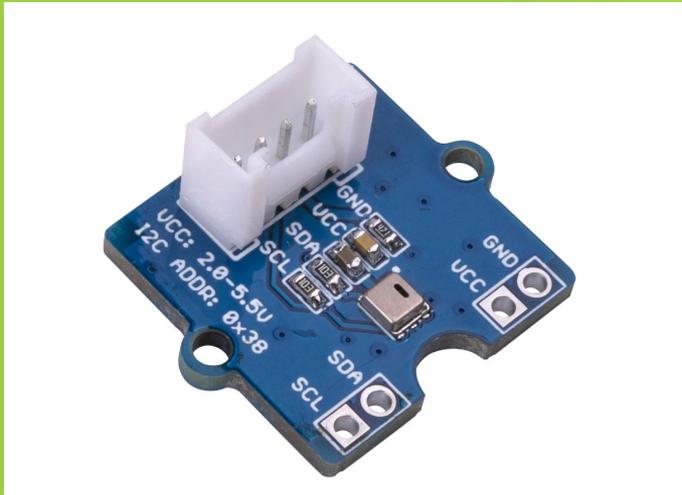


# JAMZ CLIMATE SENSOR

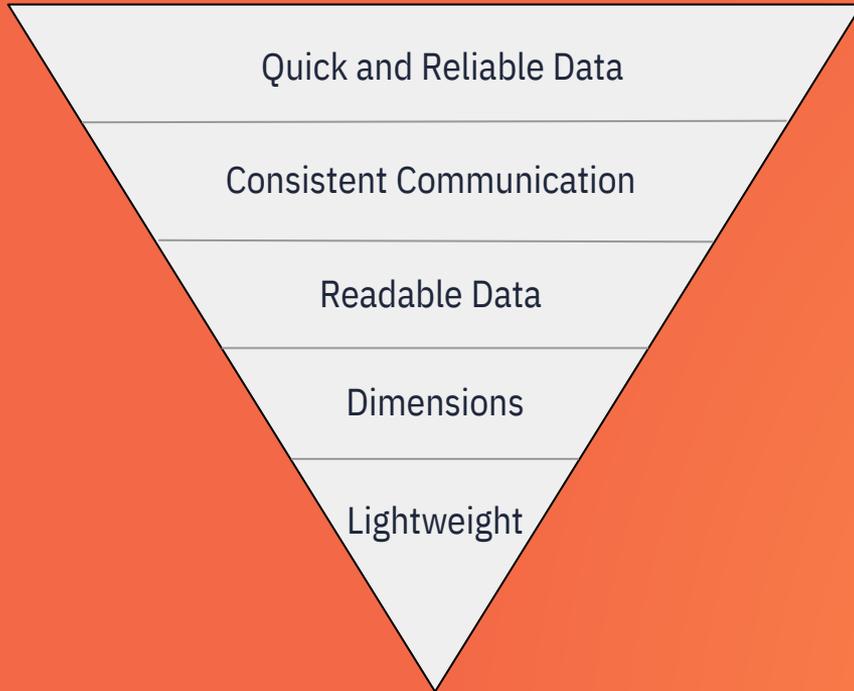
DESIGN ALGORITHM



# CLIMATE SENSOR



# CLIENT NEEDS



# CLIENT NEEDS



Priority	Customer Statement	Interpreted Need
1	“If I see consistent data I’m going to be very happy”	Consistency of data collection
2	“That information between the drone and the operator needs to be conveyed at all times. Constant communication. So whatever information you can take from the drone and give it to the operator and vice versa is very essential”	Constant communication/data exchange between all parties
3	Visual feedback/info that operator can easily interpret.	Readable and understandable data
4	“As long as it is compact...So remember, drone weight is everything so make sure you are thinking about compactness”	Dimension and compactibility
5	“With drones, weight is everything”	Light weight

