

Laboratory Temperature and Humidity Monitoring System

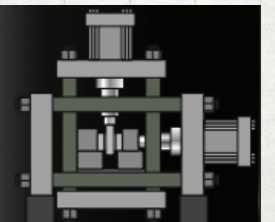


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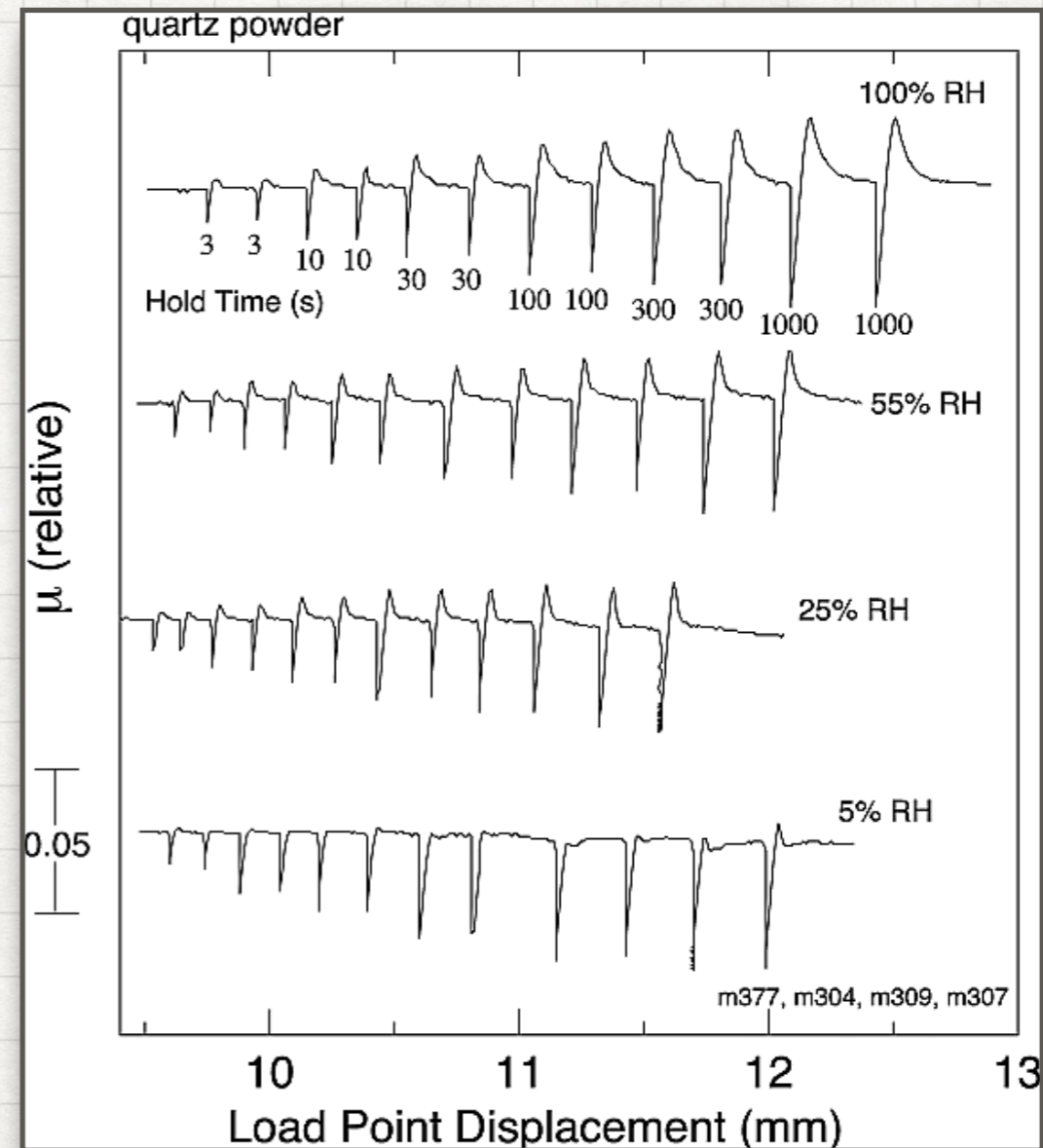
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PENN STATE ROCK AND SEDIMENT
MECHANICS LABORATORY



