Electronics and Telecommunications Measurements

Project

Facultatea de Electronică,
Telecomunicații și
Tehnologia Informației

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Group: 2023

TECHNICAL UNIVERSITY
OF CLUJ-NAPOCA
ROMANIA

Temperature and Humidity monitoring system

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1. THEORETICAL PART

1.1 Arduino

Arduino is an open-source electronics platform based on easy-to-use hardware and software. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. [1]

1.2 Our circuit

Our circuit automates the control of temperature and humidity in rooms. The temperature and humidity of the air are read by a temperature and humidity sensor named DHT11 which has an operating voltage between 3.5V and 5.5V, a temperature range of 0°C to 50°C and humidity range of 20% to 90% with an accuracy of ±1°C and ±1%. [2]

1. THEORETICAL PART

1.3 What is relative humidity?

The DHT11 measures relative humidity. Relative humidity is the amount of water vapor in air vs. the saturation point of water vapor in air.

The saturation point changes with air temperature.

The formula to calculate relative humidity is:

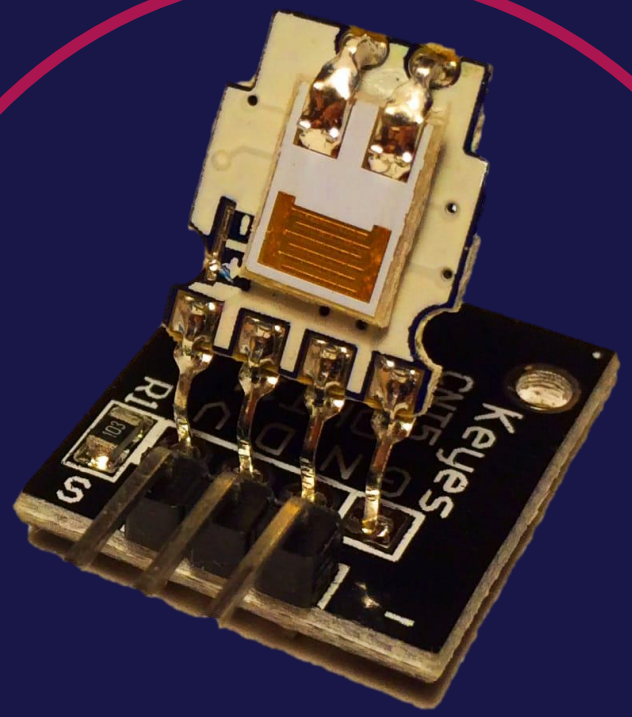
$$RH = \frac{\rho_w}{\rho_s} * 100\%$$

RH – Relative Humidity
ρ_w – Density of water vapor
ρ_s – Density of water vapor at saturation

1. THEORETICAL PART

1.4 How the DHT11 measures humidity and temperature?

- The DHT11 detects water vapor by measuring the electrical resistance between two electrodes;
- When water vapor is absorbed by the substrate, ions are released by the substrate which increases the conductivity between the electrodes;
- The change in resistance between the two electrodes is proportional to the relative humidity;
- The DHT11 measures temperature with a surface mounted NTC temperature sensor (thermistor) built into the unit.



