Established – 1961 Subject: internet of thing

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ULHASNAGAR – 421 003

CERTIFICATE

This is to certify that Mr./Ms. manish rawal **of S.Y. Computer Science (SYCS) Roll No.** 2524031 **has satisfactorily completed The Internet Of Thing Mini Project entitled** smart wearhouse temperature monitoring **during the academic year 2025 – 2026, as a part of the practical requirement. The project work is found to be satisfactory and is approved for submission.**

PROF. INCHARGE **HEAD OF DEPT**

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1. Introduction – Smart Warehouse Temperature Monitoring IoT Project

In today's world, warehouses store many important goods such as food items, medicines, electronics, and chemicals. Many of these products need a **proper temperature** to stay safe and usable. If the temperature becomes too high or too low, goods can get damaged, spoiled, or unsafe. Manually checking the temperature again and again is difficult, time-consuming, and sometimes inaccurate.

A **Smart Warehouse Temperature Monitoring System** using **IoT (Internet of Things)** helps to solve this problem. In this project, temperature sensors are used to continuously measure the warehouse temperature. These sensors are connected to a microcontroller with internet access. The temperature data is sent automatically to a mobile phone or web application, where it can be monitored in real time.

If the temperature crosses a safe limit, the system can send an **alert message** to the warehouse manager. This helps in taking quick action before any damage happens. The system works automatically, reduces human effort, and improves safety and efficiency.

This IoT-based project is simple, low-cost, and very useful for modern warehouses. It helps in better storage management, reduces losses, and ensures the quality of stored products.

2. Requirement Specification

Smart Warehouse Temperature Monitoring IoT Project
(Easy & Simple Language)
This section explains what components are required and what they do in the project.

2.1 Hardware Requirements

1. **Arduino Uno**
   - It is the main controller of the system.
   - It reads the temperature from the sensor and processes the data.
   - It sends the temperature value to the LCD display.
2. **Temperature Sensor (LM35 / DHT11)**
   - Used to measure the temperature inside the warehouse.
   - It continuously senses the surrounding temperature and sends the value to Arduino.
   - This helps in monitoring if the warehouse temperature is normal or high.
3. **16×2 LCD Display**
   - Displays the current temperature in real time.
   - It helps the user to easily see the temperature without connecting a computer.
4. **Battery / Power Supply**
   - Provides power to the Arduino and other components.
   - Makes the system portable and useful even during power cuts.
5. **Jumper Wires**
   - Used to connect Arduino, LCD, sensor, and battery.
   - Ensures proper signal and power flow between components.
6. **Breadboard (Optional)**
   - Helps in making temporary connections without soldering.
   - Makes testing and modification easy.

2.2 Software Requirements

1. **Arduino IDE**
    - Used to write, compile, and upload the program to the Arduino Uno.
    - The code controls sensor reading and LCD display.
2. **Embedded C / Arduino Programming Language**
    - Simple programming language used to control the system.
    - Helps Arduino understand how to read sensor data and display it.

2.3 Functional Requirements

- The system should continuously monitor the warehouse temperature.
- The temperature value should be shown on the LCD screen.
- The system should work using battery power.
- The system should provide accurate and real-time temperature readings.

2.4 Non-Functional Requirements

- The system should be easy to use and understand.
- It should consume low power.
- The hardware should be reliable for long-time operation.
- The system should be low cost and simple to maintain.

3. System Design

Smart Warehouse Temperature Monitoring IoT Project
(Using Arduino Uno, LCD, battery, wires, and temperature sensor — explained in easy language)

3.1 Overview of the System

The system is designed to **measure the temperature inside a warehouse** and **display it on an LCD screen**.
The **Arduino Uno** works as the **main controller**. A **temperature sensor** senses the temperature, the **LCD** shows the value, and a **battery** supplies power to the whole system.

3.2 Main Components Used

- **Arduino Uno** – Controls the whole system
- **Temperature Sensor** (like LM35 or DHT11) – Measures temperature
- **16×2 LCD Display** – Shows temperature readings
- **Battery** – Provides power supply
- **Connecting Wires** – Connect all components together

3.3 Block Diagram Description (in words)

Temperature Sensor → Arduino Uno → LCD Display

1. The **temperature sensor** senses the surrounding temperature.
2. The sensor sends this data to the **Arduino Uno**.
3. The Arduino processes the data.
4. The **LCD display** shows the temperature in °C.
5. The **battery** powers all components.

