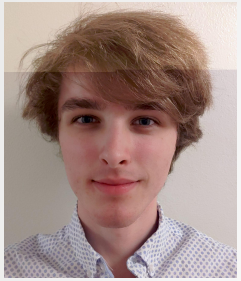
GloveSight (MDR)

Navigation Assistance for the Visually Impaired

University of Massachusetts Amherst

BE REVOLUTIONARY™

Team Makeup



Philip Colladay (Computer Engineering)

Jeffrey Matheson (Computer Engineering)

Anvita Patel (Computer Engineering)

Nick Viehl (Electrical Engineering)

Project Goal

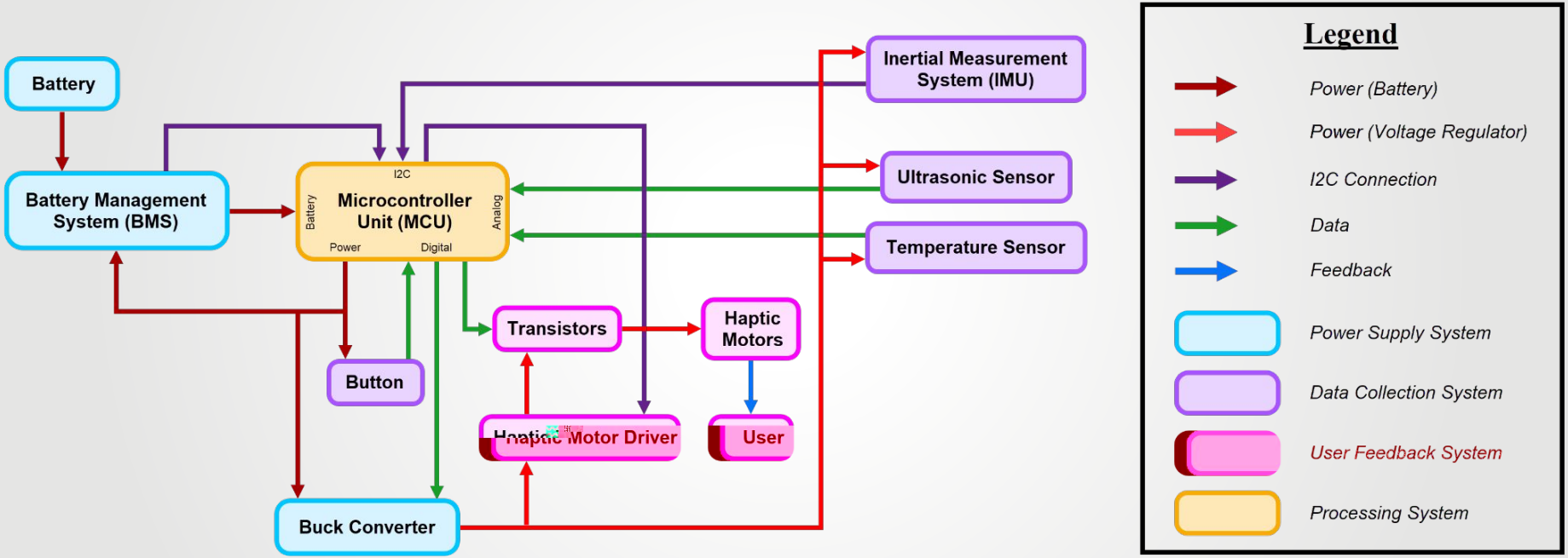
Problem Statement

Introduction: A Quick Overview of GloveSight

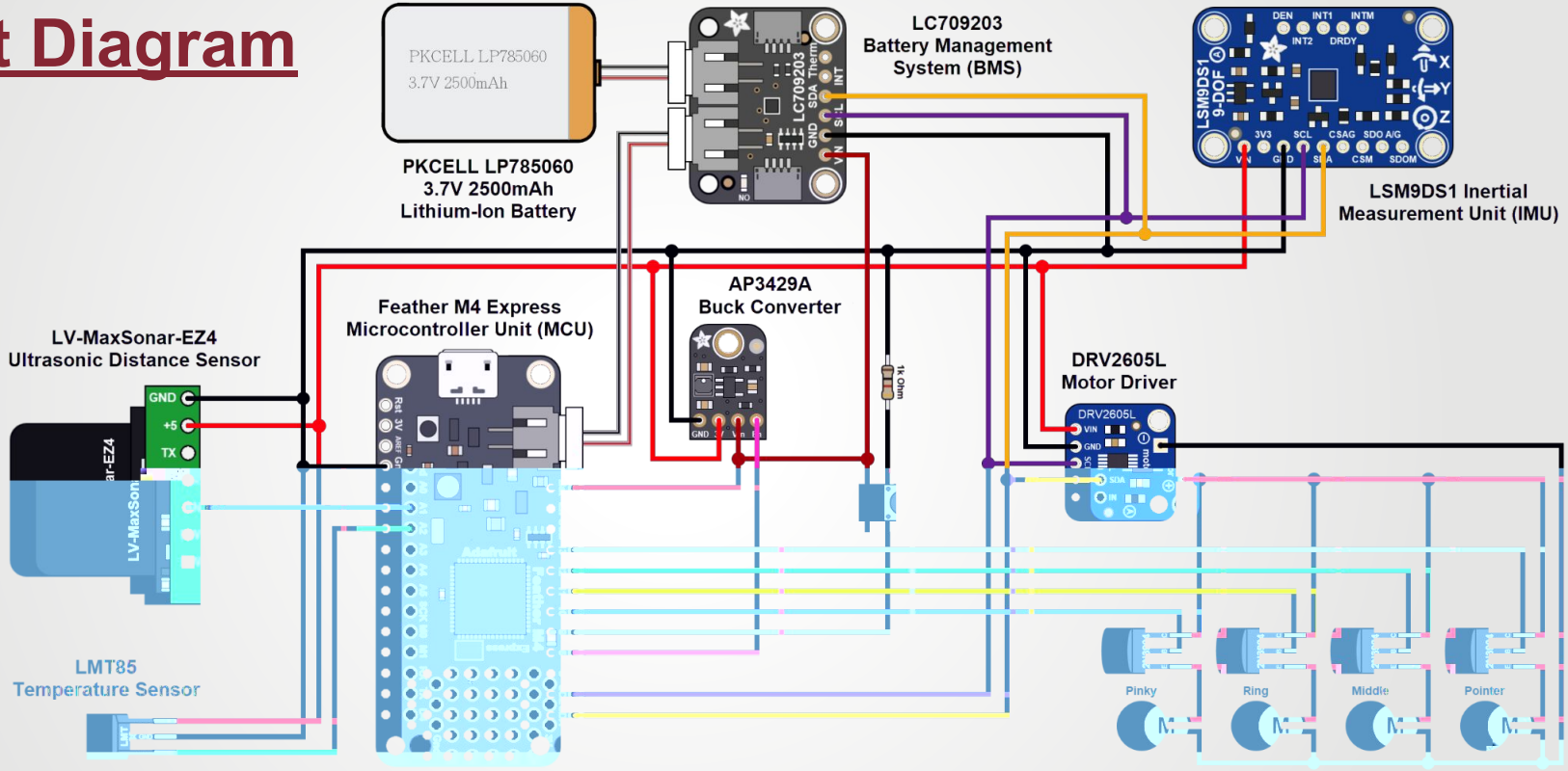
	Physically Non-Intrusive	Able to Convey Long Distances	Spherical Field of View	Mobility	Low Maintenance	Availability
Traditional Canes						
Smart Canes						
Collision Sentry Corner Pro						
Sighted Guide						
Guide Dogs						
GloveSight						

System Specifications

Updated Hardware Block Diagram



Circuit Diagram



Hardware Used

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Hardware Justification: MCU

Adafruit Feather M4 Express - Featuring ATSAMD51

