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Arduino Based Temperature and Humidity Sensor

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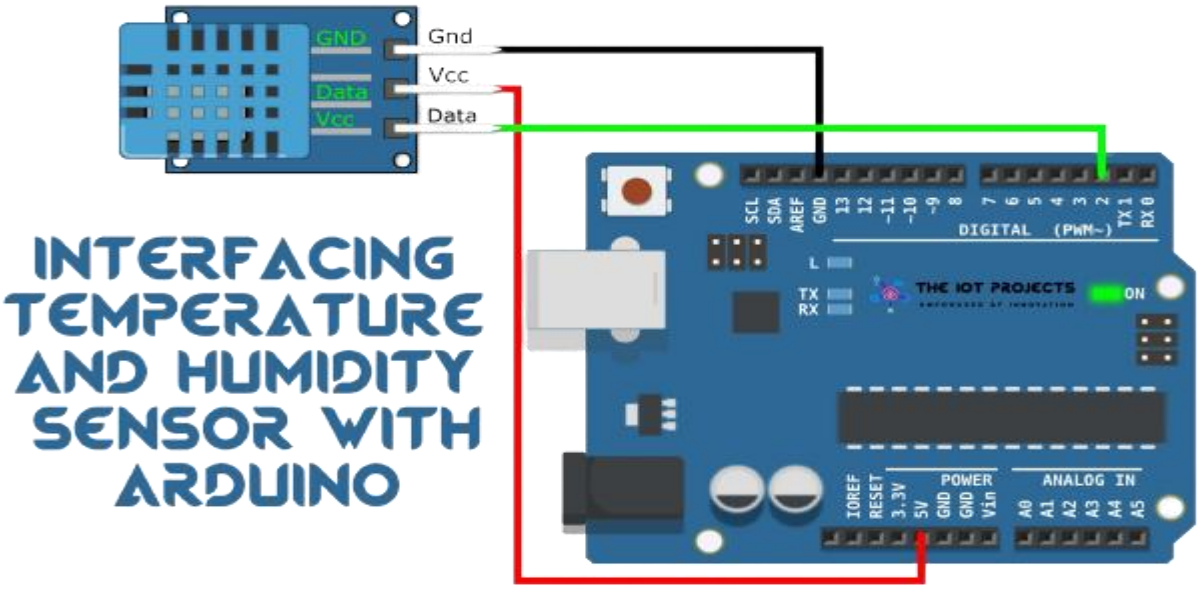

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ACKNOWLEDGEMENT

I would like to acknowledge Prof. Gunjan Kumar, Prof. Sanjar Mondal, & Prof. Sovan Ray for their instructions and supervision throughout the process of making this project and constant guidance, valuable suggestions, supervision and inspiration throughout the course work without which it would have been difficult to complete the work within scheduled time. I am grateful to all my teachers, friends. Special thanks to Prof. Gunjan Kumar for his priceless support and Prof. Sanjar Mondal, & Prof. Sovan Ray for their assistance.

ABSTRACT

Arduino is a newly developed open source hardware and software system. Yet it has drawn the attention of a large technology community. Its less technical design and affordable cost are basic features that enlarges its large volume of use, where the compatibility with many other electronics and possibility of extension are interesting characteristics that increase the range of its use. Arduino hardware is simply a motherboard which can be used to make interacting objects with suitable computer programming (IDE-Integrated Development Environment).

]The idea of this project was to build an Arduino-based embedded device for monitoring environmental variables: humidity and temperature and to study its performance in different temperature and humidity. The device was built using the microcontroller Arduino and sensors, which could sense the temperature and amount of moisture inside a building and provide information in a serial monitor and a liquid crystal display. Out of many clones and different available microcontroller boards, Arduino Uno was used in this project.

This project has two parts-a theoretical part which gives a basic introduction to the materials and equipment used during the project and the second part provides stepwise process for connection and circuitry. The project was successful to meet predetermined goals, implementation was possible with the help of the Arduino book.

