Temperature Regulation System for Poultry Farms Using IoT & Automation

[1]K Ramanan, Assistant Professor, Department of Computer Science and Engineering,

[2]Naveen J, [3]Silambarasan A, [4]Vimal M, Student, Department of Computer Science and Engineering, Paavai Engineering College (Autonomous),

Pachal, Namakkal, Tamil Nadu, India.

Abstract : Poultry farming plays a vital role in global food production, but maintaining optimal environmental conditions remains a challenge—particularly regulating temperature and humidity, which directly affect bird health, productivity, and mortality. This project proposes an IoT-based automated temperature regulation system for poultry farms that continuously monitors environmental conditions using a network of smart sensors such as DHT22 (temperature and humidity), MQ135 (ammonia gas levels), LDR (light intensity), and PIR (motion detection).The system uses a microcontroller (ESP32 or Arduino) to process sensor inputs and control actuators like cooling fans, mist sprayers, and ventilation systems to maintain the ideal temperature (around 35°C) and air quality. The system also integrates with cloud platforms (e.g., Firebase or ThingsBoard) for remote data visualization and alerting via mobile apps. The project minimizes manual effort, reduces stress-related bird deaths, and improves overall farm efficiency by ensuring real-time monitoring and automated environmental control.By leveraging IoT technology, the system contributes to cost-effective, scalable, and sustainable poultry farming, ensuring animal welfare and operational efficiency.
.

Keywords: IoT, Poultry Farming, DHT22, ESP32, Automated Temperature Control, Ammonia Sensor, Cloud Monitoring, Smart Agriculture.

I. INTRODUCTION

The integration of IoT (Internet of Things) technology into the agricultural sector has transformed traditional farming methods by introducing automation, precision, and real-time monitoring. In poultry farming, environmental conditions such as temperature, humidity, air quality, and light intensity play a crucial role in ensuring bird health, productivity, and survival. Manual methods of temperature control, such as water spraying or fan operation, are labor-intensive, inconsistent, and often insufficient during extreme weather conditions especially in heat-prone regions.

Maintaining a constant and optimal temperature, particularly around 35°C for chicks, is vital to prevent heat stress, dehydration, and mortality. The ability to automatically regulate temperature, detect gas build-up, and monitor flock activity is essential for efficient farm management. This project addresses these challenges by proposing an IoT-based automated system that utilizes smart sensors (such as DHT22, MQ135, LDR, and PIR) integrated with a microcontroller (ESP32 or Arduino). These sensors gather environmental data, which is processed to control actuators like fans, mist sprayers, and exhaust systems.

Wireless connectivity and cloud-based dashboards enable remote monitoring, real-time alerts, and historical data visualization, empowering farmers with timely, data-driven decisions. The system also supports scalability and can be adapted to different farm sizes and climatic zones.

In addition, the proposed solution offers a cost-effective and energy efficient approach to farm management, particularly beneficial for small-scale and rural poultry farms with limited resources. By reducing dependency on manual labor and enabling predictive maintenance through continuous monitoring, this system not only enhances bird welfare but also contributes to higher productivity and profitability. Through the integration of smart technologies, this project paves the way for a sustainable, modernized approach to poultry farming.

II. LITERATURE SURVEY

Recent research in smart agriculture emphasizes the role of IoT, automation, and sensor networks in optimizing poultry farm conditions. Studies published in IEEE Xplore and Elsevier journals highlight how integrating temperature and humidity sensors (such as DHT11/DHT22), air quality sensors (like MQ135), and motion detectors (PIR sensors) can significantly reduce manual intervention while improving the environmental quality inside poultry houses. These systems are designed to maintain optimal temperature thresholds (such as 35°C for chicks), ensuring better bird health and survival rates.

Prominent research from 2022 and 2023 underlines how wireless sensor networks (WSNs) and cloud-connected microcontrollers (e.g., ESP32, Arduino, Raspberry Pi) enable real-time monitoring and control of environmental factors. Some studies have incorporated machine learning algorithms to predict environmental trends and optimize actuator responses. These approaches have helped overcome the inefficiencies of traditional ventilation and manual water-spraying methods, especially in regions facing extreme heat.

Researchers have also addressed challenges like energy efficiency, sensor calibration, and data reliability by using edge computing and low-power wide-area network (LPWAN) technologies. Furthermore, literature suggests that the scalability and modularity of IoT systems make them suitable for rural deployment with limited resources. The integration of cloud dashboards and mobile applications for remote management is also becoming increasingly common in these systems.

This survey reinforces the growing adoption of smart farming technologies and the crucial role of sensor-based automation in transforming poultry management. The combination of real-time data acquisition, intelligent control, and wireless connectivity forms the foundation for a reliable and sustainable poultry environment control system.

