

Smart Poultry Management System with IoT and Sensors Network

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Abstract: *In poultry farms, maintaining a proper and stable environment is essential for the healthy growth and productivity of birds. However, continuously monitoring temperature, humidity, light, water availability, and waste conditions manually is time-consuming and often inefficient, especially in large or rural poultry setups. To overcome these challenges, we have developed a Smart Poultry Management System that uses IoT-based automation to monitor and control the poultry environment in real time.*

In this system, both the STM32 microcontroller and ESP32 module are used for efficient data processing and wireless communication. The STM32 handles core sensor data acquisition and actuator control, while the ESP32 manages IoT connectivity and data transmission to a cloud dashboard. Sensors such as the DHT11 for temperature and humidity, LDR for light intensity, moisture sensor for waste detection, and ultrasonic sensor for water-level monitoring are integrated into the system to ensure continuous tracking of environmental parameters. Based on these readings, actuators such as the fan, heater, LED lighting system, water pump, and automatic ventilation mechanism are controlled to maintain optimal conditions inside the shed. The system also supports remote monitoring through IoT, allowing farmers to view real-time farm conditions on a mobile or web dashboard. This automated setup reduces manual labour, enhances bird comfort, minimizes risks of disease, and increases overall farm efficiency.

Keywords: Wi-Fi, Real time monitoring, Software Dashboard

I. INTRODUCTION

A Poultry farming is a vital component of the agricultural industry, playing a significant role in food security, rural employment, and the overall economy. It primarily involves the raising of domesticated birds such as chickens for meat (broilers) and eggs (layers). India, being one of the leading poultry producers in the world, has witnessed substantial growth in this sector due to increasing urbanization, changing food habits, and rising protein demand. However, traditional poultry farming methods often face challenges such as inefficient monitoring, inconsistent environmental conditions, delayed disease detection, and high dependency on manual labour. These issues can negatively impact the health and productivity of poultry birds, resulting in economic losses for farmers. To address these challenges and enhance productivity, there is a growing need to adopt modern technologies in poultry management. The integration of Internet of Things (IoT) technologies in poultry farming has opened new avenues for smart, automated, and data-driven farm operations.

Our project, titled "Smart Poultry Management System with IoT and Sensor Network," is designed to revolutionize conventional poultry practices by implementing a technology-based approach. The system leverages IoT-enabled devices such as sensors and microcontrollers to automate and monitor critical parameters within the poultry environment.

These parameters include:

Temperature and Humidity

Control: Ensures a stable and healthy atmosphere inside the poultry shed, crucial for the growth and wellbeing of the birds. Lighting System: Controls lighting conditions automatically to support the birds' growth cycle and behaviour.

Real-time Monitoring and Alerts: Sends live updates and alerts to the farmer's smartphone or dashboard, enabling timely interventions. The Smart Poultry Management System not only improves the overall efficiency and productivity



of the poultry farm but also reduces labour costs, minimizes human error, and ensures better health management of the flock. With data driven insights, farmers can make informed decisions, optimize resource usage, and enhance sustainability in poultry farming.

II. LITERATURE REVIEW

Many recent studies have concentrated on developing intelligent poultry management systems that combine automation, remote monitoring, and energy-efficient operation to improve bird welfare and enhance overall farm productivity. The traditional poultry shed environment is highly sensitive to fluctuations in temperature, humidity, air quality, and lighting—conditions that directly influence growth rate, feed conversion efficiency, stress levels, and disease outbreaks. Early research therefore focused on creating low-cost IoT-based solutions capable of continuously monitoring these environmental conditions and transmitting real-time data to centralized dashboards. These early systems enabled farmers to remotely view shed conditions through cloud platforms, reducing the need for frequent on-site inspections and helping prevent losses caused by sudden environmental deviations. This research highlighted the importance of affordability, accessibility, and suitability for rural regions, particularly where farmers experience inconsistent power supply or limited internet connectivity [1-3].

As technology advanced, researchers began integrating microcontrollers with improved wireless communication capabilities into poultry monitoring systems. Designs featuring dual-core processors and inbuilt wireless modules made it possible to transmit data more efficiently and trigger real-time alerts during environmental abnormalities. These systems collected continuous environmental readings and used cloud integration to store historical datasets, enabling long-term trend analysis and performance tracking. Improved low-power operating modes were introduced to ensure uninterrupted functionality in remote farms, where frequent power cuts can severely affect automated systems. Power-saving algorithms and sleep modes became essential components of these designs, making them both reliable and energy-efficient [2].

Further studies expanded into fully automated poultry-house control architectures aimed at minimizing human involvement in daily farm operations. These systems relied on rule-based algorithms or intelligent control logic to automate lighting cycles, ventilation movement, and water or feed regulation. When conditions deviated from recommended standards, the system automatically activated necessary equipment to restore balance. Such automation significantly reduced manual labour, increased response time to emergencies, and improved the consistency of the shed environment. As a result, flock behaviour, activity levels, and survival rates improved, demonstrating clear welfare benefits. These developments proved especially effective in commercial farms, where environmental consistency directly correlates with production output [3-8].