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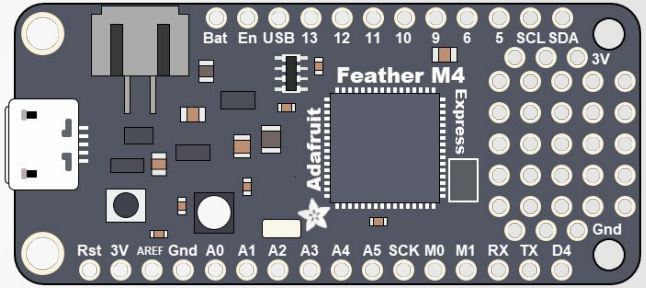

Hardware Justification: Ultrasonic Sensor & Temperature Sensor

Ultrasonic Sensor: LV-MaxSonar MB1040

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Temperature Sensor: LMT85

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Hardware Justification (Battery + BMS)

Battery

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- _____
- _____
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Battery Monitoring System (BMS)

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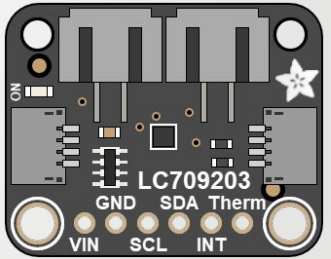

Hardware Justification (Haptic Motors + Motor Driver + Transistors)

Eccentric Rotating Mass (ERM) Haptic Motors

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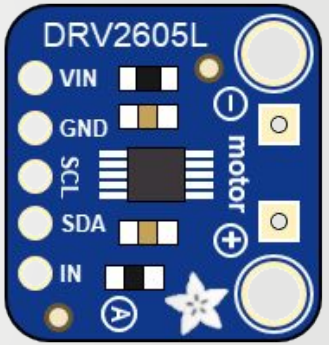

DRV2605L Motor Driver

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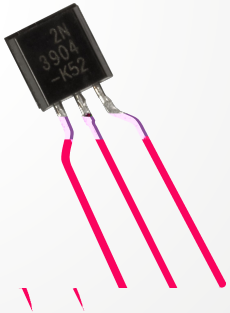

2N3904 Transistors

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Hardware Justification (IMU)