III. OBJECTIVE

1.
oultry farming as a crucial part of agriculture: Poultry farming plays a vital role in food production and rural income. However, challenges like disease outbreaks, poor environmental conditions, and manual labor inefficiencies affect productivity and bird health.

2.
imitations of traditional poultry farming: Traditional methods rely heavily on manual monitoring and control, which can be inconsistent and labor-intensive. Without real-time data, farmers may miss early signs of environmental stress or disease, leading to high mortality and losses.

3.
otential of IoT in smart poultry farming: IoT (Internet of Things) enables real-time monitoring and control of poultry farm conditions using connected sensors and automated systems. This technology ensures a healthy and productive environment for birds by continuously adjusting key parameters.

4.
ole of environmental monitoring: Factors like temperature, humidity, ammonia gas levels, and lighting directly influence poultry health and growth. Monitoring these through IoT sensors helps maintain optimal conditions and prevents disease outbreaks.

5.
mportance of automation and alerts: Automating fans, feeders, and lights using microcontrollers and relays reduces labor and improves consistency. Real-time alerts via mobile apps help farmers respond quickly to abnormal conditions, improving farm management and decision-making.

6.
roject's goal: The project aims to design and implement an IoT-based poultry monitoring system that provides real-time data, automation, and alert mechanisms to ensure efficient, healthy, and productive poultry farming.

7.
xpected outcomes: The system is expected to reduce labor dependency, improve bird health, lower mortality rates, and increase overall farm efficiency. It also promotes data-driven decisions, leading to better management and profitability for poultry

farmers.

IV. EXISTING IDEA

Traditional poultry farming methods rely heavily on manual observation and reactive interventions, which often lead to inefficiencies, high mortality rates, and increased labor costs. The emergence of smart technologies, especially the Internet of Things (IoT), has started to transform poultry farming by enabling real-time monitoring and automation. Current implementations of IoT in agriculture primarily focus on environmental monitoring through basic sensors that measure parameters like temperature and humidity. These solutions offer initial improvements in poultry management, such as climate control and feed optimization, yet remain limited in scale, integration, and intelligence.

Some existing systems utilize standalone microcontrollers (e.g., Arduino or Raspberry Pi) connected to basic sensors to automate feeding or trigger alarms when environmental conditions exceed certain thresholds. While these efforts represent a step forward from traditional farming, they often lack centralized data processing, advanced analytics, and full automation. Moreover, there is minimal use of cloud-based dashboards, predictive analytics, or AI integration to anticipate potential issues before they arise.

Disadvantage

1.
imited Intelligence and Decision-Making: Most existing systems operate on simple rule-based logic and do not incorporate machine learning or predictive analytics, which limits their ability to adapt and optimize over time.

2.
anual Data Analysis: The data collected by sensors often needs to be manually analyzed, which delays decision-making and reduces the system's effectiveness in providing real-time alerts.

3.
ack of Integration: Many current solutions are not scalable or fully integrated with cloud platforms, making remote monitoring and control difficult or impossible for large-scale poultry operations.

4.
o Predictive Maintenance or Health Forecasting: Systems lack the ability to forecast potential failures (like fan or motor breakdown) or predict disease outbreaks based on environmental data trends.

5.
igh Initial Setup Costs in Some Systems: While IoT components are generally low-cost, some semi-automated poultry solutions come with proprietary hardware and software, making them costly for small or rural farms.

6.
ow Customization and Flexibility: Farmers have limited ability to customize threshold values, add new sensor types, or expand the system based on changing needs.

7.
onnectivity and Power Issues: In rural areas, unreliable internet or power supply affects the continuous operation of existing IoT setups, leading to data loss and system downtime.

V. PROPOSED ARCHITECTURE

1. **User Interface**: This is the entry point for farmers and administrators to interact with the system via a web or mobile application. Through the UI:- Farmers can view real-time statistics (e.g., temperature, humidity, feed/water levels). They can configure thresholds (turn on fans if temp > 30°C). Alerts and recommendations are also received through this layer.

L

2. **Sensor Network Layer**: The backbone of the IoT system. It includes:- *Temperature Sensor*: Monitors ambient temperature inside the poultry shed. *Humidity Sensor*: Ensures optimal moisture levels for bird comfort. *Light Sensor (LDR)*: Controls artificial lighting, mimicking natural daylight. *Water Level Sensor*: Monitors the wate M in drinkers to avoid dehydration. *Gas Sensor (Ammonia/NH_3):* Detects toxic levels harmful to birds.

L

3. **Data Collection Module**: A microcontroller receives data from sensors:- Aggregates and filters noise or irregular data. Performs initial processing (e.g., average readings, signal calibration). Sends processed data to the

cloud for further analysis.

