

# "DECIBELESS"

An attempt towards modular barriers for noise problems

Major Project

Design Process Journal

Submission Date: 15/Aug/2022

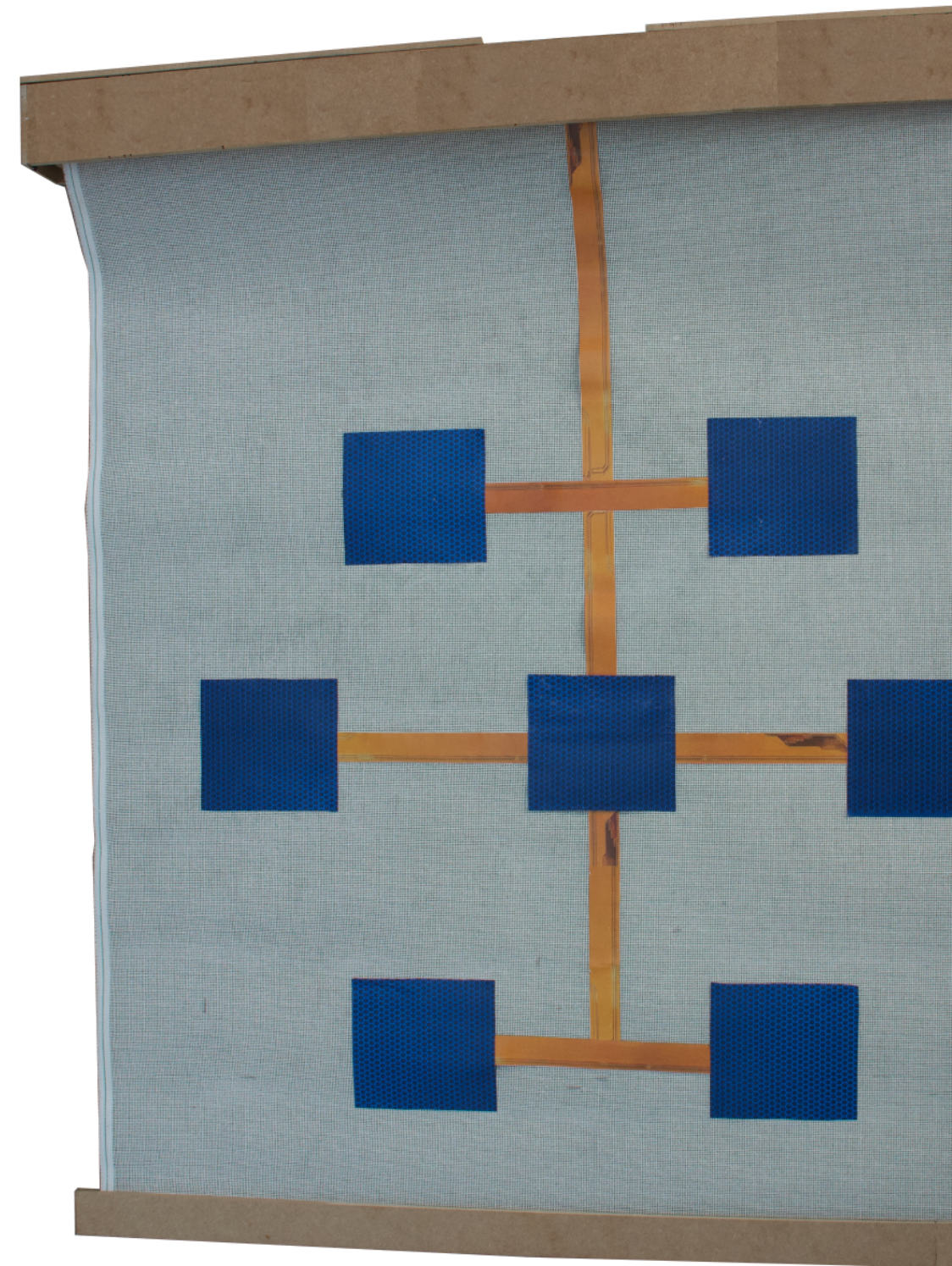
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# The Problem

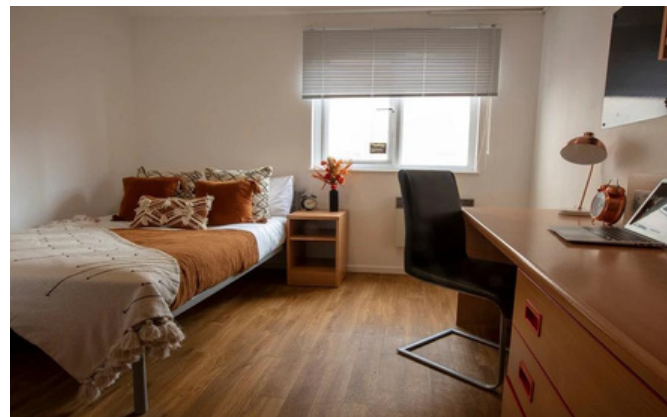
## Observation Pool



The start of the project was done with looking out for the possible problem from a pool of activities and situations.

