SecureScape

GROUP 15

MIDTERM DEMO

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Introduction & Presentation Breakdown

Project Overview :

- SecureScape is a portable security system that utilizes ESP32-CAM nodes and a central gadget for real-time threat detection in remote areas.

Presentation Breakdown:

- Project Overview – System diagram & Key components.
- Hardware Breakdown – Overview of **Node** & **Gadget** parts.
- Functionality Demo – Live tests showcasing real-time detection, peripheral activation, and remote control.
- Engineering Validation – **Accuracy** , **Response Time** , and **Range** tests with statistical analysis.
- Challenges & Next Steps – Current issues and future improvements.

Project Overview

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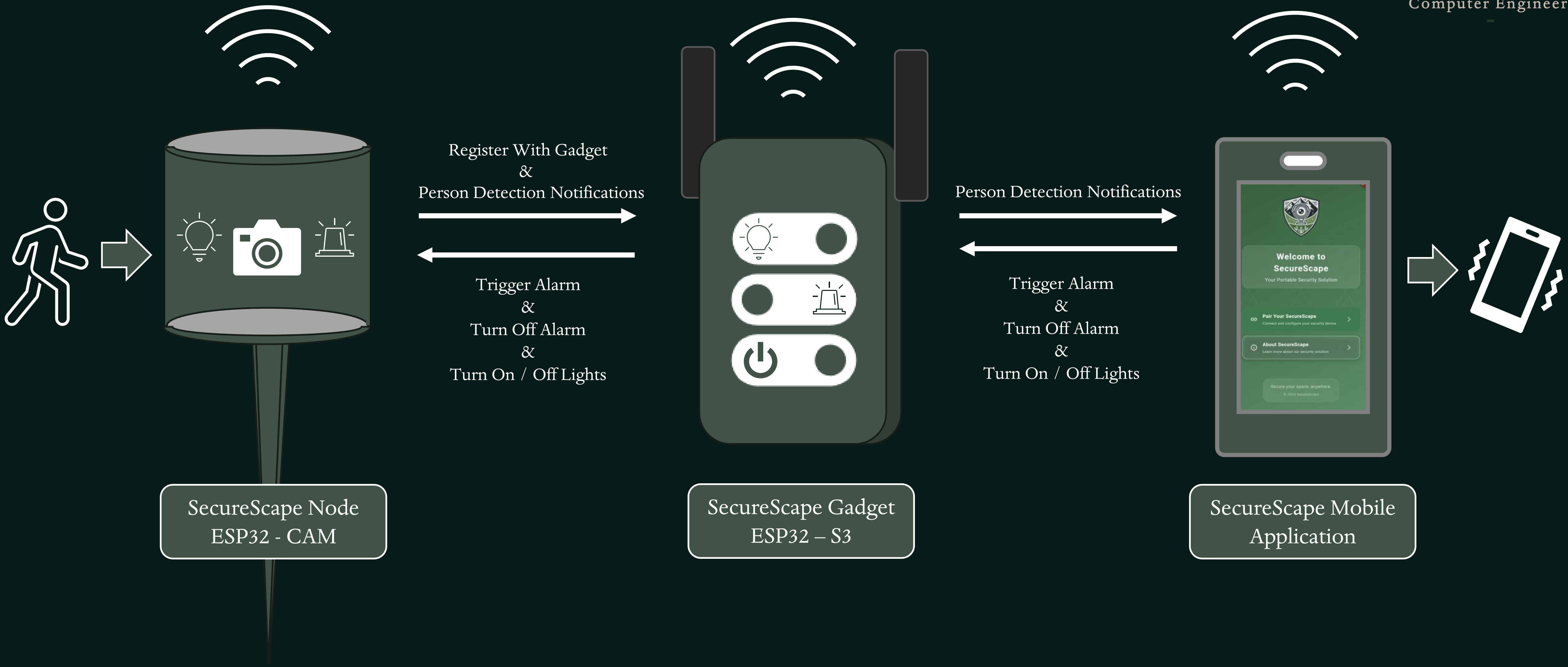

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Electrical Engineering

Overview of Hardware Parts

- Phillip Murano
- Dylan Myers

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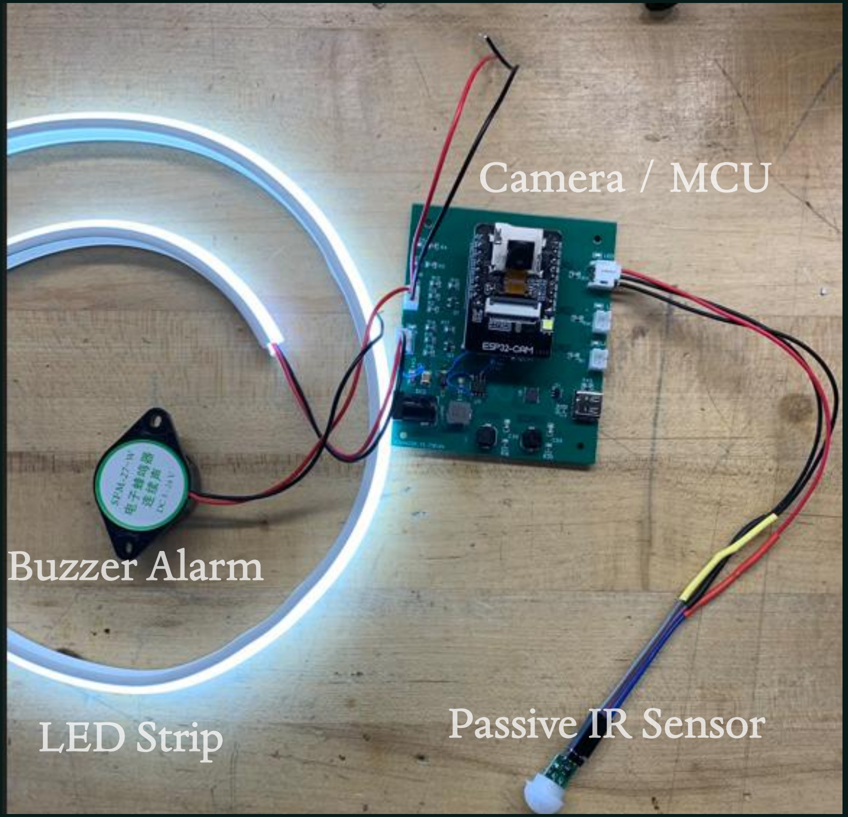
Node Parts Overview

