
Train&Go

TEAM MEMBERS

Garrett Bradshaw

Electrical Engineer

Team / Object Detection Lead

Raleigh, MS

Slade Hicks

Electrical Engineer

Wireless Comm Lead

Laurel, MS

Brandon Waldrup

Electrical Engineer

Power Supply Lead

Laurel, MS

Kyler Smith

Computer Engineer

Motion Tracking Lead

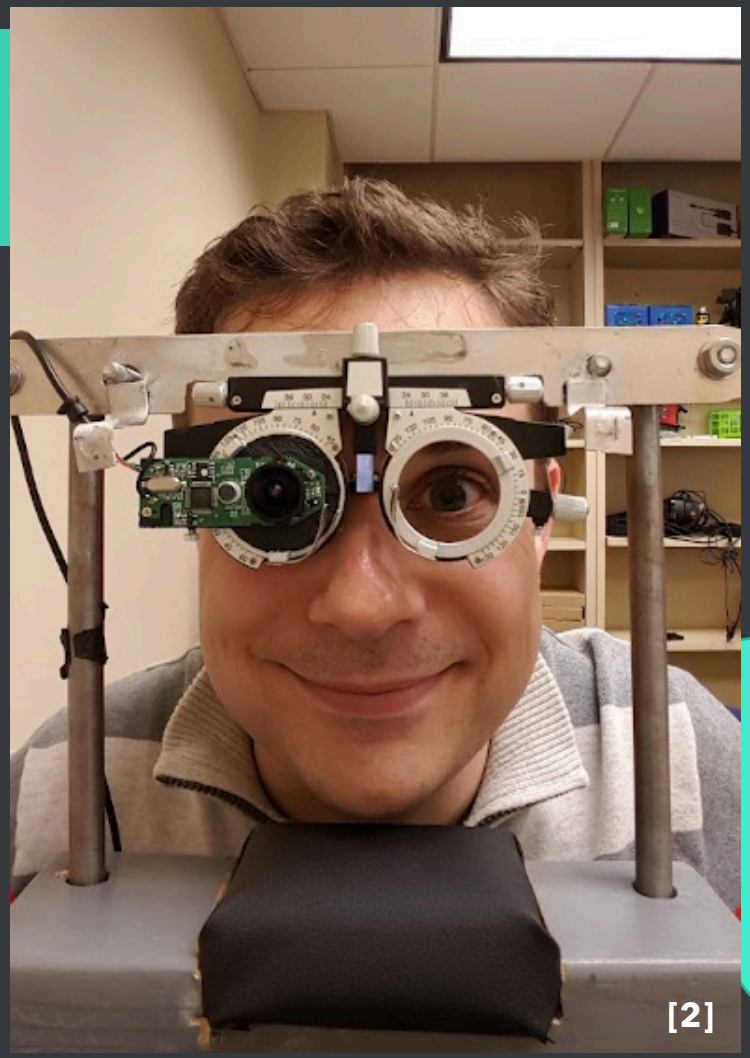
Southside, AL

INTERNAL ADVISOR

Dr. Lalitha Dabbiru

- Assistant Research Professor, Mississippi State University
- Expertise in remote sensing, radar and lidar image processing, and machine learning


[1]