Problem

- Shearing experiments are affected by temperature and relative humidity (RH)
- time-dependent frictional healing is reduced at low RH
- Increasing RH can result in velocity-weakening gouge



[Frye & Marone, 2002]

Problem

Sensors

Setup

Demo

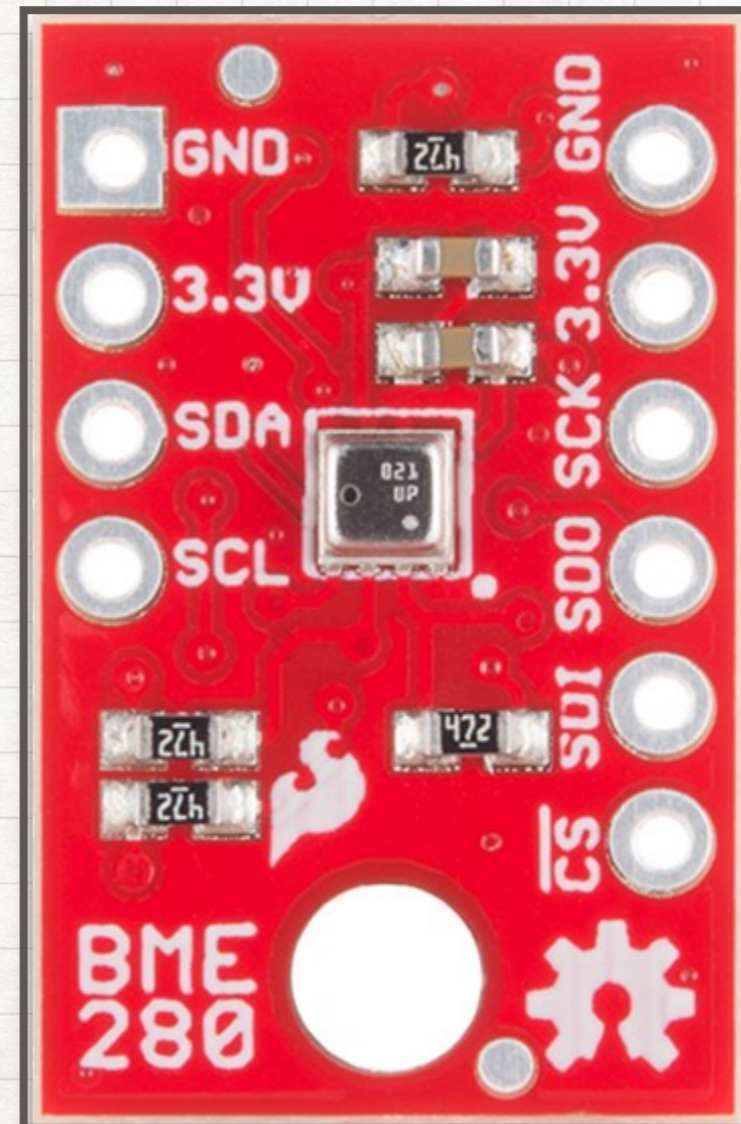
Challenges

Limitations

Expansion

Instrumentation

- Atmospheric Sensor Breakout
- BME280
- Temperature, humidity, atmospheric pressure, and altitude all in one
- Ranges:
 - T: -40C to 85C
 - Humidity: 0 - 100%
 - Pressure: 30,000Pa to 110,000Pa
 - Altitude: 0 to 9.2 km



