

Problem Statement

Existing devices to monitor **safety** of individuals with FTD rely on internet access, external devices, and **constant attention** from a caregiver.

Engineering Goal

The goal is to design and develop a wearable wristband that **alerts** users as they approach pre-defined boundaries and hazardous objects.

Methodology

Initial sketches, idea development, brainstorming

Programming the Raspberry Pi to sense the ESP32 board through BLE sensing (allows for sensing of proximity of two devices)

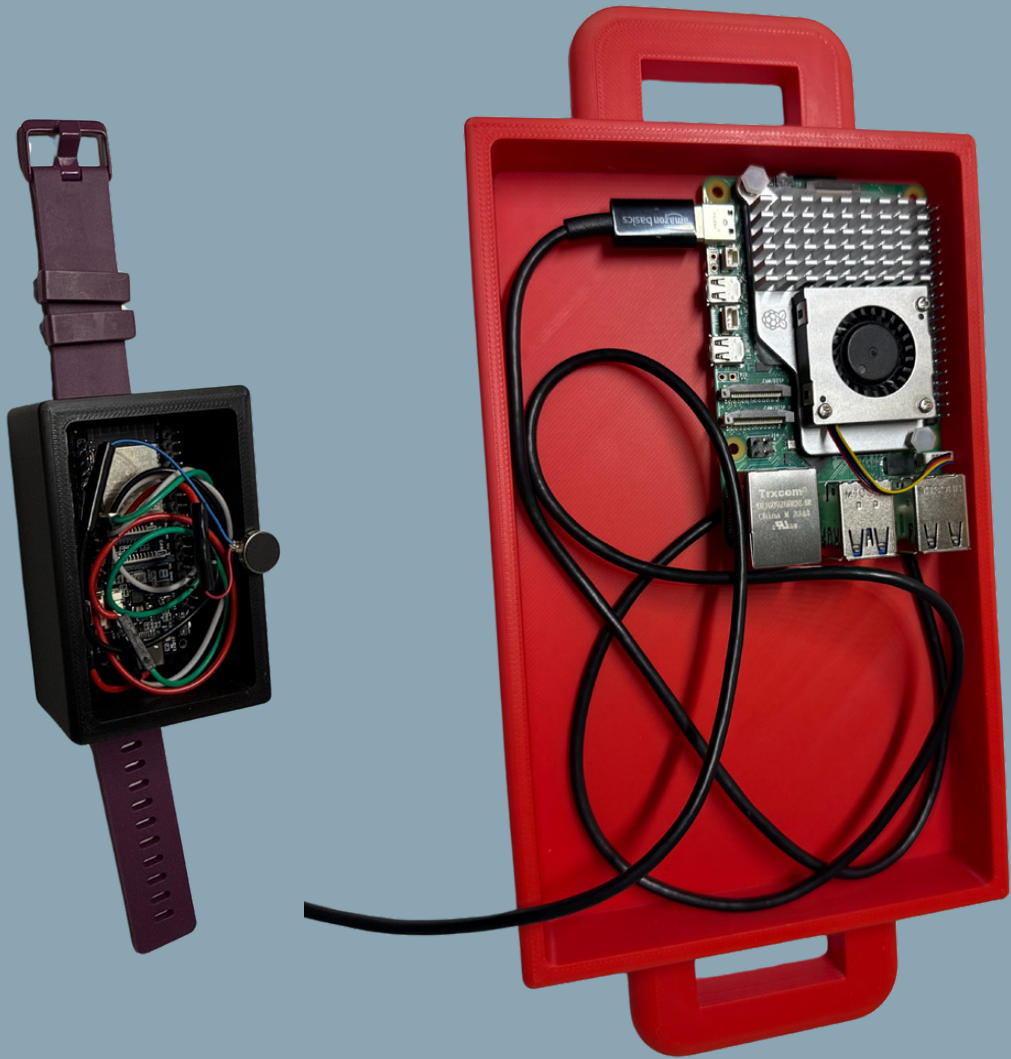
Converting RSSI to distance - measuring different RSSI values, different meter distance values as device moves around (testing)

LED vs. motor testing for optimization (activation within 1 meter of the Raspberry Pi)

Requirements

Level 1 Requirements	Y/N
The device shall detect when the user exits or enters a predefined safe zone with a location error ≤ 1 meter	Y
The device shall alert triggers within 1 second of boundary crossing/detection of a hazard	Y
The device shall provide haptic feedback when an alert condition is triggered (auditory, vibrational, visual)	Y
The device shall operate without requiring companion app connection during regular functionality	Y
The device shall allow the user to power the device on and off using a single switch	Y
The device shall be manufactured with less than \$80	Y
The device shall weigh no more than 2 lbs	Y

Current Design



Why we **chose** this design:

- Allows for **calming** messages to be played
- Non-harsh** alerts
- App-compatible
- Adjustable** straps
- Visual** alert component (LED)