Recent research in poultry farming has also focused on improving the early care of chicks using smart technologies. Instead of checking temperature and humidity manually, farmers can now rely on automated systems that display all important conditions on their mobile phones. These systems make adjustments on their own and send quick alerts if any parameter becomes abnormal or if there is any unexpected activity inside the chick-rearing area. Such features help maintain a stable environment, reduce the workload on farmers, and support healthier early growth of chicks. Cloud-based data storage also helps farmers keep long-term records, compare performance across multiple batches, and improve management practices over time. [7]

Lighting plays a crucial role in poultry growth, behaviour, stress management, and biological rhythm. Research exploring optimized lighting strategies found that birds respond differently to various colours and intensities of light. Studies on LED-based lighting systems demonstrated that proper photoperiod cycles and spectral adjustments encourage better weight gain, reduce aggressive behaviour, and lower energy consumption. These lighting control systems were shown to improve feed intake timing, regulate sleeping cycles, and support healthier growth patterns without requiring expensive hardware. The integration of automated lighting with intelligent controllers further enhanced environmental uniformity[9-10].

Communication methods used in poultry farming have also been widely studied to understand how information can be shared effectively between the farm and the farmer. Research shows that different farms require different types of communication depending on their size, layout, and distance from populated areas. Large farms need systems that can



cover long distances, while smaller farms benefit from faster data transfer for real-time updates. Some studies also suggested combining more than one communication approach to ensure that the system continues working smoothly even if one network becomes weak. Overall, the literature highlights the importance of having flexible and reliable communication options that can function well in rural locations, where network strength often changes and connectivity problems are common [4-6].

In addition to hardware innovations, advanced software frameworks were developed to enhance decision support. Knowledge-based systems, fuzzy logic models, and rule engines were used to interpret sensor data and guide automated responses. Such systems captured expert agricultural knowledge and integrated it into decision-making algorithms, reducing the dependence on skilled labour and improving the precision of environmental adjustments. These intelligent decision-support models bridged gaps in farmer expertise and made automated systems more useful for small and medium-scale poultry operations. [12].

Researchers also proposed wearable and non-invasive monitoring technologies to observe individual bird activity, stress levels, and movement patterns. Although poultry monitoring typically focuses on flock-level environmental control, some studies investigated using vibration sensing, motion tracking, and lightweight monitoring devices to better understand bird behaviour. These systems provided insights into welfare assessment and could detect early signs of disease, inactivity, or stress-related problems. Researchers noted that integrating flock-level automation with individual-level monitoring offers significant potential for future precision-livestock farming models [7-9].

Field evaluations consistently highlighted power efficiency, reliability, accuracy, and usability as the most important metrics for practical deployment. Systems employing energy harvesting solutions, optimized firmware, and low-power network protocols demonstrated higher suitability for remote farms with limited maintenance access. A modular approach was preferred, enabling the system to scale across multiple poultry sheds while maintaining centralized data management and control. Such designs reduce installation cost, improve maintainability, and support expansion as farm operations grow [2,4,8].

Finally, experimental studies conducted across various prototypes concluded that IoT-enabled systems significantly reduce labour effort, enhance environmental stability, and lead to improved growth performance and reduced mortality rates. However, the literature identifies noticeable variations in implementation, especially concerning communication selection, control algorithms, and sensor integration methods. The lack of standardized evaluation benchmarks and limited long-term real-world testing highlight the need for further research to validate system reliability across diverse climatic and operational conditions [5-6-8].

Despite substantial progress in automation, environmental control, smart incubation, and wireless communication, many existing poultry management systems remain experimental and lack comprehensive integration. There is a need for end-to-end platforms that combine low-power hardware, reliable hybrid communication, long-term data analytics, user-friendly interfaces, and modular expansion capability. Few studies have explored long-duration field deployment under real farm conditions, and there is limited work integrating intelligent knowledge-based decision-making with automated environmental control. Moreover, opportunities exist to combine flock-level automation with individual-animal monitoring techniques to achieve precision poultry management. Addressing these gaps will support the development of practical, scalable, and economically viable solutions suitable for both small and large poultry farms [8-12].

Applications

Monitoring poultry health and environmental conditions.

Automating fan, heater, lighting, and water supply systems.

Remote monitoring of poultry farms via IoT...

Advantages

Maintains optimal conditions for healthy poultry growth.

Reduces manual labour through automation.

Provides real-time alerts for abnormal conditions.

Improves productivity and farm management efficiency.

