

# Team A7: deciBright

---

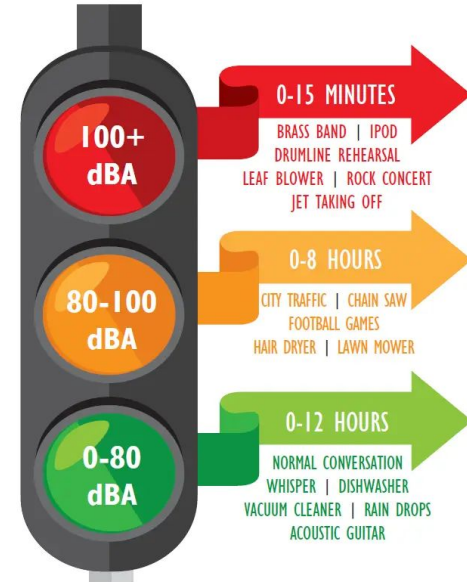
Lucy Chen, Freda Su, Katherine Sabak

# Use Case

Problem: Many people may not be aware of how loud their surroundings are, and how that can affect their hearing.

Solution: A light-up bracelet is a fashionable accessory that's a convenient and socially acceptable way to monitor sound volume and direction.

Course Areas: Software, hardware, signal processing



# MVP Requirements

Width	$\leq 46 \text{ mm}^1$
Thickness	$\leq 9 \text{ mm}^1$
Weight	$\leq 200 \text{ g}^2$
Operating temperature	$\leq 105^\circ\text{F}^3$
dB value	$\leq 2 \text{ dB of actual value}^4$
Timeliness	Response time $\leq 1 \text{ second}$
Adjustability	Bracelet length 7-10 inches <sup>5</sup>
Durability	Functions normally after 2.5-ft drop <sup>6</sup>

1. <https://www.watchesofswitzerland.com/watch-buying-guide/watch-size-guide>

2. <https://devicetests.com/how-much-does-a-smartphone-weigh>

3. <https://ntrs.nasa.gov/api/citations/20100020960/downloads/20100020960.pdf>

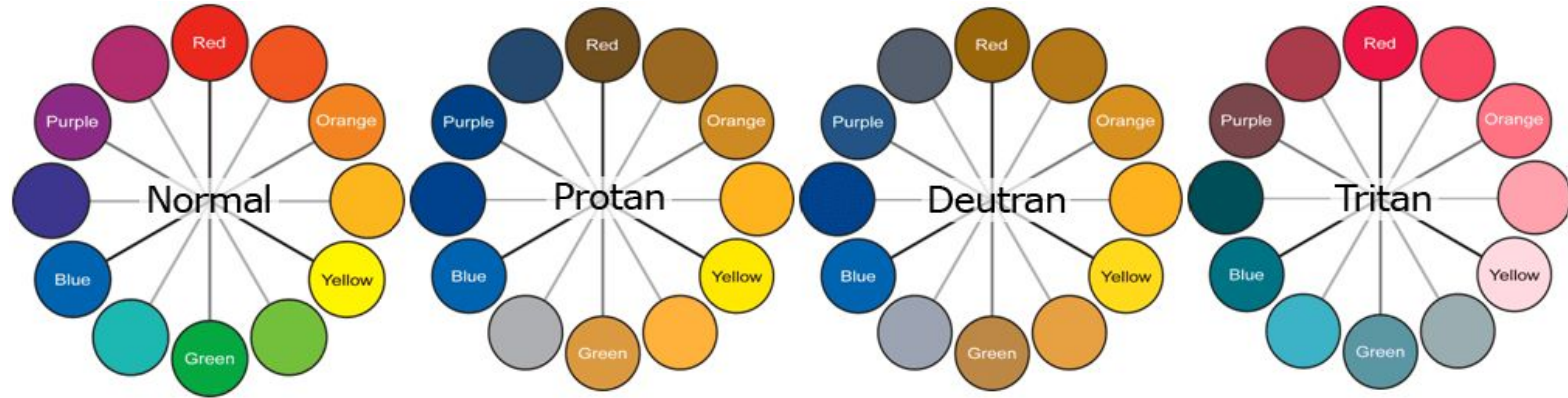
4. <https://blogs.cdc.gov/niosh-science-blog/2014/04/09/sound-apps/>

5. <https://www.blingjewelry.com/pages/bracelet-sizing>

6. <https://rapportfurniture.com/blogs/rapport-furniture/standard-dining-table-dimensions>