Current State of Node Hardware :

- The node connects directly to 3 peripherals: PIR sensor, LED strip (simulated by a single LED), and the Alarm.
- The LED strip is simulated using a single LED for testing.
- The ESP32-CAM microcontroller manages peripheral interactions, capturing images and triggering alerts.
- We are using a breadboard for prototyping, with direct wiring to components before transitioning to the final PCB.



Gadget Parts Overview

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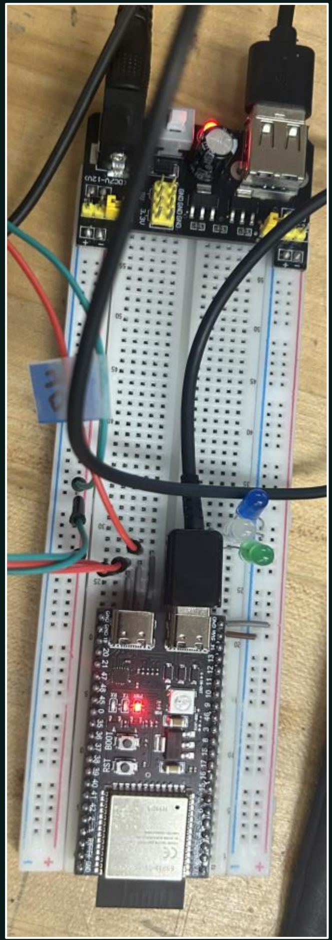
Current State of Gadget Hardware :

- The three toggle switches simulate the control switches that will be integrated into the final device, allowing for alarm activation and lighting control.
- The micro router serves as the central network, enabling HTTP communication between the node, gadget, and mobile app.
- The image on the far right displays the gadget's setup including power connections, serial monitoring, and test LEDs that align with switch operations.

Demo Gadget Switches

Micro router



MCU

PCB Overview

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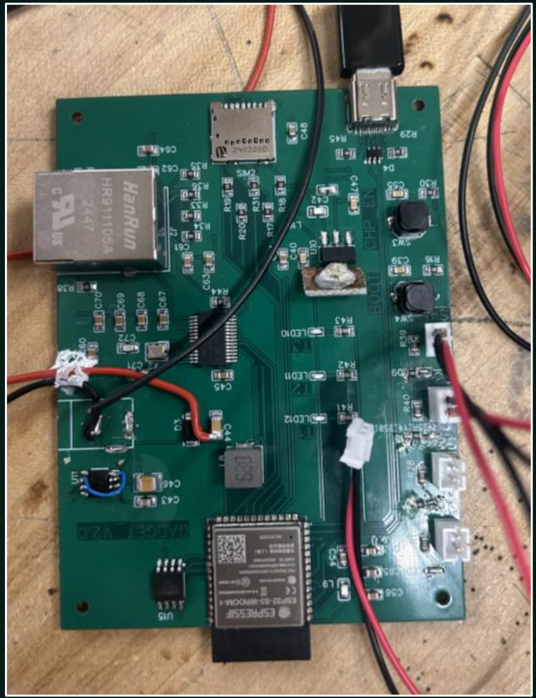
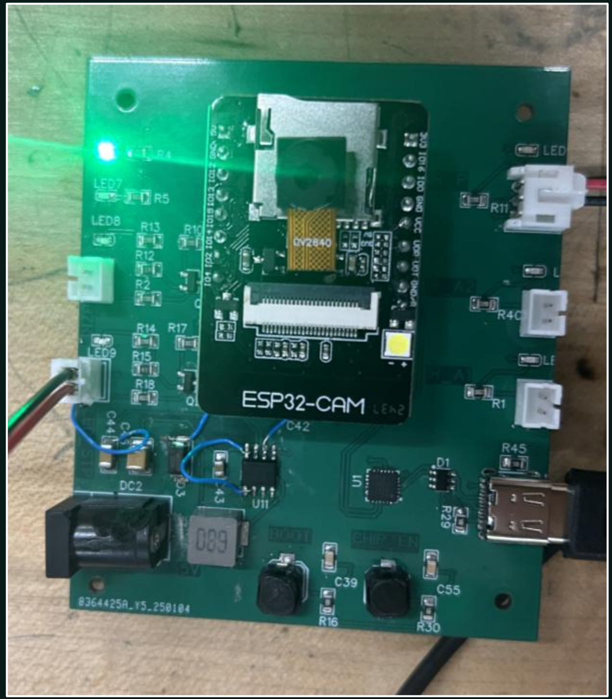
- **Current State** : PCBs are not finalized, so they were not used in the demo. They have functionality but need further refinement.
- **Functionality** : Can push code and trigger specific peripherals.
- **Improvements** : Optimizing power distribution, data reliability, and system integration.
- **Next Steps** : Finalize enhancements, then begin full-scale testing for real-world validation.



