IJECT
Indonesian Journal of Electronics and Computer Technology

Development and Design of a Remote-Controlled Vannamei Shrimp Feeder

Addhil Izzulhaq[a], Arif Rakhman[b], Lukmanul Khakim[c], Miftakhul Huda[d]

[a]Departement of Computer Engineering, Sekolah Vokasi, Universitas Harkat Negeri, Indonesia
izzulhaqadhil01@gmail.com
[b]Departement of Computer Engineering, Sekolah Vokasi, Universitas Harkat Negeri, Indonesia
cakrakirana47@gmail.com
[c]Departement of Computer Engineering, Sekolah Vokasi, Universitas Harkat Negeri, Indonesia
khakimthy@gmail.com (corresponding author)
[d]Departement of Computer Engineering, Sekolah Vokasi, Universitas Harkat Negeri, Indonesia
mh_iftah@harkatnegeri.ac.id

ARTICLE INFO

Keywords:
Shrimp pond,
Vannamei shrimp,
Load cell,
Real-time clock,
AC motor

ABSTRACT

Aquaculture pond water commonly supports multiple aquatic species, including seabass and vannamei shrimp. This study specifically concentrates on vannamei shrimp cultivation in pond systems. Feeding management in shrimp aquaculture constitutes a critical operational parameter, as appropriate feed allocation directly influences growth performance, feed conversion efficiency, and overall production yield. This research involved the design and development of an automatic shrimp feeding system utilizing an HX711 load cell weight sensor integrated with a microcontroller-based control unit. Experimental evaluation demonstrated that the Real-Time Clock (RTC) module exhibited a time deviation of approximately one minute slower than the reference time recorded on a laptop. The implementation of the HX711 load cell sensor in the feed container yielded an average measurement error of 3.1% based on a 350-gram calibration test. The system was capable of dispensing feed with a minimum output resolution of 1 gram. Furthermore, operational data generated by the system are transmitted to a database, visualized through a web-based interface, and accessible for real-time monitoring.

Handling Editor: Sukmaning R

Received: 19 March 2026 | Revised: 5 April and 3 May 2026 | Accepted: 15 May 2026
 | DOI: https://doi.org/

I. INTRODUCTION

The development of shrimp aquaculture has expanded significantly in Indonesia, particularly in Brebes Regency. The high market value of shrimp has made this sector economically attractive and capable of generating substantial income [1]. Shrimp constitute one of the most widely consumed seafood commodities in Indonesia. For shrimp pond operators, the selection of shrimp species and cultivation media represents a critical determinant of product quality and production success.

Feed management in the grow-out phase of vannamei shrimp culture is implemented to accelerate growth rates and maintain high survival rates. Proper feeding strategies must ensure accurate dosing and the use of high-quality feed to optimize biomass gain and feed conversion efficiency. Achieving optimal production outcomes requires not only appropriate cultivation practices but also suitable environmental conditions [3]. The primary environmental factor in pond-based aquaculture is water quality. Improved water quality directly correlates with a more stable and supportive culture environment [4].

In conventional shrimp farming systems, feeding practices are still predominantly manual, with farmers distributing feed by hand [5]. Field observations indicate that vannamei shrimp farmers frequently experience delays in feeding schedules. Both delayed feeding and excessive feed application adversely affect water quality; increased feed input accelerates water deterioration due to organic waste accumulation. Therefore, feeding time management and precision are essential, typically conducted three times daily: at 07:00 (morning), 12:00 (afternoon), and 16:00 (late afternoon). Uniform feed distribution and consistent daily rationing are necessary to maintain optimal shrimp growth performance.

In this study, an automatic feeder system integrated with an Internet of Things (IoT)-based control mechanism was developed. The system operates automatically using a microcontroller platform to minimize feeding delays and prevent overfeeding. This approach aims to enhance harvest productivity through a feeding process that is efficient, timely, and quantitatively controlled.

