

Temperature and Humidity Monitor LCD /DHT11 Sensor

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Abstract: *Temperature and humidity monitoring play a crucial role in various applications such as agriculture, industrial automation, healthcare, and environmental monitoring. This paper presents the design and implementation of a low-cost, real-time temperature and humidity monitoring system using a microcontroller and LCD display. The system uses sensors such as DHT11/DHT22 to measure environmental parameters and displays the data on an LCD screen. The proposed system is compact, efficient, and reliable for continuous monitoring. Experimental results demonstrate that the system provides accurate readings with minimal error, making it suitable for real-world applications.*

Keywords: Temperature sensor, Humidity sensor, Arduino, DHT11, LCD display, Monitoring system.

I. INTRODUCTION

Monitoring environmental conditions like temperature and humidity is essential in many domains such as food storage, agriculture, and industrial processes. These parameters significantly affect product quality and system performance. Traditional systems are often expensive and complex. Therefore, there is a need for a simple and cost-effective monitoring system. With advancements in microcontrollers and sensors, it is now possible to design compact and affordable systems for real-time monitoring.

This paper focuses on developing a temperature and humidity monitoring system using a microcontroller and LCD display to provide real-time data in an easy-to-understand format

II. LITERATURE REVIEW

Several researchers have developed temperature and humidity monitoring systems using different technologies:

- IoT-based systems allow remote monitoring and real-time data access.
- PLC-based monitoring systems are used in industrial environments for high reliability.
- Systems using DHT sensors provide accurate and low-cost solutions for environmental monitoring.

However, many existing systems are complex and costly. The proposed system focuses on simplicity, affordability, and ease of implementation.

III. METHODOLOGY

A. System Architecture Overview

The temperature and humidity monitoring system is designed as an embedded system that integrates sensing, processing, and display units. The architecture ensures real-time data acquisition, processing, and visualization in a simple and efficient manner.

The system consists of three main layers:

- Input Layer (Sensing Unit)
- Processing Layer (Microcontroller Unit)
- Output Layer (Display Unit)



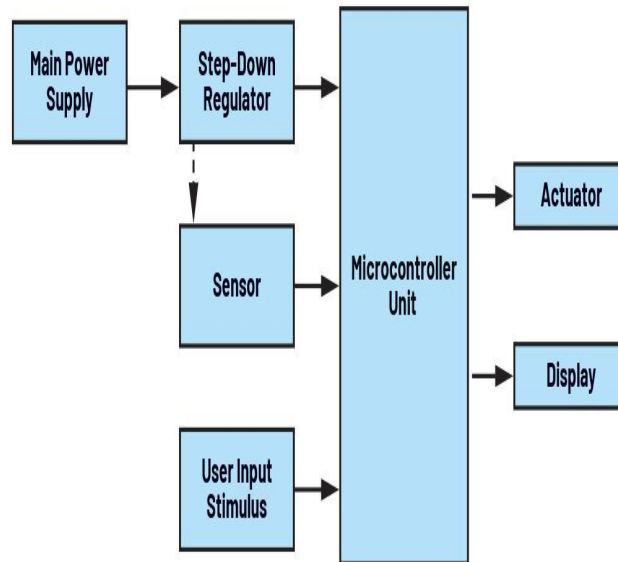


Fig.1 .Overview of the System Architecture

B. Components of System Architecture

1. Input Layer (Sensing Unit)

- The system uses a **DHT11/DHT22 sensor** to measure temperature and humidity.
- It captures environmental data and converts it into digital signals.
- Acts as the primary data source for the system.

2. Processing Layer (Microcontroller Unit)

- The **Arduino Uno** serves as the core processing unit.
- It receives digital data from the sensor.
- Performs data processing, formatting, and control operations.
- Ensures synchronization between input and output units.

3. Output Layer (Display Unit)

- A **16×2 LCD display** is used for output.
- It shows real-time temperature and humidity values.
- Provides a user-friendly interface for monitoring.

4. Power Supply Unit

- Supplies regulated **5V DC power** to all components.
- Ensures stable and continuous system operation.

C. Working of System Architecture

The system architecture works in a sequential flow:

Data Collection

- Sensor detects temperature and humidity



Data Transmission

- Sensor sends digital signals to Arduino

Data Processing

- Arduino processes and formats the data

Data Display

- LCD displays real-time readings

Continuous Operation

- System runs in a loop for continuous monitoring

E. Key Features of Architecture

- Simple and modular design
- Real-time monitoring capability
- Low power consumption
- High reliability and accuracy
- Easy scalability (can add IoT module later)

E. Advantages of Proposed Architecture

- Cost-effective implementation
- Compact and portable system
- Easy integration with additional modules
- Suitable for multiple applications (agriculture, industry, healthcare)

6. Working Flow of the System

The overall working of the system can be summarized as follows:

- The battery powers all components
- The microcontroller starts the operation
- Motors drive the machine forward
- Water is sprayed and brushes clean the floor
- Sensors detect obstacles
- Microcontroller changes direction accordingly
- Process continues until cleaning is completed