Problem

Sensors

Setup

Demo

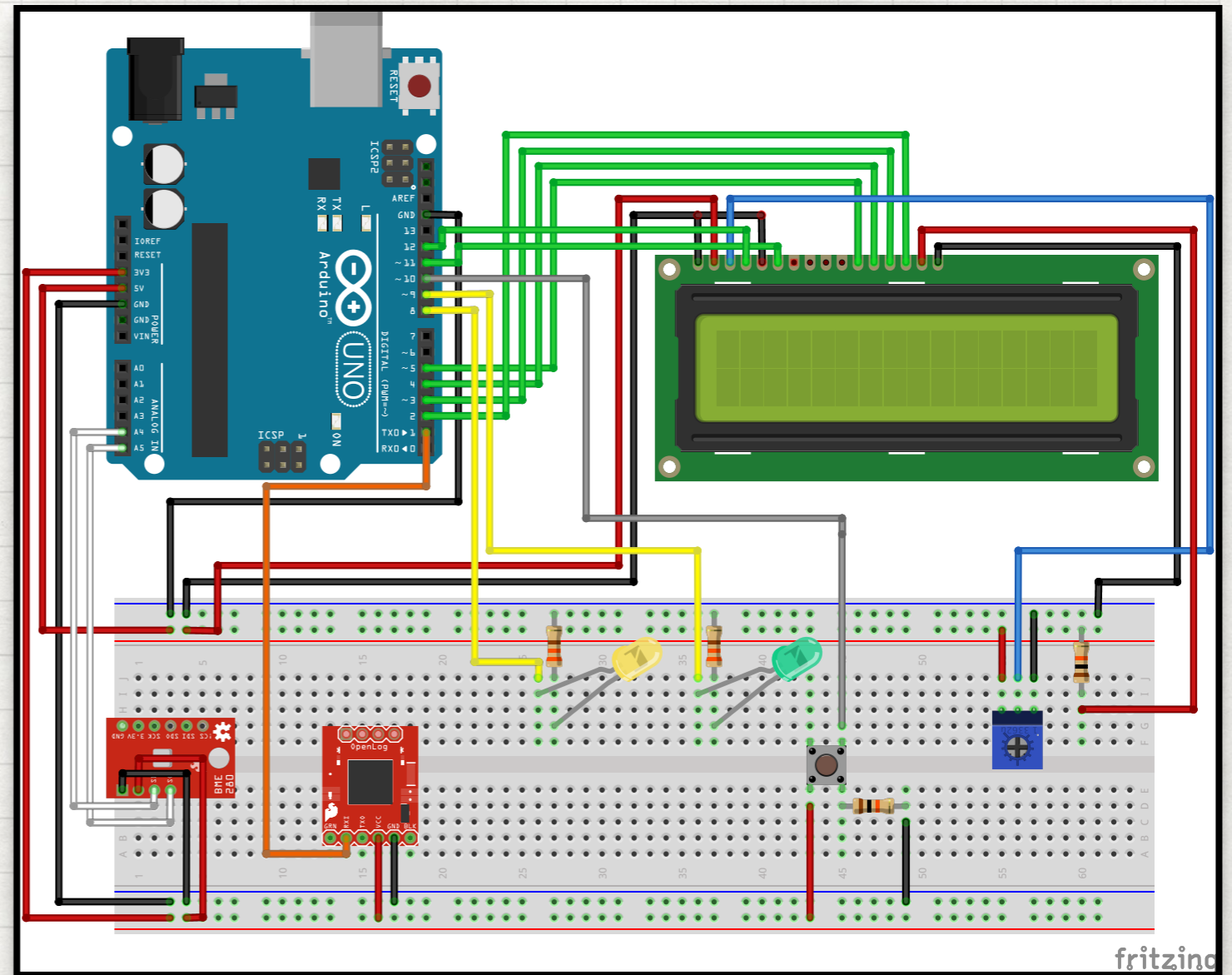
Challenges

Limitations

Expansion

Monitoring System: Setup

- Schematic of the electrical circuit
- LED lights: green for successful upload and flashing yellow when each data point is displayed
- Push button to display pressure reading



Problem

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Monitoring System: Demonstration

