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Designing an IoT-Based Food Monitoring Application for Chicken Farming

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ABSTRACT

Many broiler farming industries in Indonesia still use traditional methods in feed management, which often cause inefficiencies and human errors. Without modern solutions, these problems can have a negative impact on livestock productivity and health, as well as increase operational costs. This research aims to develop an Internet of Things (IoT)-based feed monitoring application that can monitor feed stocks in real-time, set automatic feeding schedules, and analyze feed consumption data to increase efficiency, accuracy, and overall productivity. Interim results show that the feed monitoring application with IoT technology is able to provide accurate and detailed information in real-time, reduce human error, and increase operational efficiency significantly. It is hoped that the implementation of this innovative application can help farmers optimize feed management, increase livestock productivity, enhance animal welfare, and reduce operational costs in a sustainable manner.

Keywords: Monitoring Applications, Animal Feed, Broiler Chickens, IoT, Efficiency

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INTRODUCTION

Broiler poultry farming plays a crucial role in meeting the protein needs of the Indonesian population. However, maintaining optimal poultry house conditions often poses challenges, particularly in controlling temperature and humidity. These environmental parameters significantly affect productivity and harvest quality. Manual methods of measurement and monitoring are inefficient, time-consuming, and prone to human error, leading to suboptimal management (Masriwilaga & Al-Hadi, 2019; Fitriasari & Prasetyo, 2020).

The emergence of Internet of Things (IoT) technology provides a promising solution for these challenges. IoT enables automatic environmental data collection through sensors connected to the internet, allowing users to monitor poultry house conditions in real time via mobile devices (Gunawan et al., 2021; Perdanasari et al., 2023). Suryadi and Rahayu (2021) further emphasize that IoT-based systems not only enhance management efficiency but also stabilize environmental conditions through automated temperature and humidity control. Moreover, Mulyadi et al. (2021) highlight the importance of user-friendly interfaces in facilitating small-scale farmers' adoption of IoT technology.

This study employs components such as the DHT11 sensor for temperature and humidity measurement, ESP8266 as the data transmission module, and Firebase for real-time data storage. Additionally, an Android application is developed to facilitate monitoring for farmers. This study aims to design and implement an IoT-based poultry house monitoring system that provides accurate real-time environmental data and improves poultry farm management efficiency. It also seeks to address challenges faced by small-scale farmers, such as cost barriers and usability issues, by integrating affordable and user-friendly technology.

The research contributes to existing literature by combining affordable IoT components with a tailored mobile application, ensuring accessibility for small-scale farmers. It also includes usability assessments and real-world testing, emphasizing practical application and farmer feedback.

METHOD

This research employs an experimental method with an iterative software engineering approach. The study begins with problem identification, where issues related to poultry house management and monitoring are analyzed through field observations and discussions with farmers. Following this, the system design phase integrates hardware and software components to create a cohesive monitoring system. The hardware includes a DHT11 sensor for measuring temperature and humidity, an ESP8266 microcontroller for data transmission, and actuators for maintaining air circulation. The software component involves the development of an Android application using Android Studio and Firebase for real-time data storage and retrieval. The application provides features such as graphical data visualization, historical data storage, and user authentication to ensure secure access.

During the implementation phase, the hardware is configured to collect and transmit environmental data, while the software is programmed to display real-time information and send alerts when conditions exceed predefined thresholds. System integration ensures seamless communication between hardware and software components. Testing is conducted in three stages: sensor accuracy testing, data transmission latency measurement, and application usability evaluation. Sensor accuracy is verified by comparing DHT11 readings with standard measurement devices. Latency tests measure the responsiveness of data transmission between the ESP8266 and Firebase. Usability evaluations involve user trials to assess the application's interface and functionality.

The iterative approach enables continuous feedback and refinement at each stage, ensuring the system meets the needs of small-scale poultry farmers. The results are analyzed to evaluate the system's performance and effectiveness in addressing the identified challenges.

