Synesthesia Wear

Feel the Sound

Agenda

01 Our Team

02 Project Details

03 Project Goals

04 Engineering Process

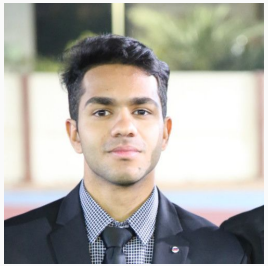
05 Demo

06 Future Plan

Meet the Team!

Jordan Bierbrier

Azriel Gingoyon



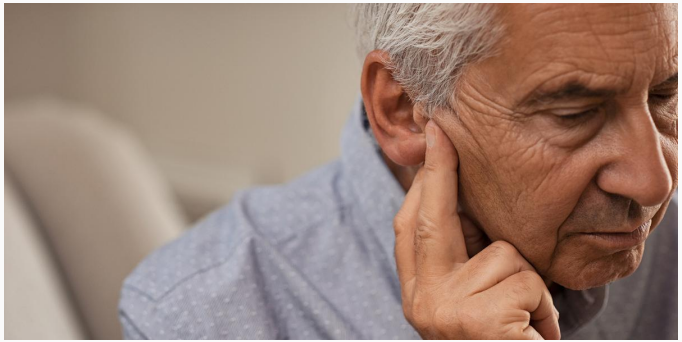
Udeep Shah

Abraham Taha

Taranjit Lotey

Problem

- Communication is crucial in daily life
- People who are Deaf or hard of hearing may struggle to recognize sounds in their environment
- Lead to missing important alerts / sounds
    - Name called
    - Fire alarm
    - Doorbell

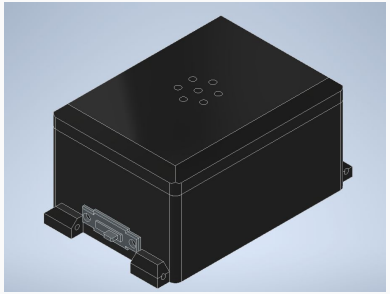


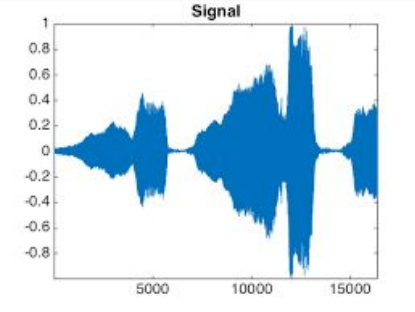
Abstract Solution

Create device that monitors environment for specific sound and alerts user (increase auditory awareness)

Preliminary Technologies

- Software → Sound Recognition
- Physical Device → Notification
- Application → Interface





Project Goals

- Inexpensive
- Portable
- Sound Recognition
- Non Intrusive
- Lightweight
- User Friendly
- Comfortable
- Compact

Intended Users

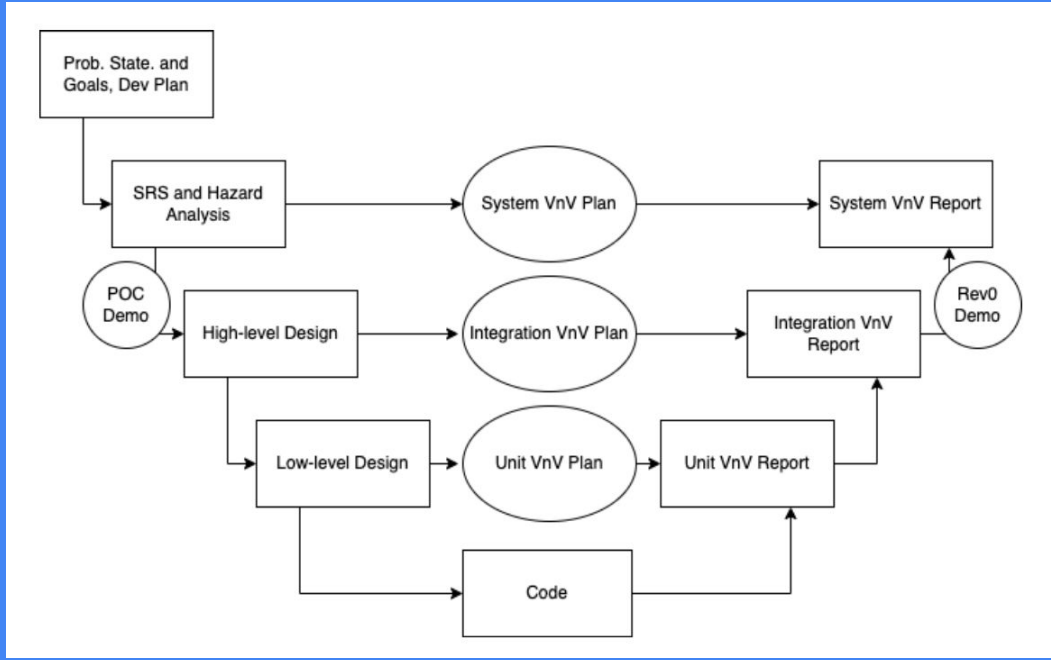
Deaf
357 000 Canadians

Hard of Hearing
3.2 million Canadians

Age Related Hearing Loss
33% of individuals (65 - 75)

