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SMART POULTRY FARM AUTOMATION AND MONITORING SYSTEM

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ABSTRACT

Poultry farming requires continuous monitoring of environmental conditions and feeding systems to ensure healthy growth and high productivity of birds. Traditional poultry farm management relies heavily on manual supervision, which can be labor-intensive, time-consuming, and prone to human error. To overcome these limitations, this paper presents the design and implementation of a Smart Poultry Farm Automation and Monitoring System based on Internet of Things (IoT) technology. The proposed system utilizes a Node MCU ESP8266 microcontroller integrated with sensors to monitor critical parameters such as temperature and water level within the poultry house. Based on the sensor readings, relay-controlled actuators automatically regulate devices such as cooling fans, exhaust fans, and a motor-driven feeding mechanism. A 16×2 LCD display provides real-time monitoring of environmental conditions and system status. The system also incorporates an automated feed distribution mechanism using a screw conveyor to ensure consistent feed delivery to multiple feeding tanks. Experimental testing was conducted in a controlled poultry environment to evaluate system performance. The results demonstrate that the system achieves over 90% climate control efficiency and approximately 92%feed distribution accuracy, ensuring reliable operation and improved farm management. The proposed solution provides a cost-effective, scalable, and efficient automation system suitable for small and medium-scale poultry farms, reducing manual labor while improving productivity and environmental control.

KEYWORDS: *Smart Poultry Farming, Internet of Things (IoT), Node MCU ESP8266,PoultryFarmAutomation,Environmental Monitoring, Sensor-Based Control, Automated Feeding System, Smart Agriculture, Temperature Monitoring, Embedded Systems.*

I. INTRODUCTION

Poultry farming plays an important role in global food production by supplying eggs and poultry meat. Maintaining proper environmental conditions such as temperature, ventilation, and feed availability is essential for the healthy growth and productivity of poultry birds. Traditional poultry farm management relies on manual monitoring and control, which is time-consuming, labor-intensive, and prone to human error. Recent advancements in **Internet of Things (IoT)** and embedded systems have enabled the development of smart agricultural solutions. IoT based systems allow sensors and microcontrollers to monitor environmental conditions in real time and automatically control farm equipment when required.

The proposed **Smart Poultry Farm Automation and Monitoring System** uses a Node MCU ESP8266 microcontroller integrated with sensors to monitor important environmental parameters such as temperature and water level inside the poultry house. The sensors continuously collect data and send it to the microcontroller for processing. Based on the sensor readings and predefined threshold values, the system automatically controls cooling fans, exhaust fans, and a motorized feeding mechanism through relay modules. This automated control helps maintain suitable environmental conditions for poultry growth. A **16×2 LCD display** is also integrated into the system to provide real-time information about temperature, water level, and overall system status, allowing easy monitoring by the farmer. The proposed system offers a **cost-effective and efficient automation solution** that reduces the need for constant manual supervision. By automatically regulating environmental conditions and ensuring timely feed distribution, the system improves operational efficiency and minimizes human error. As a result, it enhances environmental stability, supports healthier poultry growth, and increases productivity in **small and medium-scale poultry farms**.

II. LITERATURE REVIEW

Farooq et al. (2019) survey the role of IoT in enabling smart farming by integrating sensors, communication networks, and data analytics for real-time agricultural monitoring. The study highlights applications such as precision farming, greenhouse management, and livestock monitoring to improve productivity and resource efficiency. It also discusses challenges including security, interoperability, high costs, and limited rural connectivity. The authors suggest future improvements through AI integration, low-cost solutions, and better standardization.

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Khanna and Kaur (2019) examine the evolution of IoT and its impact on precision agriculture, emphasizing how connected devices enable real-time monitoring and data-driven decision-making. The study highlights applications such as soil analysis, crop health monitoring, and automated irrigation to enhance productivity and reduce resource wastage. It also discusses the integration of IoT with cloud computing and data analytics for efficient farm management. Challenges such as data security, scalability, and infrastructure limitations are identified as key concerns for widespread adoption Kodalietal. (2016) present an IoT-based system for smart home automation and security, integrating sensors and microcontrollers for remote monitoring and control. The study demonstrates how devices such as motion sensors and cameras enhance home security while enabling automation of appliances. It highlights the use of wireless communication for real-time alerts and user interaction. The paper also emphasizes improved convenience, energy efficiency, and safety through IoT-enabled smart homes.

