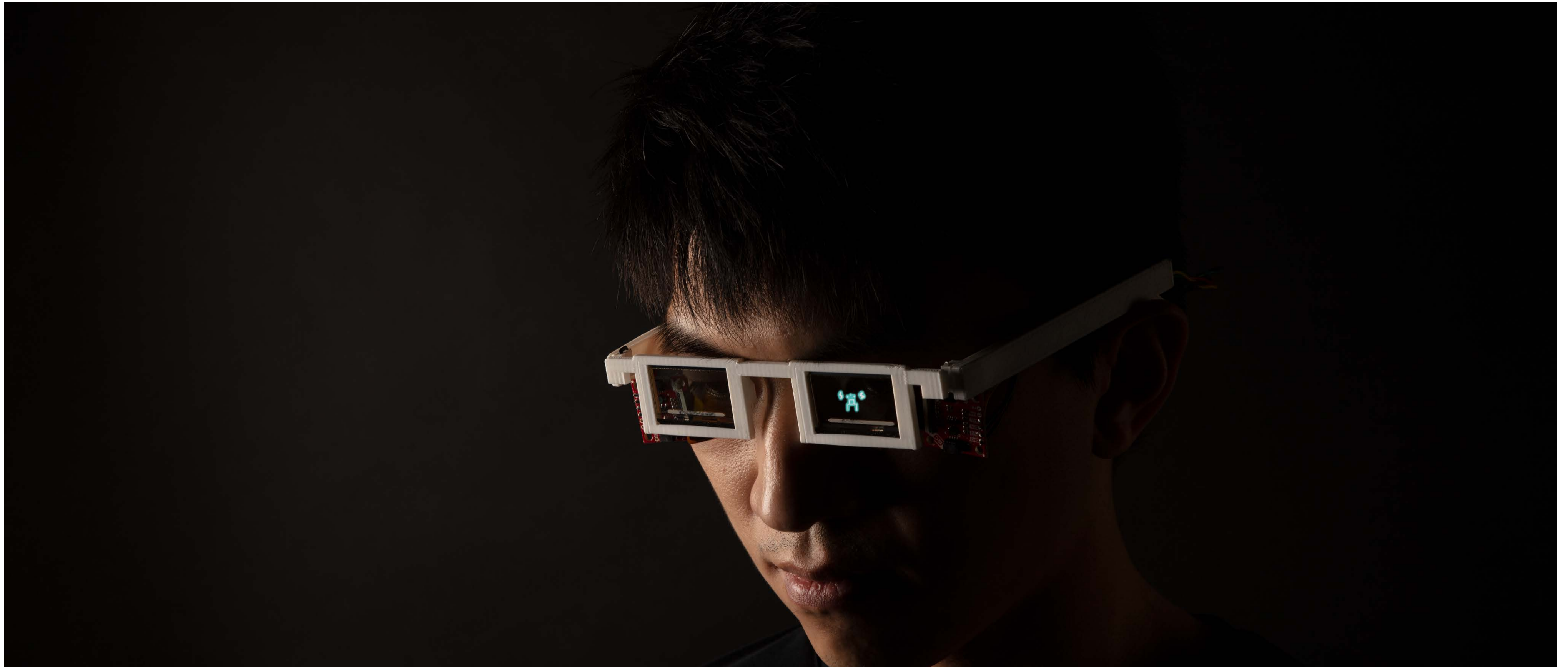


# BEYOND HEARING

Unleash Deaf people hearing superpower



## **Overview**

Beyond Hearing is an AR interface with a multi-sense feedback system to localise sound and improve Deaf people's safety, communication and daily sound engagement.

