



Food Spy - Temperature Sensor Demo

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GOALS

- With regard to our Smart Fridge-project, my goal is to demonstrate the following:
 - The DHT sensor will read the ambient Temperature of an area (specifically the Fridge) with +/- 1 Degrees accuracy.
 - Deduce and notify the user whether temperature has risen to unsafe levels or has increased to an unsafe level for an extended period of time.



Tool Walkthrough

Source Code

Code foundation found in:

[DHT-sensor-library/DHTtester.ino at master · adafruit/DHT-sensor-library](#)

Since Arduino utilizes Setup
and Loop functions for
programming MCUs, the
source code will be presented
in the following:

1. Setup();
2. Loop();
3. Custom Function(s)

```
DHT dht(DHTPIN, DHTTYPE, 6);

//Variables associated with checking for frequ
unsigned int second_tick;//counts every 2 secc
unsigned int loop_tick; //counts every 15 minu
int change_tick; //tracks amount of changes in

//Variables associated with checking for Hi-Tc
unsigned int c_Second_tick;//counts every 2 se

int err_code; //if 0, no err; if 1, temperatur
bool hiTempAlert;

float t_old;//temperature of previous loop

void setup() {
    Serial.begin(9600);
    Serial.println("DHTxx test!");

    dht.begin();

    second_tick = 0;
    c_Second_tick = 0;
    change_tick = -1;//ignore first setting of t_old to t.
    hiTempAlert = false;
    err_code = 3; //set to value != 0-2
}
```

Variable Setup

1. Setup the DHT via function.
2. Declare time-based var.,
ticker, err-code, temperature
states and bool for
temperature alerts.

Code Initialization

3. Setup Function:
 - a. Begin Serial transmission
at 9600 Baud.
 - b. Begin DHT program
 - c. Initialize variables

```
void loop() {
/*
 * Measurement Phase
 */
// Wait a ~2 seconds between measurements
delay(2000); //2,000 = ~2 sec
second_tick = second_tick + 1;
if(second_tick >= 450){ //if 15 minutes
    second_tick = 0;
    loop_tick = loop_tick + 1;
}
if(loop_tick > 2){
    loop_tick = 0;
}

// Reading temperature or humidity takes about 250ms
// Sensor readings may also be up to 2 seconds
// Read temperature as Celsius
float t = dht.readTemperature();
```

Loop Function:

1. Create 2-second delay
2. Begin time-based ticker countdown
 - a. Used for frequency checks
 - b. Each “second-tick” is equivalent to ~ 2 seconds (caused by Delay)
 - c. 15 minute (aka 450 ticks)
3. Read Temperature from DHT.

```

/*
 * Measurement Verification Phase
 */

// Check if any reads failed and exit early (to try again).
if (isnan(t)) {
    Serial.println("Failed to read from DHT sensor!");
    return;
}

Serial.print(" - Temperature: ");
Serial.print(t);
Serial.print(" *C - ");
//Serial.print(f);
//Serial.print(" *F\t\t\n");

/*
 * Deduction Phase
 */
err_code = deduceError(t);
if(err_code == 0){}{}
    Serial.print("\n");
}
if( err_code == 1 ){
    Serial.print("Issue! - Temperature has risen above safe lev
    //duration check (15 minutes)
if( err_code == 2){
    Serial.print("Issue! - Temperature has changed by 5*C over
    //frequency check

} //end loop

```

Loop Function:

1. Determine if read temperature is ‘nan’
 - a. Display err if true.
2. Print temperature on Serial Monitor
 - a. Given ESP32’s going to be connected to Raspberry Pi, can have readings go directly to App back-end.
3. Execute Deduce error Function, and print based on result