Gadget PCB



Node PCB

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Demo of Overall Functionality

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- Colin Kirby
- Phillip Murano
- Dylan Myers

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Overall Functionality Tests

- **Test 1** : ** Person Detection & Response **
  - PIR sensor detects motion → Image is processed to confirm a person → Peripherals (LEDs, Alarm) react accordingly → Notification is sent to the mobile app.
- **Test 2** : ** Mobile App Control **
  - User triggers a peripheral (e.g., alarm, LED) from the phone → Node receives the command and activates the corresponding peripheral.
- **Test 3** : ** Gadget-Controlled Activation **
  - Gadget sends a command to the node → Node responds by triggering the assigned peripheral.

Sound Warning

- On the following 3 slides we are sounding our buzzer (alarm). At certain points the audio becomes really loud, so we recommend turning your volume down.

Person Detection & Response Test

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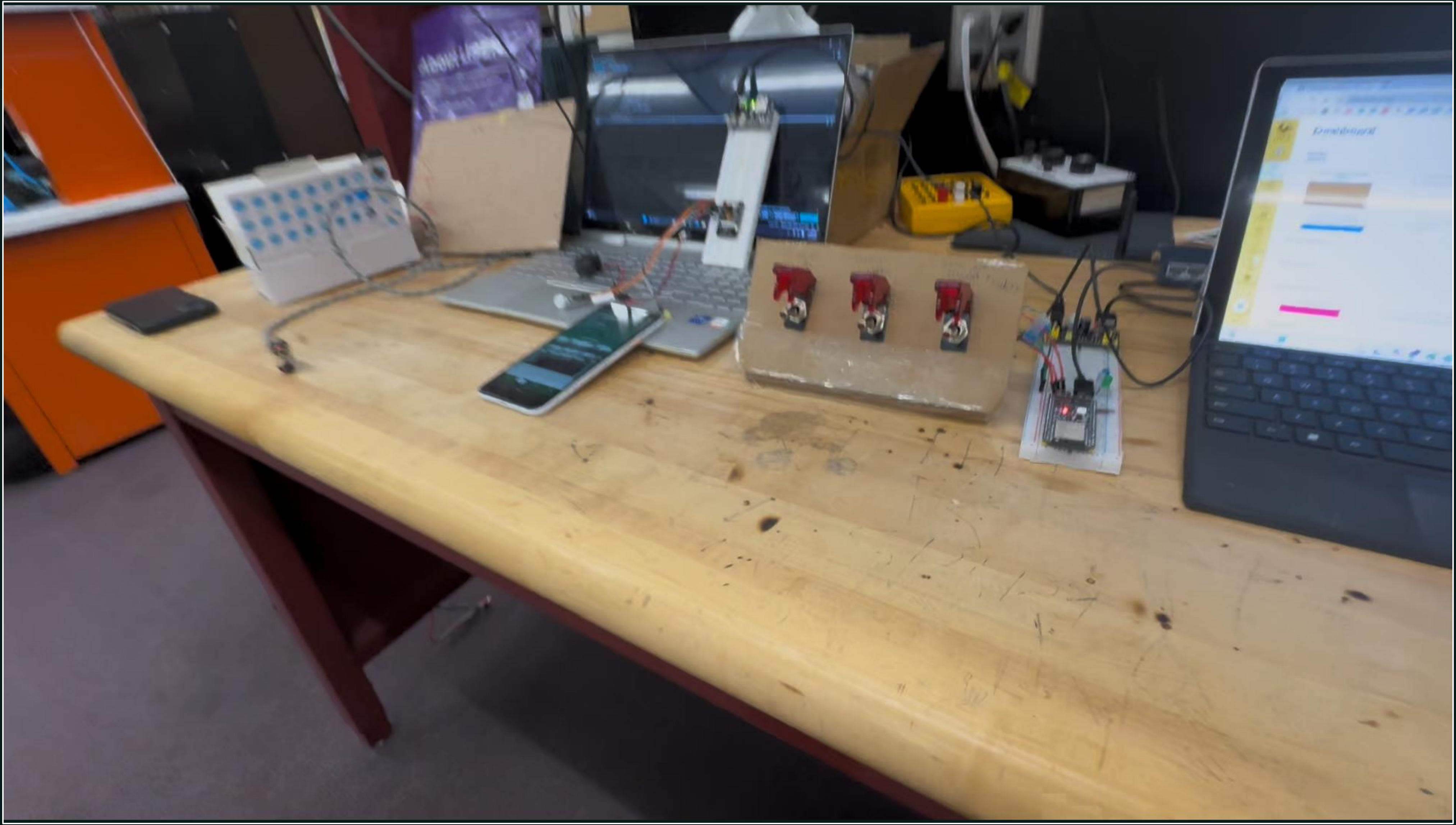

