SENSOUND

PROCESS BOOK

JANET CHOI

Headphones block your connection with the surroundings. But S E N S O U N D extends your senses with air and sound sensors, especially when you commute on the London Underground without any network signal.

Through the S E N S O U N D App, you can monitor the air quality and noise level with the built-in sensors in the headphones. Optionally, your data can be contributed to the community for collaborative monitoring.

SENSOUND

Air Pollution is an environmental problem around the world, such as Iran. Different countries face the same problem, but it may have different causes. For example, in Iran, 80% of the pollution is caused by the traffic, which is led by the limited technology.

Pollutants Produced by Vehicles

Nitrogen Dioxide (NO2)
. Reacts with hydrocarbons + Sunlight -> Ozone
. Formation of particles (Particle Matter)
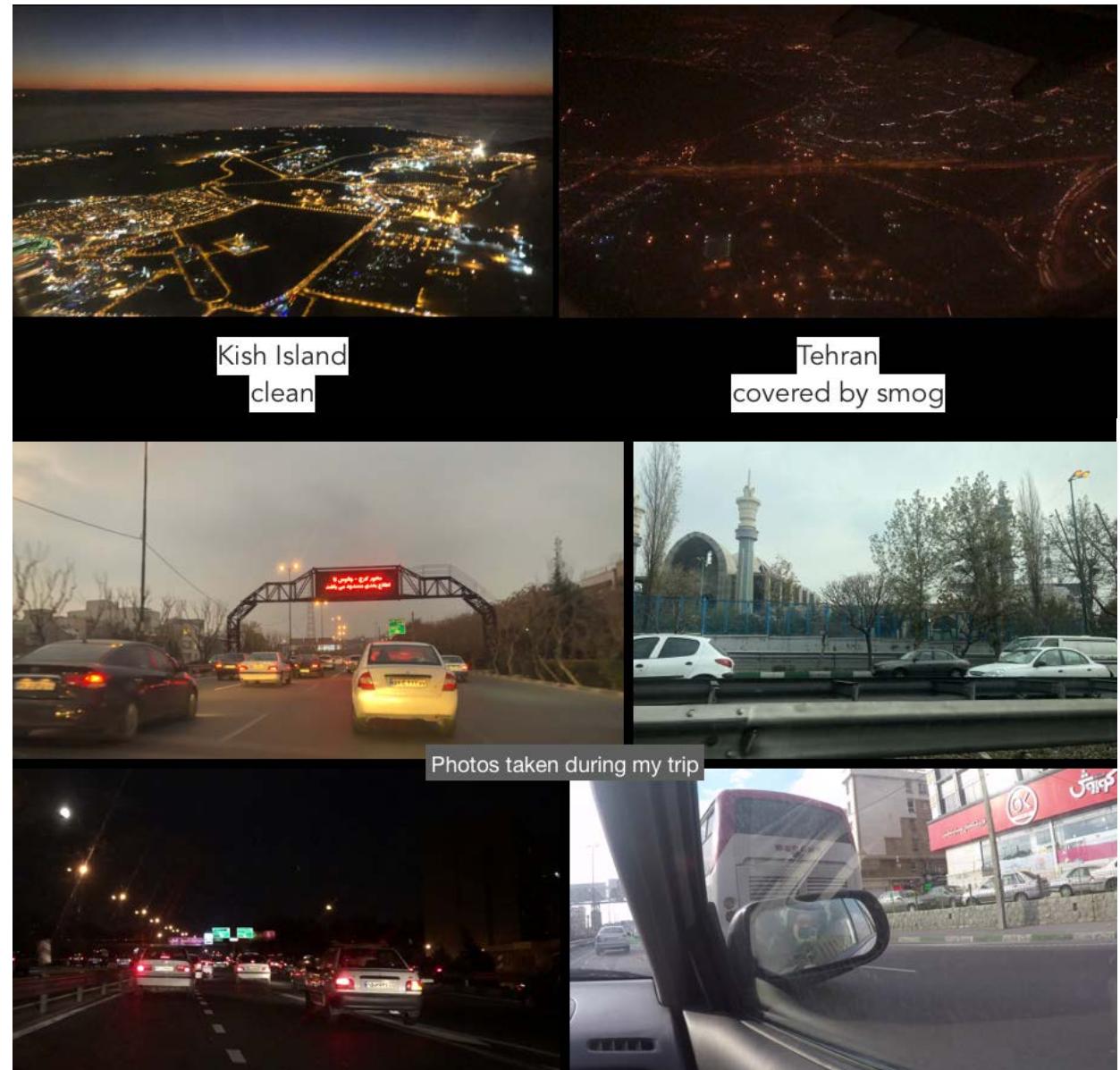
Ozone (O3)
. Leads to smog
. Irritate respiratory system

Particles (Particle Matters)
. PM2.5 = Particle smaller than 2.5 micrometers
. Carbon emission from car engines
. Metal and rubber from

Sulphur Dioxide (SO2)
. Strong odour
. When fuel or any material containing sulphur is burnt
. From low quality fuel and power station
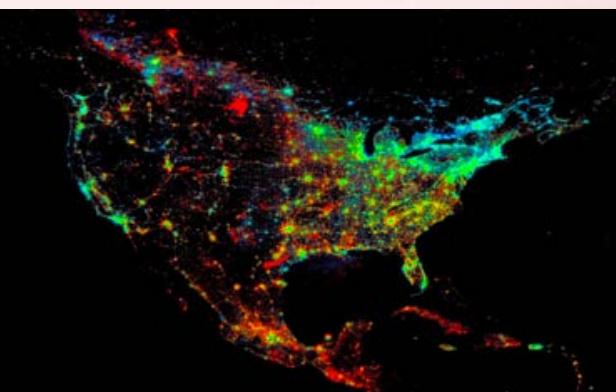
INSPIRATION
Air Pollution Around the World

Kish Island clean

Tehran covered by smog

Photos taken during my trip

Air pollution level on streets were monitored by London Air, a project managed by King's College London. However, no air monitoring system is available concerning the air quality in Underground London. According to a research by King's College London in 2019, the PM2.5 Concentration is around 15 times higher than that collected on the streets in Central London. Other than air pollution, noise pollution in Underground is also needed to be concerned.

ABOUT
Air Pollution in Undeground London

How Deaign Deal with Air Pollution Now?