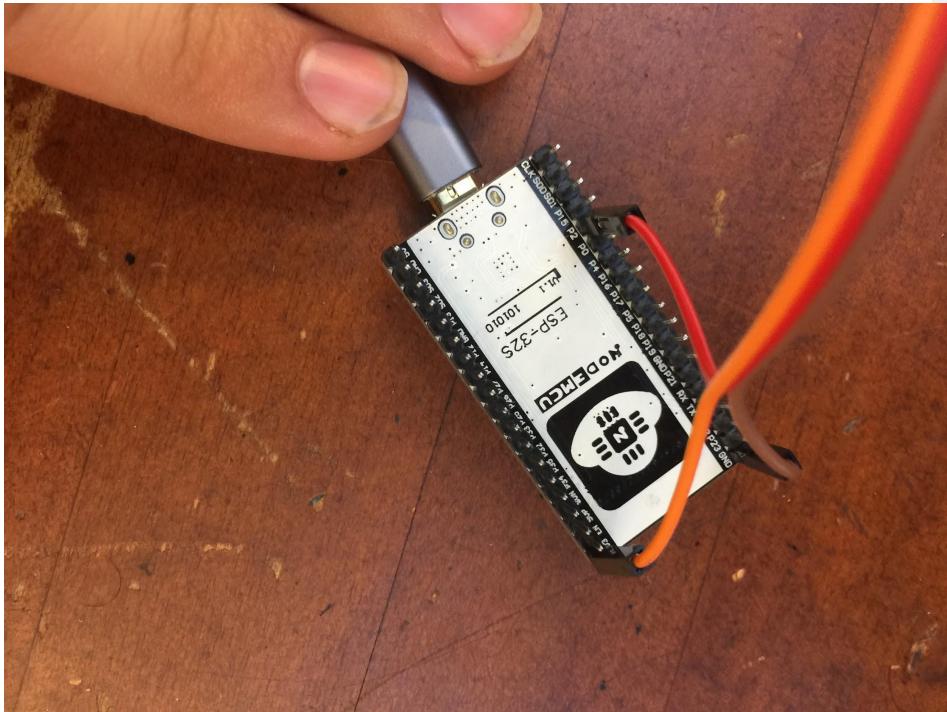


ESP32 - WROOM - 32D

A.K.A “Node MCU”,
which also appears as it’s own
variation in the Arduino IDE

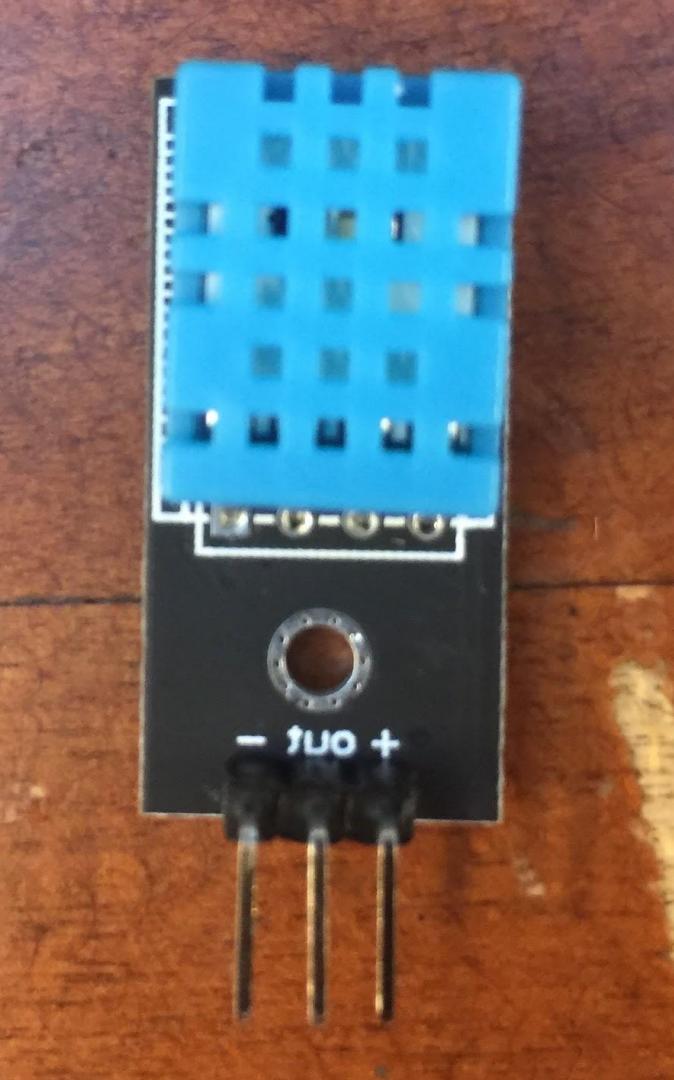
- Hybrid Bluetooth/WiFi Microcontroller (aka MCU)
- For this experiment, was chosen for its small size.
- Requires the sustained press of the “Boot” button (IO0 on the Node-MCU) for uploading code.
 - Will be discussed more in-depth in Experimentation Portion.
- 34 GPIO pins in total, but only one GPIO pin is utilized.

ESP32 - WROOM - 32D



Datasheet:

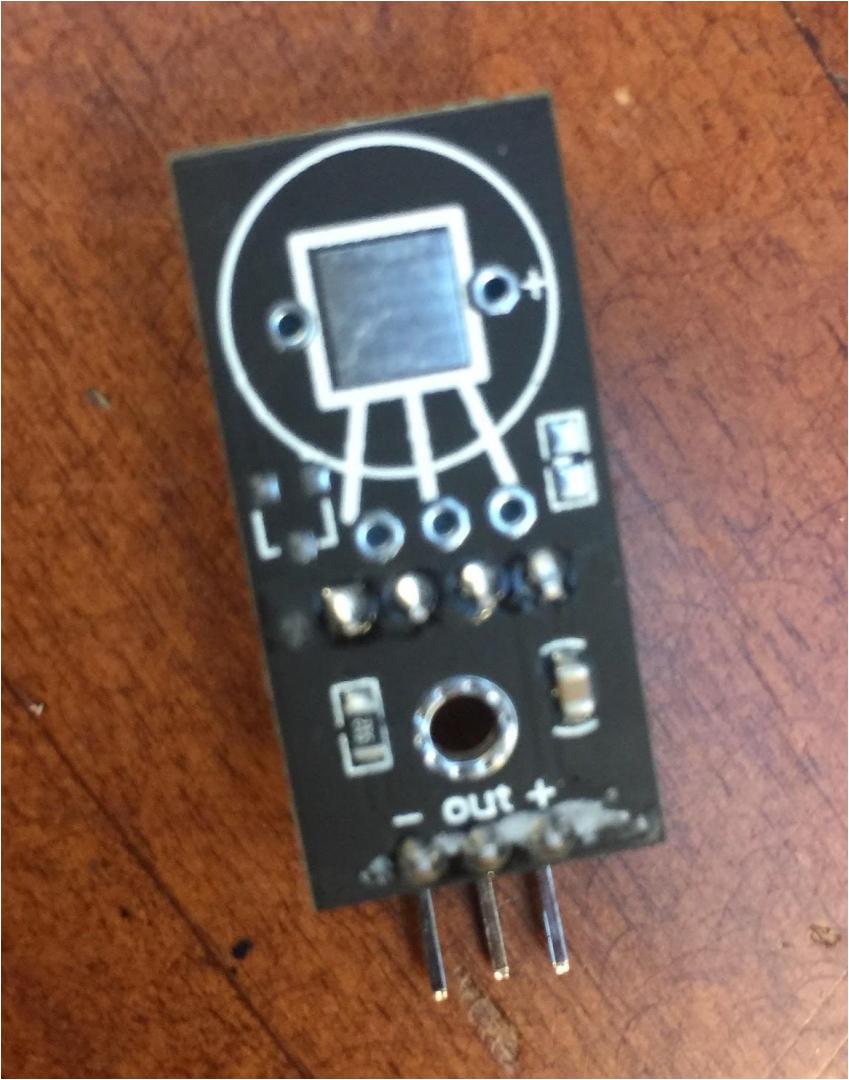
<https://drive.google.com/open?id=1hJcdxsTvX5iGDQEkZnTLFQHqwLgVSdgl>