General Public (listening to music)

The Engineering Process



Initial Stages

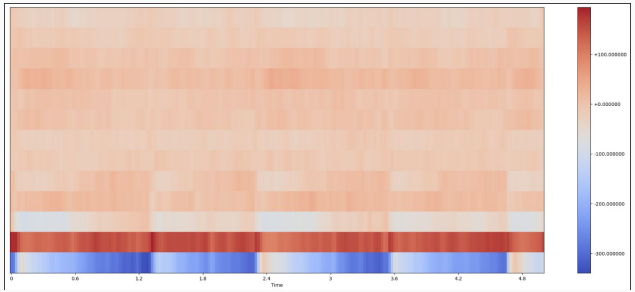
Neosensory

Hearing Aids

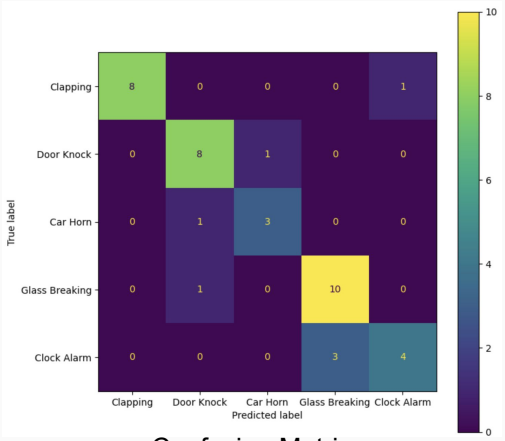
Apple Watch

- Researched current solutions
- Spoke with relevant experts
  - Katherine Hesson-Bolton
  - Dr. Martin von Mohrenschildt
- Initial design decisions
  - Classify specific sounds
  - Mobile application for user interface
  - Bracelet

Proof-of-Concept



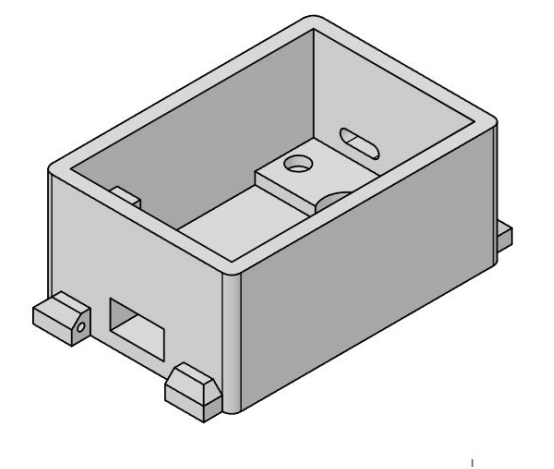
MFCCs



Confusion Matrix

- Python script to extract MFCCs and detect sound
- Interactive Android App
- Feedback
  - Real-Time Sound Processing
  - Hardware
  - Connectivity (via Bluetooth)

Physical Device (Component selection)

