IJIREEICE ISSN (O) 2321-2004, ISSN (P) 2321-5526

International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering

Impact Factor 8.414 ⵣ Peer-reviewed & Refereed journal ⵣ Vol. 14, Issue 3, March 2026

DOI: 10.17148/IJIREEICE.2026.14327

Smart Incubator for Poultry Farming

B. Sandeep kumar[1], P. Udayasri[2], P. Shivashankar[3], E. Saikumar[4], G. Vishal[5]

Professor, Dept. of Electronics & Communication Engineering,

Christu Jyothi Institute of Technology & Science, Jangaon, Telangana, India[1]

UG Students, Dept. of Electronics & Communication Engineering,

Christu Jyothi Institute of Technology & Science, Jangaon, Telangana, India[2-5]

Abstract: The Smart Incubator for Poultry Farming is designed exclusively for raising chicks, providing a controlled environment that ensures their healthy growth and survival. Unlike conventional incubators or brooding methods, this system focuses solely on post-hatch chick care by maintaining precise temperature and humidity levels, which are critical factors for chick development. Equipped with temperature and humidity sensors, the incubator continuously monitors the internal environment. The NodeMCU microcontroller processes the sensor data and automatically adjusts the heating, cooling, and ventilation systems to maintain optimal conditions. Proper temperature control prevents chilling or overheating, while maintaining humidity ensures hydration and reduces stress, improving the overall health and immunity of chicks.

Keywords: Power supply, Arduino Uno, L293D, LCD, BO motor, Buzzer, MQ3

I. INTRODUCTION

A Smart Incubator for Poultry Farming is an automated system designed to create and maintain the ideal environmental conditions required for hatching poultry eggs efficiently. The main goal of this project is to improve hatching success rates while reducing manual effort through the use of sensors, microcontrollers, and control mechanisms. In traditional incubation, farmers manually monitor and adjust parameters such as temperature, humidity, and egg turning, which can lead to errors and inconsistent results. A smart incubator eliminates these problems by automatically controlling these parameters using embedded systems and sensor technology. The system typically uses sensors to measure temperature and humidity inside the incubator. These readings are processed by a microcontroller (such as Arduino or NodeMCU), which activates devices like heaters, fans, and humidifiers to maintain optimal conditions.

An automatic egg-turning mechanism ensures that eggs are rotated periodically to prevent the embryo from sticking to the shell. Some systems also include IoT features for remote monitoring and control via a mobile application or web interface. The ideal incubation conditions for chicken eggs are around 37.5°C temperature and 55–65% humidity, which must be maintained throughout the incubation period (about 21 days). The smart incubator ensures these parameters remain stable, resulting in higher hatchability rates. This project promotes automation, energy efficiency, and precision in poultry farming. It is especially beneficial for small and medium-scale farmers as it reduces labor costs, minimizes human error, and enhances productivity. By using locally available materials and affordable electronics, the smart incubator can be made cost-effective and sustainable, supporting modern agricultural practices and rural development.

II. LITERATURE SURVEY

Modern developments of IoTs made an improvement to incubators by enabling real time monitoring and remote control via mobile applications. Studies have shown anchoring water pumps with temperature sensors to the incubator maintains humidity levels within the required limits, which prevents egg dehydration. Timer-based food dispensers have also been applied in poultry farming to dispense food according to the time for feeding-growing chicks. This combination of automating the temperature, humidity, and feeding would greatly increase efficiency and productivity on poultry incubation on the farm level.

Automated Incubation Systems Li et al. (2020) developed an IoT-enabled incubator that monitors and controls temperature and humidity in real time, increasing hatch rates by about 10%.

Sensor-Based Monitoring Kumar & Singh (2019) implemented incubators with DHT22 sensors for temperature and humidity control, integrated with microcontrollers to automate operations and reduce human errors.

Mobile and Cloud Integration Chen et al. (2021) created a mobile-based incubator control system that allowed farmers to monitor parameters remotely, enhancing convenience and control.