DHT 11 - Digital Temp. Sensor

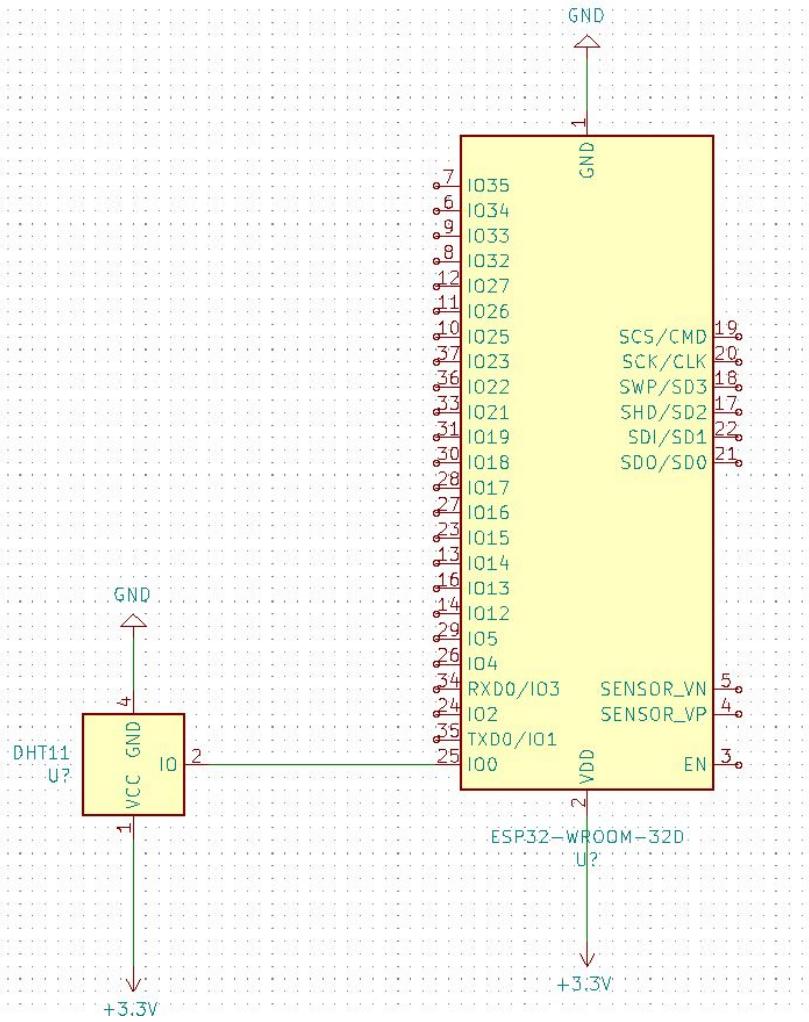
- Usually would have 4 pins, but came pre-soldered with 3.
- 3 Pins:
 - Vin - ~3.3 - 5V
 - Out: Pre-Calibrated Data Output from Sensor
 - Gnd
- 1 Degree Celsius/ 8 bit resolution
- 0-50 Degree Celsius measurement capacity

DHT-11



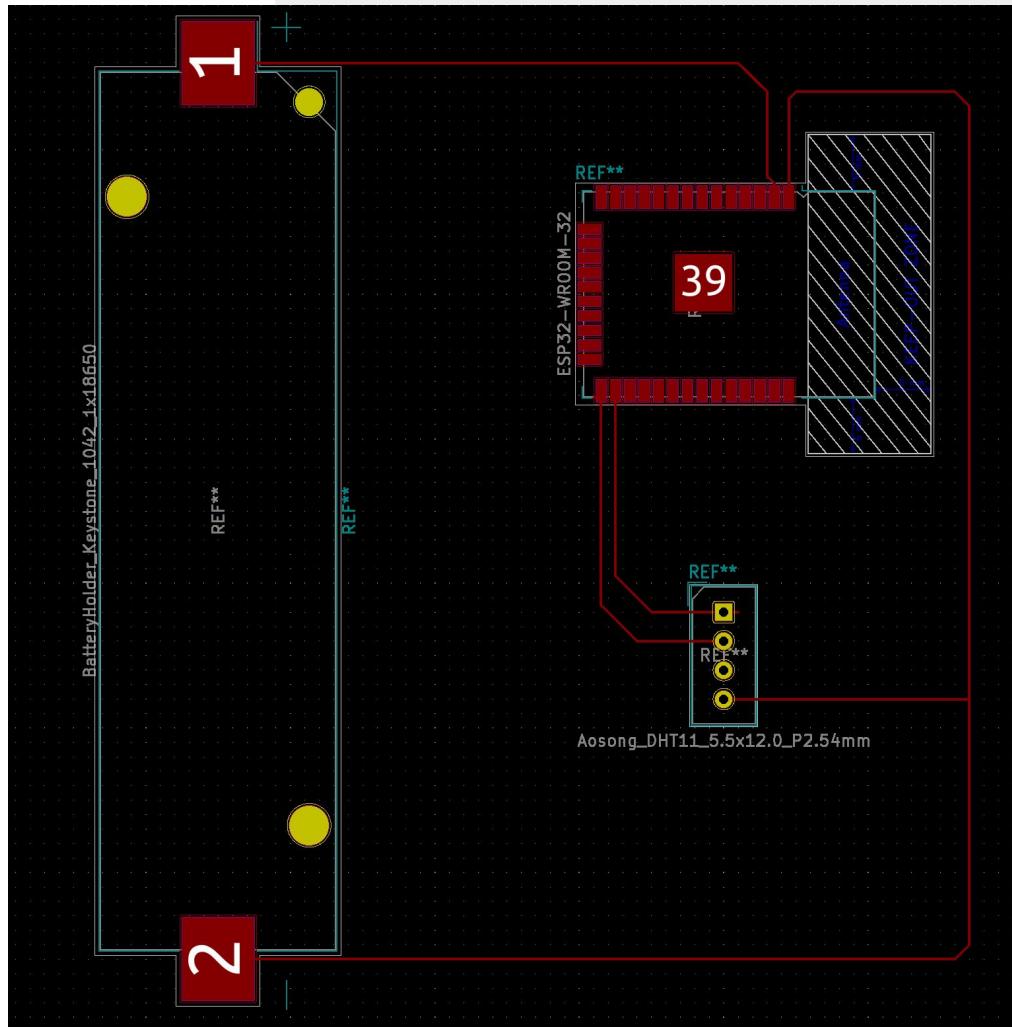
Datasheet:

https://drive.google.com/open?id=1Ry_9-7EGO1SqRgzWI25zvFgYo6G8Hs6O



Schematic (SENSOR AND ESP32)

PCB (Sensors/ ESP32 only)



Experimentation Time!

