



# Home Management System for Frontotemporal Dementia

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## 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)

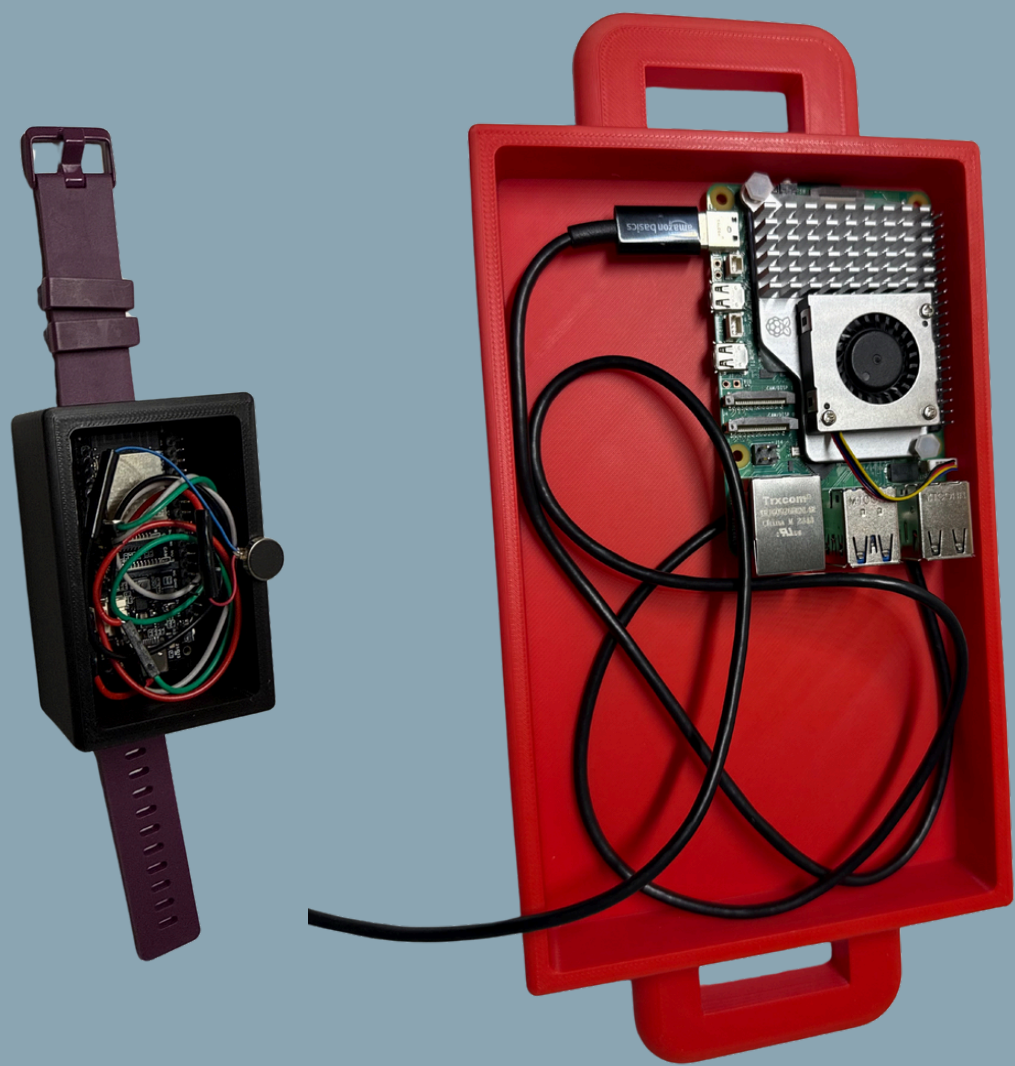
Converting RSSI to distance - measuring different RSSI values, different meter distance values as device moves around (testing)

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 $\leq 1$ 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

