Progress Report # 1

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Technical Section

Week 2:

We were tasked to create a project title/delivery form, abstract/description, test plan, and work breakdown structure (WBS). We completed all of these tasks/subtasks in their entirety. The graphs of these tasks can be seen within the administrative section. No technological advancement was made during this period, so none will be shown/discussed.

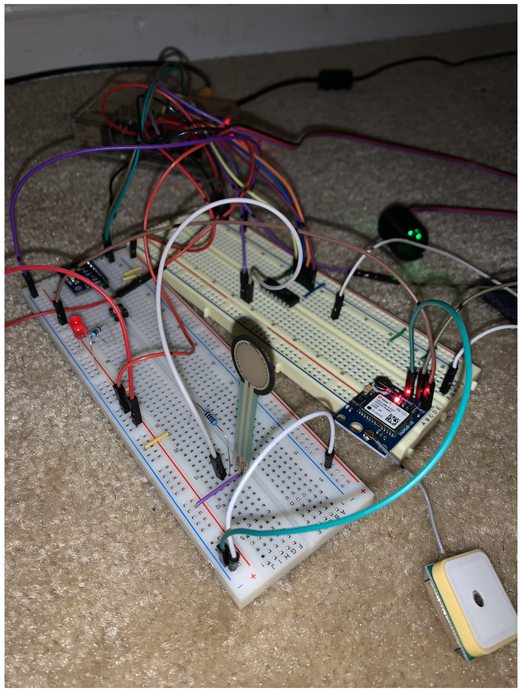
Week 3:

Our main tasks were to connect all of the sensors to the Raspberry Pi 0 w(RSP0w) and have the sensors be completely functional with the proper communication protocols. These tasks were accomplished in their entirety. We have a single python file importing the code from each individual sensor and running simultaneously to report (print) data within the console with a one-second delay. The data obtained as shown in the console from all of the sensors are as follows:

```
Fall Check: None
BPM: 76.23888182973316
______________________________


MC: 20416
Fall Check: None
BPM: 73.90072669047912
______________________________


MC: 20224
Fall Check: None
BPM: 74.92507492507492
______________________________


MC: 20288
Fall Check: None
BPM: 73.74631268436578
______________________________
```

The current setup of all the sensors connected to the Raspberry Pi 0 (using their appropriate communication protocols) are as follows:

Picture of the Raspberry Pi with all the sensors on a breadboard:



Week 4:

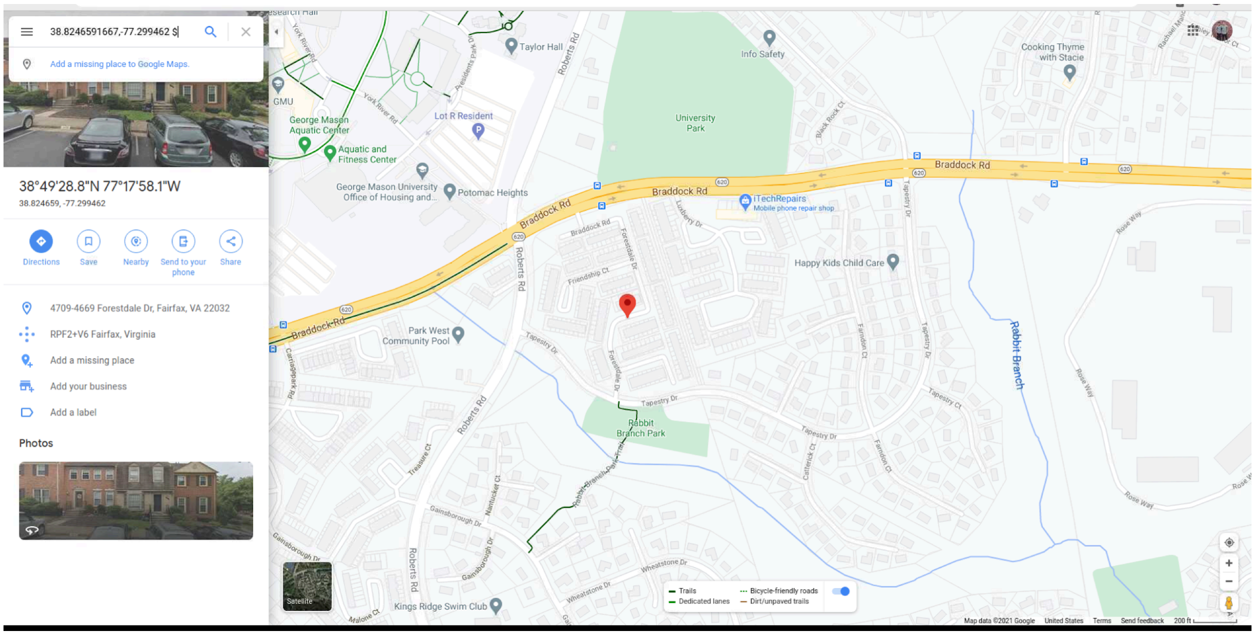
We had tasks/subtasks to accomplish that included initial testing and interfacing the sensors. We individually tested each sensor with external devices to make sure that the data received from each sensor was accurate. For example, we tested the heart beat sensor against a pulse oximeter. The data had a maximum variance of +-5 bpm. We also tested the GPS latitude/longitude detection against Apple/Google maps to record how accurately it tracked our current location. Every sensor obtained data that was greater than 87% accuracy. Lastly, we ensured that our code could interface with AWS and send a text message to the emergency contacts with a warning and GPS location of the user.

