# Boston University

# Electrical & Computer Engineering

**EC464 Capstone Senior Design Project**

# Second Prototype Testing Plan


## Personal Alert Device

by

Team 19

PAD Group

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# 1 Required Materials

Hardware:

- ➢ XIAO nrf52840 Sense (Microcontroller)
- ➢ MAX 301002 (Heart Rate Pulse Oximeter)
- ➢ B57703M0103A018 (Thermistor)
- ➢ GT-USB-7010ASV
- ➢ PAM8302AAYCR
- ➢ TSA062G60-250
- ➢ Prototype Housing and Wrist Strap
- ➢ Power System
- ➢ Multimeter

Software:

- ➢ Laptop
  - Android Studio
    - Kotlin, Compose
    - Android Device Emulator
  - LightBlue
    - BLE Scanner
  - Internet Access
    - Firebase

      i. Firestore Database

      ii. Authentication
    - Adafruit IO Database

## 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 various wearable sensors. The software portion incorporates an Android app and our ML model for speech recognition.

**Pre-testing Setup Procedure:**

Hardware:

1. Connect the nrf52840s and upload the necessary sketches
    - Speech recognition
    - Heart Rate Sensing
    - Temperature Sensing
2. Plug in 120VAC to 5VDC adapter for power system

Software:

1. Open Android Studio on a computer
2. Connect and subscribe to the microcontroller using LightBlue
3. Open Adafruit IO
4. Begin an Android emulator using “Medium Phone” API 35 or above
5. Within the emulator:
    i. Allow all permissions
    v. Begin the App emulator using the green play button
6. Open the Firebase console on a computer
7. Within Firebase Console:
    i. Open Firestore Database

# 3 Testing Procedure

Hardware:

1. Position the heart rate sensor in contact with the user's skin to measure heart rate and blood oxygen saturation. Observe the results in the serial monitor.
2. Position the temperature sensor in contact with the user's skin to measure skin temperature. Observe the results in the serial monitor.
3. Test speech recognition by saying "Send Help" into the PDM, and observe classification in the serial monitor and updates in Firestore
4. Measure the voltage at both the transmitter and receiver of the wireless power system to ensure that battery can be charged

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 functionality
4. Add/Remove designated contacts
5. Change Profile Picture and Profile Information
6. Show Firestore data for each user and how data is associated with specific users.

# 4 Measurable Criteria

The criteria for a successful prototype test is as follows:

Hardware:

- The thermistor should read skin temperature values ranging from 33° – 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 readings and detect if contact is lost.
- The power system should display 5V on both the transmitter and receiver end

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 Information
    - Latest Send Help Request
- BLE connection is established correctly
    - Speech recognition data uploads to Adafruit IO