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Design of Chicken Egg Farm based on the IoT in Padamulya Ciamis Village, West Java, Indonesia

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Abstract:

The development of smart farming using the Internet of Things (IoT) has significantly improved efficiency in various agricultural sectors, including poultry farming. This community service project aims to design and implement an IoT-based chicken egg farm in Padamulya Ciamis Village, West Java, Indonesia. The system integrates smart sensors and automated controls to monitor environmental parameters such as temperature, humidity, and feed levels, ensuring optimal conditions for egg production. Data collected in real-time will be accessible through a cloud-based platform, allowing farmers to make informed decisions to enhance productivity. This initiative is expected to improve farm efficiency, reduce manual labor, and serve as a model for sustainable poultry farming in rural areas.

Keywords: IoT, smart farming, poultry farm, egg production, rural development

1. Introduction

Smart chicken egg farming is crucial for breeders because it enhances productivity and efficiency (Chang et al., 2020; Bumanis et al., 2023). Traditional poultry farming often relies on manual monitoring and management, which can be time-consuming and prone to human error (Bumanis et al., 2022; Nicolas et al., 2019). With an IoT-based smart system, breeders can automatically monitor critical environmental parameters such as temperature, humidity, and feed levels (Macalane et al., 2023; Wu et al., 2025). Maintaining optimal conditions is essential for maximizing egg production, as any fluctuation in these factors can stress the chickens and reduce their laying rates (Budiarto et al., 2020; George & George, 2023). By utilizing smart technology, breeders can ensure a stable environment, leading to higher egg yield and better overall farm performance (Febriani et al., 2024; Peprah et al., 2022).

Another significant advantage of smart chicken egg farming is cost reduction (Yang et al., 2024). Automated feeding systems, smart water dispensers, and climate control reduce the need for constant human supervision, lowering labor costs (Koech et al., 2023; Omar et al., 2016). Additionally, real-time monitoring allows breeders to detect potential issues early, such as disease outbreaks or equipment malfunctions, preventing financial losses (Setijarso et al., 2024). Data analytics from IoT devices can also provide insights into chicken behavior and health, enabling more precise and informed decision-making (Santoso et al., 2020). This predictive capability helps in optimizing resource usage, reducing waste, and ultimately increasing farm profitability (Xin & Liu, 2017).

Beyond economic benefits, smart farming contributes to sustainability and animal welfare (Astill et al., 2020). Traditional farms often face challenges related to excessive resource consumption and inefficient waste management (Ahmed et al., 2024; Guzman-Zabala & Castro-Martin, 2023). With smart monitoring systems, breeders can optimize water and feed usage, reducing environmental impact (Um et al., 2020; Arhipova et al., 2021). Moreover, by ensuring optimal living conditions, the welfare of the chickens is improved, reducing stress-related illnesses and mortality rates (Ali et al., 2024; Islamiyah & Arifin, 2024). This sustainable and technology-driven approach aligns with modern agricultural trends and supports long-term poultry farming success (Islam et al., 2019; Sitaram et al., 2018).

The primary objective of this paper is to design and implement an IoT-based smart chicken egg farm in Padamulya Ciamis Village, West Java, Indonesia. This system aims to enhance egg production efficiency by integrating smart sensors and automation technologies to monitor and control key environmental parameters such as temperature, humidity, and feed levels. By providing real-time data accessibility through a cloud-based platform, the proposed system enables breeders to make informed decisions, reduce manual labor, and optimize resource management. Additionally, this initiative seeks to introduce modern agricultural techniques to rural farmers, empowering them with innovative tools for improving productivity and sustainability.

This paper contributes to the field of smart agriculture by demonstrating the practical application of IoT in poultry farming, particularly in rural areas with limited access to advanced farming technologies. It provides a scalable and cost-effective solution that can be adapted by small- and medium-scale breeders to improve farm management and operational efficiency. Furthermore, the study highlights the potential economic and environmental benefits of IoT-driven poultry farming, including reduced operational costs, improved animal welfare, and sustainable resource utilization. By bridging the gap between traditional and technology-driven farming, this research serves as a model for future implementations of smart agricultural systems in developing regions.

2. Material and Method

The methodology of this study follows a systematic approach to designing and implementing an IoT-based smart chicken egg farm in Padamulya Ciamis Village, West Java, Indonesia. The project begins with a site assessment to understand the existing farming conditions, infrastructure, and challenges faced by local breeders. This initial phase includes interviews and surveys with farmers to identify key issues related to egg production, environmental management, and resource efficiency. Based on this assessment, the requirements for the IoT system are determined, ensuring that the proposed solution aligns with the needs of the breeders.