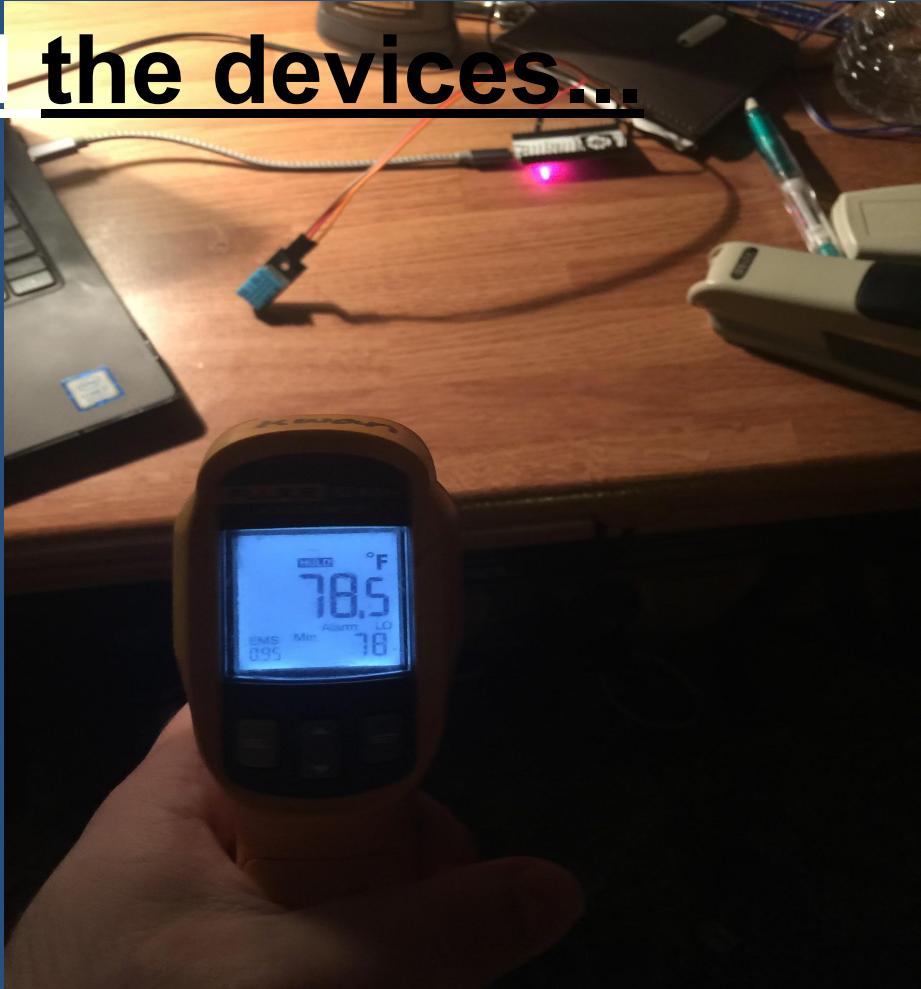
Now, to test...

1. Reading temperature
2. Signaling if Temperature is too high
3. Signaling if Temperature has fluctuated too much.



How I tested the devices...

- When I was home, I was only able to test if certain conditions were met, in what else, but my own fridge!
- But first, to test whether the sensor was functional, I had to compare the Laser-Thermometer to what the DHT read.





How I tested the devices...

- When I was home, I was only able to test if certain conditions were met, in what else, but my own fridge!
- But first, to test whether the sensor was functional, I had to compare the Laser-Thermometer to what the DHT read.
- Thermometer: 25.5556 - 27 Celsius
 - A.k.A 78 - 80 Fahrenheit
- DHT: 26 - 27 Celsius
 - A.k.A 79 - 80 Farenheit

```
00:41:48.589 -> - Temperature: 26.90 *C -  
00:41:50.444 -> - Temperature: 27.00 *C -  
00:41:52.456 -> - Temperature: 27.00 *C -  
00:41:54.486 -> - Temperature: 27.10 *C -  
00:41:56.492 -> - Temperature: 27.20 *C -  
00:41:58.541 -> - Temperature: 27.20 *C -  
00:42:00.558 -> - Temperature: 27.10 *C -  
00:42:02.569 -> - Temperature: 27.20 *C -  
00:42:04.624 -> - Temperature: 27.20 *C -  
00:42:06.655 -> - Temperature: 27.10 *C -  
00:42:08.658 -> - Temperature: 27.10 *C -  
00:42:10.671 -> - Temperature: 27.10 *C -  
00:42:12.718 -> - Temperature: 27.00 *C -  
00:42:14.728 -> - Temperature: 27.00 *C -  
00:42:16.756 -> - Temperature: 27.00 *C -  
00:42:18.774 -> - Temperature: 26.90 *C -  
00:42:20.800 -> - Temperature: 26.90 *C -  
00:42:22.818 -> - Temperature: 26.80 *C -  
00:42:24.837 -> - Temperature: 26.80 *C -  
00:42:26.876 -> - Temperature: 26.70 *C -  
00:42:28.899 -> - Temperature: 26.70 *C -  
00:42:30.927 -> - Temperature: 26.60 *C -
```

Now, for the Fridge test!

