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CIA Wearables

Team 505

2/29/2024

Team Introductions

Kartika Ahern
Systems Engineer

Maxwell Orovitz
Design Engineer

Eliot Hamilton
Materials Engineer

Malachi Johnson-Taylor
Human Factors/ Ergonomics Engineer

Patrick Molnar
Mechatronics Engineer

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Sponsor and Advisor

Team Sponsor
Franklin Roberts
Central Intelligence Agency

Teaching Faculty
Shayne McConomy
FAMU-FSU College of Engineering

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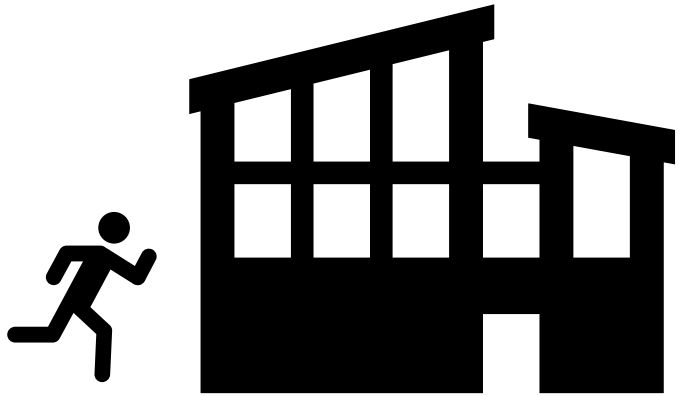
Objective

The objective of this project is to develop an innovative wearable for the CIA, featuring an integrated gas detector, as well as additional technology to aid in building collapse search and rescue missions.



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Key Goals

Successfully collaborate to implement a gas sensor into our wearable technology

Improve operative safety and communication

Develop a reliable and fully functional prototype

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Assumptions

User will be wearing the device over search and rescue gear

Device will be worn over user optical equipment

Team 506 will recognize relevant gasses and calibrate their detector accordingly

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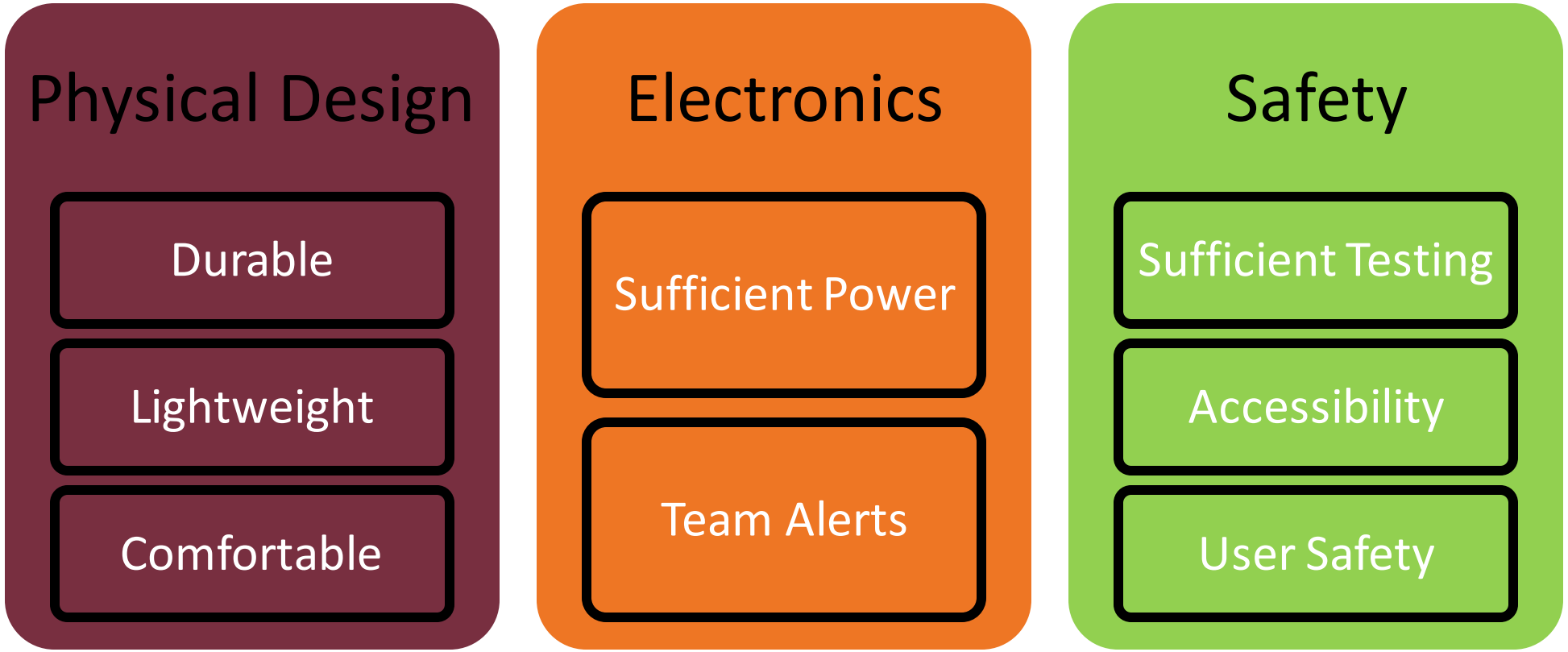
Customer Needs



