

BAE SYSTEMS

PTSD Detection Device

Jonathan Pixler, Sam Brang, Comlan Bocovo, Steven Trinco, Carver Bartz, Maisy Millage

Group 08

Client: BAE Systems & America's VetDogs

Advisor: Mohamed Selim

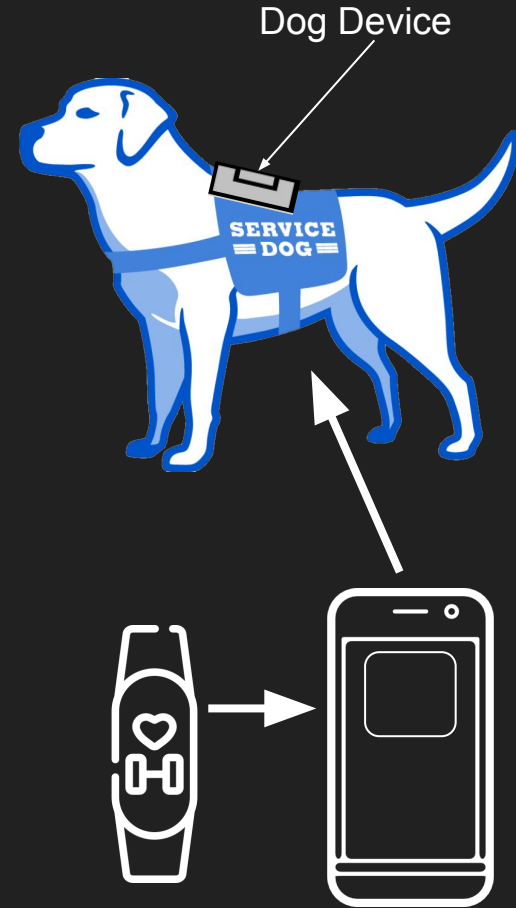


Project Statement

Many veterans have to deal with PTSD daily. Some have service dogs to help reduce the effects of episodes as they begin, but these dogs can only sense when physical symptoms become visible. To improve how quickly a service dog can help, our task is to create a device to detect a PTSD episode in a veteran and be able to notify their service dog.

Introduction

- **Functionality at a high level:**
 - Smart watch measures heart rate data
 - Phone determines PTSD attack based on watch data
 - If a PTSD episode occurs, dog device notifies dog via vibration motors



Implementation Architecture - Hardware (Electrical)

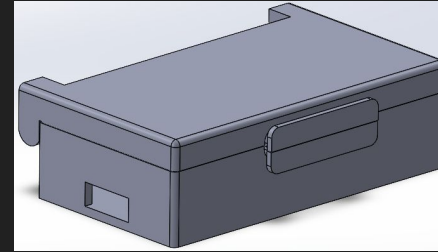
- Arduino Nano 33 IoT
- Bluetooth Module (HC-05)
- Power Supply
- 3V Button Vibration Motors (2x)



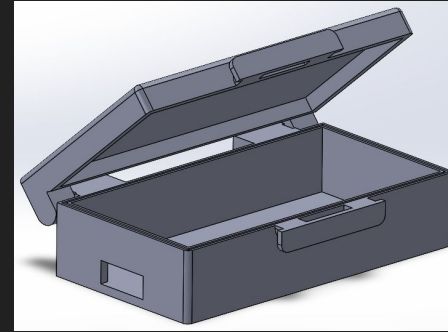
Implementation Architecture - Hardware (Mechanical)

- **Enclosure**

- Houses electrical components
- 3D printed using PLA filament
- Composed of 2 components: base and lid
- Velcro on bottom to be fixed to dog vest
- Dimensions assembled approximately 1.75" x 3.9" x 5.8"



Enclosure Closed



Enclosure Open

- **Dog Vest**

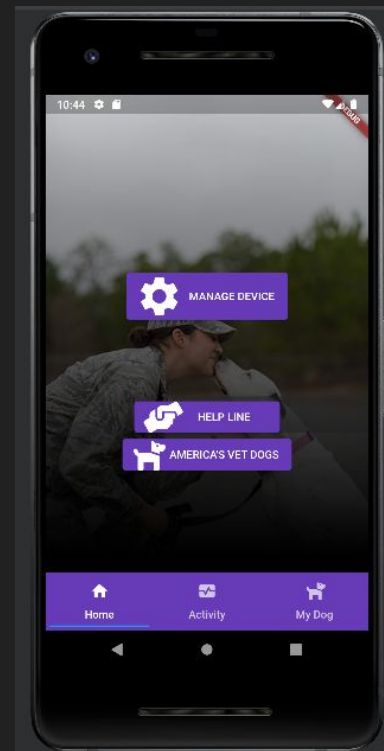
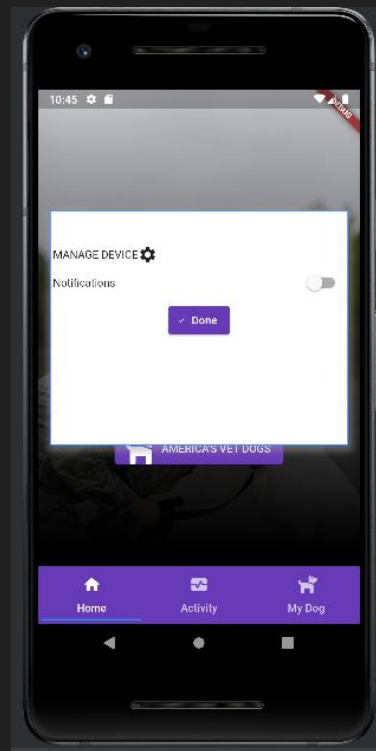
- Provided to us by America's VetDogs
- Velcro fixed to top for enclosure connection