## **Tools / Skills**

Raspberry Pi 4 / Arduino  
C++ / Python  
3D modeling / 3D prints  
Sound analysis  
sensors development

Feb. 2022 - Now

# BEYOND HEARING

Problem / Research



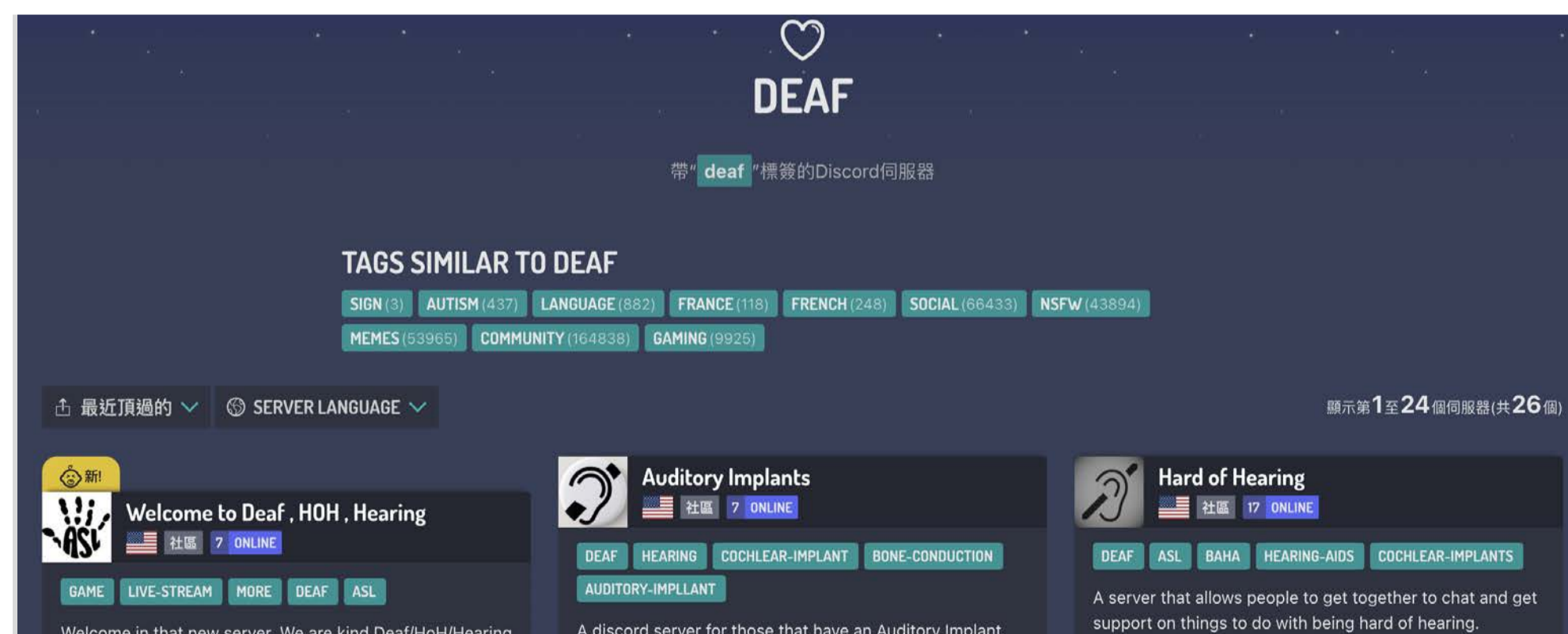
## ***Problem***

My sister was traumatised and suffered from hearing loss since the year 2021. She lost her right hearing ability which obstructs her from identifying the source of the sound correctly.

448M people in the world have defects with hearing ability. Sound localisation and engagement for Deaf people are the major problems in their daily life. 80% of my interviewees from the international Deaf community mentioned these issues limit their activities and sound experiences.