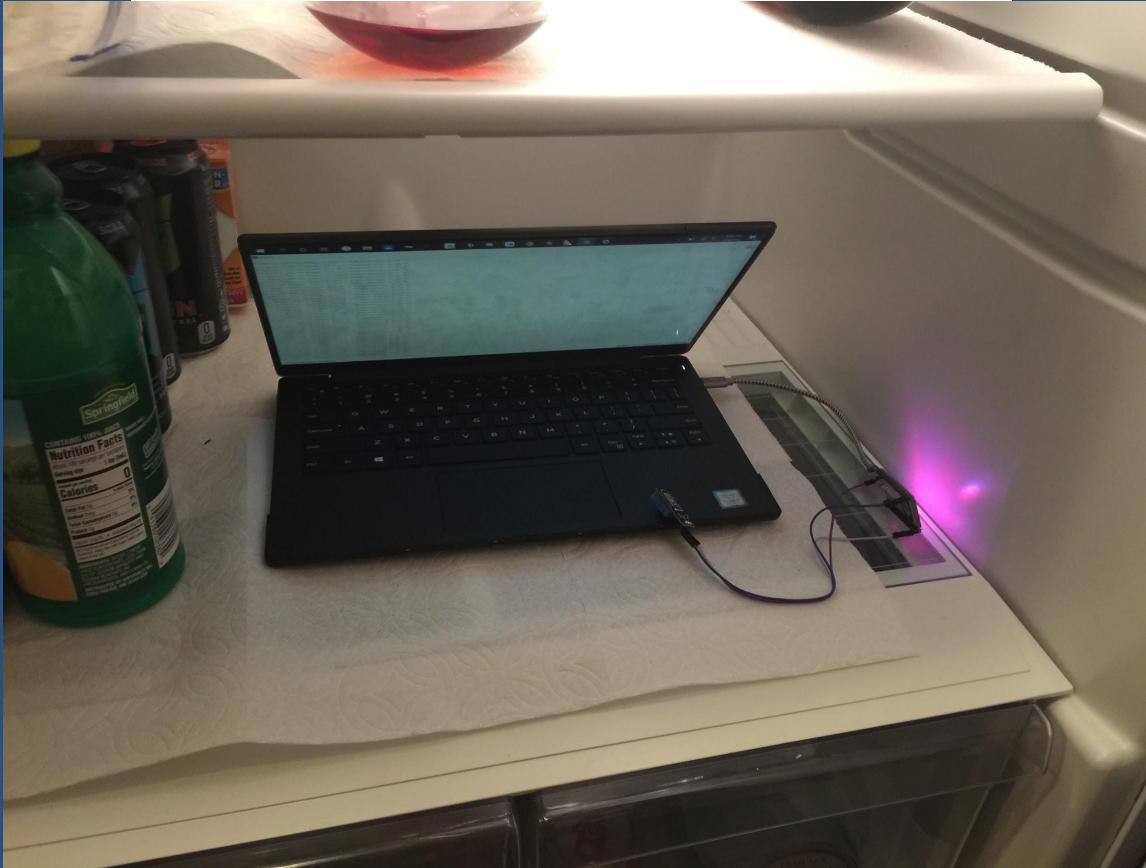
The idea is simple: Test whether the temperature in the device can measure the fridge temperature, and report if temperature has risen to high over extended period of time once OUTSIDE the Fridge.

And yes, the fridge will be closed.





The General Setup:





Alerts for High Temperature

- When I was home, I was only able to test if certain conditions were met, in what else, but my own fridge!
- But first, to test whether the sensor was functional, I had to compare the Laser-Thermometer to what the DHT read.



```
00:41:34.246 -> - Temperature: 25.70 *C -
00:41:36.262 -> - Temperature: 26.00 *C -
00:41:38.288 -> - Temperature: 26.20 *C -
00:41:40.300 -> - Temperature: 26.40 *C -
00:41:42.350 -> - Temperature: 26.50 *C -
00:41:44.354 -> - Temperature: 26.70 *C -
00:41:46.374 -> - Temperature: 26.80 *C -
00:41:48.389 -> - Temperature: 26.90 *C -
00:41:50.444 -> - Temperature: 27.00 *C -
00:41:52.456 -> - Temperature: 27.00 *C -
00:41:54.486 -> - Temperature: 27.10 *C -
00:41:56.492 -> - Temperature: 27.20 *C -
```

Alerts for High Temperature (1)

```
00:56:34.193 -> - Temperature: 22.40 *C -
00:56:36.258 -> - Temperature: 22.40 *C -
00:56:38.241 -> - Temperature: 22.30 *C -
00:56:40.276 -> - Temperature: 22.30 *C -
00:56:42.311 -> - Temperature: 22.30 *C -
00:56:44.337 -> - Temperature: 22.30 *C -
00:56:44.384 -> Issue! - Temperature has risen above safe levels for
over 15 minutes!
00:56:46.355 -> - Temperature: 22.30 *C -
00:56:48.390 -> - Temperature: 22.30 *C -
```

01:05:59.146 -> - Temperature: 19.20 *C
01:06:01.213 -> - Temperature: 19.10 *C
01:06:03.200 -> - Temperature: 19.10 *C
01:06:05.245 -> - Temperature: 19.10 *C
01:06:07.270 -> - Temperature: 19.10 *C
01:06:09.295 -> - Temperature: 19.00 *C

Alerts for High Temperature (2)

01:11:51.506 -> - Temperature: 14.80 *C -
01:11:53.517 -> - Temperature: 14.80 *C -
01:11:55.572 -> - Temperature: 14.80 *C -
01:11:57.569 -> - Temperature: 14.80 *C -
01:11:57.606 -> Issue! - Temperature has risen above safe levels for
over 15 minutes!
01:11:59.623 -> - Temperature: 14.80 *C -
01:12:01.605 -> - Temperature: 14.70 *C -
01:12:03.654 -> - Temperature: 14.70 *C -
01:12:05.658 -> - Temperature: 14.70 *C -

```
01:24:16.660 -> - Temperature: 10.70 *C -
01:24:18.681 -> - Temperature: 10.70 *C -
01:24:20.701 -> - Temperature: 10.60 *C -
01:24:22.751 -> - Temperature: 10.60 *C -
01:24:24.766 -> - Temperature: 10.60 *C -
01:24:26.775 -> - Temperature: 10.60 *C -
01:24:28.804 -> - Temperature: 10.60 *C -
01:24:30.848 -> - Temperature: 10.60 *C -
```

```
01:27:00.668 -> - Temperature: 10.00 *C -
01:27:02.699 -> - Temperature: 10.00 *C -
01:27:04.737 -> - Temperature: 10.00 *C -
01:27:06.766 -> - Temperature: 9.90 *C -
01:27:08.810 -> - Temperature: 9.90 *C -
01:27:10.824 -> - Temperature: 9.90 *C -
01:27:10.824 -> Issue! - Temperature has risen above safe levels for
over 15 minutes!
01:27:12.859 -> - Temperature: 9.90 *C -
01:27:14.865 -> - Temperature: 9.90 *C -
01:27:16.890 -> - Temperature: 9.90 *C -
01:27:18.934 -> - Temperature: 9.90 *C -
01:27:20.917 -> - Temperature: 9.90 *C -
```

Alerts for High Temperature **(3)**

Alerts for High Temperature **(4)**

01:43:16.721 -> - Temperature: 7.50 *C -
01:43:18.747 -> - Temperature: 7.50 *C -
01:43:20.731 -> - Temperature: 7.50 *C -
01:43:22.783 -> - Temperature: 7.50 *C -
01:43:24.794 -> - Temperature: 7.50 *C -
01:43:26.811 -> - Temperature: 7.50 *C -
01:43:28.872 -> - Temperature: 7.50 *C -
01:43:30.873 -> - Temperature: 7.50 *C -
01:43:32.899 -> - Temperature: 7.50 *C -