LSM9DS1

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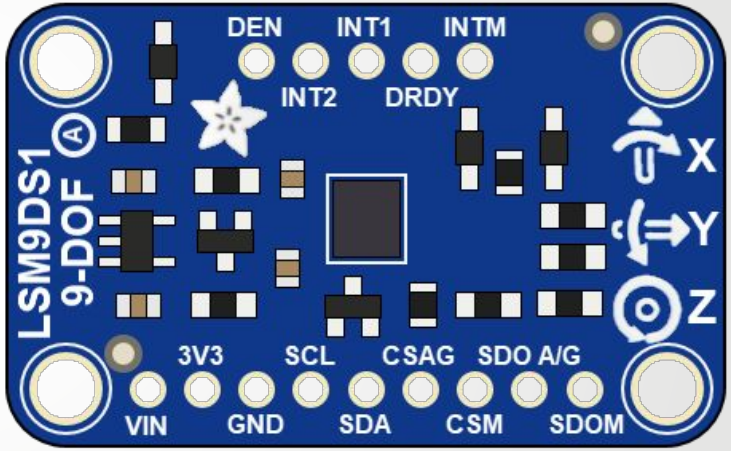
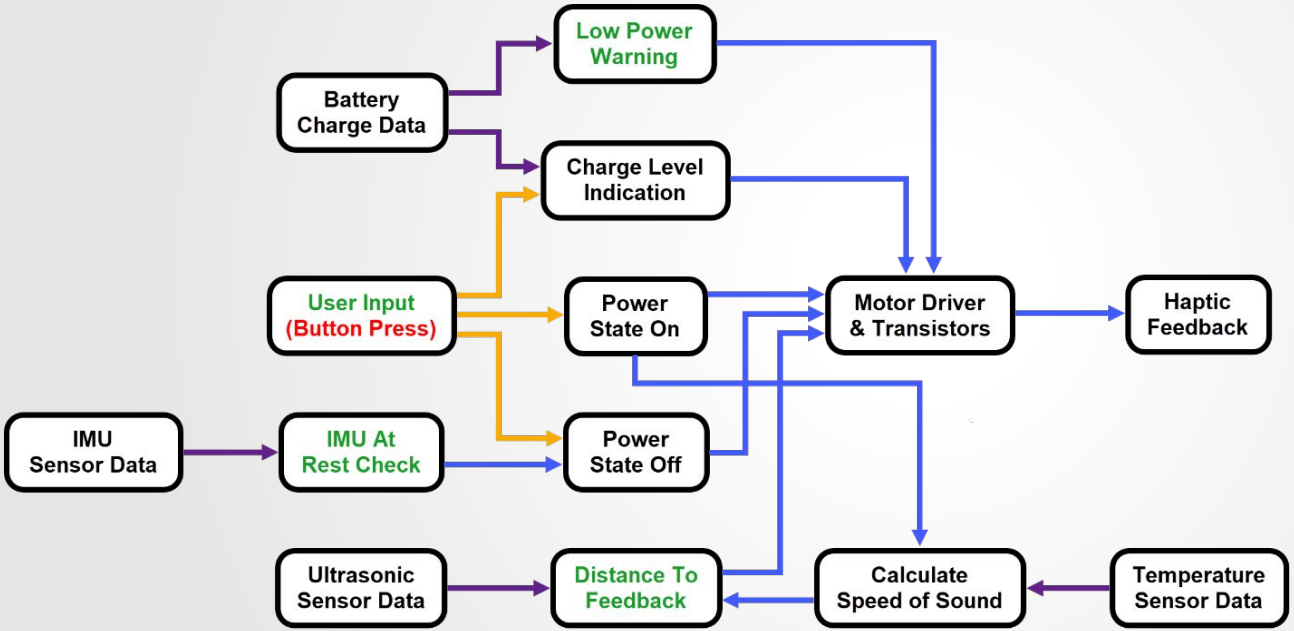


Updated Block Diagram (Software)



Legend

- Sensor Data
- User Controlled
- Function Communication
- Green — Running When Power ON
- Red — Running When Power OFF

Distance Sensing

Distance Sensing Algorithm

Distance Sensing: Correcting Distance Data

Temperature Correction

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MDR Deliverable:

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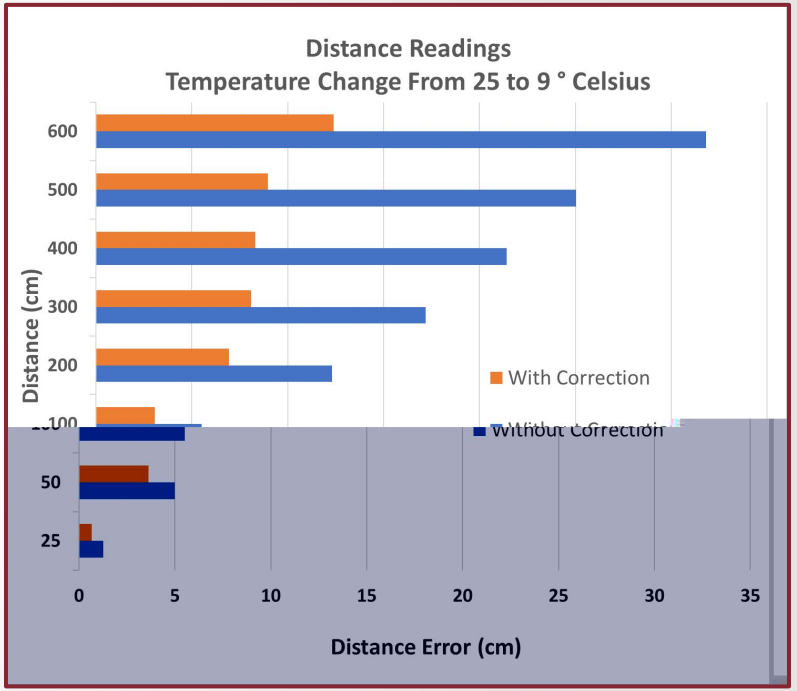
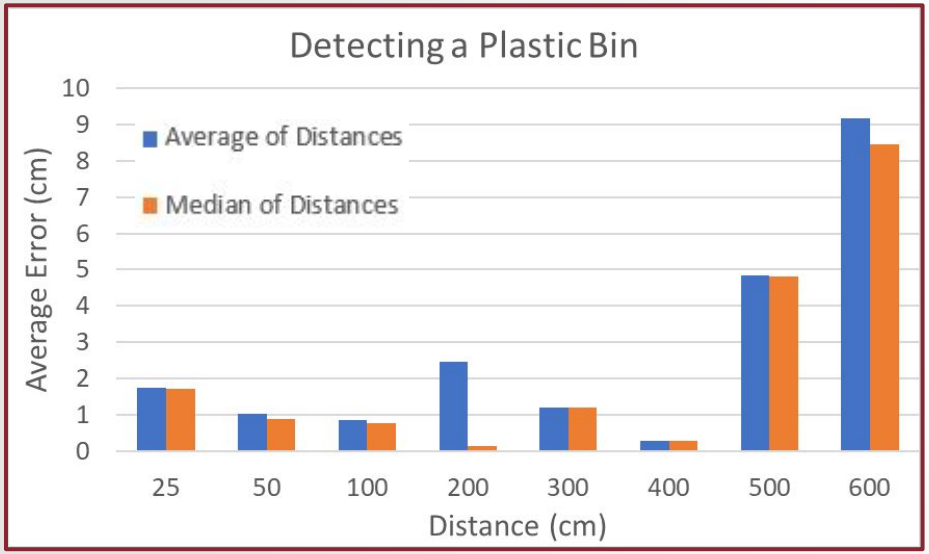
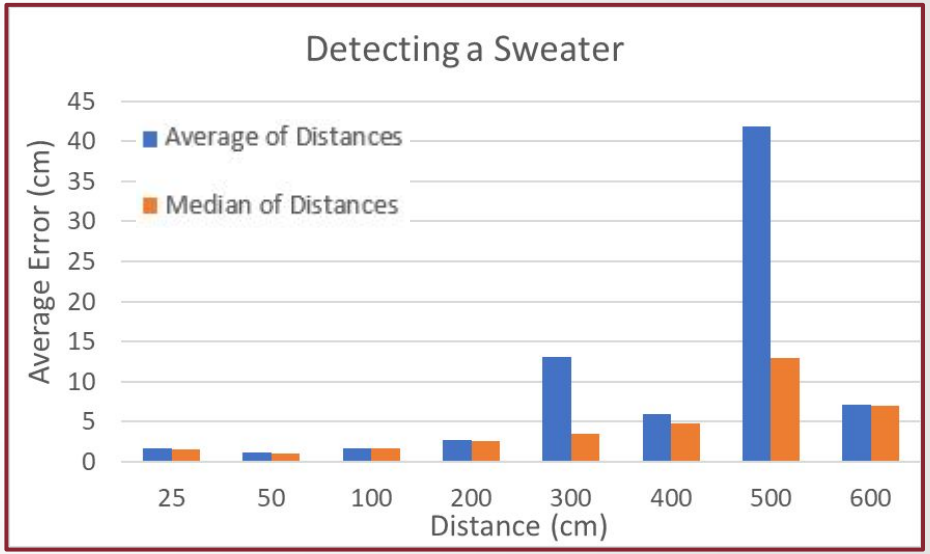
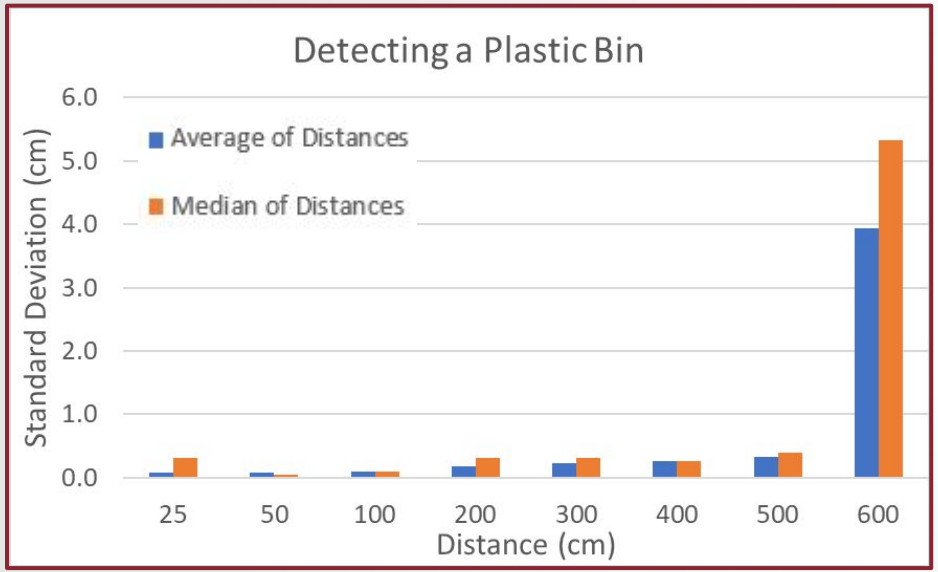