Mask Design

Artifical Tree

Air Tracker

Data Visualization

Air Filtering

>> How the design can connect to the stakeholders

RELATED PROJECTS

Source: Imperial College London

Dr Marin Sawa
Researcher from Department of Life Sciences
Imperial College London
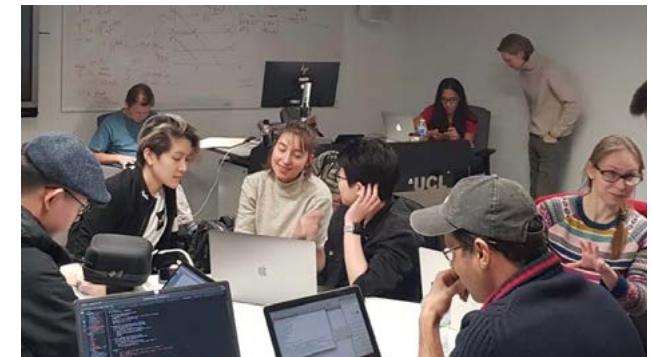
Her main suggestions for my project :
. CO_2 is not the main pollutant caused by the traffic
. Research on and find out main pollutants related to my focus
. Algae may not be the only (or best) choice for air purification
. Refer to research on air filtering plants, e.g. research by NASA
. London Air, a project concerning air quality in London by King's College London
. Refer to the pollutions in London

The AI Core - Harry Berg
Data Science Group Organized by Imperial College London Graduates

Their main suggestions:
. Possible usage of data
. Route planning
. Enhance Functions of headphones
. Simplify Experience and Interface (UX/UI)
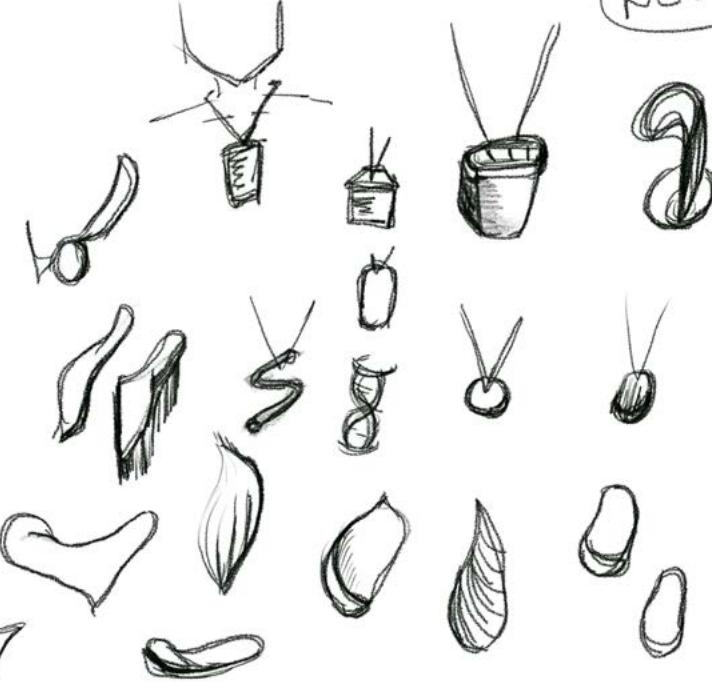
ENGAGEMENT
Advice from Professional & Expert

PM
SENSOR
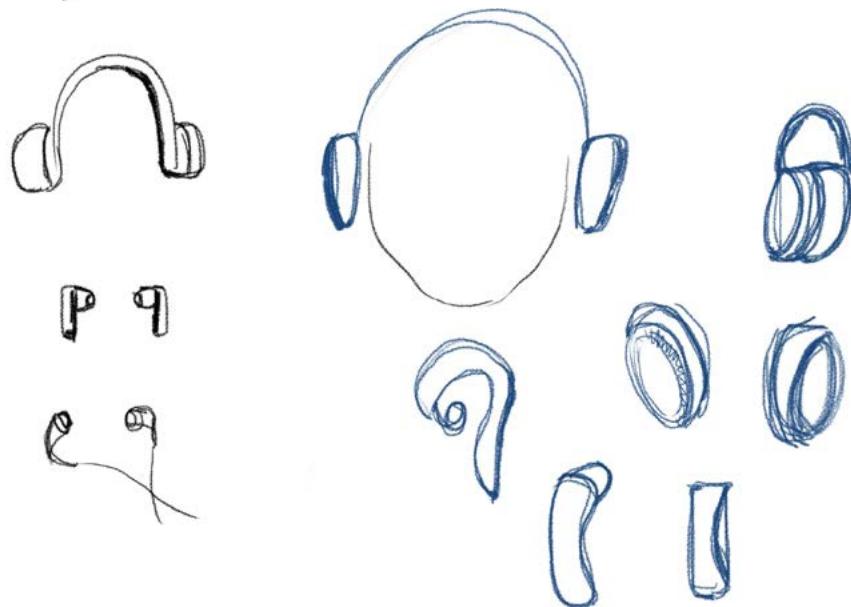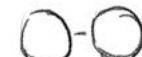
SENSES BY HUMAN

