Boston University

Electrical & Computer Engineering

EC464 Capstone Senior Design Project

Final Testing Plan

Personal Alert Device

by

Team 19

PAD Group

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1 Required Materials

Hardware:

- 1x Personal Alert Device
  - XIAO NRF53840 Sense
  - MAX 30102 Pulse Oximeter
  - Thermistor
  - PCB
  - Housing/Enclosure
  - Sensor Integrated Wrist Strap
- 1x Wireless Charging Station
- Multimeter
- 1x Laptop
- 1x Mobile Device

Software:

- Android Studio
  - Android Device Emulator
- LightBlue
  - BLE Scanner
- Firebase
  - Firestore
  - Authentication
- Adafruit IO
  - Data Feeds
  - SMS

2 Setup

The setup is divided between the hardware and software aspects of the Personal Alert Device. The hardware portion represents the functionality and accuracy of sensors, on-board emergency detection, device feedback, and charging. The software portion incorporates the Android app, device-phone communications, cloud-based data storage, and emergency responses.

Pre-testing Setup Procedure:

Hardware:

1. Connect the Personal Alert Device via USB-C to a laptop to ensure data is read in Serial Monitor
2. Unplug the Personal Alert Device from the laptop
3. Plug in the wireless charging transmitter
4. Charge the Personal Alert Device if necessary

Software:

1. Open Android Studio on a computer
2. Connect and subscribe to all BLE services/characteristics
3. Open Adafruit IO
4. Begin an Android emulator using “Medium Phone” API 35 or above
5. Within the emulator:
    i. Allow all permissions
    ii. Begin the App emulator using the green play button
    iii. Check acknowledge response of all HTTP requests to Adafruit
6. Open the Firebase console on a computer
7. Within Firebase Console:
    i. Open Firestore Database

3 Testing Procedure

Hardware:

1. Press the button switch one time to display the current battery level on the corresponding LED. Press the button switch once again to turn off the indicator.
2. Speaking toward the Personal Alert Device, say “Send Help” twice to trigger the speech activated emergency response. Cancel the response by pressing the button once during the “warning” period.
3. Hold down the button switch until the warning period for the manual activation emergency response triggers. Cancel the response.
4. Wear the Personal Alert Device. Position the wrist strap based temperature sensor and pulse oximeter in direct contact with the user’s skin to measure skin temperature. Observe the results in the app and Firestore.
5. Test fall detection by having the device detect a fall when acceleration and gyroscope thresholds are met, and print “Emergency Response!” when the user has been immobile for 5 seconds following the fall. (video)

Software:

1. Open the Personal Alert Device app
2. Press the “Sign in with Google” button and select a Google account
3. Navigate to various screens to ensure connectivity and functionality
    - Connection Status / Battery Level
    - Vitals
    - History
4. Add/Remove designated contacts
5. Change Profile and Medical Information and see reflected change in app and Firestore
6. See proper emergency response (Help Screen, History/Record, SMS)
7. Show Firestore data for each user and how data is associated with specific users.

4 Measurable Criteria

The criteria for a successful final test is as follows:

Hardware:

- The thermistor should read skin temperature values ranging from 33 °C to 37 °C.
- Speech recognition correctly classifies the words “Send Help” and ignores unknown words and/or background noise within the classification window.
- Heart rate readings display realistic BPM (in the 70-80 range) readings and detect if contact is lost.
- The user should be able to press the button for 5 seconds, which should cause the red LED and buzzer to turn on (manual activation trigger).
- After issuing an emergency, the user should be able to cancel it by pressing down on the button again.

Software:

- The app should open correctly, and the Google sign-in method should work as expected.
- Screen navigation functionality works as expected
- All APIs and SDKs function as expected
- Text fields, buttons, and displays should function as expected
- Pertinent information is stored in Firestore unique to the user ID
    - Google Account information
    - Designated Contacts
    - Personal/Medical Information
    - Emergency Records
- Phone-based emergency response functions correctly (Help Screen, History, SMS)
- All communications between device and phone function correctly