01:49:51.583 -> - Temperature: 6.90 *C -
01:49:53.576 -> - Temperature: 6.90 *C -
01:49:55.624 -> - Temperature: 6.90 *C -
01:49:57.619 -> - Temperature: 6.80 *C -
01:49:59.640 -> - Temperature: 6.80 *C -
01:50:01.676 -> - Temperature: 6.80 *C -
01:50:03.693 -> - Temperature: 6.80 *C -
01:50:05.714 -> - Temperature: 6.80 *C -
01:50:07.783 -> - Temperature: 6.80 *C -
01:50:09.772 -> - Temperature: 6.80 *C -

Alerts for High Temperature **(5)**

□ 01:56:22.358 -> - Temperature: 6.90 *C -
01:56:24.418 -> - Temperature: 6.90 *C -
01:56:26.401 -> - Temperature: 6.90 *C -
01:56:28.452 -> - Temperature: 6.90 *C -
01:56:30.462 -> - Temperature: 6.90 *C -
01:56:32.490 -> - Temperature: 6.90 *C -
01:56:34.513 -> - Temperature: 6.90 *C -
01:56:36.554 -> - Temperature: 6.90 *C -
01:56:38.594 -> - Temperature: 6.90 *C -
01:56:40.617 -> - Temperature: 6.90 *C -
01:56:42.642 -> - Temperature: 6.90 *C -
01:56:44.634 -> - Temperature: 7.00 *C -
01:56:46.690 -> - Temperature: 7.00 *C -
01:56:48.715 -> - Temperature: 7.20 *C -
01:56:50.698 -> - Temperature: 7.30 *C -
01:56:52.746 -> - Temperature: 7.40 *C -
01:56:54.761 -> - Temperature: 7.50 *C -
01:56:56.806 -> - Temperature: 7.70 *C -
01:56:58.844 -> - Temperature: 7.80 *C -
01:57:00.853 -> - Temperature: 7.90 *C -



Alerts for High Change Freq. (1)

- As you have seen, temperature change is extremely slow, but can be accurate once given enough time.
- Now, to test this feature, this required the placement of the sensor (and laptop) in the freezer.

```
08:17:39.255 -> - Temperature: 22.90 *C -
08:17:41.273 -> - Temperature: 23.00 *C -
08:17:43.330 -> - Temperature: 23.30 *C -
08:17:45.345 -> - Temperature: 23.60 *C -
08:17:47.349 -> - Temperature: 23.70 *C -
08:17:49.387 -> - Temperature: 23.90 *C -
08:17:51.405 -> - Temperature: 24.00 *C -
08:17:53.462 -> - Temperature: 24.10 *C -
08:17:55.486 -> - Temperature: 24.20 *C -
08:17:57.486 -> - Temperature: 24.20 *C -
08:17:59.537 -> - Temperature: 24.30 *C -
08:18:01.534 -> - Temperature: 24.20 *C -
08:18:03.560 -> - Temperature: 24.20 *C -
08:18:05.598 -> - Temperature: 24.20 *C -
08:18:07.591 -> - Temperature: 24.20 *C -
08:18:09.627 -> - Temperature: 24.20 *C -
08:18:11.649 -> - Temperature: 24.20 *C -
08:18:13.709 -> - Temperature: 24.20 *C -
08:18:15.708 -> - Temperature: 24.20 *C -
08:18:17.722 -> - Temperature: 24.20 *C -
08:18:19.785 -> - Temperature: 24.20 *C -
08:18:21.810 -> - Temperature: 24.10 *C -
08:18:23.834 -> - Temperature: 24.10 *C -
08:18:25.817 -> - Temperature: 24.10 *C -
08:18:27.852 -> - Temperature: 24.00 *C -
08:18:29.909 -> - Temperature: 23.90 *C -
08:18:31.898 -> - Temperature: 23.90 *C -
08:18:33.958 -> - Temperature: 23.90 *C -
08:18:35.956 -> - Temperature: 23.90 *C -
08:18:38.010 -> - Temperature: 23.80 *C -
08:18:40.005 -> - Temperature: 23.70 *C -
08:18:42.033 -> - Temperature: 23.70 *C -
08:18:44.041 -> - Temperature: 23.70 *C -
```



Alerts for High Change Freq. (2)

08:26:13.613 -> - Temperature: 2.30 *C -
08:26:15.615 -> - Temperature: 2.20 *C -
08:26:17.624 -> - Temperature: 2.00 *C -
08:26:19.665 -> - Temperature: 1.90 *C -
08:26:21.679 -> - Temperature: 1.80 *C -
08:26:23.702 -> - Temperature: 1.70 *C -
08:26:25.730 -> - Temperature: 1.60 *C -
08:26:27.751 -> - Temperature: 1.50 *C -
08:26:29.780 -> - Temperature: 1.40 *C -
08:26:31.819 -> - Temperature: 1.20 *C -
08:26:33.853 -> - Temperature: 1.10 *C -
08:26:35.890 -> - Temperature: 1.00 *C -
08:26:37.913 -> - Temperature: 0.90 *C -
08:26:39.898 -> - Temperature: 0.80 *C -
08:26:41.941 -> - Temperature: 0.70 *C -
08:26:43.969 -> - Temperature: 0.60 *C -
08:26:45.986 -> - Temperature: 0.50 *C -
08:26:48.039 -> - Temperature: 0.40 *C -
08:26:50.032 -> - Temperature: 0.30 *C -
08:26:52.065 -> - Temperature: 0.20 *C -
08:26:54.084 -> - Temperature: 0.00 *C -
08:26:56.140 -> - Temperature: -0.90 *C -
08:26:58.145 -> - Temperature: -0.80 *C -
08:27:00.159 -> - Temperature: -0.70 *C -
08:27:02.190 -> - Temperature: -0.60 *C -
08:27:04.208 -> - Temperature: -0.50 *C -
08:27:06.264 -> - Temperature: -0.50 *C -
08:27:08.259 -> - Temperature: -0.40 *C -
08:27:10.294 -> - Temperature: -0.30 *C -
08:27:12.317 -> - Temperature: -0.20 *C -
08:27:14.365 -> - Temperature: -0.10 *C -
08:27:16.377 -> - Temperature: -0.10 *C -
08:27:18.395 -> - Temperature: -0.00 *C -