- Time for a quick demonstration
- Text file produced by CoolTerm
 - <http://freeware.the-meiers.org/>



```
TGE_project | Arduino 1.6.11
TGE_project $
#include <LiquidCrystal.h>
int pushButton = 10; // choose the input pin (for a pushbutton)
int val = 0; // variable for reading the pin status
#include <stdint.h>
#include "SparkFunBME280.h"
#include "Wire.h"
#include "SPI.h"

BME280 mySensor;
```

```
CoolTerm_0
New Open Save Connect Disconnect Clear Data Options View Hex Help
25.61, 78.10, 97567.00, 328.49, 1076.26, 34.00
25.61, 78.10, Program Started
Starting BME280s... result of .begin():
Sensor: 0x60

Temperature_C, Temperature_F, Pressure_Pa, Altitude_m, Altitude_ft, RH_%
25.62, 78.12, 97573.00, 328.13, 1075.97, 34.00
25.60, 78.08, 97568.00, 328.40, 1077.42, 34.00
25.61, 78.10, 97572.00, 328.04, 1075.39, 34.00
25.60, 78.08, 97568.00, 327.87, 1075.68, 34.00
25.59, 78.08, 97568.00, 328.40, 1077.42, 34.00
25.60, 78.08, 97568.00, 328.40, 1076.84, 34.00
25.60, 78.08, 97574.00, 327.87, 1075.68, 34.00
25.60, 78.08, 97576.00, 327.69, 1078.30, 34.00
25.60, 78.08, 97566.00, 328.40, 1077.42, 34.00
25.59, 78.08, 97571.00, 328.13, 1076.55, 34.00
25.60, 78.08, 97570.00, 328.22, 1077.42, 33.00
25.60, 78.08, 97578.00, 327.51, 1074.52, 34.00
25.60, 78.08, 97570.00, 328.22, 1075.97, 34.00
25.60, 78.08, 97573.00, 328.40, 1077.42, 34.00
25.59, 78.06, 97572.00, 328.04, 1076.26, 34.00
25.59, 78.06, 97569.00, 328.31, 1076.26, 34.00
25.59, 78.06, 97570.00, 328.22, 1076.84, 34.00

usbserial-DN01JH6L / 9600 8-N-1
Connected 00:00:18 / Capturing... 1025 Bytes
TX RTS DTR DCD
RX CTS DSR RI
```