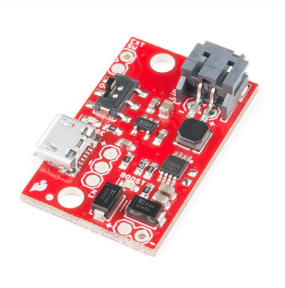


3D Printed PLA Enclosure

Arduino Nano BLE

3.7V Lipo Battery

Vibration Motor

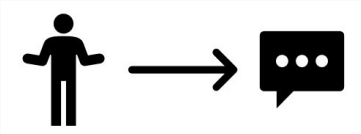


Lipo Charger/DC
Voltage Converter

Changes for Rev0

Sound processing to be done on the hardware

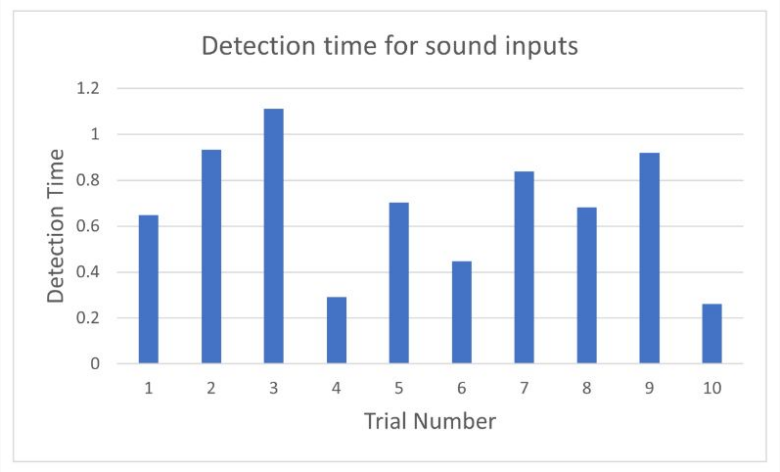
Training to be done externally

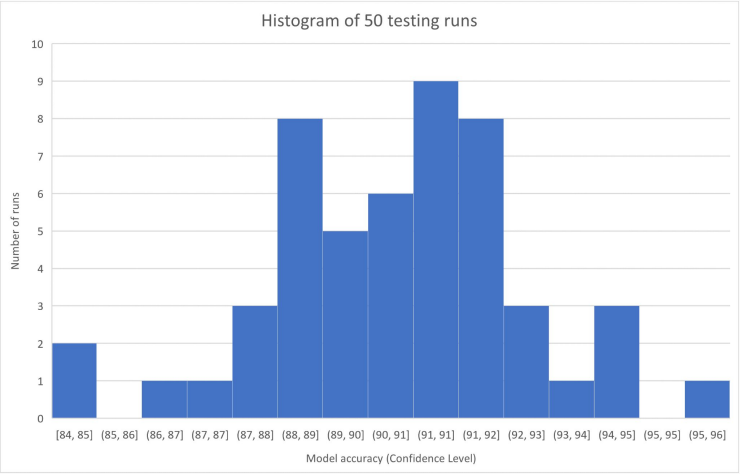


Speech-to-text eliminated

Testing / Feedback

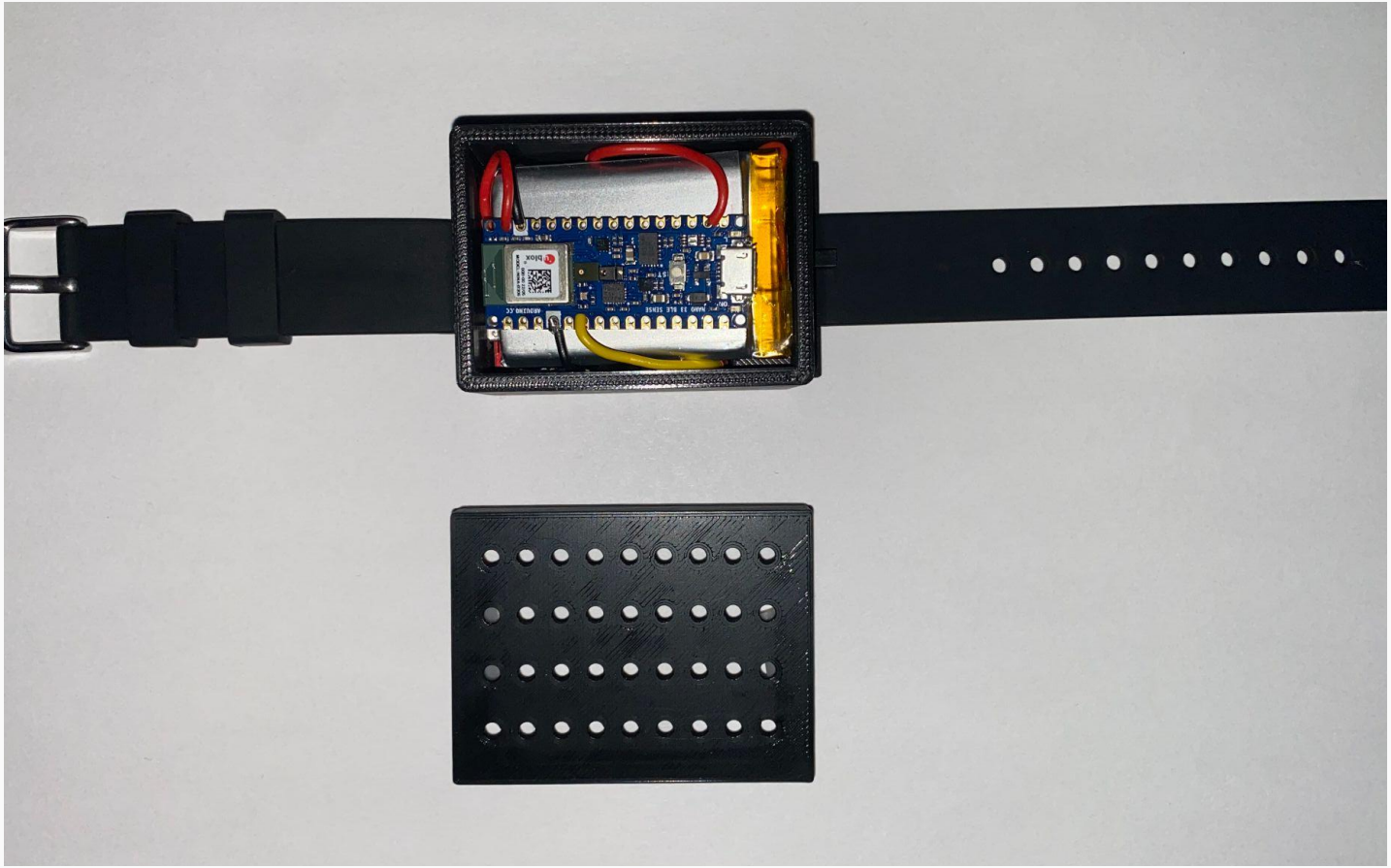
- Testing at different distances (Tested at 5m away)
- Testing variability speech (4 Different accents)
- Bluetooth connections (Disconnected at 15m)
- Surveying people (5 people)
- Spoke to Katherine (Post rev0)