CONTENT

1.INTRODUCTION :

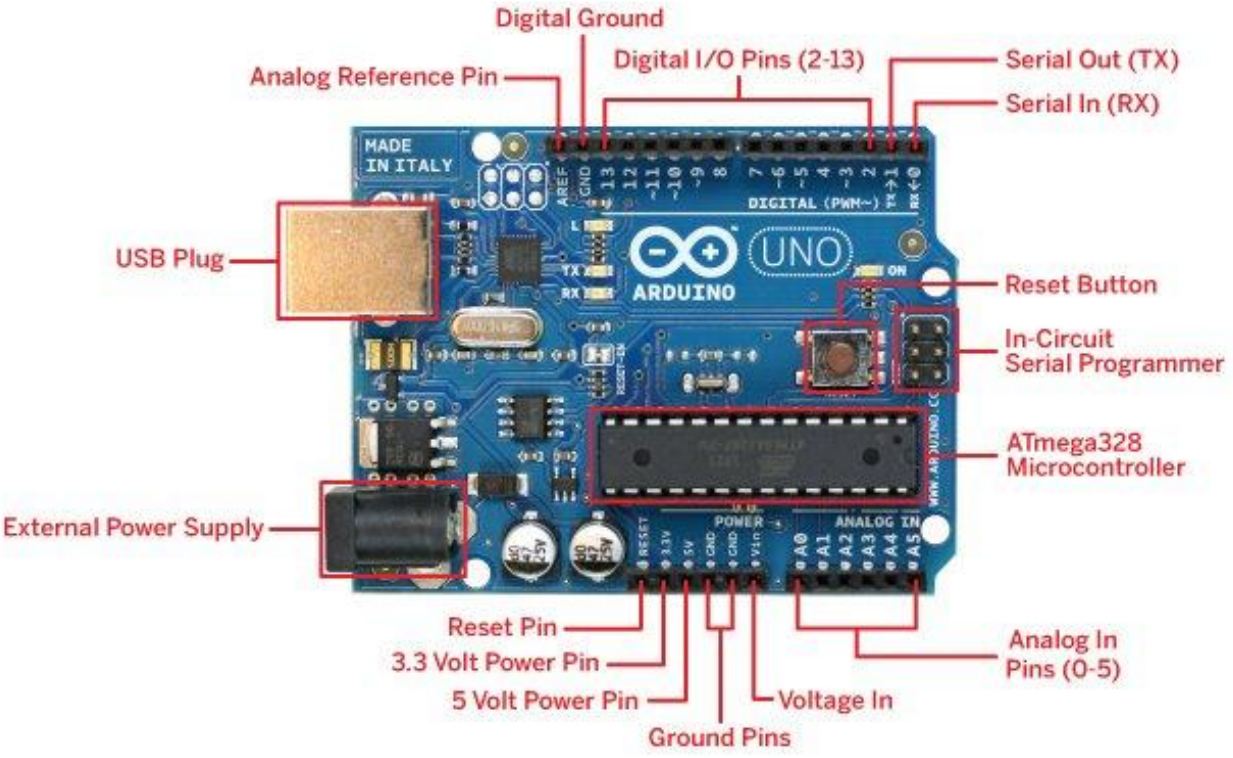
In this Arduino Project we will learn how to use the DHT11 sensor for measuring temperature and humidity with the Arduino board.

The DHT11 sensor is able to measure temperatures from 0 to + 50 °c with an accuracy of +/-2 °c and relative humidity levels of 20 to 80% with an accuracy of +/-5%. A measurement can be done every second. The DHT11 sensor senses humidity and temperature, and sends the information to digital pin 5 of Arduino UNO From Arduino MCU, humidity and temperature values are uploaded to the Cloud at regular intervals of time through ESP8266 WiFi module. From the Cloud, humidity and temperature values can be seen graphically on Thing Speak platform from anywhere in the world.

2.MATERIALS AND METHOD :