(ON NECK)
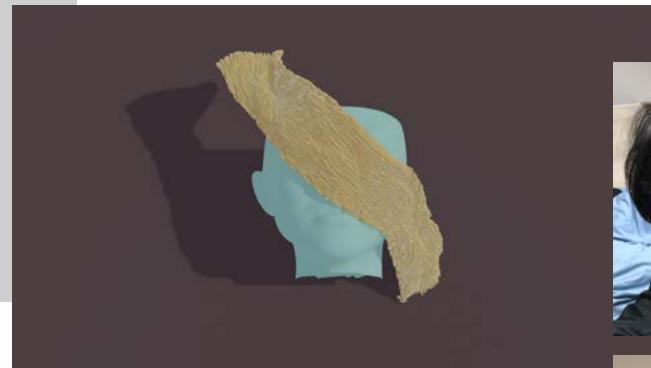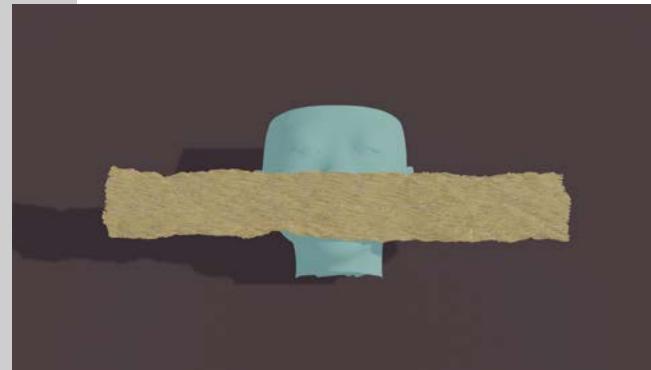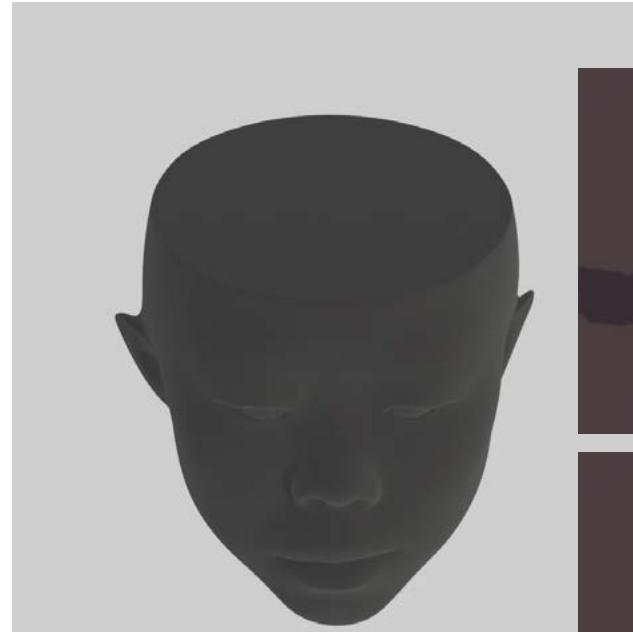
SIGHT   "POWER OF SEEING → VISUALIZE DATA"

1st Stage: What is the medium?

Both air and noise pollution stimulate sensations, so in the design process, I brainstormed different applications to merge with daily use for the development of the final deliverables.

IDEA DEVELOPMENT
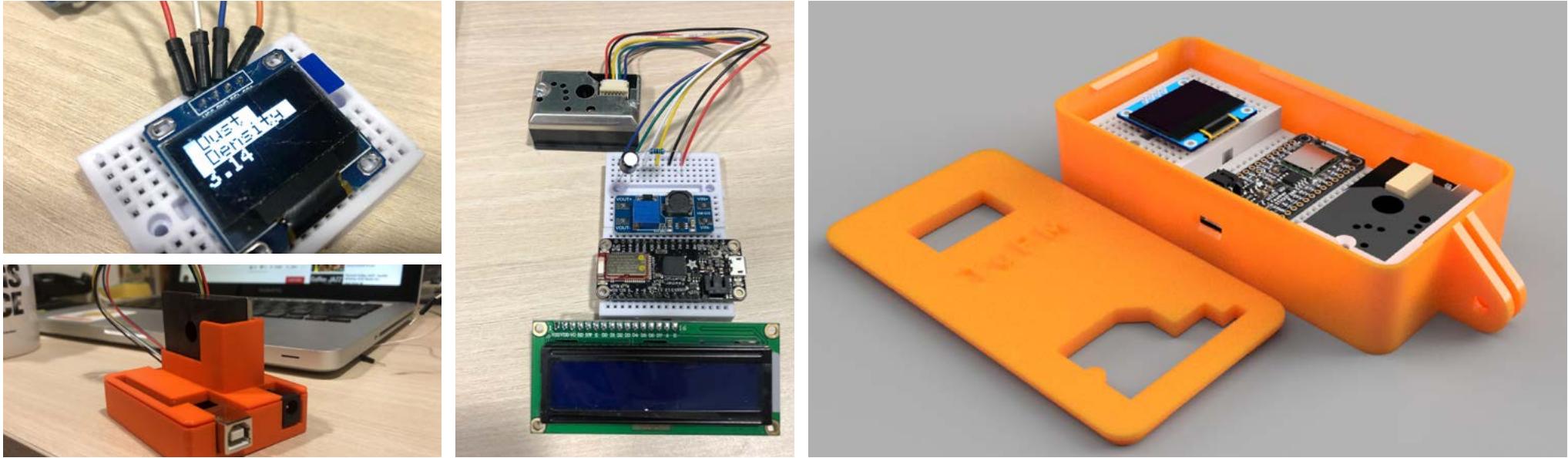
2nd Stage: Data Visualization

In order to visualize the pollution is harmful to the body, I made my head in Blender to experiment the animation with pyhsical simulation, where I rethought the relationship between the pollution and human body.

IDEA
DEVELOPMENT
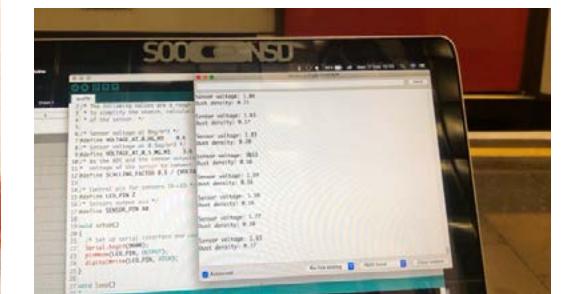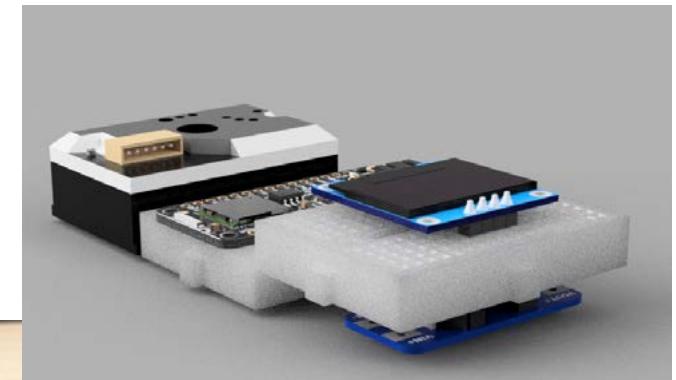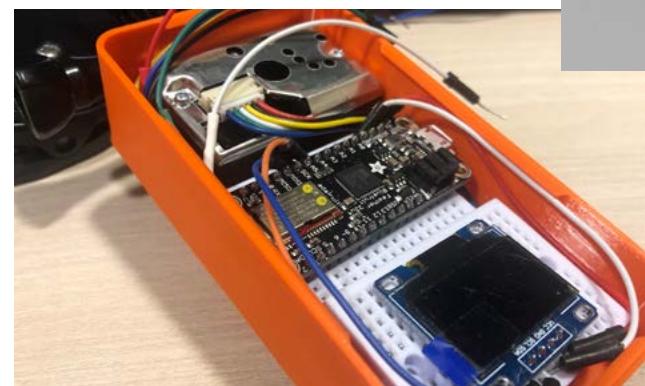
IDEA DEVELOPMENT