# PROBLEM STATEMENT

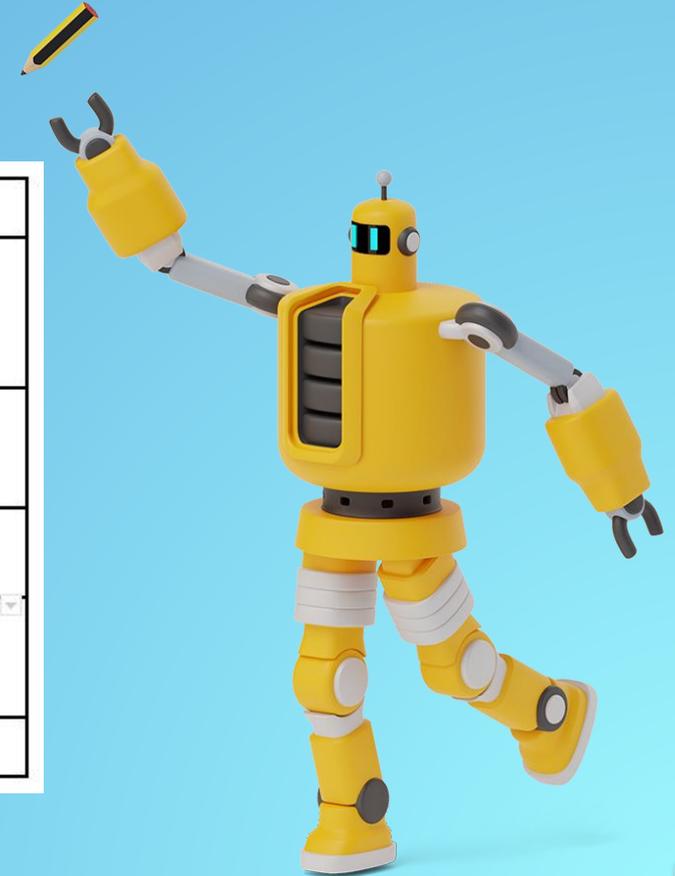
JAMZ needs a climate sensor add-on system for a food delivery drone that provides consistent data for temperature and humidity values.

Constant communication to the flight operator is also necessary so JAMZ can figure out when the temperature and humidity values go out of the optimal range.



# DESIGN CRITERIA

Interpreted needs	Design Criteria
Consistency of data collection	Sensor needs to accurately read temperature. Reliability. Temperature reading needs to be consistently collected
Constant communication/data exchange between all parties	Temperature readings are constantly being sent to drone operator (and any other sources)
Data is readable and understandable	Data from sensor is easily interpretable to the operator
Dimension and compactibility	Size (small) Depth and length correspond to aerodynamics
Light weight	Weight (minimal)