Gadget Controlled Activation Test

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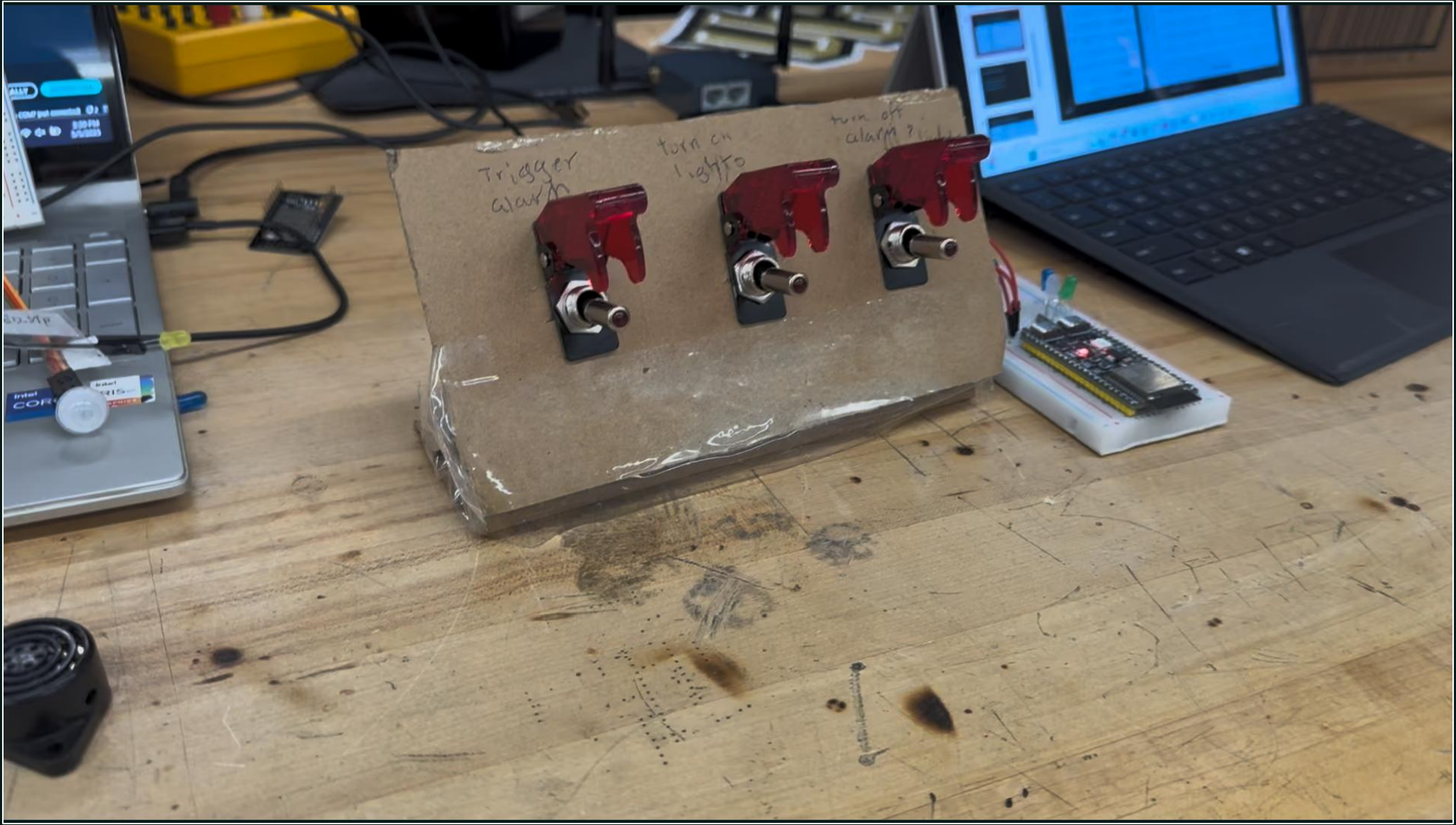