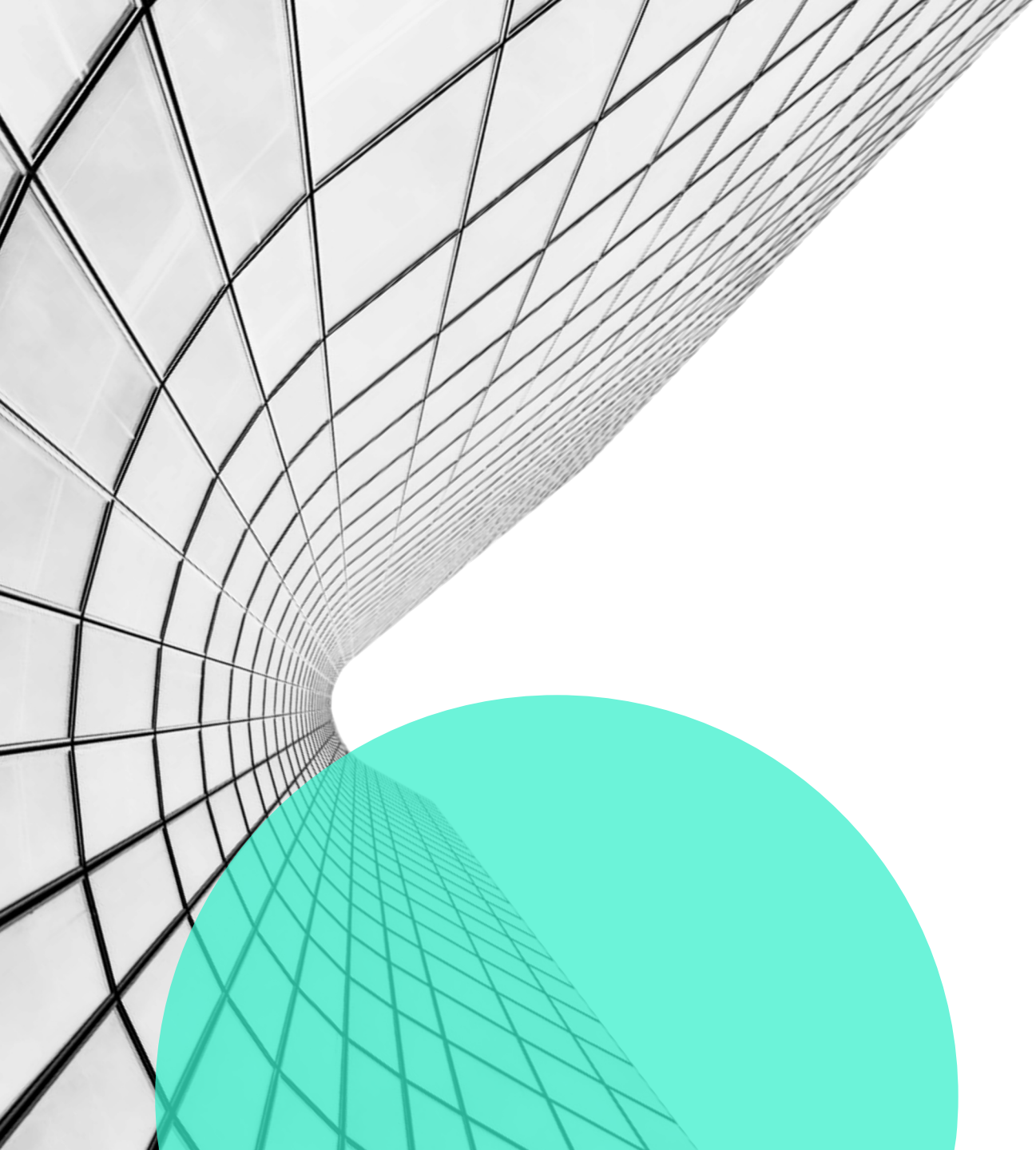


EXTERNAL ADVISOR

Dr. Adam Jones

- Assistant Professor, Mississippi State University
- Expertise in neuroscience, psychophysics, and virtual reality

OUTLINE



OVERVIEW

Problem

- Power wheelchair accidents
- Personal injury
- Property damage
- Emotional distress

