

Hwa Chong Institution
Project Work
Category 3 Inventions Log Book

Title of Project:	<u>Callity</u>
Project ID:	3-
Group Name:	<u>Callitizers</u>
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1 – PROBLEM FINDING

Ideation Stage

We brainstormed and identified 5 problems, which either we as students or the people around us face in our daily activities.

Problem 1

Some people prefer to use the mouse instead of the track pad on their laptops as some track pads on the laptops are small. However, we observed that many students like us who bring laptops and mouse to school, often forget to bring the mousepads. Without the mouse pad, a mouse cannot be used on rough, soft, or glass surfaces.

Therefore, a mousepad which can double-up as a bag for the mouse would not only serve to protect the mouse from damage but also ensure one would no longer forget to bring the mousepad.

Problem 2

With climate change, the weather is getting more and more erratic. When someone is walking outdoors under the sun, it might suddenly rain and the person would be at the mercy of the elements.

Thus, it would be convenient to have a bag with an attached hood so that it can turn into a partial raincoat when it rains.

Problem 3

When one's laptop runs out of battery in public, he might not have the charging wire for the laptop. Even if he has, there might not be a charging port.

Thus, it would be convenient to have a 2-in-1 power-bank + adaptor which can charge a variety of devices on the go.

Problem 4

Many e-scooter riders ride above the speed limit of 15 km/h without knowing it. This might lead to accidents. Pedestrians may also be unaware of an e-scooter coming up behind them and be unable to move away in time.

Hence, a device that tracks the e-scooter's speed and beeps continuously when the speed crosses the speed limit would solve the problem. Firstly, the e-scooter rider would be informed that he has crossed the speed limit so that he can slow down. If he does not slow down, he would be embarrassed by the continuous beeping sound and "forced" to slow down. Second, the pedestrians will hear the e-scooter that is coming at a high speed and have time to respond. Lastly, the LTA Enforcer will know that the e-scooter rider has exceeded the speed-limit without the need of a speed gun.

Problem 5

Firstly, imagine you receive a call when you are in a noisy place such as the mall or the school canteen. When faced with this situation, it is common for anyone with a smartphone to encounter the problem of not being able to hear what the person on the other line says. This is because the top front-facing speaker of the phone is not loud enough.

Thus, a compact universal amplifier attached to the top front-facing speaker of most smartphones would solve the problem.

Problem Identification Methodology

Three main considerations were used to select our problem.

First, the validity of the problem. We carried out a survey to find out if people face the same problems.

Second, whether the problem is solvable within the time limits and our abilities. We are required to come up with the solution, or to build an actual prototype. Thus, if the problem we choose is unsolvable within the time limits and our abilities, our solution will not be realistic.

Third, whether existing solutions need improvements. If the problem has an existing solution, we will have to consider if we can do it better than them, be it cheaper, better in design or more user friendly.

Finally, a problem evaluation grid was used to identify the problem we would solve.

Validity of the problem

The link and the results to the survey to find out if people face the same problems are as follows:

Link to Survey 1 (Problems 1 to 3): <https://docs.google.com/forms/d/e/1FAIpQLScnSDVQ-ZPxgCtVh1I6-166EoZxsPgMRfmVxoUFVrjJXQNIQ/viewform>

Link to Survey 2 (Problem 5): <https://forms.gle/gnshNZR84umSbxix5>

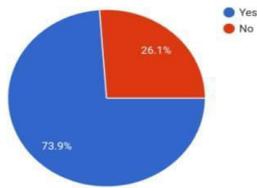
For Problem 4, as of 5th November 2019, e-scooters were banned on footpaths, hence Problem 4 is no longer valid and omitted from the survey.

Problem 5 was added later on, hence it is featured in a separate survey.

Survey 1

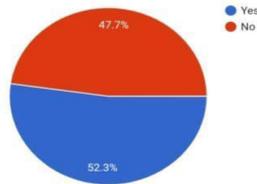
Do you use a mouse when you use a laptop?

88 responses



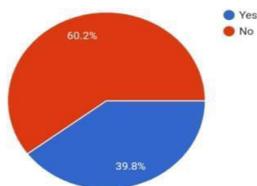
Do you often forget to bring a mouse pad when bringing the mouse?

88 responses



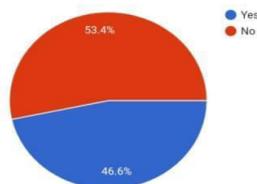
Do you often forget to bring your umbrella / raincoat?

88 responses



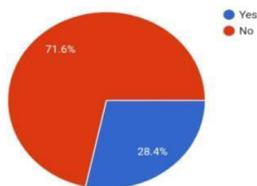
Do you often bring a haversack when going outdoors?

88 responses



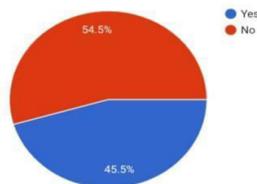
Does your laptop's battery often run out when you are not at home?

88 responses



Are charging points in public areas easily available?

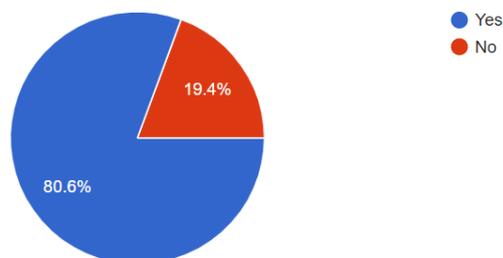
88 responses



Survey 2

When making a call in a noisy environment, do you face the problem where the front-facing speaker may be too soft, which results in inability to hear the person on the other line?