FINDING AND DISCUSSION

Analysis

At this stage of analysis, researchers conducted direct field observations and informal discussions with several broiler farmers in the Sleman area. During the discussions, researchers identified the main issues faced by farmers. Most farmers expressed concerns about the quality of their poultry, which is highly dependent on weather conditions. Field observations revealed that extreme weather conditions negatively impact poultry health, causing stress and decreased productivity. Farmers often struggle with manual monitoring, especially small-scale operators with limited resources. Older farmers also face challenges in adopting new technologies. These findings underscore the need for a cost-effective and easy-to-use system (Fitriasari et al., 2020; Hadyanto & Amrullah, 2022). Additionally, Suryadi and Rahayu (2021) found that IoT systems effectively mitigate stress in poultry caused by environmental fluctuations.

Farmers reported that during extreme weather, either too hot or too cold, chickens often experience stress, which causes decreased growth rates and increased mortality. In addition, fluctuations in temperature and humidity make it difficult to maintain optimal conditions in poultry houses. Many farmers, especially those with limited resources, struggle to purchase automated environmental control systems. Some of these farmers are also elderly, making it difficult for them to adopt new technologies that could help them manage their poultry houses more efficiently. These issues highlight the urgent need for accessible, cost-effective, and easy-to-use solutions that enable farmers to increase poultry productivity despite environmental challenges.

Masriwilaga and Al-Hadi (2019) explained that the use of Internet of Things (IoT) technology can help improve the efficiency of monitoring in broiler chicken farming through the automatic collection of environmental data. Perdanasari et al. (2023) revealed that IoT-based systems are capable of controlling environmental parameters, such as temperature, humidity, and ammonia levels, to enhance poultry farm productivity. Mulyadi et al. (2021) also stressed the importance of designing systems with affordable hardware components to make IoT adoption feasible for small-scale farmers. Furthermore, Handayani and Widodo (2023) highlighted how IoT systems enable precise data collection, simplifying environmental analysis and decision-making.

System Design

Implementation

In this implementation phase, the researchers designed an application based on the system design created during the design process. The application development utilized Android Studio with Kotlin programming language and Firebase as the database. This application consists of several components, including the Splash Screen, Login Screen, Registration Screen, Home Screen, Feed Data Input, IoT Settings, IoT Time Adjustment, IoT Logs, Chicken Data Statistics, and User Screen.

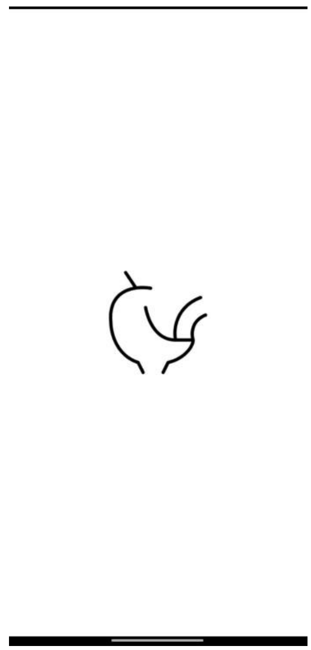

Figure 1. Splash Screen

The first is the splash screen display used as a page when the application is opened which displays the logo of this application. This first page will display a chicken logo related to the function of the application used as a chicken coop monitoring.

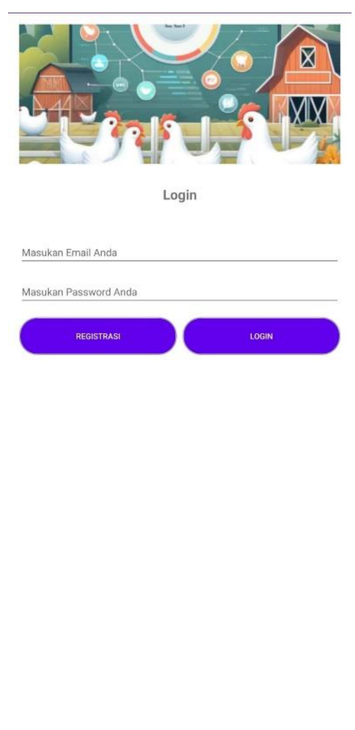

Figure 2. Login Screen

The second screen that appears after the splash screen when users open the application, allowing them to log in by entering valid credentials, such as a username and password. There is a button to direct to the registration page for users who do not have an account.

