Boston University

Electrical & Computer Engineering

EC464 Capstone Senior Design Project

Customer Installation Report

Personal Alert Device

by

Team 19

PAD Group

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1 Details of Customer Installation

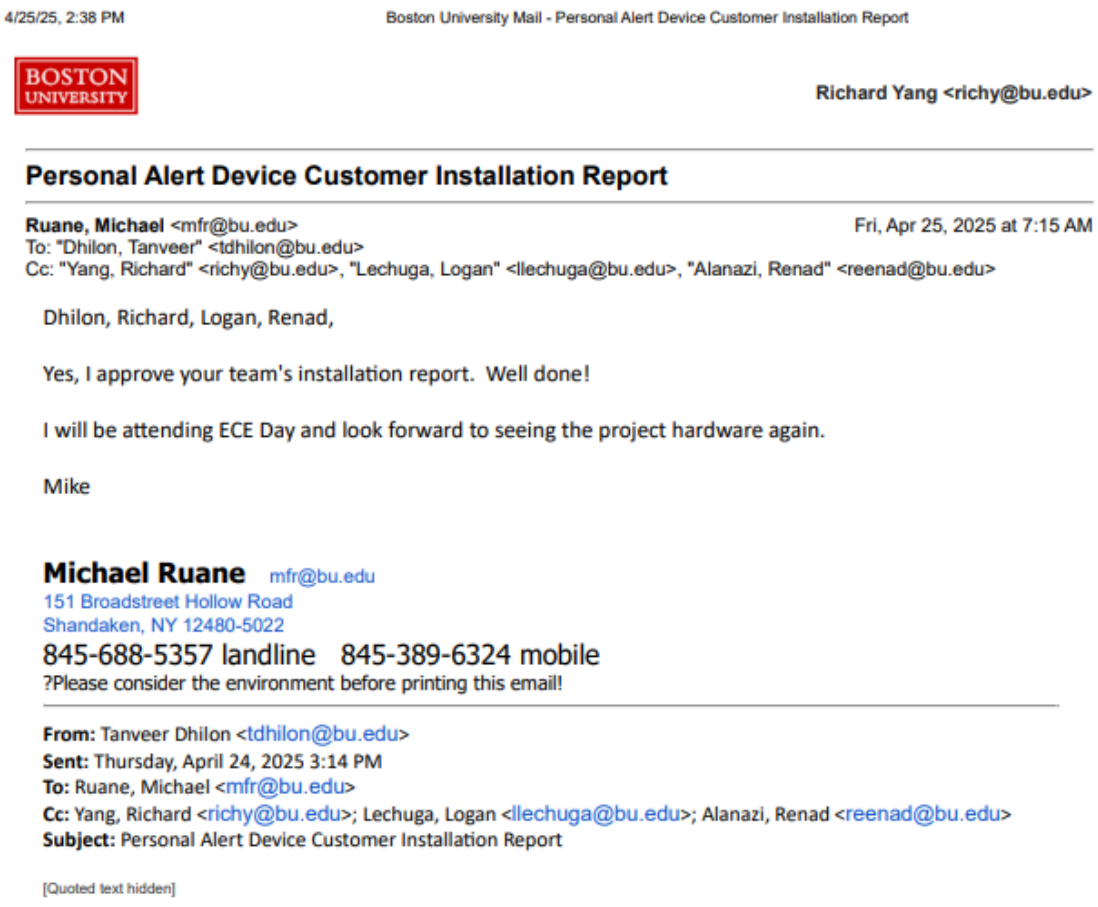
Installation Date: April 7th, 2025

Installation Place: Pavement Coffeehouse - BU

Team Members Present: Richard Yang, Tanveer Dhilon, Logan Lechuga, Renad Alanazi

Customer Present: Professor Michael Ruane

Customer installation approved by Professor Ruane on April 25, 2025.



4/25/25, 2:38 PM Boston University Mail - Personal Alert Device Customer Installation Report

BOSTON UNIVERSITY

Richard Yang <richy@bu.edu>

Personal Alert Device Customer Installation Report

Ruane, Michael <mfr@bu.edu> Fri, Apr 25, 2025 at 7:15 AM
To: "Dhilon, Tanveer" <tdhilon@bu.edu>
Cc: "Yang, Richard" <richy@bu.edu>, "Lechuga, Logan" <llechuga@bu.edu>, "Alanazi, Renad" <reenad@bu.edu>

Dhilon, Richard, Logan, Renad,

Yes, I approve your team's installation report. Well done!

I will be attending ECE Day and look forward to seeing the project hardware again.

