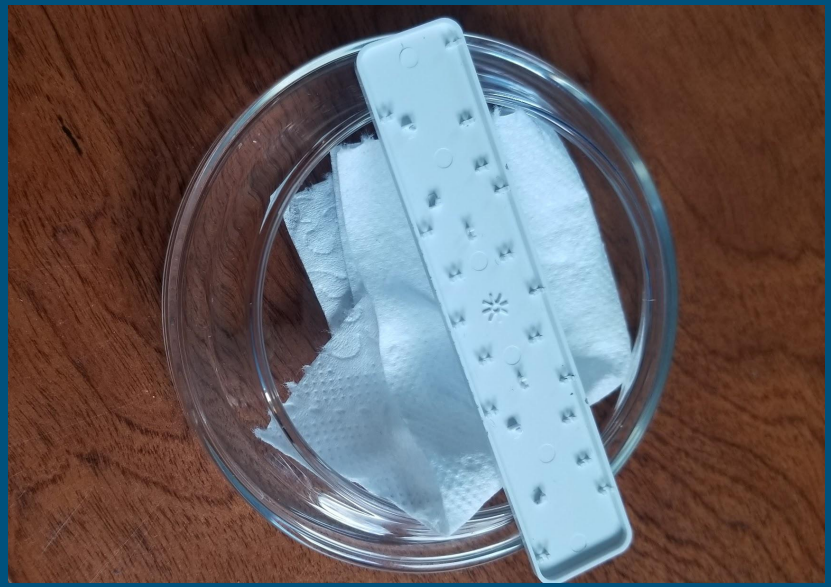
Prototype 1

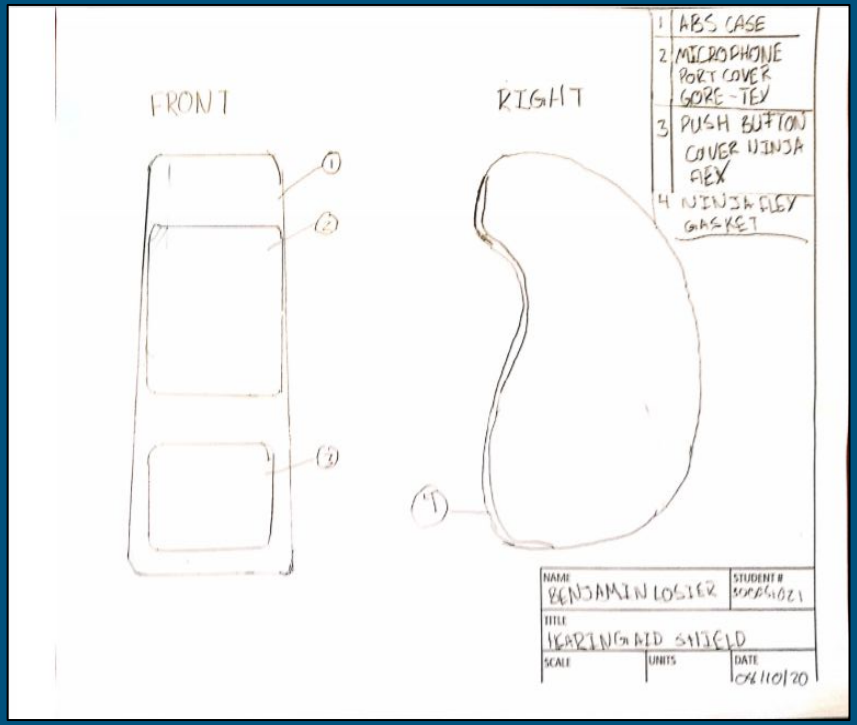
Testing ABS

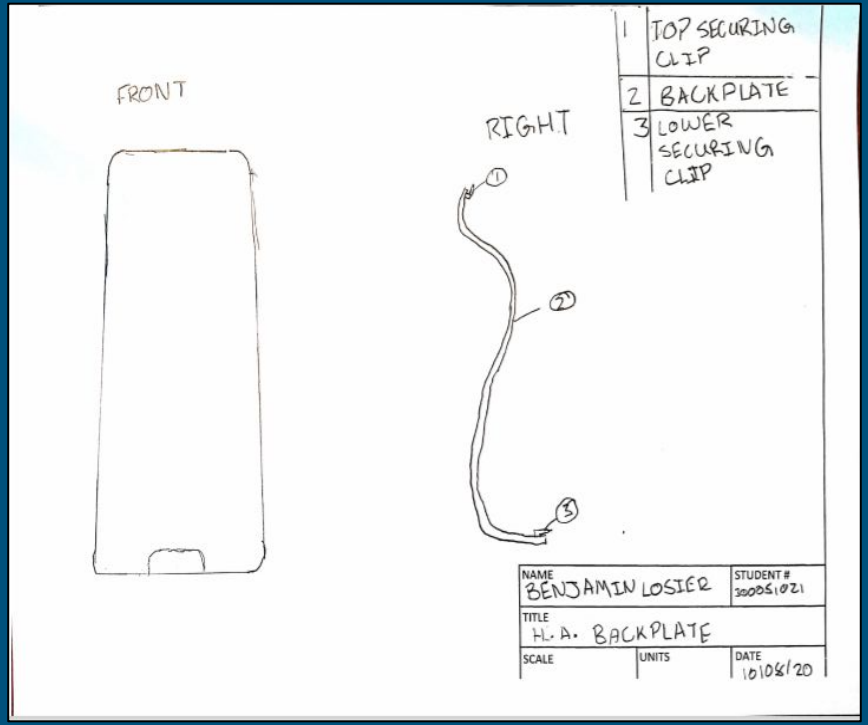
An experiment was conducted to test the quality of ABS.

