IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

IoT-Based Temperature Regulatory System

USING SENSOR INTEGRATION(IOT)

Ms.G.Aishwaryalakashmi, M.Hariharan, S.Akilesh, S.Sanjayrahul, R.Siddharth

Lecturer, Student, Student, Student
DIPLOMA IN INFORMATION TECHNOLOGY
PSG POLYTECHNIC COLLEGE, COIMBATORE, INDIA

ABSTRACT:

This paper presents the design and implementation of an IoT-based temperature regulatory system aimed at optimizing the performance of centralized air conditioning (AC) systems in large spaces, such as auditoriums, hospitals, and meeting halls. The system integrates DHT22 sensors for continuous real-time monitoring of temperature and humidity. Using these data points, the system autonomously adjusts AC settings to maintain optimal environmental conditions, ensuring both comfort and energy efficiency. This study explores the operational mechanisms of the system, the benefits of IoT integration, and its potential to reduce operational costs. The system also features a user-friendly monitoring interface, making it easily accessible for real-time adjustments and data analytics.

IoT, Temperature Regulation, DHT22 Sensor, Energy Efficiency, Centralized Air Conditioning, Automation, Smart Control, Environmental Monitoring, Real-Time Data, System Integration

1.INTRODUCTION

Efficient temperature regulation in large indoor environments, such as hospitals, auditoriums, and conference halls, is a critical factor in ensuring occupant comfort and optimizing energy consumption. Traditional air conditioning systems in these settings often rely on manual control or basic thermostatic mechanisms that struggle to maintain consistent temperature and humidity levels. These challenges are amplified in large spaces due to varying occupancy rates, external weather conditions, and the heat generated by equipment or activities. Consequently, these systems tend to operate inefficiently, leading to excessive energy usage and fluctuating temperature zones, which can negatively impact both comfort and operational costs.

In recent years, the integration of **Internet of Things (IoT)** technologies has emerged as a transformative solution to address these inefficiencies. IoT enables real-time monitoring, data-driven decision-making, and remote control capabilities, allowing for a more responsive and adaptable approach to temperature management. By leveraging sensor networks and intelligent automation, IoT-based systems can dynamically adjust air conditioning operations based on real-time environmental data, thus reducing energy wastage and enhancing occupant comfort.

This paper presents the development of an **IoT-enabled temperature regulatory system** designed specifically for large spaces. At the core of the system is the **DHT22 sensor**, a reliable and precise device capable of continuously monitoring both temperature and humidity. The system is powered by a ESP32, which functions as the central controller, processing sensor data and executing control commands to regulate air conditioning units automatically.

2. METHODOLOGY

2.1 SYSTEM ARCHITECTURE:

The architecture of the IoT-based temperature regulatory system consists of the following key components:

1. DHT22 Sensors:
These sensors are used to measure temperature and humidity in the environment. The DHT22 is chosen due to its high accuracy and affordable cost, making it ideal for real-time environmental monitoring.

2. Controller :
The ESP32 processes the sensor data, performing calculations to decide when to turn on or adjust the AC unit. It functions as the central controller that processes incoming data and sends commands to actuators (relays).

3. Smart Relay and AC Control:
A smart relay interface is used to control the AC units based on the processed data. The relay sends on/off commands to the AC depending on the temperature or humidity thresholds set by the system.

4. Display Interface :
The real-time data regarding temperature, humidity, and system status are displayed on an LCD screen, making it easy for users to monitor system performance.

5. Wi-Fi Communication :
Wi-Fi connectivity is used to enable remote monitoring and adjustments through ThingSpeak or similar platforms. Users can access data remotely, visualize environmental trends, and adjust system settings.

2.2 WORKING PRINCIPLE:

The operation of the system is based on the following principles:

1. Data Collection:
The DHT22 sensors continuously monitor environmental conditions. The collects these data points at regular intervals and processes them.

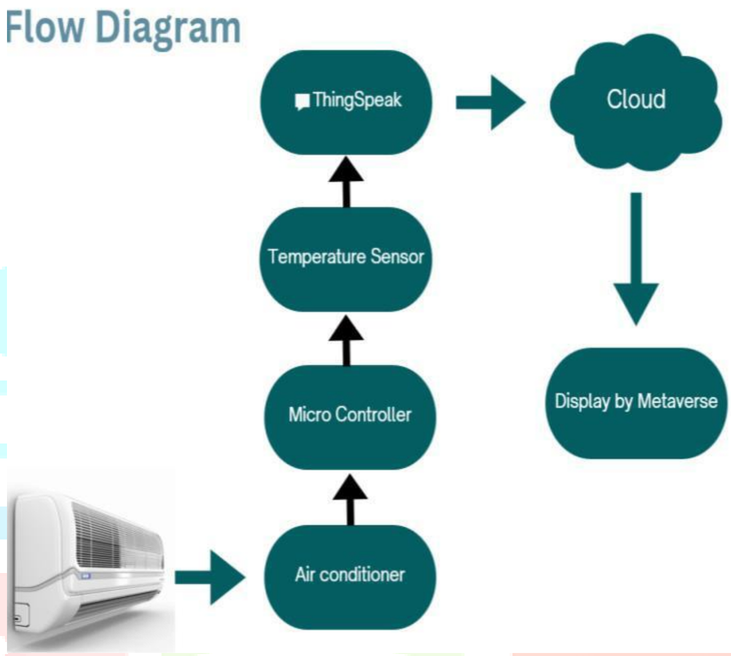
2. Data Processing:
The controller uses predefined threshold values to decide whether the temperature or humidity readings require intervention.
If the values fall outside of comfortable parameters, the system automatically adjusts the AC settings.