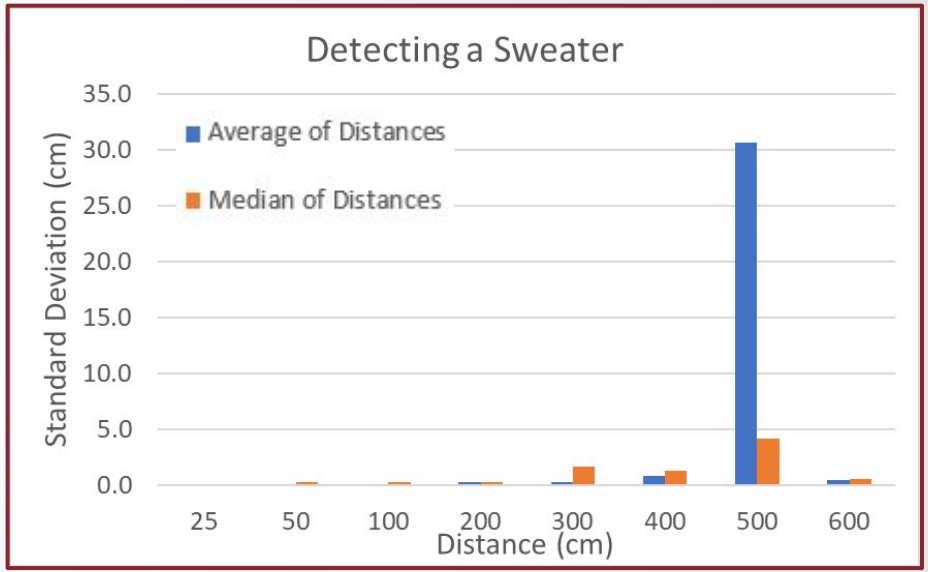
Distance Sensing Testing: Average Distance Error





Distance Sensing Testing: Data Consistency





Distance-To-Feedback

3. Will non-verbally communicate varying distance information to the user.

a. The user should be able to accurately approximate distances with only a minimal learning curve.

Distance to Feedback

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Accurate Distance Approximation

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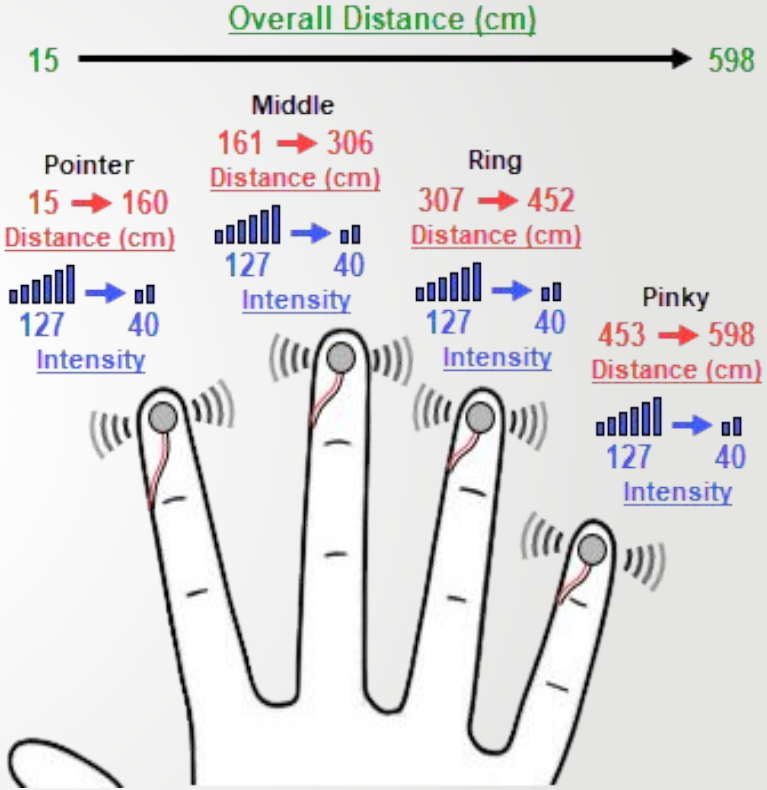
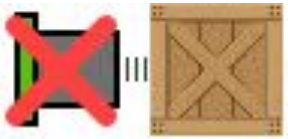