3rd Stage: Wearables

After meeting with Dr Sawa, I started to test with a dust particle sensor for checking the concentration of particle matters in the tube platform.
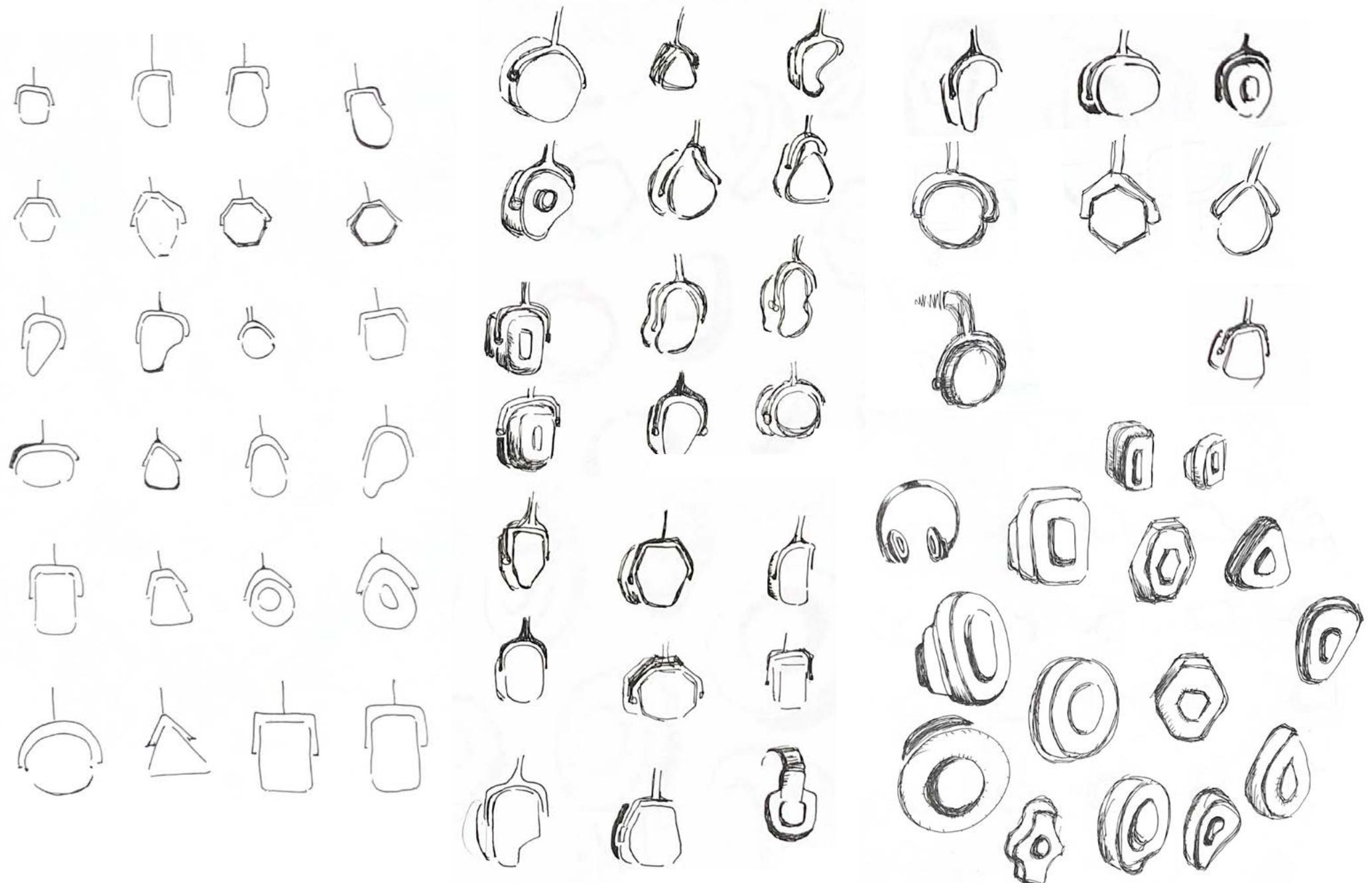
IDEA DEVELOPMENT

4th Stage: Headphones with Air and Noise Sensors

When I was observing in the Underground, I realized that most of the passengers on the train are looking at the phone, listening to music or reading books. A pair of headphones is a common object in daily life, which could be a factor to attract potential stakeholders to use.

>> Rethink the relationship between the surrounding and ourselves, who are using the headphones and ignored the happneings around.
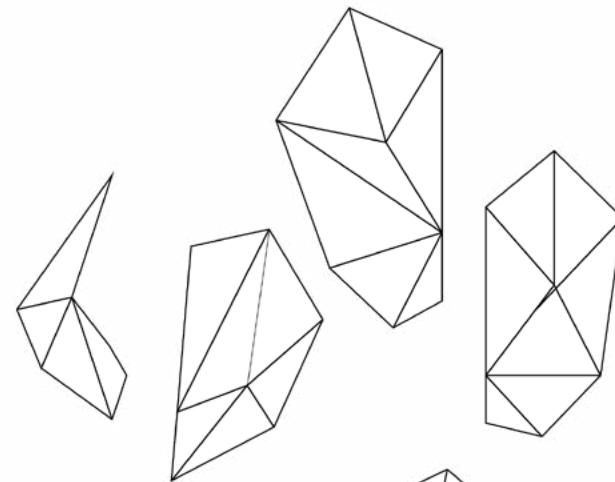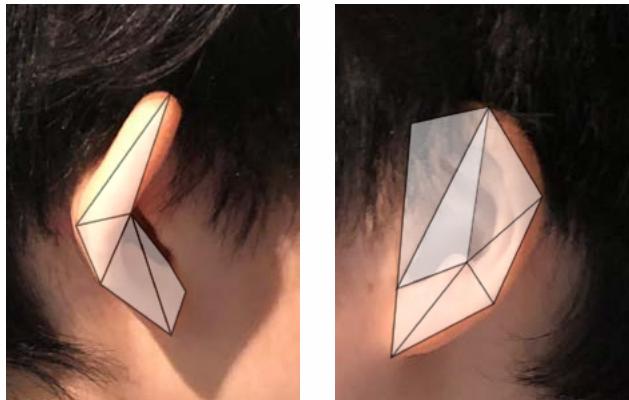
EXPERIMENT