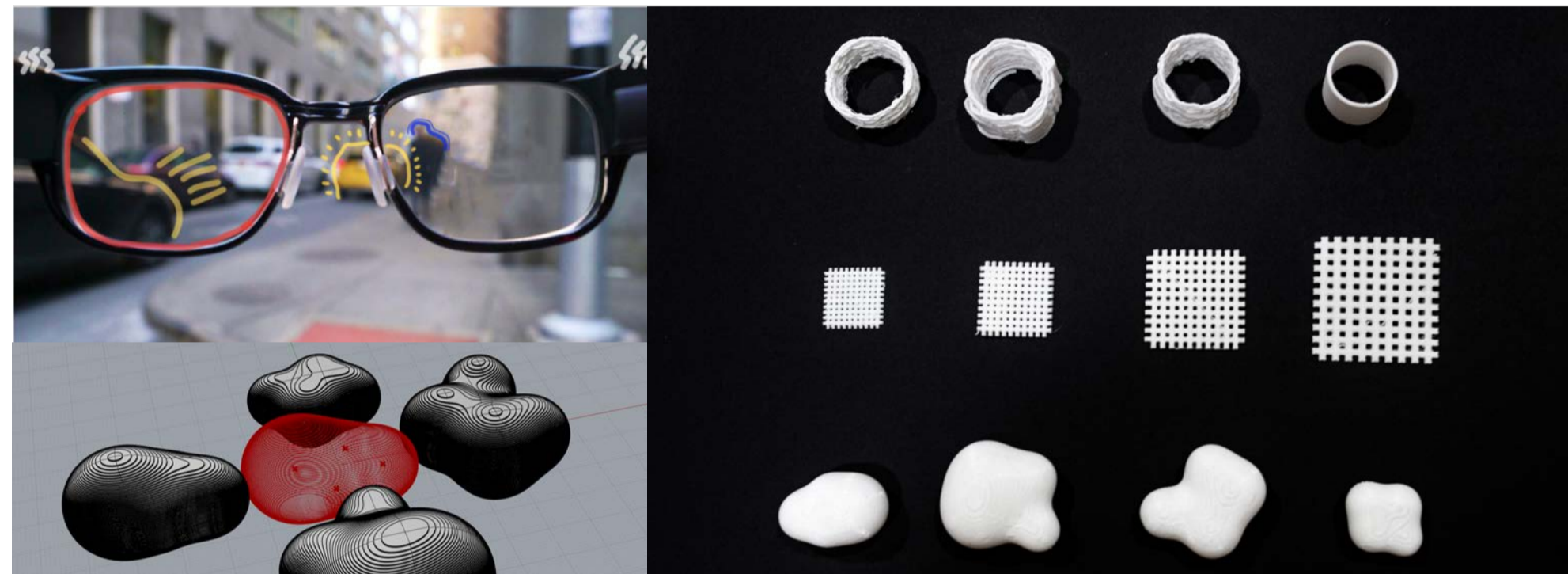
## ***Qualitative and Quantitative Research***

To understand more about hard of hearing people needs, the quantitative and qualitative survey have been done. In the interview with Deaf community, 80% of them point out sound localisation is the major problem in their daily life. The safety and communication problems are the two category they cared most.



# BEYOND HEARING

Process



## Ideation / EXP

In this stage, I try various method to present the location of sound. For example, tangiblised the sound into sculpture. Sound ttaatto and meta balls and the AR glasses. Then I test with users and found out the AR glasses on is the capable solution to achieve sound localisation.

## Iteration

From users' feedback, the revised version II and III were made, it increased the sensation of the sound and made the way of presentation more engaging

## HMW

How might I create an Argument Reality interface for Deaf people to localise and experience shape of sound