This was done using a spacebar from a keyboard, water, napkin and a round dish.

Results proved that ABS is a water resistant material.

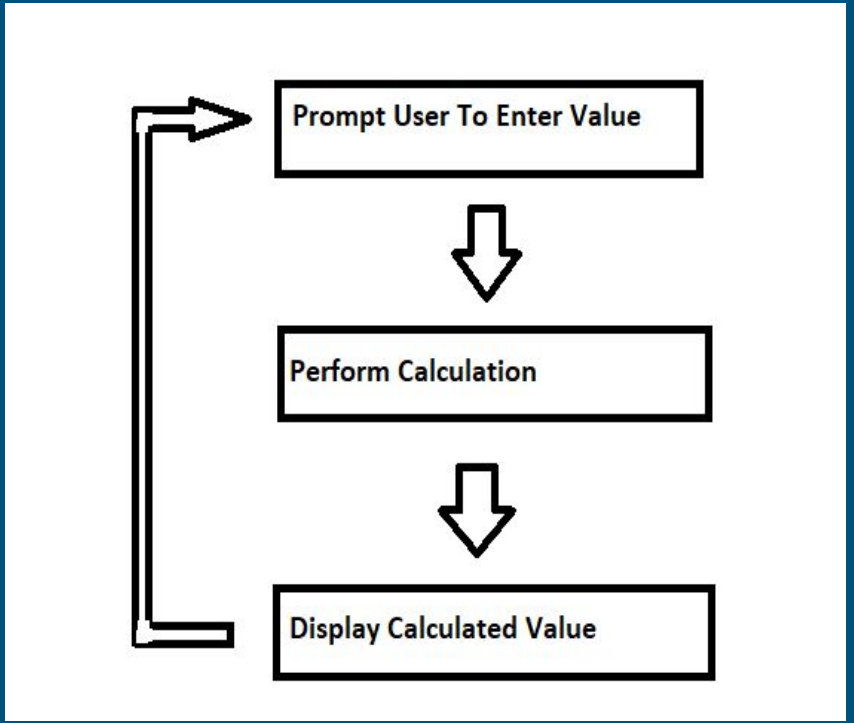






The two photos above form the complete ABS shield. NinjaFlex is used for the push button as well as for the gasket creating a seal between the two parts. A Gore-Tex mesh is used over the microphone to allow sound to pass through but prevent water from seeping through.

A simple flow chart explaining the functionality of the app was created.



Client Feedback and Improvements

In our last client meeting we showed our client the conceptual design of the water-resistant case, we also explained some features we intend to add with the case (app to calculate battery level).

Our client was happy with the progress we made, and didn’t have much to say regarding what we should change, since our design concept satisfies most of the needs we got from the first client interview.

Future Plans for Prototype

Using our conceptual design we will start to make the design on SolidWorks, using SolidWorks will allows us to see our design in much greater detail.
Once we are satisfied with the design we will send it to the 3D printing station so we can print off the physical case. We'll use the waterproof material in the 3D printer so we can run experiments with the case and confirm it will be able to withstand a reasonable amount of water.
The next part of our plan is to create the user interface for the app and build the software necessary to make the remaining battery life calculations.

Updated Project Plan

GANTT CHART

24	✓	PD E: Project Progress Presentation	No	Benjamin L		Thu 20-10-08	Thu 20-10-15	Thu
25		Client meet 3	No	Joey B		##########	##########	NA
26		PD G	No	Omolola O		##########	Tue 20-09-22	NA
27		Prototype 2	No	Rehana I		##########	Fri 20-09-25	NA
28		Sub-task related to prototype 2	No	Benjamin L		Tue 20-09-15	Tue 20-09-22	NA
29		Sub-task related to prototype 2	No	Joey B		Tue 20-09-15	Tue 20-09-22	NA
30		Testing	No	Omolola O		##########	Thu 20-09-17	NA
31		PD I	No	Rehana I		##########	##########	NA
32		Final Prototype	No	Benjamin L		##########	##########	NA
33		Sub-task related to final prototype	No	Joey B		Tue 20-09-15	Wed 20-09-30	NA
34		sub-task related to final prototype	No	Omolola O		Tue 20-09-15	Wed 20-09-30	NA
35		Design Day	No	Rehana I		##########	Tue 20-09-15	NA
36		Project Objectives	No	Benjamin L		##########	Tue 20-09-15	NA
37		Quality of deliverables	No	Joey B		Tue 20-09-15	Tue 20-09-15	NA
38		Project performance and cost	No	Omolola O		Tue 20-09-15	Tue 20-09-15	NA
39		Schedule status	No	Rehana L		##########	Tue 20-09-15	NA
40		Closing	No			##########	Tue 20-09-15	NA
41		PD J: User manual	No	Benjamin L		##########	Sat 20-09-26	NA
42		PD K: Final presentation	No	Joey B		Tue 20-09-15	Thu 20-09-24	NA