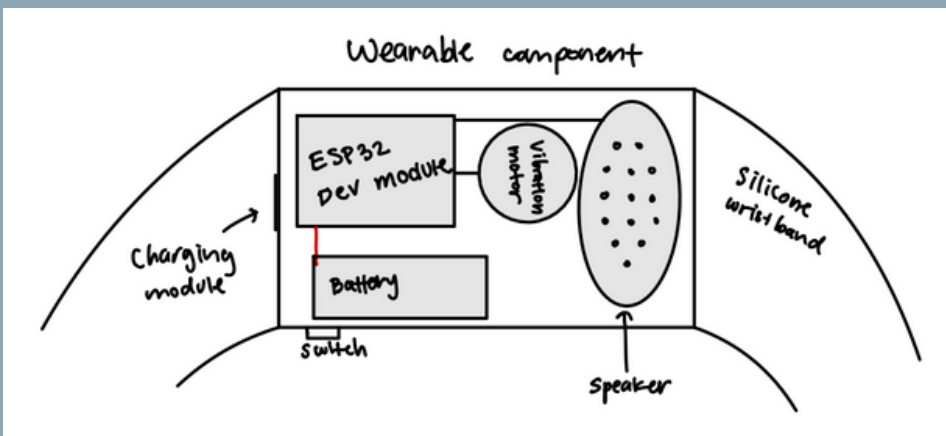


Why we **chose** this design:

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

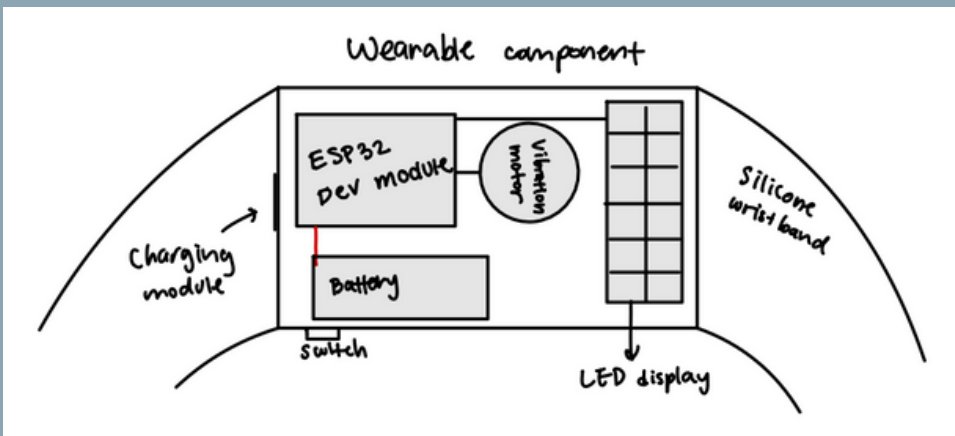
## Design I

- Pros:
- RFID activation
  - Physical, immediate alerts
- Cons:
- RFID activation requires close proximity
  - Haptic feedback can be harsh



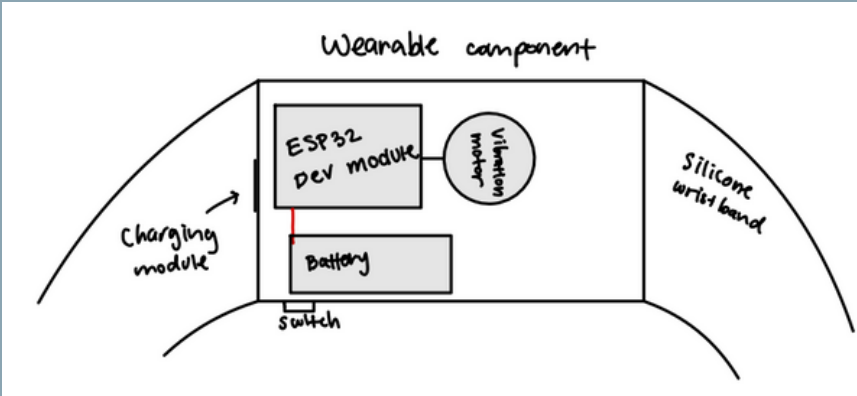
## Design II

- Pros:
- Non-haptic feedback alerts (LED blinking)
  - App-based caregiver notifications
- Cons:
- Visual cues can be missed
  - Smartphone dependence limits accessibility