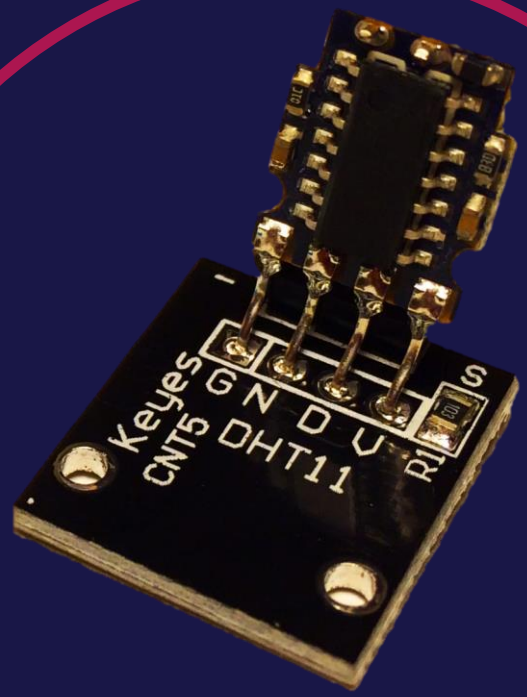
Front view with cover removed

1. THEORETICAL PART

1.4 How the DHT11 measures humidity and temperature?

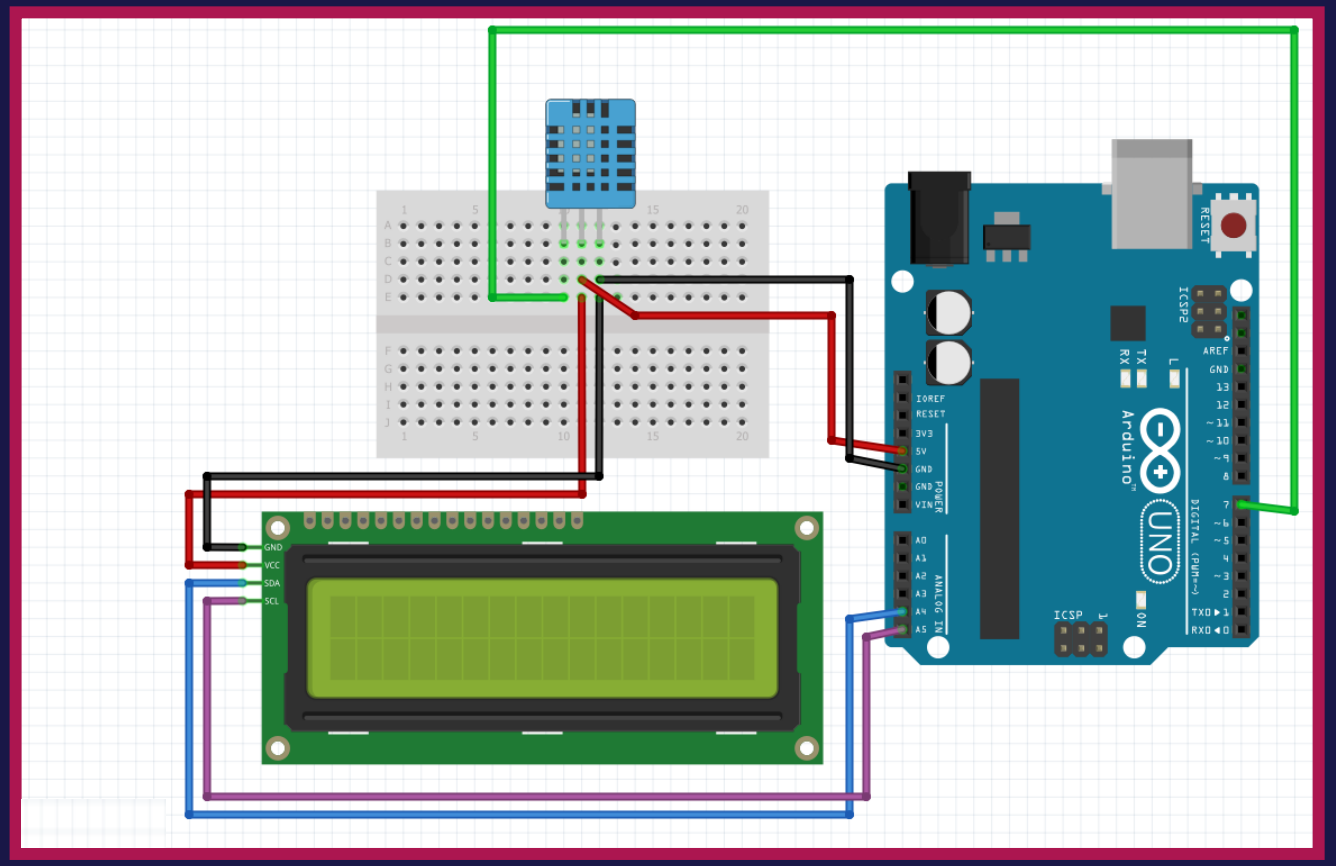
- An Integrated Circuit mounted on the back of the unit converts the resistance measurement to relative humidity. It also stores the calibration coefficients, and controls the data signal transmission between the DHT11 and the Arduino;

- The DHT11 uses just one signal wire to transmit data to the Arduino.



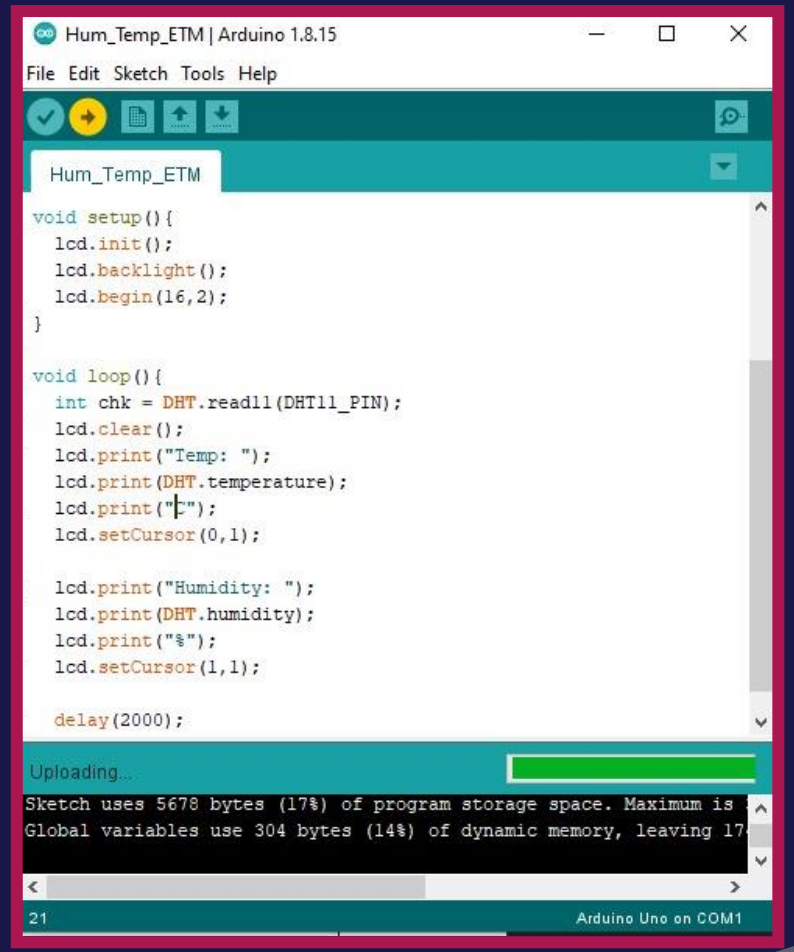
Rear view with cover removed [3]