Mobile App Control Test

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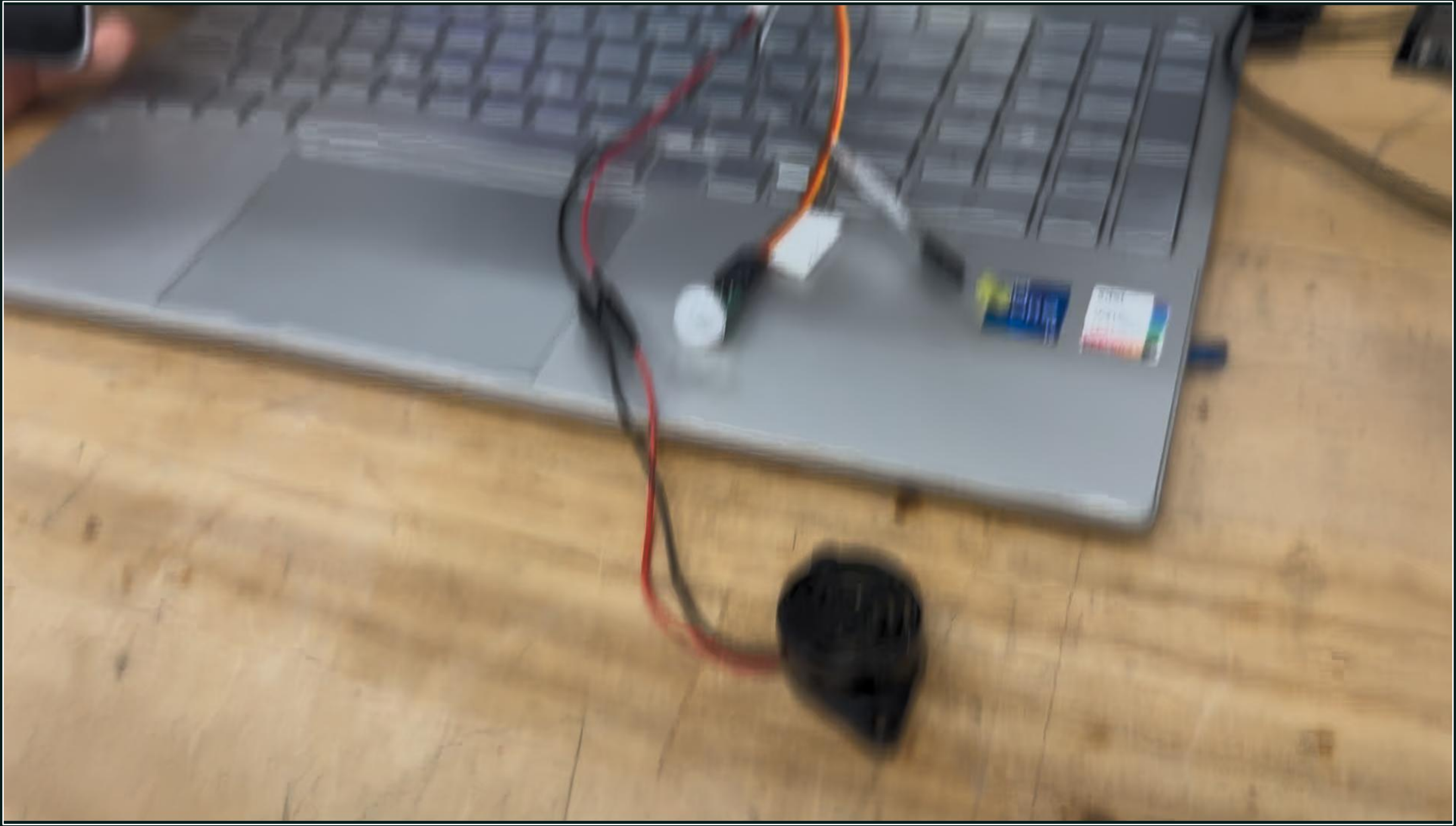

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Engineering Specs Demo

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Specifications

= Demonstratable Specifications

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Metric	Minimum	Maximum	Relevance to project
Detection Accuracy	60%	~90%	Essential for reliable threat identification.
Image Processing Time	500 ms	2 seconds	Topic one Critical for timely classification of threats.
Response Time	5 seconds	10 seconds	Important for timely notifications and threat management.
Deployment Time	5 minutes	N / A	Ensures a focus on quick set up in remote locations.
Detection Range	5 ft	15 – 20 feet	Critical for effective coverage of a secure area.
Mobile App Latency	100 ms	300 ms	Important for smooth UX when controlling the system.

1a. Detection Accuracy Demo

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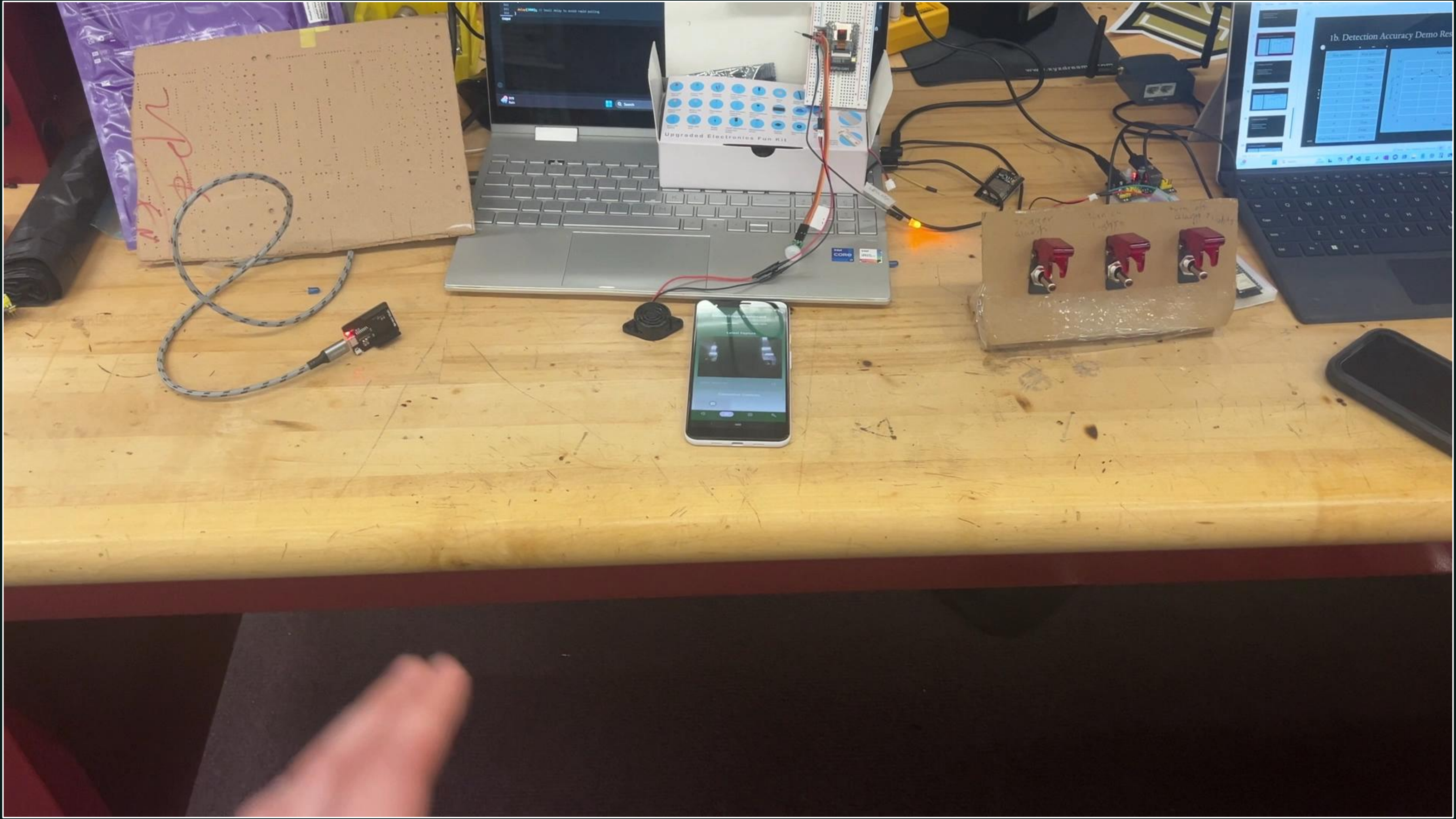