Fig. AR Glasses sound localisation imagination



Fig. Prototype I, LED indication glasses

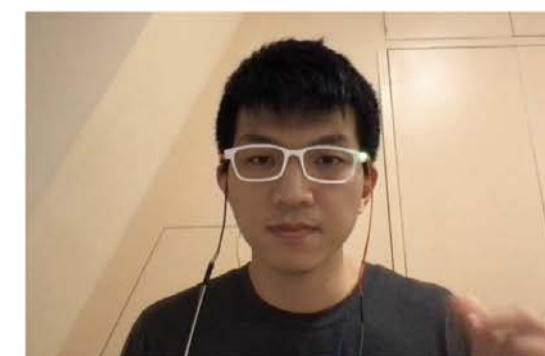


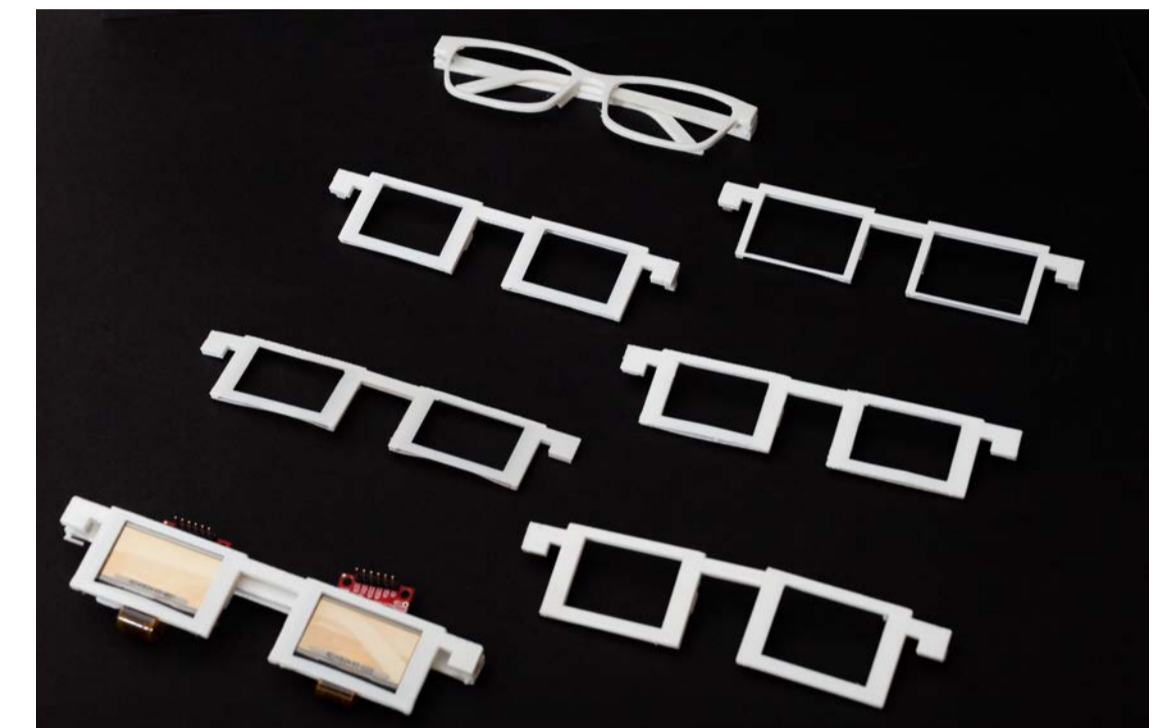
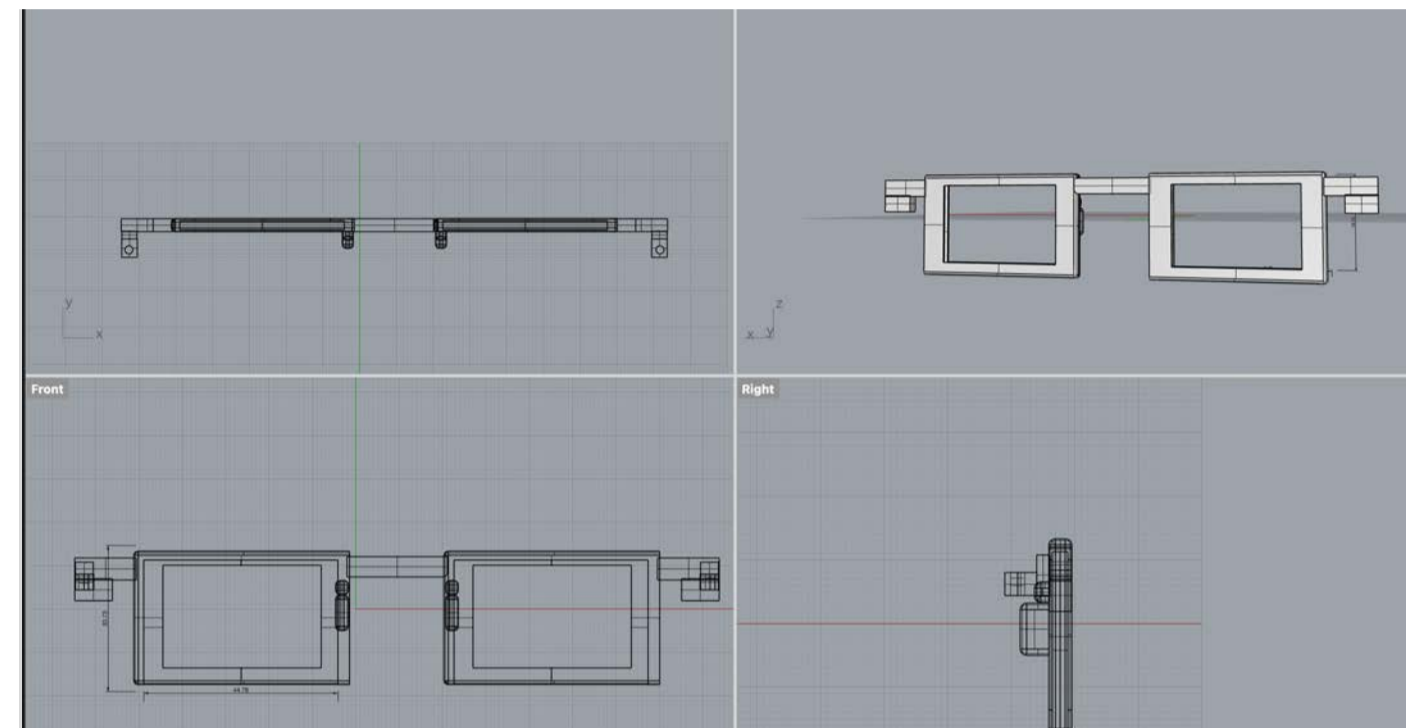
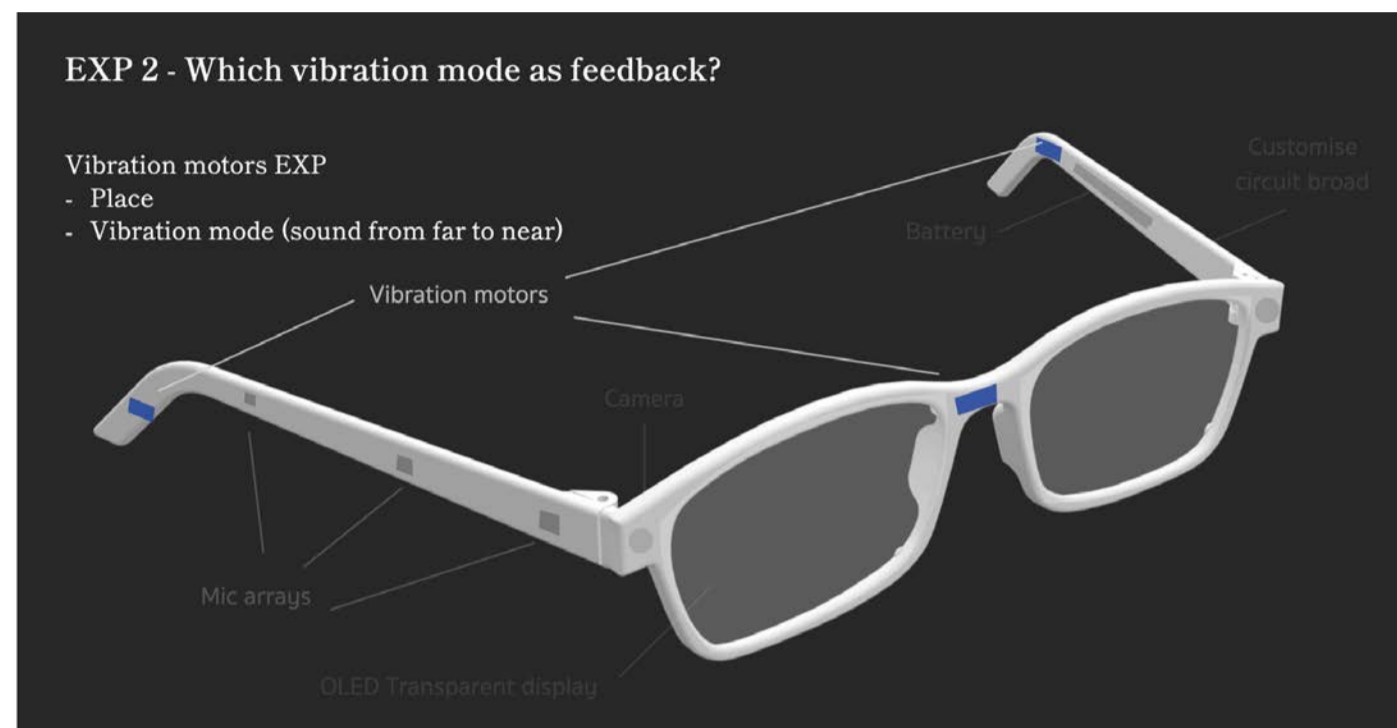
Fig. Sound indication tests (left and right)