67 responses



Based on the two surveys, Problem 5 had the highest percentage of people who face the problem among all the 5 problems identified.

Solvability of the problem

Solvability of problem 1:

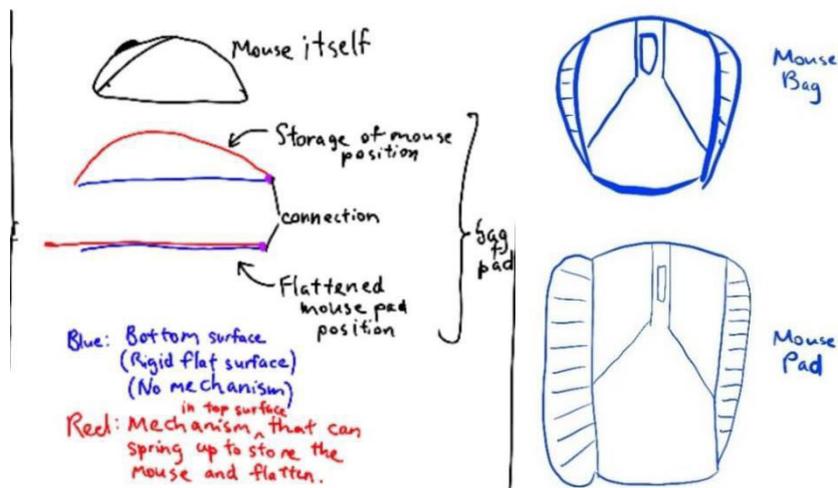
A mousepad can curve into a rigid bag to store and protect the mouse from damage when bringing around, and be flattened into a mousepad when needed.

Inspiration: Microsoft Surface Arc Mouse.



The Microsoft Surface Arc Mouse can be flattened for portability and bent into a curved shape for usage as a mouse.

The Arc Mouse makes use of two metallic strips. When a force is applied to bend it, the inner strip will protrude out from the outer strip until the position is locked by a stud attached to the inner strip. A similar mechanism can be manufactured for our invention of the One-Click Mousepad.



The red part of the mouse pad, when flattened, will be larger than the blue part, which means that the mousepad will be much larger than the mouse itself. Thus, despite the mouse bag being approximately the size of the mouse, the mousepad is still large enough so that the user can still use it like a normal mousepad.

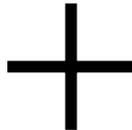
Solvability of problem 2:

The bag has a hood attached to a small compartment at the top of the bag and the sides of the raincoat are kept in compartments at the sides of the bag. They can be removed from the compartments and zipped up into a partial raincoat

Inspiration:



Bag



Hooded jacket

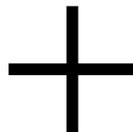
Solvability of problem 3:

A power bank can be combined with a travel adaptor to have various different outlets to charge different devices, like smartphones, tablets or laptops.

Inspiration:



Adaptor



Power Bank



Travel

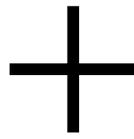
Solvability of problem 4:

There are existing e-scooter speed trackers attached to the wheel that will track the speed. We can look into modifying the speed tracker and incorporating a buzzer. This way, the speed tracker will have a shrill beep when the speed-limit is crossed to warn the rider to slow down.

Inspiration:



Wheel Speed Tracker Attachment



Buzzer

Solvability of problem 5

The objective of the solution is to increase the volume of the top speaker of handphones. A compact universal amplifier which can be attached to the front-facing speaker of most smartphones would solve the problem. Inspirations for the solution come from the phone horn and the clip-on lens for handphones. Therefore, we can design a universal amplifier for the top front-facing speaker that can be used for most phones.

Inspiration:



(Phone Horn that is attached to main speaker) (A clip-on microscope for phone cameras)

Whether existing solutions need improvements

Existing solutions for problem 1:



Foldable Mouse Pad

The foldable mouse pad can be folded into a mouse bag and unfolded into a mouse pad. However, it is soft and has very little rigidity, which means that, on soft surfaces such as sofas, beds, or one's lap, it cannot function.



Laptop Sleeve with Mouse Pad

The laptop sleeve keeps the user's laptop and when opened, the cover can be used as a mouse pad. However, the folding creases on the mousepad makes it very bendable and movable, which means that it will not be flat on surfaces that are not flat, and may move on soft surfaces.

Existing solutions for problem 2:



Jacket with a bag attached

This jacket has a bag attached to the back of the jacket. However, the jacket cannot be kept inside the bag and the capacity of the bag is small.

Existing solutions for problem 3:



Mobison Universal Powerbank

This power bank adaptor is high capacity and high voltage with different types of outlets, effectively solving the problem.

Existing solutions for problem 4:



E-scooter Speedometer

Speedometers only allow the user to see their speed and do not notify them when they have crossed a certain speed. It does not help pedestrians to avoid e-scooters, nor does it allow law enforcers to easily track e-scooters travelling past the speed limit.

Existing solutions for problem 5:

When one cannot hear through the top speaker of handphones, one might use the loudspeaker to mitigate the problem of not being able to hear the person on the other line. However, that will result in a loss in privacy of the conversation and may not be feasible if the information to be related is confidential.

The other option would be to use earphones which may be wireless ones which are blue-tooth enabled or wired ones.



However, both types of earphones take time to connect to the handphones and by then it might be too late to pick up the call. Wireless earphones require Bluetooth connection and that takes time to connect. For wired earphones, people may be put off by the long and entangling wires. Hence, the current solutions are not ideal.

