FORGE Lab Room Temperature Distribution Analysis

Group 6
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Background

- The **FORGE** Lab is to better understand the materials of modern optical fiber.
- Fiber is temperature sensitive
- Change in temperature causes thermal expansion in the fibers, cause the output laser to drift in one direction.

Fiber **O**ptics **R**esearch & **G**lass **E**ngineering **L**ab (FORGE Lab)

Background

- Drift will have significant impact in moving off from the detectors. If a movement is larger than ~1cm, it will have large negative impact to the experiment, cause inaccuracy in the lab result.

- Investigate the temperature fluctuations in the lab room, as it has a significant impact on some of their experiments.

Fiber Optics Research & Glass Engineering Lab (FORGE Lab)

Purpose

- To identify areas within the lab room that are

  suitable for experiments that require temperature control

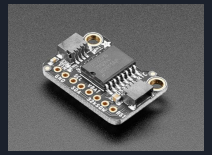
- To determine the temperature changes across the lab room (in a certain time period), as it affects the experiments being conducted

- To identify areas directly underneath vents and far away from them

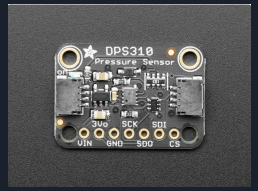
  to prepare experiments for these conditions.

Details of the board

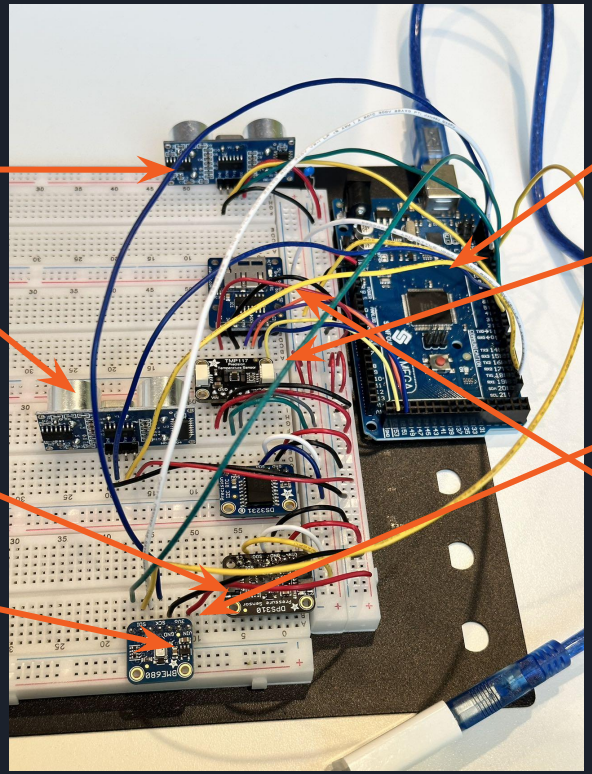
HC-SR04
(Ultrasonic)



RTC

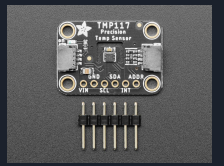


DPS 310

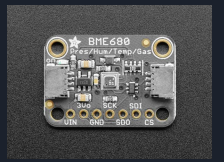


Arduino

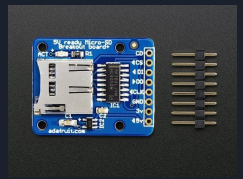
TMP 117



BME 680



MicroSD card
breakout board



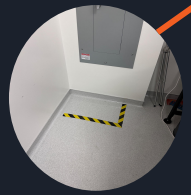
Sensor’s Detail

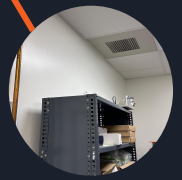
1. TMP117: a high-precision digital temperature sensor that can measure temperatures from -55° C to 150°C with an accuracy of ±0.1°C.
2. BME680: a sensor that can measure temperature, humidity, pressure, and air quality.
3. RTC: Real-Time Clock, and it's a type of clock that keeps track of the current time even when the device it's connected to is turned off.
4. MicroSD Card Breakout Board.
5. DPS310: a high-precision digital barometric pressure sensor that can measure pressure with an accuracy of ±0.005 hPa.
6. HC-SR04: The HC-SR04 is an ultrasonic sensor that can be used to measure distance. It works by sending out a high-frequency sound wave and measuring the time it takes for the sound wave to bounce back.