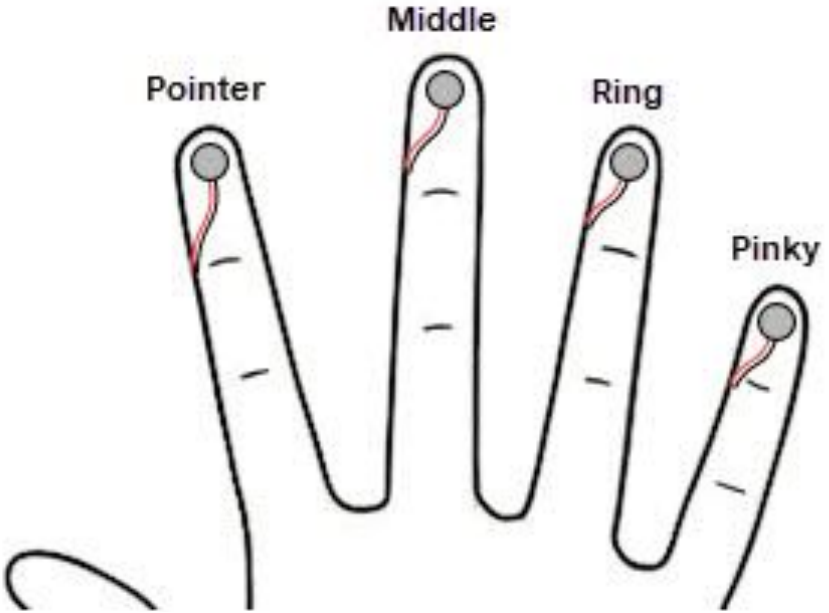
Distance-To-Feedback (Demonstration)



Distance (15 to 598): < 15cm

Intensity (40 to 127): N/A

Finger: N/A



Power: BMS Implementation

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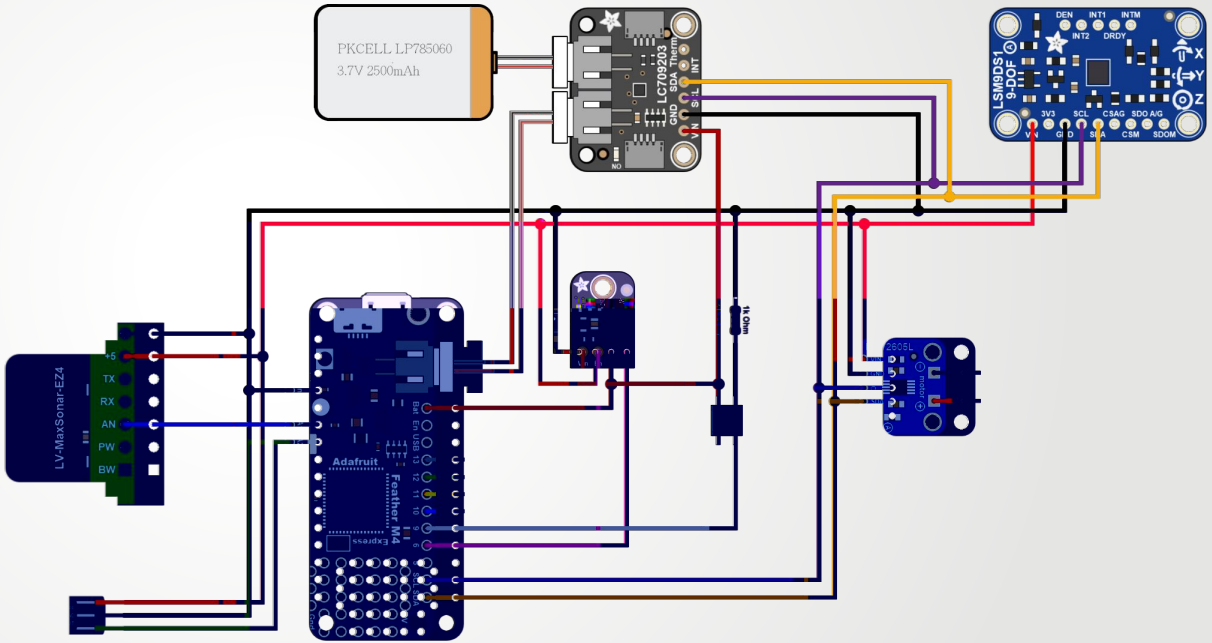

Power: Power Usage

PDR comments:

Typical day of the user consists of:

MDR Deliverable:

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Power: Battery Testing and Results

