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Monitoring and Controlling of Environmental Conditions in Godowns

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Abstract: Monitoring environmental conditions in storage facilities, especially for crops like ragi and wheat, is crucial for maintaining their quality and safety. Traditionally, manual methods for tracking temperature, humidity, air quality, and fire risks are labor- intensive and prone to errors. Ourprototype offers a modern, automatedsolution using an ESP32 microcontroller integrated with various sensors. This system ensures reliable and continuous monitoring, with data logged to ThingSpeak and alerts sent via Pushbullet for immediate response, providing a cost-effective and efficient approach to managing storage environments.

Keywords: Environmental monitoring, ESP32, temperature and humidity, air quality, fire detection, automated alerts, data logging, cost-effective.

INTRODUCTION

The "Monitoring and Controlling of Environmental Conditions in Godowns" project is designed to efficiently manage and maintain optimal environmental conditions within storage facilities. This system employs advanced sensors and microcontrollers, including the ESP32, DHT11 for temperature and humidity, and MQ135 for air quality. The system ensures that conditions within the godown are continuously monitored and controlled, preventing damage to stored goods.

By integrating real-time data collection with automated control mechanisms, the system can activate cooling fans or buzzers when necessary, ensuring the environment remains within desired parameters. The use of an LCD display provides instant feedback on current conditions, while WiFi connectivity enables monitoring and alerts via platforms like ThingSpeak.

This innovative approach not only enhances the preservation of stored items but also reduces manual intervention, leading to improved efficiency and reliability in managing storage environments. this system minimizes errors, saves time, and streamlines tasks, ultimately contributing to a more efficient and productive environment.

LITERATURE PAPER

[1] Anil Kumar, Manoj Singh, and Preeti Sharma's proposal for a Real-Time Warehouse Management System utilizes the DS1307 RTC and ESP32 for accurate timekeeping and data synchronization. Thissystem ensures precise time tracking, whichis crucial for various warehouse management activities. The integration with ESP32 allows for wireless communication, enabling remote monitoring and control. This system can be particularly useful for tracking inventorymovement and ensuring timely updates in the database. Moreover, it supports real-timealerts and notifications for critical events, enhancing operational efficiency. The system's architecture allows for easy scalability, making it adaptable to warehousesof different sizes.

[2] Deepak Singh, Neha Gupta, and Sanjay Kumar developed an Air Quality Monitoring System for warehouses using the MQ135 sensor and ESP32. This system benefits from the ESP32's wireless capabilities, enabling remote monitoring and safety alerts for hazardous air quality levels. The system continuously monitors the concentration of various gases and pollutants, providing real- time data to the warehouse management. The integration with ESP32 allows for seamless data transmission to a centralized server or cloud platform. This enables historical data analysis and trend identification, which can inform decisions about ventilation and air purification. The system is designed to becost-effective and easy to deploy, making it suitable for a wide range of warehouse environments.

[3] Rajesh Kumar, Priya Sharma, and AmitPatel's IoT-Based EnvironmentalMonitoring System leverages the ESP32

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and DHT22 sensor to provide real-time monitoring of temperature and humidity in warehouses. This system is advantageous for maintaining optimal storage conditions, which is critical for preserving the quality of stored goods. The real-time data provided by the system allows warehouse managers to respond promptly to any deviations from the desired environmental conditions. The system can also generate alerts and notifications in case of abnormaltemperature or humidity levels, ensuringtimely interventions. Additionally, the datacollected can be used for long-term analysis and optimization of storage conditions, leading to improved efficiency and reduced spoilage or damage of goods.

[4] Suresh Verma, Ramesh Gupta, andMeena Devi's IoT-Based Storage Condition Monitoring system employs the ESP32 and an LCD display to monitor storage conditions in warehouses. The system provides immediate visual feedback on environmental parameters, making it easy for users to monitor conditions at a glance. The user-friendly interface of the LCD display ensures that even non-technical personnel can operate the system effectively. The system continuously tracks parameters liketemperature, humidity, and air quality, displaying the information in real-time. This helps in ensuring that storage conditions are always optimal, thereby protecting the stored goods from potential damage. The integration with ESP32 enables remote monitoring and control, adding an extra layer of convenience and flexibility for warehouse managers.

