IOT Climate Sensor Development for HVAC Efficiency Analysis

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Background

- **Motivation**
  - Create indoor and outdoor air quality sensors that are capable of taking accurate measurements to verify the existing measurement systems within our buildings.

- **Our Goals**
  - Determine the accuracy of existing systems
  - Determine the change in air quality when entering a building
  - Predict how systems will respond to changes
  - Low-cost and portable

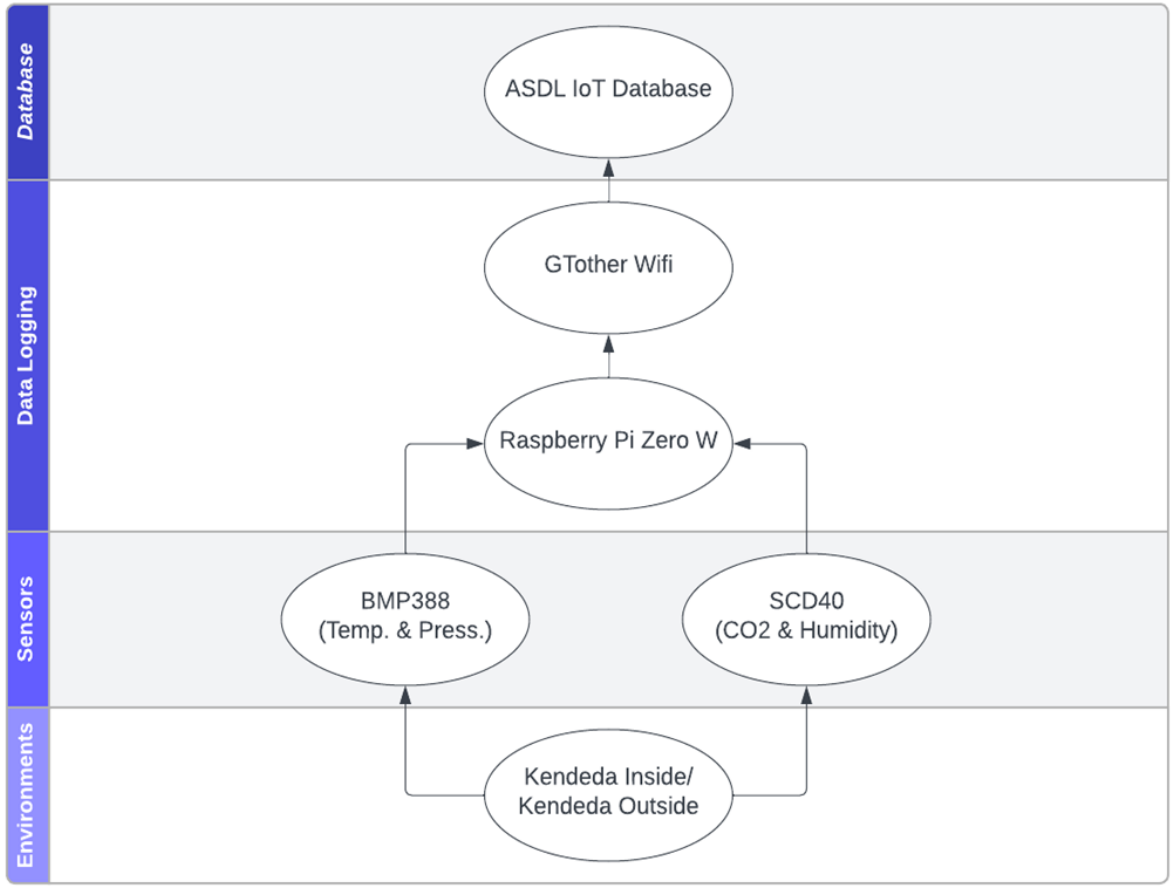
Approach

What should be measured?

- CO_2
- Humidity
- Temperature
- Pressure

How will data be recorded?