Prathibha et al. (2017) propose an IoT-based monitoring system for smart agriculture that uses sensors to collect real-time data on soil moisture, temperature, and humidity. The system enables automated irrigation and remote monitoring through wireless communication technologies. It aims to improve crop productivity while optimizing water usage and reducing manual effort. The study highlights IoT as an effective solution for efficient and sustainable farm management.

III. SYSTEM ARCHITECTURE

The proposed **Smart Poultry Farm Automation and Monitoring System** is designed using a sensor-based embedded architecture that integrates environmental monitoring, automated control, and real-time display. The system consists of three main components: **sensor modules, a central controller, and actuator modules**.

At the core of the system is the **Node MCU ESP8266 microcontroller**, which acts as the main processing unit. It collects data from sensors such as the **DS18B20 temperature sensor** and the **ultrasonic water level sensor (HC-SR04)**.These sensors continuously monitor the environmental conditions inside the poultry house. The collected data is processed by the microcontroller and compared with predefined threshold values to determine whether corrective actions are required.

Based on the sensor readings, the microcontroller controls different **actuators through relay modules**.

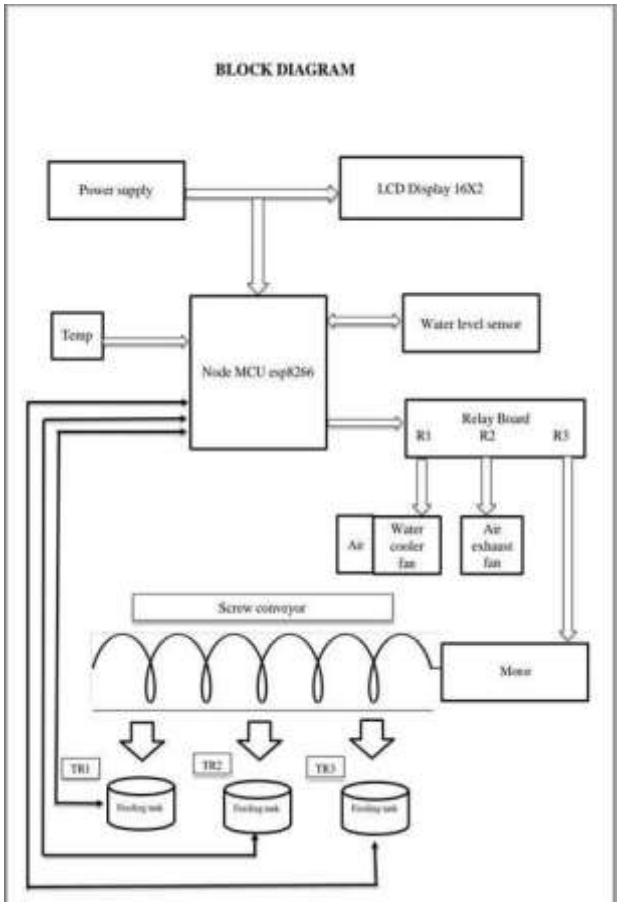

Fig1.System architecture of Poultry farm

The relays operate devices such as cooling fans, exhaust fans, and a feeding motor. When the temperature exceeds the specified threshold, the cooling and ventilation systems are automatically activated. Similarly, the feeding motor is triggered when feed levels in the tanks fall below the required level.

A**16×2LCDdisplay** is integrated into the system to provide real-time monitoring of temperature, water level, and system status. The architecture ensures reliable communication between sensors, controller, and actuators, enabling efficient automation and monitoring of poultry farm operations. This modular architecture makes the system **scalable, cost-effective, and suitable for small and medium-scale poultry farms**.