2. CIRCUIT DIAGRAM



3. CODE FROM ARDUINO

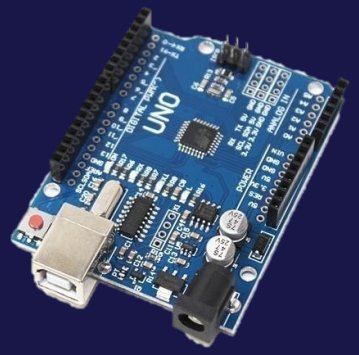
```
#include <dht.h>
#include <Wire.h>
#include<LiquidCrystal_I2C.h>

LiquidCrystal_I2C lcd(0x27, 16, 2); // I2C address 0x27, 16 column and 2 rows
dht DHT;

#define DHT11_PIN 7
void setup() {
    lcd.init(); // initialize the lcd
    lcd.backlight(); // open the backlight
    lcd.begin(16,2);
}

void loop() {
    int chk = DHT.read11(DHT11_PIN);
    lcd.clear();  lcd.print("Temp: "); // print the temperature
    lcd.print(DHT.temperature);
    lcd.setCursor(0,1); // start to print at the second row
    lcd.print("Humidity: "); // print the humidity
    lcd.print(DHT.humidity);
    delay(2000); // wait a few seconds between measurements
}
```



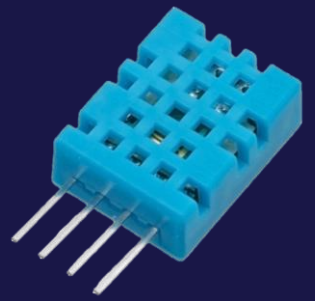
4. COMPONENTS REQUIRED

The project was implemented using:

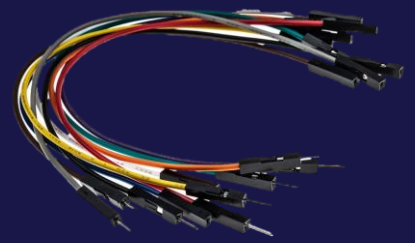
Arduino Uno R3 board



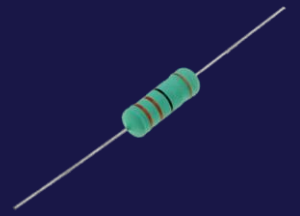
DHT11 Temperature & Humidity Sensor (4 pins)



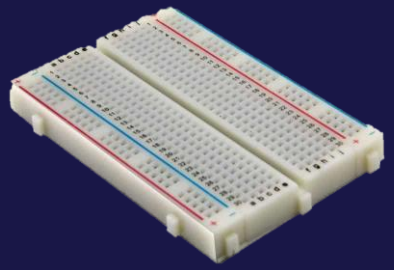
Jumper Wires



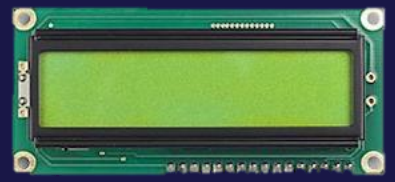
10 kΩ Resistor



Breadboard (generic)