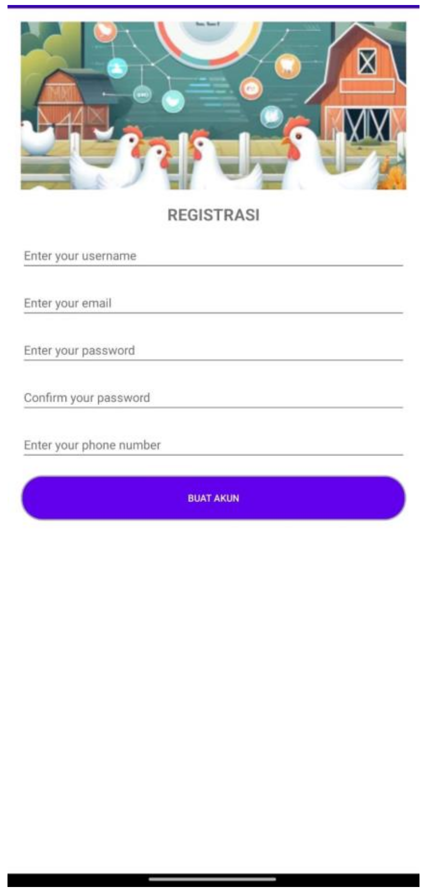

Figure 3. Regist Screen

The Registration screen will open when the user presses the registration button. This registration screen is used by users when they do not have an account and want to create a new account that will be used later. Here the user is asked to fill in the username, email, password, and mobile number. When the user presses the create account button, the data will be saved into the database located in firebase.

Figure 4. Home Screen

The home screen is the main page of this application, here the user can see the temperature taken from IoT and the feed log that has and has not been given.

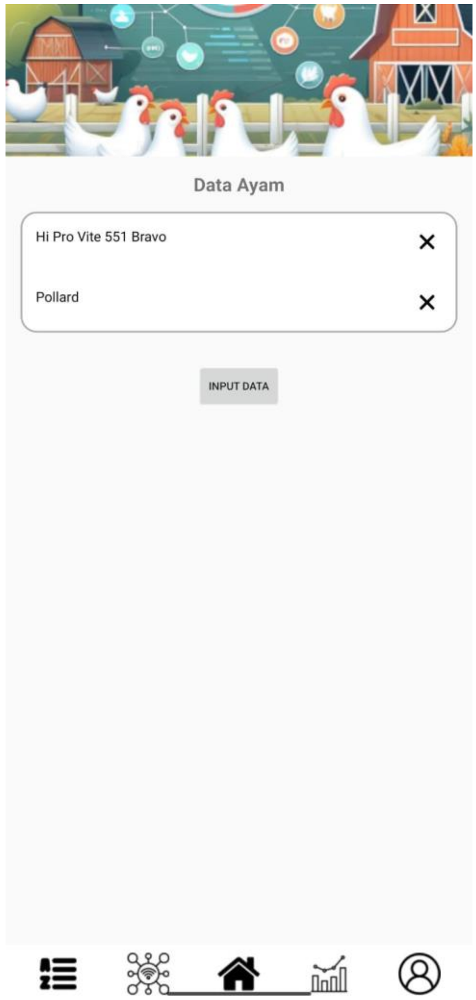

Figure 5. Feed Data Input

On this screen is a page used by farmers to list chicken feed data that has been used for feeding. This list can be used by farmers to compare the quality of one feed with another.