1b. Detection Accuracy Demo Results

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Test #	Detected ?
1	True
2	True
3	True
4	True
5	True
6	False
7	True
8	True
9	True
10	False
Total Detected (%)	80%

Results Explanation :

- We achieved an 80% detection rate across 10 test runs. We observed that detection accuracy decreased as the person moved further from the camera.
- While person detection remained consistent, delays in data transfer affected mobile notifications, contributing to the less-than-100% functionality rate.
- Our results establish a strong baseline, and we have identified key areas for improvement, including refining detection range and optimizing data transmission for more reliable notifications.

2a. Response Time Demo

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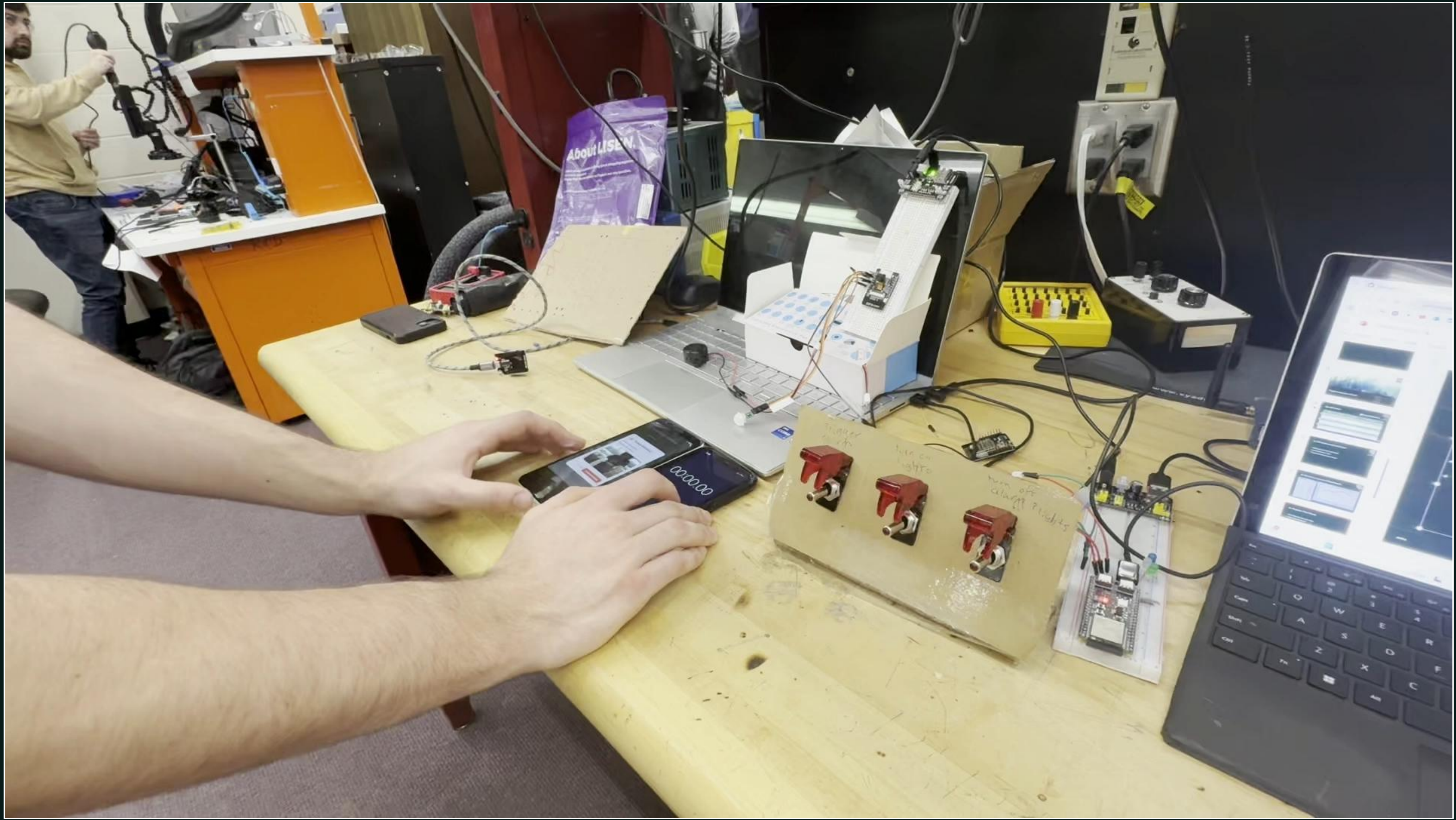