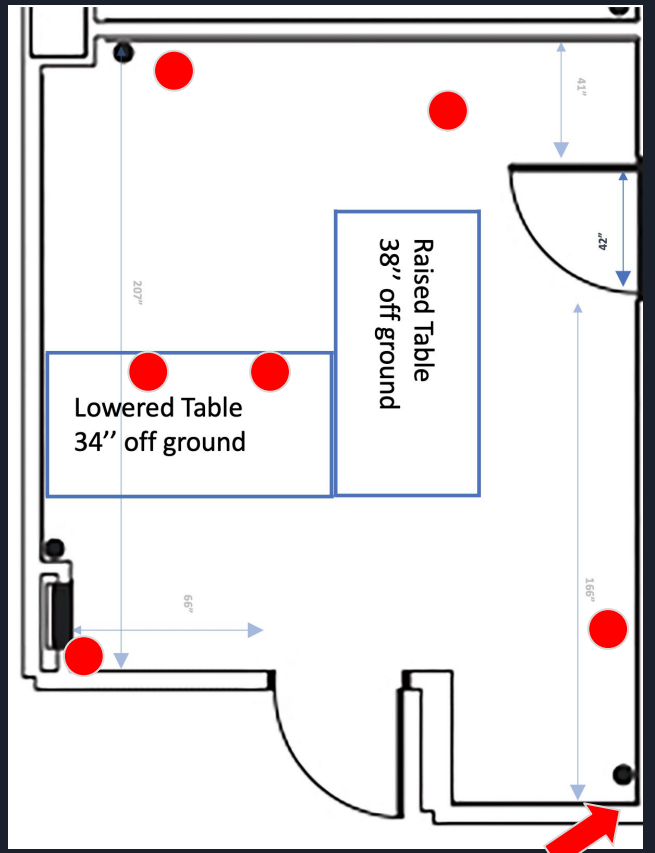
What are we measuring?

- The x and y coordinates
- Pressure for altitude calculation
- Temperature and humidity
- The overall change of temperature and humidity in the room
- Use RTC for synchronization

Lab Schematics





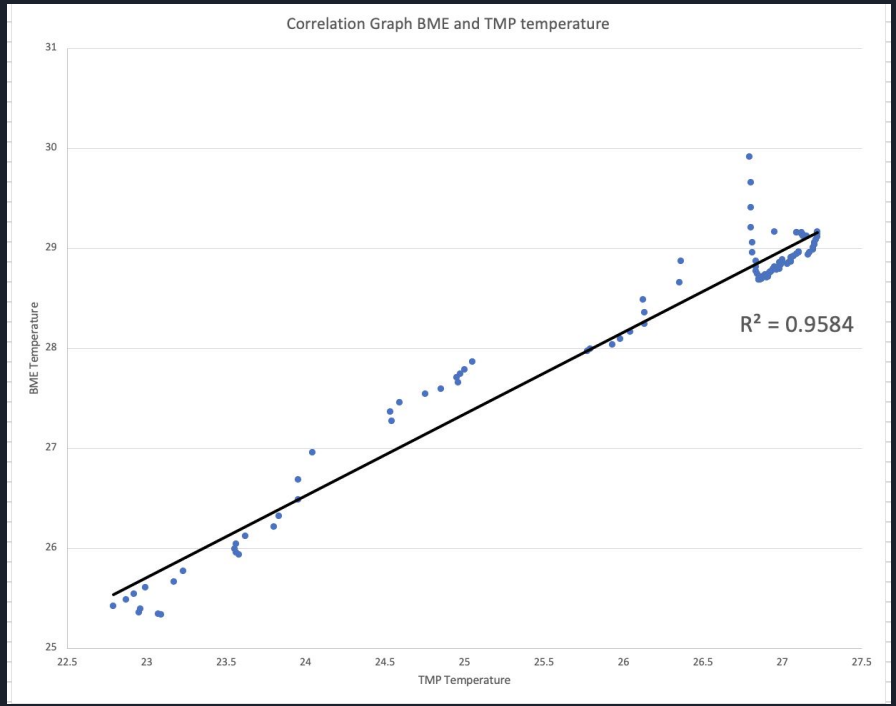


How to obtain data? In what forms?