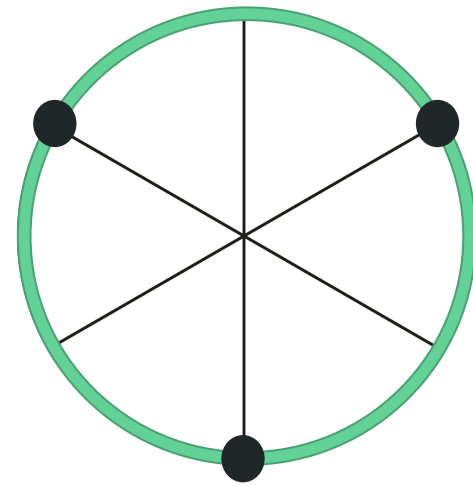
# Health and Safety Considerations

- Heat<sup>1</sup>
- Weight<sup>2</sup>
- Accuracy<sup>3</sup>
- Electrical safety
- Wireless<sup>4</sup>
- Accessibility<sup>5</sup>



# Technical Challenges

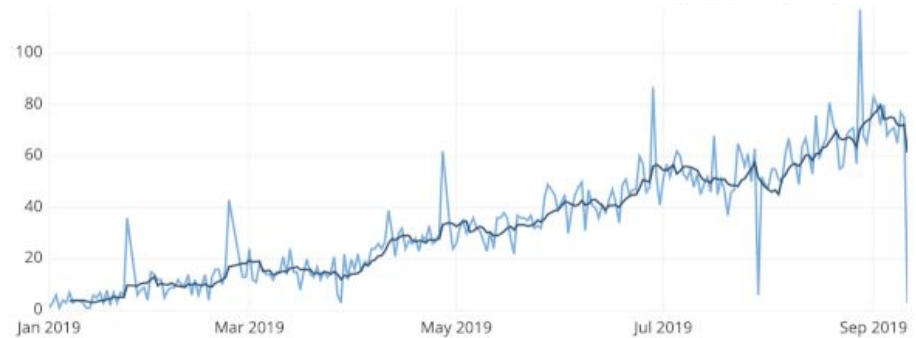
- **Miniaturization (size, weight)**
  - dB accuracy (microphone sensitivity)
  - Multiple microphones (3+) required for directionality
- **Web app (wireless communication)**
  - Reading/syncing information
  - Visualizing data
  - Discarding old data
- **Mitigation strategies**
  - Minimize number and size of components
  - Plan for large amount of time spent on webapp development
  - Order extra components for prototypes



# Implementation Plan

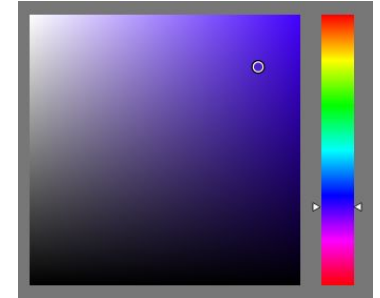
- Bracelet with lights

- Instantaneous & average volume
- Directionality
- Wireless communication



- Webapp controls

- Exact decibel reading
- Range threshold and color settings
- Individual session graphs: volume, directionality vs. time



- Bracelet controls

- Button 1: Turn bracelet on/off
- Button 2: Toggle instantaneous vs. average mode; toggle directionality mode

# Solution Approach

- Hardware

- Casing material: Plastic tubing, string, plastic cord lock
- Power source: 3.6V rechargeable coin cell battery<sup>1</sup>
- Microcontroller: Nano-size BLE-capable and safe for minimal distance from body<sup>2</sup>
- Microphones: Akustica analog
- Lights: Individually addressable<sup>3</sup> dense LED strip<sup>4</sup>, possible boost converter<sup>5</sup>



- Software

- React Native for front end development<sup>6</sup>
- Django for backend development
- Google OAuth for security and password protection
- Firebase for data storage

1. <https://learn.sparkfun.com/tutorials/battery-technologies/coin-cell> & <https://onlybatteries.com/lir2025-3-6-volt-lithium-ion-button-battery/> or <https://www.canadarobotix.com/products/1436>

