Group #59
Aarushi Biswas, Anitya Kapoor, Yash Gupta

Bracelet Aid for d/Deaf People
Our Team

Aarushi Biswas
*Computer Engineering, Senior*

Anitya Kapoor
*Computer Engineering, Senior*

Yash Gupta
*Computer Engineering, Senior*
HOW IMPORTANT ARE SOUNDS?
Our Solution
How does the device work?

1. Sound received by watch
2. Watch vibrates with visual cue to inform user of the sound
3. Press buttons to stop vibration / display battery percentage
4. Swap batteries when bracelet is dead
5. Enclosure for circuit
6. External swappable battery charging
Physical Design : Initial Prototype

- Display for visual cues
- Display charge
- Turn off vibration
- Battery slot
- Elastic band
- Vibration motor on the bottom
Physical Design: Our Final Product
High Level Requirements

- Lightweight and comfortable with a total weight of less than 70 grams
- Can detect up to 10 different sounds and produce 10 distinct vibrations
- The feedback time between detection and notification is less than 10 seconds
Our device weighs just under 70 grams, making it extremely lightweight and wearable.
Our Block Diagram
Power Subsystem
Power Subsystem

- Most critical requirement → Battery life of >24 hours
- Swappable Batteries provided
- Additional Charger circuit included

Ensures that user has 0 downtime
Sound Detection Subsystem
Sound Detection Subsystem

- Major Requirements:
  - Subsystem should detect sounds with a frequency range of 200 Hz - 15 KHz
  - Detection time of <10 seconds
- How are we doing the Sound Detection? Using Fast Fourier Transforms
FFTs
Our Subsystem can detect sounds with frequencies from 200 Hz to 15 KHz
Vibration Subsystem
Vibration Subsystem

- It should be able to produce at least 10 unique vibration patterns
- The subsystem should successfully produce a vibration within 10 seconds of when a sound is produced
We asked 15 people whether they can distinguish the 10 vibrations

We asked a group of 15 people to verify whether they can differentiate between our 10 vibrations and 10 symbols. The results were as followed:

<table>
<thead>
<tr>
<th>Name</th>
<th>Vibrations</th>
<th>Display</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anuraag Agarwal</td>
<td>No</td>
<td>Yes</td>
<td>Microwave and Fire alarm vibrations felt similar, changes made according to user input</td>
</tr>
<tr>
<td>Trusha Vernekar</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Achyut Agarwal</td>
<td>No</td>
<td>Yes</td>
<td>Phone ringing and Fire alarm vibrations felt similar, changes made according to user input</td>
</tr>
<tr>
<td>Kartik Mehra</td>
<td>No</td>
<td>Yes</td>
<td>Smoke Detector and Burglar alarm vibrations felt similar, changes made according to user input</td>
</tr>
<tr>
<td>Elina Mehra</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Malhar Vora</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Rohan Batra</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Eshrit Tiwary</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Panav Munshi</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Aliva Panigrahi</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Aumkar Renavikar</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Daniel Abdoue</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Sruti Kamarajugadda</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Adit Arora</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>
Display Subsystem
Display Subsystem

- It should be able to clearly display symbols associated with detected sounds
We asked 15 people whether they can distinguish the 10 icons

We asked a group of 15 people to verify whether they can differentiate between our 10 vibrations and 10 symbols. The results were as followed:

<table>
<thead>
<tr>
<th>Name</th>
<th>Vibrations</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anuraag Agarwal</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Trusha Vernekar</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Achyut Agarwal</td>
<td>No</td>
<td>Yes, Microwave and Fire alarm vibrations felt similar, changes made according to user input</td>
</tr>
<tr>
<td>Kartik Mehra</td>
<td>No</td>
<td>Yes, Smoke Detector and Burglar alarm vibrations felt similar, changes made according to user input</td>
</tr>
<tr>
<td>Elina Mehra</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Malhar Vora</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Rohan Batra</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Eshrit Tiwary</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Panav Munshi</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Aliva Panigrahi</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Aumkar Renavikar</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Daniel Aboue</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Sruti Kamarajugadda</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Adit Arora</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>
User Interaction Subsystem
User Interaction Subsystem

- 2 buttons
  - Display Power on the Display
  - Turn off vibrations once user has been notified
- Easily accessible and spaced far enough apart to ensure buttons aren’t accidentally pressed
Conclusion

- High Level Requirements met
- Subsystem requirements met
- Project working on a PCB
Major Problems Faced

- Changed Microcontroller → Changed PCB design
- Too much computing load on Microcontroller → Changed FFT libraries
- End moment soldering issue
Future Plans

- Switch to Neural Nets for Sound Detection for more reliable results
- Better packaging in order to prevent absorption of vibrations
- Connection with a phone app
- Allow user to record their own sounds
Thank You!

Any Questions?