Dog Vest

Implementation Architecture - Software

- Flutter Framework
- Google Pixel 6a application testing
- Galaxy Watch 4 application testing



Project Milestones

- Created custom functional low cost enclosure for components
 - Required 3 iterations of models and printing
 - Sturdy yet cost effective solution for housing components
- Created first implementation of driving vibration motor from arduino pins
- Created first software application implementation
- Debugged BLE and ordered new bluetooth module



Assembled Final Enclosure




Project Milestones - Continued

- Debugged Bluetooth module HC-05 and nearly established full connectivity
- Created final electrical hardware implementation and installed in housing
- Debugged Galaxy watch 4 health data and due to financial constraints the watch libraries were too old for compatibility
- Created software PTSD detection over dataset and vibration to show impulse that would be sent over Bluetooth to dog device for proof of concept
- Added bluetooth pairing to software application




Gantt Chart

TASK	Plan Start:	Duration in weeks	Start Week	Duration in Weeks	Progress	START	END	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Semester 492	18	18	18	18	100%	1/16/23	5/8/23																	
Backend	16	8	16	8	70%	1/16/23	3/13/23																	
2nd Iteration	18	8	18	8	50%	1/16/23	3/13/23																	
UI	18	8	18	8	70%	1/16/23	3/13/23																	
Hardware	18	11	18	18	70%	1/16/23	5/8/23																	
Testing	18	11	18	8	70%	1/30/23	5/8/23																	

Team Member Contributions

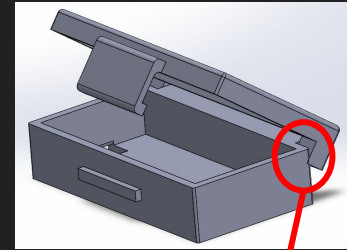
Name	Role	Contributions/Responsibilities
Carver Bartz 	Software Design	<ul style="list-style-type: none">• Building out backend features for the app
Common Bocovo 	Client Interaction, Software design, and Time-management	<ul style="list-style-type: none">• Design requirement• Conceptual design
Jon Pixler 	Hardware-software bridge and embedded systems leader	<ul style="list-style-type: none">• Hardware design and part acquisition.• Embedded systems programming.

Team Member Contributions - Continued

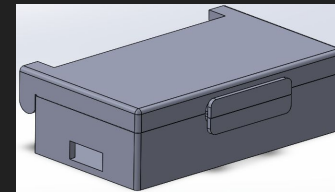
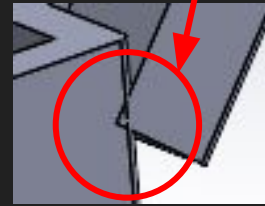
Name	Role	Contributions/Responsibilities
Maisy Millage 	Writing and Upper-level software	<ul style="list-style-type: none">• Worked on UI for phone app• Video Editing• Document and Poster Writing Editor• Poster Design
Sam Brang 	Team organization and electrical design	<ul style="list-style-type: none">• Worked on enclosure design and implementation for dog vest• Worked on getting the power supply for our device• Kept website up to date
Steven Trinco 	Hardware Design and Discord Admin	<ul style="list-style-type: none">• Used CAD software to model enclosure parts• Printed and tested 3D models for enclosure• Conceptualize hardware system and physical integration• Created and maintained group communication

Challenges and Solutions

- Initial 3D models connecting structurally but not working functionally
 - No space for the rotation of the hinge therefore making it unable to pivot
 - Clasp mechanism was too thick and could not flex to lock the box
 - **Solution:** remade the clasp structure to depend on rubber band force to close the lid at the notches and trimmed edges near hinging pieces for more room



Original Enclosure



Final Enclosure

Challenges and Solutions - Continued

- Current supply for vibration motors solved by stringing 5 pins in parallel
- Bluetooth BLE too weak for application, ordered and debugged external Bluetooth modules that had range capabilities within constraints.
- After debugging everything possible on the HC-05, connectivity couldn't be maintained for more than a few seconds. With more time, other modules would have been sourced and ordered until full connectivity established.

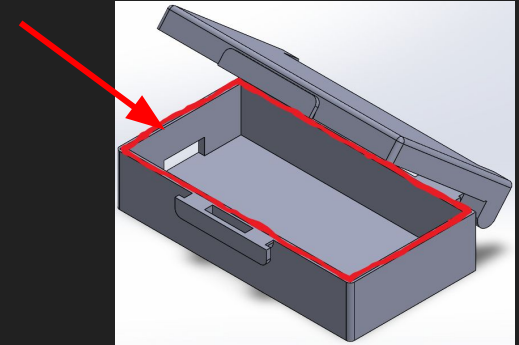
Challenges and Solutions - Continued

- Flutter Framework is new...
- Pairing Issues
 - For different system (Android vs. IOS)
- Galaxy watch 4 libraries were too old for use with our application and despite best efforts were nonfunctional. With more time, a Google Pixel watch would be sourced to ensure full compatibility and newest hardware for updated libraries.
- Other options are still in beta stages, functionality was not ready for our implementation.

Future Work

- Create better mechanisms for water resistance on enclosure
 - Custom gasket around upper perimeter of base
- Data collection and analysis
- Improve the system for ios devices
- Set up Bluetooth background protocol
- Testing the system

Gasket Location



Conclusion

- Hoped to establish full health data and Bluetooth connectivity
- Debugged all problems and establish paths forward had we more time to implement the solutions necessary
- Client is pleased and stated we should be proud our accomplishments on this project
- We are proud of our work and hope you have enjoyed our presentation

**Thank you for attending our
presentation! Questions?**

BAE SYSTEMS