Headphones - drafts
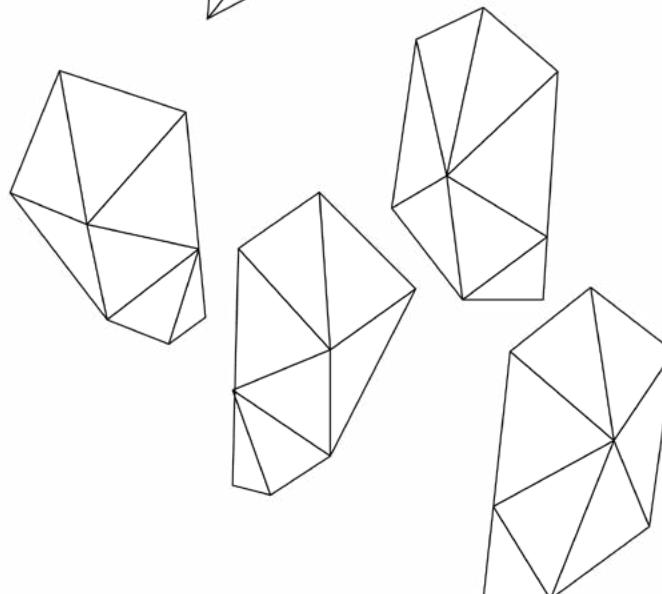
Headphones for Ears - Impression of Ear
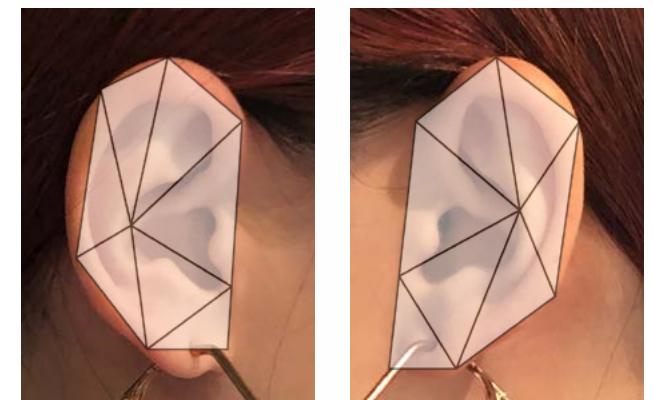
My Ears

Lars' Ears

Elsa's Ears
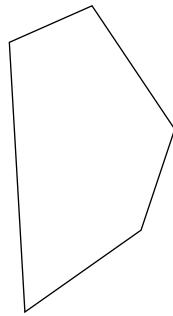
Luyao's Ears
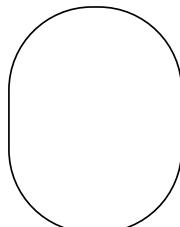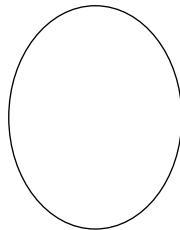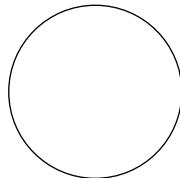
RESEARCH
Digitalize Human Ears - Extend Senses
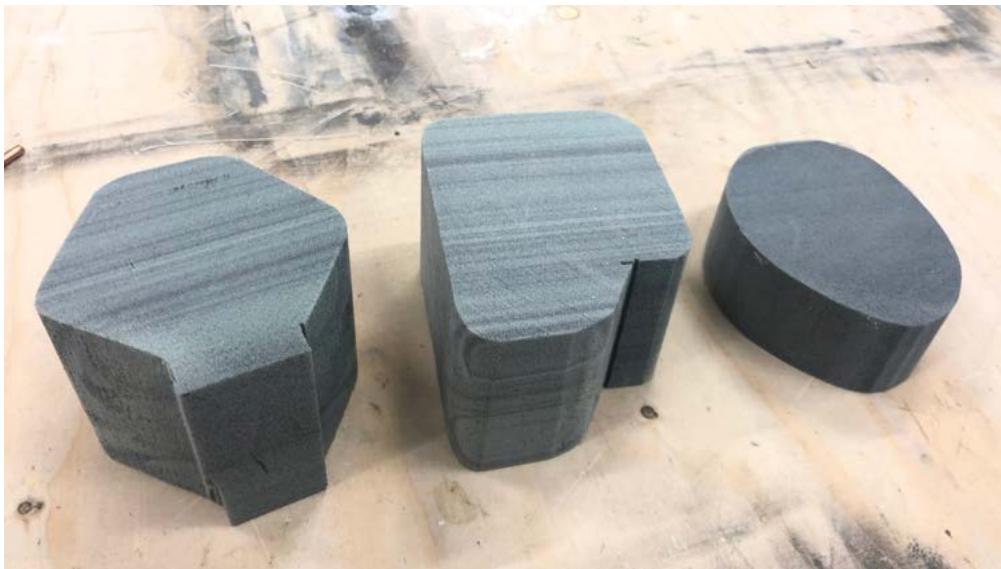
[Ears]

Existing Ear Pads Styles   [Shapes]

RESEARCH Ear form

Forms were selected from draft in order to experiment with foam.