Worst-Case Test: System On For 6 Hours

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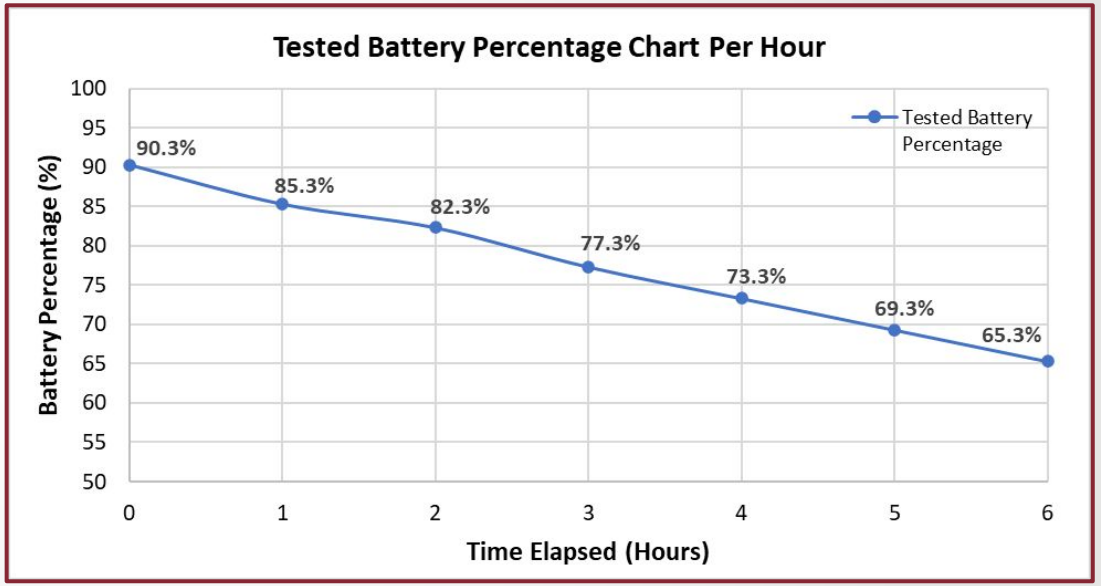

User Input

5. The user must be able to interact with the device without the need of their other hand.

a. Able to control the power state of the device.

Why a Push Button?

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Power State Control

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Charge Level Indication

5. The user must be able to interact with the device without the need of their other hand.

b. Able to communicate charge level to the user upon request.

User Input

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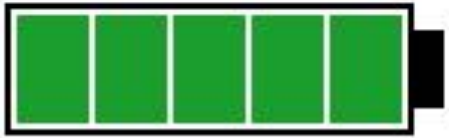
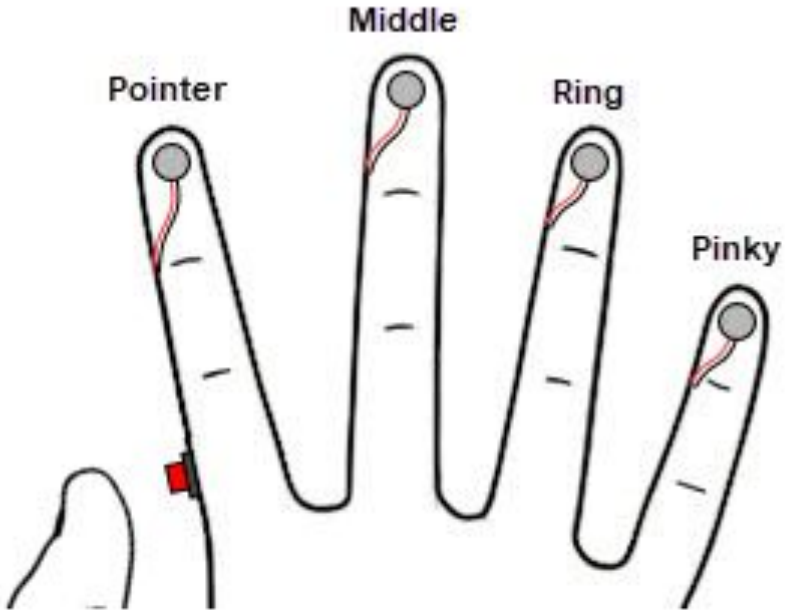
4. Have a rechargeable battery life of at least 6 hours.

Charge Level Indication (Demonstration)