Problem

Sensors

Setup

Demo

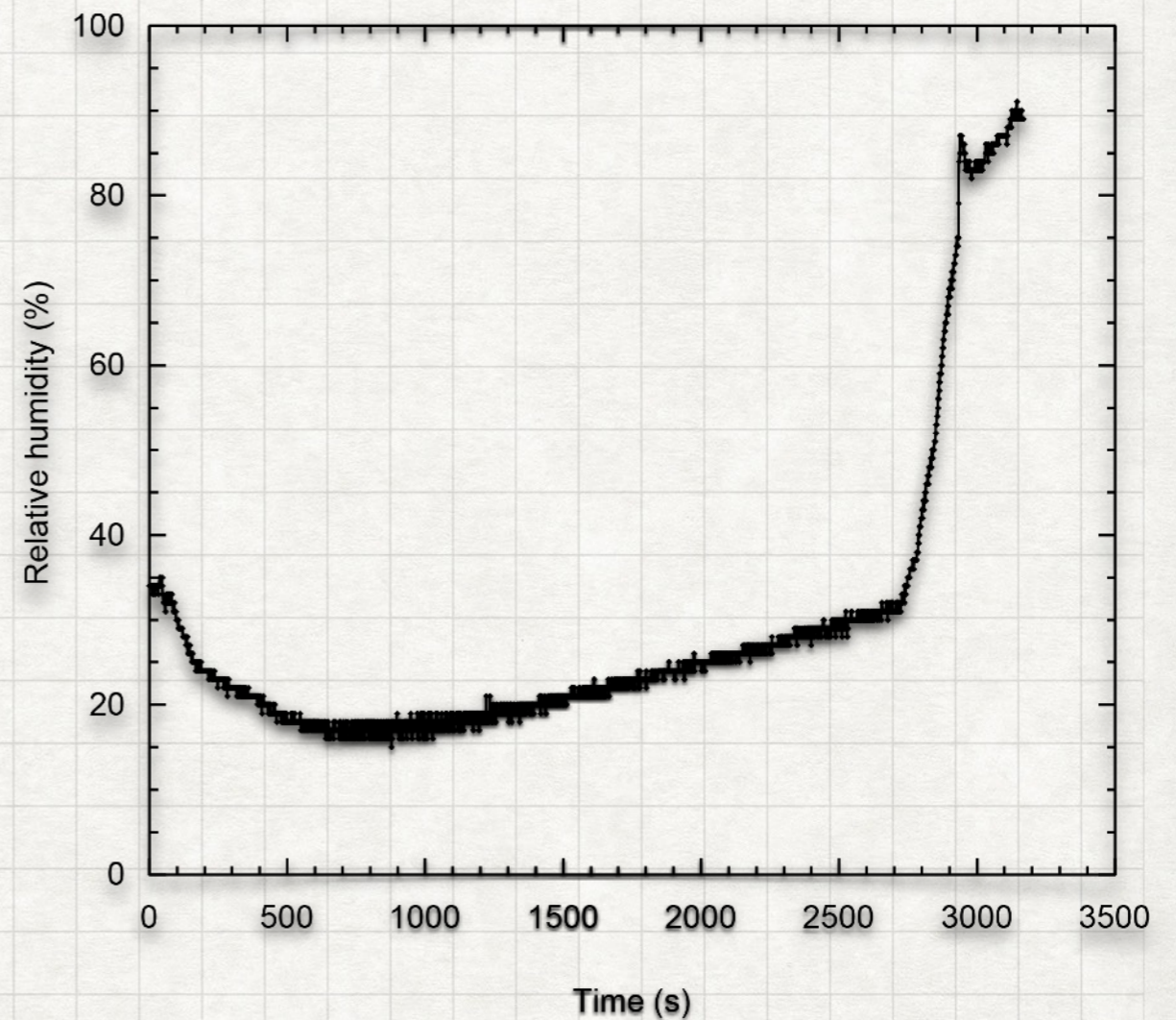