Polygon formed by ear shape

EXPERIMENT Test with Foam

EXPERIMENT

Material Finishing

3D Printed Model
+
Spray Paint

1

2

1st Experiment: No Sanding x Spray x 1
1. Shine Black Spray x 1 time

2nd Experiment: Sanding x 1; Spary x 1
1. Sanded
2. Shine Black Spray x 1 time

Result: Smooth, but strictly depends on the quality of the 3d print

Result: Very rough, spray print clotted on the some rough edges

3rd Experiment: Sanding x 1; Spary x 1
1. Shine Black Spray x 1 time
2. Sanded

4th Experiment: Sanding x 1; Spary x 2
1. Shine Black Spray x 1 time
2. Sanded
3. Shine Black Spray x 1 time

5th Experiment: Sanding x 2; Spary x 3
1. Shine Black Spray x 2 time
2. Sanded
3. Shine Black Spray x 2 time
4. Sanded
5. Shine Black Spray x 2 time

Result: Smooth; rubber-like but color is lost

Result: Smooth throughout the surface

Result: Very Smooth and sharp color

# EXPERIMENT Material Finishing

Sand
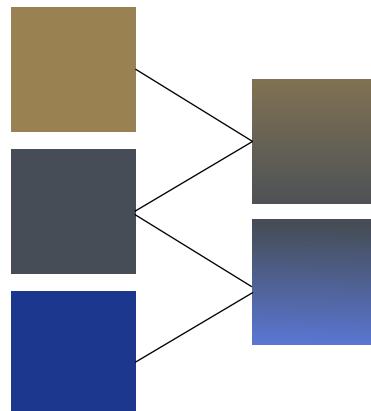

Grey

Blue

Gradient Test

Grey & Sand

Grey & Blue

EXPERIMENT Color

Assembly Components

Sanding and Spray Process
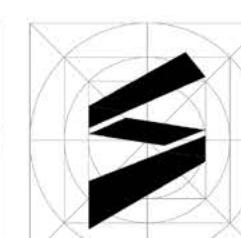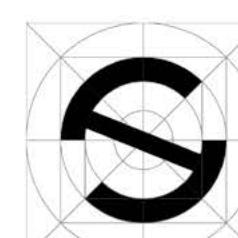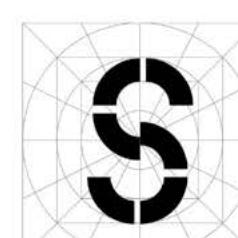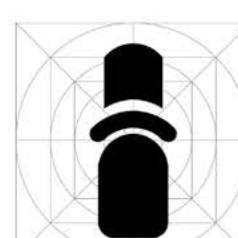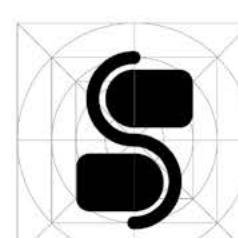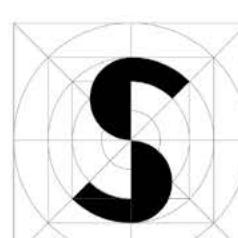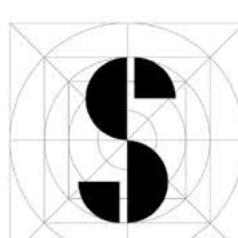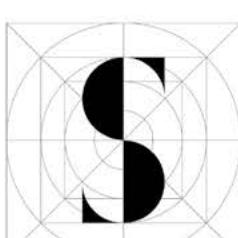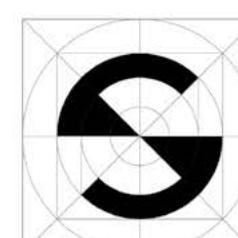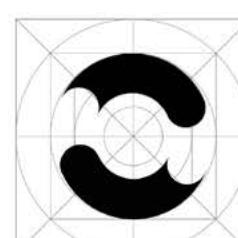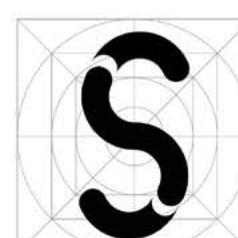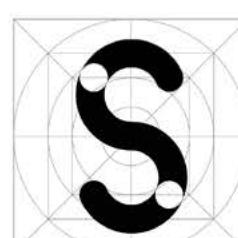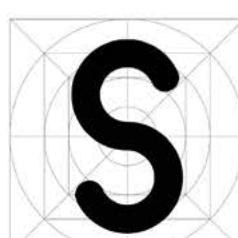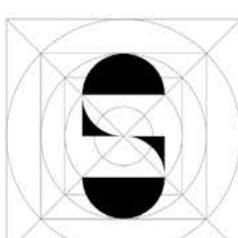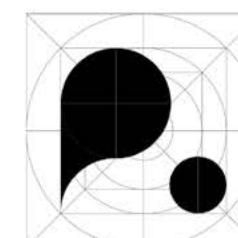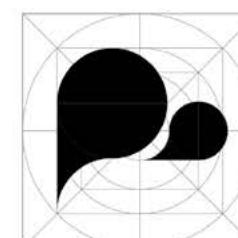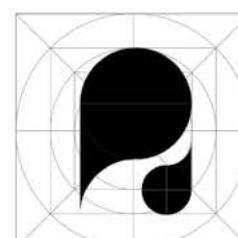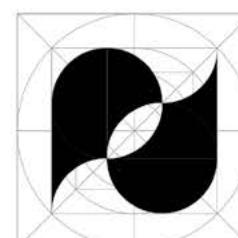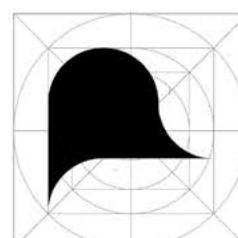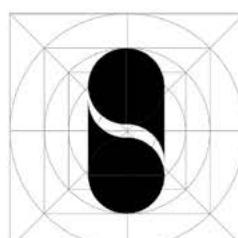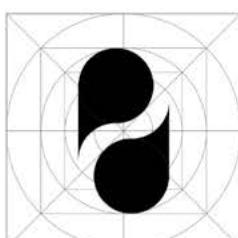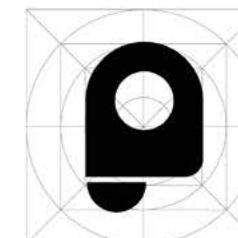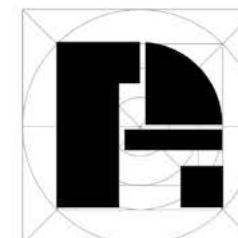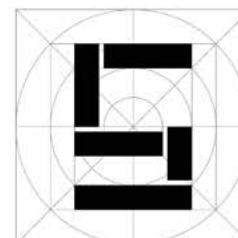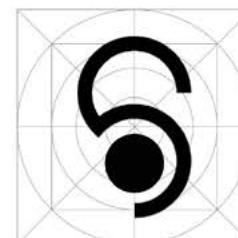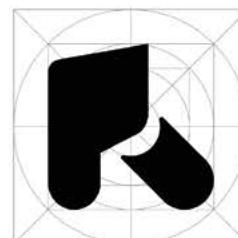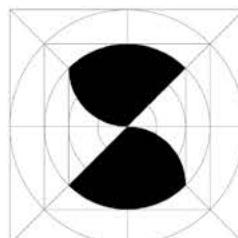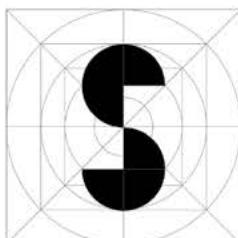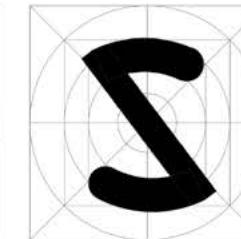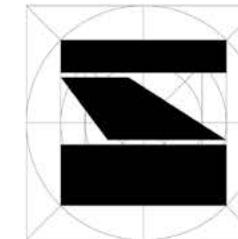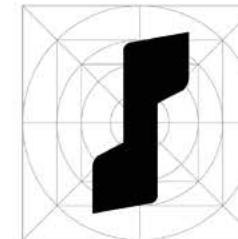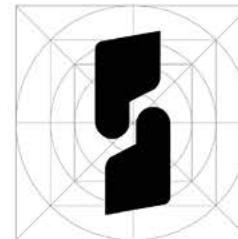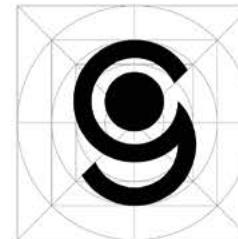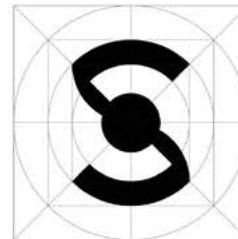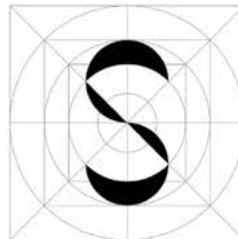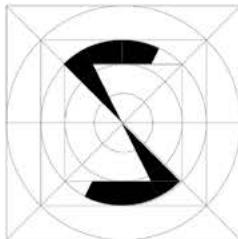
**FINAL DELIVERABLE** Headphones
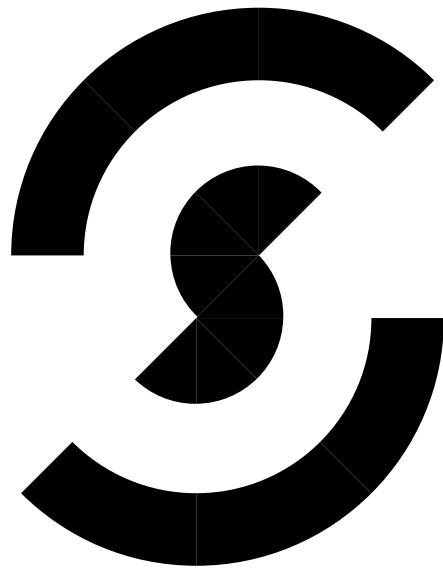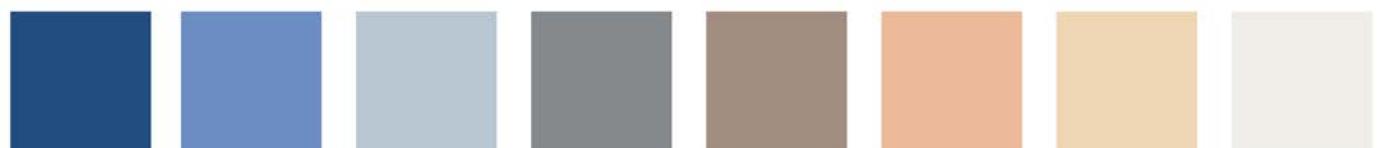
APP DEVELOPMENT