Fig. Prototype user testing, using LED light to indicate the direction of sound

# BEYOND HEARING

Prototyping iteration / User test



```
ts_wsl1_140322
nt ledpin= 13;
nt ledpin= 12;
nt soundpin= 8;
nt soundpin= 7;
nt threshold = 200;
nt SAMPLE_TIME = 10;
d long millisCurrent;
d long millisLast = 0;
d long millisElapsed = 0;

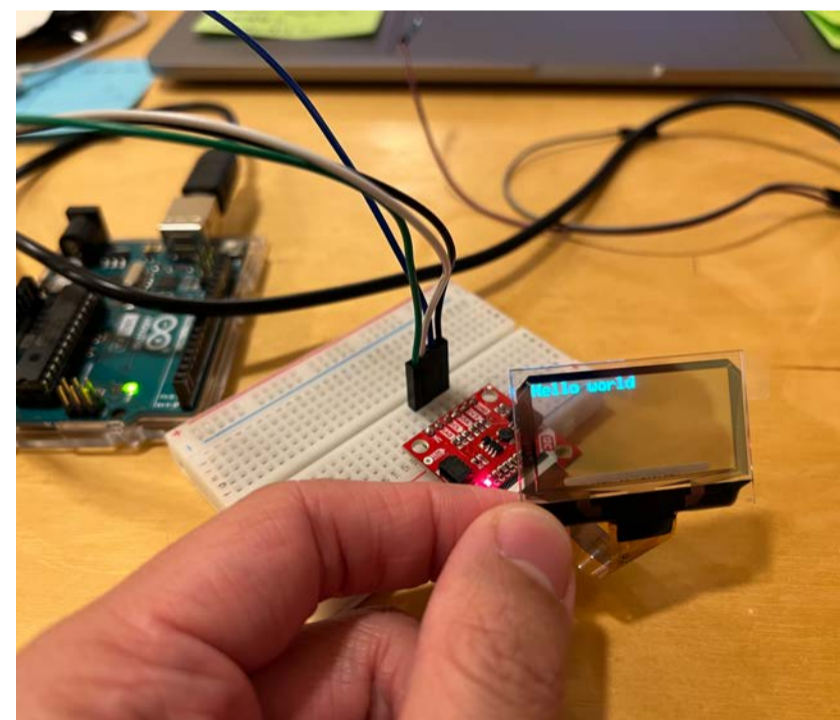
pleBufferValue = 0;
pleBufferValueR = 0;
top() {
  t your setup code here, to run once:
  l.begin(9600);
  de(ledpin, OUTPUT);
  de(soundpin, INPUT);
  de(ledpinR, OUTPUT);
  de(soundpinR, INPUT);
}

sp() {
  sCurrent = millis();
  sElapsed = millisCurrent - millisLast;
  digitalRead(soundpin) == LOW {
    pleBufferValue++;
  }

  digitalRead(soundpinR) == LOW {
    pleBufferValueR++;
  }

  (millisElapsed > SAMPLE_TIME){
    serial.println(pleBufferValue);
    ampleBufferValue = 0;
    millisLast = millisCurrent;
  }

  f (millisElapsed > SAMPLE_TIME){
    serial.println(pleBufferValueR);
    ampleBufferValueR = 0;
    millisLastR = millisCurrentR;
  }
}
```



```
OA.py X test.py serialposix.py VAD.py tuning.py AXD W5 te
DOA.py
from tuning import Tuning
import /Users/chunteho/usb_4_mic_array/DOA.py
import usb.util
import time
import serial
import struct
import math

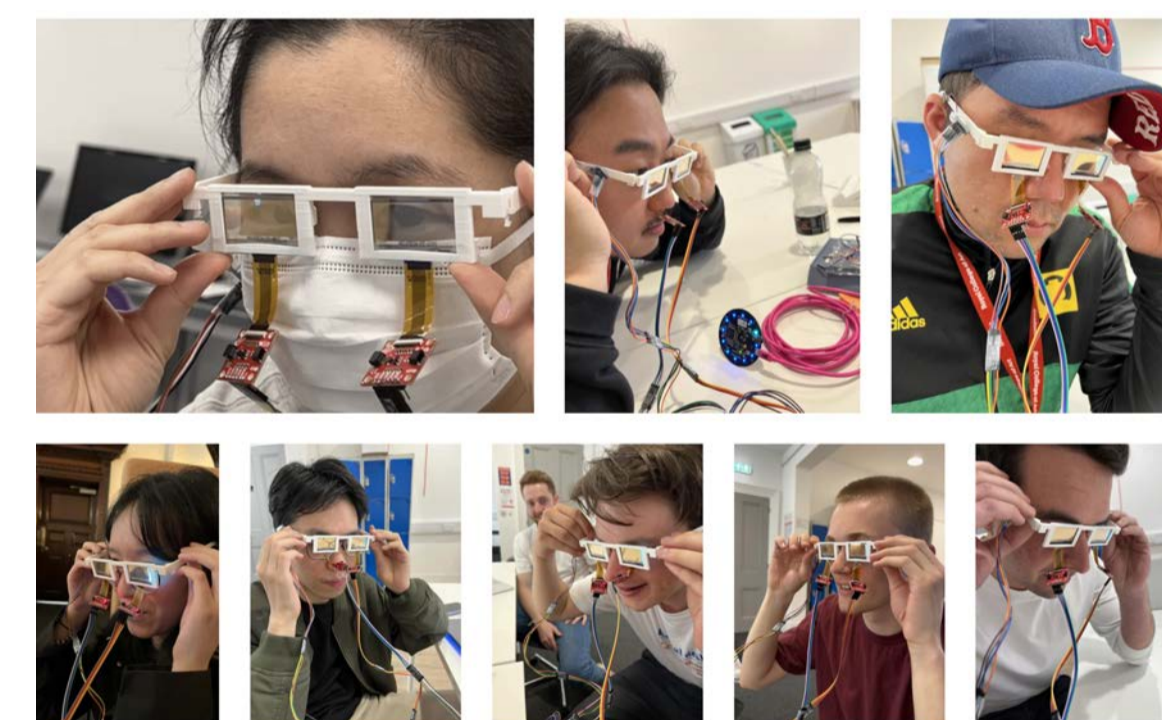
arduino = serial.Serial(port='/dev/cu.usbmodem142101', baudrate=9600, timeout=.1)