Problem Identification

Scoring the three main considerations against the problems using a problem evaluation grid, it was identified that the fourth problem on top front-facing audio speaker being too soft to enable conversation in noisy places will be solved.

Considerations for Selection	Problems			
	When one brings his laptop, he often forgets to bring his mousepad	Erratic weather can cause an unprepared person to get wet during a sudden rain.	When one's laptop runs out of battery in public, he may not have the wire or an available port to charge it.	Top front-facing audio speaker for calls is too soft, resulting in users being unable to listen to calls in noisy places.
Validity of the problem	3	2	2	4
Whether the problem is solvable	3	2	1	4
Whether existing solution needs improvements	1	1	1	4
Total Score	7	5	4	12

2 – THE PROBLEM

Now that the problem has been identified, information on the extent of the problem was gathered so as to come up with our problem statement. A target needs analysis was then carried out on our target audience through a survey. In addition, the usefulness of existing solutions were compared against each other. Finally, a solution evaluation grid was used to evaluate the existing solutions against our proposed invention to demonstrate that our solution would be better.

Extent of Problem

There are various situations where a “speaker amplifier” for the top front-facing speaker of a handphone will come in handy. Besides the situation of the noisy environment, there are also people whose hearing has deteriorated such as the elderly that will find the top speaker being too soft.

Callity is a front facing microphone speaker, ideal in situations such as:

1. Usage in **public places**, where noisiness would not be a problem due to Callity being effective in amplifying the volume, providing one with clear audio in high definition in noisy surroundings.
2. Usage for **people with weaker hearing such as the elderly, or people suffering from clinical hearing loss**, or one who enjoys louder volume, allowing them to communicate with their family and friends with crisp and clear audio definition. This means that one would no longer have to struggle to grasp the words that are being emitted from the mobile device, and instead listen with ease.

Thus, the **problem statement** to solve the problem of not being able to hear well when using the top speaker of handphone is:

How might we improve call quality of handphones in noisy situations

Target Needs Analysis

A survey to find out the extent of the problem was sent out to our target audience who were students and adults to find out:

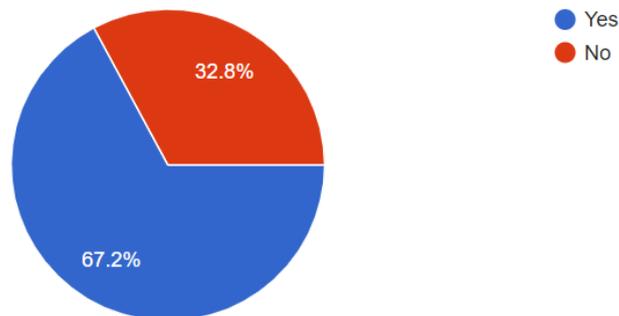
- a) Whether people would like to have a device that will amplify the sound of the top front-facing speaker for calls faster than having to connect to Bluetooth or wired earphones which takes time
- b) Whether people would like a device that will allow them to hear the person on the other line better without putting their phone to loud-speaker mode so that one does not lose their privacy in conversation

The link and the results to the survey are as follows:

Link: <https://forms.gle/L4cZew6UjQGa4JMd6>

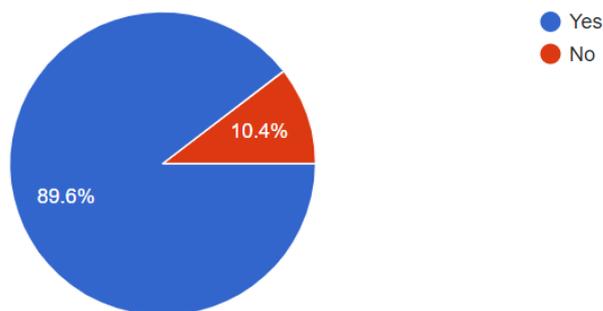
When you are in a noisy environment, would you like to have a device that will amplify the sound of the top front-facing speaker for calls faster than having to connect to Bluetooth or wired earphones which takes time?

67 responses



When you are in noisy environment, would you like a device that will allow you to hear the person on the other line better without putting your phone to loud speaker mode so that you do not lose your privacy in conversation?

67 responses



The results of our survey, where 67 responses were received, showed that:

- Around two-thirds of the respondents would like a device that amplifies the sound of the top front-facing speaker rather than having to connect to Bluetooth or wired earphones
- Almost 90% of the respondents would like a device that would allow them to hear the person on the other line better without putting their phone to loud-speaker and losing their privacy.

Based on the survey, people would like to use our solution.

Compare and Contrast the Existing Solutions

These are the existing solutions in the market.

Features	 (True) Wireless Earphones	 Wired Earphones
Ease of usage (Easy to set-up)	Yes No entangling wires	No Wires entangle easily
Time taken to set-up	Moderate Requires turning on and connecting via Bluetooth	Slow Requires unwinding of wires
Effectiveness (does it solve the problem)	Yes	Yes
Cost	\$100-\$500	\$10-\$400

The table above compares and contrasts the existing solutions in the market, wired and wireless earphones. Wired earphones face the problem of being difficult and time-consuming to set up, due to the entangling wires and the need to plug into the audio port as well as hooking it to the ears. Wireless or Bluetooth earphones also take time to connect, making them unviable for picking up calls. There are bluetooth earphones that can connect much faster than others like the Apple Airpods Pro, but their hefty cost at \$450 may not be ideal for the purpose of picking up calls.