Impact Factor 8.414 ⪤ Peer-reviewed & Refereed journal ⪤ Vol. 14, Issue 3, March 2026

DOI: 10.17148/IJIREEICE.2026.14327

Predictive Analytics in Incubation Zhang & Wang (2022) applied AI models to predict hatching outcomes based on sensor data, improving incubation accuracy and efficiency.

IoT and Sensor Integration: Smart incubators commonly use microcontrollers (such as ESP32) and sensors (DHT22/DHT11) for real-time monitoring and control of temperature and humidity, with automation replacing manual adjustments.

PID & AI-Based Control: Advanced control techniques, such as PID controllers (tuned via Ziegler–Nichols) and fuzzy logic AI, dynamically regulate temperature and humidity, improving hatch rates and maintaining stable incubation environments.

Remote Monitoring & Automation: Mobile applications and dashboards (often built using platforms like Blynk) allow farmers to monitor, adjust, and receive notifications about hatch conditions from anywhere, minimizing manual labor and reducing human errors. Systems may include automated food dispensing and egg-turning mechanisms to ensure uniform heating and healthy chick growth during and after hatching.

Many researches and revolutions have resulted in developing automated incubation devices. The majority of research emphasized keeping a temperature range of 37.5 degrees Celsius to 38 degrees Celsius for optimum embryonic development. In such kind of setups, sensor-based solutions like DHT22 were applied for humidity and DS18B20 for temperature to ensure proper incubation. For poultry, it brought so much success to hatchability and reduced chick mortality through improved control of the environment during incubation. Smart incubators combine sensors, microcontrollers, control algorithms and networking to monitor and actively control the incubation environment (temperature, humidity, ventilation, turning) to improve hatchability and chick health. The body of work shows steady progress from sensor-based automation toward cloud-connected systems and AI-driven prediction and control.

III. INTERNET OF THINGS

Internet of Things (IoT) is an ideal buzzing technology to influence the Internet and communication technologies. IoT allows people and things to be connected anytime, anyplace, with anything and anyone, by using ideally in any path/network and any service. This project introduces a thought or an idea for home computerization utilizing voice acknowledgment, also the development of a prototype for controlling smart homes devices through IoT and controlling of dumb devices through IoT by the means of Wi- Fi driven chipset solution – ESP8266.

This is also acknowledged by the need to give frameworks which offers help to matured and physically impaired individuals, particularly individuals who lives alone. Smart home or home automation can be said as the residential extension of building automation, it also involves the automation and controlling of lightings, ACs, ventilation and security which also includes home appliances such as dryers/washers, ovens or refrigerators/freezers which uses Wi-Fi for monitoring via remote for ease of use. Now a day's speed of the processing and communication through smart mobile devices at very affordable costs, to improve the lifestyle concept relevant to smart life, like smart T.V, Smart cities, smart phones, smart life, smart school and Internet of Things.

To improve human health and well-being is the ultimate goal of any economic, technological and social development. The rapid rising and aging of population is one of the macro powers that will transform the world dramatically, it has caused great pressure to food supply and healthcare systems all over the world, and the emerging technology breakthrough of the Internet-of-Things (IoT) is expected to offer promising solutions. Therefore, the application of IoT technologies for the food supply chain (FSC) (so-called Food-IoT) and in-home healthcare (IHH) (so called Health-IoT1) have been naturally highlighted in the strategic research roadmaps.

IV. EXISTING SYSTEM

In the existing system of poultry incubation, most of the processes involved in hatching eggs are carried out manually without the support of automated or smart control technologies. The maintenance of suitable environmental conditions such as temperature, humidity, and ventilation depends entirely on the experience and attention of the operator. Farmers usually use basic instruments like thermometers and hygrometers to check temperature and humidity levels inside the incubator. Any adjustment to these parameters is done manually, which requires constant observation and effort.