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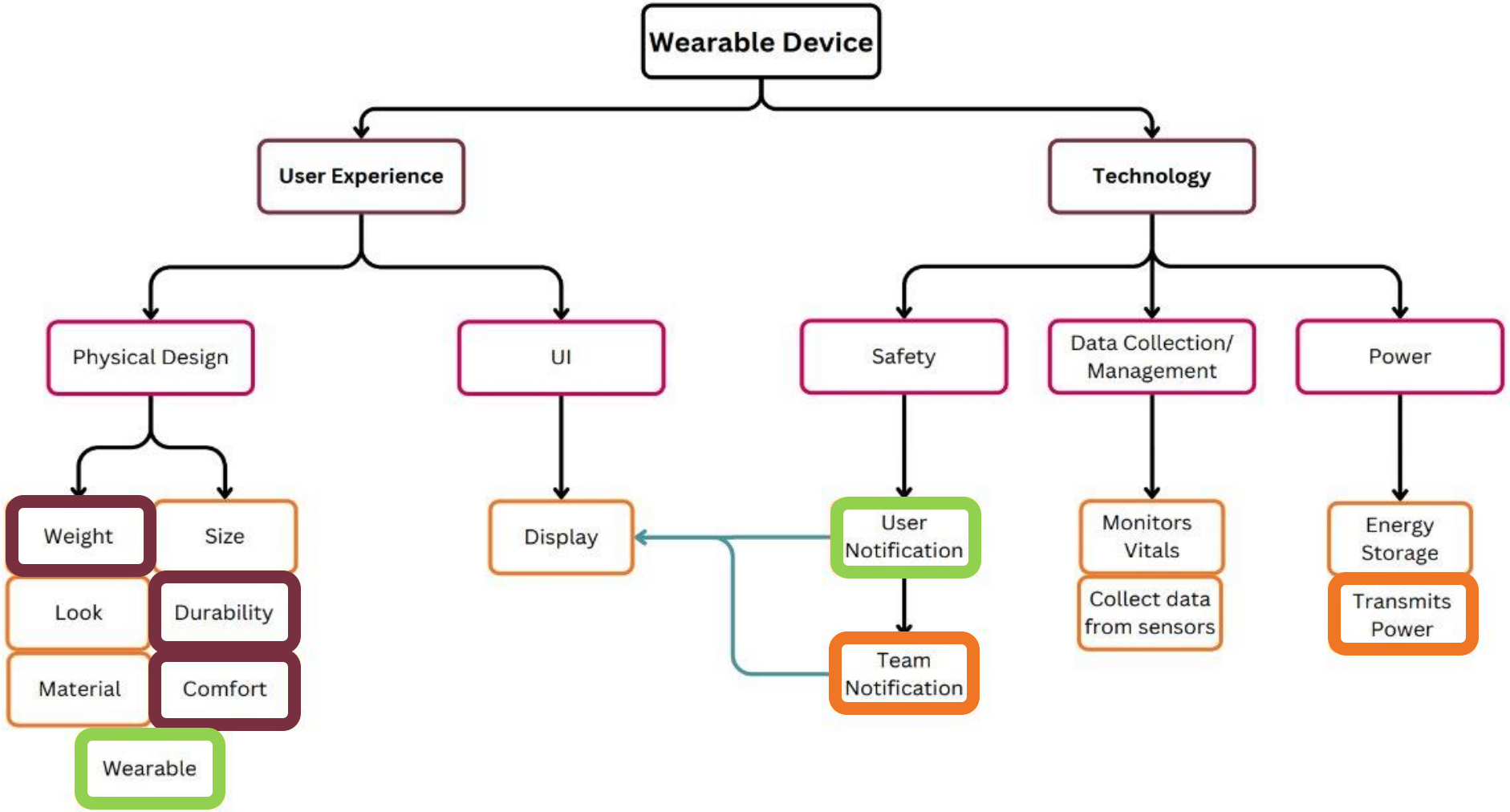
Functional Decomposition

Customer Needs Key

- Physical Design
- Electronics
- Safety



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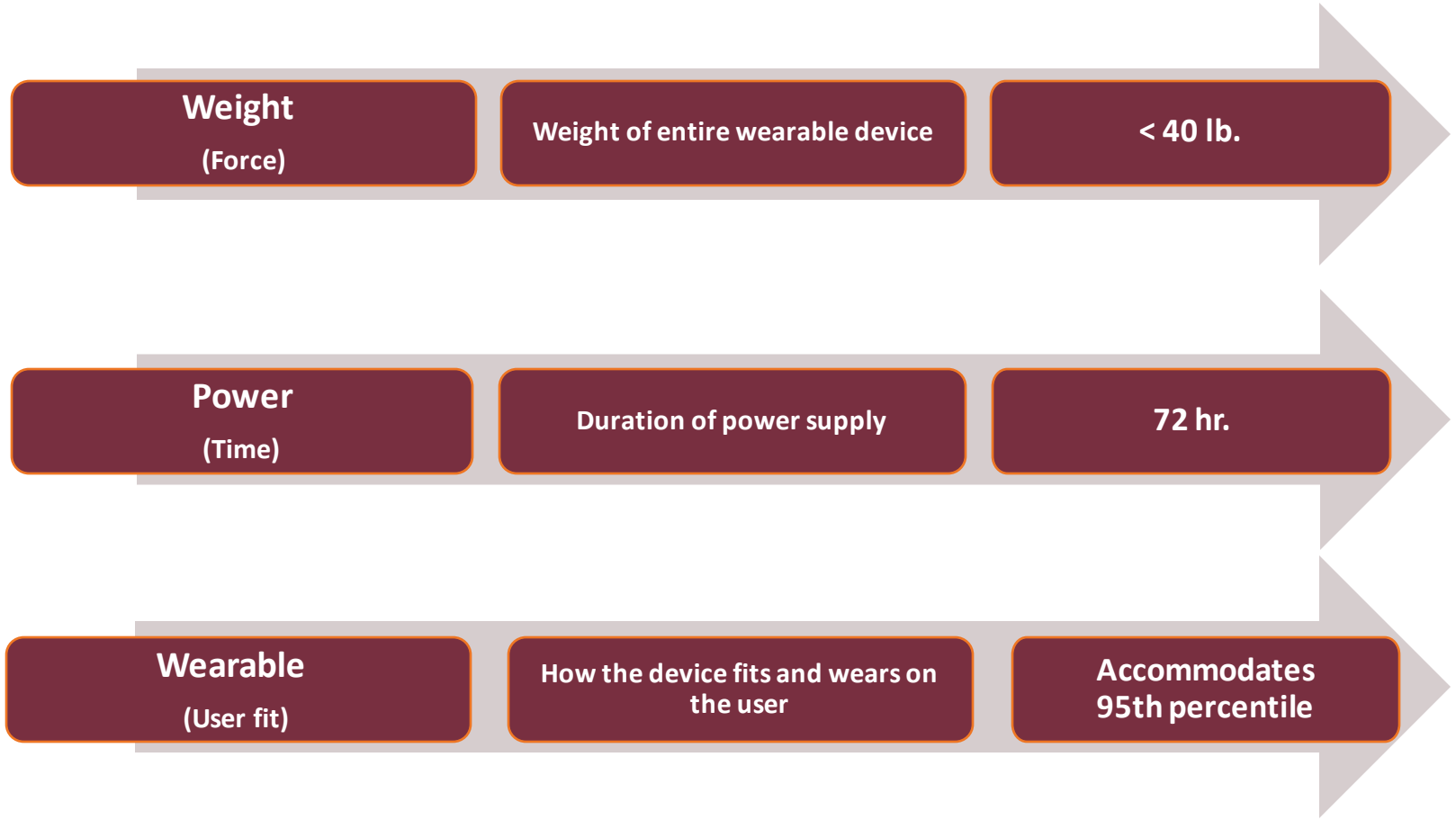
Critical Targets