3.4 Working of the System (Step-by-Step)

1. The **battery** supplies power to the Arduino and other components.
2. The **temperature sensor** continuously measures the warehouse temperature.
3. The sensor sends an electrical signal to the **Arduino Uno**.
4. Arduino converts this signal into temperature values.
5. The **LCD screen** displays the temperature clearly.

6. If the temperature changes, the LCD updates automatically.

3.5 Power Supply Design

- A **battery** is connected to the Arduino Uno.
- Arduino provides required voltage to the sensor and LCD.
- This makes the system **portable and suitable for warehouses**.

3.6 Advantages of This Design

- Simple and easy to understand
- Low cost and low power consumption
- Accurate temperature monitoring
- Useful for protecting goods in warehouses

3.7 System Design Summary

This system design uses a **simple hardware setup** to monitor warehouse temperature.
The **Arduino Uno** reads temperature data from the sensor and shows it on the **LCD display**.
It helps warehouse managers **monitor temperature easily** and **prevent damage to stored goods**.

4. Implementation – Smart Warehouse Temperature Monitoring (IoT)

This section explains how the **Smart Warehouse Temperature Monitoring System** is implemented using **Arduino Uno**, **temperature sensor**, **LCD**, **battery**, and **connecting wires**.

Step 1: Component Setup

We use the following components:

- **Arduino Uno** – main controller of the system
- **Temperature sensor** (like DHT11 / LM35) – to measure warehouse temperature
- **16×2 LCD display** – to show temperature values
- **Battery** – to power the system
- **Jumper wires** – to connect all components

Step 2: Circuit Connections

1. The **temperature sensor** is connected to the Arduino.
    - Sensor data pin → Arduino digital/analog pin
    - VCC → 5V of Arduino
    - GND → GND of Arduino
2. The **LCD display** is connected to Arduino.
    - Data pins of LCD → Arduino digital pins
    - VCC → 5V
    - GND → GND
3. The **battery** is connected to power the Arduino.
    - Battery positive → Arduino VIN
    - Battery negative → Arduino GND

All components are connected using **jumper wires**.

Step 3: Working of the System

- The **temperature sensor** continuously senses the temperature inside the warehouse.
- Arduino reads the temperature value from the sensor.
- The measured temperature is displayed on the **LCD screen** in real time.

- If the temperature changes, the LCD updates automatically.
- This helps warehouse staff to easily monitor temperature conditions.

Step 4: Program Upload

- A simple Arduino program is written to:
  - Read temperature from the sensor
  - Convert it into readable units (°C)
  - Display the value on the LCD
- The program is uploaded to Arduino using **Arduino IDE**.

Step 5: Final Operation

- When power is ON, the system starts working automatically.
- The LCD shows the current warehouse temperature.
- The system works continuously and requires very little maintenance.

Result

The implementation successfully monitors warehouse temperature and displays it clearly on an LCD. This helps in protecting goods from damage due to high or low temperature.