Icon - Hand Drawing

APP DEVELOPMENT

Geometric Shape

APP DEVELOPMENT Color Exploration
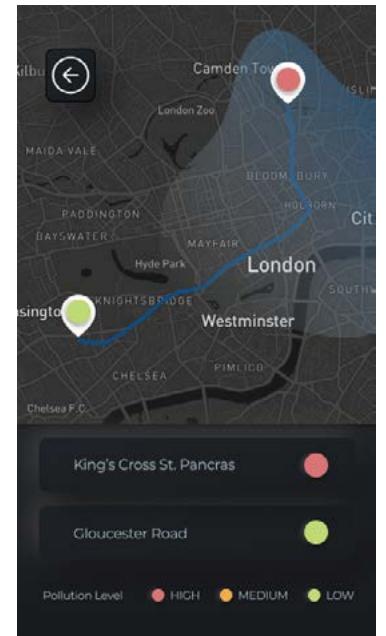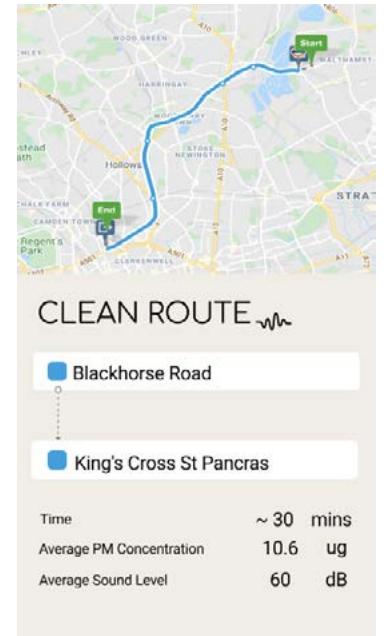
PANTONE®
19-4305 TCX
Pirate Black

PANTONE®
19-4052 TCX
Classic Blue

PANTONE®
14-4115 TCX
Cashmere Blue

PANTONE®
13-0550 TCX
Lime Punch

PANTONE®
11-0608 TCX
Coconut Milk

Avenir
Roboto

Ag

Black ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
0123456789
!@#$%^&*()
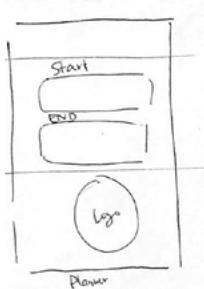
Regular ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
0123456789
!@#$%^&*()