The cheeks are turned by hand multiple times a day to ensure that the embryo develops uniformly. However, failure to turn the eggs at the right intervals can lead to poor hatching rates or embryo death. Similarly, the water tray used to maintain humidity must be refilled regularly, as there is no automatic mechanism to regulate it. There is no feedback or alert system to indicate abnormal conditions, which makes it difficult to maintain consistent incubation parameters.

IJIREEICE ISSN (O) 2321-2004, ISSN (P) 2321-5526

International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering

Impact Factor 8.414 ⁙ Peer-reviewed & Refereed journal ⁙ Vol. 14, Issue 3, March 2026

DOI: 10.17148/IJIREEICE.2026.14327

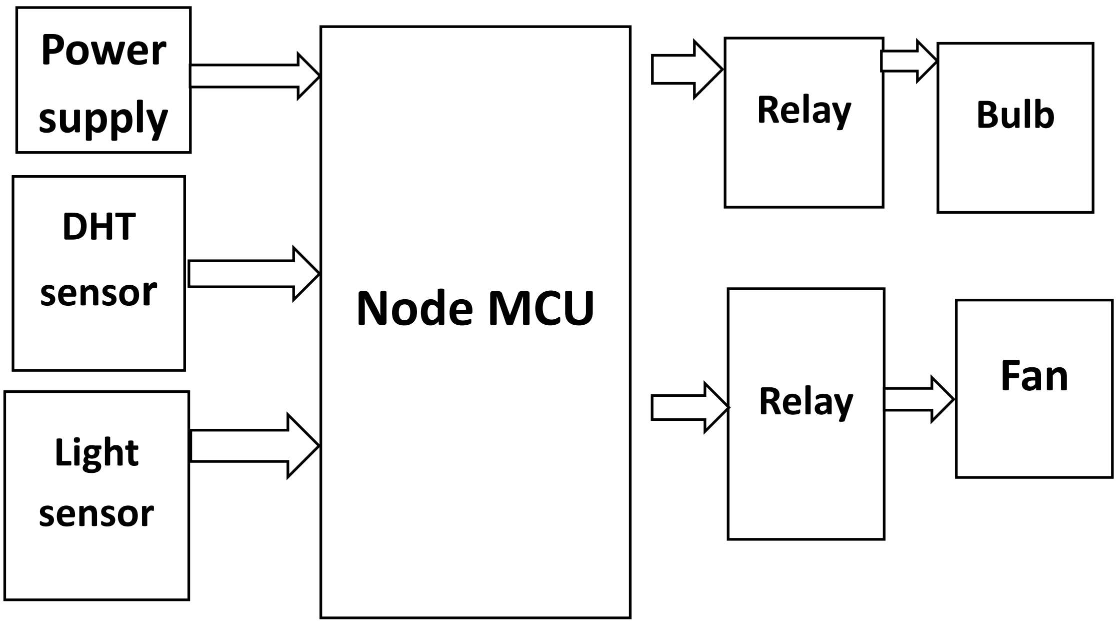
Because the process depends heavily on human effort, the chances of error are high. Slight changes in environmental conditions can adversely affect the development of the eggs, leading to low hatching efficiency. Moreover, continuous monitoring increases the workload of the farmer and makes the process time-consuming. Thus, the existing system is not efficient for large-scale poultry production. It lacks automation, accuracy, and reliability. The dependence on manual control not only reduces productivity but also increases operational costs. Therefore, there is a need for a smart automated system that can monitor and control temperature, humidity, and egg rotation automatically to improve the efficiency and success rate of poultry incubation.

V. PROPOSED METHOD

The proposed system is designed to automate and improve the traditional poultry incubation process by integrating smart technologies, microcontrollers, and IoT-based monitoring. The main objective of this system is to provide a controlled and stable environment for egg hatching with minimal human intervention. It ensures that the key incubation parameters such as temperature, humidity, and egg rotation are maintained automatically and precisely throughout the incubation period.