UNO
DIGITAL PWM(~)
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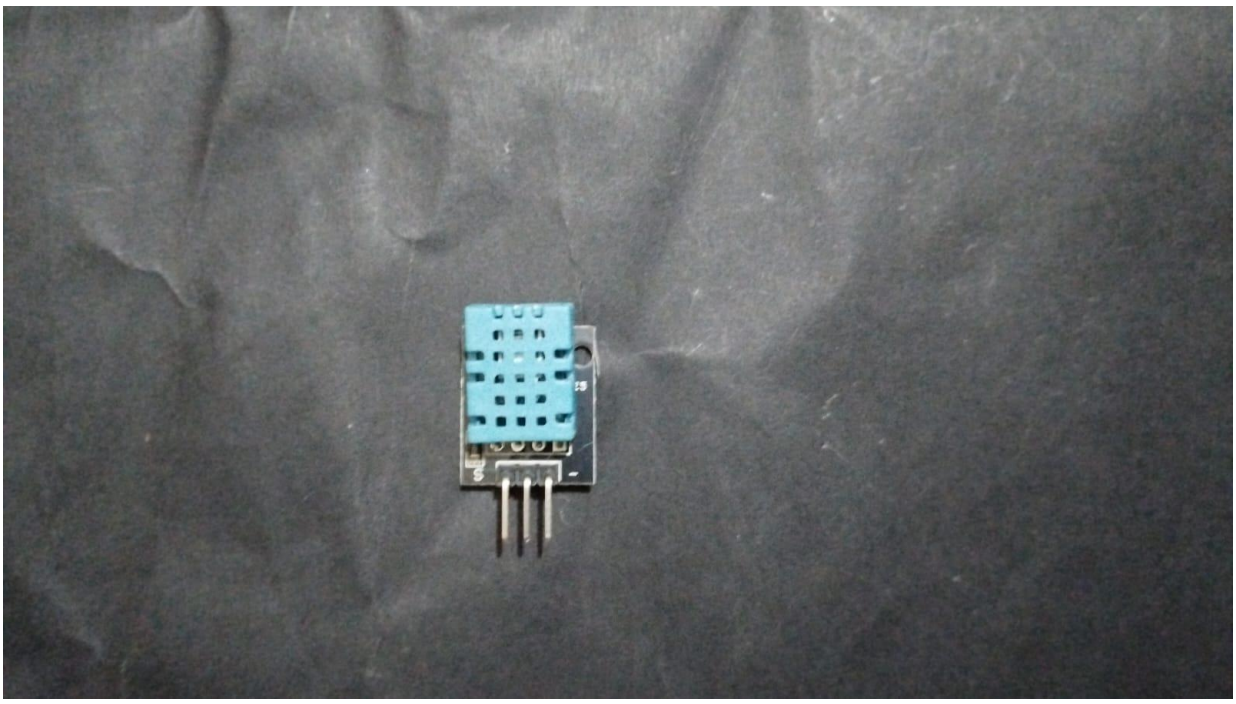
ANALOG IN




JHD 162A


SUPER
HYW
LONG LIFE
6F22 9V
BATTERY
FOR
TRANSISTOR
RADIOS
GENERAL PURPOSE
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5. System Testing and Result

5.1 System Testing

After completing the hardware connections and uploading the program to the **Arduino Uno**, the system was tested to check whether it works correctly in real conditions. Testing was done step by step to ensure each part of the system performs as expected.

5.1.1 Power Supply Testing

- The system was powered using a **battery**.
- When the battery was connected, the Arduino Uno turned ON properly.
- This confirms that the power supply is stable and suitable for warehouse use.

5.1.2 Sensor Testing

- A **temperature sensor** was placed in the surrounding air.
- When the room temperature changed (by touching the sensor lightly or placing it near a warm object), the sensor detected the change.
- The sensor sent the temperature data to the Arduino Uno correctly.

5.1.3 LCD Display Testing

- A **16×2 LCD display** was connected to the Arduino.
- The LCD successfully displayed:
  - Current temperature value
  - Units in degree Celsius (°C)
- When temperature changed, the LCD updated the value automatically.

5.1.4 Wire and Connection Testing

- All **connecting wires** were checked for loose connections.
- No flickering or incorrect values were observed on the LCD.
- This confirms proper wiring and stable data transfer.

5.2 Result

After successful testing, the **Smart Warehouse Temperature Monitoring System** worked accurately and reliably.

Observed Results

- The system continuously monitors the warehouse temperature.

- Temperature readings are displayed in real time on the LCD.
- The system works on battery power, making it portable and suitable for warehouses.
- Temperature changes are detected quickly and shown clearly.

Final Outcome

The project successfully meets its objective of monitoring warehouse temperature using a simple IoT-based system. It helps in:

- Preventing damage to stored goods
- Maintaining safe storage conditions
- Providing an easy and low-cost solution for warehouse monitoring

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Conclusion of Testing

The system passed all testing stages and produced correct results. It is reliable, easy to use, and suitable for small and medium warehouses.