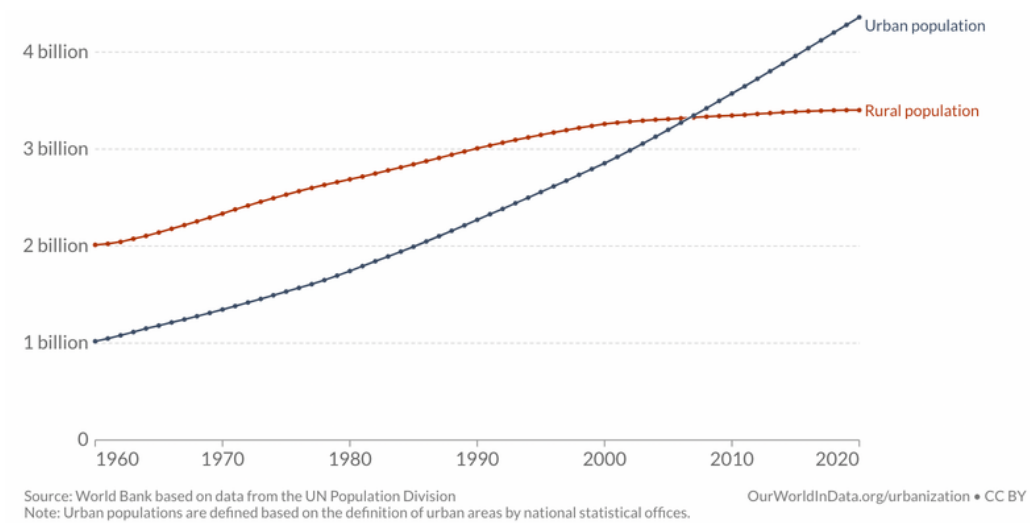
## Focus on Noise

While studying and living in a student accommodation and having classes in Reid building, a problem of noise was faced. This led the focus to further observe the situation involving Noise and its pollution.

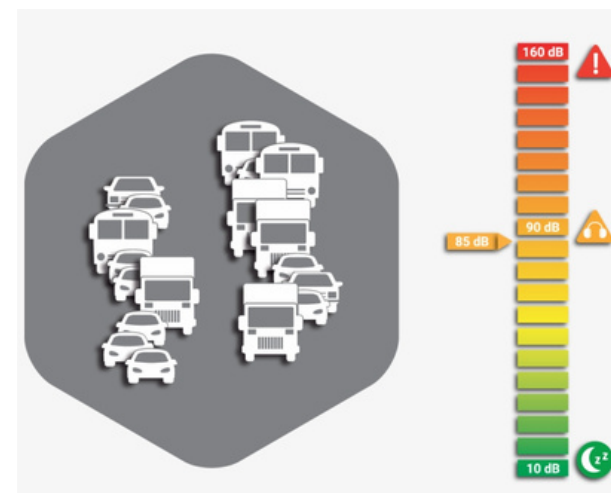


## Noise Pollution in Numbers

- 280 million people or 40% of the European population is affected from noise pollution.
- With an increase in Urbanisation, affected world population is expected to increase by 7 billion 2050.



- The exposure limit is **80dB** above which ear protection is recommended.



For reference, below are the decibel range of different cases.

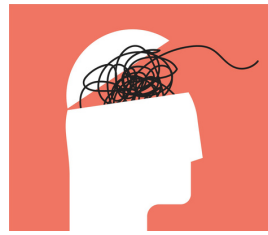
- A whisper - 30 dB.
- Normal conversation - 60 dB.
- A busy street - 80 dB.
- Pneumatic drill - 125 dB.

# The Problem

## Effects on Health

Noise pollution and exposure to loud noise not only creates the auditory problems but impacts human health in other critical ways. Some of the problems are as follows:

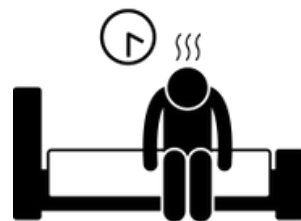
- ADHD (Attention Deficit Hyperactivity Disorder)



- Cardiovascular Diseases



- Sleeplessness



- Cognitive Impairment

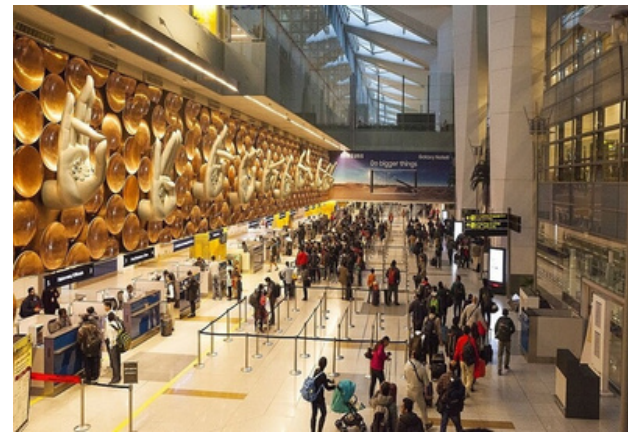


- Auditory Problems



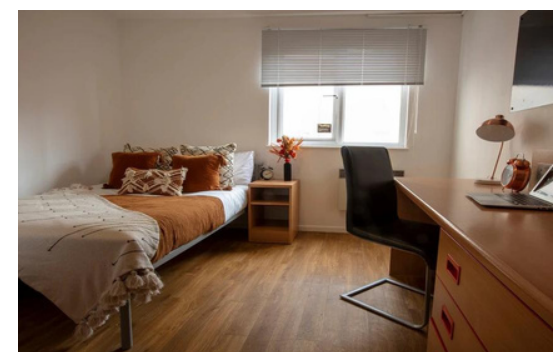
## Problem Analysis

At the beginning, the intention was to develop a product which could be used at the different places where noise problems occur. Places like Airport, Auditoriums, Stadiums, Libraries, Stations, Hospitals were considered.



After further discussions in the tutorials with Professors and with other designers, it was advised to narrow down the problem. From all the places and spaces, Small spaces was chosen for further exploring the problem.

Small spaces like **Hotel Rooms, Office Rooms, Hostel Rooms, Bed Rooms** are the places where people spend their time sleeping, studying and living majorly and are regularly exposed to the noise for long hours.