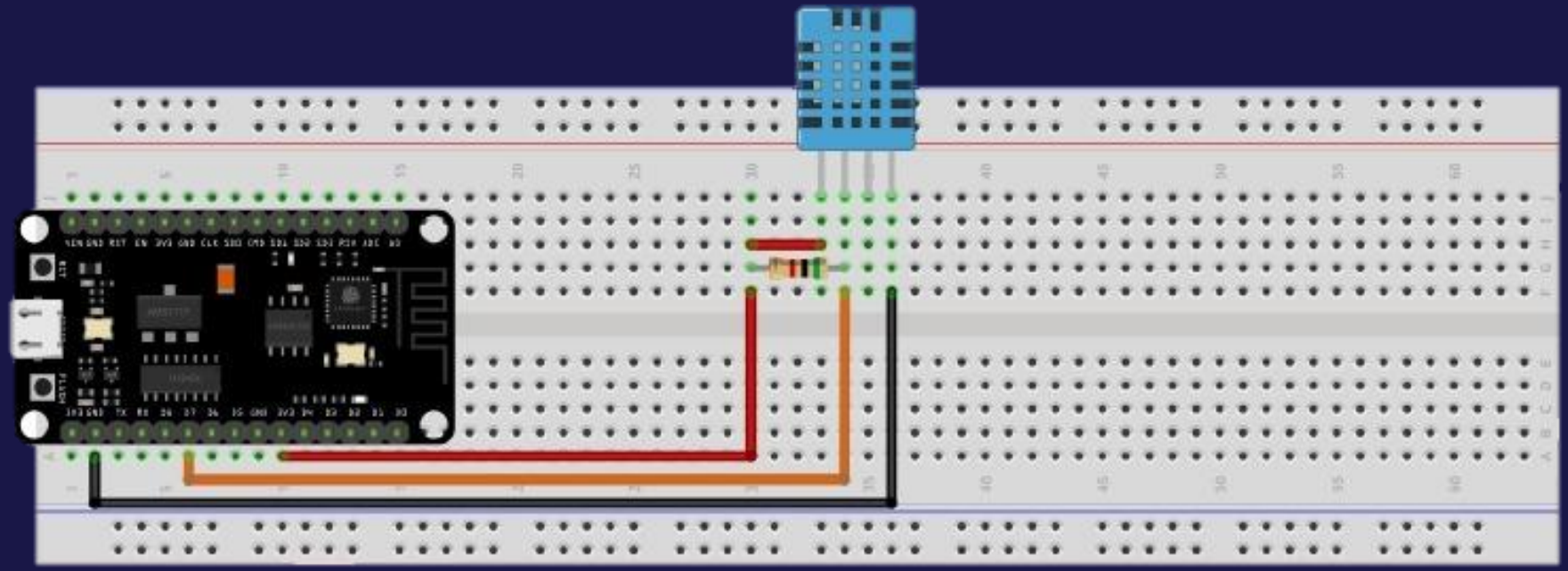
Liquid Crystal Displays (LCD I2C model)



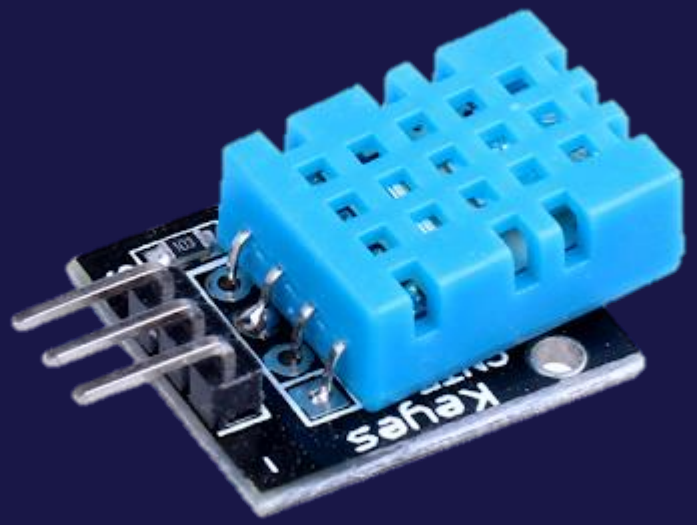
Arduino USB 2.0 Cable

5. ELECTRICAL CIRCUIT

Below, you can find a visual representation of the connections for breadboard and DHT11 sensor:

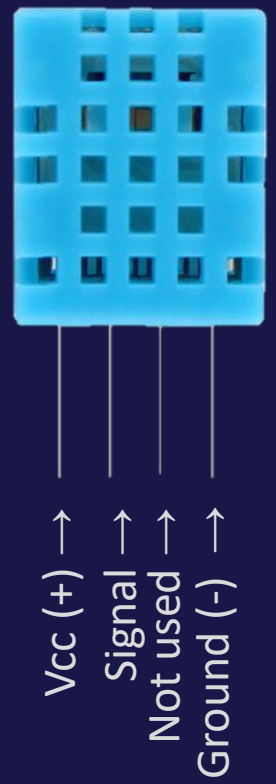


5.1 DHT11 sensor



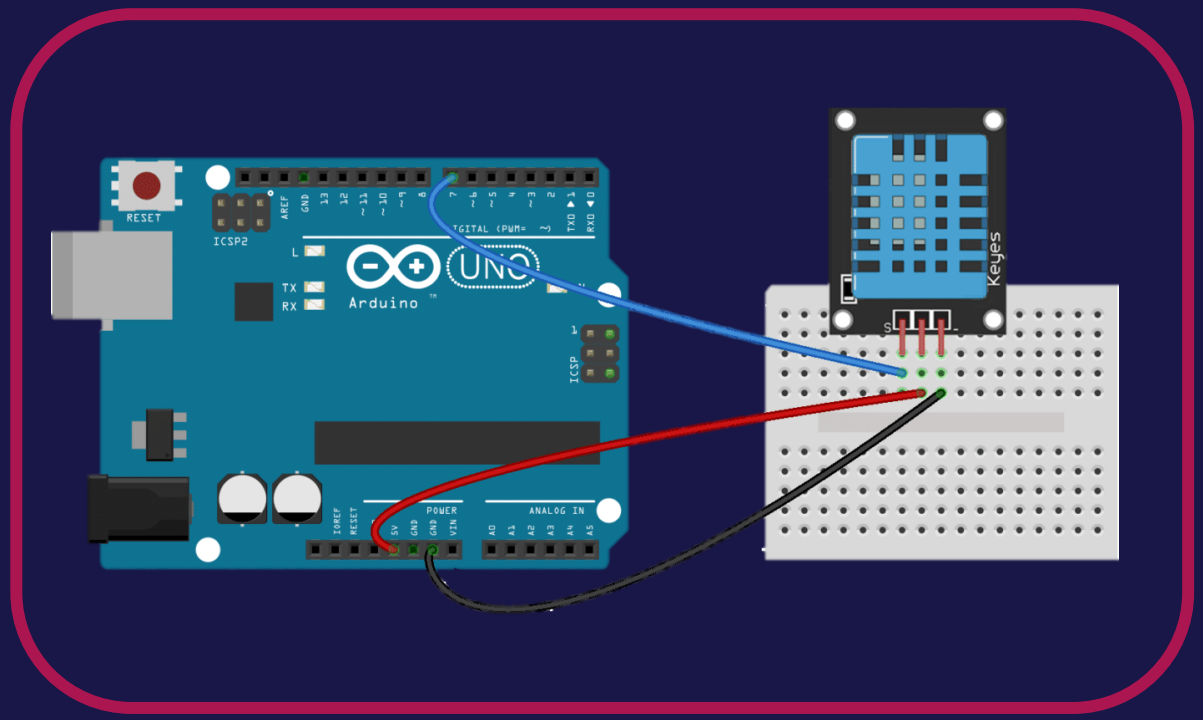
Humidity and Temperature
DHT11 Sensor

We used a DHT11 sensor with 4 pins, like this one:

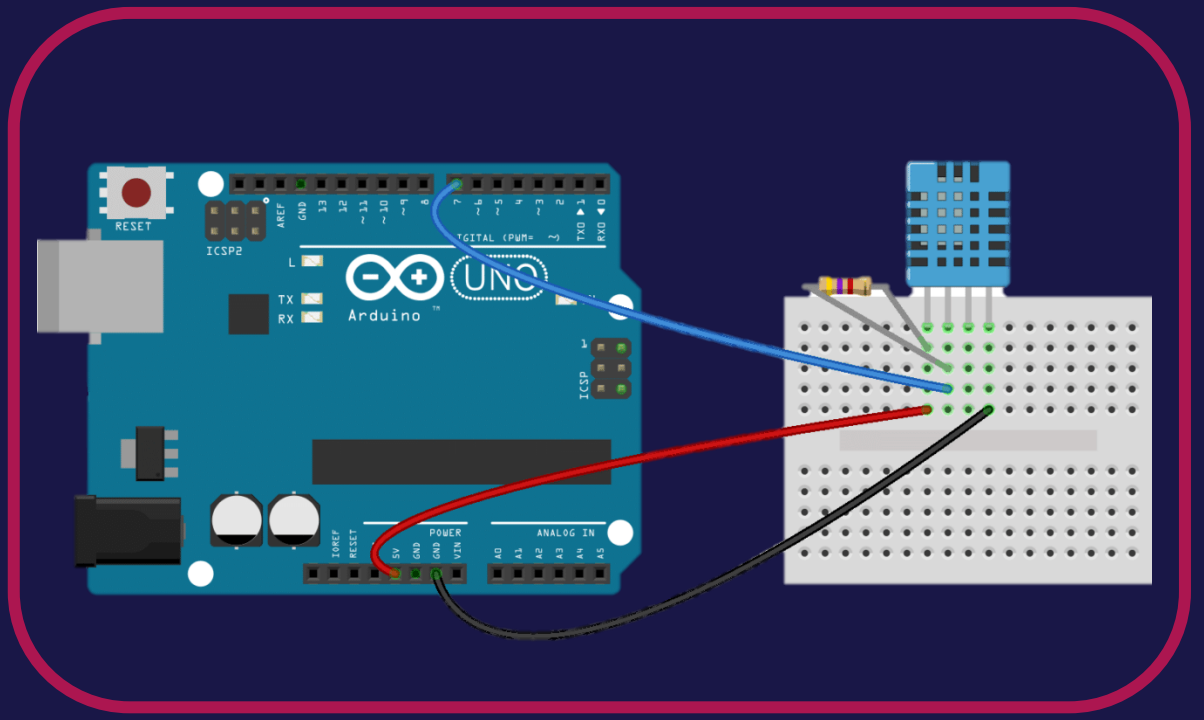


5.1 DHT11 sensor

The difference in the connection
of a 3-pin and 4-pin DHT11 [5]



Connecting a three pin DHT11



Connecting a four pin DHT11

5. ELECTRICAL CIRCUIT

We also have an LCD connected to our board:

Step 01

We connected the SDA and SCL in A4 and A5 on the Arduino board.