Pulse Oximeter vs Heart beat sensor picture:


```
Fall Check: None
BPM: 76.23888182973316
____________________________


MC: 20416
Fall Check: None
BPM: 73.90072669047912
____________________________


MC: 20224
Fall Check: None
BPM: 74.92507492507492
____________________________


MC: 20288
Fall Check: None
BPM: 73.74631268436578
____________________________
```

GPS(lat/long) vs Google or Apple Maps Picture:

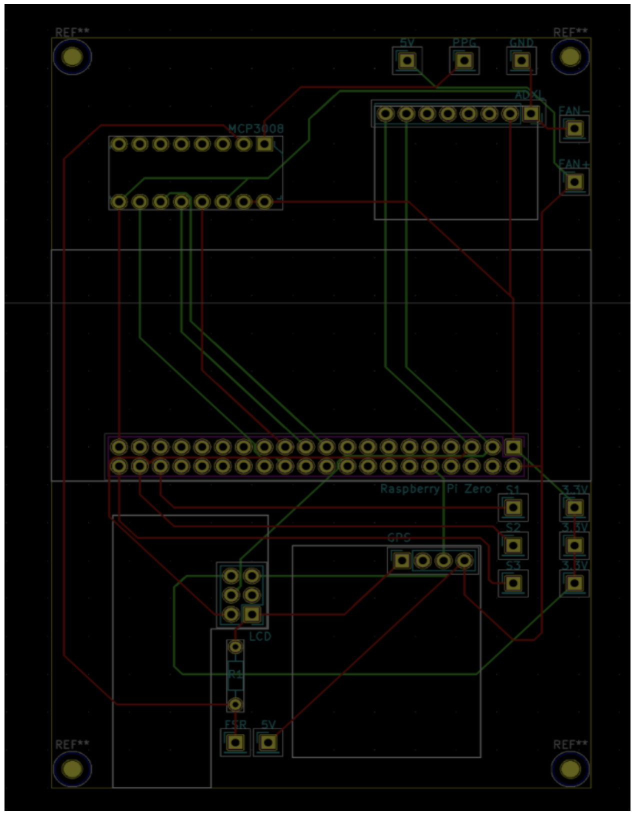
```
Latitude=38.8246591667
Longitude=-77.299462
Altitude:104.3
Timestamp: 02:00:27

Google Maps Link: https://www.google.com/maps/search/?api=1&query=38.8246591667,
-77.299462

Apple Maps Link: https://maps.apple.com/?11=38.8246591667,-77.299462
____________________________________________________________________
Latitude=38.8246521667
Longitude=-77.2994508333
Altitude:102.5
Timestamp: 02:00:28

Google Maps Link: https://www.google.com/maps/search/?api=1&query=38.8246521667,
-77.2994508333

Apple Maps Link: https://maps.apple.com/?11=38.8246521667,-77.2994508333
____________________________________________________________________
```