- Raspberry pi
  - Wifi enabled
  - Data recorded 4 times every hour
  - Plots created to compare IAQ, OAQ, and existing systems data



Outdoor Air Quality Sensor

Requirements

- Aesthetics
- Eternal Power
- Accurate
- Durable
- Waterproof

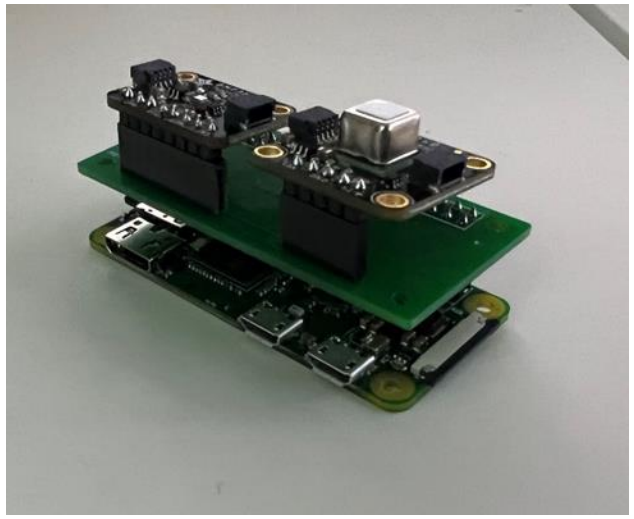
Design Specifications and Challenges

- 3D printed sensor housing
- Raspberry Pi
  - BMP388
  - SCD40
- Power
- Mounting

Indoor Air Quality Sensor

Requirements

- Small and Non-intrusive
- Constant Power
- Accurate



Design Specifications and Challenges

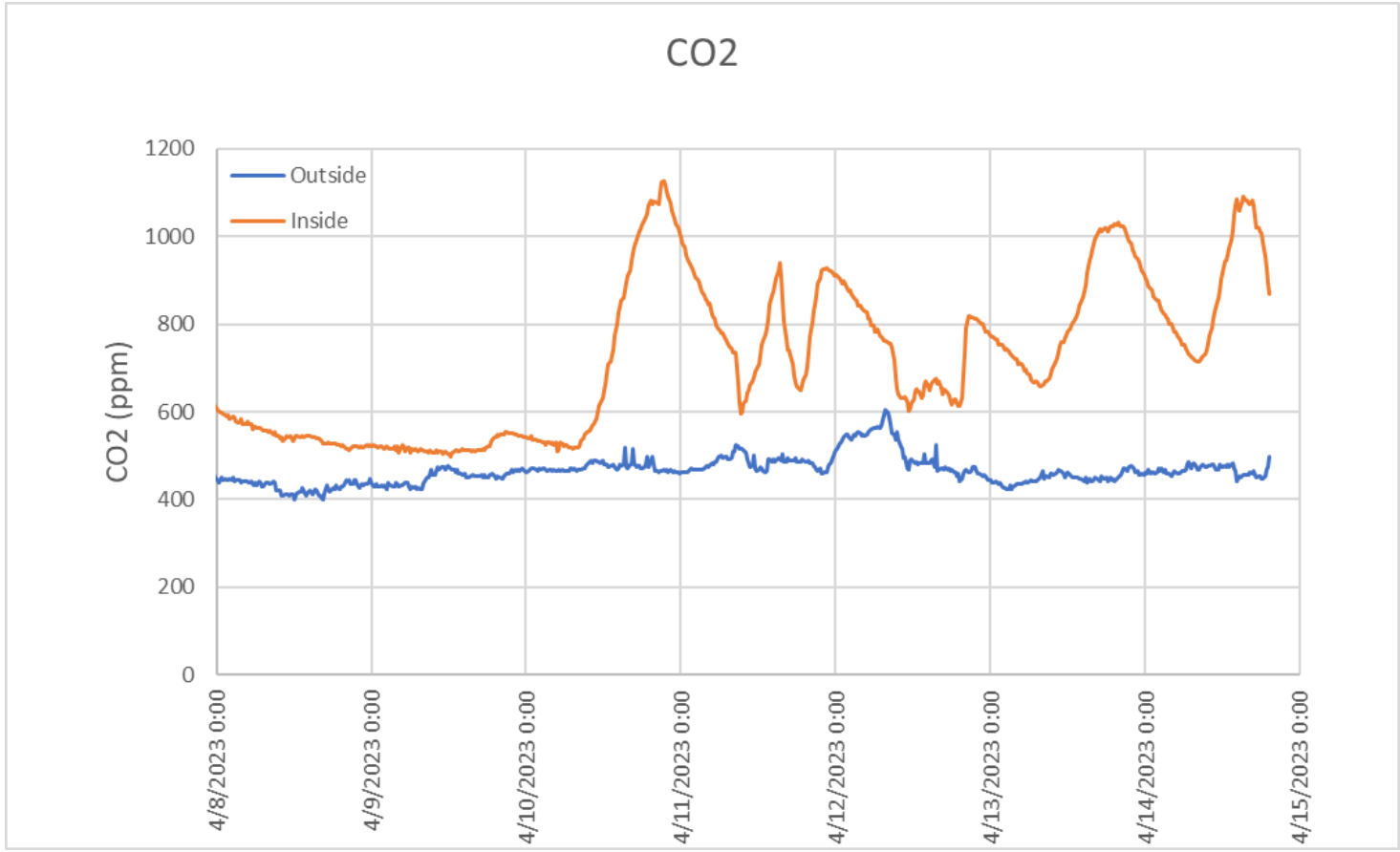
- 3D printed sensor housing
- Raspberry Pi
  - BMP388
  - SCD40
- Heat from Raspberry Pi