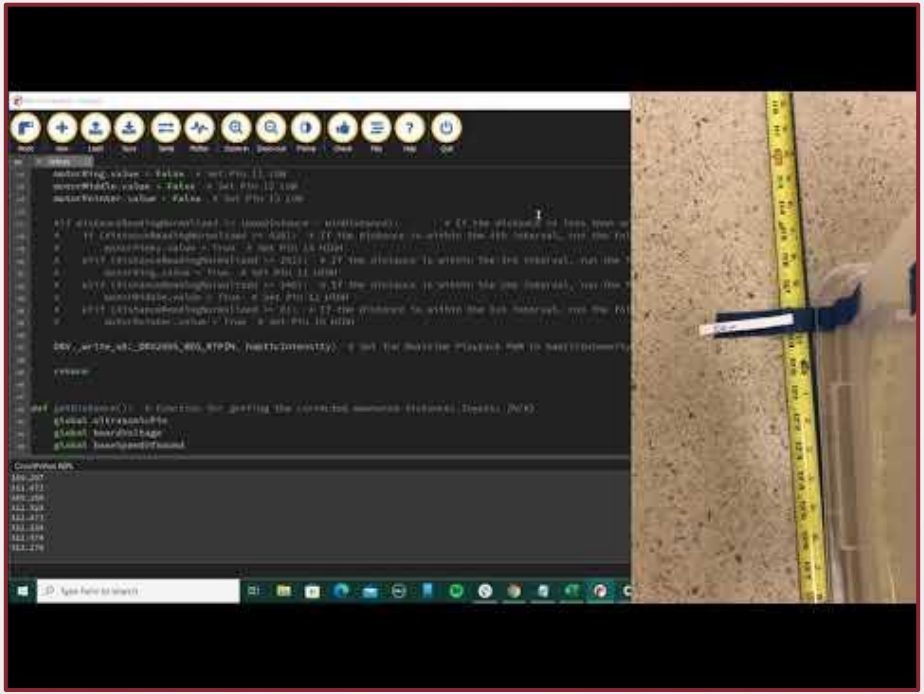


Charge Level (0 to 100): 100/100

Finger(s): N/A



Performance of the Integrated System



PCB

PCB Commitment

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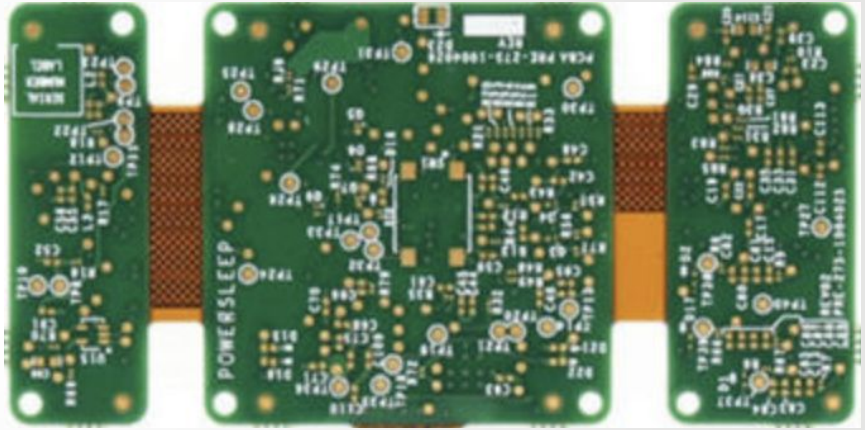
  - _____



PDR Comments:

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Current Expenditures and Weights

System Component	Quantity	Costs	
		Price of Part(s)	Shipping Costs
Push Button Switches	2	$1.90	$7.96
Temperature Sensors	2	$1.45	$15.53
Motor Driver	1	$7.95	
ERM Coin Motor	12	$14.40	
USB LiPoly Charger	1	$5.95	$9.02
BMS	1	$6.95	
Li-Po Battery	1	$14.95	
Buck Converter	2	$7.80	
Total		**$93.86**	

System Component	Current Weight (g)
Push Button Switch	0.5
Temperature Sensor	0.5
Motor Driver	1
ERM Coin Motors	0.9 * 4 = 3.6
Transistors	0.5 * 4 = 2
Ultrasonic Sensor	4.3
IMU	1.8
BMS	2.4
Li-Po Battery	43
Buck Converter	0.9
MCU	5
Total	**65g**

Projected Expenditures

System Component	Cost ($)	
	Predicted	Contingencies
Total (Ranged)	$280 - 500	

Team Member Responsibilities

Philip Colladay

- _____

Jeffrey Matheson

- _____
- _____

Anvita Patel

- _____
- _____

Nick Viehl

- _____
- _____

MDR Deliverables

Overall Goal

✔

Specific Goals

✔

✔

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✔

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✔

Plan for CDR

Software

1. **Distance Sensing Improvements:**
   - _____
2. **Haptic Feedback**
   - _____
3. **Conversion of System Code From Python to C**

Hardware

1. **Ultrasonic Sensor:**
2. **Power**
   - _____
3. **Determining Final Battery Size**
4. **Button**
   - _____
5. **First PCB Design Fabrication**

Other

1. **Glove Design Prototype**

Addressing PDR Comments and Concerns

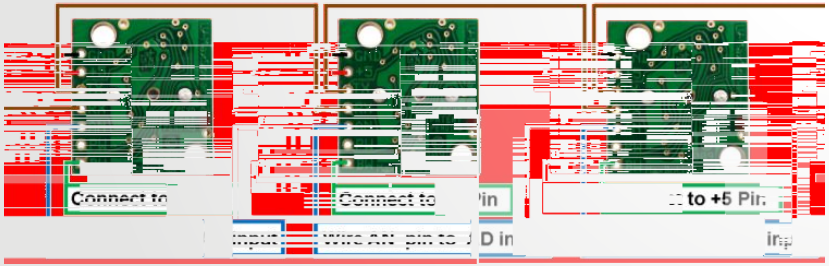
Distance Sensing

Comment:

Action:

Comment:

Action:



Range (meters)	PDR Tolerance (centimeters)	Updated Tolerance (centimeters)

Addressing PDR Comments and Concerns

User Experience

Comment
Action p s el t

-

General Citations

Image Citations

Lithium Ion Battery

Maxbotix Ultrasonic Rangefinder - LV-EZ4 - LV-EZ4

Coin Vibration Motors

Transistor - 2N3904, TO-92 case, NPN, Lead Free

Tactile Push Button Switch 4 Pin

OEM ODM FPC Flexible Cable Flex PCB

LMT85LPGM

Questions / Answers Session