Step 02

We connected GND in series with the GND of the DHT11 sensor.

Step 03

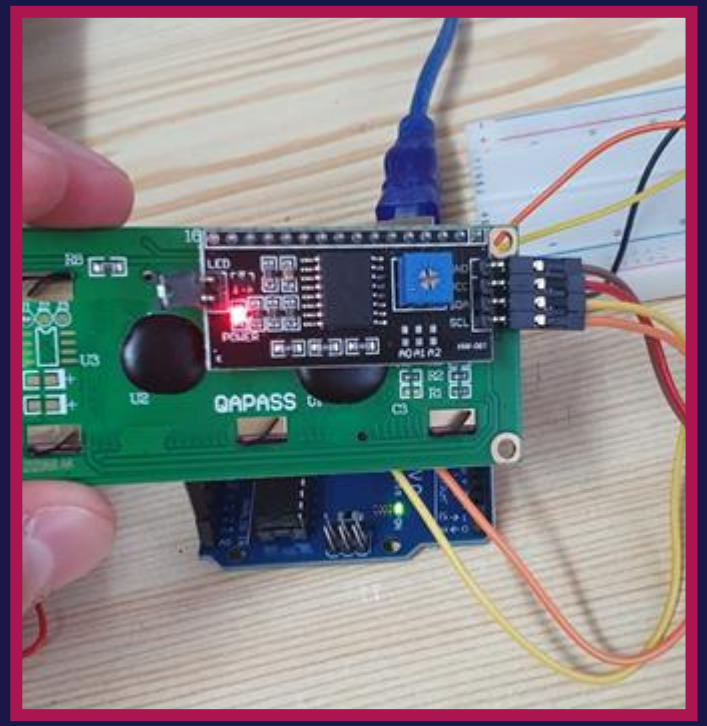
We connected the GND on the Arduino.

Step 04

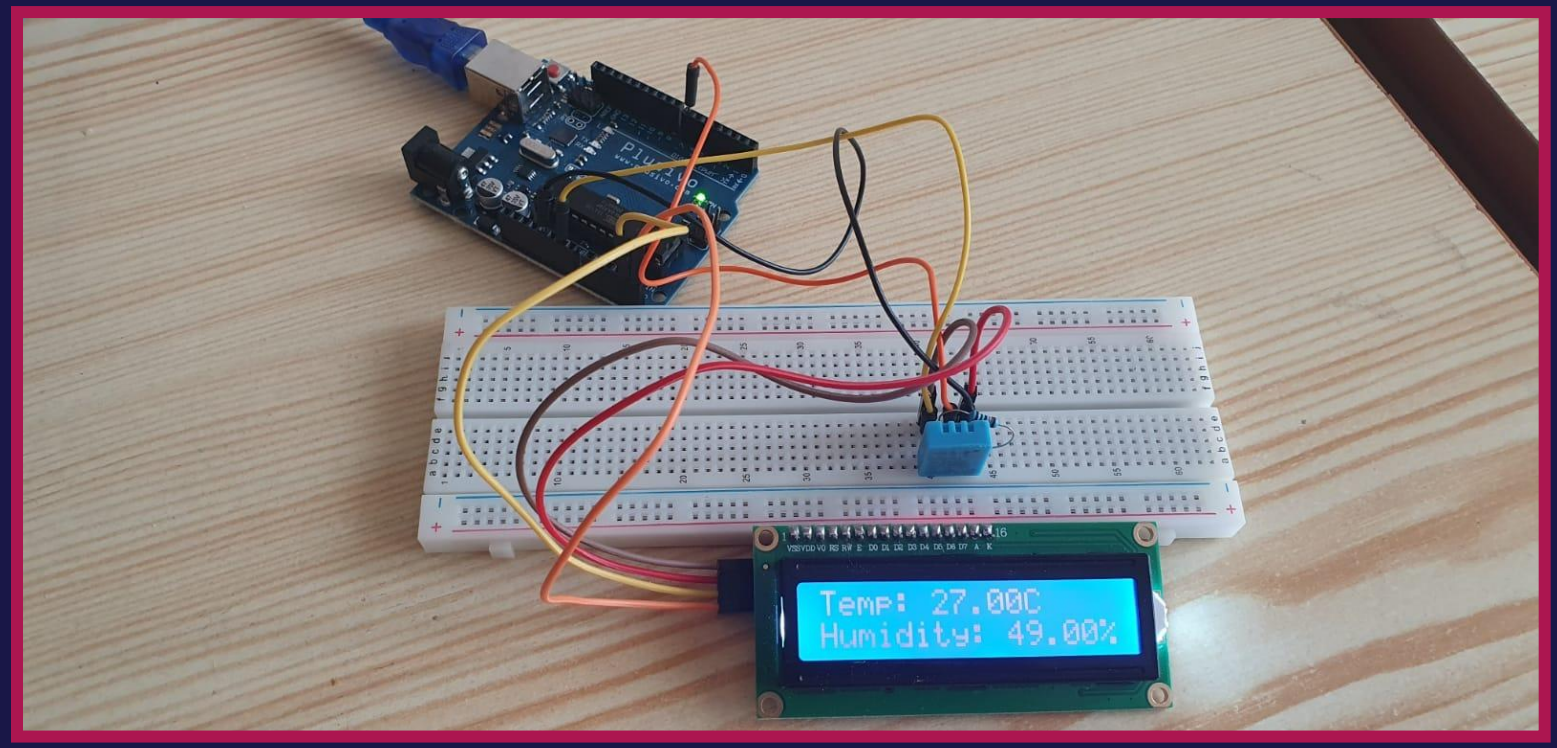
The Vcc in series with the Vcc of the sensor on the breadboard.