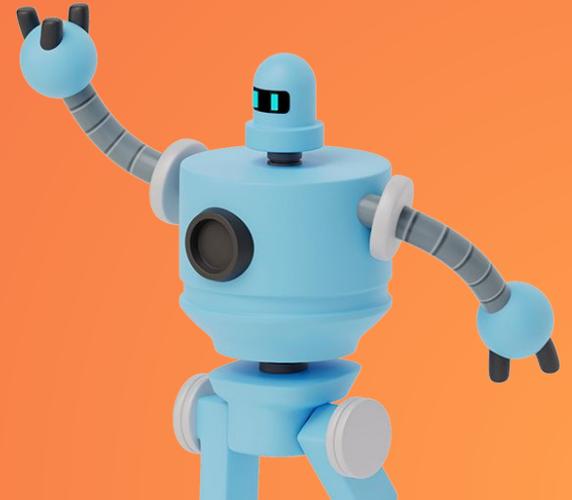
# BENCHMARKING

## Temperature Sensors:

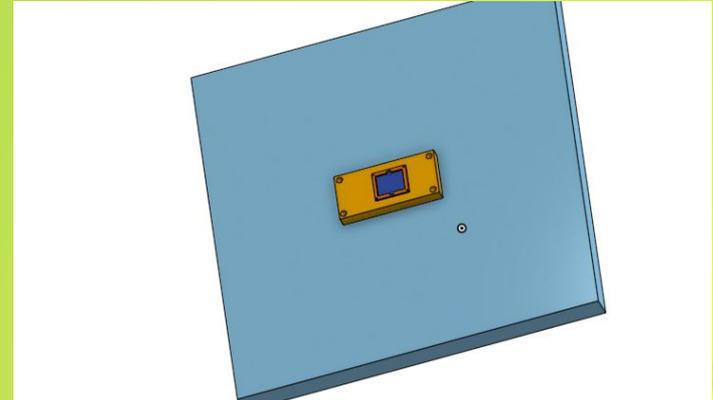
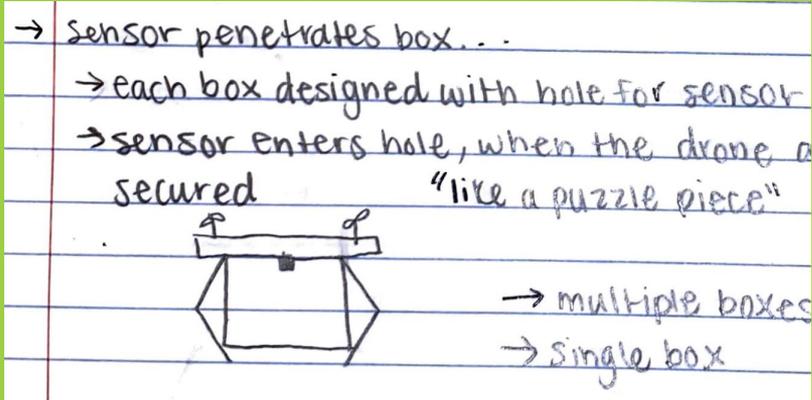
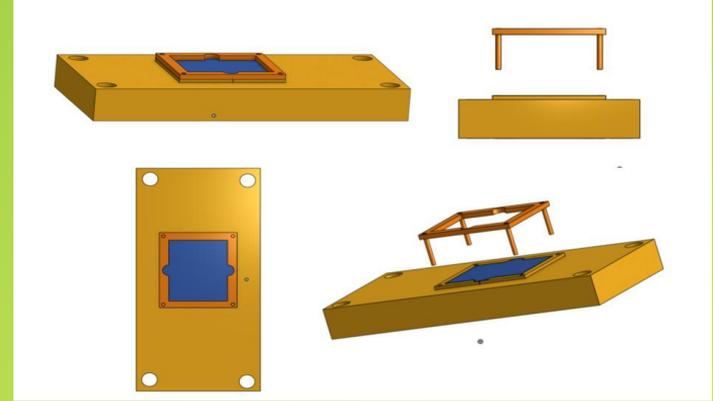
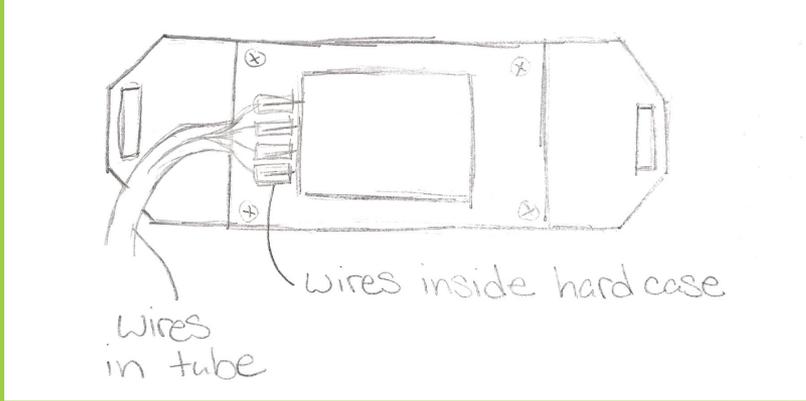
	DHT11	DHT22	AM2302	BME280	Grove AHT20
Price (CAD)	\$5.2	\$8.6	\$15.3	\$5.15	\$5.73
Temperature Range	0-50°C	-40-80°C	-40-125°C	-40-85°C	-40-85°C
Temperature Accuracy	± 1°C	± 0.5°C	± 0.2°C	± 1°C	± 0.3°C
Data Transfer	Serial Data				
Response Time	6-15s	2s	2s	1s	0.5s (with ease)

## Microcontrollers:

	Arduino Uno	Arduino Leonardo	Arduino Due	Teensy 4.0	Raspberry Pi 4
Price (CAD)	\$29	\$25.5	\$51	\$25	\$44.6
Programming Language	C/C++	C++	C/C++	C++	Python
Size (cm)	6.86 x 5.34	6.86 x 5.33	10.2 x 5.33	3.56 x 1.78	8.56 x 5.65
Weight (g)	25	20	36	2.8	46
Input Voltage Limits	6-20v	6-20v	6-16v	3.3v	6v



# CONCEPTUAL DESIGN



## ◆ Team formation and contract

## ◆ Needs Identification

## ◆ Design Criteria

- ◆ Benchmarking (aesthetics/practicality) • Michaela J.
- ◆ Benchmarking (functionality) • Julio M.
- ◆ Defining Design Criteria • Olivia C.
- ◆ Defining Metrics • Ogechi A.
- ◆ Wrike Planning and Delegating • Zach L.

## ◆ Reading Week

## ◆ Conceptual Design

- ◆ Making a list of potential durability and material concepts • Olivia C.
- ◆ Making a list of potential coding concepts • Julio M.
- ◆ Making a list of potential concepts for data communication • Zach L.
- ◆ Making a list of potential concepts for the attachment of the sensor to the drone • Ogechi A.
- ◆ Making a list of potential concepts for the fitting of the sensor in the box • Michaela J.