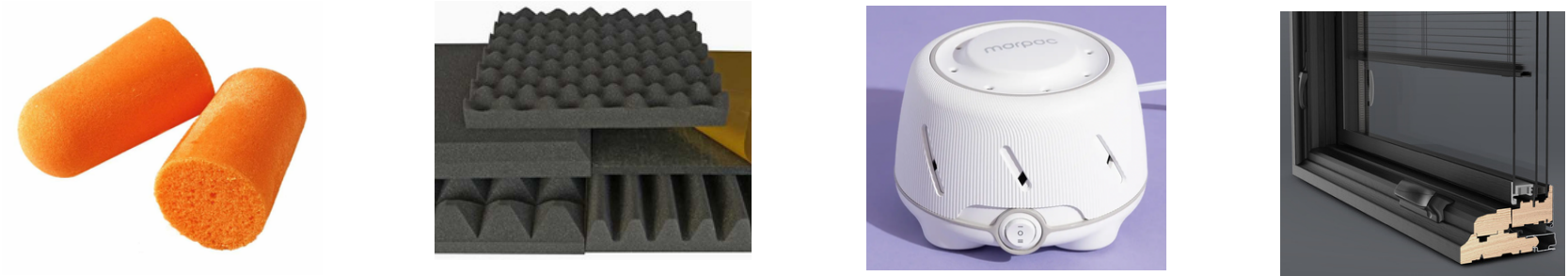
## Reflection

Noise pollution is one of the biggest problems our world is facing and with time it is expected to increase exponentially. An attempt towards a product development is required to provide a noise free and calm living spaces.

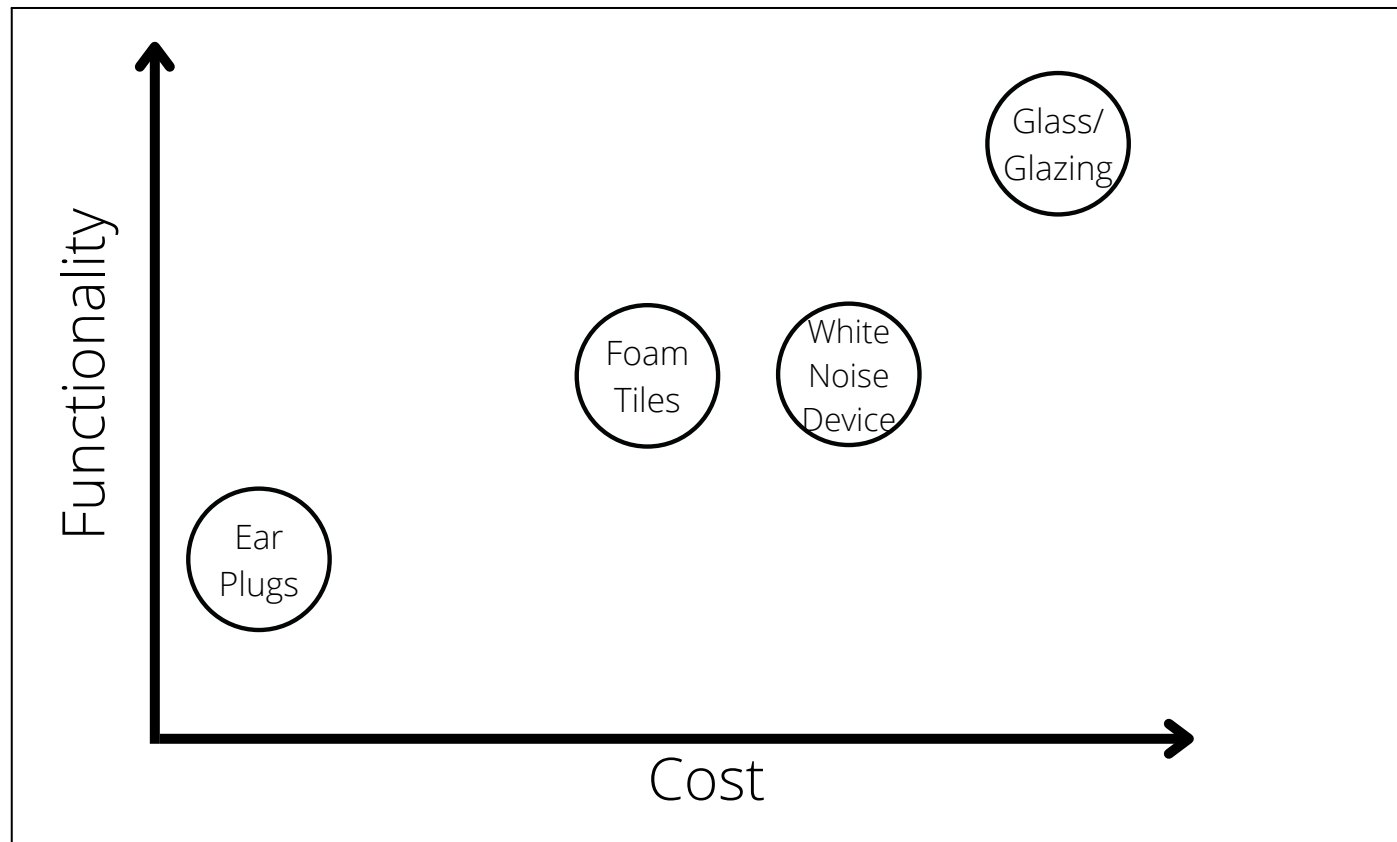
# Research Insights

## Market Research

Existing product were explored and their properties were compared. Factors like Cost, Effectiveness, Feasibility of usage and Sustainability. All these products are used for the desired spaces in the project, i.e., Small spaces like Study Rooms



	Cost	Effectiveness	Feasibility	Sustainability
1 Ear Plugs	Cheap	Decent but uncomfortable	Very easy	Harmful
2 Foam Tiles	Cheap-Mod Expensive	Moderate-Good	Immense work	Harmful
3 White Noise Devices	Mod Exp-Expensive	Moderate-Good	Very easy	Good scope of being sustainable
4 Glass/ Glazing	Expensive-Highly Exp	Moderate Good-Very Good	Immense work	Recyclable but Harmful



Besides the above factors, these products also affect the health of the user in negative way. White noise devices cause auditory problems while Foam tiles and Acoustic tiles can cause breathing problem in the user.