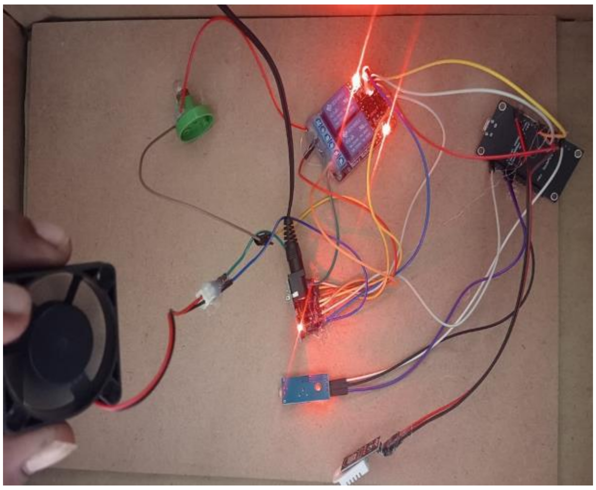
In this system, a NodeMCU (ESP8266 or ESP32) microcontroller acts as the central control unit. It receives input signals from different sensors — such as the DHT11 or DHT22 for temperature and humidity sensing — and processes the data to maintain the required conditions. The microcontroller compares the sensed values with the predefined set points. If there is any deviation, it automatically triggers actuators such as heaters, cooling fans, or humidifiers to restore the ideal environment.

VI. BLOCK DIAGRAM OF PROPOSED SYSTEM



International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering
Impact Factor 8.414 ⋟ Peer-reviewed & Refereed journal ⋟ Vol. 14, Issue 3, March 2026
DOI: 10.17148/IJIREEICE.2026.14327

VII. RESULTS



The smart incubator was tested for egg hatching under controlled temperature, humidity, and turning conditions. Final results from smart incubators for chicken farming show significantly improved hatch rates, operational efficiency, and remote monitoring capabilities compared to traditional methods. By precisely controlling critical environmental factors, these incubators increase productivity and profitability for both small and large-scale farmers.

VIII. CONCLUSION

The Smart Incubator for Poultry Farming (Chicks) is a modern and technology-driven system designed to create a safe, controlled, and healthy environment for chicks after hatching. It automatically manages essential factors like temperature, humidity, air circulation, and light intensity, ensuring that chicks grow comfortably without stress or environmental imbalance.

This system uses sensors, microcontrollers (like NodeMCU), and IoT technology to continuously monitor the living conditions of chicks. Data collected from these sensors helps to maintain the ideal environment, reducing manual supervision and human error. Through real-time updates, farmers can monitor and control the system remotely, improving efficiency and convenience.

The smart incubator contributes significantly to reducing chick mortality, improving growth rates, and ensuring consistent health and development. It also minimizes labor costs and operational difficulties in traditional chick-rearing methods. In the future, the integration of AI and data analytics could make the system even more intelligent—capable of predicting health issues and adjusting conditions automatically. Overall, the Smart Incubator for Chicks represents a major step toward smart, automated, and sustainable poultry farming, improving both productivity and animal welfare while empowering farmers with modern agricultural technology.

Hence, the Smart Incubator for Poultry Farming (Chicks) is not only an innovation but a practical and futuristic solution for improving productivity, reducing losses, and ensuring better animal welfare in the poultry industry. The Smart Incubator for Poultry Farming (Chicks) represents a significant advancement in modern poultry management. It ensures precise control of temperature, humidity, and ventilation, creating a stable and healthy environment for chicks to grow. By automating critical functions, it minimizes human intervention, reduces errors, and enhances the overall efficiency of the poultry rearing process. The integration of sensors and IoT technology allows for real-time monitoring and remote management, providing farmers with greater flexibility and control over environmental conditions.