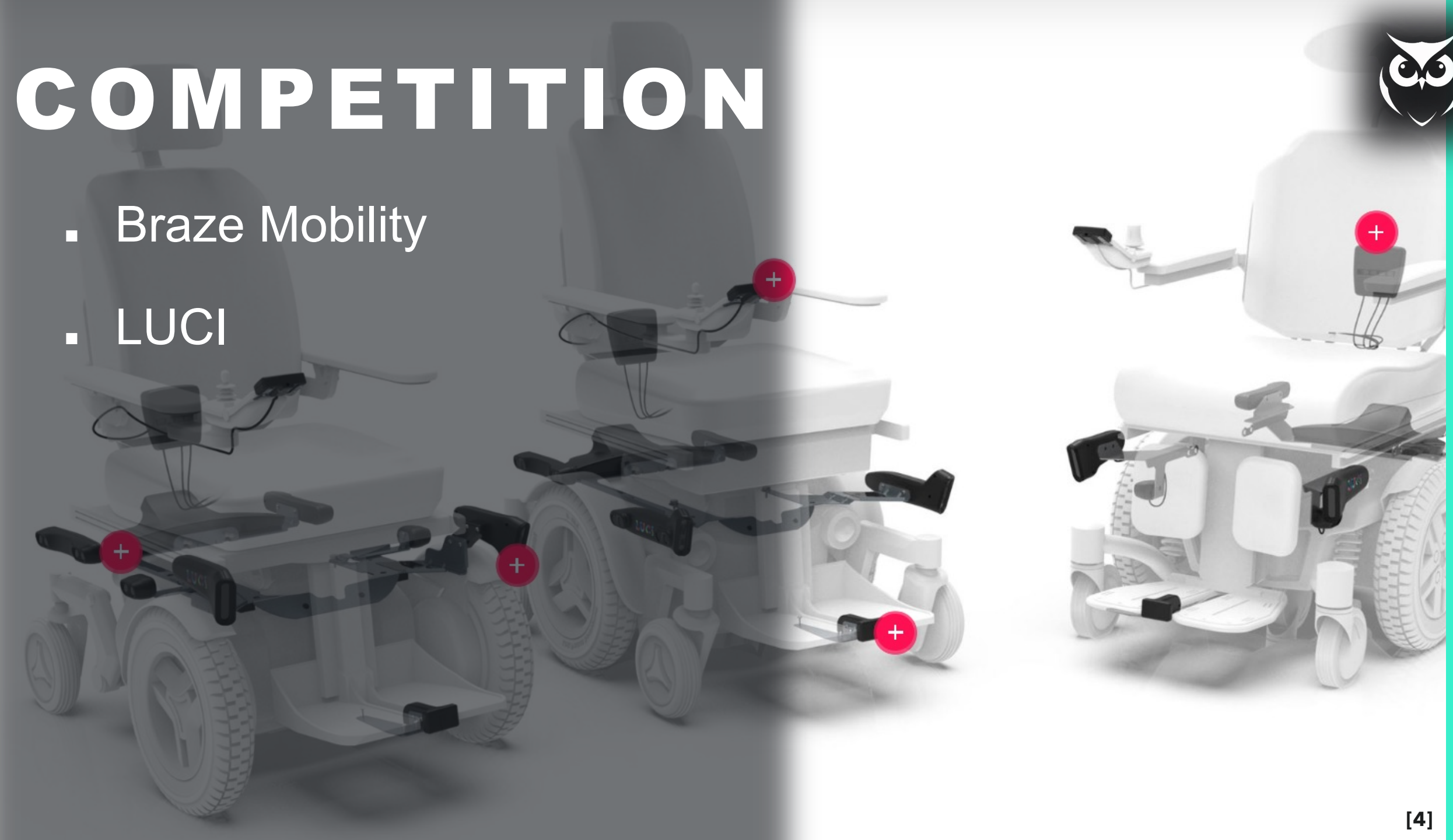
[3]

Solution

- Virtual Reality training
- Spatial awareness
- Confidence

COMPETITION

- Braze Mobility
- LUCI



PRODUCT DESCRIPTION

- VR Software (Headset not included)
- Controller Mount
- Control box and six sensors
- Haptic Feedback Package

CONSTRAINTS

TECHNICAL CONSTRAINTS

Name	Description
Wheelchair Speed	The system is attached to a wheelchair moving no faster than five miles per hour [5].
Detection Distance	The system detects objects within a radius of no more than 2.2 meters.
Feedback Latency	The system's latency for sending feedback to the user in response to an object is no more than 250 milliseconds.
Sensor Accuracy	The system's false detection rate is less than 16 percent.
Wireless Range	The system can connect wirelessly to a Quest VR headset within 2.31 meters.
Wireless Latency	The wireless latency is less than 250 milliseconds.

