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Climate Monitoring System

Rahul Rai[1], Soniya Singh[2], Prof. Santosh Jha[3], Dr. Deepak Soni[4]

Department of Electronics and Communication Engineering, Lakshmi Narain College of Technology Excellence, Bhopal, India[1,2]

(Project Guide), Department of Electronics and Communication Engineering, Lakshmi Narain College of Technology Excellence, Bhopal, India[3]

(Project In-Charge), Department of Electronics and Communication Engineering, Lakshmi Narain College of Technology Excellence, Bhopal, India[4]

ABSTRACT: We present the working model of "HUMIDITY & TEMPERATURE MONITORING SYSTEM BY USING ARDUINO" for the partial fulfillment of the certificate of Diploma in Electrical Engineering.

This project is a prototype of embedded Arduino, which utilizes a Humidity Sensor and LM35 Temperature Sensor to obtain environmental details like Temperature and Humidity. The main aim of this prototype is to study the implementation of temperature and humidity systems over industrial units, which will perform live observation and monitoring through the LCD that constantly displays details provided and processed by the microcontroller.

Additionally, IoT technology has been integrated for real-time internet monitoring. An Automated Alarm is also embedded to indicate when temperature and humidity exceed critical values. Furthermore, a networking interface enables user control and accessibility to change settings via an online portal, preventing damage to the sensors or industrial units. This project demonstrates utility in industrial environments, automating environmental monitoring 24x7 without human intervention.

I. INTRODUCTION

The project involves creating a temperature and humidity detector using Arduino Uno. The report covers component specifications and their roles in building the detector. The core components include Arduino Uno, LCD display, breadboard, jumper wires, I2C module, DHT11 sensor, and a 5V adapter.

Purpose and Motivation:
In today's world, monitoring environmental conditions like temperature and humidity is essential for various applications such as weather forecasting, industrial automation, and agriculture. The simplicity and low cost make this system viable for both professional and DIY use cases.

Key Objectives:
- Understand the role of each component in the system.
- Create a functional prototype using an Arduino Uno microcontroller.

SECTIONS:
1. Arduino Uno
- **Features:**
  - Microcontroller: ATmega328P
  - Operating Voltage: 5V
  - Input Voltage: 7–12V
  - Digital I/O Pins: 14 (6 PWM pins)
  - Flash Memory: 32KB

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- **Role in the Project:**
  The Arduino Uno acts as the project's brain, processing data from the DHT11 sensor and communicating it to the LCD for real-time display.

2. LCD Display

- **Features:**
  - 16x2 character format
  - Backlight LED
  - Interface: Parallel or I2C module
- **Role in the Project:**
  Displays real-time temperature and humidity readings.

3. Breadboard

- **Features:**
  - Solderless construction base
  - 830 tie points
- **Role in the Project:**
  Connects all components for easy prototyping.

4. Jumper Wires

- **Features:**
  - Types: Male-to-male, male-to-female
  - Length: 5–20 cm
- **Role in the Project:**
  Facilitates connections between components.

5. I2C Module

- **Features:**
  - Interface: I2C
  - Address: Typically 0x27 or 0x3F
  - Adjustable via potentiometer
- **Role in the Project:**
  The I2C module simplifies communication between the Arduino and the LCD by using only two data lines (SDA and SCL), reducing wiring complexity.

6. DHT11 Sensor

- **Features:**
  - Operating Voltage: 3.5V–5.5V
  - Humidity Range: 20–80% (±5% accuracy)
  - Temperature Range: 0–50°C (±2°C accuracy)
- **Role in the Project:**
  Captures real-time temperature and humidity data, sending it to the Arduino for processing.

7. 5V Adapter

- **Features:**
  - Input: AC 100–240V
  - Output: DC 5V, 1A or higher
  - Connector: Barrel jack
- **Role in the Project:**
  Supplies stable power to all components, ensuring reliable performance and accurate sensor readings.

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8. Circuit Diagram

The circuit diagram visually represents the connections among components, ensuring clarity for wiring and assembly. It includes:

- Arduino Uno connections
- Sensor pins (VCC, GND, Data)
- LCD connections via I2C

[Insert Circuit Diagram Here]

9. Assembly and Connections

Step-by-Step Assembly:

1. Place the Arduino Uno on the breadboard.
2. Connect the DHT11 sensor to the breadboard and wire it to the Arduino:
    - **VCC** to **5V**
    - **GND** to **GND**
    - **Data Pin** to **Digital Pin 2**
3. Attach the I2C module to the LCD:
    - **SDA** to **A4**
    - **SCL** to **A5**
4. Power the Arduino using the 5V adapter.

10. Programming the Arduino

Below is an example code snippet to read data from the DHT11 sensor and display it on the LCD:

cpp

Copy code

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

#define DHTPIN 2
#define DHTTYPE DHT11

DHT dht(DHTPIN, DHTTYPE);
LiquidCrystal_I2C lcd(0x27, 16, 2);

void setup() {
  lcd.begin();
  dht.begin();
  lcd.print("Initializing...");
}

void loop() {
  float humidity = dht.readHumidity();
  float temperature = dht.readTemperature();

  if (isnan(humidity) || isnan(temperature)) {
    lcd.print("Error reading data");
    return;
  }

  lcd.setCursor(0, 0);
  lcd.print("Temp: ");
  lcd.print(temperature);
  lcd.print("C");
  lcd.setCursor(0, 1);
```

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```
  lcd.print("Humidity: ");
  lcd.print(humidity);
  lcd.print("%");
  delay(2000);
}
```

11. Testing and Calibration

Testing Procedure:

1. **Hardware Inspection:** Check all connections to ensure they are secure and free of shorts.
2. **Power Supply Verification:** Confirm voltage levels are within the operating range of all components.
3. **Software Validation:** Upload the Arduino code and verify proper sensor and LCD operation.

Calibration Steps:

1. Adjust the DHT11 sensor using manufacturer-provided calibration tables.
2. Fine-tune the LCD contrast for optimal visibility using the potentiometer.

12. Applications

The temperature and humidity detector has versatile applications across multiple sectors:

Home Automation:

- Monitor and regulate indoor conditions for comfort.
- Automate air conditioning or heating systems based on data.

Agriculture:

- Optimize greenhouse conditions to enhance crop growth.

Industrial Use:

- Maintain ideal storage conditions for temperature-sensitive products.

Healthcare:

- Monitor environmental parameters in hospitals or laboratories.

Educational Projects:

- Serve as a learning tool for students and electronics enthusiasts.

II. CONCLUSION

The temperature and humidity detector demonstrates how a simple yet effective system can address real-world challenges. By integrating Arduino Uno, DHT11 sensor, and IoT capabilities, this project provides:

- Reliable environmental monitoring.
- Opportunities for scalability with additional features such as wireless connectivity and mobile app integration.

FUTURE SCOPE

1. **Wireless Connectivity:** Add ESP8266 for IoT capabilities.
2. **Enhanced User Interface:** Integrate touchscreens or mobile applications.
3. **Data Analytics:** Enable long-term data storage and analysis.

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निस्केयर NISCAIR

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