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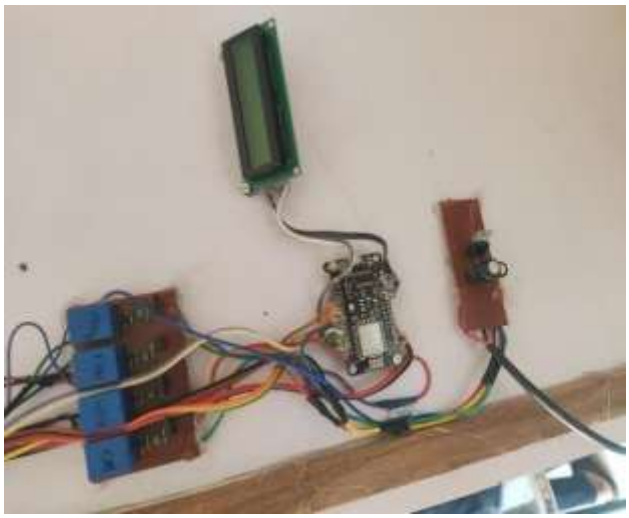

Fig 2. Internal structure of hardware

Fig.3 ***Internal system design***

Fig.4 Indications of parameters on mobile

Fig.5. Fan arrangements at outside of farm

IV. RESULT AND DISCUSSION

The proposed **Smart Poultry Farm Automation and Monitoring System** was tested in a controlled environment to evaluate its performance in monitoring environmental conditions and automating farm operations. Several tests were conducted to analyze the system's response to changes in temperature, water level, and feed availability. The system demonstrated reliable sensor data acquisition and effective actuator control through the Node MCU ESP8266 microcontroller.

Experimental results show that the automated climate control mechanism successfully maintained the environmental temperature within the desired range. The system achieved Climate **Control Efficiency (CCE) of more than 90%**, indicating that the poultry house conditions remained within the optimal temperature range for most of the testing duration. The response time of the system to temperature changes was observed tobeapproximately**5–10seconds**,which is adequate for gradual environmental adjustments in poultry houses.

The automated feeding mechanism also performed effectively during testing. The screw conveyor feeding system successfully distributed feed to multiple tanks with an average **feed distribution accuracy of approximately92–94%**.This ensured that feed levels remained sufficient for the birds while minimizing wastage. The system automatically activated the feeding motor whenever the feed level sensors detected a low feed condition in any tank.

The **Node MCU ESP8266microcontroller** proved to be reliable for integrating sensor monitoring and actuator control. The real-time data displayed on the **16×2 LCD** allowed easy monitoring of temperature and water level conditions. Overall, the system demonstrated stable performance and efficient automation of key poultry farm operations. These results confirm that the proposed system can significantly reduce manual labor while maintaining optimal environmental conditions in poultry farms. The integration of sensors, microcontroller- based control, and automated feeding mechanisms provides a **cost-effective and efficient solution for small and medium-scale poultry farm automation**.

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V. CONCLUSION

This paper presented the design and implementation of a **Smart Poultry Farm Automation and Monitoring System** using a Node MCU ESP8266 microcontroller. The system integrates temperature and water level sensors with relay-based actuators to automatically control ventilation, cooling, and feed distribution in a poultry farm environment. The proposed system successfully demonstrated real-time monitoring and automated control of essential farm operations.

Experimental testing showed that the system achieved **over 90%climate control efficiency and approximately 92–94% feed distribution accuracy**, indicating reliable performance in maintaining suitable environmental conditions and ensuring proper feed supply. The automated operation reduces manual labor, minimizes human errors, and helps maintain stable conditions for poultry growth.

Overall, the proposed system provides a **cost-effective, reliable, and scalable solution** for small and medium-scale poultry farms. By integrating IoT-based monitoring with automated control mechanisms, the system improves farm management efficiency and productivity. In the future, the system can be further enhanced by incorporating additional sensors, cloud-based monitoring, and intelligent data analysis for advanced smart farming applications.

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