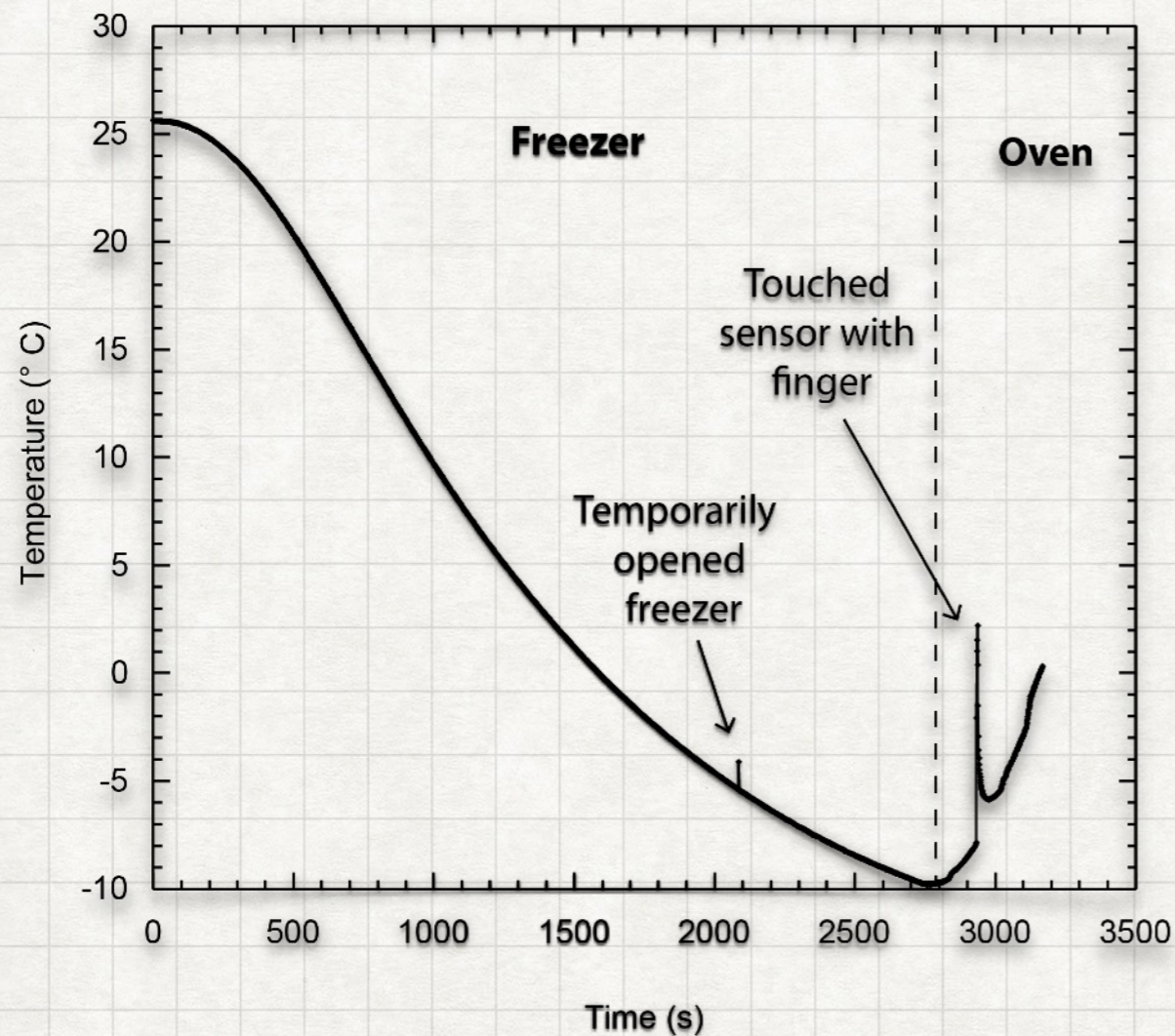
Challenges