## ◆ Project Schedule and Cost

- Preparing a backup plan to prevent things from going wrong • Julio M.
- Preparing a cost estimate for less expensive materials • Ogechi A.
- Preparing a cost estimates for more expensive materials • Olivia C.
- Preparing a list of all the risks or things that could go wrong • Michaela J.
- Preparing the main plan for the upcoming deliverables • Zach L.

## ◆ Prototype I and Customer Feedback

- ◆ Building physical prototype #1 • Zach L.
- ◆ Prepare analysis of critical components • Olivia C.
- ◆ Designing the case covering prototype on AutoCad • Michaela J.
- ◆ Designing the sensor attachment prototype on AutoCad • Ogechi A.
- ◆ Write code and organize material gathering/purchasing • Julio M.

## ◆ Prototype II and Customer Feedback

- ◆ Add adjustments to the AutoCad design • Ogechi A.
- ◆ Build physical prototype #2 • Zach L.
- ◆ Prepare a revised analysis of critical components • Olivia C.

Months ▾

# PROJECT PLAN (WRIKE)

◆ Test the code and organize material gathering/purchasing (if still needed) • Julio M.

◆ Prepare analysis of results • Michaela J.

## ◆ Prototype III and Customer Feedback

- ◆ Add new adjustments to the AutoCad design • Ogechi A.
- ◆ Build physical prototype #3 • Zach L.
- ◆ Add to the revised analysis of the critical components • Olivia C.
- ◆ Add new features or adjustments to the code and test it • Julio M.
- ◆ Prepare revised analysis of results • Michaela J.

## ◆ Final Project Presentations

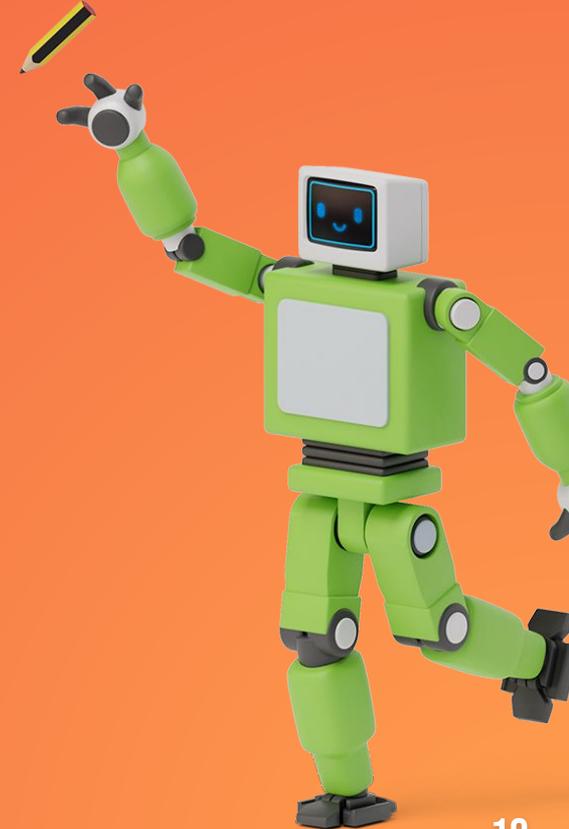
## ◆ Design Day

- Prepare the "So what?" portion of the presentation • Zach L.
- Prepare the "Who cares?" portion of the presentation • Michaela J.
- Prepare the "Why now?" portion of the presentation • Olivia C.
- Prepare the "Why you?" portion of the presentation • Ogechi A.
- Prepare the demonstration of our product with explanations • Julio M.

## ◆ Archive/ User Manual

# COSTS

Material	Estimated cost (for JAMZ)	Actual cost (for prototype)
Sensor and Arduino case printing	\$5	\$0
Temperature and Humidity Sensor (Grove - AHT20)	\$6.24	\$5.73
Arduino Uno	\$29	\$0
Wires	\$10	\$0
Screws/nuts and bolts	\$4	\$4
Styrofoam box	--	\$9
Wire Wrapping <input type="checkbox"/>	\$5	\$5 (estimated)
Power converter	\$20	\$0
Female connector	\$2	\$0



# PROTOTYPE I: CODE



COM3

5cf

Time Stamp	Temperature	Humidity	Warning
	36.84°C	25.28%	
	36.85°C	25.28%	
	37.07°C	25.30%	
	37.42°C	25.31%	
	37.72°C	25.30%	
	37.80°C	25.31%	
	37.70°C	25.29%	
	37.59°C	25.30%	
	37.55°C	25.30%	
	37.44°C	25.30%	
	37.49°C	25.30%	
	37.70°C	25.30%	
	37.98°C	25.30%	
	38.24°C	25.30%	
	38.38°C	25.30%	
	38.57°C	25.29%	
	38.86°C	25.31%	
	39.09°C	25.32%	
	39.23°C	25.31%	
	39.41°C	25.32%	
	39.63°C	25.32%	
	39.69°C	25.32%	
	39.69°C	25.31%	
	39.64°C	25.31%	
	39.82°C	25.32%	
	39.94°C	25.32%	
	40.13°C	25.31%	
	40.20°C	25.30%	