6. Future Scope and Conclusion

6.1 Future Scope

The **Smart Warehouse Temperature Monitoring System** can be improved and expanded in many ways in the future:

1. **IoT Cloud Integration**
   The system can be connected to an IoT platform such as ThingSpeak or Blynk. This will allow warehouse managers to monitor temperature remotely using a mobile phone or computer.
2. **Mobile Alert System**
   Alerts can be sent through SMS or mobile notifications if the temperature crosses a safe limit. This helps in taking quick action to protect stored goods.
3. **Multiple Sensors**
   More temperature and humidity sensors can be added at different locations inside the warehouse to get accurate and real-time data.
4. **Data Logging and Analysis**
   Temperature data can be stored for long-term analysis. This data can help in identifying patterns and improving warehouse conditions.
5. **Automation**
   The system can be connected to cooling fans or air conditioners. When temperature increases, the system can automatically turn ON cooling devices.
6. **Battery Optimization**
   In the future, better power management or solar power can be used to increase battery life and reduce maintenance.

6.2 Conclusion

The **Smart Warehouse Temperature Monitoring IoT Project** is a simple and effective system designed to monitor temperature inside a warehouse using **Arduino Uno**, temperature sensors, LCD display, battery, and connecting wires. This system helps in preventing damage to temperature-sensitive goods such as food items, medicines, and electronic products.

The LCD shows real-time temperature values, making it easy for workers to monitor the environment.
The project is **low cost**, **easy to implement**, and **reliable**. It also helps students understand basic concepts of **IoT, sensors, microcontrollers, and embedded systems**.
Overall, this project proves that technology can be effectively used to improve warehouse safety and management in a simple and efficient way.

7. References

1. **Arduino Official Website**
   Reference used to understand Arduino Uno board, pin details, power supply, and basic programming.
   Website: https://www.arduino.cc
2. **Arduino Uno Datasheet**
   Used to study the technical specifications of Arduino Uno such as voltage levels, digital and analog pins.
3. **LCD 16×2 Datasheet**
   Reference used to understand how a 16×2 LCD works, its pin connections, and display control.
4. **Temperature Sensor Datasheet (LM35 / DHT11)**
   Used to learn how the temperature sensor measures temperature and sends data to Arduino.
5. **Basic IoT Learning Notes**
   Reference materials from class notes and beginner IoT tutorials were used to understand the concept of IoT-based monitoring systems.
6. **YouTube Educational Tutorials**
   Beginner-friendly videos were referred to for practical wiring of Arduino, LCD, temperature sensor, battery, and jumper wires.
7. **Electronics for Beginners – Online Articles**
   Articles explaining basic electronics components such as batteries, jumper wires, and sensors were used for understanding connections.

8. Glossary

Arduino Uno

Arduino Uno is a small electronic board used as the main controller in this project. It reads data from sensors and controls devices like the LCD display. It is easy to program and commonly used in IoT projects.

IoT (Internet of Things)

IoT means connecting physical devices to the internet so they can collect and share data. In this project, IoT helps monitor warehouse temperature automatically.

Temperature Sensor

A temperature sensor is a device that measures the surrounding temperature. In this project, it detects the warehouse temperature and sends the value to the Arduino.

Warehouse

A warehouse is a large storage place used to keep goods. Monitoring temperature in a warehouse is important to protect items like food, medicines, and electronics.

LCD (Liquid Crystal Display)

An LCD is a screen used to display information. In this project, it shows the current temperature readings clearly.

Battery

A battery provides power to the circuit. It allows the system to work even when external power is not available.

Jumper Wires

Jumper wires are used to connect different electronic components on the circuit. They help in transferring signals and power between parts.

Sensor Module

A sensor module includes the sensor and supporting components. It makes it easier to connect the sensor with the Arduino board.

Microcontroller

A microcontroller is a small computer on a single chip. Arduino Uno contains a microcontroller that controls all operations of the system.

Embedded System

An embedded system is a combination of hardware and software designed for a specific task. This project is an embedded system

used for temperature monitoring.

Monitoring System

A monitoring system continuously checks conditions like temperature and displays or sends the data for observation.

Real-Time Data

Real-time data means information that is measured and displayed instantly without delay. The temperature shown on the LCD is real-time data.

Power Supply

A power supply provides electrical energy to the system. In this project, the battery acts as the power supply.

Circuit

A circuit is a path through which electricity flows. It connects the Arduino, sensor, LCD, and battery together.

Automation

Automation means performing tasks automatically without human effort. This project automates temperature monitoring in a warehouse.

Data Output

Data output refers to the information displayed or sent by the system. Here, the temperature shown on the LCD is the output.