Limitations

Expansion

Monitoring System: Demonstration

- Examples of data (~ 1 hr time frame)
 - Temperature and humidity



Problem

Sensors

Setup

Demo

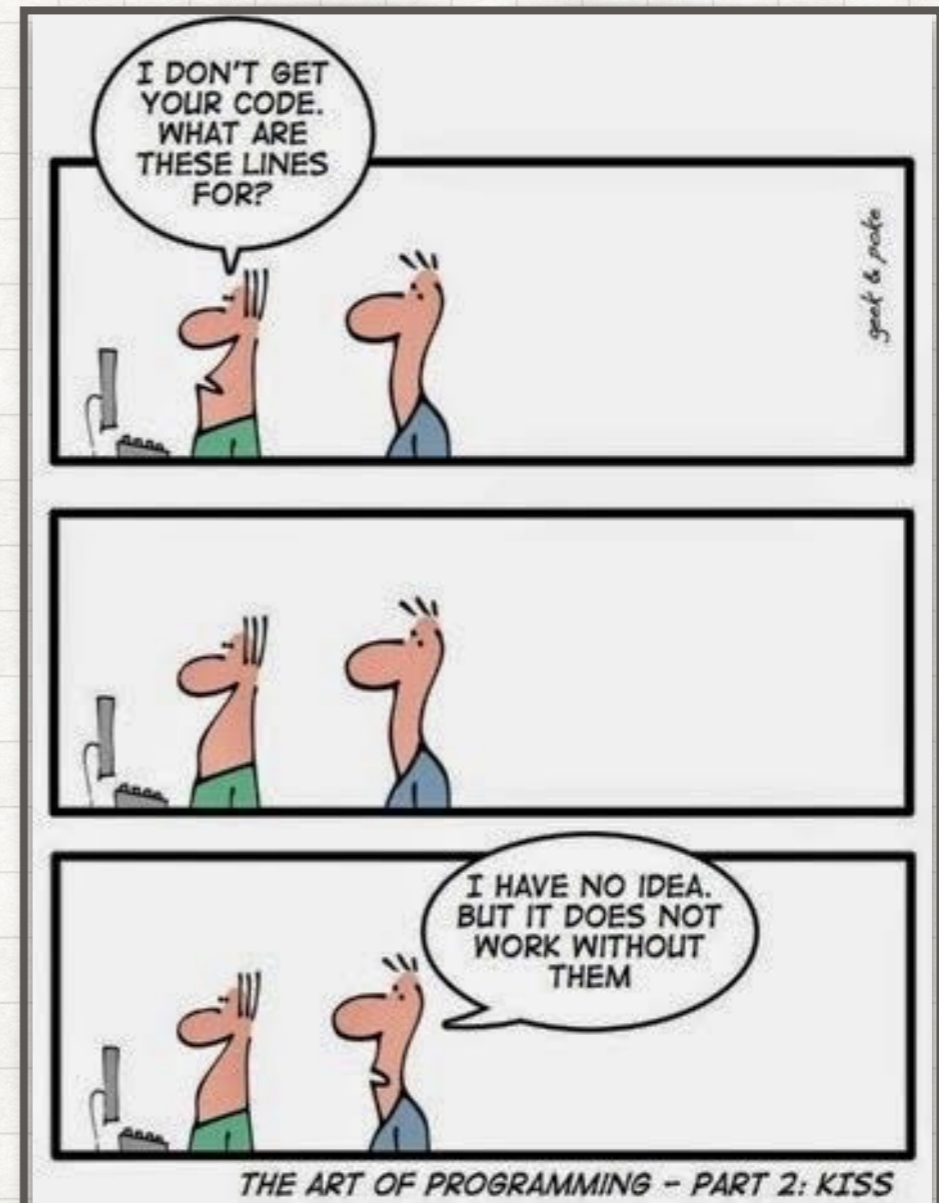
Challenges

Limitations

Expansion

Monitoring System: Challenges

- Failure to implement data logger and wifi into current system
- Mainly a problem with coding and syncing errors