PRACTICAL CONSTRAINTS

Type	Name	Description
Sustainability	Reliability	Train and Go is designed to operate for at least five years without component failure.
Sustainability	Sensor Maintenance	Sensor connections are placed strategically to allow simple maintenance or replacement.
Usability	Product Versatility	Train and Go offers a flexible packaging system to attach to a variety of wheelchair designs and does not inhibit existing chair functionality.
Safety	**Collision Detection**	Train and Go provides the user with feedback to minimize the risk of collisions with obstacles.
Functionality	VR Communication	Train and Go communicates with a Quest VR headset.

ENGINEERING STANDARDS

Specific Standard	Standard Document	Specification / Application
IP-44	International Electrotechnical Commission Standard 60529	The system is protected from solid particles that are over 1 millimeter in size and from splashes of water [6].
Bluetooth	Institute of Electrical and Electronics Engineers 802-15.1	The system adheres to IEEE Bluetooth standards [7].
Protection Against Electric Shock	International Electrotechnical Commission Standard 62368	The electrical components of the system are isolated from the user to prevent electric shock [8].
Wheelchair Accessory	FDA 21 Code of Federal Regulations § 890.3910	Train and Go satisfies the FDA standards for a wheelchair accessory [9].

Marketing

- Customers: PWDs using a wheelchair
- Purchases recommended through insurance
- Directly sold to Consumers in the US
- Marketing Strategies:
  - Word of mouth
  - Expert recommendation

APPROACH

SOFTWARE

Meta [11]

ARDUINO™ [13]

F 360 [14]

UNREAL ENGINE [12]

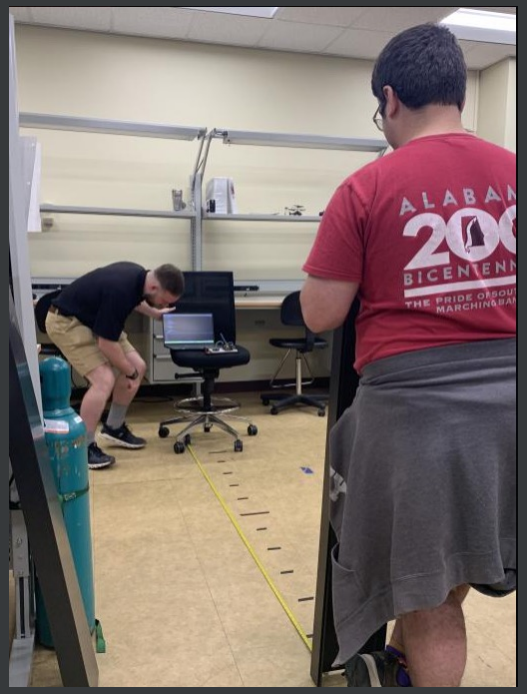
EasyEDA [15]

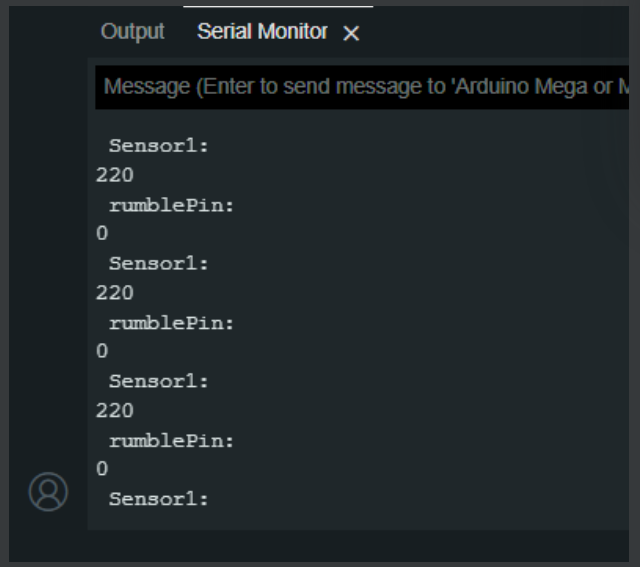
HARDWARE – COST ANALYSIS

Part Type	Part	Quantity	Unit Cost (USD)
Ultrasonic Sensor [17]	HCSR04	6	1.30
Rumble Motor [18]	Tatoko	1	2.00
Detection Microcontroller [20]	Elegoo Mega	1	21.00
Battery [21]	Octelect 103454	1	10.00
Power Protection Board [22]	MH-CD42	1	1.67
USB-C Charging Port [23]	USBC Breakout	1	1.00
Additional Materials		1	3.00
Custom PCB		1	0.40
Total			**46.87**