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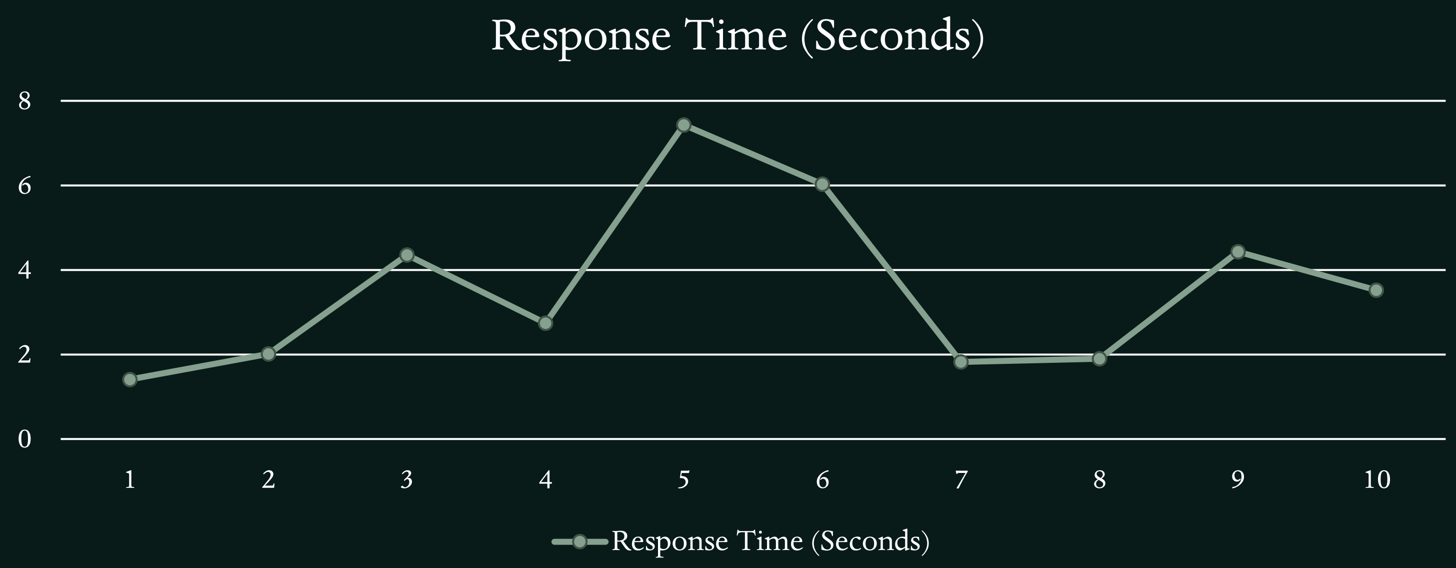
2b. Response Time Demo Results

Test #	Time (seconds)
1	1.41
2	2.01
3	4.35
4	2.74
5	7.43
6	6.03
7	1.82
8	1.90
9	4.43
10	3.52
Mean Response Time	~ 3.56



- Our response times ranged from **1.41s** to **7.43s**, showing some variability. With a mean of **3.56s**, the system operates efficiently in most cases but occasionally experiences delays.
- The primary factor contributing to this variability is network latency in HTTP communication, along with fluctuations in image processing time.
- Understanding these influences gives us a clear direction for optimizing consistency and reducing response time outliers.

3a. Detection Range Demo

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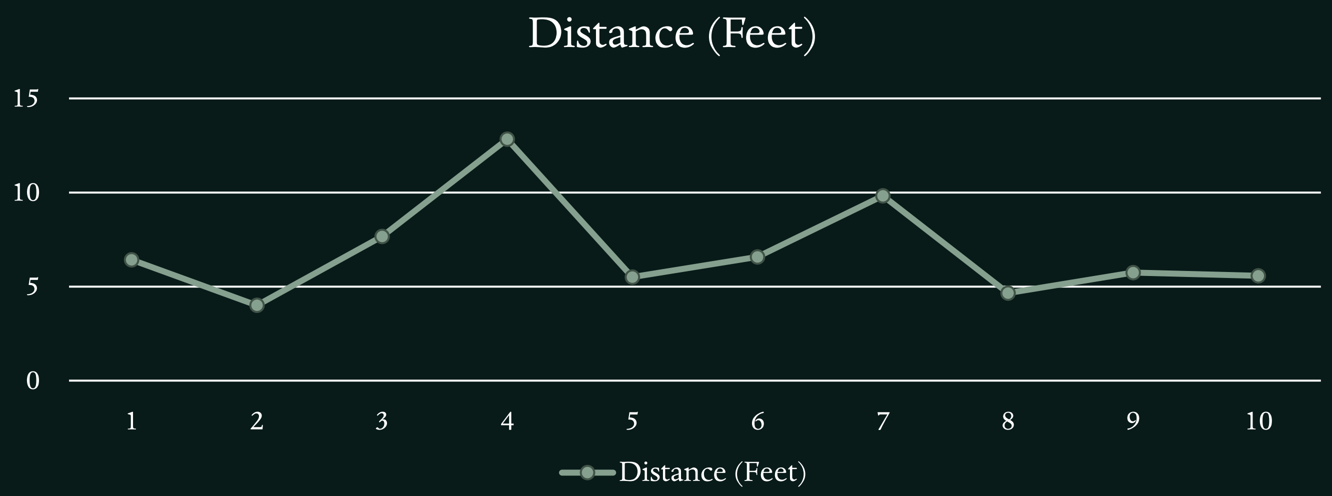
3b. Detection Range Results