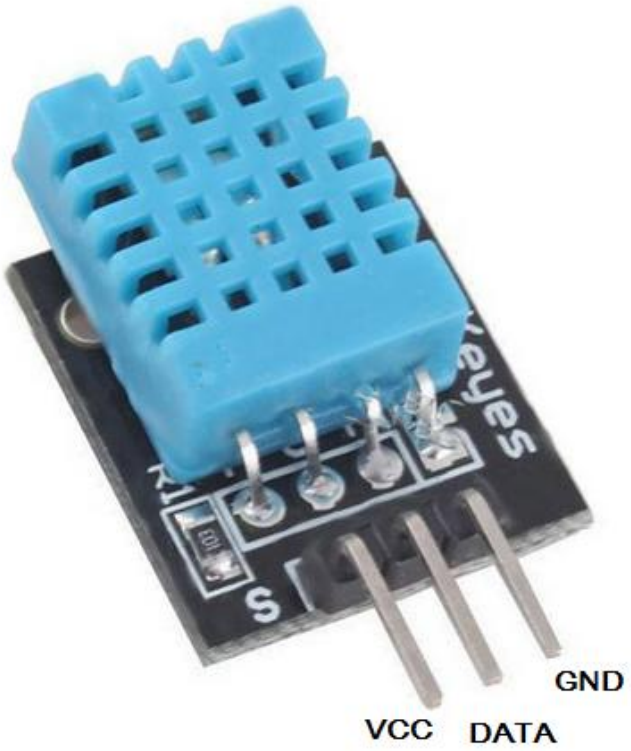
Arduino :

Arduino Uno is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.



SENSORS :

The sensors used in this work is temperature and humidity sensor-DHT11. The sensorDHT11 is an Analog sensor designed to sense the physical change in heat and moisture when exposed in air with suitable wiring and programming.



DHT11 Sensor Module

Measurement range:

Temperature: 0 to 50°C
Temperature: ±2 %

Accuracy:

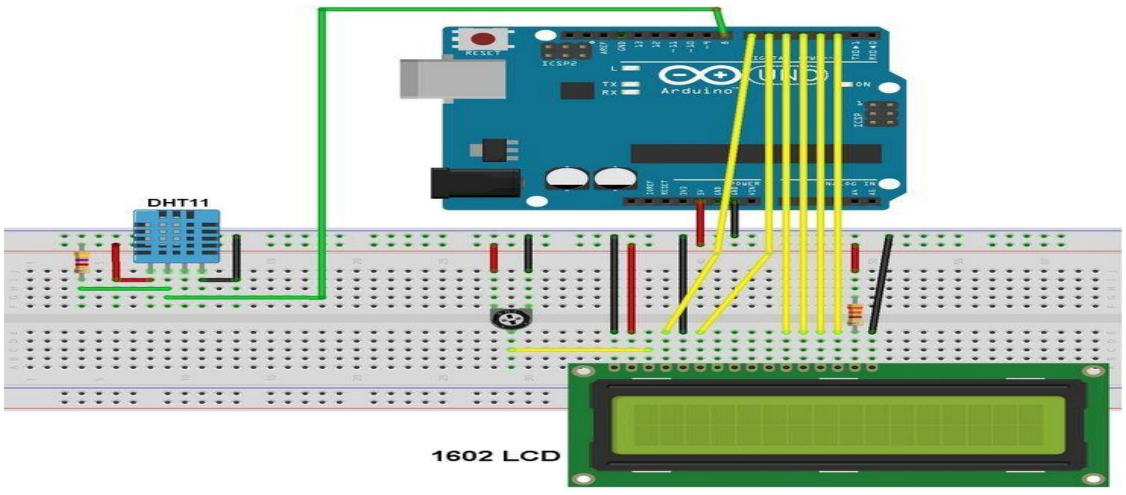
Humidity: 20 to 90%
Humidity: ±5 %

Where the operating Voltage remains between 3V to 5.5V

IDE :

An Integrated Development Environment (IDE) is software that consolidates the basic tools needed for software testing and writing. Without IDE, a developer would have to select and manage all these tools separately, but IDE brings all these tools together as a single framework or service.

SETUP/CONNECTION :



Arduino can be programmed to give the readings (measurement data) in serial monitor and/or in the LCD display. The wiring and connection is one of the most important part of electronics to work it properly.

The required materials for the project are listed below:

- an Arduino board (Arduino Uno)
- a breadboard
- a sensor (DHT11)
- a 220 Ω resistor
- a potentiometer
- jumper wires
- an LCD Display