### Key Insights

- Easy to use and install.
- No side effect on health of the user.
- Effective
- No special training required before usage.

# User and Product Requirements

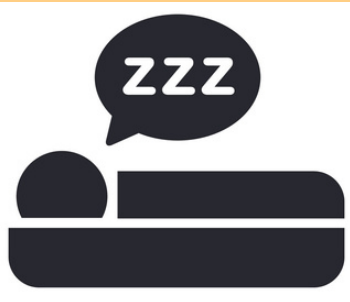
## User Persona



Meet **Harshil Jogi**

A 25 years old student at **The Glasgow School of Art.**

- Lives near a busy road in a rented accommodation.



### **Sleeping**

- Finds it difficult to sleep in noon because of loud traffic noise outside his window.

- Uncomfortable in using earplugs for sleeping.



### **Studying**

- Comfortable at night but finds it difficult to study at day time.

- Difficult to have a group session or discussion.

### **Limitations faced by Harshil to tackle the noise problems**

- Landlord does not have architectural scope and budget of installing double glazed windows.

- Acoustic curtain are expensive and not effective. Need heavy maintenance and care.

## Design Opportunity

As the existing product were explored and studied, a lot of drawbacks and limitations were observed.

Following opportunities were concluded from the desired product.

- Affordable or have the scope of being affordable.
- Provide effective results.
- Comfortable to use.
- Easily installed or removed.
- Environmentally sustainable.
- Need no special training for usage.
- No negative health impact from usage.

## Product Requirement

**Effectiveness** - Must be able to reduce noise.

**Usability** - Can be used not only by young adults but also by old aged people or young aged children.

**Health and Safety** - No harmful side effects and safe to use in homes.

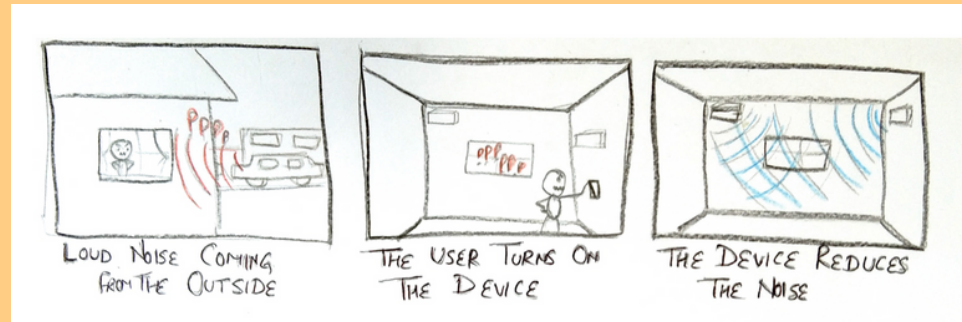
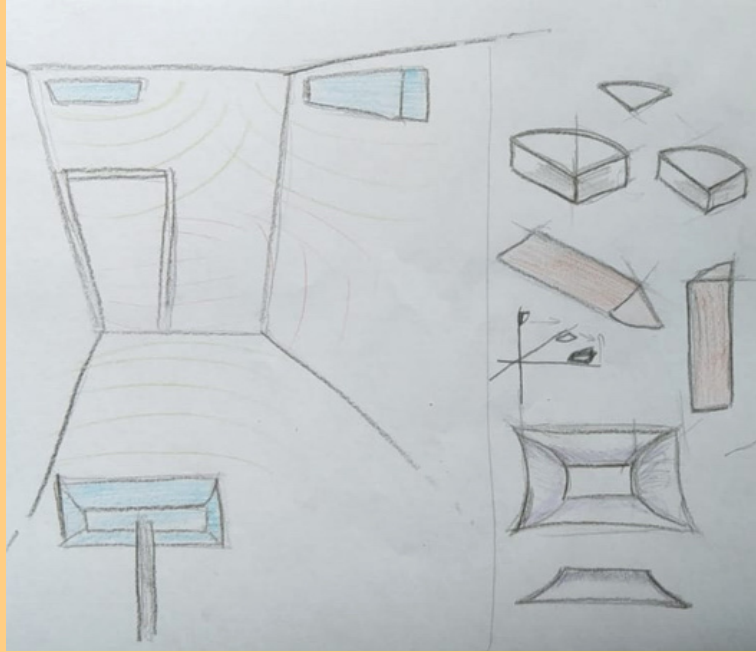
**Adaptability** - Easy to install and remove without heavy modifications.

## Sustainability

Sustainability is one the most important concern while designing a product. Here, the parts, materials and usage must be considered by keeping environmental factors in mind.