EVALUATION

ULTRASONIC SENSOR ACCURACY

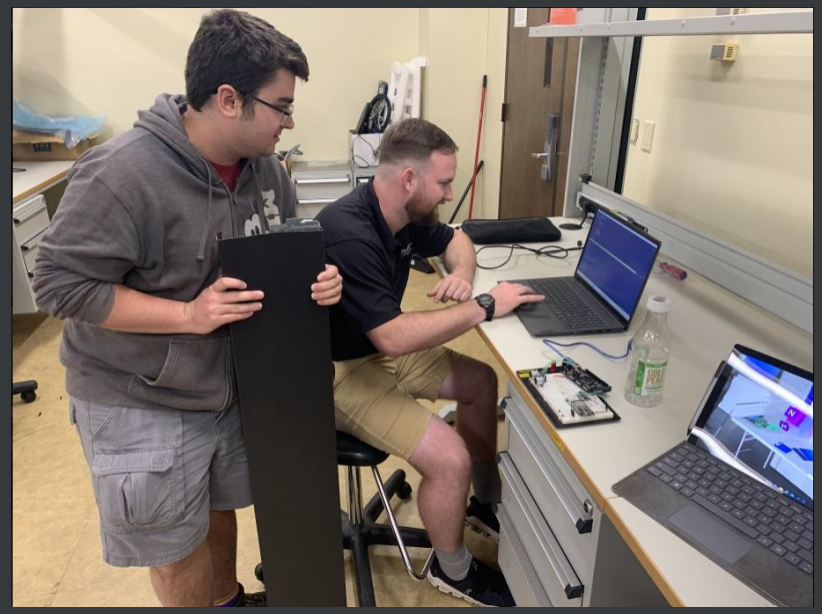




Actual Distance (m)	Sensor 1 (m)	Sensor 2 (m)	Sensor 3 (m)
0.40	0.44	0.45	0.44
0.60	0.65	0.63	0.65
0.80	0.86	0.82	0.84
1.00	1.04	1.03	1.03
1.20	1.20	1.21	1.20
1.40	1.41	1.41	1.40
1.60	1.61	1.61	1.60
1.80	1.83	1.82	1.80
2.00	2.03	2.03	2.00
2.20	2.25	2.23	2.21