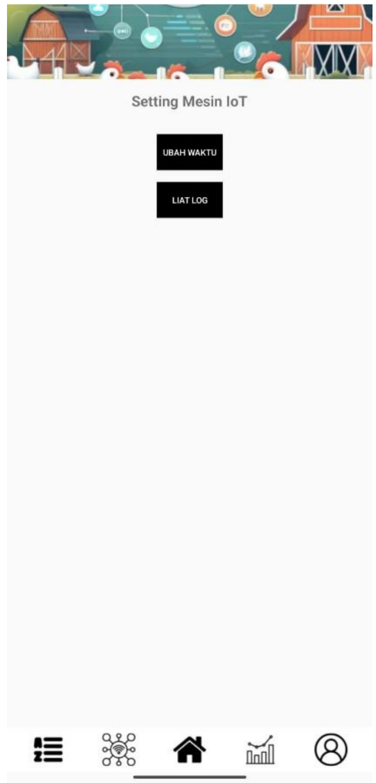

Figure 6. Setting IoT

On the IoT setting screen, there are 2 menus, change time and view log on IoT. If the user presses change time, they will be directed directly to the change time screen, and when they press view log, they will be shown information about the feed log.

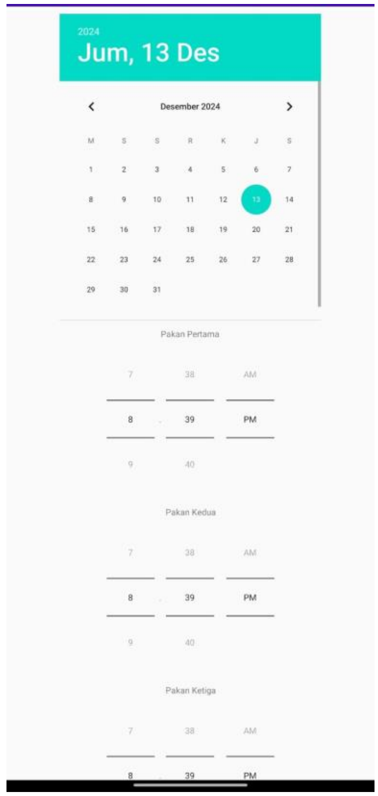

Figure 7. Change IoT Time

On this time change screen, the user is shown the date and time within 24 hours to change the IoT device that will operate later. The date is used to determine the date on which the IoT will operate, and at the bottom there is a time setting for the IoT to operate so that it can be carried out according to the specified time.

Figure 8. Log IoT

On this IoT LoG screen, the user will be shown information about the IoT feed that has been given and those that are waiting for their turn to provide chicken feed according to a previously determined schedule.

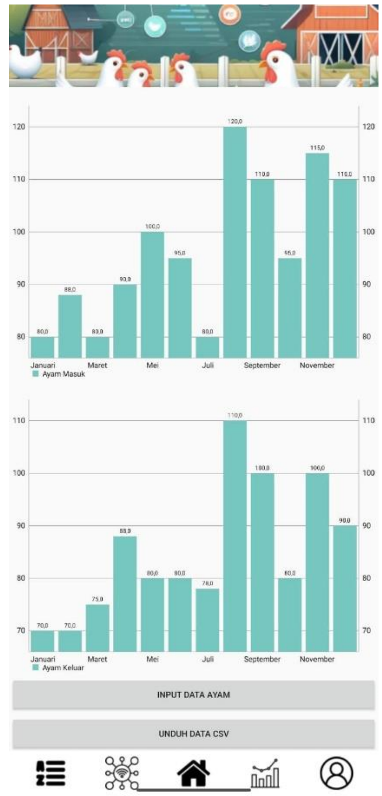

Figure 9. Chicken Data Statistics

On this chicken data page is used to input incoming and outgoing chicken data for each month so that farmers can find out how much the weather and others affect the quantity of chickens produced each month. data that has been filled into the statistics can be downloaded by users in csv format