METHODOLOGY

A. BLOCK DIAGRAM

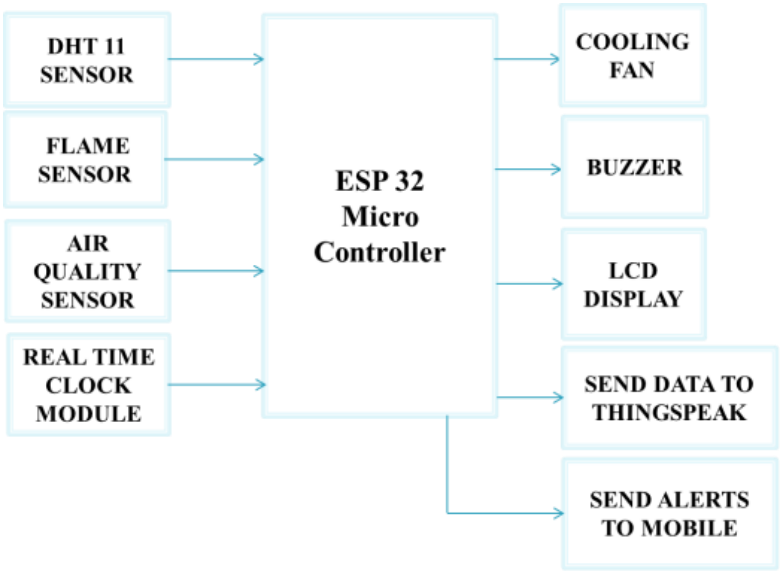

Fig 1:Block diagram of the system

Figure 1 represents the block diagram of the environmental monitoring and control system. The system utilizes an ESP32 microcontroller. The DHT11 sensor is used for measuring temperature and humidity, while the flame sensor detects fire. The air quality sensor monitors the air quality, providing crucial data for maintaining safe conditions. The real-time clock module ensures accurate timekeeping fortime-stamped data logging. The ESP32 processes the data and activates the cooling fanand buzzer based on preset conditions. The LCD display provides immediate visualfeedback of the environmental parameters.Additionally, the system is capable of sending data to ThingSpeak for cloud storage and analysis, as well as sending alerts to mobile devices for real-time notifications.

B. WORKING

The environmental monitoring and control system operates by continuously collecting data from various sensors connected to the ESP32 microcontroller. The DHT11 sensor monitors temperature and humidity, while the flame sensor detects the presence of fire. The air quality sensor continuously measures air quality levels. The DS3231 RTC module provides accurate timekeeping, ensuring that all data is time-stamped correctly. When the temperature or humidity exceeds predefined thresholds, the ESP32 activates the cooling fan to maintain optimal conditions. If a fire is detected, the buzzer sounds an alarm to alert personnel. Data from all sensors is displayed inreal-time on the LCD screen for easy monitoring. Additionally, the system sends collected data to ThingSpeak for cloud-based

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analysis and storage, allowing for historical data review and trend analysis. Alerts are also sent to mobile devices in case of critical conditions, ensuring immediate attention and response. The system operates continuously, ensuring the safety and optimal environmental conditions in godowns.