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Concept Selected

- Lightweight and Maneuverable physical design
- Easy to See Displayed information
- Central Location for Vital Collection

Helmet HUD

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Design Review Updates

Design Changes
- Important design standards and updates

Helmet
- Schematic and CAD mockup of proposed design with custom mounts

How it Works
- Step-by-step walkthrough on how design works within the field

Alerting
- Details of various alerting devices included within the overall design

HUD
- Schematic and proposed process on how to get data to display on visor

Batteries
- Details of battery type needed and proposed design of enclosure

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Important Design Changes

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Helmet Design Standards

Head Breadth

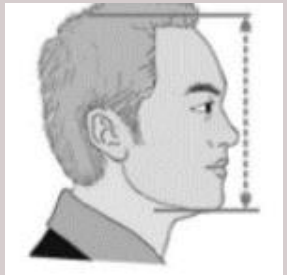
95% Male: 22.43 cm

5% Female: 12.43 cm

Menton to Top

95% Male: 28.24 cm

5% Female: 19.66 cm



Diametric menton to the back of head

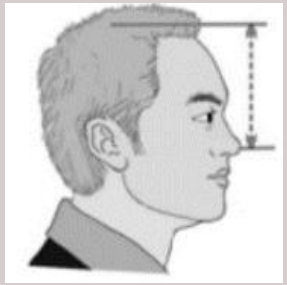
95% Male: 29.21 cm

5% Female: 22.59 cm

Nose to top of the head

95% Male: 18.78 cm

5% Female 12.88 cm



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Helmet Design Standards Cont.

Pronasale to eye

95% Male: 23.70 cm

5% Female: 16.39 cm

Face Breadth

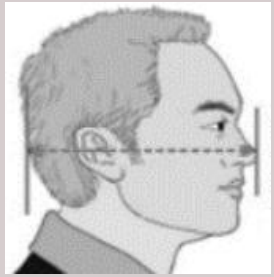
95% Male: 19.85 cm

5% Female: 13.02 cm

Eye to back of the head

95% Male: 21.18 cm

5% Female: 13.05 cm



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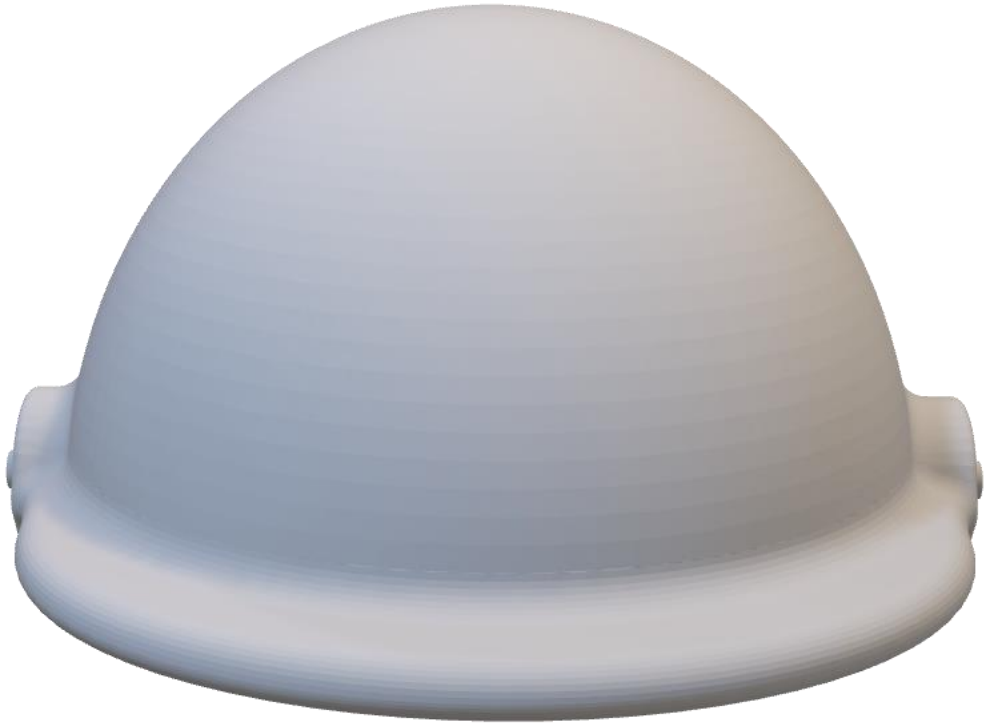
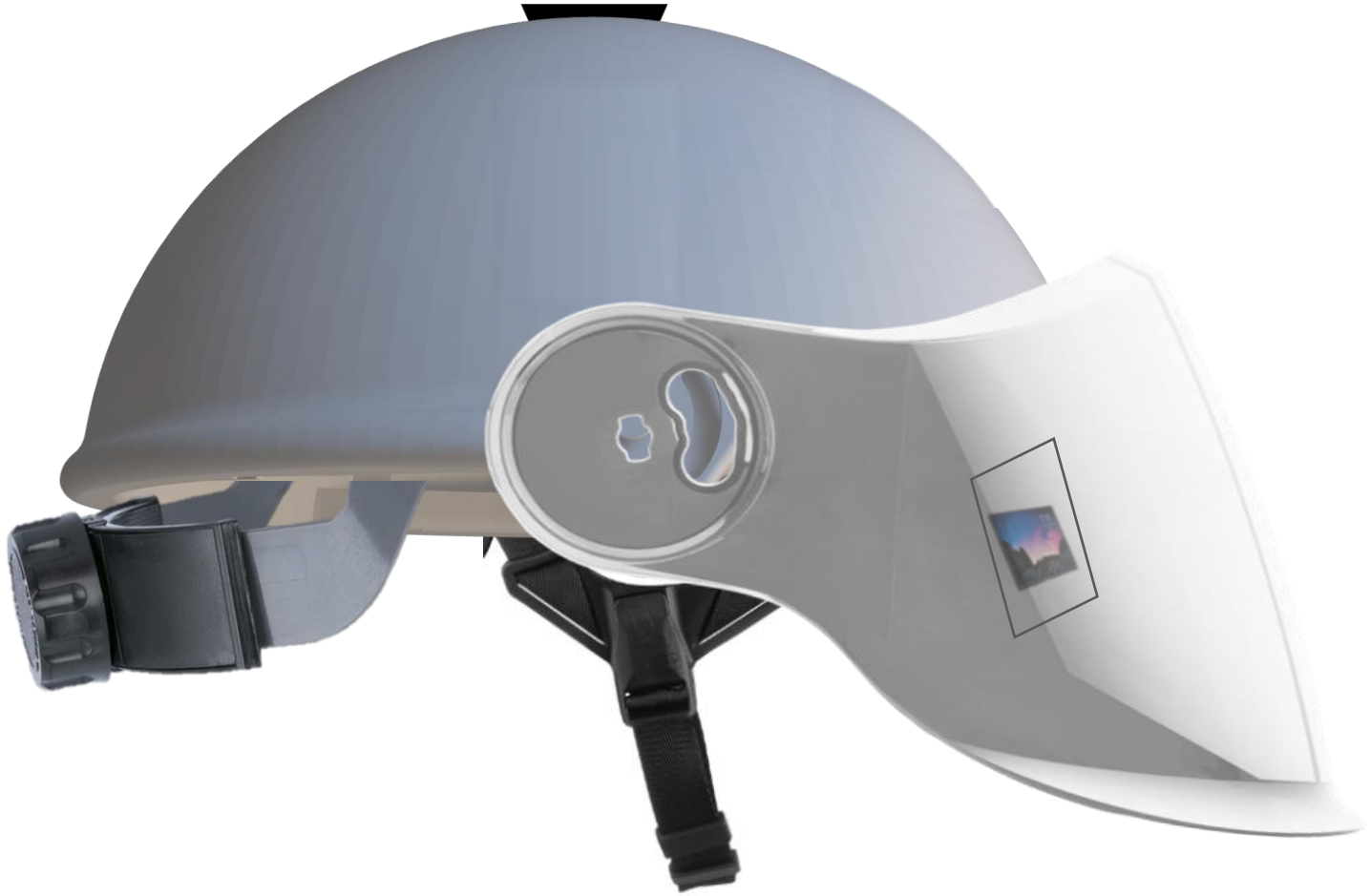
Updated Helmet Design