Solution Evaluation Grid

This is the results of the Solution Evaluation Grid (Scale of 1 to 3). Scoring the considerations against the various solutions, our solution is a better choice in terms of ease of usage, time taken to set up and cost. Therefore, our proposed invention will bring greater benefits to the users.

Considerations for Selection	Solutions		
	(True) Wireless Earphones	Wired Earphones	Our Solution – Callity
Ease of usage	3	1	3
Time taken to set-up	2	1	3
Effectiveness	3	3	3
Cost	1	2	3

Total Score	9	7	12
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These are the limitations of the existing solutions, which we would take into consideration when coming up with Callity.

Firstly, for ease of usage, entangled wires from traditional wired earphones are troublesome and time consuming to disentangle, causing physical inconvenience. In contrast, Callity has no wires to disentangle and only needs attaching to the mobile device, making it convenient and easy to use.

Next, time taken to set-up. Some (true) wireless earphones or bluetooth earphones do not perform well in this area. They take time to turn on, pair and connect to the phones. Wired earphones may take even longer due to unwinding of the wire. We envision Callity to perform well in this area as it would be just an “attach and work” device.

In addition, the cost of (true) wireless earphones spans a wide range. Good Bluetooth earphones that connect much faster than others are extremely expensive, making them not very affordable for the general public. For example, the AirPods Pro costs more than 300 SGD and the Sennheiser Momentum True Wireless costs more than 450 SGD. In comparison, Callity would be much cheaper..

Finally, how well the sound is amplified. Earphones are able to direct the sound right into the ear as the earpiece is inserted into the ear. Thus, users would be able to hear clearly in most environments. This will be one of the considerations when making the prototype for Callity. Callity must be able to amplify the sound of the top speaker so that the user can hear the other party in a noisy environment.

In conclusion, Callity would be an inexpensive solution that does not take excessive time to attach to the mobile device.

3 – THE BIG IDEA

Our Proposed Invention

Our proposed solution is to come up with a speaker amplifier that can capture the sound from the top speaker of handphones, amplify it and direct the sound to the ear.

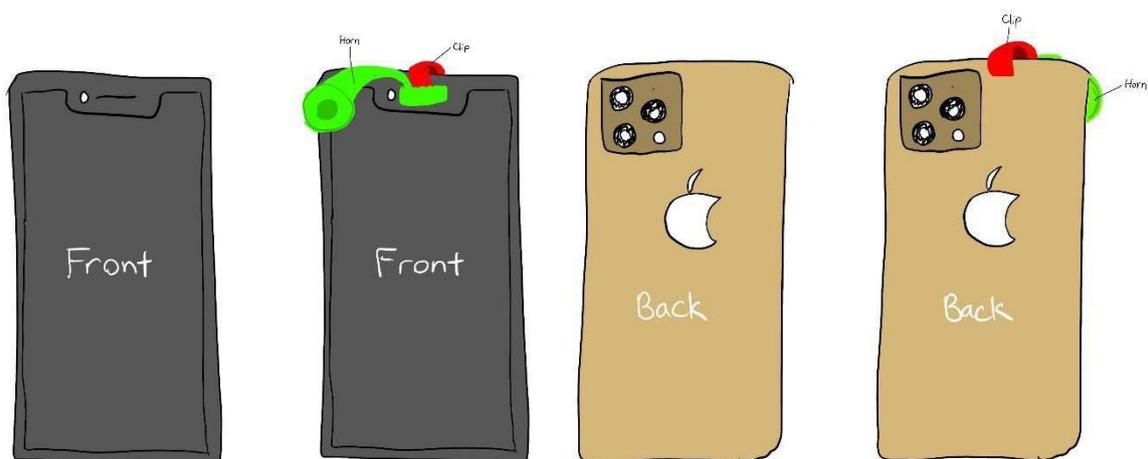
Inspiration of the invention was from the phone horn for main speakers of handphones which are typically located at the bottom.

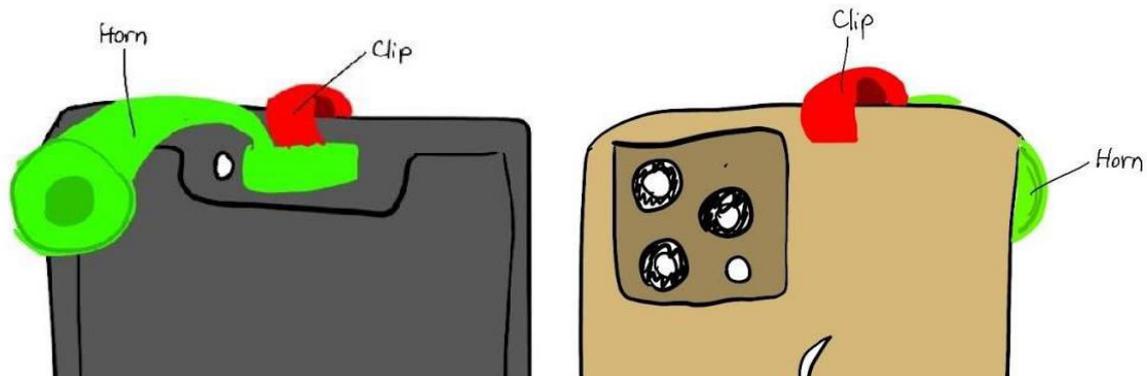
The phone horn is a passive sound amplifier and achieves its amplifying effect by improving the coupling efficiency between the speaker and its cone-shaped funnel. The cone-shaped funnel directs the sound so that more of the sound energy is sent in the direction of the cone, instead of radiating outwards in all directions. Thus, the result is a greater acoustic output from the speaker.