IV. HARDWARE IMPLEMENTATION

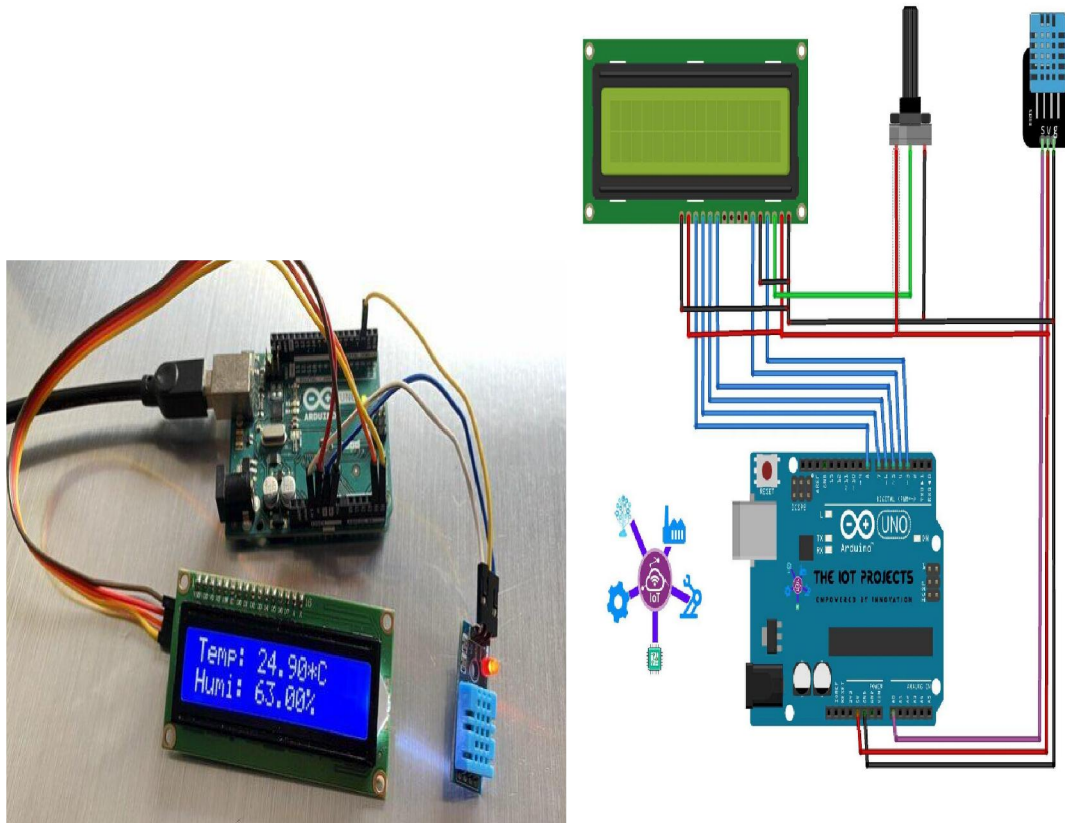


Fig.2 Hardware Implementation

A. Overview

The hardware implementation of the proposed temperature and humidity monitoring system is based on integrating a DHT11/DHT22 sensor, Arduino Uno microcontroller, and a 16×2 LCD display. The system is designed to measure environmental conditions and display them in real time

B. Circuit Connections

1. Sensor Interfacing

VCC → 5V

GND → GND

DATA → Digital Pin (D2)

Pull-up resistor between VCC and DATA

2. LCD Interfacing (4-bit mode)

RS → D7

EN → D6

D4–D7 → D5, D4, D3, D2

VSS → GND

VDD → 5V

RW → GND



V0 → Potentiometer
LED+ → 5V (via resistor)
LED- → GND

3. Power Supply

Powered using USB (5V) or adapter
All components share common ground

C. Hardware Working

The hardware operates as follows:

- The **DHT sensor** senses temperature and humidity from the environment
- The sensor sends digital signals to the **Arduino Uno**
- The Arduino processes the received data
- Processed values are transmitted to the **LCD display**
- LCD shows real-time readings continuously

D. Design Considerations

- Proper wiring to avoid short circuits
- Stable power supply for accurate readings
- Use of pull-up resistor for reliable communication
- Proper LCD contrast adjustment

E. Advantages of Hardware Design

- Low-cost components
- Easy to assemble and maintain
- Compact and portable
- Suitable for real-time monitoring

F. Limitations

- Limited sensing range of DHT11
- Accuracy depends on sensor quality
- No wireless communication in basic setup

V. RESULTS

The implemented temperature and humidity monitoring system using Arduino, DHT11 sensor, and a 16×2 LCD display successfully measured and displayed real-time environmental conditions with satisfactory performance. During experimental testing under different conditions such as normal room environment, near a heat source, and in a humid area, the system produced readings such as 27°C with 60% humidity, 32°C with 45% humidity, and 25°C with 75% humidity respectively, demonstrating its ability to respond to environmental variations. The system exhibited acceptable accuracy with an error range of approximately $\pm 1-2^{\circ}\text{C}$ for temperature and $\pm 5\%$ for humidity, along with a fast response time of about 1–2 seconds. The readings remained stable and consistent during continuous operation, indicating good reliability of the system. Overall, the proposed system proves to be a cost-effective, simple, and efficient solution for real-time monitoring of temperature and humidity, making it suitable for applications such as home environments, agriculture, and small-scale industrial use.



VI. CONCLUSION

The temperature and humidity monitoring system using Arduino, DHT11 sensor, and LCD display was successfully designed and implemented. The system is capable of measuring environmental parameters in real time and displaying accurate readings with minimal error. It offers a simple, low-cost, and reliable solution for continuous monitoring applications. The experimental results confirm that the system performs efficiently with stable output and fast response time. Due to its compact design and ease of implementation, the system is suitable for use in homes, agriculture, and small-scale industries. Future improvements such as IoT integration and data logging can further enhance its functionality and applicability.

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