Will Include:

- Mount for:
  - Flashlight
  - Vitals Sensors
  - LCD Screen
  - Alerting System (LED and Speaker)
  - Visor
- Adjustable Helmet Harness
- Custom Wire guides for Cable Management

Updated Helmet Design



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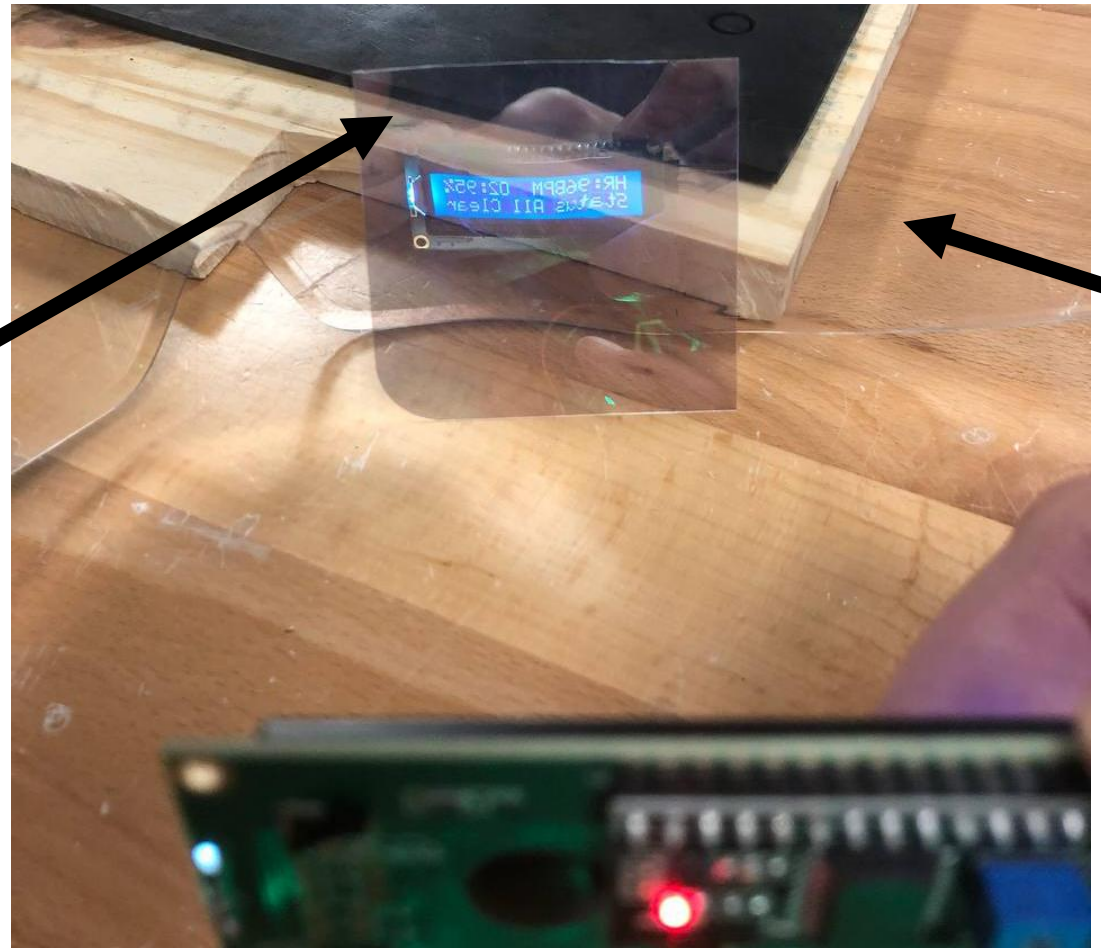
Updated Helmet Design