SENSOR LATENCY

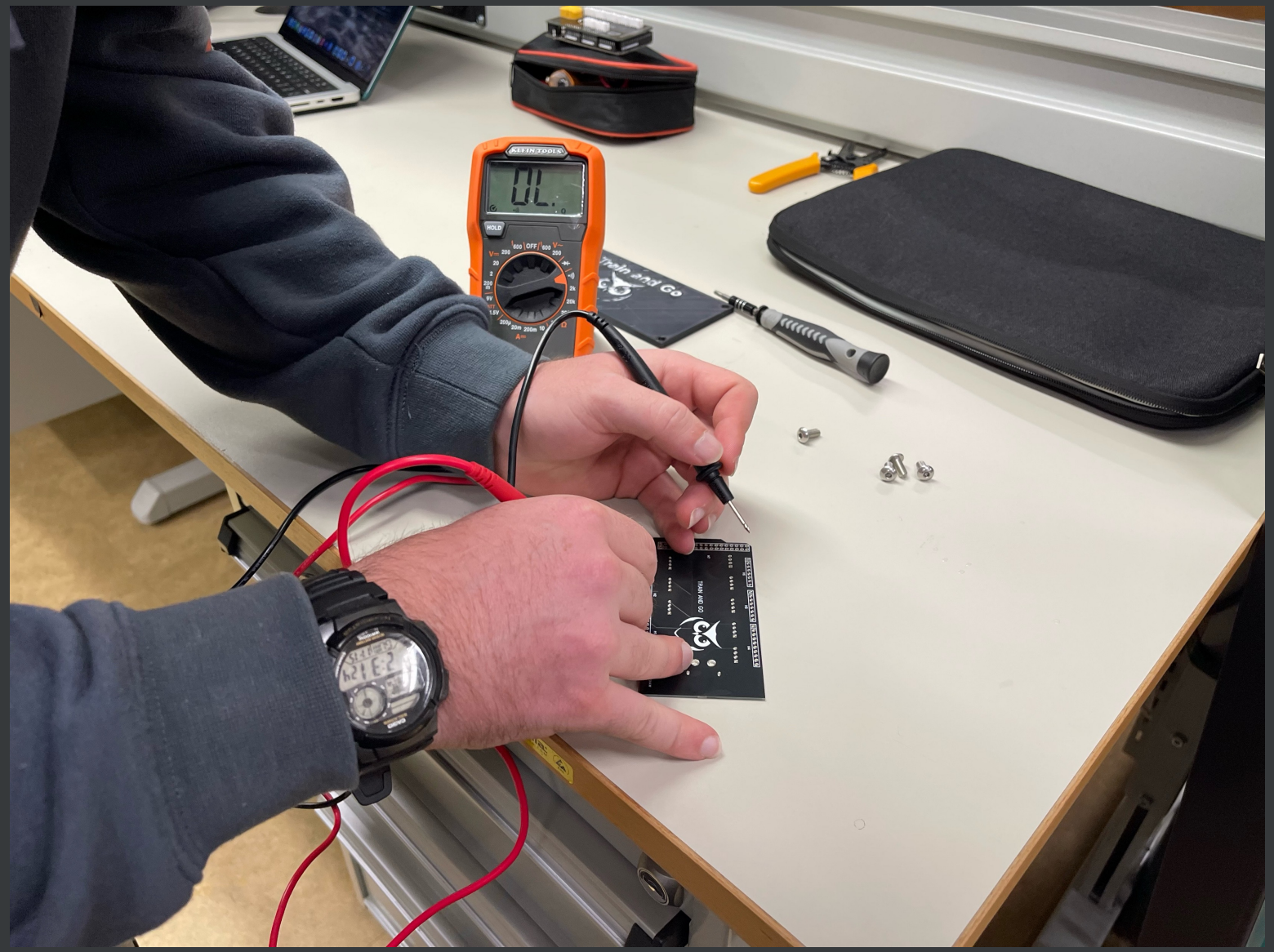
```
14:06:46.719 ->  Sensor1:
14:06:46.760 -> 29
14:06:46.760 ->  rumblePin:
14:06:46.760 -> 1
14:06:47.744 ->  Sensor1:
14:06:47.744 -> 19
14:06:47.744 ->  rumblePin:
14:06:47.744 -> 1
14:06:48.743 ->  Sensor1:
14:06:48.743 -> 19
14:06:48.743 ->  rumblePin:
14:06:48.783 -> 1
14:06:49.741 ->  Sensor1:
14:06:49.741 -> 19
14:06:49.741 ->  rumblePin:
14:06:49.782 -> 1
14:06:50.761 ->  Sensor1:
14:06:50.761 -> 19
14:06:50.761 ->  rumblePin:
14:06:50.761 -> 1
14:06:51.842 ->  Sensor1:
14:06:51.842 -> 1207
14:06:51.842 ->  rumblePin:
14:06:51.882 -> 0
14:06:52.860 ->  Sensor1:
14:06:52.860 -> 1207
14:06:52.860 ->  rumblePin:
14:06:52.903 -> 0
14:06:53.894 ->  Sensor1:
14:06:53.894 -> 1207
14:06:53.894 ->  rumblePin:
14:06:53.942 -> 0
14:06:54.886 ->  Sensor1:
14:06:54.918 -> 1207
14:06:54.918 ->  rumblePin:
14:06:54.918 -> 0
14:06:55.938 ->  Sensor1:
14:06:55.938 -> 1207
14:06:55.938 ->  rumblePin:
```