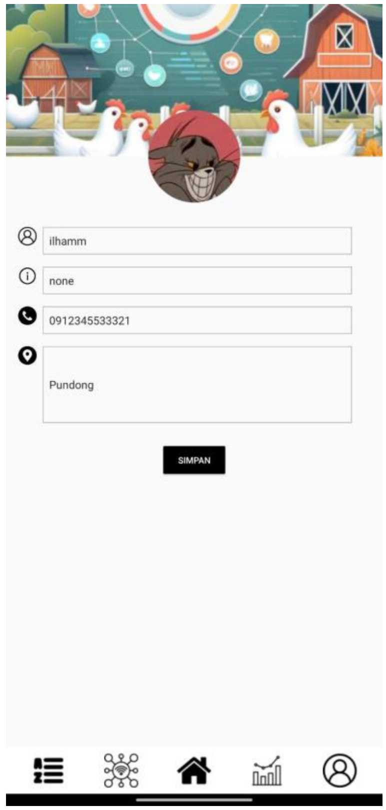

Figure 10. User Screen

On this user page, users can change their username, status, mobile phone number and address and later this data will be saved directly to the Firebase database.

System Architecture

The system is designed as an Internet of Things (IoT)-based feed monitoring and management system. It integrates hardware components, such as microcontrollers and sensors, with software components, such as the mobile application and cloud services, to automate feed management in poultry farms. As highlighted by Mulyadi et al. (2021), the integration of low-cost components such as DHT11 and ESP8266 ensures cost-effectiveness without compromising system quality. Similarly, Suryadi and Rahayu (2021) emphasized the importance of testing data accuracy and responsiveness to maintain reliable system performance.

System testing

In this system testing section, researchers conducted testing on the application that had been created. There were several tests conducted, namely creating a new user, then logging in, finding out that the temperature and humidity were functioning, entering chicken feed data, entering incoming and outgoing chicken data, downloading incoming and outgoing chicken data in csv format, and making changes to the user section.

Table 1. System testing table

No	Scenario	Expexted outcome	Status
1	New User Creation	data is stored in the database	Passed
2	login to the application using the user data that has been created	Login to the application using the user data that has been created	Passed
3	check the temperature and humidity of the cage	temperature can be displayed in the application	Passed
4	Enter the name of the feed used	Chicken feed data can be input into the database	Passed
5	Delete the chicken feed data that has been entered	The stored chicken data will be deleted	Passed
6	Change feeding time	Feeding time on IoT can change	Passed
7	Users can view the Feeding Log	Users can view the Feeding Log	Passed
8	Enter the number of chickens entering and exiting	Data on incoming and outgoing chickens can be input into the database and displayed in a graph.	Passed
9	Download data on chickens entering and exiting with csv output	chicken data in and out can be downloaded with output in the form of a csv file	Passed
10	Make changes to user data in the profile section	Changes to profile data then save the new data into the database.	Passed

CONCLUSION

The IoT-based poultry house monitoring system successfully addresses challenges in temperature and humidity control. By integrating affordable hardware components and a user-friendly mobile application, the system enhances efficiency and productivity for small-scale poultry farmers. Future work could focus on further simplifying the application interface and expanding functionalities, such as predictive analytics for proactive management.

REFERENCES

Alfaridli, H. S. (2023). Teknologi Pemantau Suhu Kandang Ayam Berbasis IoT. *Jurnal Pepadun*, 254–260. Retrieved from https://pepadun.fmipa.unila.ac.id/index.php/jurnal/article/view/180

Efendi, F. S. (2024). Penerapan Sistem Monitoring Kandang Ayam Broiler Closed House Berbasis IoT pada Studi Kasus Moldovar Farm. *Jurnal Pengabdian pada Masyarakat Ilmu Pengetahuan dan Teknologi Terintegrasi*, 67–79. Retrieved from https://jurnal.polinema.ac.id/index.php/j-indeks/article/download/4652/3720

Fitriasari, F. I. (2020). Perancangan Sistem Monitoring dan Controlling Kandang Ayam Berbasis IoT. *Indonesian Journal of Engineering and Technology*, 24–30. Retrieved from https://journal.unesa.ac.id/index.php/inajet/article/download/12683/5218