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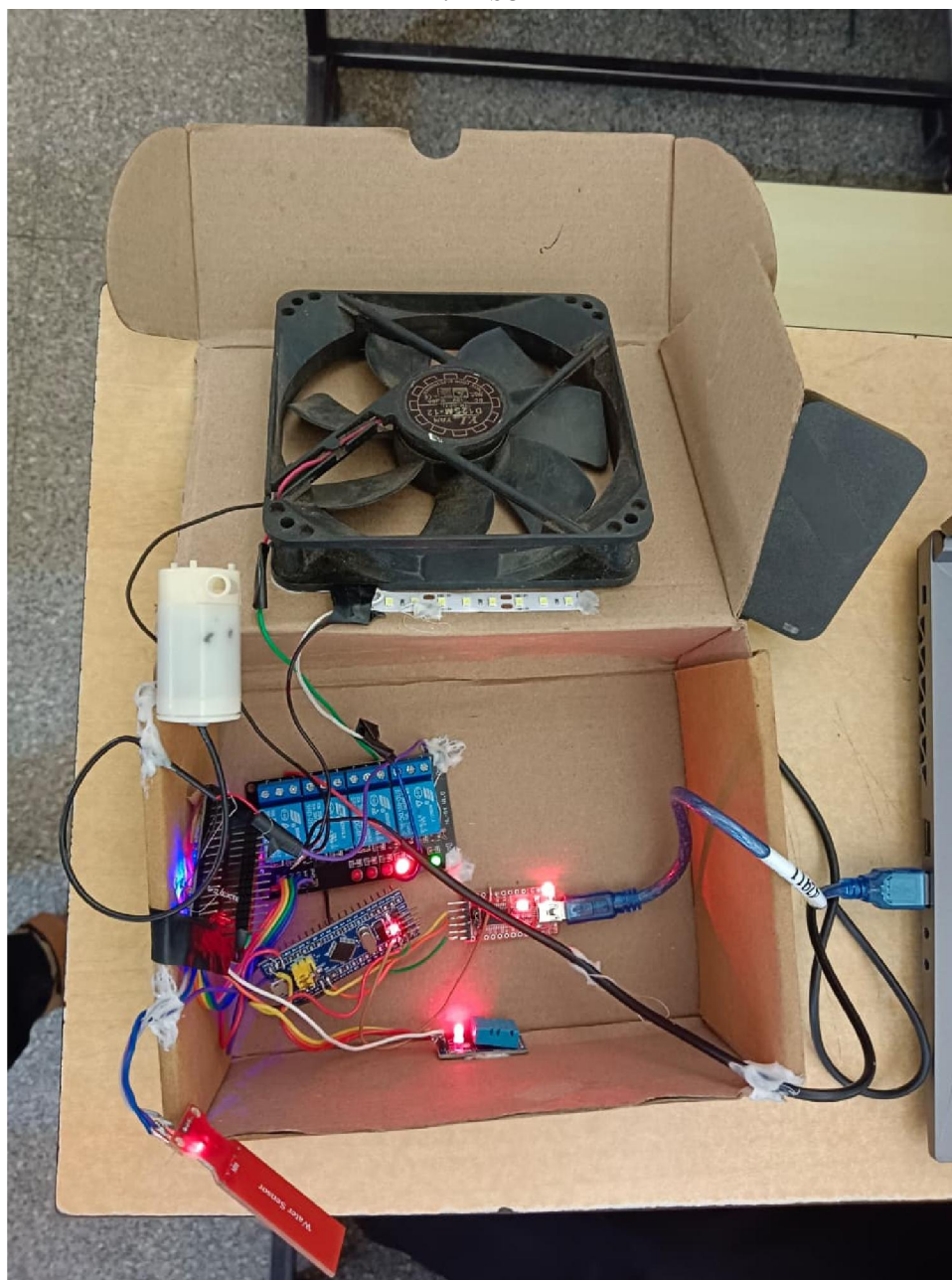
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III. RESULT



IV. DISCUSSION

The developed Smart Poultry Management System efficiently monitors and controls temperature, humidity, light, and water levels using IoT and sensors. It ensures a stable environment for poultry by automating fan, heater, LED, and pump operations. The ESP32 microcontroller enabled reliable wireless data transfer and real-time monitoring. Compared to manual methods, the system reduces labour, increases accuracy, and improves bird health. Minor issues like sensor calibration and internet delay were noted. Overall, it provides a cost-effective and scalable solution for modern poultry farming.



V. CONCLUSION

Wildlife monitoring is important for effective protection, sustainable use and scientific management of wildlife resources. Although there is currently a lot of work on building real sensor systems, very few attempts have been made to deploy them in the field and then maintain and develop them. The study of the animals through this system or their conservation. Proposed system is the best possible way to keep track of the animal's location and their health 24 hours-a-day. Proposed new system can find the animal over large, dense forest areas with the help of a Node MCU. It also gives a live update of their health through the temperature and pulse sensors.

The app in the mobile phones of forest officers will allow them to keep track of the wildlife from anywhere and at all times. The notification system will alert them immediately. if anything is wrong with the species, the caretaker can reach the exact location immediately. Proposed system does not require any human attention as this is a completely selfindependent and automated system. Proposed project will help us save wildlife at a much better rate.

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