Sensor Verifications

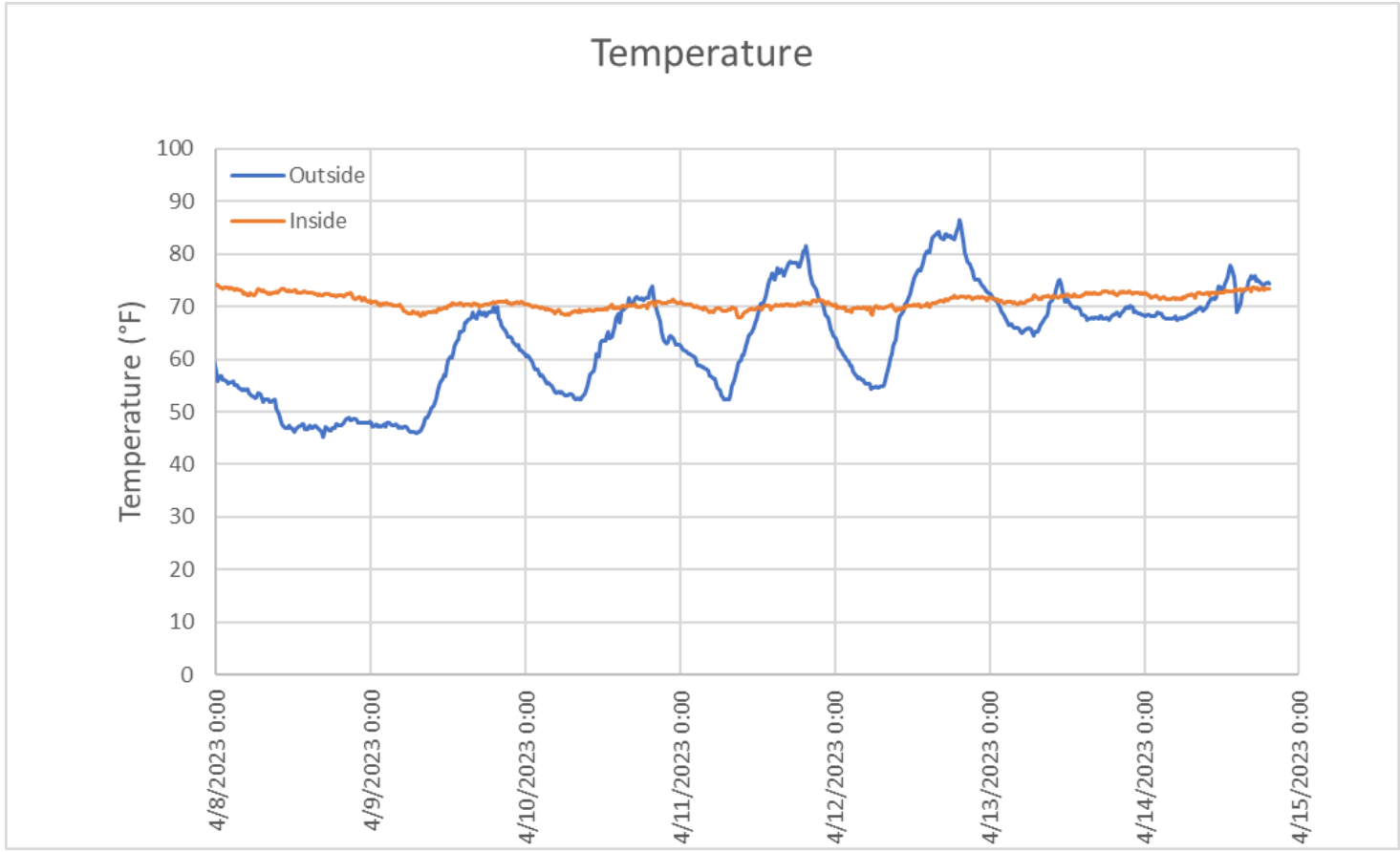
Verification

- Accuracy
- Durability