IX. FUTURE SCOPE

The future scope of the Smart Incubator for Poultry Farming (Chicks) is vast and promising as technology continues to advance in the field of smart agriculture. In the coming years, this system can be further enhanced with artificial intelligence (AI), machine learning (ML), and data analytics to predict and maintain the ideal environment for chick growth automatically. These technologies will enable the incubator to learn from real-time data, adapt to different climatic conditions, and ensure better health and growth of chicks.

International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering
Impact Factor 8.414 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 14, Issue 3, March 2026
DOI: 10.17148/IJIREEICE.2026.14327

Future models can include automated feeding and watering systems, which will further reduce manual effort and ensure that chicks receive consistent nutrition and hydration. Additionally, health monitoring sensors can be integrated to detect early signs of disease or stress among chicks, allowing farmers to take preventive action in time. Advanced Temperature Control – Future systems can use high-precision temperature sensors to maintain stable and uniform warmth for chicks. Automatic Humidity Regulation – Intelligent humidity sensors can automatically adjust moisture levels for a comfortable environment. Smart Fan Speed Control – Fans can be programmed to adjust their speed based on real-time temperature and humidity changes. Energy-Efficient Bulb System – LED or infrared bulbs can provide controlled heating and lighting while saving energy.

AI-Based Environment Adjustment – AI can automatically balance temperature and humidity by controlling fans and bulbs efficiently. Real-Time Monitoring – Temperature and humidity data can be tracked continuously using IoT for precise control. Automatic Alerts – The system can send alerts when temperature or humidity goes beyond safe levels. Solar-Powered Heating and Cooling – Future incubators can use solar energy to power bulbs and fans for sustainable operation.

Uniform Air Circulation – Improved fan design will ensure even airflow and prevent hot or cold spots. Integration of Health Monitoring Sensors: Future versions can include biometric or thermal imaging sensors to monitor chick body temperature, activity, and behavior. This would help detect early signs of illness, dehydration, or abnormal growth patterns automatically. AI-Powered Predictive Maintenance: The system could use Artificial Intelligence and predictive analytics to identify potential equipment failures before they occur. This will reduce downtime and maintenance costs while ensuring uninterrupted operation.

REFERENCES

[1]. Karim, M. Hasnat, Navid Newaz, and Md. Ijtihad Abtahi (2025). This paper presents an IoT-based smart chicken brooder designed to automate environmental and resource management for chicks. The system uses an ATmega2560 microcontroller and DHT22 sensors, with remote monitoring and SMS notifications.

[2]. Jagatheeshbabu, S., S.T. Selvan, and G. Sujatha (2025). These authors detail the "Design and Development of SMART Brooder Using Raspberry Pi," focusing on energy conservation and enhancing poultry welfare. Their work uses a Raspberry Pi Pico W for real-time monitoring and control.

[3]. Mahmud, Imon, et al. (2025). In their work on an "IoT-Based Smart Poultry and Hatchery Farm," the authors cover integrated solutions for efficient farming, including smart brooding.

[4]. Godinho, António, et al. (2025). This conceptual study on "Wireless Environmental Monitoring and Control in Poultry Houses" discusses using IoT to maintain optimal conditions for brooding, focusing on environmental control.

[5]. Muhammad, Faiz Haji Hambali, Ravi Kumar Patchmuthu, and Au Thien Wan (2025). Their research, aimed at reducing chick mortality, developed an automated IoT-based brooder that monitors temperature, humidity, air quality, and feeding.

[6]. Muttha, Rupesh I. et al. (2014). "PLC Based Poultry Automation System". This paper explores the use of Programmable Logic Controllers (PLCs) in automating poultry farms. It demonstrates an early implementation of automation technology for managing the environmental conditions of chicks.

[7]. Tibot Technologies (2021) / T-Moov (2022) Citation. Commercial autonomous mobile robots, T-Moov and Spoutnic NAV.Cited in research on robotics for poultry farming, these commercial robots are designed to move autonomously within a poultry house. Their motion triggers chicks to be more active, leading to improved health and reduced issues like floor eggs in free-range systems.