Test Number	Latency (ms)
1	72
2	73
3	72
4	72
5	72
6	73
7	72
8	73
9	72
10	72

IP44 WATER RESISTANCE TEST

PCB CONTINUITY TEST

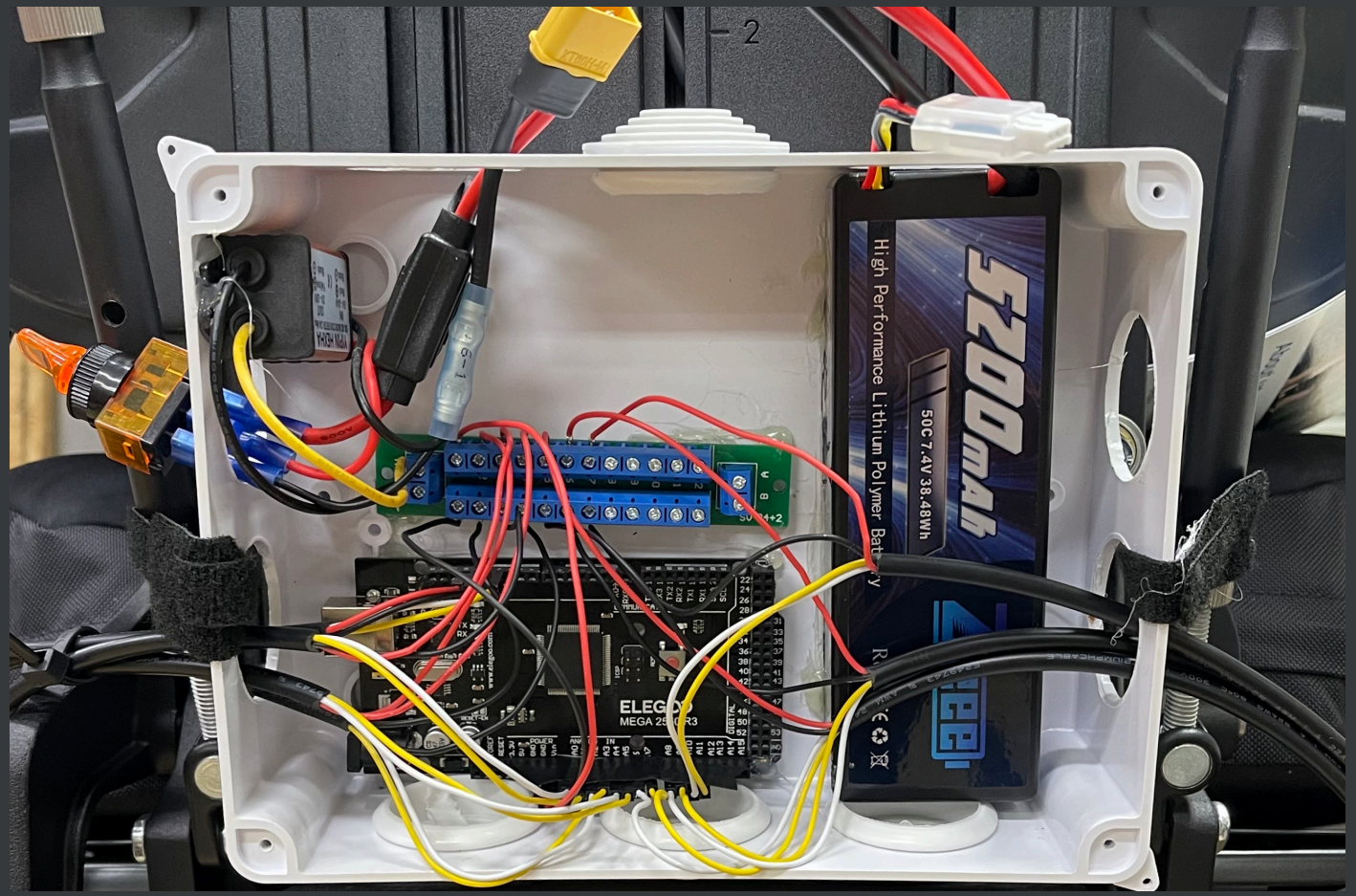


PROGRESS

VR ENVIRONMENT BEFORE


VR ENVIRONMENT
AFTER

PACKAGING BEFORE



PACKAGING AFTER - MOUNTS

PACKAGING AFTER - PCB

QUESTIONS?

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