(Phone Horn)

Sketches





Purpose Statement of Our Proposed Invention

Considering the user needs, the top speaker amplifier will be designed to be versatile so that it can be attached to most handphones, affordable for most people, portable, and easy to use so that the user can attach the device to the phone and pick up the call quickly.

Thus, our purpose statement is:

To design a speaker amplifier, which is easy to use, and can be attached to most handphones

Potential Benefits to Users

The potential benefits to users are:

- a) Users no longer have to put their mobile device to loud-speaker mode and lose their conversation privacy when they are in a noisy environment;
- b) Users will be able to amplify the volume of the top speaker at a fraction of the cost of existing (true) bluetooth earphones and wired earphones;
- c) Our invention is a detachable speaker amplifier, which can be attached to most handphones.

Therefore, our proposed invention will be better than existing solutions.

Expected Problems of Proposed Invention

We expect the following problems in the course of our proposed invention:

- a) The weight and size of the speaker amplifier which may impact on the portability;
- b) The amplification of background noise which impacts on the user to hear clearly in most environments;
- c) The degree of sound amplification accorded to the user.

We will include ergonomics considerations in the course of our invention so that the user can handle the device with ease.

Major Milestones

The project timeline of our invention was as follows:

Proposal Evaluation Stage

Part 1 - Generation of problems □ 17 October 2019 onwards

Meeting with mentor □ 23 October 2019

Meeting with mentor □ 29 October 2019

Problem Identification □ 29 October onwards

1st Survey on Validity of Problems □ 13 November 2019

End of 1st survey on Validity of Problems □ 19 November 2019

Part 2 – The problem □ 19 November 2019 onwards

Internal group meeting □ 26 November 2019

Meeting with mentor □ 20 January 2020

Official registration of project on ISP □ 21 January 2020

Registration for IVP □ 21 January 2020

New problem identified □ 1 February

IVP meeting □ 3 February 2020

2nd survey on Validity of Problems (New Problem) □ 7 February 2020

Survey on Needs Analysis sent out □ 7 February 2020

End of 2nd survey on Validity of Problems □ 13 February 2020

Completion of Part 1 of logbook □ 13 February 2020

End of Survey on Needs Analysis □ 13 February 2020

Sketching of Prototype □ 13 February 2020 onwards

Meeting with mentor □ 17 February 2020

Mid-term Evaluation Stage

Searching for materials for prototype □ 18 February 2020 onwards

Meeting with mentor □ 10 March 2020

Final Evaluation Stage

Making of Prototypes → 1 March onwards

Disruption due to circuit breaker

4 – Construction Process

Main Considerations for Fabrication of Prototype / Product

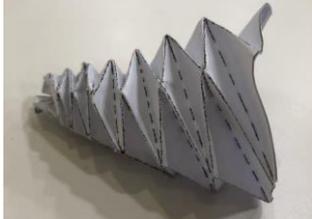
The following are the main considerations that guided not only the construction of our prototype/product but also the selection of materials for the making of our prototype.

- Whether the prototype amplifies the sound to a degree of more than putting the phone directly to the ear
- Whether the prototype would be able to attach to most phones securely
- Whether the prototype is portable
- The cost of the product

Selection of Materials for Prototype / Product

Amplifier

We made use of objects that we could find at home. In selecting the amplification device, we chose between the bamboo pole cover, plastic funnel and origami spiral cone based on the criteria: size, weight and cost. All 3 are extremely lightweight and cheap.

Features	 Bamboo Pole Cover	 Plastic Funnel	 Origami Spiral Cone
Size	3.5cm long	7cm long	7cm long (lengthened) 0.5cm long (compressed)
Weight	Very light	Very light	Very light
Cost per piece	25 cents	50 cents	Negligible

All 3 products are low cost and fulfil the condition of directing sound. However, the origami spiral cone would occupy the least volume when folded (when not in use), and can easily unfold into a horn structure (when in use). Hence, the origami spiral cone is the most portable as it is compressible.

Although the origami spiral cone is favoured for its portability, all 3 materials will be tested for their ability to amplify the sound.

Attachment to Handphone

For attachment to the handphone, we found a Fish Eye Lens Phone Clip which costs \$2. The phone clip is versatile as it is able to attach to most smartphones easily. Besides, there is an existing hole meant for the fish eye lens, which allows sound from the top speaker of the handphone to pass through.



5 - Fabrication

Test Iteration for Modification and Evaluation

With the completed prototype, we evaluated it against 4 main criteria to check if the prototype works. We then proceeded to identify areas of weakness for modification prior to making another prototype.

The test criteria were:

1. Degree of amplification of sound from handphone
2. Blocking of background noise
3. Ability to attach to most smartphones
4. Portability

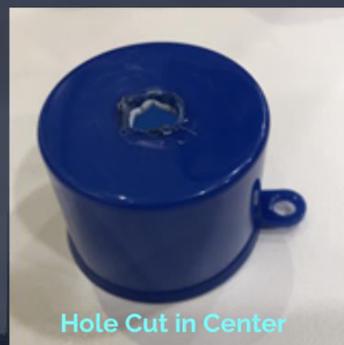
Making of Prototypes

Prototype 1

For our first prototype, we tested the bamboo pole cover. We cut a hole in the centre of the bamboo pole cover and attached the phone clip.

Prototype 1

Bamboo Pole Cover with Hole Cut in Center



Test Iteration 1 for Prototype 1

Test Iteration: Prototype 1	Tick			Remarks
	Pass	Fail	Potential Failure	
Test Date:				
Amplification of sound		✓		Did not amplify sound from handphone
Blocking of background noise	✓			Able to block out noise from surroundings
Able to attach to most handphones	✓			Clip is versatile
Portability		✓		Bulky

After conducting an iteration test on it, we found prototype 1 was able to block out the noise from surroundings. However, it was not able to amplify the sound from the handphone.