def write_read(x):
  arduino.write(x.encode())
  time.sleep(0.05)
  data = arduino.readline()
  return data

dev = usb.core.find(idVendor=0x2886, idProduct=0x0018)

if dev:
  Mic_tuning = Tuning(dev)

  while True:
    try:
      BA = math.floor(Mic_tuning.direction* 127.0/360.0)
      write_read(chr(BA))
      # write_read(chr(int (Mic_tuning.direction) + 255/360))
      # write_read(chr(Mic_tuning.direction % 255))
      # arduino.write(struct.pack('h', Mic_tuning.direction))
    except:
      pass
```



# BEYOND HEARING

## Outcomes

Beyond Hearing allows users to locate and identify sounds in their environment, empowering them to navigate their surroundings with greater awareness and independence in their daily lives. In addition, it also improves their safety when walking on the street and communication with people.

### Key Achievement:

- Participant in the Deaf community and have their feedback
- Exhibition on RCA SHOW 2022, and ICL Summer show 2022
- Press on RCA 2022 website
- Developed from ideas to functional prototype with users
- Winner of year for the RS grassroots Global Student Project Competition
- Shortlisted for the Global Design Graduate Show 2022 collaboration with GUCCI
- [IDA Official Selection 2022](#) (out of 1000+ works) and honorable mention \*3