Problem

Sensors

Setup

Demo

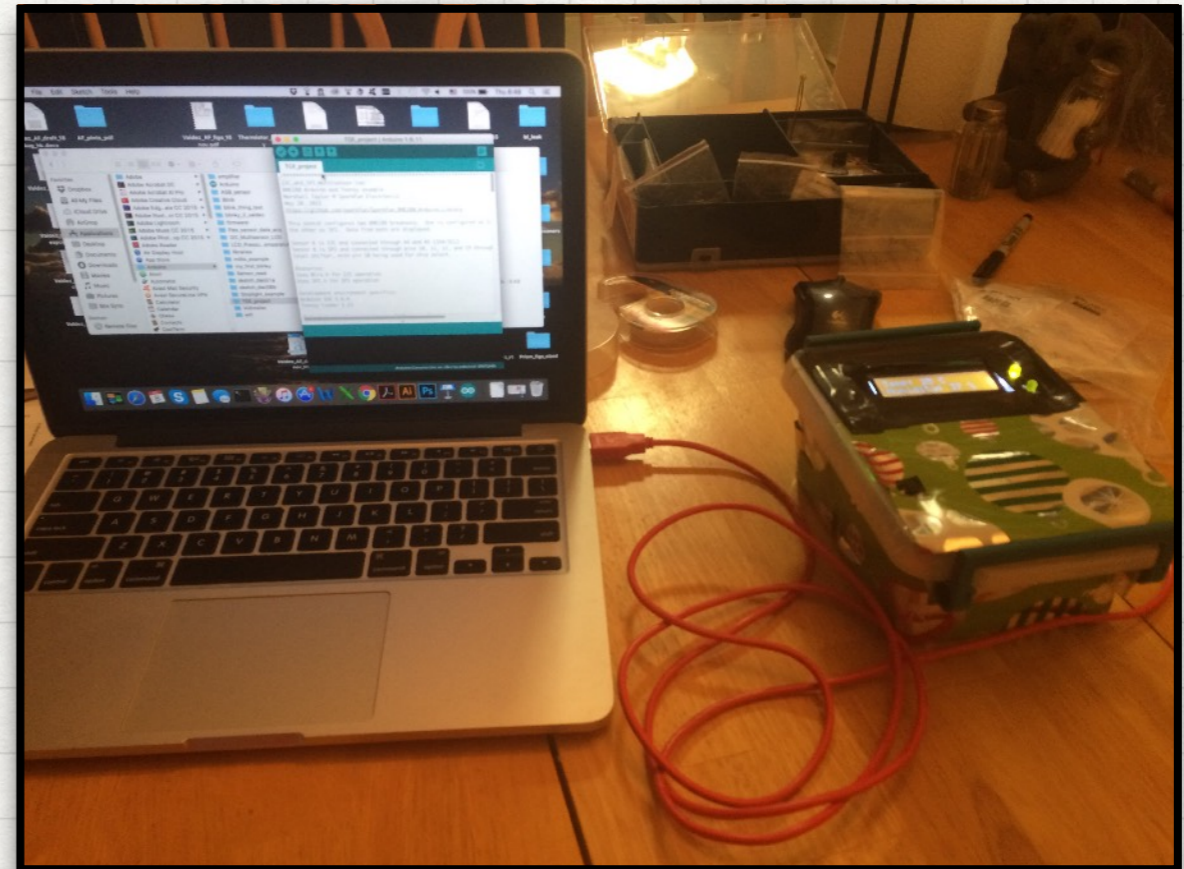
Challenges

Limitations

Expansion

Monitoring System: Limitations

- No built in data logging component
- Fixed to a computer
- More favorable for indoor usage



Problem

Sensors

Setup

Demo

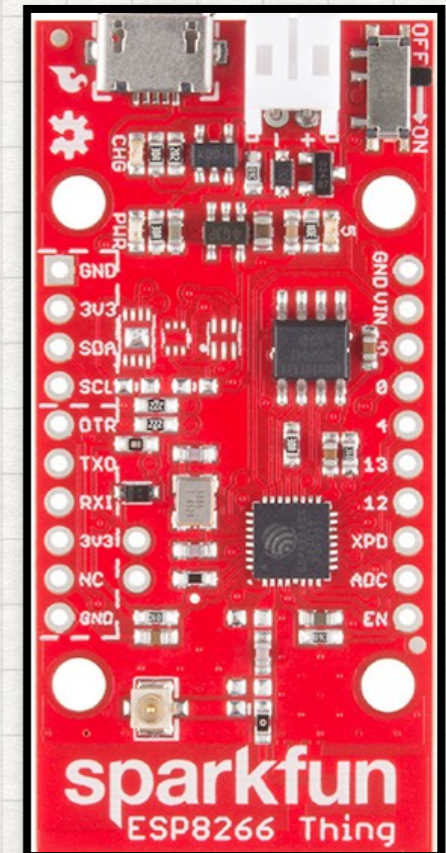
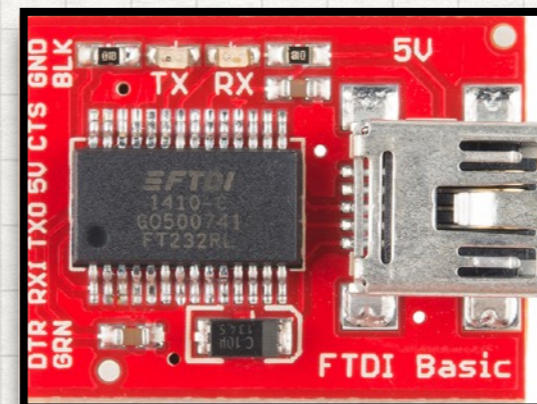
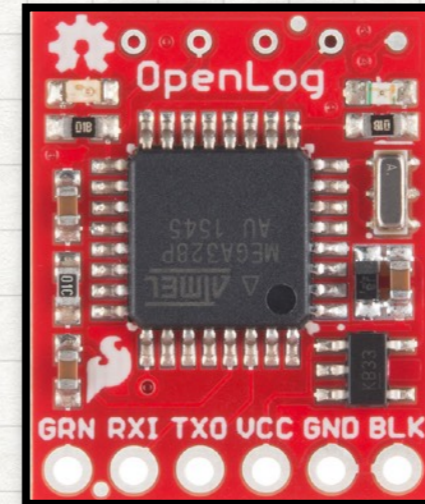
Challenges

Limitations

Expansion

Monitoring System: Expansion

- Fix errors associated with the data logger
- Implement Sparkfun Thing
- Automatic uploading and plotting of sensor data
- Battery powered/drop and go sensor



Problem

Sensors

Setup

Demo

Challenges

Limitations

Expansion