Reflective Film



Tinted Visor

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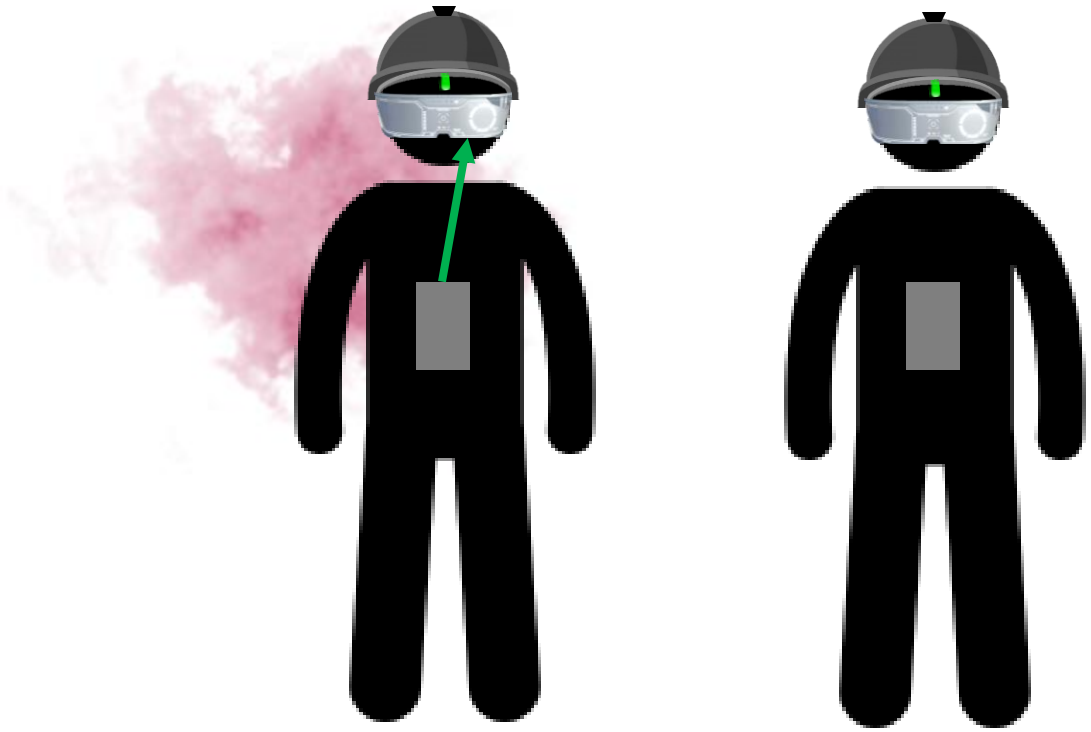
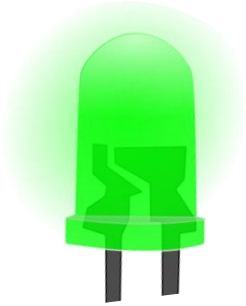
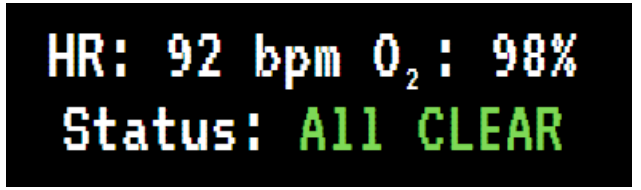
How it Works



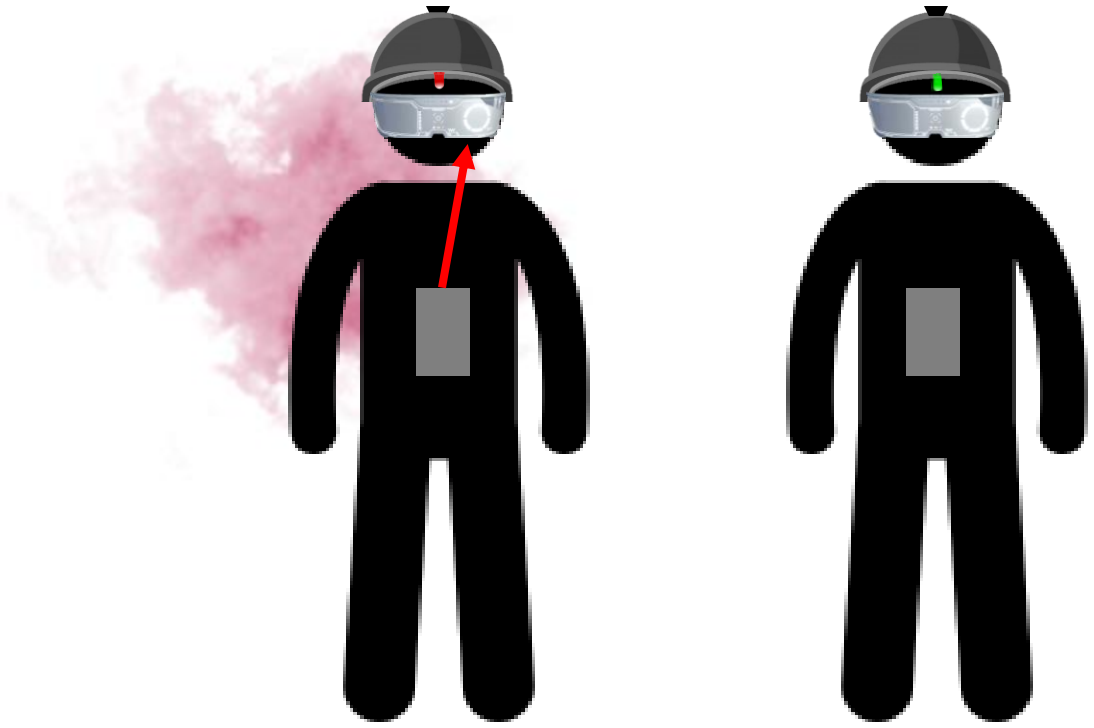
Standby Light



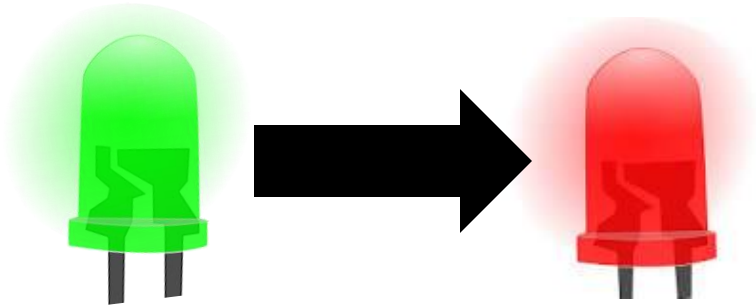
HUD Example Visual:



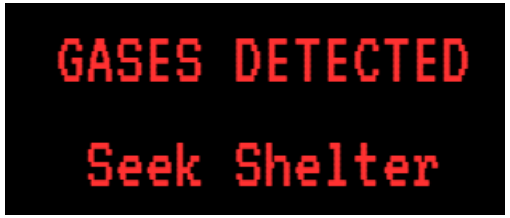
How it Works



Personal Alert Light



HUD Example Visual:



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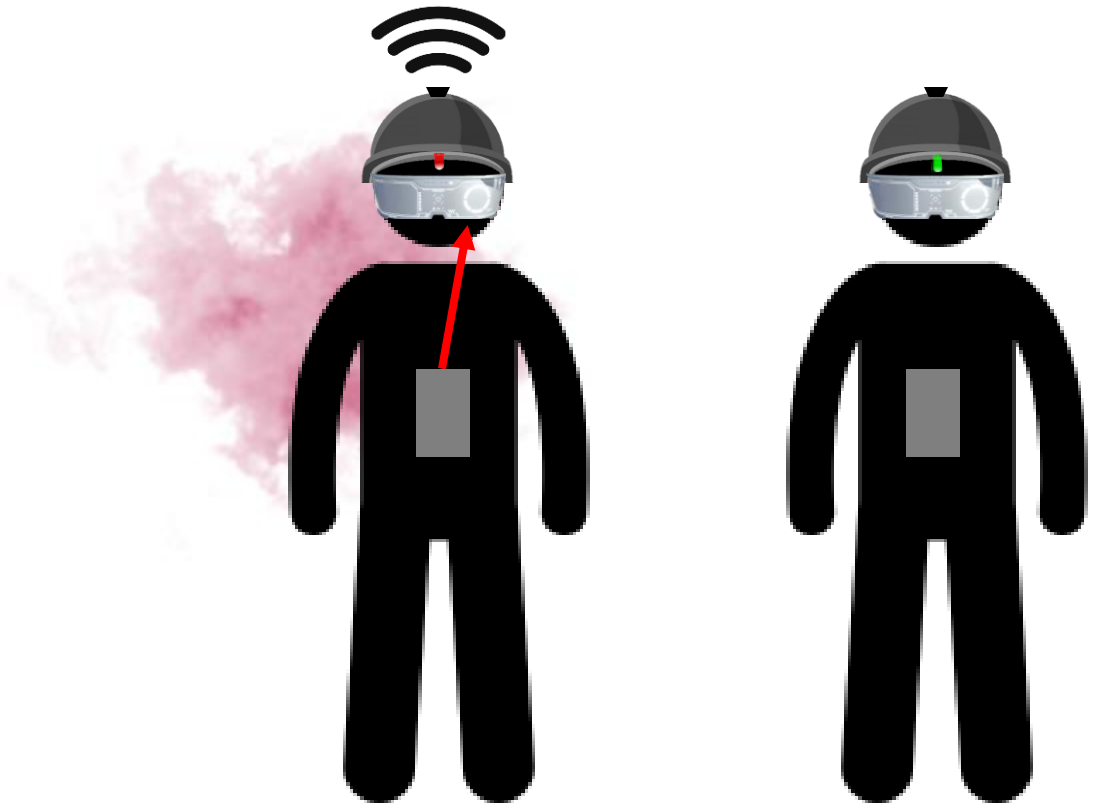
How it Works



Surrounding Team Alert

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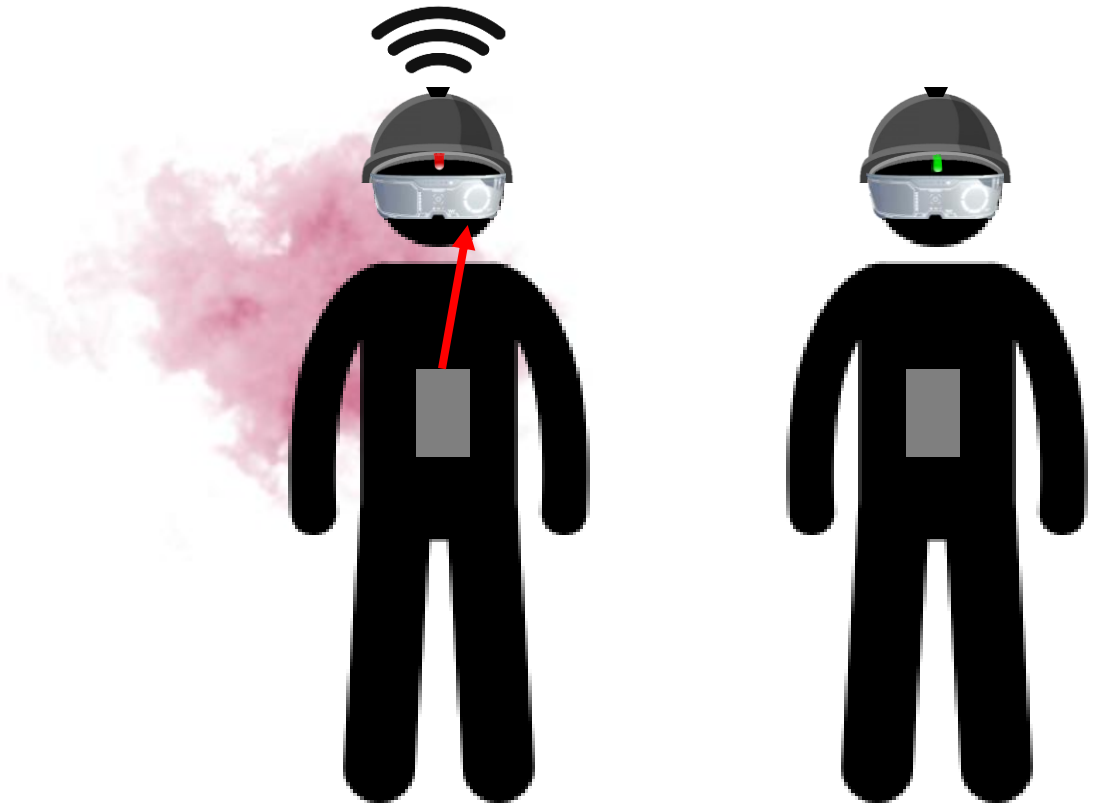
How it Works