- Waterproofing

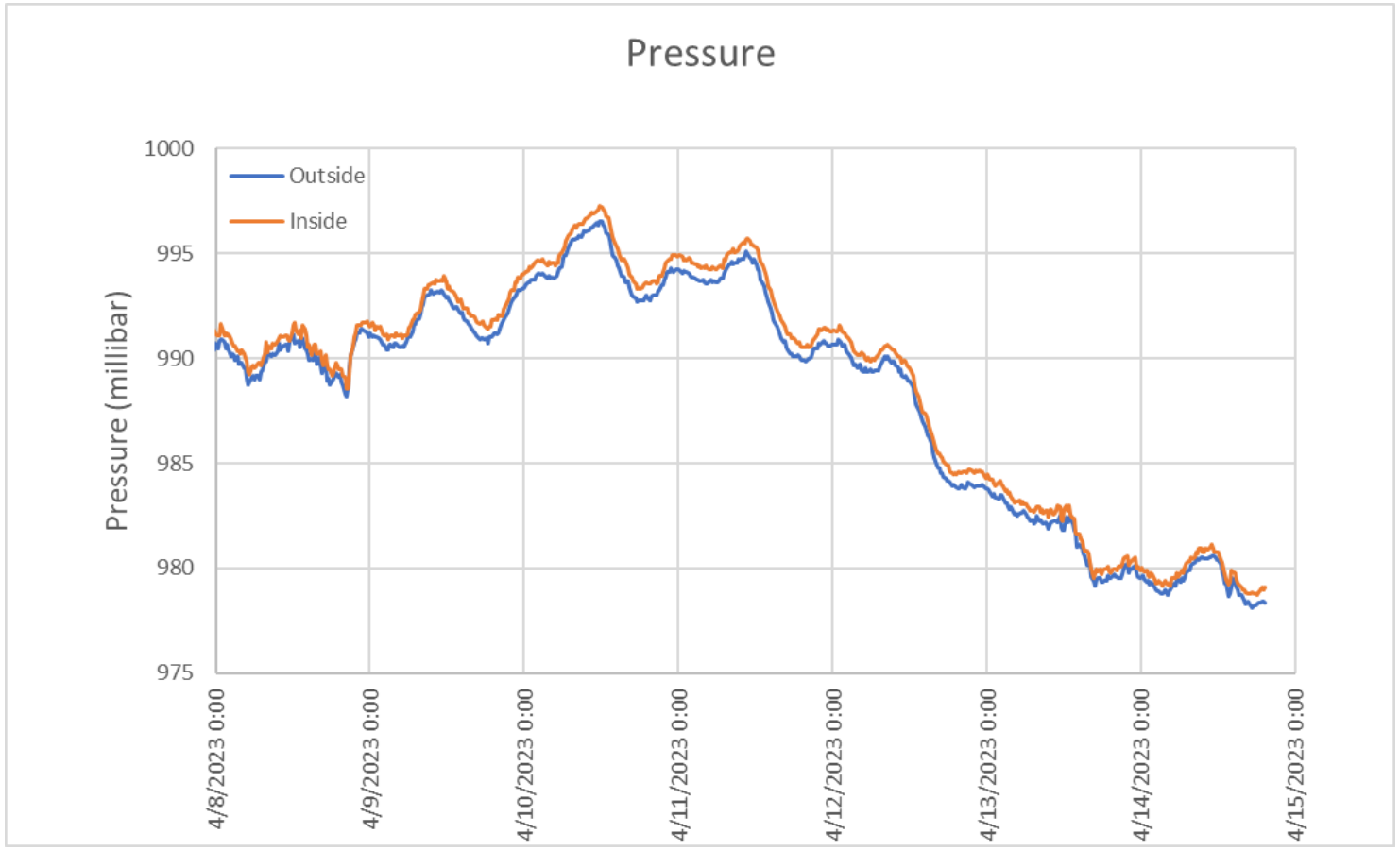
Measurement: CO2