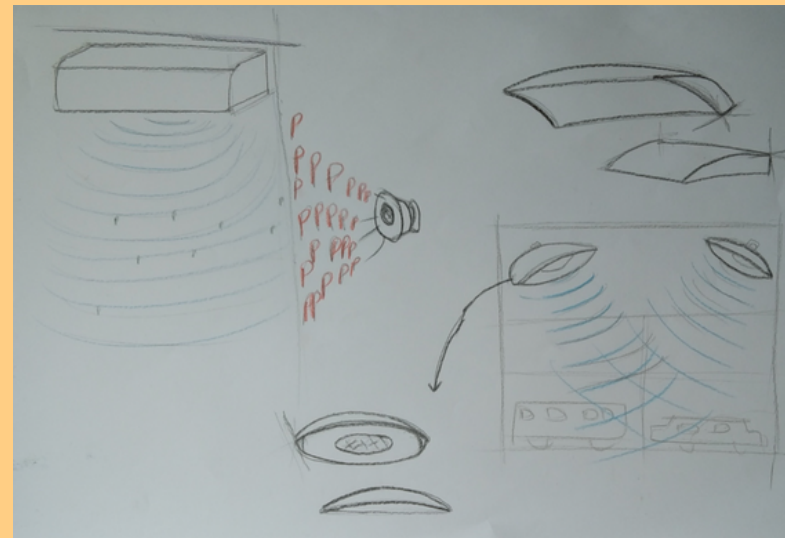
# Concepts

## Concept 1 Active Noise Cancelling Assembly



Ideation and story board of Concept 1

## Concept 2 Ultrasonic Wave Barrier



Sketch and visualization of Concept 2

## Concept 3 Active Noise Cancelling Blind



Live hinge mockup for Concept 3

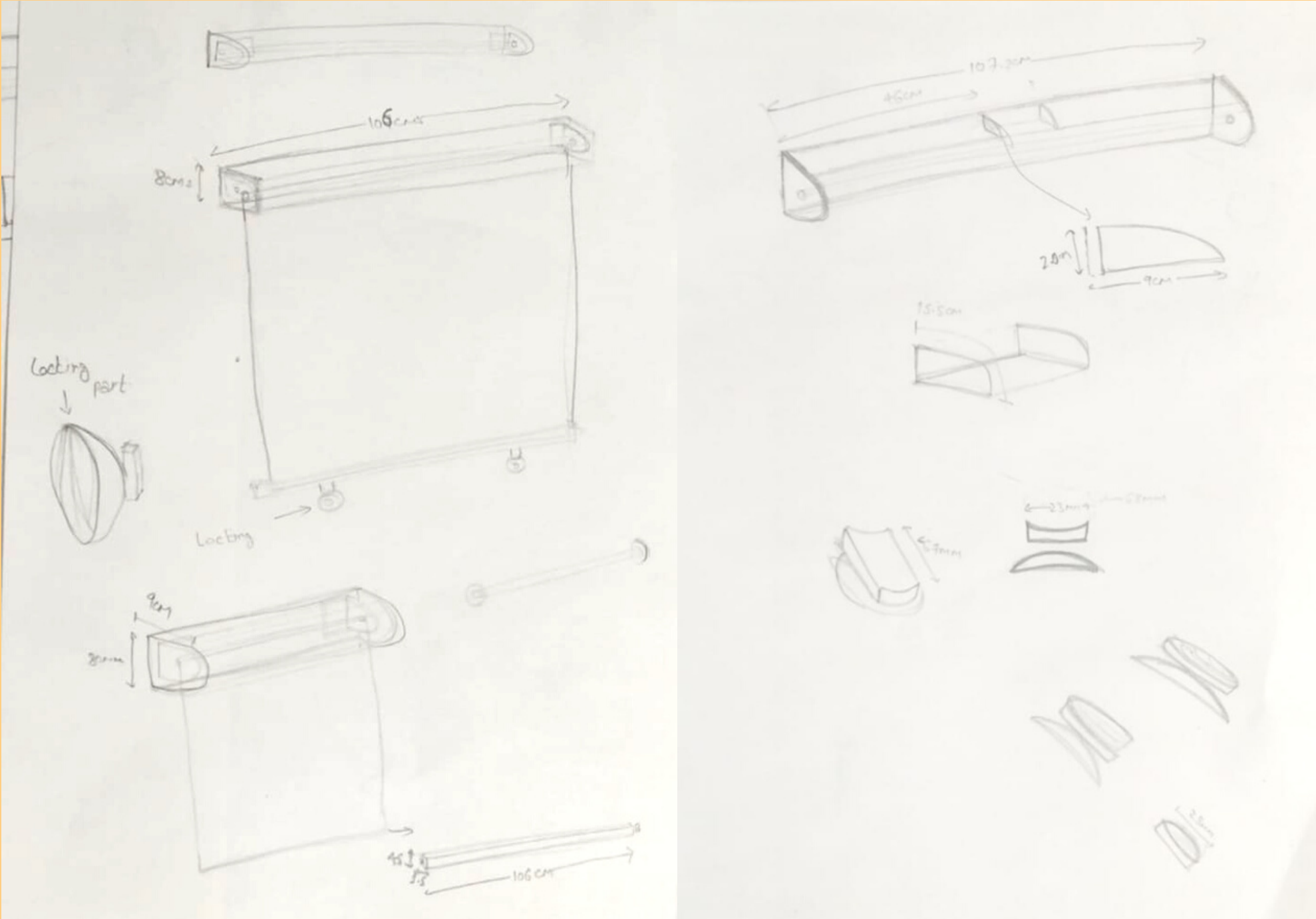
## Feedback of the concepts

The concepts ideated were studied and the possibility of them being turned into a feasible product were analysed. As it turned out the practical feasibility and possibility were not meeting the expectation so further conceptualisation was done.