Baseline Test	Range (Feet)	Detected ?
1	2 ft	True
2	5 ft	True
3	10 ft	*True
4	15ft	*True

Test #	Range (Feet)
1	6’ 5”
2	4’ 0”
3	7’ 8”
4	12’ 10”
5	5’ 6”
6	6’ 7”
7	9’ 10”
8	4’ 8”
9	5’ 9”
10	5’ 7”
Mean Distance	~ 6’ 11”



- The baseline test confirmed person detection was possible, but 10 ft and 15 ft detections took over 20 seconds, highlighting motion-based detection delays.
- Main tests showed consistent detection around the 5–7 ft range, confirming system functionality at moderate distances.
- Delayed detection was a key issue—motion was detected, but image processing lagged. Optimizing the detection model and HTTP response times can improve performance.

Current Issues & What's Left

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- Response speed and notification accuracy still have room for improvement. While our system is functional, we still aim to enhance performance further.
- We have a strong baseline, already exceeding the minimum engineering specs. The system is consistently detecting motion and sending notifications, but further refinements will improve real-world robustness.
- Additional improvements focus on enhancing mobile app notifications and improving detection accuracy in varied environments, ensuring reliable operation across different conditions.
- The next steps involve implementing the PCBs, conducting thorough testing, and integrating them into the constructed housing before final verification for the demo.

Thank You!

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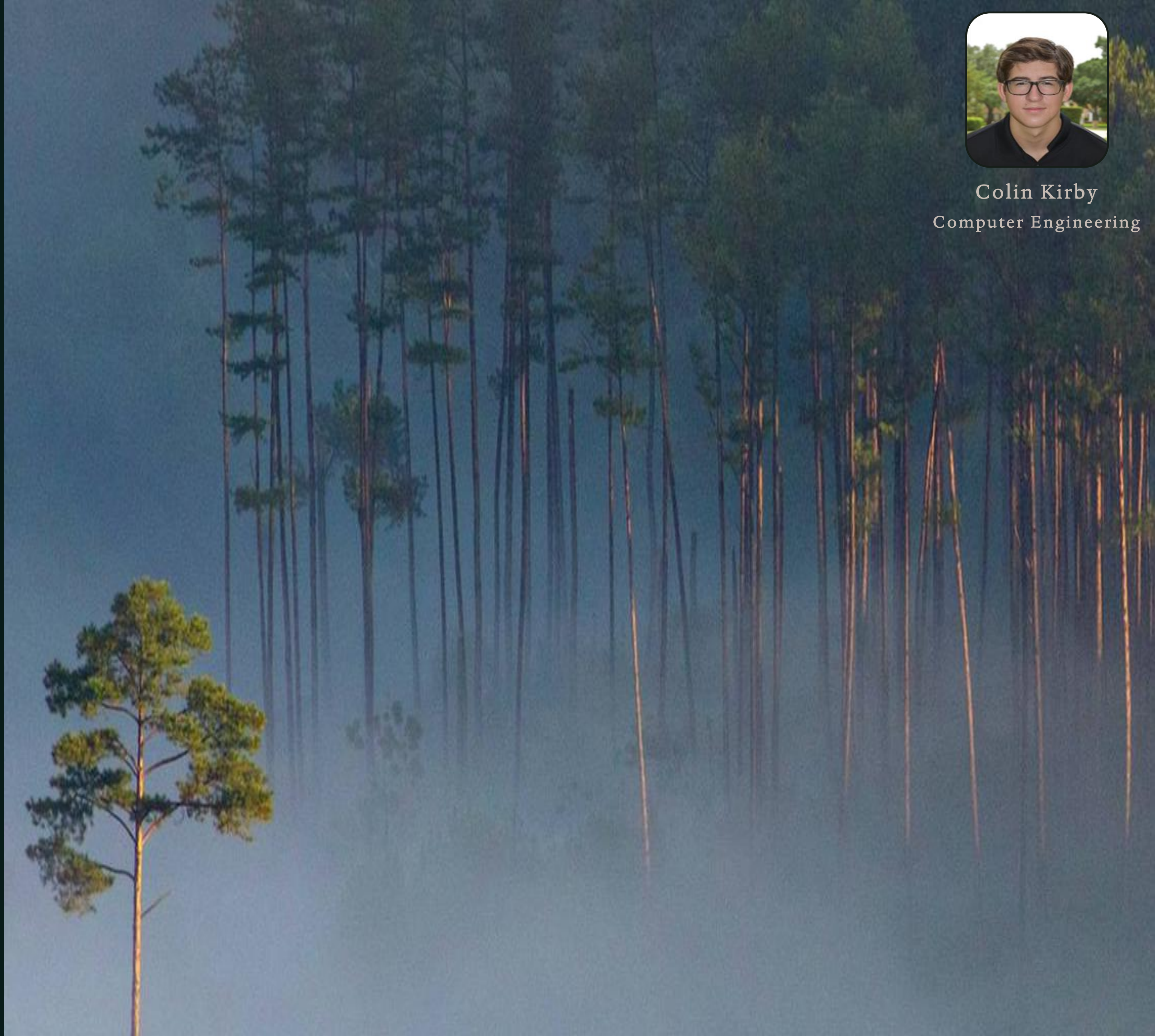
Phillip Murano



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