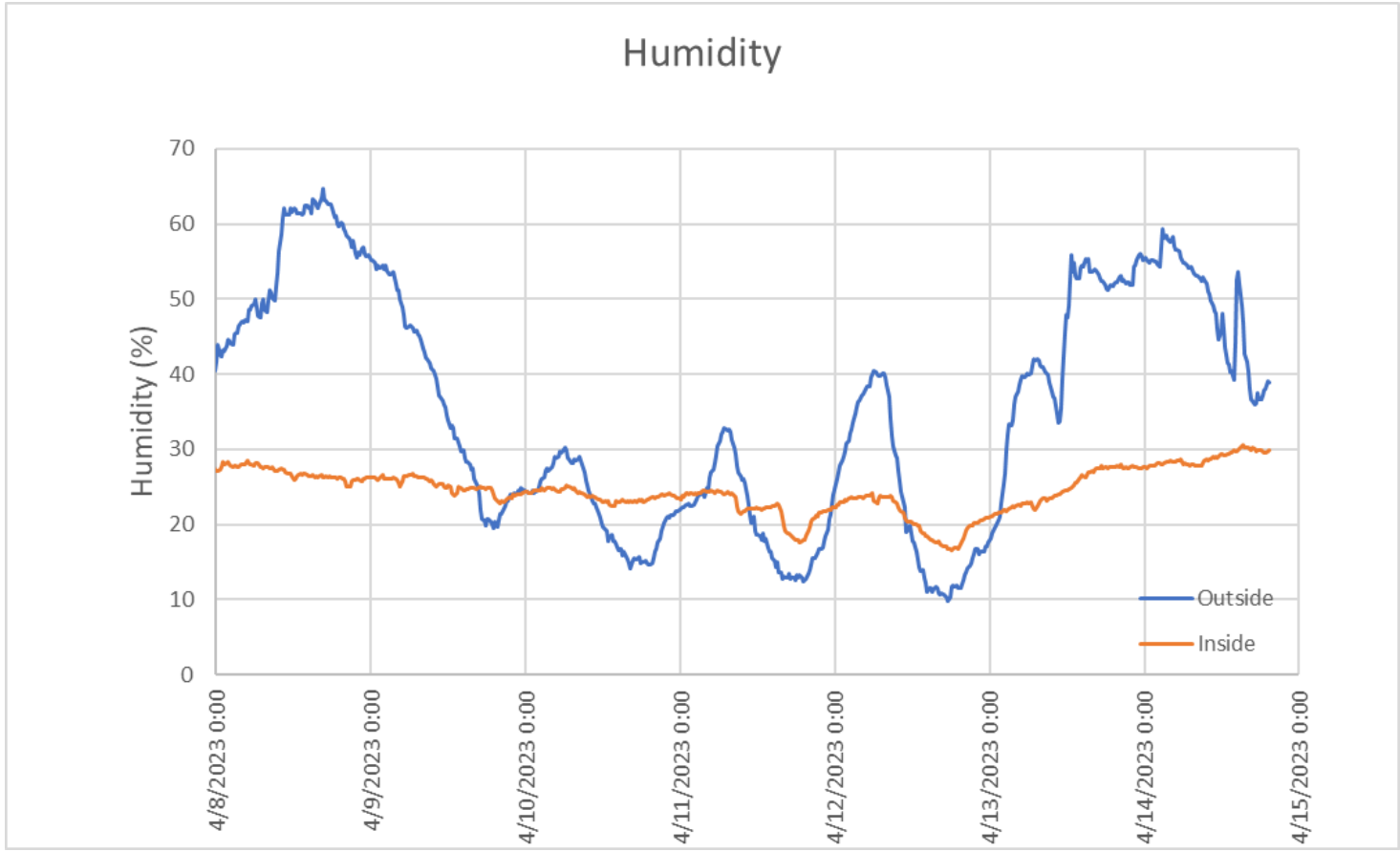
Measurements: Temperature



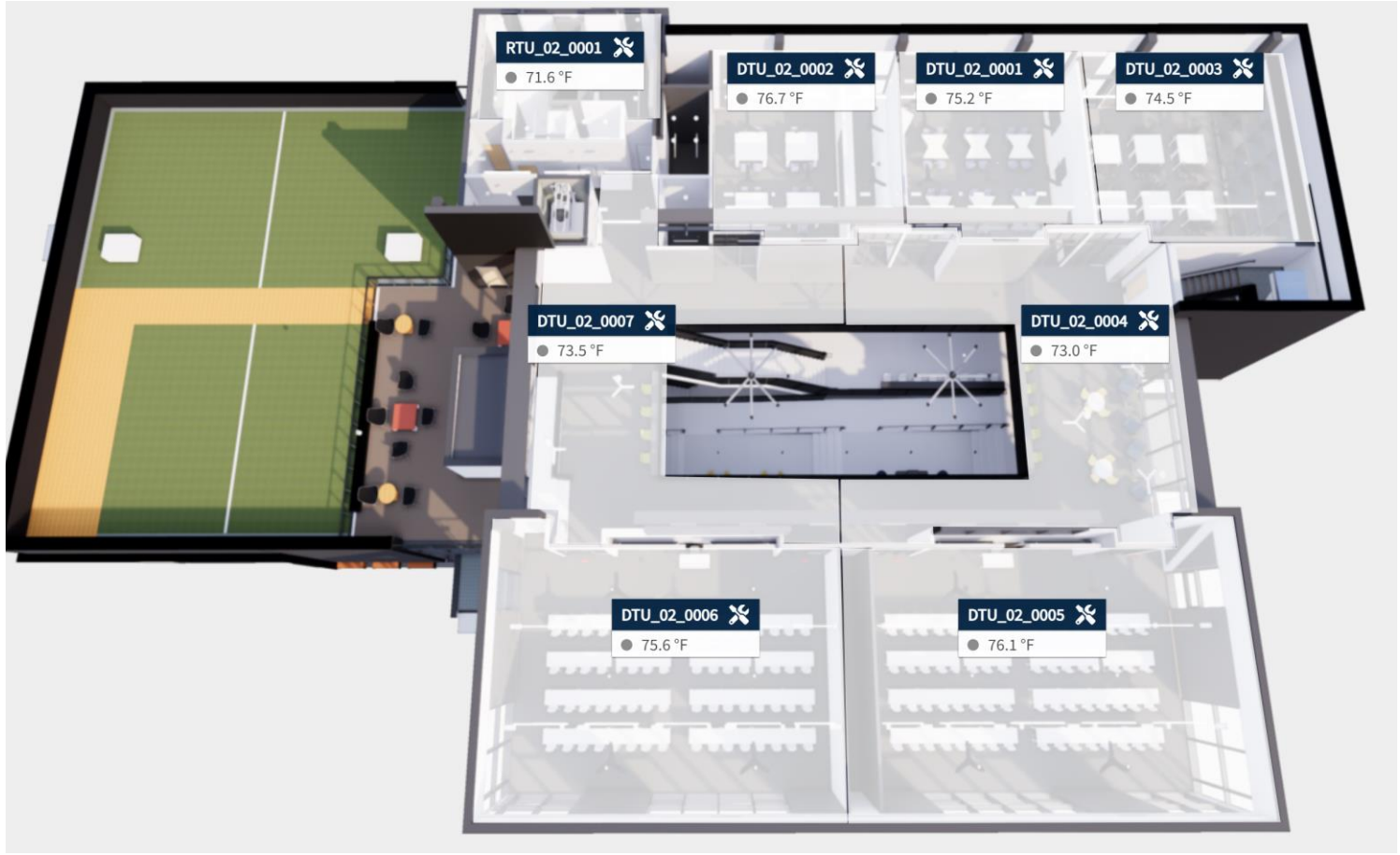