Step 05

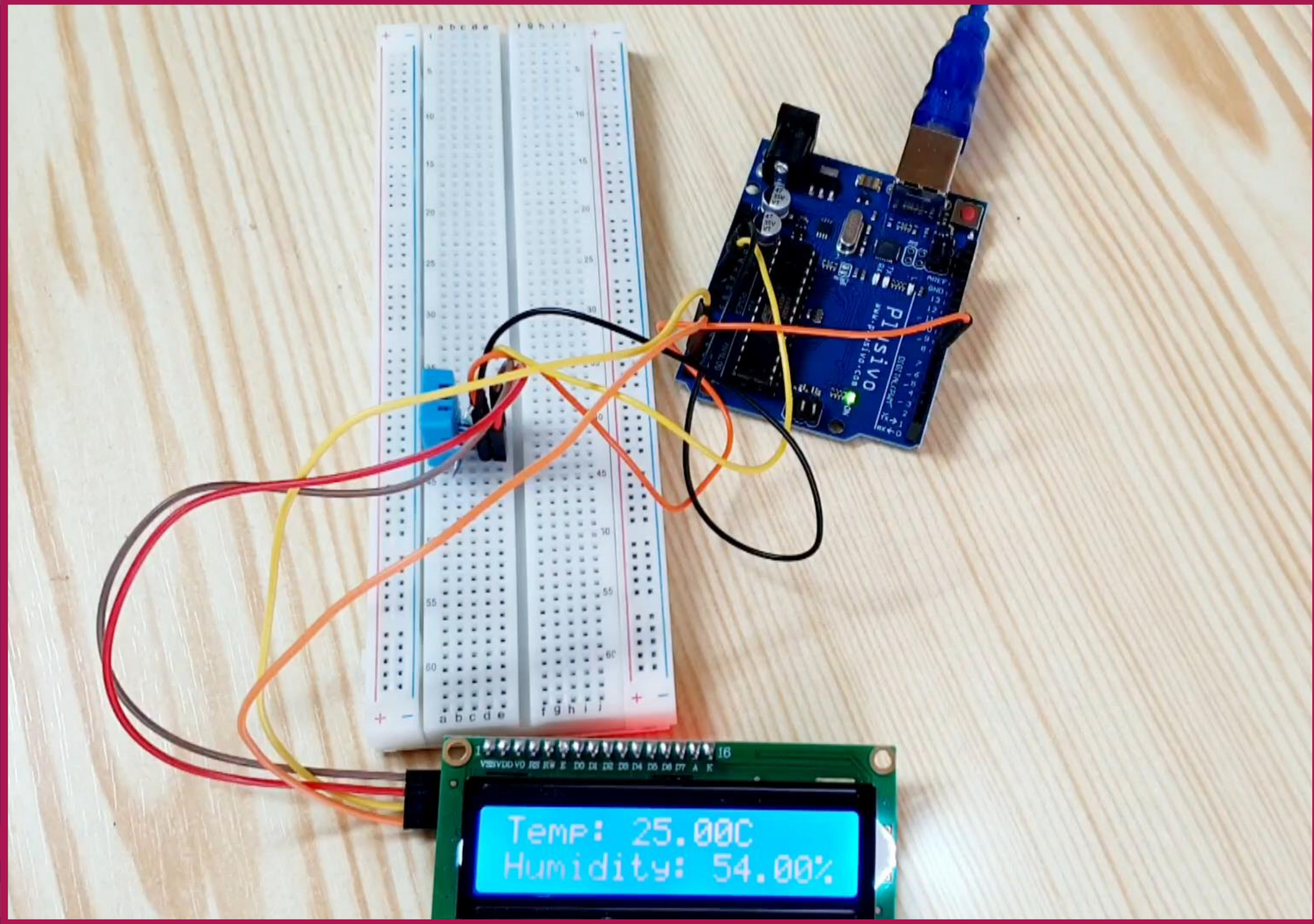
Then we connected the breadboard to the Arduino at 5V supply voltage.