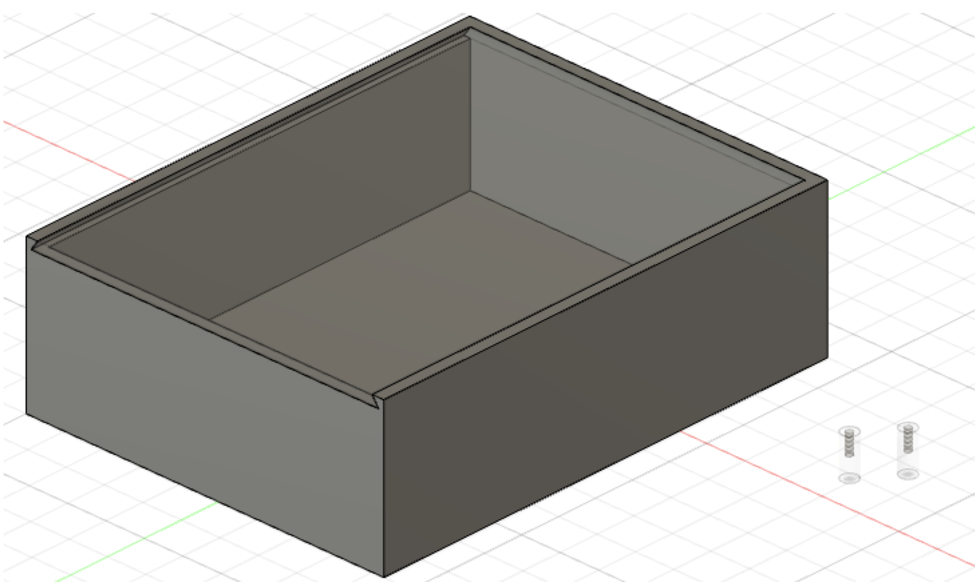
Week 5:

Our main tasks were to design, manufacture, and print a PCB and 3D print design for our E-band. Both were completed in their entirety. The PCB will be a soldered circuit containing all of our components for the E-Band. Also included in the design is a fan to keep the Raspberry Pi 0 cool (this is to ensure hardware reliability and resist heat against the patient's skin). The 3D print will house all of the components on the PCB. This will protect the components against any external damage that might occur while wearing the E-Band.

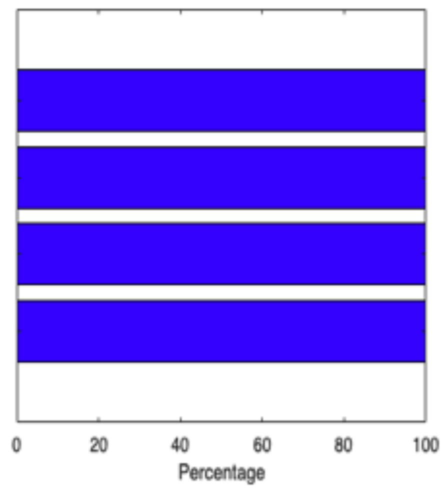
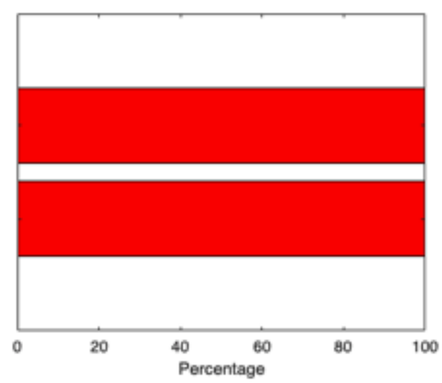
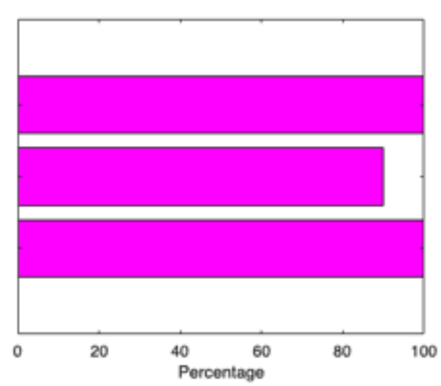
Picture of E-band PCB design:

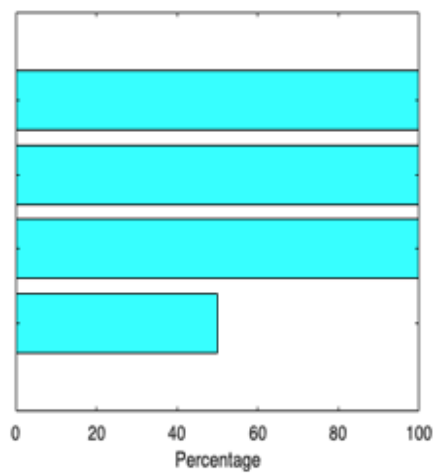


Picture of the 3D File:



Administrative Section

Week	Tasks	Status of Completion	Percent of Completion
2	<u>Deliverables</u> Project Title Delivery Form Project Description/Abstract Test Plan WBS		 100% 100% 100% 100%
3	<u>Communication Protocols & Connections</u> SPI & i2C Connect All Sensors		 100% 100%
4	<u>Initial Testing & Interfacing</u> Sensors functional on breadboard Accuracy of Sensors Operational Code with AWS		 100% 87% 100%

5	Designing, Manufacturing, Printing Design of PCB Design of 3D file Manufactured PCB Printed 3D Component		 100% 100% 100% 50%

Results Achieved in Reporting Period

Item	Cost	Person who Purchased Item
Pulse Ox	$21.15	Albin
1st GPS Receiver	$11.65	Albin
2nd GPS Receiver	$19.00	Padmini
LCD Screen	$19.02	Eric
MCP	$7.00	Brad
2 FSRs	$110.00	AJ
PPG Sensor	$25.00	Padmini
New Pi	$5.29	Eric
Neo6m GPS	$19.00	Padmini
PCB	$50.70	AJ
TENS unit	28.79	Albin
Battery Pack	$12.50	Nathalia
Fan	$6.99	Nathalia
3D Print Filament	$23.99	Nathalia

Micro USB Male Connector	$4.25	Nathalia
2x3 Male Header	$0.24	Nathalia
1x4 Male Header	$0.50	Nathalia
1x4 Female Header	$1.70	Nathalia
1x8 Female Header	$2.34	Nathalia
2x20 Female Header	$3.60	Nathalia
1k Thermistor	$5.46	Nathalia

Table of Funds (as of 2/26)

		Estimated Man Hours			
		492 Total	**493 Deliverable**	**493 Project**	**Total**
Albin	Alex	55	9	22	86
Andrew	Gambino	52	8	18	78
Eric	Holsworth	51	8	17	76
Bradley	Jean	50	7	21	78
Padmini	Yerramasu	52	7	18	77

Estimation of Man Hours

Plans for Next Reporting Period

Before the next reporting period, there are some tasks that need to be completed to stay on schedule. One of these tasks is to 3D-print the enclosure for the device. In addition to this, the components and headers need to be soldered to the PCB. The finished PCB needs to be fitted into the enclosure to confirm that the two fit together properly. The next task is to create and attach a sleeve to hold the enclosure on the forearm. After the PCB, enclosure, and sleeve have all been assembled together, the next task is to begin testing. There are many individual parts that need to be accomplished in order to complete testing. During testing, the device will be worn by multiple individuals to get an assortment of data from multiple users. The device will be worn during daily activity for long periods of time. The data recorded will be stored in the Amazon Web Server. While the user is wearing the device, he/she will conduct experiments to surpass the thresholds of different sensors.

There will be videos to demonstrate that the device is functioning. These demos will take place during testing when the device has been completely assembled. There will be multiple videos to demonstrate what actions were used to surpass sensors' thresholds and show the independent variables in our experiment that affect the output of the device. Another demo will show the interaction between the user and the device when the input data indicates that the user may be experiencing a seizure.

One problem area that needs to be addressed is creating a dome structure for the FSR. This dome structure will provide better contact between the FSR and the skin to measure more accurate readings on muscle contraction.

Answers to Questions

Overall, our project is on schedule. However, we ran into integration and manufacturing issues. Certain components have been shipped late, hence the soldering of the components to the PCB will be delayed. One problem we encountered was in selecting a GPS module that outputted reliable results. We decided to interface the NEO-6M GPS module with the rest of the sensors. Overheating of the PCB board and Raspberry Pi Zero W was another problem we encountered. Hence, a fan will be installed on the enclosure of the Raspberry Pi Zero W. A design problem we faced was minimizing the surface area of the PCB board while incorporating all sensors and components.