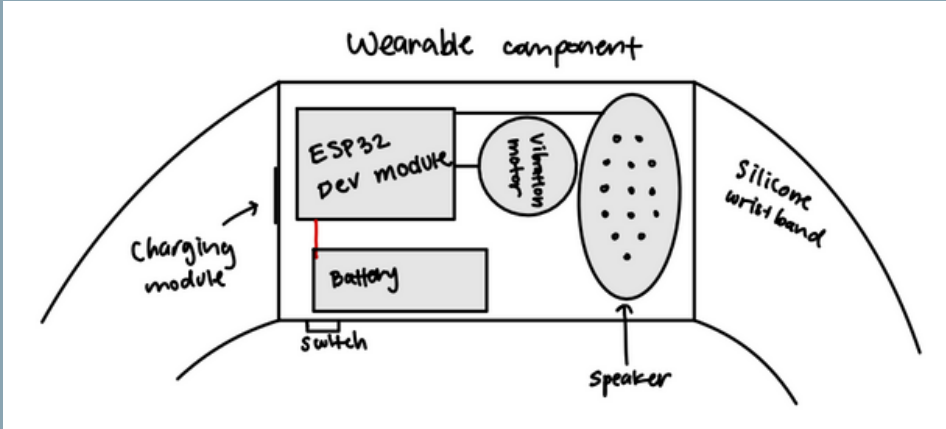
Design I

Pros:

- RFID activation
- Physical, immediate alerts

Cons:

- RFID activation requires close proximity
- Haptic feedback can be harsh



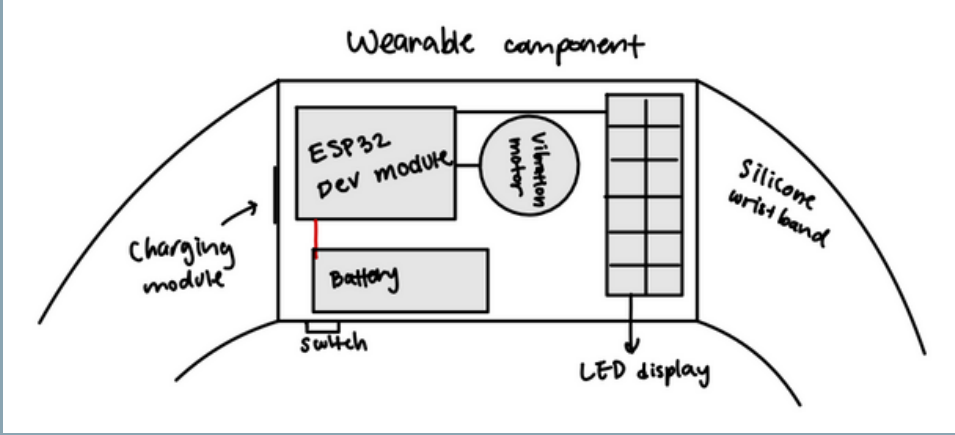
Design II

Pros:

- Non-haptic feedback alerts (LED blinking)
- App-based caregiver notifications

Cons:

- Visual cues can be missed
- Smartphone dependence limits accessibility



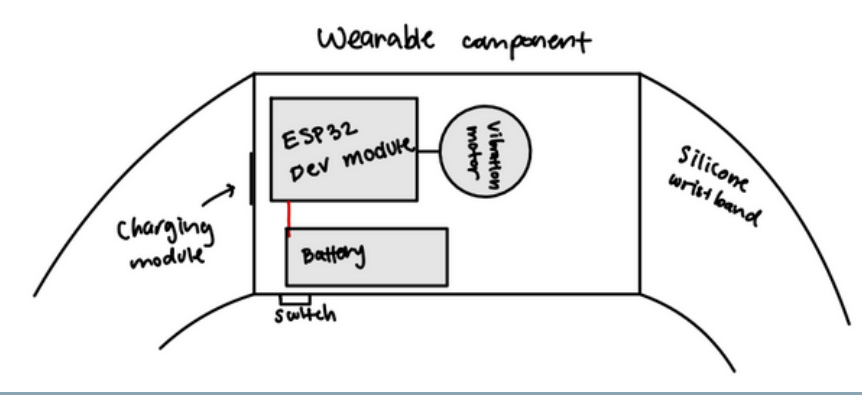
Design III

Pros:

- Implemented voice module
- Calming, pre-recorded voice warnings (customizable)
- Ability to be paired with companion app but can operate standalone

Cons:

- Audio cues also have the potential to be missed



Design Study I

Purpose:

To determine if vibration motor is activated at different distances

Independent Variable:

