IOWA STATE UNIVERSITY
Department of Electrical and Computer Engineering

AMERICA'S VetDogs EST. 2003
BAE SYSTEMS

PTSD DETECTION DEVICE

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Introduction

Service dogs aid veterans and others with severe PTSD by responding to PTSD attack symptoms when they occur. While the dogs senses are keen, they mainly rely on physical queues. Our goal is to create a design that provides a solution that closes the window between the dogs natural detection and response times to PTSD attacks.

High-level System Diagram

Bluetooth Connection → Bluetooth Connection →

Smartwatch   Smartphone & Application   Dog Device

Implementation

The system we have devised consists of 3 subsystems. The first subsystem is the smartwatch which reads heart rate data from a user and transmits said data to the second subsystem being a smartphone. Once the smartphone receives the data via bluetooth, it then logs the data in our own app which processes said data by running an algorithm for PTSD detection. In this algorithm, the software actively looks for an abnormal peak in user heart rate. Additionally, this app allows user interface capabilities like turning notifications off while exercising, viewing data, etc.

Software System
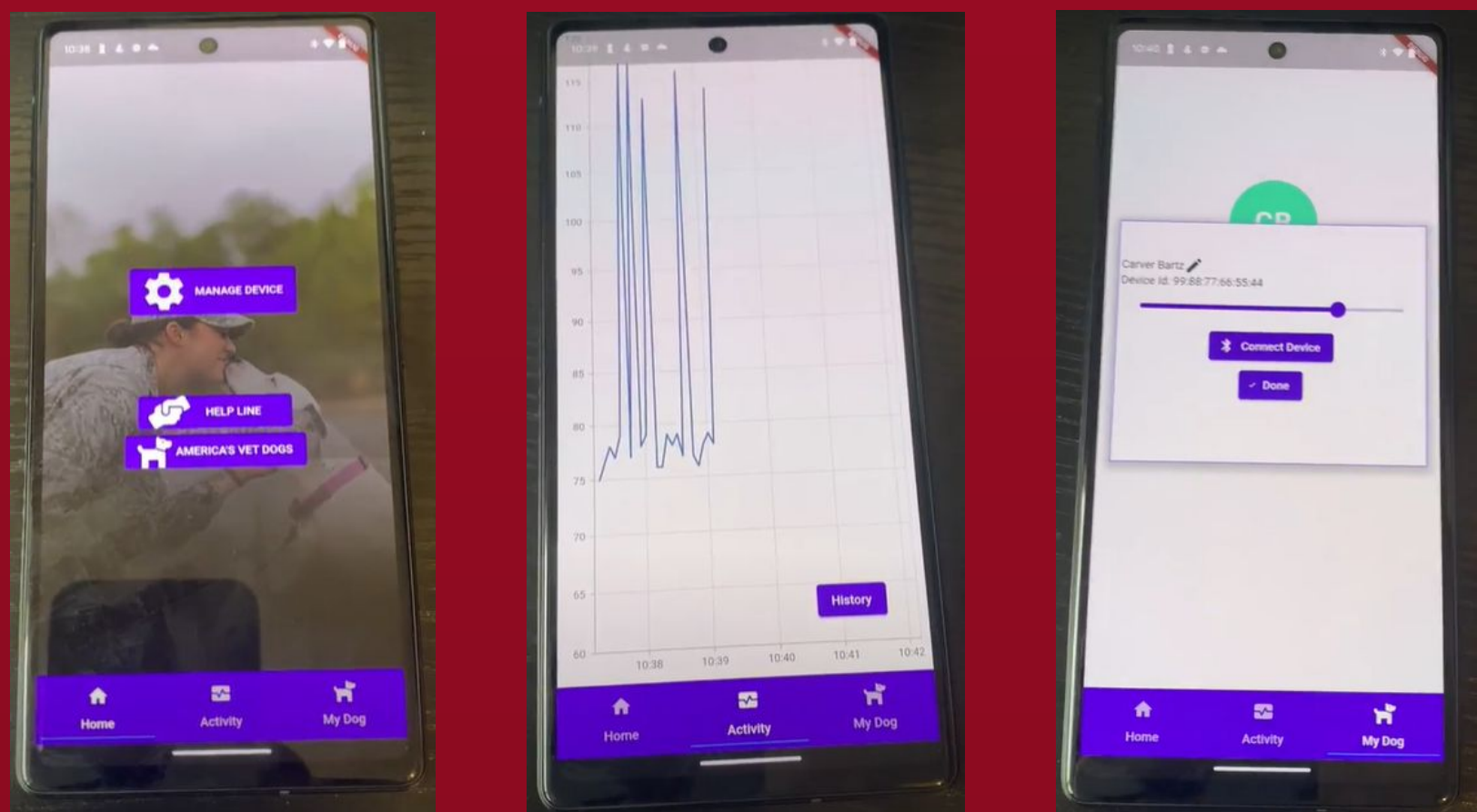
Finally, if a flag is detected, the smartphone will then send a signal to the dog device alerting the dog via vibration. This system consists of a custom enclosure, Arduino Nano 33 BLE, power supply, bluetooth module, breadboard, and vibration motor.

Hardware System

Impact

Overall, the development of a PTSD detection device has the potential to improve the monitoring of PTSD attacks and provide timely intervention, ultimately improving the quality of life for individuals suffering from PTSD.

Takeaways and Significance

In this semesters time, we were able to create and test all the subsystems successfully in a controlled environment. However, when connecting all components as a whole, the system was unable to work correctly due to bluetooth communication complications.

Overview

For this project, it is paramount that we are to listen to our clients at BAE and America's Vet Dogs along with our users being individuals with PTSD given that the problem our design is addressing is a serious concern. After speaking with veterans with PTSD and our client, we were able to break down the essential requirements, features, and functionalities we would need which are as follows...

FUNCTIONAL REQUIREMENTS:

- ❑ Detects PTSD episodes using heart rate
- ❑ Dog is alerted when episode is detected
- ❑ App must run on any mobile OS
- ❑ Must be able to turn off during exercise
- ❑ Quick Signaling (constraint)

NON-FUNCTIONAL REQUIREMENTS:

- ❑ Comfortable for user and dog
- ❑ Discrete physical profile/appearance
- ❑ Not disruptive to everyday tasks
- ❑ Does not worsen PTSD episodes
- ❑ Configurable to user's needs
- ❑ Ability to view and track data

Methodology

This project was entirely based on an agile approach since we anticipated many revisions and iterations on our design given that we will be creating a product for two users. To figure out appropriate considerations on our design, we communicated on a weekly basis with our client and on occasions with veterans with PTSD who have service dogs. Additionally, each group member researched PTSD and its effects on humans to be able to understand the issue we are trying to lesson.

Results

To test our design we tested incrementally. Testing each component separately. To test the software, we built out a UI skeleton to get a feel for how the navigational flow will feel for a user, and then put together some of the backend logic. We tested with mock data to make sure the components were communicating and updating as expected. We also tested components such bluetooth connectivity between the app and the dog's hardware, to ensure we can discover the device and maintain a connection. For the results, everything works individually, but as a whole system, there are some complications, some that are beyond our control. We discovered multiple issues and limitations within the bluetooth hardware on the arduino and the HC-05 module we hoped would be the solution. Due to financial constraints, we opted to use a galaxy watch to test, however, there are many limitations between Samsung's software and flutter at the moment. Overall, with our testing we found our system's components work individually (and can work together with the right hardware, such as a Google Pixel watch and the right BLE module).