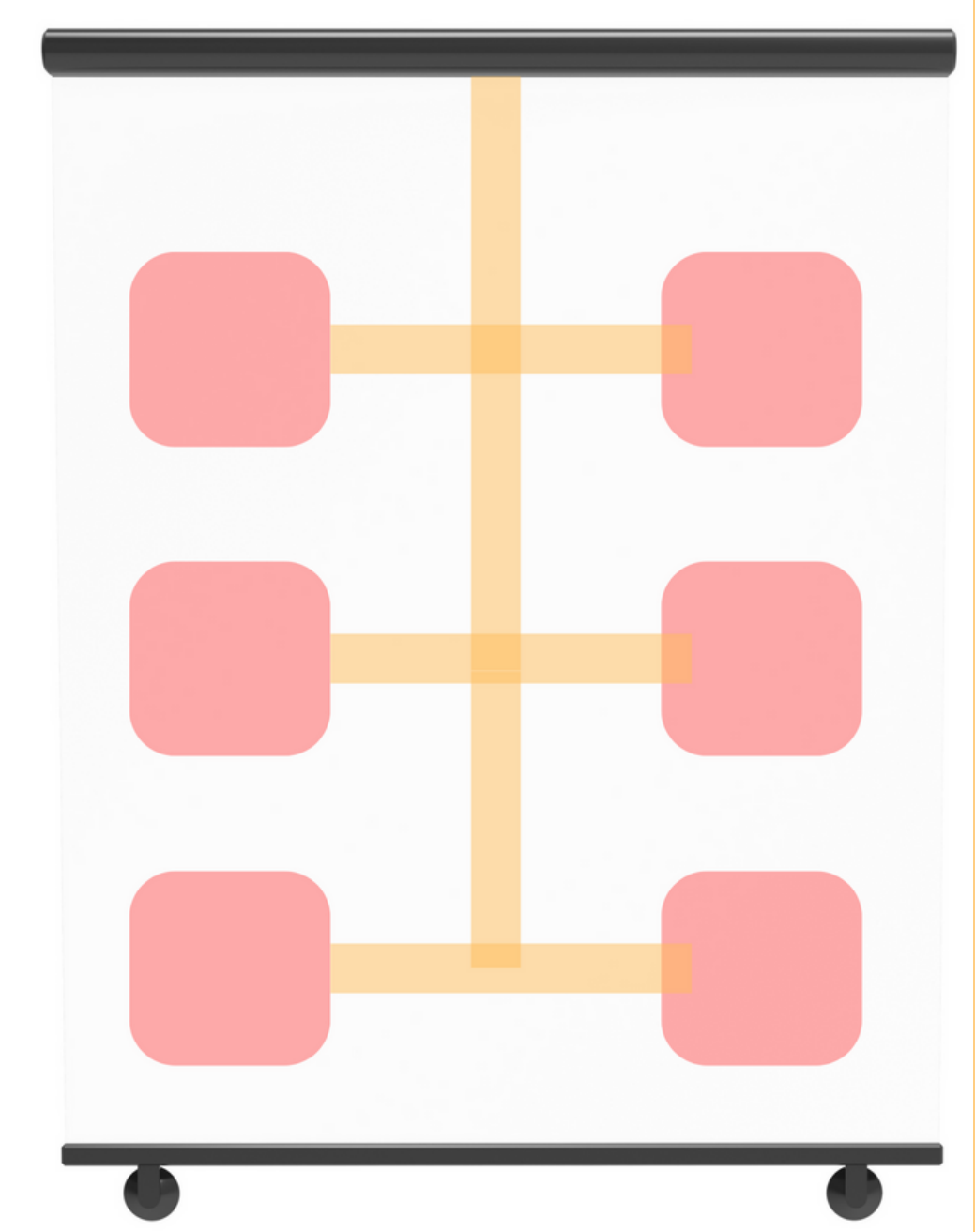
# Final Concept - DECIBELESS

For the final concept, a combination of Concept 1 and Concept 3 was taken. After further research and technical confirmation, the final concept was stated.

## Concept 4 Noise Reduction Blind



Final Concept Sketches and Ideation



Minimal Representation of the Concept



# Mockups and Human Factors

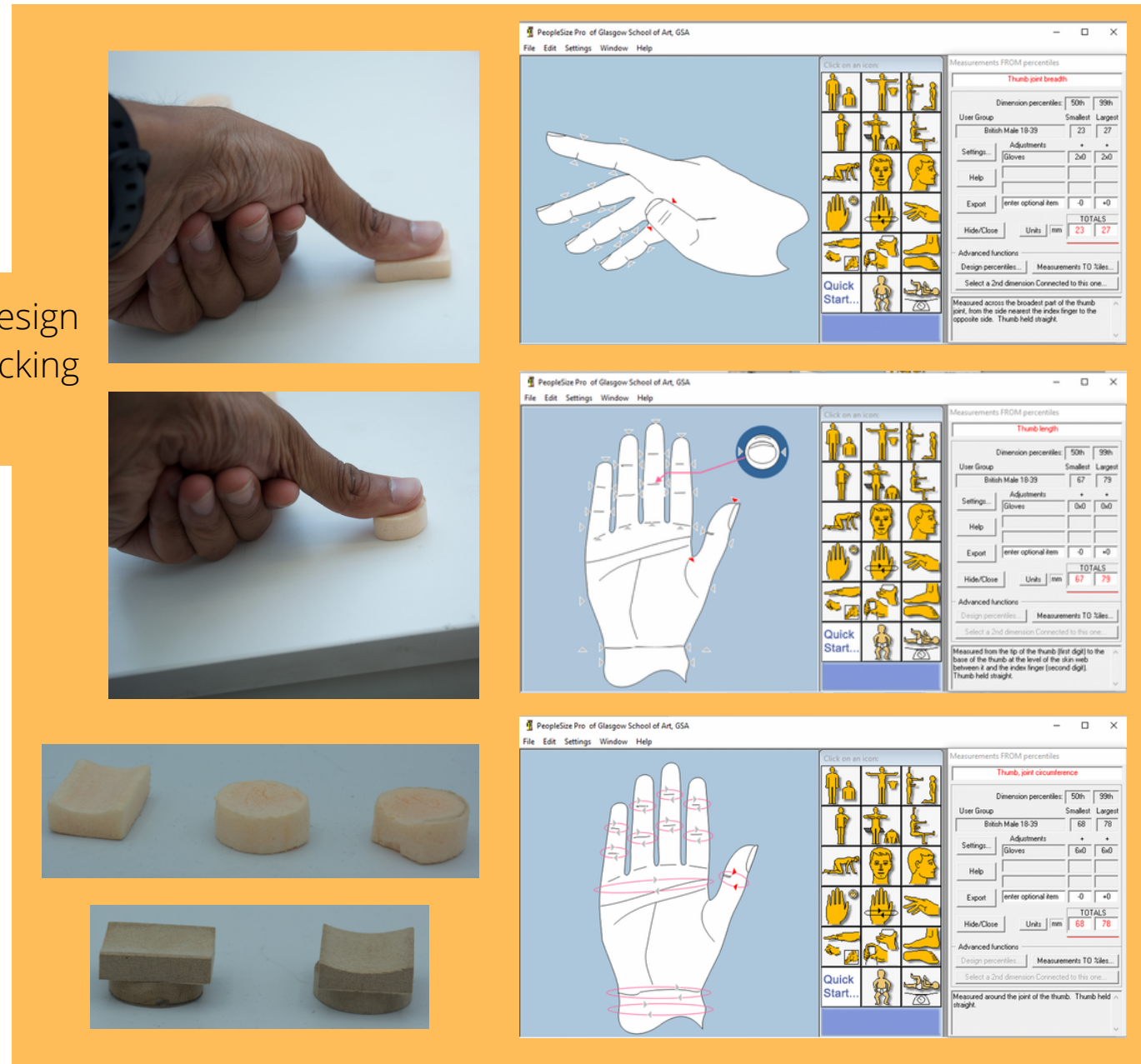
DECIBELESS can be segregated into 2 parts.