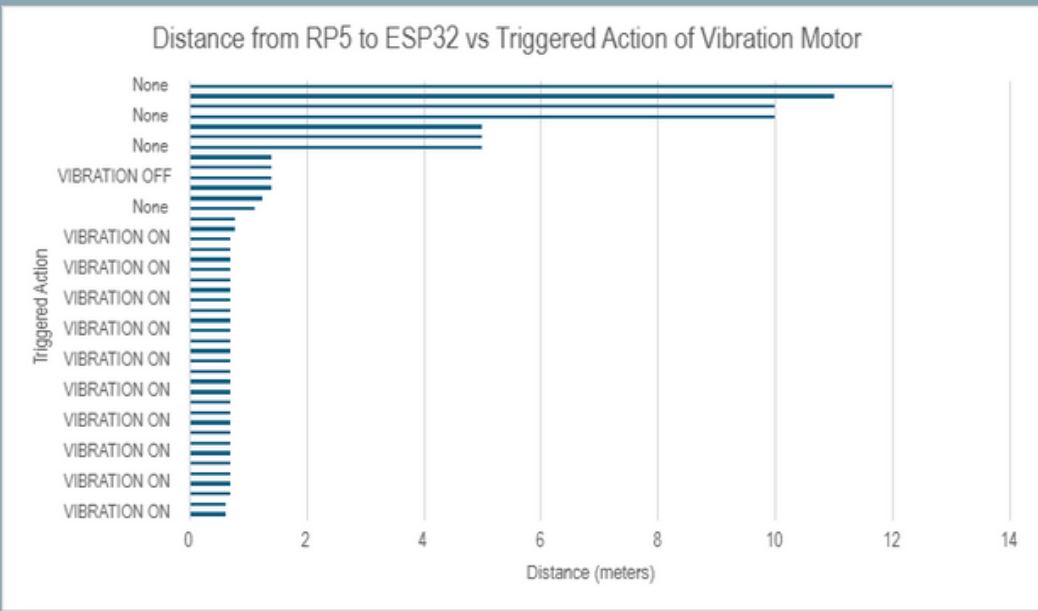
Distance between RP5 and ESP32

Dependent Variable:

If vibration motor is activated

Conclusion:

The vibration motor is activated up to distance of around 0.8m.



Design Study II

Purpose:

To determine optimal distance of RP5 from ESP32, compared with RSSI

Independent Variable:

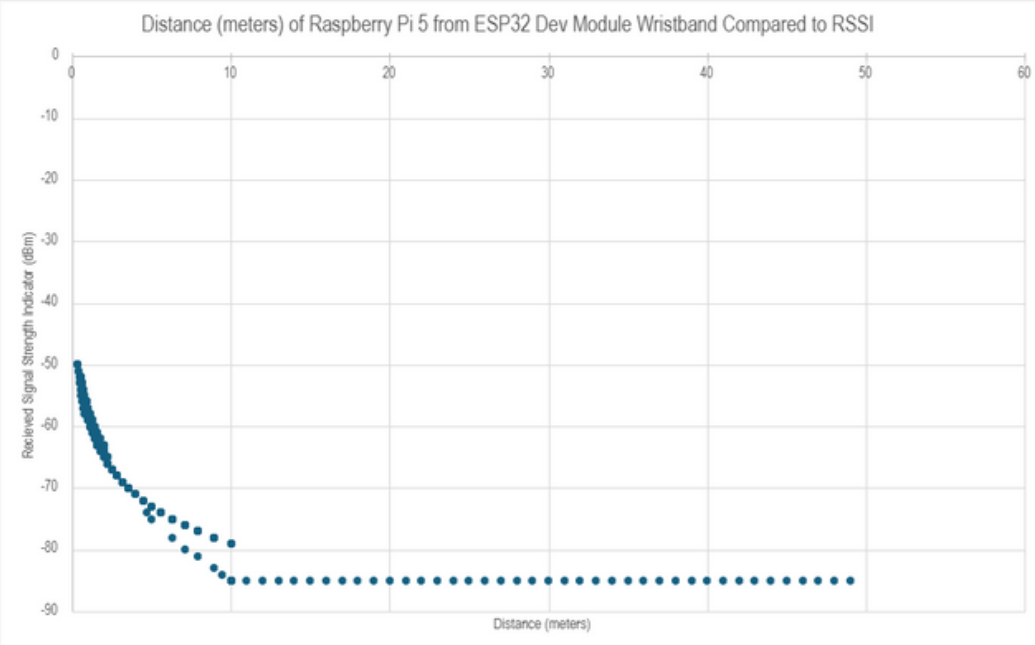
Distance between RP5 and ESP32

Dependent Variable:

Received signal strength indicator (dBm)

Conclusion:

The RSSI was less than -85 dBm up to 10 meters, so signal strength is classified as 'Good' until 10 meters.



Conclusions & Future Work

- The most challenging part was making the device compact and ensuring the alert system would be comfortable for individuals with FTD
- Monitor performance over long periods
- Adjust design based on comfort and accessibility
- Develop system for caregivers to record messages for the individual with FTD, instead of using pre-recorded messages