

2. Requirements, Constraints, And Standards

2.1 REQUIREMENTS & CONSTRAINTS

Functional Requirements

The device must be able to effectively detect the biological markers of a PTSD episode, without producing false positive or false negative readings. The device must reliably communicate via Bluetooth with another device secured to the dog without losing signal due to range. The dog device must be able to reliably control a haptic vibration device to alert the dog to a PTSD attack.

Resource Requirements

The device will require the use of two main microcontrollers: One that interfaces with the veteran, and one that interfaces with the dog. The human-wearable microcontroller must have sufficient processing power to handle process management and semi-complex data analysis algorithms. The dog microcontroller should be sufficient to handle low power draw to enable a vibration device. All devices must have efficient power dissipation to ensure a sufficiently long battery life. More specifically, both batteries for the microcontrollers should last at least a day (**Constraint**).

Physical Requirements

There must be two devices; a wearable device for the veteran and a device that fits in a dog vest. The wearable must be comfortable for the veteran and be nondisruptive to daily activities. The device for the dog must fit inside a dog vest comfortably and humanely relay a signal to the dog.

User-Interface Requirements

For UI we are attempting to make it as simple as possible for our user. Our design is as simple as a button to turn the device on and off. The device also will have multiple LEDs to tell the user if there are problems with the device. One UI LED will be used for power, another LED for low battery in the device located on the user, another LED for Bluetooth connection, and the last will be an LED to indicate low battery for the device on the dog.

Economic / market requirements

We have been given a budget of \$5000 for our design. (**Constraint**). The final product should be inexpensive and competitive to current mental health monitoring substitutes. Our goal is to produce and distribute our designed device for sub 200 USD. Having a more affordable product will increase accessibility contributing to an improvement in quality of life. Additionally, will increase the use of PTSD detection devices.

2.2 ENGINEERING STANDARDS

Importance of engineering standards

Engineering standards are set criteria and guidelines ranging in varying industries to ensure the safety of use, production, and quality control.

These standards are crucial for product production as they hold every business, enterprise, and inventor to given principles. Setting safety criteria helps protect consumers from accidents. Encouraging quality assurance promotes consistency and reliability. Giving production protocols increases efficiency as well as assembly safety. In all, these standards are vital for creating a safe, useful, friendly, and viable product.

Current Applied Standards

- [IEEE 802.15.1](#): WPAN / Bluetooth
- [ISO/IEEE 11073](#): Medical / Health Device Communication Standards
- [IEEE 360-2022](#): IEEE Standard for Wearable Consumer Electronic Devices
- [IEEE 11073-10407-2020](#): Health informatics--Personal health device communication Part 10407: Device specialization--Blood pressure monitor

External IEEE Standards

Consumer Electronics

1. [IEEE 360-2022](#): IEEE Standard for Wearable Consumer Electronic Devices--Overview and Architecture
 - a. This standard is intended to address concerns and help industry confidence when it comes to the reliability and quality of wearable electronics. As well as standardizing the safety and security of these wearable devices.
2. [IEEE 11073-00103-2012](#): Health informatics - Personal health device communication Part 00103: Overview
 - a. This standard defines set practices for data communication and standards for mobile health devices and separate computing engines. It is intended to ensure that personal health devices follow secure communication practices and are horizontally integrated.
3. [IEEE 11073-10407-2020](#): Health informatics--Personal health device communication Part 10407: Device specialization--Blood pressure monitor
 - a. This standard is part of a set of standards for personal health device communication specializing in blood pressure monitoring and promotes a plug-and-play for the user.

Project Relevance to IEEE Standards

After reviewing the three chosen published standards, we believe that all three have relevance to our project. This is because our product is a wearable electronic device that would directly apply to the IEEE standard for a wearable consumer electronic device. This standard is relevant because we need to design a product that is reliable, safe, and secure. We also feel that the standards for health informatics and device communication apply to our product specifically because of the communication of medical data from the sensor to the microcontroller.

Design Changes Based on IEEE Standards

We plan to implement communication between the human-wearable device and the dog device that adheres to the personal health device communication standards. This includes implementing previously defined Bluetooth protocols to make the communication compatible with other devices. We also plan to adhere to the standard for wearable consumer electronic devices so that the veteran-worn device implements all necessary personal wearable device protocols.