CLEAN ROUTE

Blackhorse Road

King's Cross St Pancras

Time	~ 30	mins
Average PM Concentration	10.6	ug
Average Sound Level	60	dB

Montserrat
Montserrat

Ag

Black ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
0123456789
!@#$%^&*()

Book ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
0123456789
!@#$%^&*()

King's Cross St. Pancras

Gloucester Road

Pollution Level   HIGH   MEDIUM   LOW

EXPERIMENT Font & Style - Sans Serif
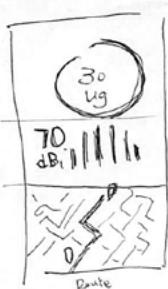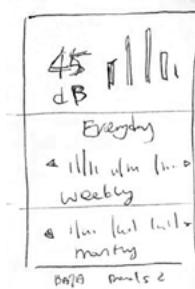
Wireframes

Route Plan   Clean Route   Daily Report   Most Polluted   Contribution   Profile   Connections
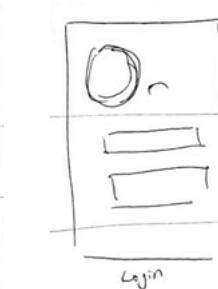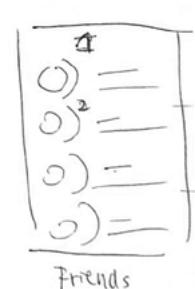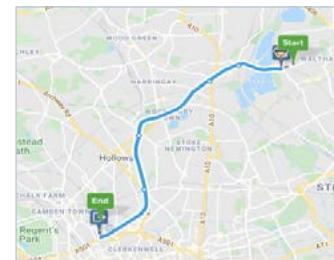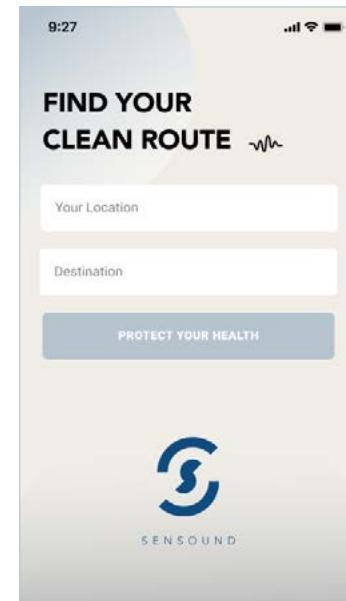
Login Screen is cancelled to encourage more people to use the app, and it aims to encourage users to contribute data.

Avenir
Roboto

As the stakeholders are targeted as young people (15 - 30) who concern the environment, I change the color scheme to dark for the style, in order to make it more stylish and vivid in the next stage. Dark theme can enhance the battery performance so as to attract users.


EXPERIMENT Font & Style - Sans Serif

Journey Planner
Pollution Updates
Collect Data
Contribute Data

Montserrat
Montserrat
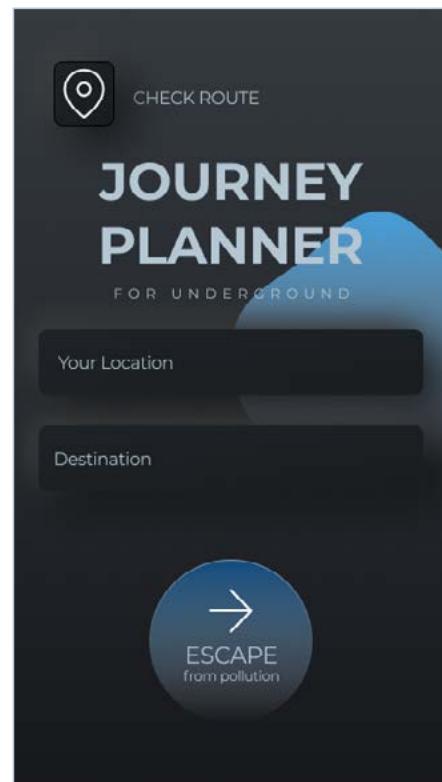
FINAL DELIVERABLE   Mobile App
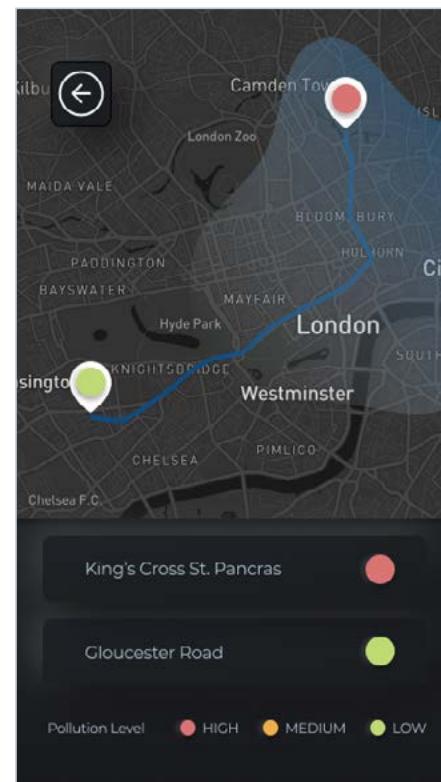
Most Polluted

Keep the users updated with the most polluted station according to the average dust particle concentration and noise level

Journey Planner

Simplistic interface for people to check the route

Best Route

Areas having high average pollution level are covered by a gradient color for better data visualization

Data Contribution

Data panel shows the latest collected data and allows users to contribute data easily

FINAL APP Main Functions

Environmental Research Group, and King's College. London Air Quality Network - King's College London Guide,
King's College London,
www.londonair.org.uk/LondonAir/guide/WhatIsSO2.aspx.

Fur, Gareth. "London Underground Noise Could Damage Hearing, Says Academic." BBC News, BBC, 29 Jan. 2018,
www.bbc.co.uk/news/uk-england-london-42791299.

J.D. Smith, et al., "PM2.5 on the London Underground", Environment International,
https://doi.org/10.1016/j.envint.2019.105188

Saunders, Brynmor M., et al. "Spatial Variability of Fine Particulate Matter Pollution (PM2.5) on the London
Underground Network." Urban Climate, Elsevier, 20 Oct. 2019,
www.sciencedirect.com/science/article/abs/pii/S2212095519301488?dgcid=coauthor#!

REFERENCES