C. FLOWCHART

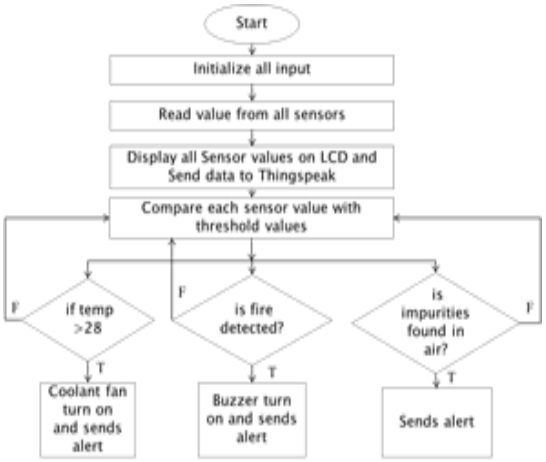

Fig 2: Flow chart of the system

The flowchart in Figure 2 illustrates the operational sequence of the system. The process starts with initializing all inputs and reading values from all sensors. These sensor values are displayed on an LCD and sent to ThingSpeak for monitoring. The system then compares each sensor value against predefined threshold values to determine the appropriate response. If the temperature exceeds 28°C, a coolant fan is activated, and an alert is sent. If fire isdetected, a buzzer turns on, and an alert is sent. If impurities are found in the air, an alert is sent. The flowchart ensures that the system responds appropriately to different sensor readings to maintain safety and proper environmental conditions.

RESULTS

The prototype of the proposed system is shown in Figure 3.

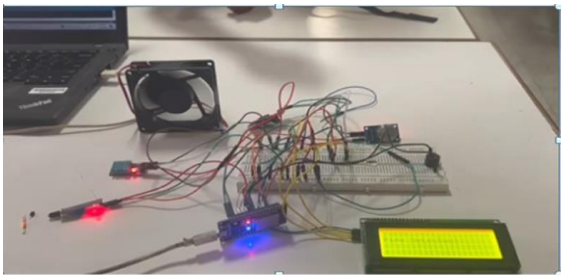

Fig 3:Prototype of proposed system

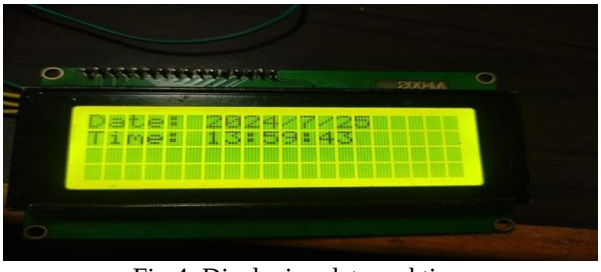

Fig 4: Displaying date and time

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Fig 5: Displaying Temperature andhumidity values

Fig 6: Displaying air quality value

Fig 7: Displaying fire detection

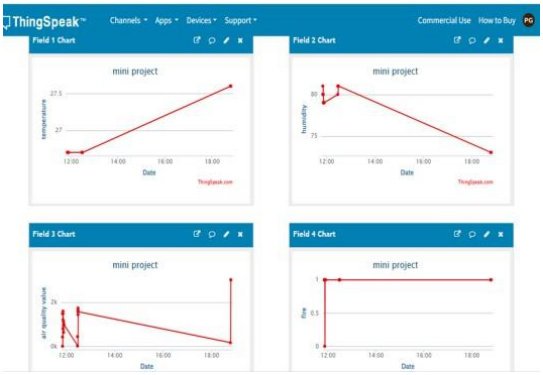

Fig 8: Data uploaded in the Thingspeak

Fig 9: Notifications received on mobile

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APPLICATIONS

1. Agricultural Management: Monitor greenhouse conditions to optimize plant growth by regulating temperature, humidity, and air quality.
2. Industrial Environment Monitoring: Maintain safe working conditions by monitoring air quality and detecting hazardous gases.
3. Home Automation: Integrate with smart home systems to automatically control heating and air conditioning systemsbased on temperature and humidity data.
4. Healthcare Facilities: Ensure clean and safe air quality in hospitals and clinicsby continuously monitoring environmental conditions.
5. Office Buildings: Improve workplace comfort and productivity by monitoring and controlling indoor air quality andclimate.
6. Data Centers: Monitor temperature and humidity to ensure optimal operating conditions for servers and equipment. Automate cooling systems to preventoverheating and ensure data integrity.

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