08:29:01.685 -> - Temperature: -4.50 *C -
08:29:03.678 -> - Temperature: -4.40 *C -
08:29:05.702 -> - Temperature: -4.30 *C -
08:29:07.760 -> - Temperature: -4.30 *C -
08:29:09.751 -> - Temperature: -4.20 *C -
08:29:11.809 -> - Temperature: -4.20 *C -
08:29:13.813 -> - Temperature: -4.10 *C -
08:29:15.847 -> - Temperature: -6.00 *C -
08:29:17.874 -> - Temperature: -6.00 *C -
08:29:19.872 -> - Temperature: -5.90 *C -
08:29:21.935 -> - Temperature: -5.80 *C -
08:29:23.956 -> - Temperature: -5.80 *C -
08:29:25.983 -> - Temperature: -5.80 *C -
08:29:28.009 -> - Temperature: -5.80 *C -
08:29:30.017 -> - Temperature: -5.80 *C -
08:29:32.014 -> - Temperature: -5.90 *C -
08:29:34.083 -> - Temperature: -5.90 *C -
08:29:36.107 -> - Temperature: -4.10 *C -
08:29:38.133 -> - Temperature: -4.30 *C -
08:29:40.127 -> - Temperature: -4.50 *C -
08:29:42.150 -> - Temperature: -4.60 *C -
08:29:44.181 -> - Temperature: -4.80 *C -
08:29:46.203 -> - Temperature: -5.00 *C -
08:29:48.221 -> - Temperature: -3.30 *C -
08:29:50.239 -> - Temperature: -3.50 *C -
08:29:52.278 -> - Temperature: -3.70 *C -
08:29:54.334 -> - Temperature: -3.90 *C -
08:29:56.318 -> - Temperature: -2.20 *C -
08:29:58.387 -> - Temperature: -2.30 *C -
08:30:00.388 -> - Temperature: -2.50 *C -
08:30:02.410 -> - Temperature: -2.70 *C -
08:30:04.415 -> - Temperature: -2.90 *C -
08:30:06.455 -> - Temperature: -3.00 *C -

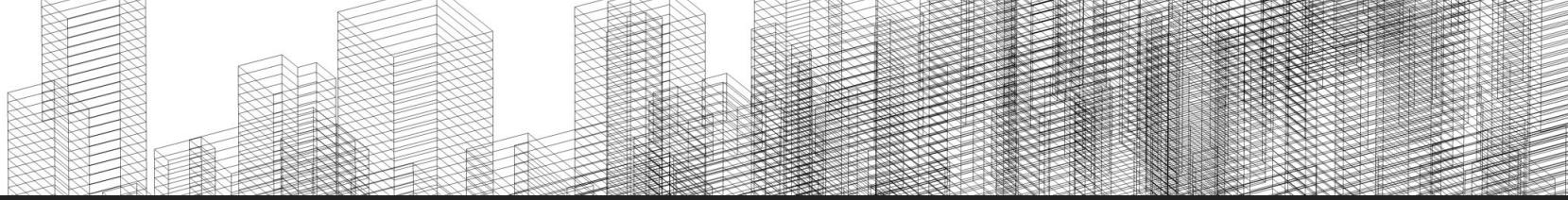
08:34:11.460 -> - Temperature: 12.30 *C
08:34:13.497 -> - Temperature: 12.40 *C
08:34:15.515 -> - Temperature: 12.40 *C
08:34:17.541 -> - Temperature: 12.50 *C
08:34:19.583 -> - Temperature: 12.60 *C
08:34:21.612 -> - Temperature: 12.60 *C
08:34:23.648 -> - Temperature: 12.70 *C
08:34:25.632 -> - Temperature: 12.70 *C
08:34:27.681 -> - Temperature: 12.70 *C
08:34:29.691 -> - Temperature: 12.90 *C
08:34:31.747 -> - Temperature: 12.90 *C
08:34:33.736 -> - Temperature: 12.90 *C
08:34:35.765 -> - Temperature: 13.00 *C
08:34:37.794 -> - Temperature: 13.10 *C
08:34:39.803 -> - Temperature: 13.10 *C
08:34:41.829 -> - Temperature: 13.20 *C
08:34:43.875 -> - Temperature: 13.20 *C
08:34:45.901 -> - Temperature: 13.20 *C
08:34:47.903 -> - Temperature: 13.30 *C
08:34:49.936 -> - Temperature: 13.30 *C
08:34:51.997 -> - Temperature: 13.40 *C
08:34:53.993 -> - Temperature: 13.40 *C
08:34:56.003 -> - Temperature: 13.50 *C
08:34:58.039 -> - Temperature: 13.50 *C
08:35:00.069 -> - Temperature: 13.60 *C
08:35:02.090 -> - Temperature: 13.60 *C
08:35:04.147 -> - Temperature: 13.70 *C
08:35:06.145 -> - Temperature: 13.70 *C
08:35:08.169 -> - Temperature: 13.70 *C
08:35:10.220 -> - Temperature: 13.80 *C
08:35:12.207 -> - Temperature: 13.80 *C
08:35:14.273 -> - Temperature: 13.90 *C
08:35:16.262 -> - Temperature: 13.90 *C

Alerts for High Change Freq. (3)