Time Stamp	Temperature	Humidity	Warning
	25.13°C	37.22%	WARNING, HUMIDITY IS TOO LOW
	25.15°C	37.15%	WARNING, HUMIDITY IS TOO LOW
	25.15°C	37.12%	WARNING, HUMIDITY IS TOO LOW
	25.16°C	37.04%	WARNING, HUMIDITY IS TOO LOW
	25.14°C	36.99%	WARNING, HUMIDITY IS TOO LOW
	25.15°C	37.25%	WARNING, HUMIDITY IS TOO LOW
	25.16°C	37.53%	WARNING, HUMIDITY IS TOO LOW
	25.16°C	37.71%	WARNING, HUMIDITY IS TOO LOW
	25.16°C	37.93%	WARNING, HUMIDITY IS TOO LOW
	25.17°C	38.43%	WARNING, HUMIDITY IS TOO LOW
	25.16°C	38.97%	WARNING, HUMIDITY IS TOO LOW
	25.16°C	39.18%	WARNING, HUMIDITY IS TOO LOW
	25.17°C	39.58%	WARNING, HUMIDITY IS TOO LOW
	25.16°C	40.08%	WARNING, HUMIDITY IS TOO LOW
	25.16°C	40.33%	WARNING, HUMIDITY IS TOO LOW
	25.16°C	40.30%	WARNING, HUMIDITY IS TOO LOW
	25.16°C	40.17%	WARNING, HUMIDITY IS TOO LOW
	25.16°C	39.95%	WARNING, HUMIDITY IS TOO LOW
	25.16°C	39.68%	WARNING, HUMIDITY IS TOO LOW
	25.17°C	39.45%	WARNING, HUMIDITY IS TOO LOW
	25.16°C	39.23%	WARNING, HUMIDITY IS TOO LOW
	25.16°C	39.03%	WARNING, HUMIDITY IS TOO LOW
	25.16°C	38.76%	WARNING, HUMIDITY IS TOO LOW
	25.16°C	38.52%	WARNING, HUMIDITY IS TOO LOW
	25.15°C	38.30%	WARNING, HUMIDITY IS TOO LOW
	25.16°C	38.13%	WARNING, HUMIDITY IS TOO LOW
	25.17°C	37.98%	WARNING, HUMIDITY IS TOO LOW
	25.15°C	37.82%	WARNING, HUMIDITY IS TOO LOW
	25.16°C	37.73%	WARNING, HUMIDITY IS TOO LOW
	25.16°C	37.60%	WARNING, HUMIDITY IS TOO LOW
	25.16°C	37.50%	WARNING, HUMIDITY IS TOO LOW
	25.15°C	37.41%	WARNING, HUMIDITY IS TOO LOW
	25.16°C	37.34%	WARNING, HUMIDITY IS TOO LOW
	25.16°C	37.28%	WARNING, HUMIDITY IS TOO LOW
	25.16°C	37.28%	WARNING, HUMIDITY IS TOO LOW
	25.17°C	37.56%	WARNING, HUMIDITY IS TOO LOW
	25.15°C	37.66%	WARNING, HUMIDITY IS TOO LOW
	25.16°C	37.54%	WARNING, HUMIDITY IS TOO LOW
	25.15°C	37.49%	WARNING, HUMIDITY IS TOO LOW
	25.16°C	37.37%	WARNING, HUMIDITY IS TOO LOW
	25.14°C	37.31%	WARNING, HUMIDITY IS TOO LOW
	25.15°C	37.16%	WARNING, HUMIDITY IS TOO LOW
	25.17°C	37.09%	WARNING, HUMIDITY IS TOO LOW