The Current Solution

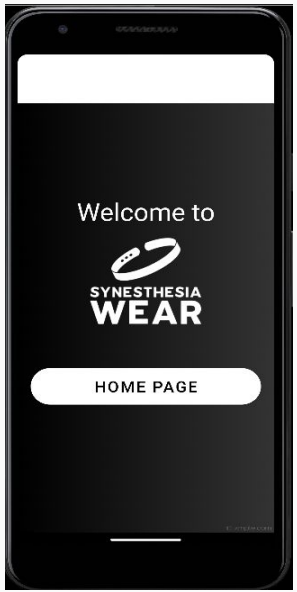
Wearable Device



The Application

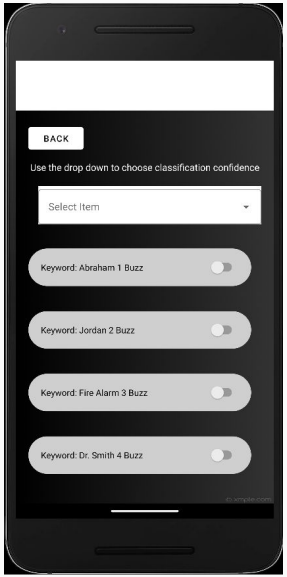
- **Developed using Android Studio**
- **Written in Java**
- **Uses the in-platform Bluetooth Low Energy API**

Home Page



Pairing

Keyword Selection

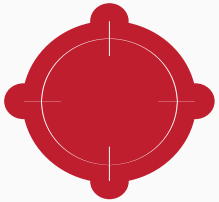
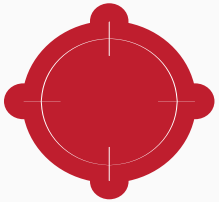
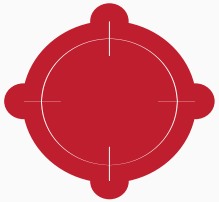
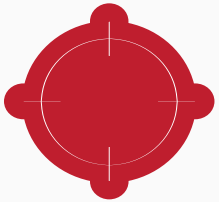
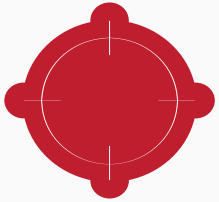
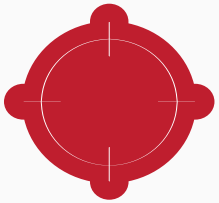
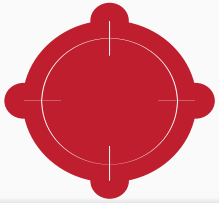
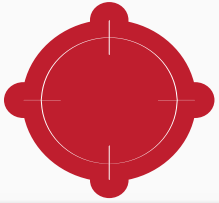


Audio Processing

- Improved machine learning model (added early stopping in training)
- Added training samples (included new class)
- Real-time confidence level change
- Training samples at farther distances

Demo

Goals - Revisited

	Inexpensive	**$85**		Portable	**8/10 Portability**
	Sound Recognition	**Accuracy >95%**		Non Intrusive	**User Tested**
	Lightweight	**80 grams**		User Friendly	**User Tested** (10/10 use device within 5 mins)
	Comfortable	**9/10 Comfort**		Compact	**6.5 cm x 5 cm x 4 cm**

Future Plan

More tests with the target audience

Sound detection in loud environments

Live Training

Make the device more compact

Thank You!

Questions?