Habibuddin, J. A. (2024). Development of a light intensity monitoring system in broiler chicken coops based on Arduino IoT Cloud. *INTEK: Jurnal Penelitian*, 45–52. Retrieved from https://jurnal.poliupg.ac.id/index.php/Intek/article/view/5085

Hadyanto, T. &. (2022). Sistem Monitoring Suhu dan Kelembaban pada Kandang Anak Ayam Broiler Berbasis Internet of Things. *Jurnal Teknologi dan Sistem Tertanam*, 9–22. Retrieved from https://ejurnal.teknokrat.ac.id/index.php/jtst/article/view/2179

Hendrikus, S. F. (2022). Sistem Pengontrolan dan Monitoring pada Kandang Ayam Broiler Berbasis Internet of Things (IoT). *Jurnal Informatika dan Rekayasa Perangkat Lunak (JATIKA)*, 117–128. Retrieved from https://jim.teknokrat.ac.id/index.php/informatika/article/view/1922

Hurul Aini, A. S. (2021). Rancang Bangun Smart System pada Kandang Ayam Menggunakan Mikrokontroler. *Jurnal Sistem Informasi, Teknologi Informasi dan Komputer*, 38–46. Retrieved from https://jurnal.umj.ac.id/index.php/just-it/article/view/12419

Imam, &. A. (2024). Sistem Pemantau Suhu dan Kelembapan pada Kandang Anak Ayam Berbasis Internet of Things. *Jurnal Rekayasa Sistem Informasi dan Teknologi*, 509–517. Retrieved from https://journal.ppmi.web.id/index.php/jrsit/article/view/1035

Masriwilaga, A. A.-h. (2019). Monitoring system for broiler chicken farms based on Internet of Things (IoT). *Telekontran Jurnal Ilmiah Telekomunikasi, Komputer dan Kontrol*, 29–36. Retrieved from https://ojs.unikom.ac.id/index.php/telekontran/article/view/1641

Parandy, L. M. (2024). Design of temperature monitoring and control system in smart hen coop based on Internet of Things. *Journal of Information System, Technology and Management*, 78–85. Retrieved from https://gemapublisher.com/index.php/jiste/article/view/68

Perdanasari, L. E. (2023). Control system for temperature, humidity, and ammonia levels in laying hens farms based on Internet of Things. *IOP Conference Series: Earth and Environmental Science*, 1-7. Retrieved from https://iopscience.iop.org/article/10.1088/1755-1315/1168/1/012053/meta

Ramdhan, D. B. (2023). Perancangan Smart System Ternak Ayam Berbasis IoT Menggunakan Arduino UNO. *Jurnal Informatika dan Rekayasa Komputer (JAKAKOM)*, 511–522. Retrieved from https://ejournal.unama.ac.id/index.php/jakakom/article/download/814/646/4127

Suprianto, D. P. (2022). Smart chicken coop ecosystem for optimal growth of broiler chickens using fuzzy on IoT. *Inform: Jurnal Ilmiah Bidang Teknologi Informasi* *dan Komunikasi*, 123–130. Retrieved from https://ejournal.unitomo.ac.id/index.php/inform/article/view/4231

Suryadi, &. R. (2021). Sistem Pemantauan dan Pengendalian Lingkungan Kandang Ayam Berbasis IoT. *Jurnal Teknologi dan Sistem Tertanam*, 45–53. Retrieved from https://ejurnal.teknokrat.ac.id/index.php/jtst/article/view/1025

Suryanto, &. A. (2023). Sistem Monitoring Kualitas Udara, Suhu, dan Kebersihan Kandang Ayam Otomatis Berbasis Internet of Things (IoT). *Journal of Industrial Management and Technology*, 117–124. Retrieved from https://jurnal.bsi.ac.id/index.php/imtechno/article/view/2150/1292