- 6 sensors
- Each measure record temperature and record data
- Over a time span of at least 8 hrs
- The time interval between each time data recording is 10s
- SD cards will be the primary data storage device
- Data will be stored in CSV form in SD card

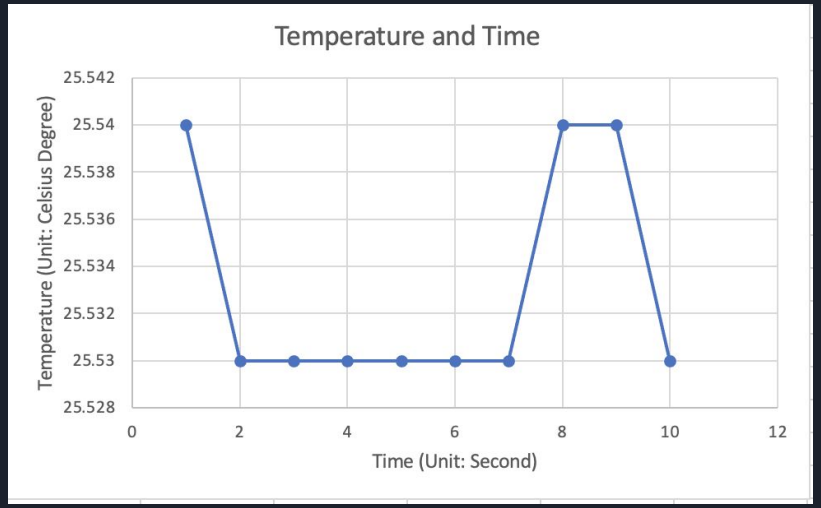
How to check if sensors are all properly working?

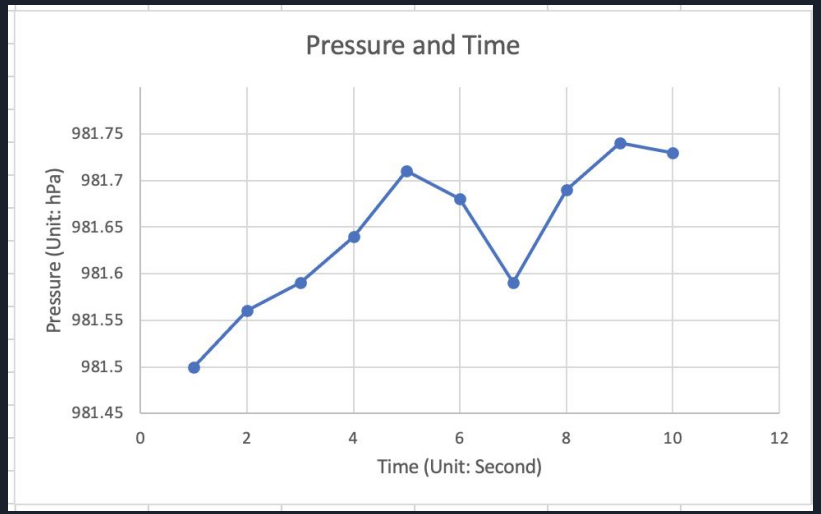
- Correlations help us do a sanity check to prevent bias.