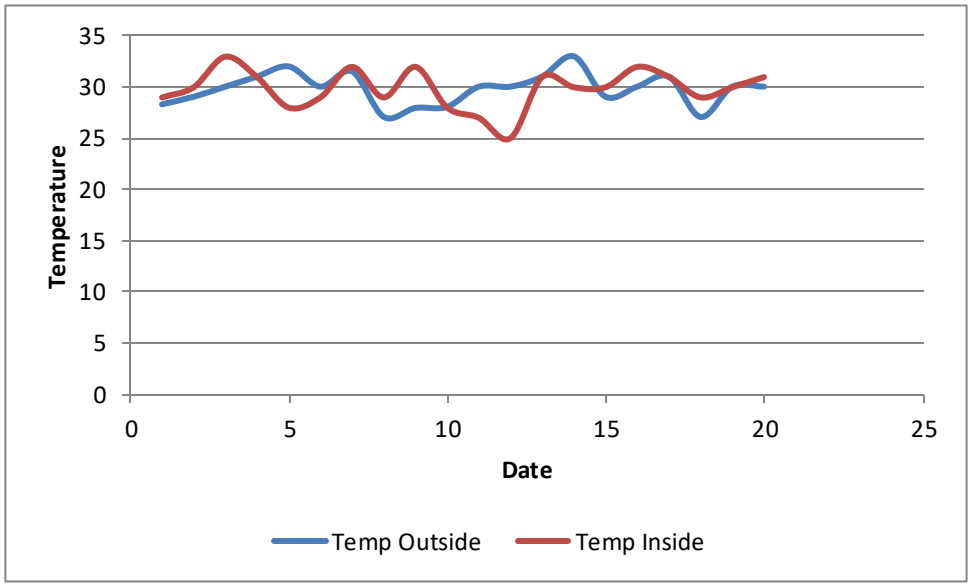
The required wiring and pins to connect the LCD display and the sensor with Arduino is given below :

- Arduino GND Breadboard -ve power rail
- Arduino 5v Breadboard +ve power rail
- DHT11 -ve pin Breadboard -ve power rail
- DHT11 +ve pin Breadboard +ve power rail
- DHT11 S Arduino Analog pin A0
- LCD 1 Breadboard -ve power rail
- LCD 2 Breadboard +ve power rail
- LCD 3 Potentiometer centre pin
- LCD 4 Arduino Digital pin 12
- LCD 5 Breadboard -ve power rail
- LCD 6 Arduino Digital 11
- LCD 11 Arduino Digital Pin 5
- LCD 12 Arduino Digital Pin 4
- LCD 13 Arduino Digital Pin 3
- LCD 14 Arduino Digital Pin 2
- LCD 15 220 Ω (ohm) resistor and the other pole of 220 Ω resistor to Breadboard positive power rail
- LCD 16 Breadboard -ve power rail
- Potentiometer +ve Breadboard negative power rai

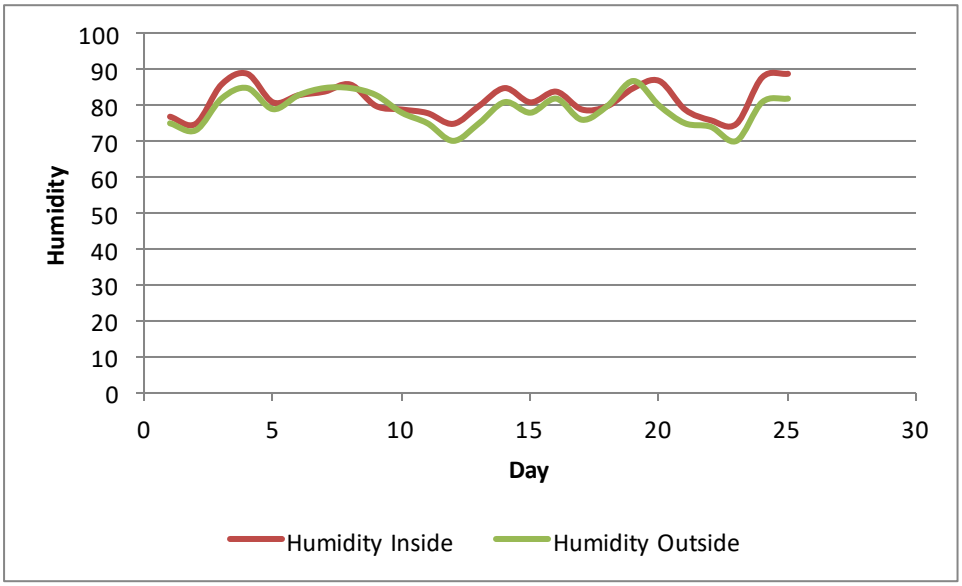
When all the connections and wiring are done, the code should be written in IDE and the codes written in IDE tells the Arduino to function so that the measurement obtained from sensor can be read in LCD display.