The second phase involves the selection and integration of hardware components. The IoT system consists of smart sensors for monitoring temperature, humidity, light intensity, and feed levels, as well as actuators for automated control of ventilation, lighting, and feeding mechanisms. Microcontrollers, such as Arduino or Raspberry Pi, are used to process the sensor data and communicate with the cloud-based platform. Wireless connectivity, including Wi-Fi or LoRa, is implemented to ensure real-time data transmission. The hardware installation is carried out within the poultry farm, ensuring proper placement of sensors for accurate environmental monitoring.

In the third phase, software development and cloud integration are conducted. A web-based or mobile application is developed to provide real-time monitoring and control capabilities for the farmers. The software includes data visualization, alerts for critical conditions, and historical data analysis to support decision-making. Cloud services, such as Firebase or ThingsBoard, are utilized to store and manage sensor data efficiently. Additionally, automated alerts are configured to notify breeders of abnormal environmental conditions, enabling immediate corrective actions.

The fourth phase focuses on testing and validation of the system. The IoT-based farm is monitored over a specific period to evaluate its performance in maintaining optimal environmental conditions and improving egg production. The collected data is analyzed to assess the accuracy and reliability of the sensors, the effectiveness of automation, and the overall impact on farm operations. Feedback from local breeders is gathered to identify potential improvements and ensure user-friendliness of the system. Any necessary adjustments are made to optimize the system's functionality.

Finally, the last phase involves implementation, training, and impact assessment. The smart farming system is fully deployed, and training sessions are conducted for local breeders to familiarize them with the technology and its usage. The long-term benefits, such as increased efficiency, cost savings, and improved poultry health, are analyzed by comparing pre- and post-implementation data. The findings of this study serve as a foundation for future improvements in smart farming techniques and provide a model for similar implementations in other rural farming communities.

3. Results and Discussion

The implementation of the IoT-based smart chicken egg farm in Padamulya Ciamis Village has demonstrated significant improvements in environmental monitoring and farm management efficiency. The smart sensors successfully provided real-time data on temperature, humidity, and feed levels, ensuring that optimal conditions were maintained for egg production. Automated control mechanisms, such as temperature regulation and feed dispensing, reduced manual labor and minimized human error. Farmers reported an increase in egg production stability, as fluctuations in environmental conditions were effectively managed through automated adjustments based on sensor readings.

A comparative analysis between traditional and IoT-based farming methods revealed notable improvements in productivity and resource efficiency. The automated feeding system reduced feed wastage by approximately 20%, and real-time monitoring helped detect potential health issues among chickens earlier, reducing mortality rates. Furthermore, the cloud-based data analytics enabled farmers to track historical trends and make informed decisions regarding farm management. The integration of mobile applications also provided convenience, allowing farmers to monitor and control farm conditions remotely, improving overall farm operations.

Despite these positive outcomes, some challenges were identified during the implementation phase. Connectivity issues, particularly in rural areas with limited internet coverage, affected real-time data transmission. To address this, alternative connectivity options such as LoRa technology or offline data storage mechanisms can be explored. Additionally, training and adaptation among local farmers required continuous support to ensure effective system utilization. Overall, the study highlights the potential of IoT-based smart farming in enhancing poultry production, and with further refinements, the system can be a scalable model for sustainable farming in other rural areas.

Figure 1 illustrates the workshop on IoT-based smart chicken egg farming conducted in Padamulya Ciamis Village, West Java, Indonesia. The workshop served as a key step in introducing modern farming techniques to local breeders, emphasizing the integration of smart technology in poultry management. Participants, including local farmers, researchers, and facilitators, engaged in discussions on the benefits of real-time monitoring, automated feeding systems, and environmental control for improving egg production efficiency. The banner in the background highlights the event's theme and key speakers, reinforcing the significance of knowledge transfer in adopting smart farming practices.

This workshop played a crucial role in bridging the gap between traditional and technology-driven farming. The active involvement of local breeders demonstrates their interest in adopting innovative solutions to enhance productivity and sustainability. By fostering collaboration between academic institutions and farming communities, this initiative ensures that IoT-based solutions are accessible, practical, and tailored to the specific needs of rural farmers. The engagement documented in the figure reflects the first step toward implementing and sustaining smart farming systems in the region.