Measurement: Pressure



Measurements: Relative Humidity



Existing Systems Validation Data



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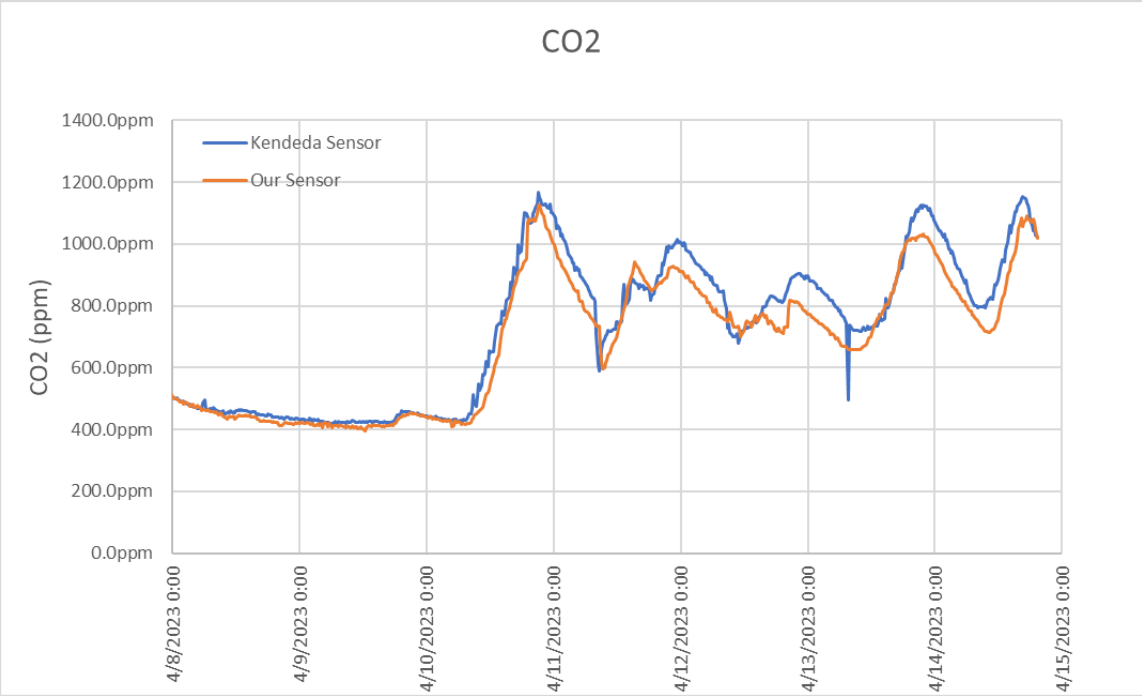

