Real Time Reading of Humidity and Temperature using DHT Sensor and Arduino Board

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Abstract

This project focuses on the real-time monitoring of humidity and temperature using a DHT (Digital Humidity and Temperature) sensor interfaced with an Arduino board. The integration of these components allows for accurate data collection and transmission, enabling continuous environmental monitoring according to our chosen time stamp.

The DHT sensor provides precise humidity and temperature measurements, which are then processed by the Arduino board. The Arduino serves as the central processing unit, collecting data from the sensor and executing programmed tasks. The real-time nature of the system ensures instant feedback on environmental conditions.

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Introduction

Background:

The need for real-time monitoring of environmental parameters like humidity and temperature has become increasingly crucial in various fields. Whether it's optimizing living conditions in smart homes, ensuring ideal growing conditions in agriculture, or maintaining controlled environments in industries, accurate and timely data plays a pivotal role.

Combining the DHT sensor with an Arduino board creates a powerful synergy, offering not only accurate and instant measurements but also the ability to customize and extend the system's capabilities. The integration of data visualization and logging enhances the usability of the project, providing users with valuable insights into environmental trends and fluctuations.

Project Relevance:

Understanding how to interface sensors, in this case, the DHT sensor, with a microcontroller is a fundamental skill. It introduces learners to the basics of sensor technology, data acquisition, and signal processing. Working with an Arduino board involves writing code to control and process data. This project enhances programming skills, teaching learners how to program the microcontroller to read sensor data, make decisions, and perform actions based on that data.

Project Objective

Purpose:

The goal is to learn and apply basic electronics and programming skills by creating a system that monitors humidity and temperature in real-time using a DHT sensor and Arduino board with the time stamps we specify. This hands-on project aims to develop skills in sensor integration, data analysis, and IoT concepts while fostering problem-solving and customization abilities.

Learning Outcome:

- Acquiring proficiency in basic electronics, sensor integration, and programming with Arduino Board.
- Understanding the principles behind the DHT sensor and its application in real-time environmental monitoring.
- Gaining insights into Internet of Things (IoT) concepts, including data communication and remote monitoring.
- Developing problem-solving skills through troubleshooting challenges encountered during the project.

Overall Description

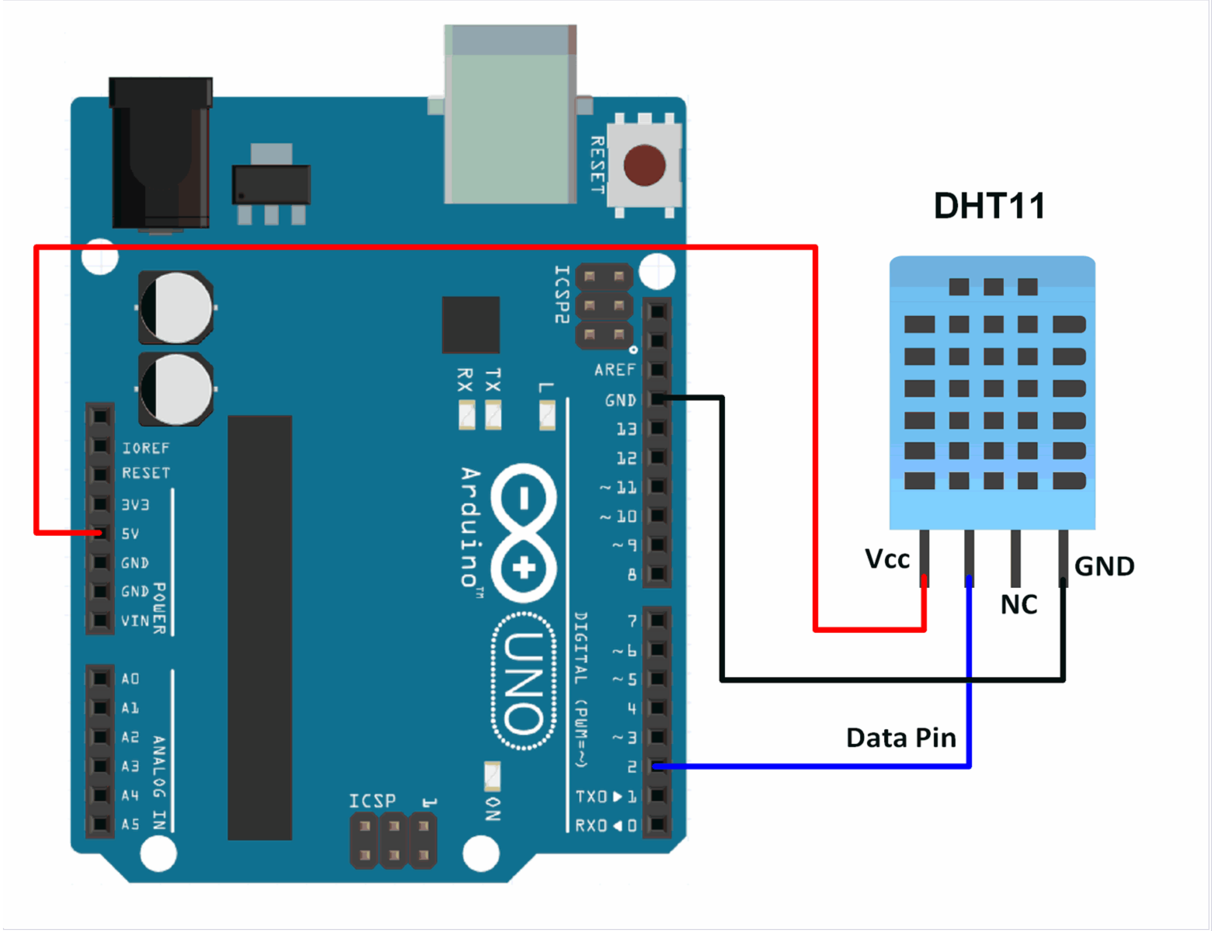
The Real Time Reading of Humidity and Temperature using DHT Sensor and Arduino Board has multiple libraries as well apart from the materials and tools which are as follows:

- serial
- time
- datetime
- csv
- streamlit
- pandas
- plotly.express

Materials and Tools

- Arduino Uno Board
- DHT 11 Sensor
- Jumper Wires
- USB Cable for Arduino

Circuit Diagram



Step-by-Step Instructions

1. Setting Up the Arduino IDE:

- Install the Arduino IDE on your computer.
- Connect the Arduino board to your computer using the USB cable.

2. Install DHT Library:

- Open the Arduino IDE.
- Go to "Sketch" -> "Include Library" -> "Manage Libraries..."
- Search for "DHT" and install the library that corresponds to your sensor (e.g., "DHT Sensor Library").

3. Connect DHT Sensor to Arduino:

- Connect the DHT sensor to the Arduino using jumper wires.
- If using a DHT11, connect VCC with 5V port, Data Pin with 2 number port and GND with GND port.

4. Write Arduino Code:

- Write a simple Arduino sketch to read data from the DHT sensor.
- Use the DHT library functions to acquire humidity and temperature values in real time.

5. Safety:

- Make sure the ports are correctly connected to each other through jumper wires.

Code Explanation:

```
// Read DHT11 sensor and send serially to PC
#include <DHT.h>         // Include Adafruit DHT11 Sensors Library
#define DHTPIN 2          // DHT11 Output Pin connection
#define DHTTYPE DHT11     // DHT Type is DHT11

DHT dht(DHTPIN, DHTTYPE);   // Initialize DHT sensor
void setup () {
  dht.begin();
  Serial.begin(9600);         // To see data on serial monitor
}
void loop (){

    float H = dht.readHumidity();     //Read Humidity
    float T = dht.readTemperature();    // Read temperature as Celsius

    // Check if any reads failed and if exit
   // Combine Humidity and Temperature into single string
    if (!isnan(H) && !isnan(T)) {
        String dhtData = String(H) + "," + String(T);
        Serial.println(dhtData);
    }
   delay(3000);   // Wait two seconds between measurements
}
```

Explanation:

- We included the DHT library for working with the DHT sensors.
- We then defined the DHT pin and type (DHT11).
- The DHT sensor is initialized in the setup function.
- The loop function reads humidity and temperature values and combines them into a single string.
- The values are checked to ensure they are valid before sending them serially.
- The combined data (humidity and temperature) is printed to the Serial Monitor.
- There's a delay of 3000 milliseconds (3 seconds) between measurements to avoid excessive data output.

Testing and Troubleshooting

Testing Steps:

- Load Arduino sketch onto the board.
- Open Serial Monitor, verify accurate and responsive humidity/temperature readings.
- Adjust sensor readings for accuracy.
- Test system's quick response to environmental changes.
- Ensure documentation aligns with project setup.
- Share project, gather feedback, and make improvements as needed.
- Make adjustments for enhanced functionality based on testing results.

Common Issues and Troubleshooting:

Check Wiring:

- Ensure that all connections between the DHT sensor and Arduino are correct. Check for loose or disconnected wires.

.**Calibration:**

- If sensor readings seem inaccurate, recalibrate the sensor or consider using calibration factors in your code.

Serial Monitor Output:

- Examine the Serial Monitor output for error messages or unexpected behavior. This can help pinpoint issues in your code.

Code Review:

- Double-check your Arduino code for syntax errors, typos, or logical mistakes. Ensure that the code matches your hardware setup.

Library Compatibility:

- Ensure that you are using the correct DHT sensor library version that is compatible with your Arduino board and the DHT sensor model.

Conclusion:

Project Recap:

- **Real-Time Monitoring System:** Successfully created a real-time monitoring system for humidity and temperature.
- **Data Accuracy**: Achieved accurate and responsive sensor readings, enhancing the reliability of the system.
- **Troubleshooting Skills:** Developed effective troubleshooting skills to address common issues in wiring, power, and code.

Key Learnings:

- **Arduino Programming:** Developed skills in writing Arduino sketches for data acquisition and control.
- **Sensor Integration:** Learned how to interface and integrate sensor data with the Arduino platform.
- **IoT Concepts:** Gained insights into Internet of Things (IoT) concepts through real-time data monitoring.

Further Exploration:

- We can expand the project by integrating multiple DHT sensors to monitor humidity and temperature in different locations simultaneously.
- We can extend the project to integrate with a mobile app, enabling users to monitor environmental conditions remotely.

References:

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