4. **Cloud & Storage Layer**: Data from multiple farms or devices is stored in the cloud, providing:- Historical trends of sensor data. Access to analytics dashboards. Support for scalability and multi-location operations.

5. **Data Analytics & Machine Learning Module**: This is the brain of the system. It analyzes incoming sensor data to:-Detect anomalies (e.g., sudden rise in ammonia levels). Predict environmental risks (e.g., overheating). Identify trends (e.g., frequent temperature drops during nights). *Machine Learning Models:*- Trained on past sensor data to predict disease outbreak conditions or suggest optimized feed/water schedules. Can auto-adjust thresholds for optimal growth based on bird age or breed.

6. **Automation and Control Layer**: Based on decisions from the ML model or predefined rules: Actuators are triggered:- Turn on/off heaters or fans, Control light intensity, Start/stop water pumps, Dispense feed at intervals.

7. **Noification and Alert System**: In case of abnormalities (e.g., water empty, high temperature), the system:- Sends SMS/email/app notifications Highlights issues on the dashboard Enables remote override of controls.

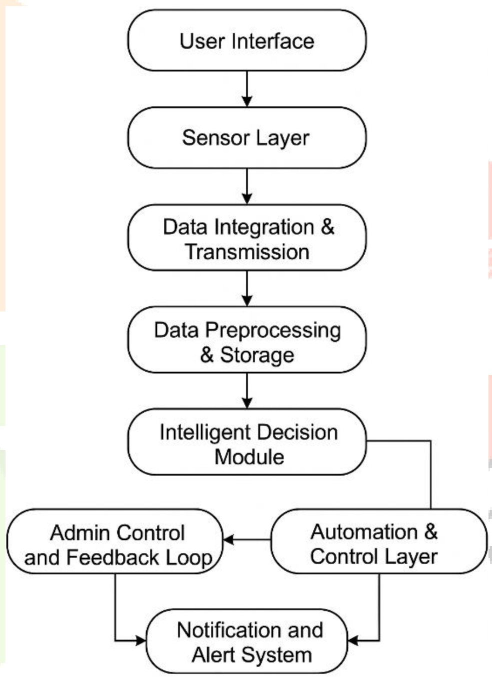

Figure 1

VI. CONCLUSION

The IoT-Based Smart Poultry Farming System developed in this project represents a transformative step in modern agricultural technology, specifically designed to enhance productivity, efficiency, and sustainability in poultry farming. By integrating real-time sensor networks with machine learning algorithms and automated control systems, the solution provides farmers with intelligent insights and responsive environmental management, ensuring optimal conditions for bird growth and well-being.

The system's layered architecture—from data collection and cloud storage to automated actuation and user-friendly interfaces—demonstrates a robust and scalable approach to smart farming. It empowers farmers with real-time alerts, predictive analytics, and data-driven recommendations, reducing manual effort and minimizing risks such as disease outbreaks, feed waste, or temperature-related stress.

This project not only addresses key challenges in traditional poultry management but also opens the door for future expansion, including integration with advanced AI models, mobile-based remote monitoring, and large-scale data analytics for livestock health forecasting. Aligned with the global movement towards smart agriculture, the system paves the way for more sustainable, efficient, and informed farming practices.

By combining IoT, automation, and intelligent analytics, this project contributes significantly to the digital transformation of the poultry industry—ensuring better resource management, higher productivity, and improved animal welfare while enabling farmers to make proactive, informed decisions in real time.

VII. REFERENCES

[1] A. Kumar, R. Verma, and P. Singh. *IoT Based Smart Poultry Farm Monitoring System*, International Journal of Advanced Computer Science and Applications, vol. 11, no. 3, pp. 177–183, 2020.

[2] M. H. Hassan, S. M. Ahmed, and K. A. Zayed. *Automation of Poultry Farm Using IoT and Machine Learning*, Journal of Intelligent & Fuzzy Systems, vol. 39, no. 5, pp. 6987–6998, 2021.

[3] N. Sharma and B. S. Gill. *Real-Time Environmental Monitoring for Poultry Farms Using Wireless Sensor Networks*, Procedia Computer Science, vol. 167, pp. 2035–2042, 2020.

[4] S. Roy, T. Chattopadhyay, and P. Banerjee. *Smart Poultry Farming System Using Embedded Technology and IoT*, In Proceedings of the 5th International Conference on IoT and Cloud Computing, pp. 118–123, 2021.

[5] J. George, L. Mathew, and A. J. George. *AI and IoT Integration for Poultry Farming Automation and Monitoring*, International Journal of Engineering and Technology, vol. 8, no. 2, pp. 115–120, 2022.