# Multi-Sensor Measurement Device

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## INTRODUCTION

Our goal for this project is to deliver a portable device that measures pressure, carbon dioxide, temperature, and humidity. Additionally, the device:

- Takes an average and displays these values on an LCD screen.
- Is usable in an industrial setting.
- Is easily modifiable and repairable for future use.

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## METHODS

Construction of the device revealed areas of improvement for the device. Revisions of the design include:

- Microchip switched for an Arduino Uno R3
- Thermistor removed
- The TVOC reading from the SGP30 Sensor is now included in the output to the screen
- Cone shortened by half an inch and printed in resin rather than ABS
- I2C LCD display switched for a 20x4 rt204-1(ver3.0) (comparable to 20x4 HD44780 LCD)
- Dimensions of test case finalized

**Tests and Checks**

- Check to ensure everything is wired as specified in the diagram
- Check to ensure that the sensors are outputting to the screen as specified in the code
- Standard room test, with an overhead fan and air conditioning set to 75°F
- Oven test, inside a conventional oven preheated to 200°F
- Freezer test, inside a freezer set at -4°F

## RESULTS

Since the tube, fan, and cone were not installed due to COVID-19, the device serves more as an environmental measurement box, instead of a sampling chamber.

- This is reflected in the rate at which the device cools and heats up
- Our values reflect anticipated patterns for each measurement
  - Temperature: Oven > Standard Room > Freezer
  - Humidity: Standard Room > Freezer > Oven
  - TVOC: Oven > Freezer > Standard Room
  - eCO2: Oven > Standard Room > Freezer

| Test (Average) | Temperature °F | Humidity RH | TVOC ppb | eCO2 ppm |
|---|---|---|---|---|
| Standard Room | 80.28 | 55 | 75.36 | 526.27 |
| Oven | 145.09 | 21.83 | 396.67 | 761 |
| Freezer | 67.03 | 52.77 | 114.69 | 411.54 |

Figure 1. Test Averages

## CONCLUSIONS

From the tests we were able to perform, it is clear that the device is performing how our team expected. A major strength of the project is that the current code is very lightweight, and the connected sensors were working accurately. One weakness that we can identify is the wiring. We started with a $600 budget and spent $156.63. With our revisions, we believe we could reproduce this project for $128.75.

Figure 2. Resin Cone


Figure 3. Internals

**Recommendations**

The greatest improvement to the project would be to research the best way to pull air into the chamber. Implementing a protoboard would clean up the internals. A directional pad instead of four buttons would improve menu navigation. Using an I2C screen would simplify the wiring to the Arduino Uno R3, perhaps a touchscreen.

## Acknowledgements

The team would like to recognize the following individuals and lab for their aid in the completion of the project:
Dr. Hill
Dr. Schultz
Professor Gill
Professor Newman
Mercer's Machine Intelligence and Robotics Laboratory