Prototype 2

In an attempt to increase sound amplification, we modified prototype 1 by adding the plastic funnel with its end sawed off to the bamboo pole cone. The funnel mimics the cone-shaped horn in a loudhailer that is used to amplify a person’s voice or sounds and direct it in a given direction.

Prototype 2

Modification to Prototype 1 using Plastic Funnel



Test Iteration 2 for Prototype 2

Test Iteration: Prototype 2	Tick			Remarks
	Pass	Fail	Potential Failure	
Test Date:				

Amplification of sound		✓		Did not amplify sound from handphone
Blocking of background noise	✓			Able to block out noise from surroundings
Able to attach to most handphones	✓			Clip is versatile
Portability		✓		Very bulky

The modification did not increase the amplification of the sound, and made the prototype even bulkier.

Prototype 3

Moving on to Prototype 3, we created the origami spiral cone based on online instructions. Origami spiral cone was modelled after the conical shell by Taketoshi Nojima. The origami spiral cone was attached to a phone attachment which encloses the top speaker of the handphone.

Prototype 3

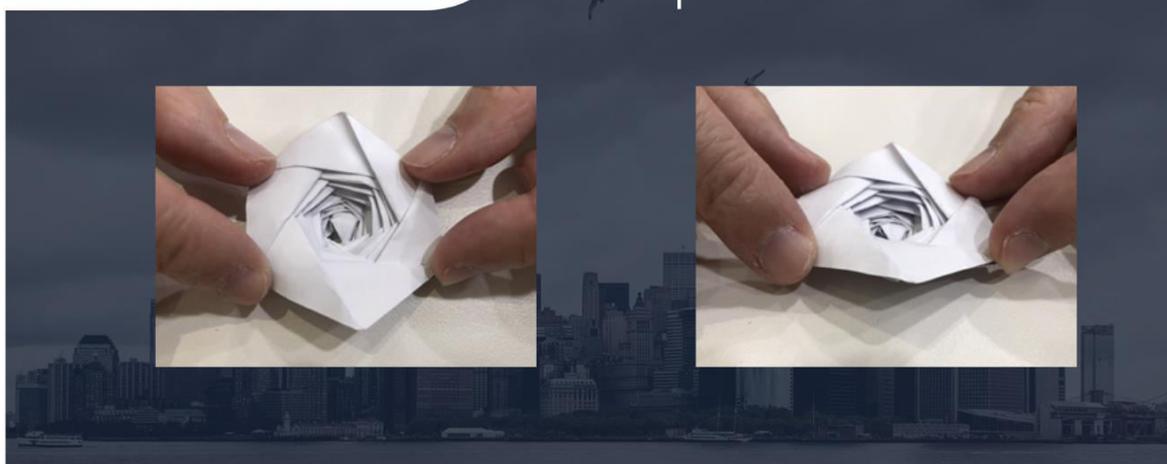
Origami Spiral Cone



Below are photos of the origami spiral cone when it is compressed when not in use. A video of the origami spiral cone being compressed and lengthened is included in the external video.

Origami Spiral Cone

Compressed



Test Iteration 3 for Prototype 3

Test Iteration: Prototype 3	Tick			Remarks
	Pass	Fail	Potential Failure	
Amplification of sound		✓		Did not amplify the sound from the phone.
Blocking of background noise	✓			
Able to attach to most handphones	✓			
Portability	✓			Very portable

Upon iteration, the origami spiral cone tremendously improved the portability of the prototype, but it did not amplify the sound from the top speaker of the phone, which is the most important criteria to fulfil.

Problem with All the Prototypes

At this point, we faced a problem with using passive amplifiers to amplify the sound of the top front-facing speaker as every single one of the prototypes were unable to amplify the sound to a degree higher than listening directly from the speaker. As they do not fulfill the main condition, they cannot be used.

In conclusion, although a passive amplifier like the phone horn works for the bottom main speakers of phones, it does not work for top speakers of phones. It is possibly due to the bottom main speakers projecting the sound out of the phones while the top speakers do not.

