

MONITORING THERMAL COMFORT

Combine an input and output device together and collect data for an activity connected to you.

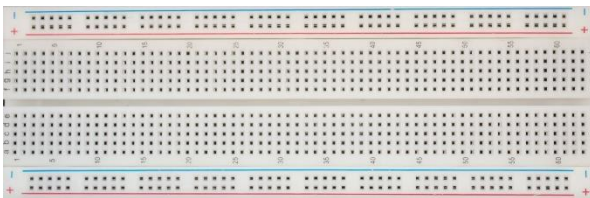
The main aim of this model is to monitor thermal comfort of patients put in quarantine centres so as to maintain appropriate ventilation in those spaces. This model involves creating a temperature and humidity monitor which shows whether a space is comfortable or not by just getting a signal from the colour of the glowing LED.

Components Used:

- Arduino UNO



- Breadboard



- DHT11 temperature and humidity sensor



DHT11 is a digital Humidity and Temperature Sensor, which consists of a resistive type Humidity Sensor, an NTC Type Temperature Sensor and an 8-bit Microcontroller. It can measure Humidity in the range of 20% to 80% Relative Humidity and temperatures in the range of 0deg C to 50deg C.

- 10k ohm resistor



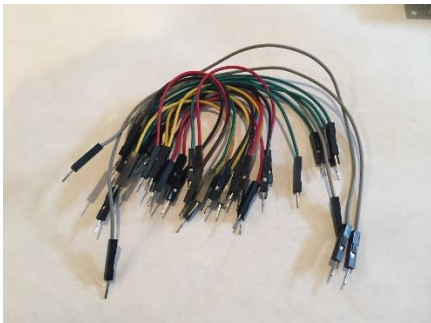
- USB A-B cable



- Red and green LEDs



- Jumper wires



All the hardware components are purchased from Amazon.in.

Please document the steps.

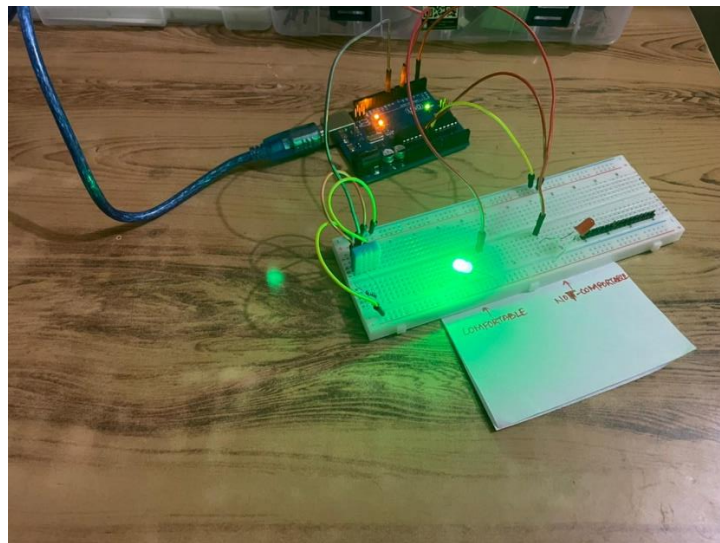
Steps involved:

Connection done as below on the breadboard:

- 1) DHT11-
 - a. Pin1- Vcc
 - b. Pin2- Arduino pin 9
 - c. Pin3- No Connection
 - d. Pin 4- Gnd
- 2) 10K ohm resistor- between pin 1 and 2 of the DHT11

- 3) Arduino:
 - a. Pin 9 – Connected to DHT11
 - b. Pin 3- to Positive terminal of Green LED
 - c. Pin 2- to Positive terminal of Red LED
- 4) LEDs- Positive terminal connected to Arduino as above and negative to Gnd.
- 5) Vcc line of Breadboard connected to 5V on Arduino.
- 6) Gnd line of Breadboard connect to Gnd pin of Arduino.
- 7) Arduino is connected to Laptop using the USB port for code upload and viewing Serial Output.

All the components are connected to Arduino as shown in the figure below:



Analyze that data and make sense of it.

Working Mechanism:

The model follows the logic that:

- If the temperature of the room, **18 deg Celsius $\leq t \leq 28$ deg Celsius,**
AND
- If the relative humidity of the room, **30% $\leq t \leq 60$ %,**

It implies that the room has the temperature within thermal comfort range, the **green** LED is given HIGH command and it glows, signalling the incharge the room environment is comfortable.

- If the temperature of the room, **28 deg Celsius $\leq t$ or $t \leq 18$ deg Celsius,**
AND/OR
- If the relative humidity of the room, **60% $\leq t$ or $t \leq 30$ %,,**

It implies that the room has the temperature within thermal comfort range, the **red** LED is given HIGH command and it glows, signalling the incharge the room environment is not comfortable and additional ventilation/cooling needs to be provided.

Testing:

Step 1: As soon as the code is uploaded to Arduino, the green LED glows as the room temperature and relative humidity at that point as seen in the serial monitor is found to be 27 deg Celsius and 48% respectively. During this period, the room air conditioner was operating at setpoint of 26 deg Celsius.

Step 2: The AC is switched off. A lighted matchstick is brought near the sensor for a few seconds. The green LED stops glowing and at that very instant the red LED glows. It seen through the serial monitor that the temperature at that instant detected by DHT11 is 33 deg Celsius.

The testing was successful!!!! 😊

Please also upload the codes used

Source Code:

```
#include <SimpleDHT.h>
#include <Wire.h>
#include <DHT.h>

#define DHTPIN 9
#define DHTTYPE DHT11
#define CPIN 3
#define NCPIN 2
DHT dht(DHTPIN, DHTTYPE);

void setup() {
  Serial.begin(115200);
  pinMode(CPIN,OUTPUT);
  pinMode(NCPIN,OUTPUT);
  dht.begin();
}

void loop() {
  delay(500);
  int h = dht.readHumidity();
  int t = dht.readTemperature();

  Serial.print("Humidity- ");
  Serial.print(h);
  Serial.println("%");
  Serial.print("Temperature- ");
  Serial.print(t);
  Serial.println("`C");
```

```

if((t>=18) && (t<=28))
{
Serial.println("Temperature in Comfort Zone");
if((h>=30) && (h<=60))
{
Serial.println("Humidity in Comfort Zone");
digitalWrite(CPIN,HIGH);
digitalWrite(NCPIN,LOW);
return;
}
}
digitalWrite(CPIN,LOW);
digitalWrite(NCPIN,HIGH);
return;
}

```

Challenges faced:

1. Initially my program was not compiling due to absence of DHT library which kept on showing error message. This was later resolved by installing the library.
2. While uploading the sketch to board, I was getting the following error message:
System wide configuration file is "C:\Program Files\WindowsApps\ArduinoLLC.ArduinoIDE_1.8.49.0_x86__mdqgnx93n4wtt\hardware\tools\avr/etc/avrdude.conf"

After reading the troubleshooting documents of Arduino, I found out that my Arduino board was faulty. Once I changed it, I was successfully able to upload the sketch and execute the code.

3. The jumper wires after executing the code got short. So, it was time taking to determine, why the code stopped executing. Once I found that out, the code was tested and did not face any other issue.