Surrounding Team Alert

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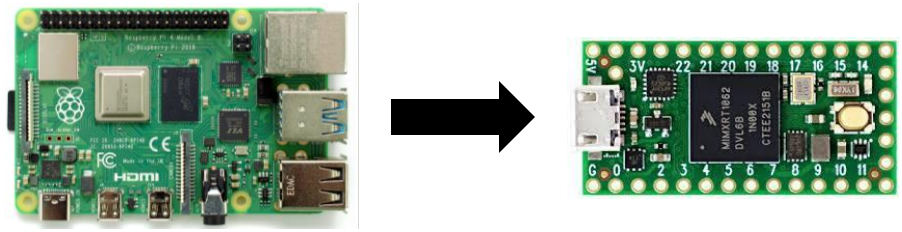
Hardware Updates



- First, we decided to switch from the Raspberry Pi 4b to Arduino Teensy 4.0
  - The Teensy aligns with the goals of the project better
  - It draws significantly less current ~100mA
  - Roughly 1/9 the size
  - Operates on 3.3V logic, which is compatible with our sensors
  - And it still provides powerful CPU features

Battery Information

92x60x6mm (LxWxH)

Lithium Polymer Battery (3.7V 4000mAhr):

- Teensy + Components require ~4,000 mAhr for 18hr continuous use
- 3.7V allows us to avoid using a voltage regulator, which increases battery efficiency and reduces heat
- This battery has a high discharge rate (4000 mA), but we will also implement fuses for further protection
- Other benefits of this choice:
  - Small form-factor battery
  - Lightweight
  - Fast charging
  - Low maintenance
  - Wide operating temperature range

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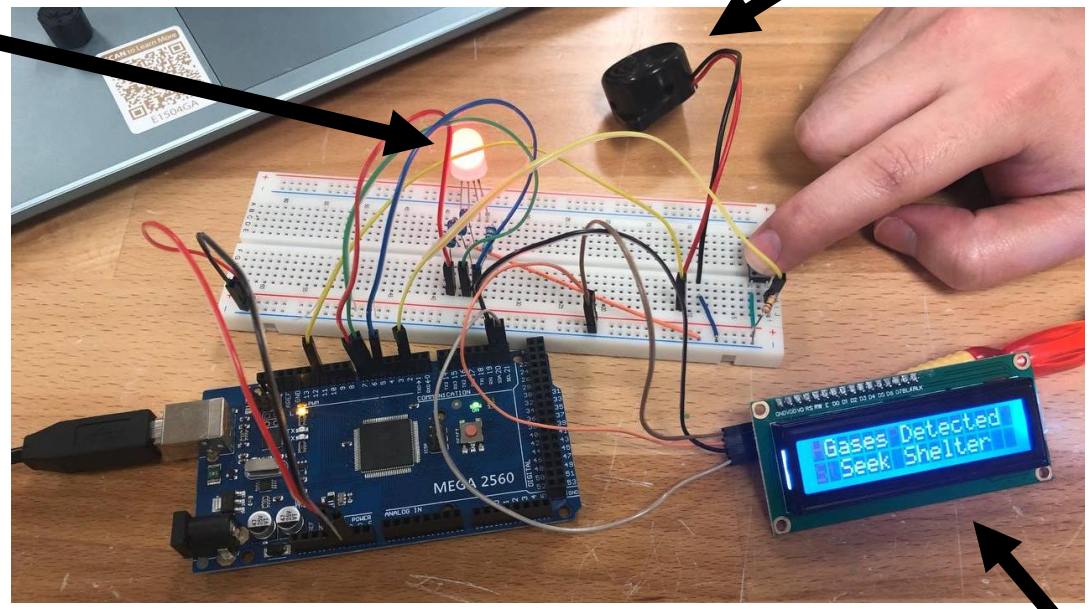
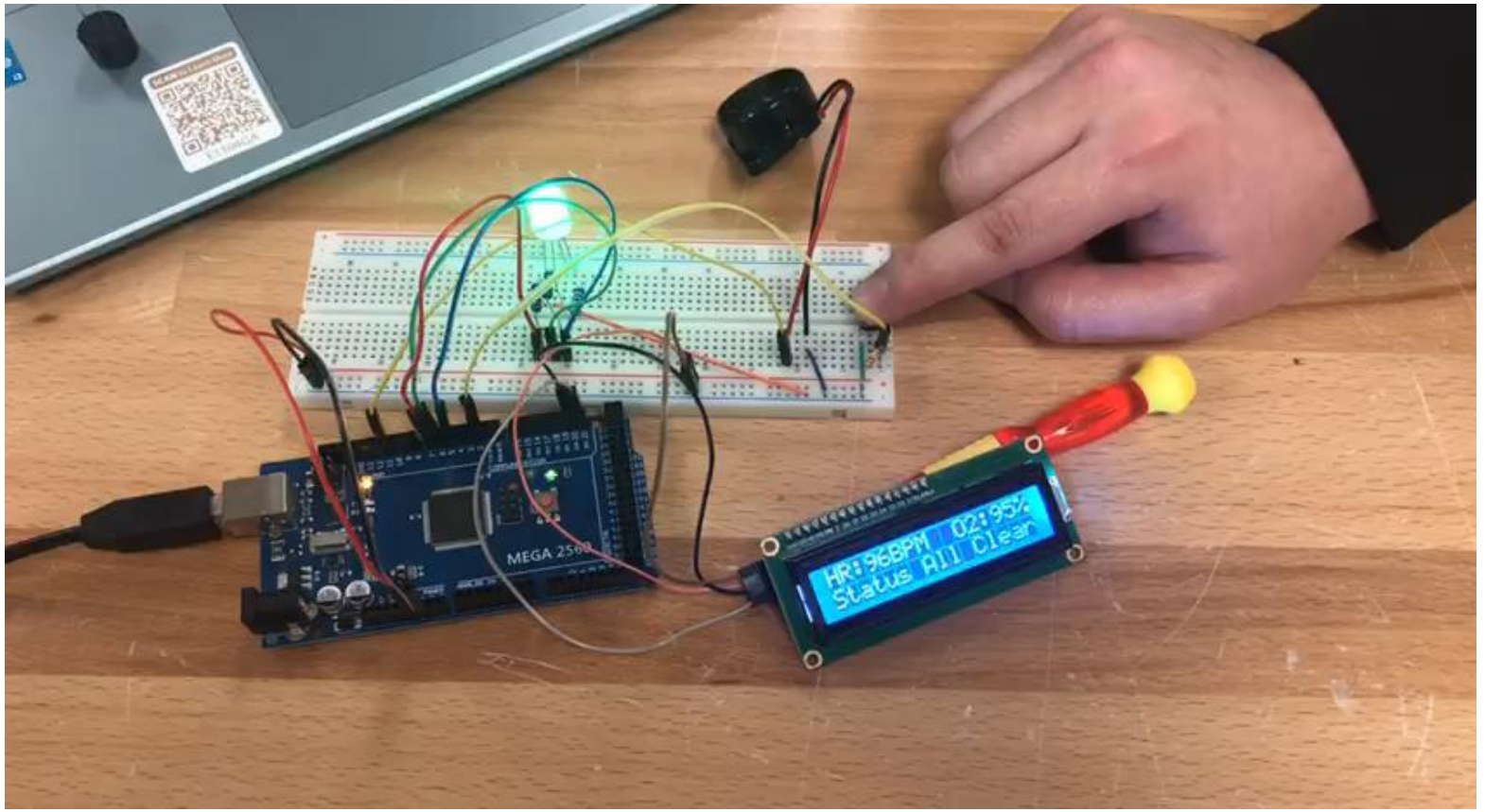
Alerting Overview