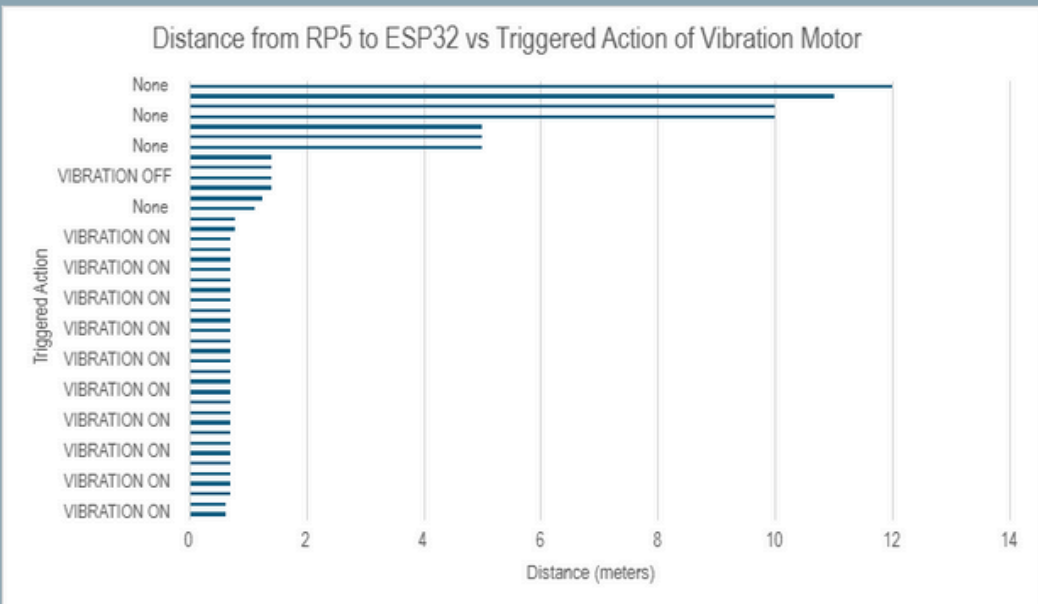
## Design III

- 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



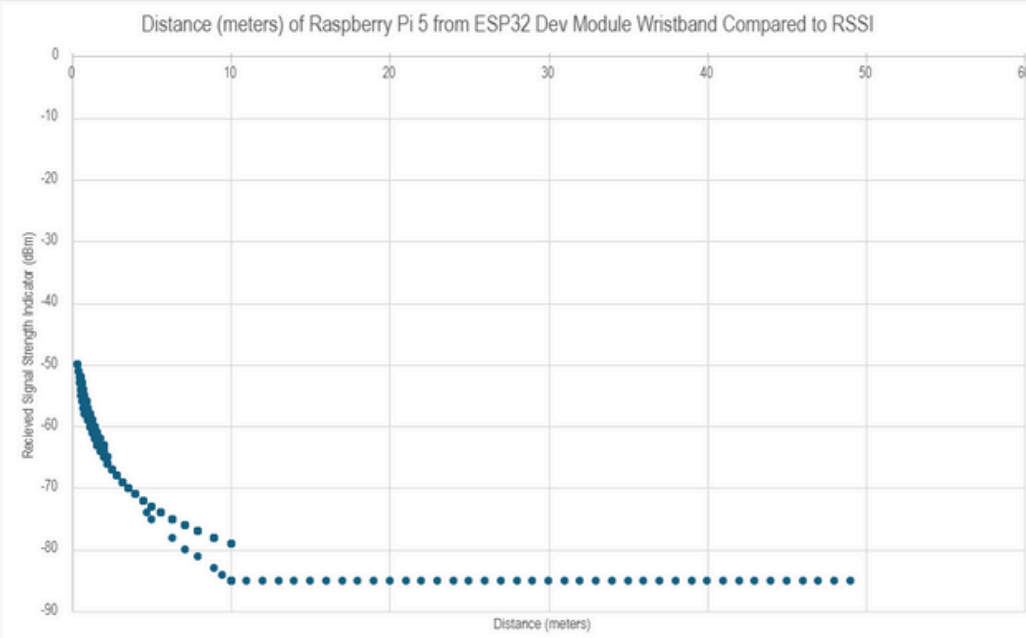
## Design Study I

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