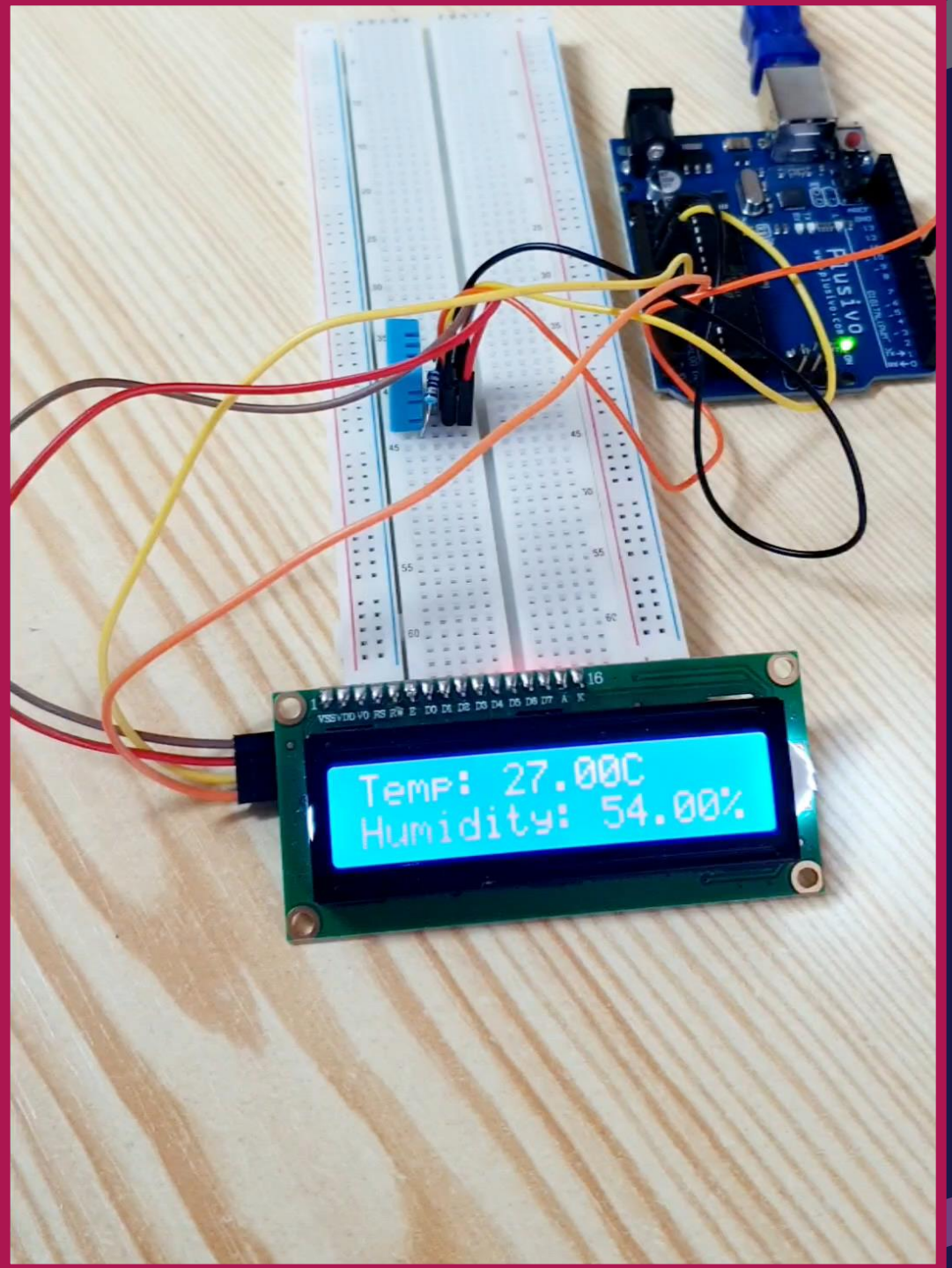
5. ELECTRICAL CIRCUIT



6. HOW IT WORKS?



6. HOW IT WORKS?



7. USE OF TEMPERATUE AND HUMIDITY SENSOR

- Heating system
- Ventilation system
- Air conditioning system
- Weather stations
- Safety measure

8. REFERENCE LIST

- [1] https://www.arduino.cc/en/guide/introduction
- [2] https://www.circuitbasics.com/wp-content/uploads/2015/11/DHT11-Datasheet.pdf
- [3] shorturl.at/orwD9
- [4] shorturl.at/gtwP0
- [5] shorturl.at/ikyF8





THANKS FOR WATCHING!

ANY QUESTIONS?