Figure 1. Workshop activities at Bumdes Mulyajaya Ciamis

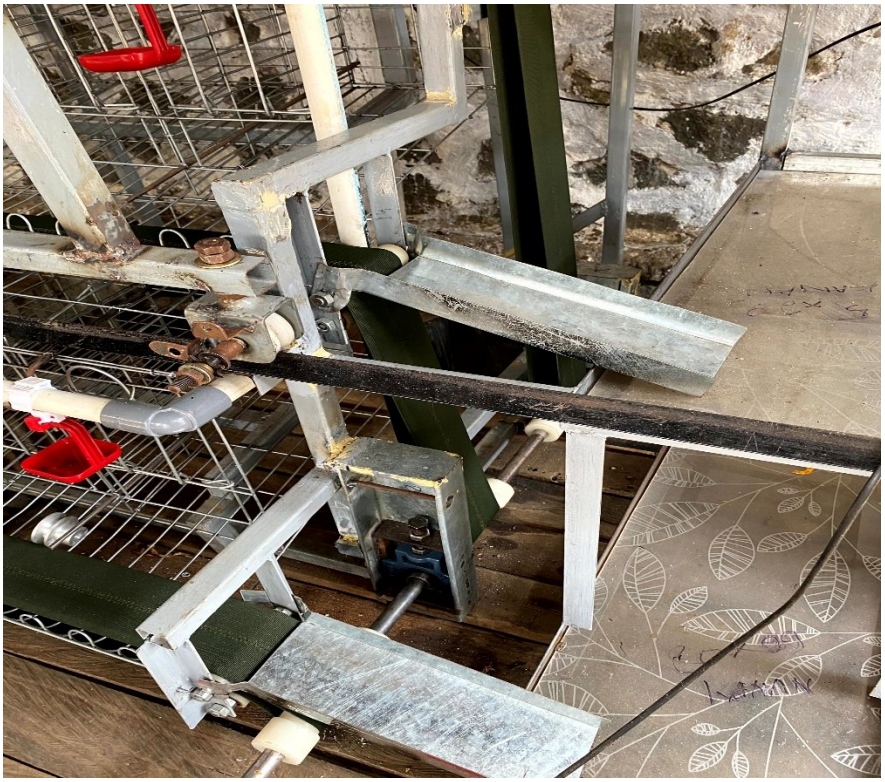
The automated chicken egg farming system showcased in the Figure 2 represents an advanced approach to poultry management, integrating smart farming technology to improve efficiency and productivity. The system features a multi-tiered cage structure designed to optimize space utilization while ensuring the well-being of the chickens. Equipped with an automated feed dispenser and a clean water supply system, the setup minimizes manual labor and ensures that the hens receive consistent nutrition and hydration. The automated mechanisms not only reduce the workload for farmers but also improve accuracy in feed distribution, preventing overfeeding or underfeeding.

One of the most significant advantages of this system is its ability to maintain a hygienic environment for the chickens. The structured cage design allows for easy waste management, reducing the risk of disease transmission and enhancing biosecurity. Additionally, the slanted flooring ensures that eggs roll safely into designated collection trays, minimizing breakage and contamination. This streamlined process not only improves the quality of the eggs but also reduces losses, making the farming operation more cost-effective and sustainable in the long run.

The integration of smart farming technology in egg production offers numerous benefits, including real-time monitoring and data collection. Sensors and IoT-based systems can be incorporated to track environmental conditions such as temperature, humidity, and feed levels, allowing farmers to make data-driven decisions to optimize production. By leveraging automation, small and medium-scale poultry farmers can improve operational efficiency, reduce dependency on manual labor, and enhance overall productivity. This innovation is particularly crucial in rural areas where access to skilled labor and resources may be limited.

Furthermore, this modernized poultry farming system aligns with sustainable agricultural practices by reducing feed waste, improving resource management, and promoting animal welfare. With increasing global demand for eggs, adopting technology-driven solutions helps farmers meet market needs while ensuring ethical and environmentally friendly practices. By implementing this system in Padamulya Ciamis Village, local farmers can benefit from increased egg production, improved profitability, and a more sustainable approach to poultry farming.

(a)



(b)

Figure 2 Construction for Chicken Egg Farm

4. Conclusion

The implementation of an IoT-based smart chicken egg farm in Padamulya Ciamis Village has demonstrated significant improvements in farm management efficiency, productivity, and sustainability. The integration of smart sensors and automated controls enabled real-time monitoring of environmental parameters, ensuring optimal conditions for egg production. By reducing manual labor and minimizing human errors, the system has contributed to increased efficiency and profitability for local farmers.

Comparative analysis between traditional and IoT-based farming methods highlights the advantages of smart farming in reducing feed waste, improving animal welfare, and enhancing overall resource utilization. The ability to remotely monitor farm conditions through a cloud-based platform has empowered farmers with data-driven decision-making capabilities.

Despite some challenges, such as connectivity limitations and the need for training local farmers in using the technology, the findings indicate that IoT-based smart farming can be a scalable and sustainable solution for poultry production in rural areas. Future improvements, including enhanced connectivity options and user-friendly interfaces, will further optimize system performance. This initiative serves as a model for integrating modern agricultural technology into traditional farming practices, supporting the transition towards a more efficient and sustainable poultry farming industry

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