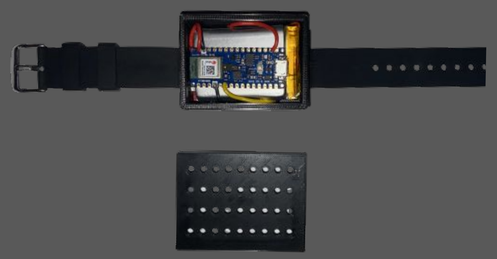
Synesthesia Wear

McMaster University

Introduction

We have created a compact wearable device that aims to improve the user's auditory awareness by monitoring their environment for specific sounds. The device alerts the user using haptic feedback if a keyword is detected.



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 Team

Jordan Bierbrier, Azriel Gingoyon, Udeep Shah, Abraham Taha, Taranjit Lotey

Product Design & Use

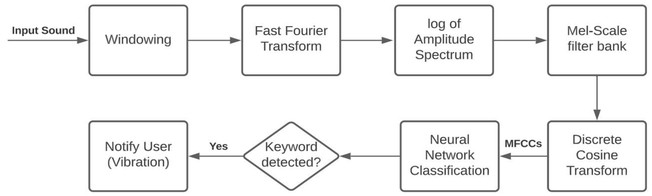


Figure 1 - Keyword detection workflow diagram

The device collects audio data from the user's environment and extracts Mel-frequency cepstral coefficients (MFCCs). These coefficients/features are then classified using a neural network. If a user-specific sound is detected, the wearable device will provide a unique vibration to notify the user.

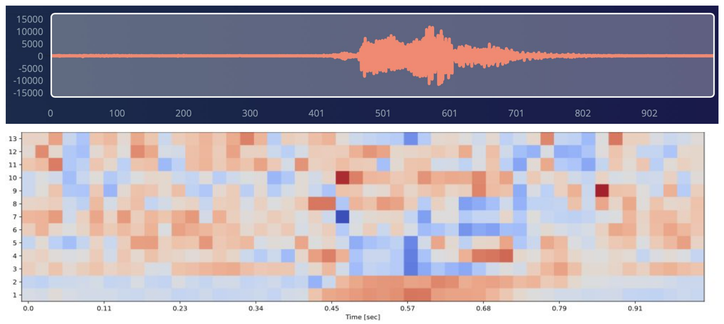


Figure 2 - MFCCs from raw sound wave of "Jordan"

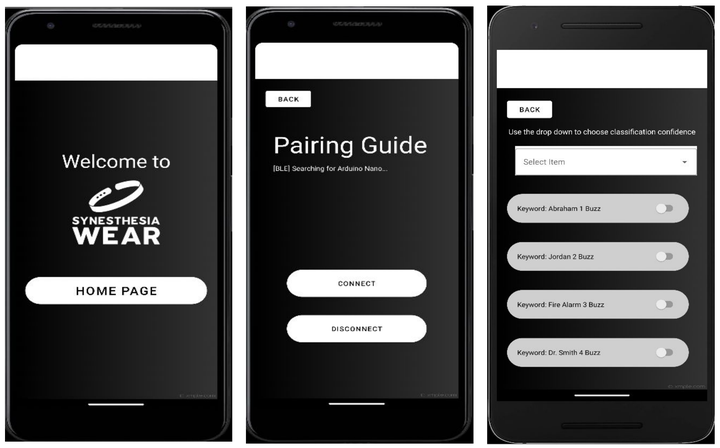


Figure 3 - Screenshots of the Synesthesia Wear App

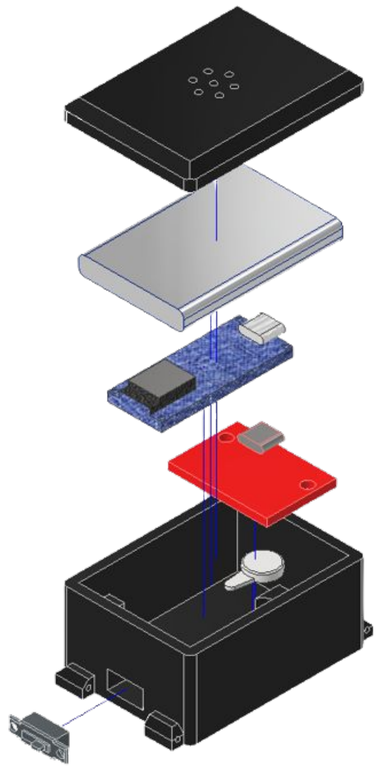


Figure 4 - Exploded diagram

	ABRAHAM	DRSMITH	FIRE ALAR	JORDAN	_NOISE	_UNKNOW
ABRAHAM	99.2%	0%	0%	0%	0.8%	0%
DRSMITH	0%	98.8%	0%	0%	0%	1.2%
FIRE ALARM	0%	0%	100%	0%	0%	0%
JORDAN	0.4%	0%	0%	98.8%	0.4%	0.4%
_NOISE	0%	0%	0%	0.4%	98.7%	0.9%
_UNKNOWN	2.2%	0.4%	0.9%	6.2%	2.7%	87.6%

Figure 5 - Confusion matrix from trained neural network

Technology Used

Arduino, Python, Java, Autodesk Inventor, C, Audacity, TensorFlow

Testing

- **Testing at different distances**
- **Testing variability speech (4 accents)**
- **Bluetooth connections (Disconnect - 15m)**
- **Surveying people (5 people)**

Goals Achieved

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

What's Next?

- **More tests with the target audience**
- **Sound detection in loud environments**
- **Live training**
- **Make the device more compact**