Mike

Michael Ruane mfr@bu.edu
151 Broadstreet Hollow Road
Shandaken, NY 12480-5022
845-688-5357 landline 845-389-6324 mobile
?Please consider the environment before printing this email!

From: Tanveer Dhilon <tdhilon@bu.edu>
Sent: Thursday, April 24, 2025 3:14 PM
To: Ruane, Michael <mfr@bu.edu>
Cc: Yang, Richard <richy@bu.edu>; Lechuga, Logan <llechuga@bu.edu>; Alanazi, Renad <reenad@bu.edu>
Subject: Personal Alert Device Customer Installation Report

[Quoted text hidden]

2 Requirements

Original:

Alert devices currently on the market are often expensive and suffer from high false alarm rates. The original design for the Personal Alert Device was driven by the need for a more intelligent and reliable system. The requirements for this project can be divided into both hardware and software subsystems:

- Hardware
    1. A compact, wearable device with sensors for monitoring the user's biometrics and location
    2. Integrated sensors to monitor user location and vitals to clarify emergency situations and detect falls
    3. Simple wireless recharging capabilities with a battery life of at least 24 hours
    4. The size of the wearable should be no larger than 60 mm x 60 mm and weigh less than 85 grams
    5. Bluetooth or cellular modules to connect the wearable to a mobile device
    6. Suitable for installation indoors
- Software
    1. User-friendly app with a straightforward interface to manage alerts, track real-time data, and view emergency history
    2. AI-driven software for analyzing sensor data to reduce false alarms and assess emergencies
    3. Built-in features to contact emergency responders or family members automatically during an emergency event
    4. Cloud-based storage to maintain a history of sensor data, user authentication, and user health metrics
    5. Secure transmission of data between various servers
    6. Real-time notifications, updates, and user interface elements that provide ease of use for both seniors and responders

Modified Requirements:

In the original requirements, the location of the device itself would be monitored. However, the GPS module was unable to read accurate data indoors due to weak satellite signals. To combat this, an Android API that can track the user's location on the software side was used to monitor the user's location. Additionally, the AI driven analysis of sensor data was performed on the microcontroller instead of on the mobile application. A speech recognition model developed and trained on Edge Impulse was deployed onto the microcontroller to allow for the user to say the keyword "send help" into the device to activate an emergency response.

Final Design:

The Personal Alert Device was able to meet the original requirements of the device, with some modification applied:

- Hardware
    1. A compact wrist wearable device with sensors for monitoring the user's biometrics
    2. Wrist strap with integrated sensors to monitor vitals such as heart rate, blood oxygen levels, and temperature
    3. Detect falls and trigger emergency response when user is unable to move
    4. Button hold feature to trigger emergency response
    5. Simple wireless recharging capabilities with magnets to align the device and wireless charging stand
    6. Battery life of ~72 hours
    7. Size of the wearable is 47 mm x 37 mm x 26 mm and weighs less than 58 grams
    8. Bluetooth Low Energy to connect the wearable to a mobile device
    9. Speech recognition model for keyword detection to trigger emergency response
    10. Manual emergency trigger and device battery indicator
    11. Emergency trigger warning with flashing LED and buzzer

- Software
    1. User-friendly app with a straightforward interface to manage alerts, track real-time data, and view emergency history
    2. Alerts designated contacts with the user's name, location (and directions), means of trigger, timestamp, and vitals at the time of emergency trigger
    3. Cloud-based storage to maintain a history of sensor data, user authentication, and user health metrics
    4. Secure transmission of data between various servers
    5. Real-time notifications, updates, and user interface elements that provide ease of use for both seniors and responders
    6. Emergency notifications to designated contacts and connection status alert

3 Overall Assessment

During the installation of the PAD, a full functionality test was conducted. The device was powered by an integrated lithium battery. The wireless charging was tested by measuring the voltage across the transmitter and the receiver modules. The heart rate and temperature sensors were tested by wearing the device and viewing the real time data on the mobile app. Fall detection was simulated through sudden movement and an alert was sent to the mobile app. The emergency push button was tested and it triggered a notification on the app.

All requirements including sensor integration, wireless charging, and the mobile app were met. A suggestion given to us by our customer was to incorporate magnets into our wireless charging system to allow the user to easily charge their charge. This was incorporated into the final version of the product. Requirements involving size constraints were also met. One minor challenge was with the GPS module, which was not able to obtain a location signal indoors during testing. Therefore, the location was obtained through the mobile app to ensure consistent and accurate tracking.

As a follow up plan, we will send a client satisfaction form to gather feedback and suggestions. Additionally, future iterations may include a more sensitive GPS module or hybrid tracking using both device and app data for improved reliability. Overall, all primary project requirements were met successfully with the addition of new features which further improves user experience and safety.