08:38:10.395 -> - Temperature: 0.90 *C -
08:38:12.434 -> - Temperature: 0.70 *C -
08:38:14.488 -> - Temperature: 0.50 *C -
08:38:16.487 -> - Temperature: 0.30 *C -
08:38:18.509 -> - Temperature: 0.10 *C -
08:38:20.522 -> - Temperature: -0.90 *C -
08:38:22.590 -> - Temperature: -0.70 *C -
08:38:24.585 -> - Temperature: -0.50 *C -
08:38:26.617 -> - Temperature: -0.30 *C -
08:38:28.665 -> - Temperature: -0.20 *C -
08:38:30.673 -> - Temperature: -2.00 *C -
08:38:32.729 -> - Temperature: -1.90 *C -
08:38:34.716 -> - Temperature: -1.70 *C -
08:38:36.731 -> - Temperature: -1.50 *C -
08:38:38.756 -> - Temperature: -1.40 *C -
08:38:40.802 -> - Temperature: -1.20 *C -
08:38:42.812 -> - Temperature: -1.10 *C -
08:38:44.826 -> - Temperature: -2.90 *C -
08:38:46.856 -> - Temperature: -2.80 *C -
08:38:48.870 -> - Temperature: -2.70 *C -
08:38:50.906 -> - Temperature: -2.50 *C -
08:38:52.947 -> - Temperature: -2.40 *C -
08:38:54.987 -> - Temperature: -2.30 *C -
08:38:56.987 -> - Temperature: -2.10 *C -
08:38:58.999 -> - Temperature: -4.00 *C -
08:39:01.062 -> - Temperature: -3.90 *C -
08:39:03.052 -> - Temperature: -3.70 *C -
08:39:05.076 -> - Temperature: -3.60 *C -
08:39:07.137 -> - Temperature: -3.50 *C -
08:39:09.133 -> - Temperature: -3.30 *C -
08:39:11.161 -> - Temperature: -3.20 *C -
08:39:13.191 -> - Temperature: -3.10 *C -
08:39:15.236 -> - Temperature: -4.90 *C -

08:42:45.828 -> - Temperature: 6.60 *C -
08:42:47.852 -> - Temperature: 6.70 *C -
08:42:49.877 -> - Temperature: 6.80 *C -
08:42:51.901 -> - Temperature: 6.90 *C -
08:42:53.927 -> - Temperature: 6.90 *C -
08:42:55.908 -> - Temperature: 7.00 *C -
08:42:57.957 -> - Temperature: 7.10 *C -
08:42:59.973 -> - Temperature: 7.10 *C -
08:43:02.000 -> - Temperature: 7.20 *C -
08:43:04.014 -> - Temperature: 7.30 *C -
08:43:06.052 -> - Temperature: 7.30 *C -
08:43:08.102 -> - Temperature: 7.40 *C -
08:43:10.094 -> - Temperature: 7.50 *C -
08:43:12.114 -> - Temperature: 7.60 *C -
08:43:14.179 -> - Temperature: 7.60 *C -
08:43:16.202 -> - Temperature: 7.70 *C -
08:43:18.209 -> - Temperature: 7.70 *C -
08:43:20.227 -> - Temperature: 7.80 *C -
08:43:22.276 -> - Temperature: 7.90 *C -
08:43:24.285 -> - Temperature: 7.90 *C -
08:43:26.313 -> - Temperature: 8.00 *C -
08:43:28.314 -> - Temperature: 8.10 *C -
08:43:30.375 -> - Temperature: 8.10 *C -
08:43:32.400 -> - Temperature: 8.20 *C -
08:43:34.406 -> - Temperature: 8.20 *C -
08:43:36.452 -> - Temperature: 8.30 *C -
08:43:38.434 -> - Temperature: 8.30 *C -
08:43:40.462 -> - Temperature: 8.40 *C -
08:43:42.524 -> - Temperature: 8.40 *C -
08:43:44.506 -> - Temperature: 8.50 *C -
08:43:46.539 -> - Temperature: 8.60 *C -
08:43:48.567 -> - Temperature: 8.60 *C -

08:46:50.843 -> - Temperature: 1.60 *C -
08:46:52.851 -> - Temperature: 1.40 *C -
08:46:54.860 -> - Temperature: 1.20 *C -
08:46:56.890 -> - Temperature: 1.10 *C -
08:46:58.916 -> - Temperature: 0.90 *C -
08:47:00.956 -> - Temperature: 0.70 *C -
08:47:02.981 -> - Temperature: 0.60 *C -
08:47:05.006 -> - Temperature: 0.40 *C -
08:47:06.999 -> - Temperature: 0.20 *C -
08:47:09.041 -> - Temperature: 0.10 *C -
08:47:11.092 -> - Temperature: 0.00 *C -
08:47:13.104 -> - Temperature: -0.80 *C -
08:47:15.144 -> - Temperature: -0.70 *C -
08:47:17.167 -> - Temperature: -0.50 *C -
08:47:19.193 -> - Temperature: -0.40 *C -
08:47:21.197 -> - Temperature: -0.30 *C -
08:47:23.242 -> - Temperature: -0.20 *C -
08:47:25.268 -> - Temperature: -0.10 *C -
08:47:27.292 -> - Temperature: -2.00 *C -
08:47:29.291 -> - Temperature: -1.80 *C -
08:47:31.343 -> - Temperature: -1.70 *C -
08:47:33.331 -> - Temperature: -1.60 *C -
08:47:35.351 -> - Temperature: -1.50 *C -
08:47:37.418 -> - Temperature: -1.40 *C -
08:47:39.418 -> - Temperature: -1.30 *C -
08:47:41.451 -> - Temperature: -1.20 *C -
08:47:43.469 -> - Temperature: -1.10 *C -
08:47:45.473 -> - Temperature: -3.00 *C -
08:47:47.531 -> - Temperature: -2.80 *C -
08:47:49.540 -> - Temperature: -2.70 *C -
08:47:51.567 -> - Temperature: -2.60 *C -
08:47:53.582 -> - Temperature: -2.50 *C -
08:47:55.603 -> - Temperature: -2.40 *C -
08:47:57.639 -> - Temperature: -2.30 *C -



RESULTS

Regarding Hi-Temp Alerts:

- While successful, this does bring the question: how often should we display the error?
 - Currently, the alert is triggered every 15 minutes.

Regarding Hi-Freq. Checks:

- Given the slow update of the temperature as a whole, this doesn't seem viable with the current equipment.
- In addition, the opening/closing of the door (repeatedly) doesn't trigger the sensor quickly enough to cause significant temp. Drop
- Conclusion: shift alert to a possible motion sensor element.

For our Project...

- The Frequency System needs an alternate method for temperature drop frequency (if the implied reason is door open/close).
- Since the ESP32 can be connected to the Raspberry Pi, this can be utilized to easily print data from each report and have the Pi read a file/data and trigger a display on the app.

References

All links used for reference, research, and assistance:

1. <https://github.com/adafruit/DHT-sensor-library/blob/master/examples/DHTtester/DHTtester.ino>
2. <https://drive.google.com/file/d/1hJcdxsTvX5iGDQEkZnTLFQHqwLgVSdgl/view?usp=sharing>
3. https://drive.google.com/open?id=1Ry_9-7EGO1SqRgzWI25zvFgYo6G8Hs6O



Any Questions?