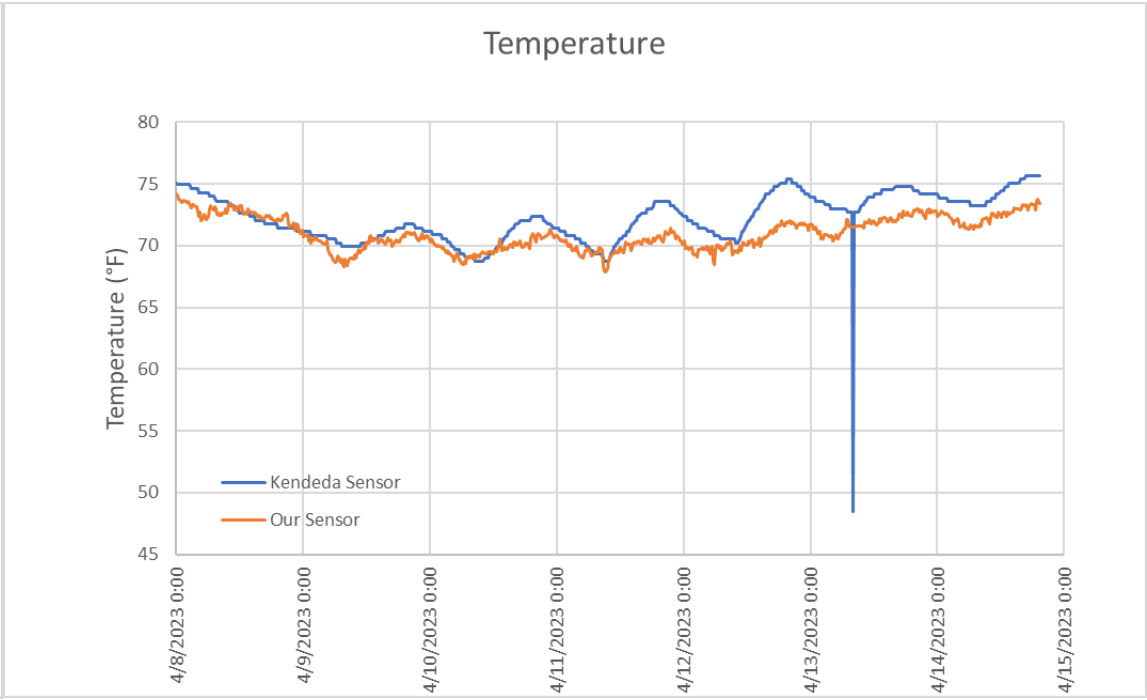

Results

First Phase Goals Achieved

- Produced a low profile, affordable, portable device to measure CO2, temperature, pressure, and humidity
- Verified sensor self-reliability
- Tested sensor accuracy
- Gathered data that can be used to evaluate HVAC performance

Second Phase Goals to Achieve

- Streamline the process of deployment
- Update sensor systems
- Deploy sensors to other building around campus

Attempts at Alternative Power Generation

PV panels were tested to offer an alternative option for power supply for the OAQ sensor package.

Requirements

- A PV panel large enough to supply sufficient power
- A battery to store gathered power
- A sensor housing with space to fit the PV panel and the battery

Design Specifications and Struggles

- The sensor profile would be larger than our previous design goals

Potential Future Changes

Future Updates

- Cellular Data rather than Wi-Fi
- Battery powered
- Solar power recharging
- More Accurate Sensors