100dB at 12V

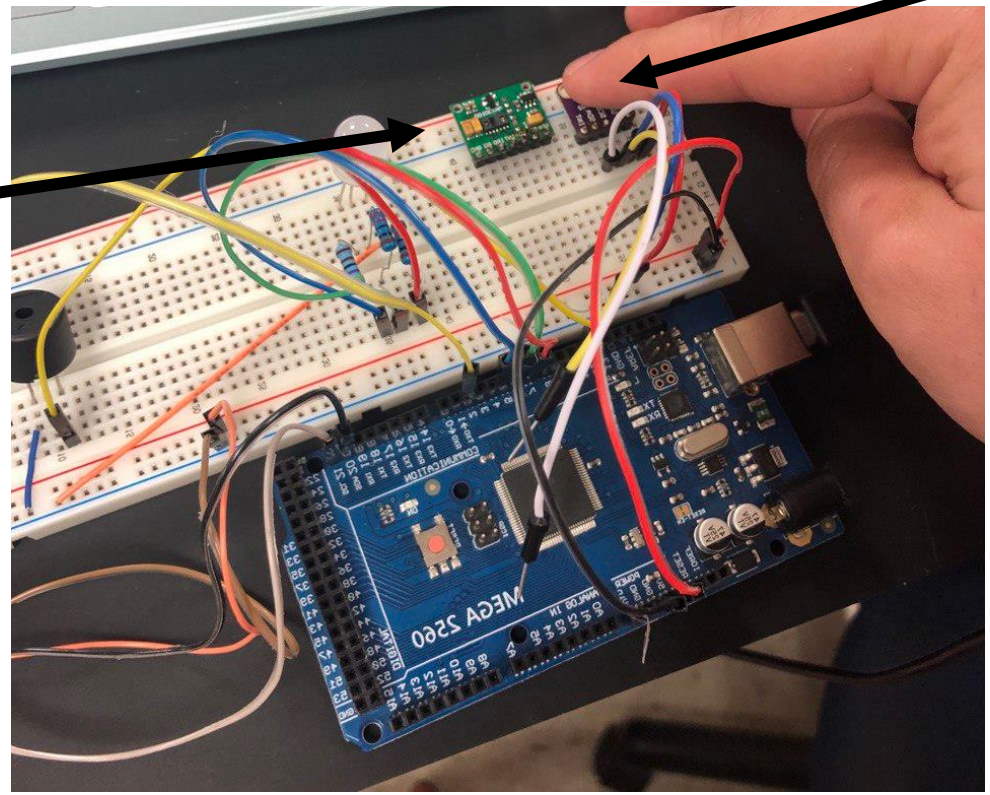


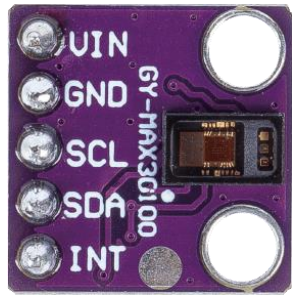
Alerting Overview



Monitoring Vitals Overview

Heart Rate Oxygen Pulse Sensor (MAX30100)





Pulse Oximeter and Heart Rate Sensor (MAX30102)

Integration with 506 Update

- Both teams utilizing Arduinos to improve communication efficiency
- Exploring the validity of using the HC-05 Bluetooth module
  - Both teams are working on testing Bluetooth, if unsuccessful by spring break, we will move forward with a wired connection
- 506 is now solely responsible for connecting their device to the user
  - Allowing for specific sensor placement and freedom of preferred mounting system

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Budget Overview

	Oct	Nov	Dec	Jan	Feb	Mar	Apr
$ Exp	$0	$0	$0	$360	$0	TBD	TBD
% Exp	%0	%0	%0	%18	%18	TBD	TBD

Running Total of Current Product:
12.49 (Headgear) +
185 (Tinted Visor) +
3.25 (1 reflective film) +
57.50 (Culminating Lens) = **$ 258.24**

= on product

Pro Order 1

Item	Received Y/N
MedTac Bag	Y (Returned)
Pi 4b	Y
Rachet Headgear	Y

Pro Order 2

Item	Received Y/N
Culminating Lens	Y
LCD	Y
Chinstrap	N (Reorder)
Reflective Film	Y
Tinted Visor	Y

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Future Work

Pre Spring Break

Procurement Order

Finalize and Test all Components

Helmet Updates (Mounting & Ergonomics)

Design PCB

Post Spring Break

Full Integration with 506

Final Helmet Design Improvements & PCB Testing

Prepare for Senior Design Day

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Thank you from Team 505

2/29/2024