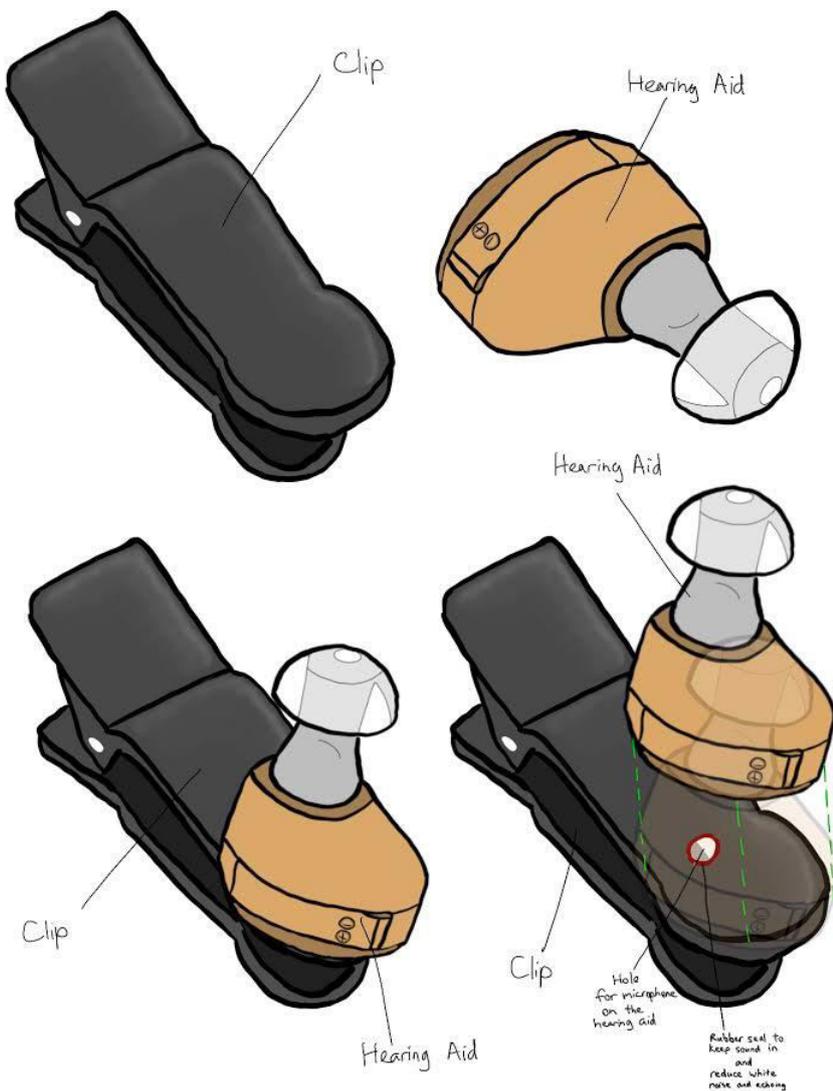
Hence, instead of using passive amplifiers, we decided to switch to using an active sound amplifier, which is an electronic device containing a microphone, amplifier and speaker.

Proposed Solution: Active Sound Amplifier

One example of an active sound amplifier is a hearing aid. It is the smallest active amplifier that contains the 3 main parts: the microphone to capture the sound, an amplifier to increase the volume and a receiver which transmits the sound to the ear. The use of an electronic device such as the hearing aid may be a viable design as it is small and can amplify the sound.



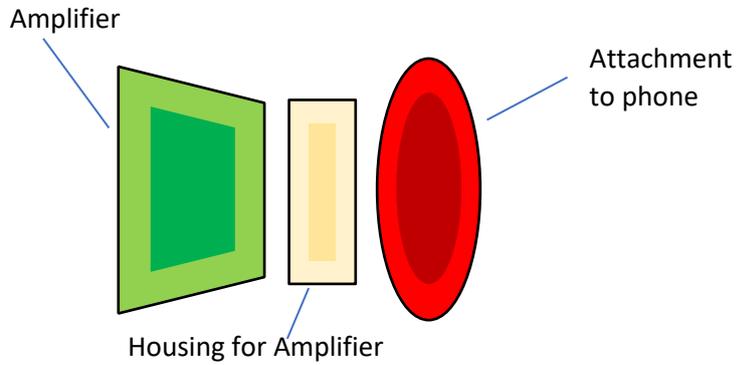
Sketches



Prototype Parts

Our Prototype has 3 main parts:

1. Amplifier
2. Attachment to phone
3. Housing for Amplifier



Selection of Materials

Amplifier (Active)

In selecting the ideal hearing aid, we contrasted three different hearing aids as can be seen in the table below. The table below shows a comparison of the features of the 3 amplifiers.

Features	 Axon K-80	 Axon K-86	 Siemens Hearing Aid
Size	2cm long	2cm long	~5cm
Weight	Very Light	Very Light	Moderately Light
Presence of power switch	Absent	Present	Present
Presence of volume control	Present	Present	Present
Cost	~\$7	~\$10	~\$100

Axon K-86 hearing aid has a power switch as compared to Axon K-80, thus conserving battery power. Besides, it is also smaller than the Siemens Hearing Aid and 10x cheaper.

Thus, the Axon K-86 Hearing Aid was chosen for its small size and lightweight, giving it portability, as well as the presence of the power switch and the low cost.

Attachment to Handphone

For attachment to the handphone, we will use the same phone clip that we have used for the making of the earlier prototypes.