# PROTOTYPE II: CODE



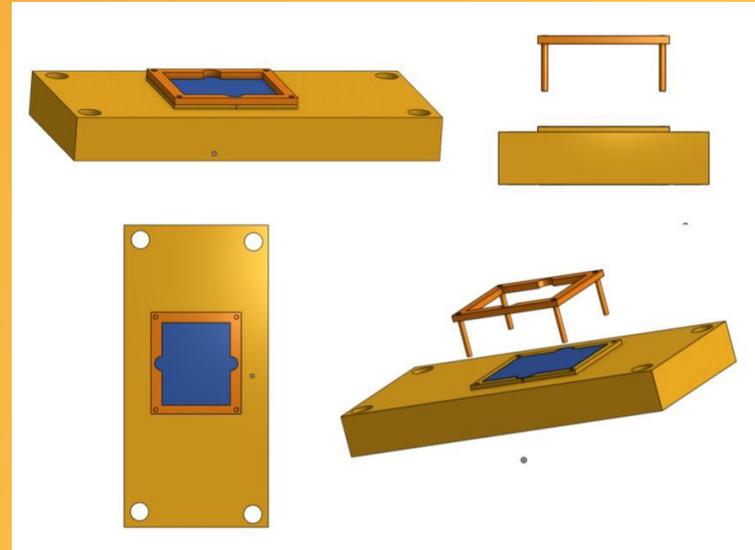
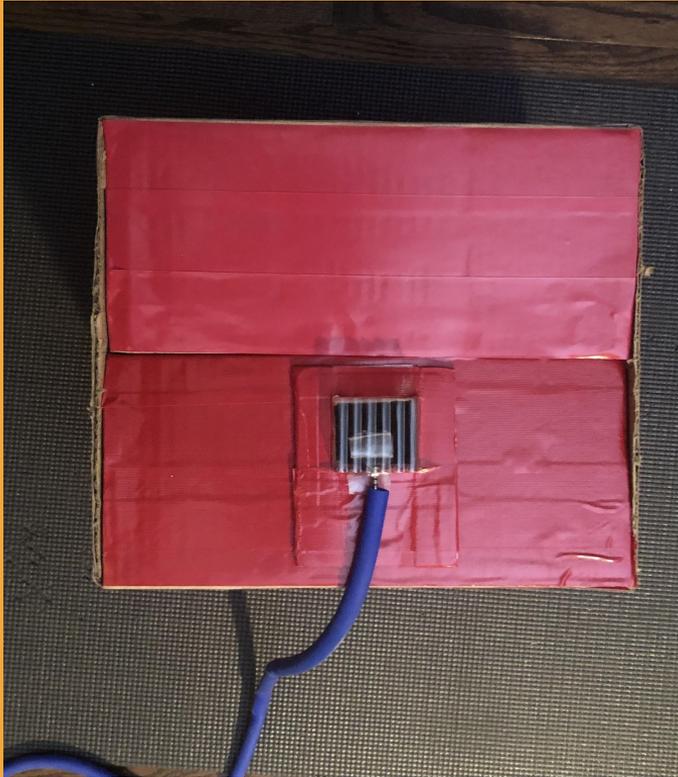
# PROTOTYPE III: CODE