- 1) The Noise Cancellation Technology consisting Speaker rigs, flexible PCB, Microphones and Processing Unit.
- 2) The Roller Blind designed to work with the technology for efficient results.



Anthropometry for the design and selection of lower locking part.

Mockup Construction



# User Journey and Testing

The testing was intended to check the rollability and working of the blind when the **Ultra Thin Speaker Rig** and **Flexible PCB** are stitched to it.

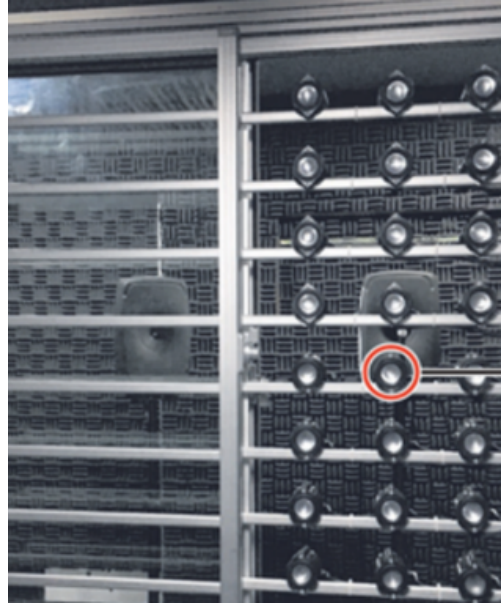


Product on the window

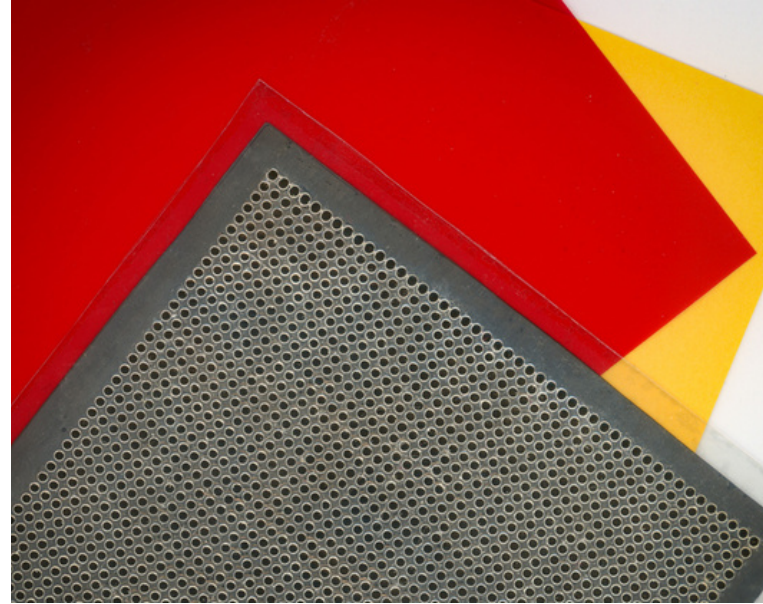


Rolling down the surface to activate the noise reduction system.

# Technical Specification



Noise Cancelling Speaker Rig



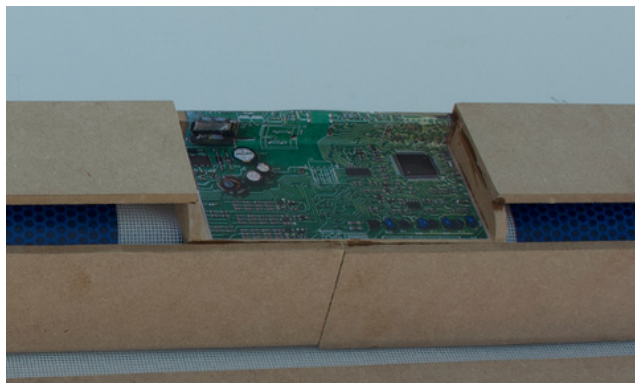
Ultra thin Speakers

A speaker rig designed with a processing system creates an equal and opposite noise in real-time after getting feedback from the microphones. Currently reducing 50% of the incoming noise, the technology is expected to reduce and work more efficiently with time.

The noise reduction rig and system designed is bulky and needs to be thin enough to behave as a flexible system and could be attached with a rolling blind.