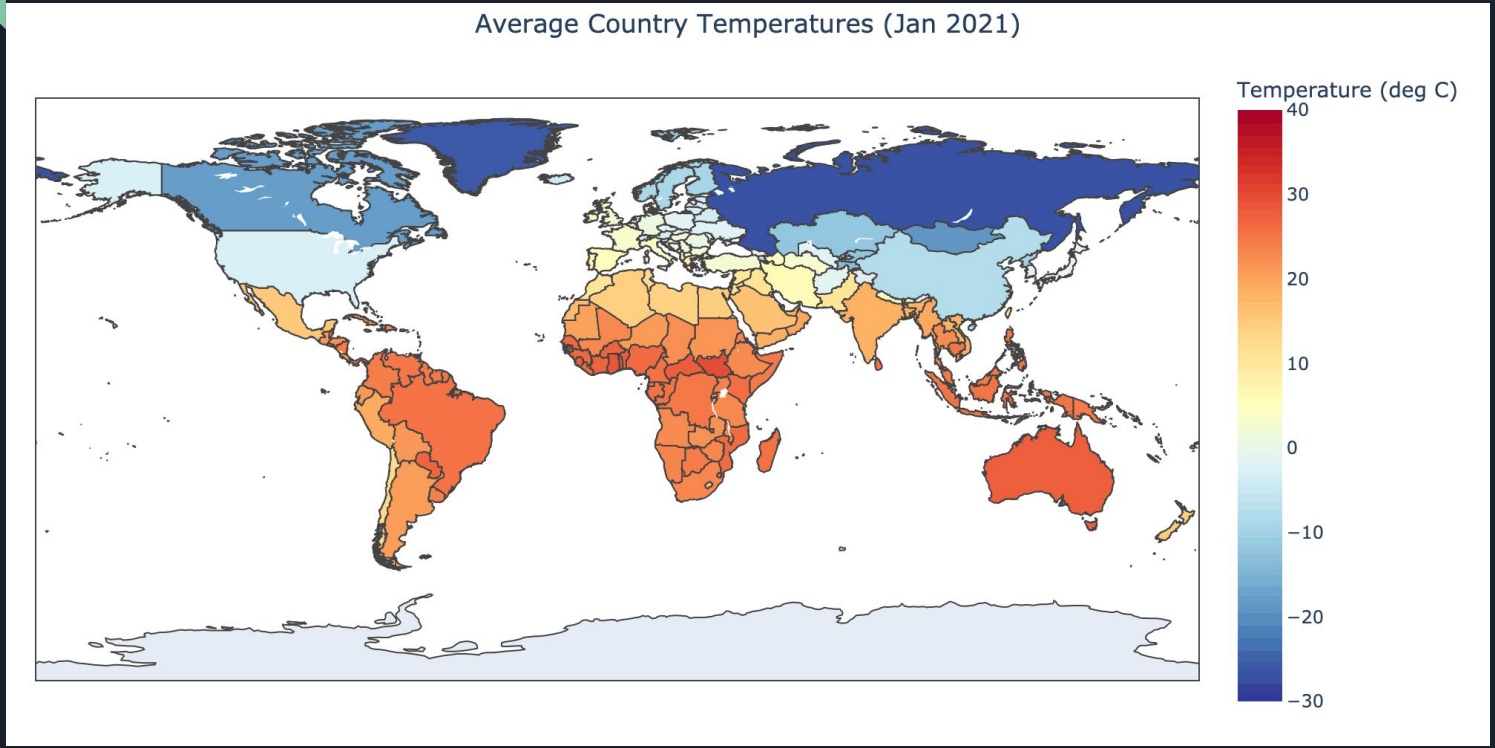
Data analysis

- Line graph--visualize the data
- Draw out a heat map GIF for temperature changing over time.
- Find the change of temperature between each data point





An example of GIF intend to create



Plans: next steps

- 3D printing specific holder for HC-SR04
- Putting all the Arduinos into the lab room, do measurements for a short period of several days.
- Gather data obtained to check if all the components works fine.
- Search on the internet for ways to draw heat map for this room (Python)
- Plot out the data on lab schematics and indicate the changing of temperature over measurement time period

Questions?

Reference

https://towardsdatascience.com/how-to-use-python-to-obtain-the-temperature-of-any-place-on-earth-b92aae44b831

https://open.maricopa.edu/psy230mm/chapter/chapter-5-measures-of-dispersion/