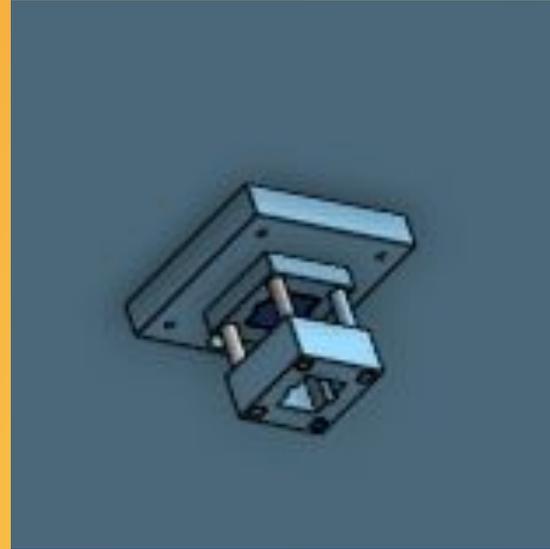
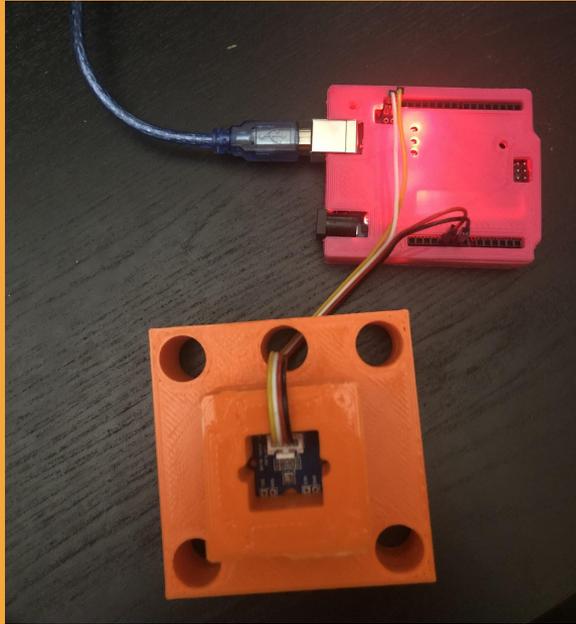
COM3

```
-----  
|Time Stamp      |Temperature    |Humidity       |Warning  
0:0:0.50s       |25.09°C       |36.37%        |WARNING, HUMIDITY IS TOO LOW  
0:0:1.00s       |25.11°C       |36.33%        |WARNING, HUMIDITY IS TOO LOW  
0:0:1.50s       |25.11°C       |36.33%        |WARNING, HUMIDITY IS TOO LOW  
0:0:2.00s       |25.10°C       |36.29%        |WARNING, HUMIDITY IS TOO LOW  
0:0:2.50s       |25.09°C       |36.25%        |WARNING, HUMIDITY IS TOO LOW  
0:0:3.00s       |25.12°C       |36.24%        |WARNING, HUMIDITY IS TOO LOW  
0:0:3.50s       |25.11°C       |36.25%        |WARNING, HUMIDITY IS TOO LOW  
0:0:4.00s       |25.10°C       |36.24%        |WARNING, HUMIDITY IS TOO LOW  
0:0:4.50s       |25.12°C       |36.29%        |WARNING, HUMIDITY IS TOO LOW  
0:0:5.00s       |25.11°C       |36.26%        |WARNING, HUMIDITY IS TOO LOW  
0:0:5.50s       |25.13°C       |36.29%        |WARNING, HUMIDITY IS TOO LOW  
0:0:6.00s       |25.12°C       |36.27%        |WARNING, HUMIDITY IS TOO LOW  
0:0:6.50s       |25.12°C       |36.26%        |WARNING, HUMIDITY IS TOO LOW  
0:0:7.00s       |25.11°C       |36.27%        |WARNING, HUMIDITY IS TOO LOW  
0:0:7.50s       |25.11°C       |36.21%        |WARNING, HUMIDITY IS TOO LOW  
0:0:8.00s       |25.11°C       |36.26%        |WARNING, HUMIDITY IS TOO LOW  
0:0:8.50s       |25.12°C       |36.27%        |WARNING, HUMIDITY IS TOO LOW  
0:0:9.00s       |25.11°C       |36.24%        |WARNING, HUMIDITY IS TOO LOW  
0:0:9.50s       |25.10°C       |36.25%        |WARNING, HUMIDITY IS TOO LOW  
0:0:10.00s      |25.11°C       |36.27%        |WARNING, HUMIDITY IS TOO LOW  
0:0:10.50s      |25.09°C       |36.21%        |WARNING, HUMIDITY IS TOO LOW  
0:0:11.00s      |25.11°C       |36.21%        |WARNING, HUMIDITY IS TOO LOW  
0:0:11.50s      |25.11°C       |36.20%        |WARNING, HUMIDITY IS TOO LOW  
0:0:12.00s      |25.11°C       |36.23%        |WARNING, HUMIDITY IS TOO LOW  
0:0:12.50s      |25.10°C       |36.19%        |WARNING, HUMIDITY IS TOO LOW  
0:0:13.00s      |25.11°C       |36.22%        |WARNING, HUMIDITY IS TOO LOW  
0:0:13.50s      |25.11°C       |36.26%        |WARNING, HUMIDITY IS TOO LOW  
0:0:14.00s      |25.10°C       |36.25%        |WARNING, HUMIDITY IS TOO LOW  
0:0:14.50s      |25.11°C       |36.25%        |WARNING, HUMIDITY IS TOO LOW  
0:0:15.00s      |25.11°C       |36.33%        |WARNING, HUMIDITY IS TOO LOW  
0:0:15.50s      |25.11°C       |36.38%        |WARNING, HUMIDITY IS TOO LOW  
0:0:16.00s      |25.08°C       |36.50%        |WARNING, HUMIDITY IS TOO LOW  
0:0:16.50s      |25.10°C       |36.58%        |WARNING, HUMIDITY IS TOO LOW  
0:0:17.00s      |25.09°C       |36.69%        |WARNING, HUMIDITY IS TOO LOW  
0:0:17.50s      |25.10°C       |36.79%        |WARNING, HUMIDITY IS TOO LOW
```