CODING OF IDE :

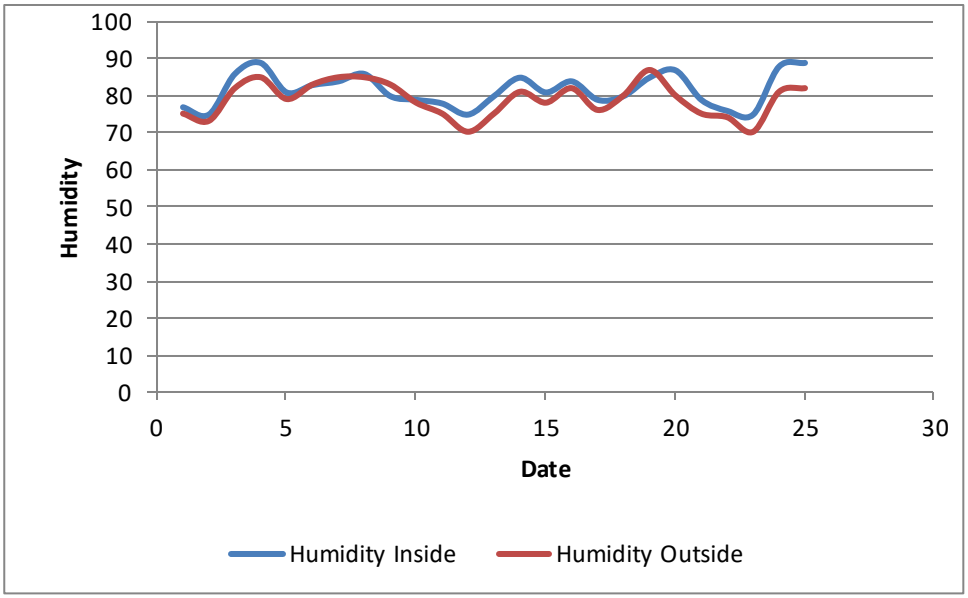
```
#include "DHT.h"

#define DHTPIN 2
#define DHTTYPE DHT11
DHT dht(DHTPIN, DHTTYPE);
void setup() {
  Serial.begin(9600);
  Serial.println(F("DHTxx test!"));
  dht.begin();
}
void loop() {
  delay(2000);
  float h = dht.readHumidity();
  float t = dht.readTemperature();
  float f = dht.readTemperature(true);
  if (isnan(h) || isnan(t) || isnan(f)) {
    Serial.println(F("Failed to read from DHT sensor!"));
    return;
  }
  float hif = dht.computeHeatIndex(f, h);
  float hic = dht.computeHeatIndex(t, h, false);

  Serial.print(F(" Humidity: "));
  Serial.print(h);
  Serial.print(F("%  Temperature: "));
  Serial.print(t);
  Serial.print(F("C "));
  Serial.print(f);
  Serial.print(F("F  Heat index: "));
  Serial.print(hic);
  Serial.print(F("C "));
  Serial.print(hif);
  Serial.println(F("F"));
}
```



Temperature plotted against the Date



Humidity plot against the Day-time



Humidity plotted against Days at Night

COST ESTIMATION :

NO	Requirments	Quantity	Unit cost	total
1	DHT 11 Sensor	1	110/-	110/-
2	Arduino UNO R3	1	720/-	720/-
3	Liquid Crystal Display	1	100/-	100/-
4	I2c module	1	83/-	83/-
5	Bread Board	1	65/-	65/-
6	Wires	12	2/-	24/-
7	9v Battery	1	25/-	25/-
8	Connector	1	15/-	15/-
				1142/-

CONCLUSION :

The work was successful in building a monitoring device which works as a thermometer for measuring temperature and humidity inside a building; it is capable of measuring humidity and temperature outdoors. Compared to expensive sensor, the Arduino-based monitoring system successfully reduces the power consumption, cost and complexity of the process. The performance of the system was accurate and reliable with some error in measurement and limitations of the used sensor.

The project was interesting and was practically helpful to learn to use microcontrollers (Arduino), programming language C and basic electronics. This was a very helpful project in learning and understanding the world of microcontrollers, and using microcontrollers in real life.