2. <https://store-usa.arduino.cc/products/arduino-nano-33-ble>

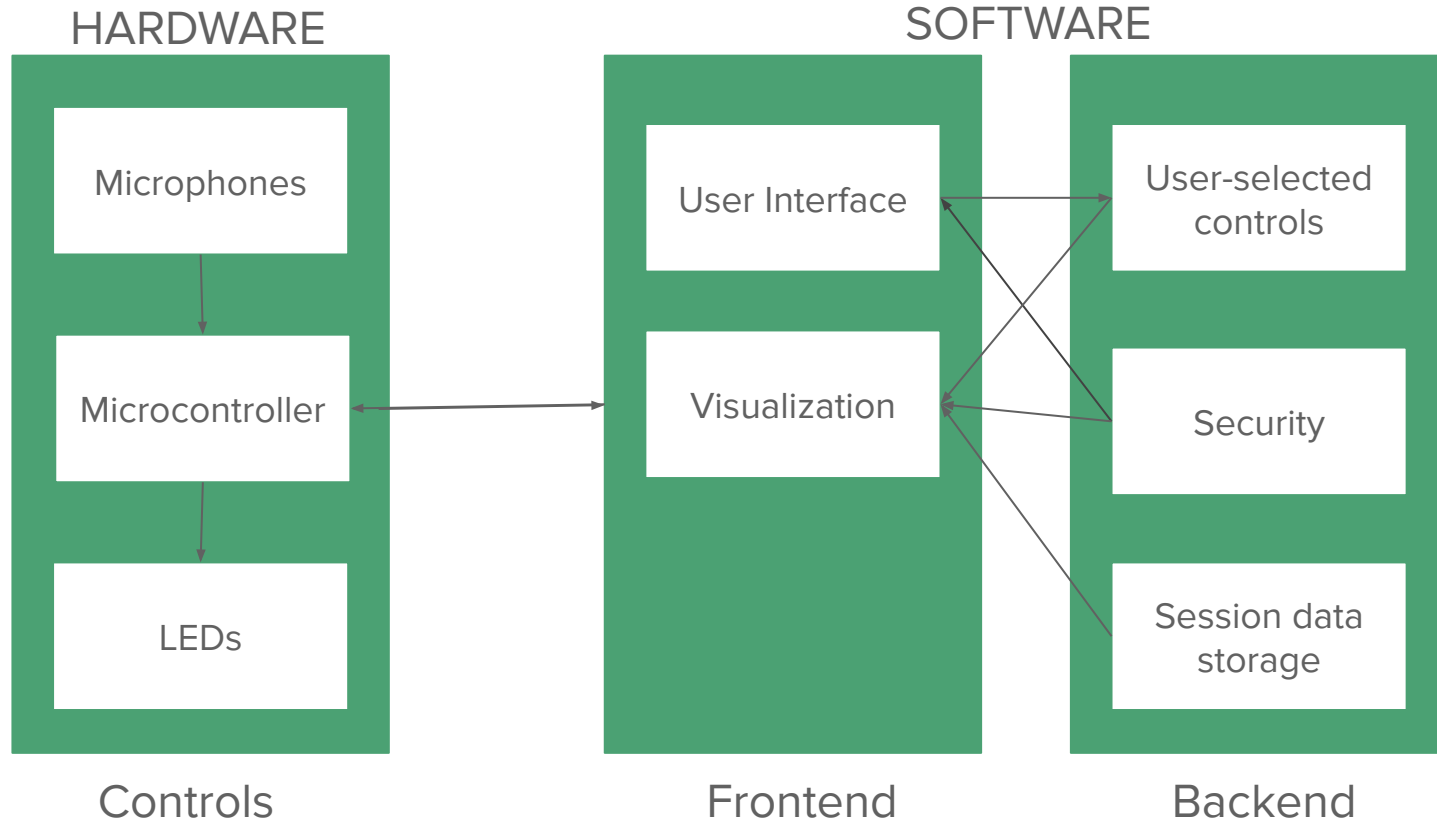
3. <https://www.superlightingled.com/addressable-led-strip-lights-c-5.html>

4. <https://www.pololu.com/product/2531>

5. <https://www.pololu.com/product/2564>

6. <https://www.devlane.com/blog/flutter-vs-react-native-a-2023-developer-perspective>

# Solution Approach Diagram





# Unit Testing, Verification and Metrics

## Bracelet

Size	Scale, ruler
Operating temp	Temperature sensor during other tests
Adjustability	Try on different people's wrists
Volume within +/- 2 dB & directionality accuracy within 60°	Test with soundproof room, speaker, validated decibel meter
Timeliness	Video recordings
Durability	2.5-ft drop test
Color control	Cycle through all the colors

## Web app

UI	Users can't break the system with bad inputs
Data management	Sample data disposed after a week
Visualization	Graphs display correctly
Security	Login/Password needed to use

# Integration Testing, Verification and Metrics

Bluetooth	Test wireless connection between web app and bracelet through sending/receiving data
Wear test	Comfortable, adjustable, responsive, battery-life
UI, UX of web app	Easy to navigate and understand, customizations update accurately

# Tasks and Division of Labor

<b>Katherine</b>	<b>Freda</b>	<b>Lucy</b>	<b>All Team Members</b>
<ul style="list-style-type: none"><li>● Electronic prototyping and I/O</li><li>● Bluetooth connection</li><li>● Microphone signal processing</li></ul>	<ul style="list-style-type: none"><li>● LED signal setup</li><li>● Physical bracelet fabrication</li><li>● Arduino code</li></ul>	<ul style="list-style-type: none"><li>● Webapp setup</li><li>● Data management and security</li><li>● UI and Design</li></ul>	<ul style="list-style-type: none"><li>● Unit testing</li><li>● Integration testing</li></ul>