To complement this, the paper-like thin speaker developed by the researchers is adopted. These speakers work as regular speakers and physically behave like a thin, flexible sheet.

## Processing Unit



The processing unit is placed on the top of the blind casing. The reason for that is to provide an easy option to replace or repair the electronics.

The top placement of the processing unit is also meant to easily dissipate the generated heat if any due to hot weather in countries like India.

## Microphones



The microphone in the product work along with the speaker rigs.

A function of the microphone is to receive the disturbance noise, feed it to processing unit.

A pair of microphones is used here,

- 1) Reference Microphone
- 2) Error Microphone.

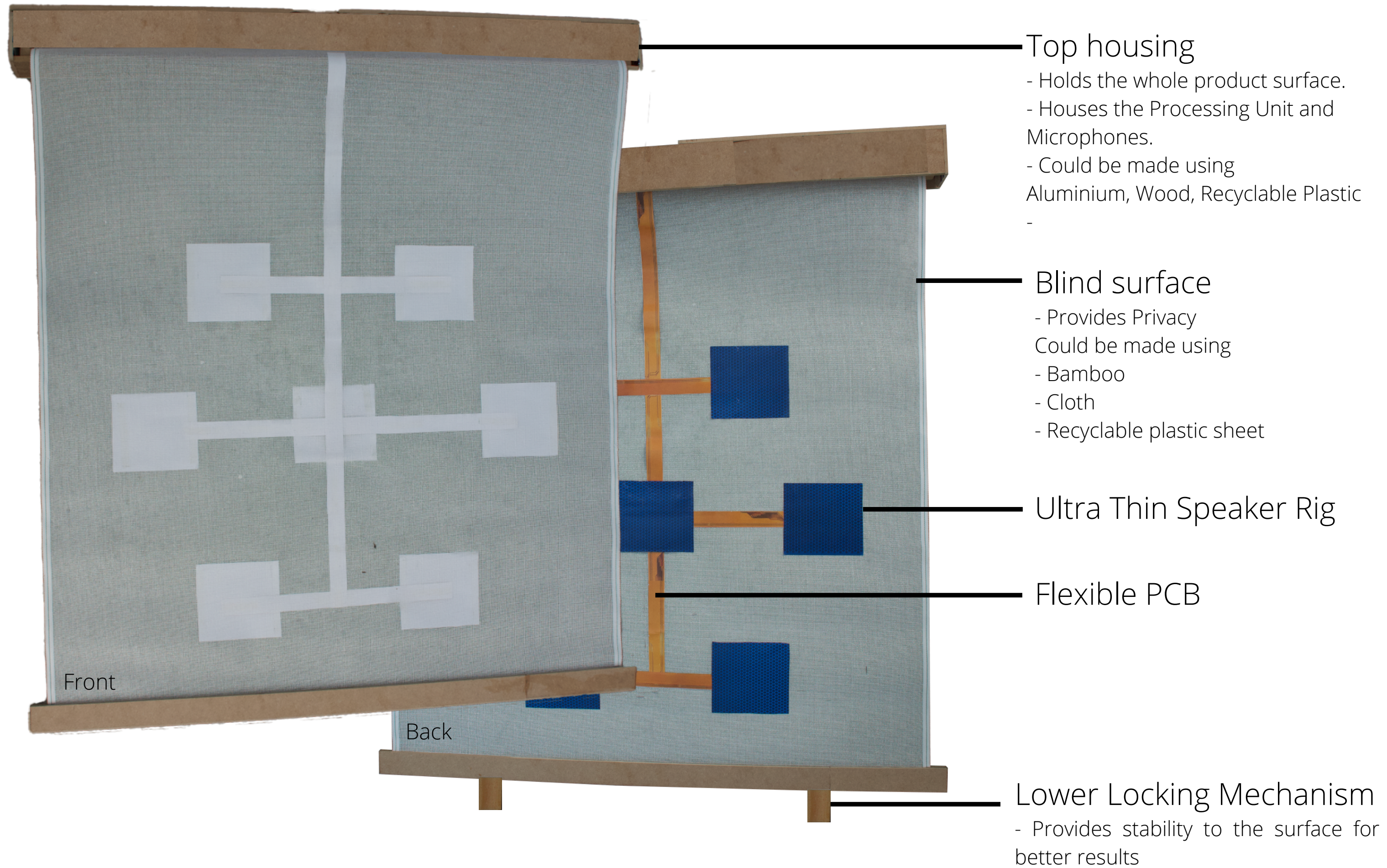
## Flexible PCB



Flexible PCB is the connectivity between the processing unit and the speaker rigs.

The pcb is stitched on the blind surface and behave like a fabric. In other words it can be rolled in the blind without hindering the structural design.

# Final Product



# Conclusion and Future Development

The aim of the project and multiple objectives of the project were achieved, and the concept initiation was completed. The problem statement was narrowed down to specific user areas and groups, starting from the basic concepts of noise-related problems, and the whole situation was studied. The affected population and the seriousness of the problem were significant enough to work toward this problem.

After looking for different solutions and analyzing their limitations, a way and target were created to provide an easy solution. Going through different possibilities and other methods to curb the noise problem, the technique went towards active noise reduction systems.

Working on these methods, few problems occurred, and the options and considerations could not meet the expectations as assumed. The lack of proof and data caused further work on the definition phase and concept proposition to evolve.

Looking further in the direction of the process, an existing and proven method of canceling the noise in an open and expansive space was observed. The research and the data provided a great chance to look in that direction. A newly developed speaker system was discovered to explore further to extract away from that research. After studying that research, it became clear that the design process could be explored in this direction, and using the analysis, and this product can be developed for betterment.

For further study and development, the possibility of making the concept affordable and marketable would be done.

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