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

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

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

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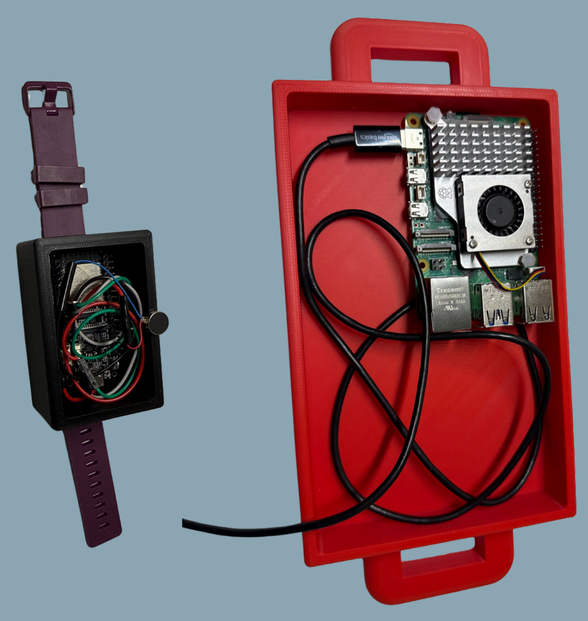
LED vs. motor testing for optimization (activation within 1 meter of the Raspberry Pi)

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)

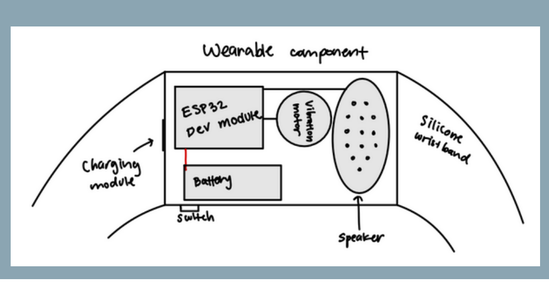
Design I

Pros:

- RFID activation
- Physical, immediate alerts

Cons:

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



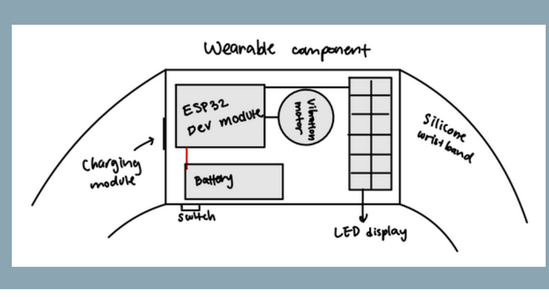
Design II

Pros:

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

Cons:

- Visual cues can be missed
- Smartphone dependence limits accessibility



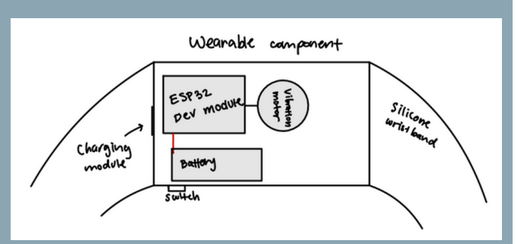
Design III

Pros:

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

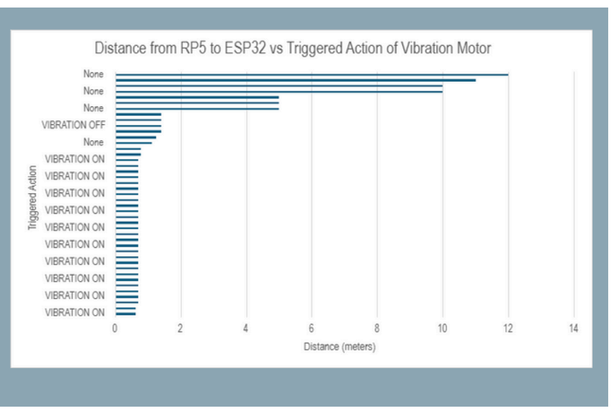
Cons:

- Audio cues also have the potential to be missed



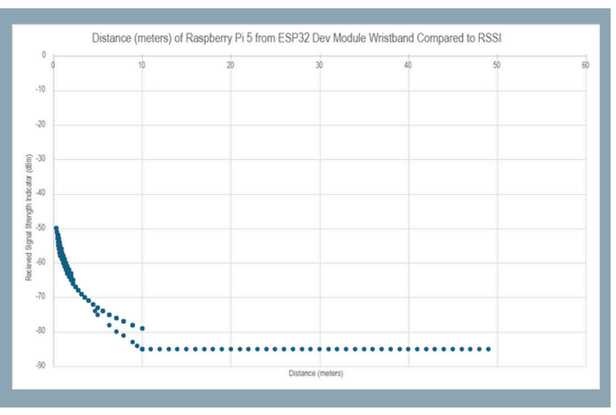
Design Study I

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