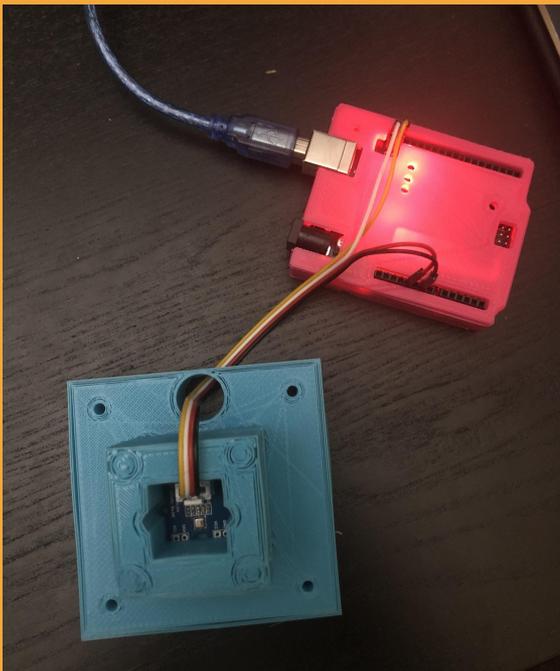
# PROTOTYPE I: CAD & PHYSICAL



# PROTOTYPE II: CAD & PHYSICAL

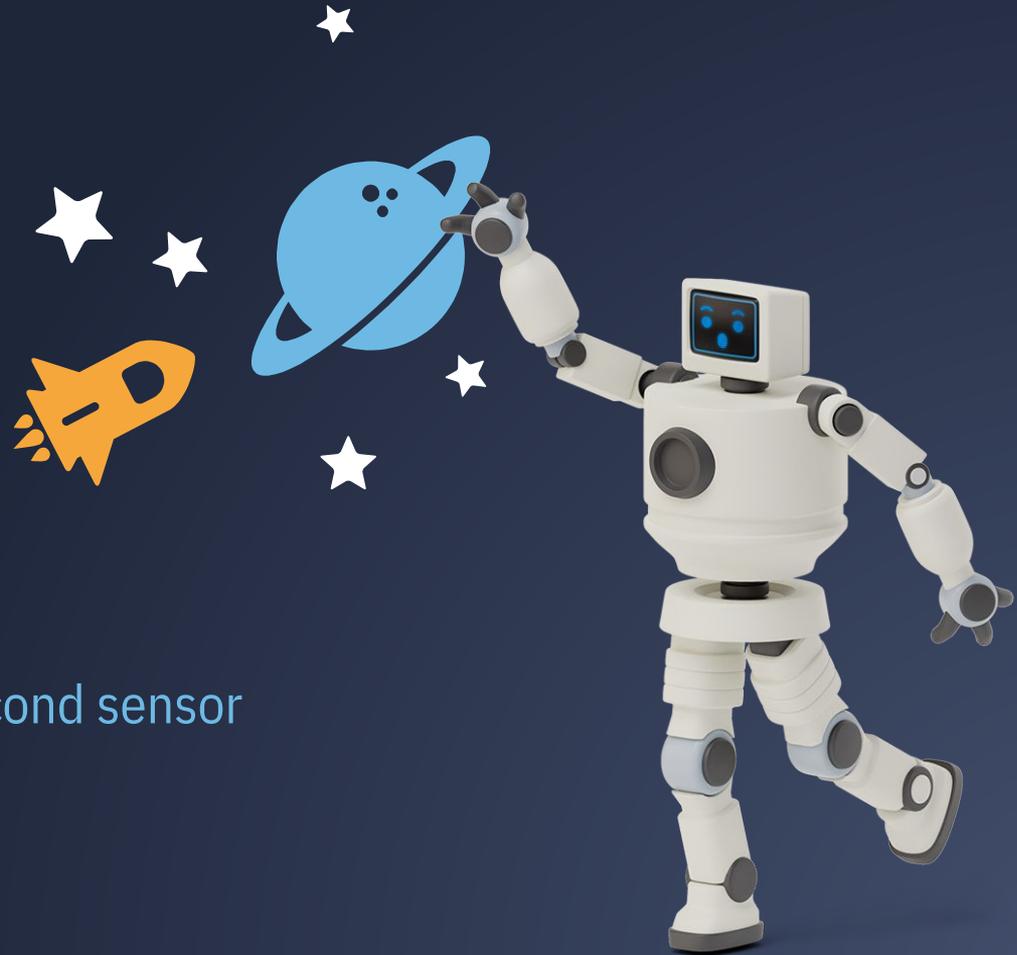


# PROTOTYPE III: CAD & PHYSICAL



# NEXT STEPS

- Waterproofing
- Potential addition of second sensor
- Attachment



**ANY QUESTIONS?**