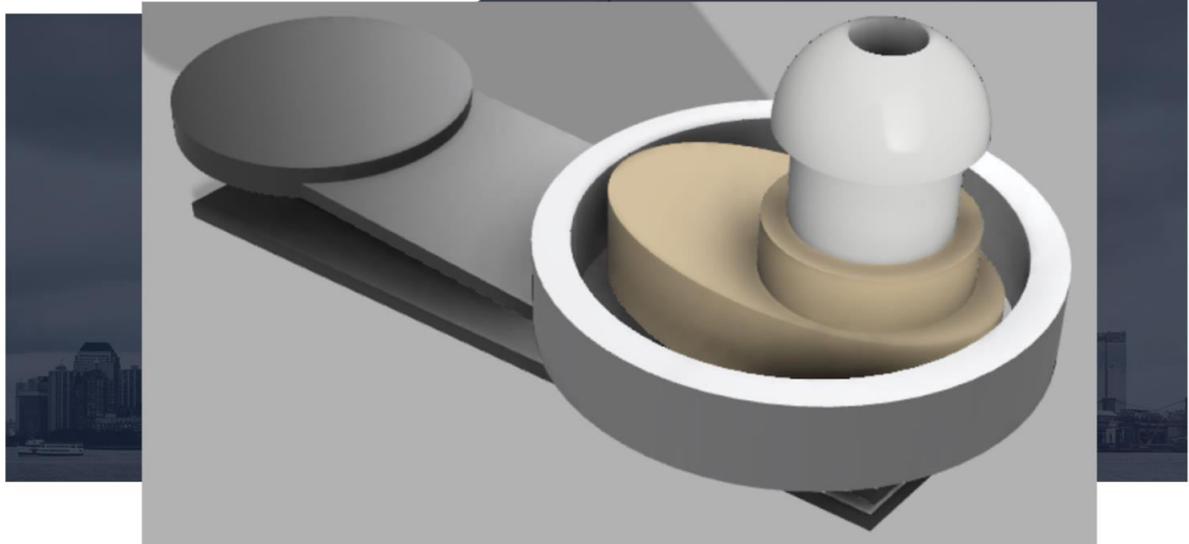


Housing for Amplifier

Our concept is to make a housing for the hearing aid which would attach to the phone clip. A model of the concept is shown below. More details about the concept are included in the external video.

Hearing Aid Prototype Concept

Concept created using 3D-modelling software
Fusion 360



Total Expected Costs

The total expected cost for the prototype is \$12.

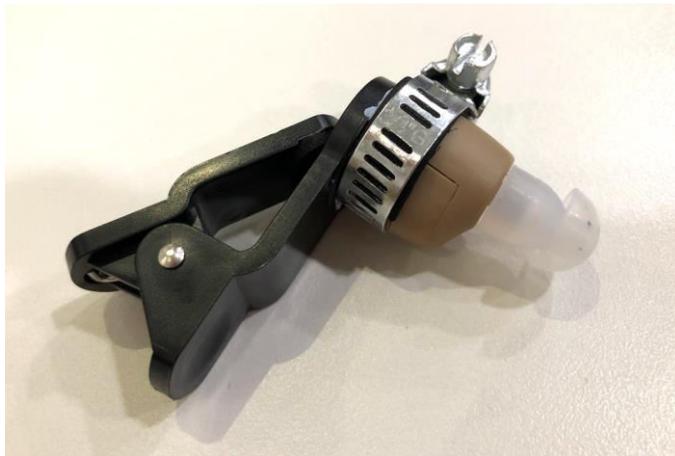
Hearing Aid	\$10
Housing	Negligible
Phone Clip	\$2
Total	\$12

Prototype 4 (Rapid Prototype)

For a test of concept before 3D printing, a ‘rapid prototype’ was made. A hose securing ring was used to house the hearing aid which was then connected to a phone clip.



Hose Securing Ring



Prototype 4 Completed

Test Iteration 4 for Prototype 4

Test Iteration: Prototype 4	Tick			Remarks
	Pass	Fail	Potential Failure	
Test Date:				
Amplification of sound	✓			
Blocking of background noise		✓		Shrill beeping sound was heard.
Able to attach to most handphones	✓			
Portability	✓			

Hearing aid effectively amplified the sound from the top speaker of the handphone. However, a shrill beeping sound due to interference of sound from the phone with the clip was emitted.

Prototype 5 (Rapid Prototype)

Prototype 4 was modified to solve the problem of the interference of sound with the phone clip. Another 'rapid prototype', which makes use of a heel repair rubber and super glue, was made for a test of concept before 3D printing. The heel repair rubber was used to position the hearing aid next to the phone clip, instead of right over it.



Repair Rubber



Heel

Cut Heel Repair Rubber to fit Hose Securing Ring and use Super Glue to adhere Rubber to Ring



Prototype 5 Completed



Front View



Attached to Phone - Side View



Attached to Phone, Top View

Test Iteration 5 for Prototype 5

Test Iteration: Prototype 5	Tick			Remarks
	Pass	Fail	Potential Failure	
Test Date:				
Amplification of sound	✓			
Blocking of background noise	✓			
Able to attach to most handphomes	✓			
Portability	✓			

Putting the hearing aid beside the phone clip effectively solved the shrill beeping sound problem. Prototype 5 met the objective of effectively amplifying the sound of the top front-facing speaker of smartphones

Final Product

It is proposed that 3d-printing can be used to print the housing for the hearing aid.

The housing would replace the hose securing ring and heel repair rubber currently used on working prototype, prototype 5.

Purpose is to improve on the aesthetics of the product.



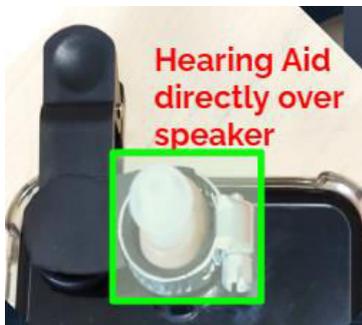
3D model of proposed design housing for 3d-printing

User Manual

Step 1: Switch on product. (Power Switch is on the screen-facing side)



Step 2: Attach product to phone using clip, ensuring that hearing aid is directly over speaker.



Step 3: Enjoy amplified and clear audio while on the line!

Step 4: Turn off product. (Power Switch is on the screen-facing side)

User Reviews

Four users tried out the prototype and their experiences using it were collated. Overall, the prototype met its intended purpose of amplifying the sound of the top front-facing speaker when on the line.

(1) Review by Benz Chong

The product was easy to turn on and attach to a handphone. The degree of amplification was significantly louder than the speaker itself .

(2) Review by Darrin Tan

Product was effective at carrying out its task of amplification, yet was significantly lighter and easier to use than conventional earphones.

(3) Review by Aw Jia Wei

The product was light, portable and relatively sturdy. The product significantly helps with hearing problems in crowded and noisy public locations.

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