3. Actuation:
Based on the data, the ESP32 sends control signals to the smart relay to adjust the AC's settings. This could involve turning the AC on/off or adjusting its intensity depending on the real-time requirements.

4. User Interface:
The system presents the current status, including temperature, humidity, and AC status, on a real-time display. Additionally, remote access is provided through IoT platforms like ThingSpeak, which allows for cloud-based monitoring and adjustments.

2.3 FLOWCHART:

The flowchart of the **IoT-Based Temperature Regulatory System** illustrates the sequence of processes involved in monitoring, analyzing, and adjusting the air conditioning (AC) system in real-time based on environmental data. Below is a step-by-step description of the flow:



3. PROBLEM STATEMENT:

1. Energy Inefficiency:
Traditional AC systems often run continuously without adjustment, leading to over-cooling or under cooling, both of which contribute to increased energy consumption and higher costs.

2. Inconsistent Temperature Distribution:
Large spaces often experience uneven temperatures, making it uncomfortable for occupants and impacting environments that require precise temperature control, such as hospitals or data canters.

3. Limited Automation:
Existing systems rely on manual adjustment or basic thermostats, which do not account for fluctuating conditions or varying occupancy, leading to inefficiencies in maintaining the desired environmental conditions.

4. RESULTS & DISCUSSION

4.1 TESTING AND DATA ANALYSIS :

The system was tested in various environments, including a meeting hall, a hospital ward, and an auditorium. the preliminary results show:

Energy Savings: One of the primary objectives of the system was to reduce energy consumption through smart, data-driven control of air conditioning units. Across all tested environments, the system demonstrated significant energy savings, achieving an average reduction of **30%** in energy consumption compared to traditional thermostat-based systems.

Temperature Consistency: Maintaining consistent temperatures across large spaces can be challenging with conventional systems, often resulting in hot or cold zones due to uneven airflow and varying external influences. The IoT system resolved this by continuously monitoring temperature and humidity levels across different zones and adjusting AC settings accordingly.

System Efficiency: The deployment of real-time IoT monitoring and automated control mechanisms allowed the system to react quickly to changes in environmental conditions. Unlike traditional systems that rely on periodic manual adjustments, the IoT-enabled system processed sensor data every few seconds, enabling near-instantaneous responses. This rapid reaction time not only improved operational efficiency but also reduced the need for human intervention, minimizing the burden on facility management staff

4.2 USER EXPERIENCE :

Feedback from users indicated that the real-time display and remote monitoring features significantly enhanced user control over the system, providing a seamless user experience:

Real-Time Display: The system's real-time data visualization feature was consistently praised by users for its clarity and accessibility. Facility managers were able to monitor temperature, humidity, and energy consumption metrics in real-time through a web-based dashboard.

Remote Monitoring and Control: One of the standout features of the system was its **remote accessibility**, which allowed users to adjust settings and monitor performance from any location via a smartphone, tablet, or computer. This capability significantly enhanced operational flexibility, particularly for large facilities with multiple zones.

Seamless Integration and Ease of Use: The system's **user-friendly interface** and seamless integration into existing infrastructure were also highly valued. Users reported that the setup process was straightforward and that the system required minimal training to operate.

User Control Logs and Reports:The system generated detailed logs and reports of all user interactions, such as manual adjustments, automatic changes, and system alerts. These reports provided insights into system performance over time and were helpful for energy audits and maintenance planning.

4.3 OUTPUT:

The output of the **IoT-Based Temperature Regulatory System** can be categorized into three main components: **sensor data**, **system actions.**

5. CONCLUSION

The **IoT-based Temperature Regulatory System** presents a transformational approach to climate control in large-scale environments by seamlessly integrating environmental sensors, smart control mechanisms, and remote monitoring platforms. This integration enables real-time monitoring and precise adjustment of temperature and humidity levels, optimizing energy usage while maintaining a consistent and comfortable indoor environment. By addressing inefficiencies in traditional centralized AC systems, the solution not only enhances operational efficiency but also significantly reduces energy consumption and operational costs.

The system's adaptability and scalability make it an ideal solution for a variety of sectors where energy efficiency, climate control, and occupant comfort are crucial. In **hospitals**, maintaining precise temperature and humidity levels is essential for patient care and infection control. In **auditoriums**, the system ensures a comfortable environment for large audiences while minimizing energy waste during non-peak hours. For **corporate buildings**, the technology promotes a healthier, more productive workspace by maintaining optimal indoor air quality and temperature, which can lead to increased employee satisfaction and reduced absenteeism.

Furthermore, the system's integration with **remote monitoring platforms** enables centralized management across multiple locations, providing actionable insights through data analytic. Facility managers can make informed decisions, predict maintenance needs, and implement energy-saving strategies based on real-time data trends. This predictive capability helps in reducing downtime, extending equipment lifespan, and minimizing operational disruption

6. REFERENCES:

1.Jecheche, P. **(2010)**. Inflation and Stock Returns: Evidence from Zimbabwe. **Journal of Financial Research.**

2.Iqbal, M., et al. **(2010)**. Relationship Between Macroeconomic Variables and Stock Returns. **International Journal of Economics.**

3.Yang, B., & Wang, C. (**2017).** Smart IoT Solutions for Energy Efficiency in Commercial Buildings. **Journal of Sustainable Ene**