II. THEORETICAL FRAMEWORK

According to D. Eridani and N. Kholid (2020), in their study entitled Design and Development of a Monitoring and Controlling System for Tiger Shrimp Ponds Using the Internet of Things Concept with the Message Queuing Telemetry Transport (MQTT) Protocol, environmental issues affecting the sustainability of aquaculture businesses particularly water quality were identified as major challenges. In response to these issues, a monitoring and control system for tiger shrimp ponds was developed based on the Internet of Things (IoT) concept utilizing the MQTT protocol. The system was designed to assist tiger shrimp farmers in managing and overcoming water quality problems in their ponds. The study resulted in the successful implementation of an IoT-based monitoring and control system using the MQTT protocol [6].

According to Mulkan Iskandar Nasution (2020), in the study entitled Design and Development of an Automatic Feeding and pH Control System for Shrimp Ponds Based on ATmega32, a significant problem identified was the high mortality rate of shrimp larvae. One of the main triggering factors was the imbalance in environmental parameters, including salinity, water temperature, dissolved oxygen levels, pH, and overall salinity fluctuations. To address these issues, an automatic feeding and water pH regulation device was developed to assist shrimp farmers in managing pond conditions. The results indicated that the automatic pH control and feeding system was successfully designed and operated effectively. The pH value was maintained within a range of 6 to 8.5, and feeding was conducted twice daily. The system proved capable of facilitating pond management without requiring farmers to be physically present at all times [7].

According to S. Lia (2022), in the research entitled Design and Development of an Automatic Feed Control and Monitoring System for Shrimp Ponds Using an Android-Based Microcontroller, the primary issue addressed was the need for balanced and timely feeding in shrimp ponds to avoid overfeeding or underfeeding. Overfeeding leads to uneaten feed residues, which negatively affect water quality. To overcome these limitations, an improved automatic feed control and monitoring system was developed using an Android interface and incorporating an HX711 load cell sensor to precisely measure feed quantities. This enhancement aimed to prevent overfeeding and underfeeding. Experimental results showed that with a voltage setting of 70 volts, the average feed throwing distance was 4.4 meters, with 56.66% of the feed distributed within a range of 0–3 meters [8].

According to A. Geofmi Putra and W.M. Faizal (2022), in their study entitled Analysis and Design of an Automatic Shrimp Feeding Machine, shrimp farmers in Pambang Village, Bantan District, Bengkalis Regency experienced challenges related to feeding delays and inconsistencies with predetermined schedules. Repeated delays negatively affected shrimp growth and harvest yields. Manual feeding methods were also considered inefficient and ineffective due to inaccurate feed dosing. As a solution, an automatic shrimp feeding device was developed. The system operated automatically based on scheduling controlled by an RTC module at 08:00 WIB and 17:00 WIB. The servo motor rotated 90° to dispense feed, and a buzzer sounded when feed levels were low or depleted. The system's effectiveness depended on proper feed discharge through the servo mechanism. During testing, issues were observed, including reversed servo rotation and inaccuracies in the distance sensor used to detect feed depletion. Overall, the test results demonstrated that the system functioned adequately, achieving a success rate of 80% [9].

According to Miftakhul Reski Putra Nasium (2020), in the study entitled Modification and Design of a Semi-Automatic Feeder for Vannamei Shrimp Under 30 Days Old Based on the Internet of Things (IoT), one of the principal challenges faced by shrimp farmers is the manual feeding process, which is considered inefficient due to its high labor demand and time consumption. Moreover, manual feeding often results in feed accumulation at a single point within the pond, leading to deterioration in water quality. Such conditions can adversely affect shrimp growth performance.

To address this issue, an IoT-based automatic feeder system was developed. The primary objective of the study was to facilitate the feeding process in shrimp ponds, thereby improving operational efficiency. The system utilizes IoT as its core component, enabling integrated control and monitoring. An HX711 load cell sensor was employed to monitor feed quantities and provide an indicator of the remaining feed supply.

The automatic feeder can be operated in both automatic and manual modes via a personal computer (PC), and system monitoring can be conducted through a website accessible from both PCs and smartphones. The results reported in the study indicate that the system displays data on remaining feed and feeding session schedules, consisting of morning, afternoon, and evening sessions in accordance with predetermined times.

In addition to a progress bar visualization, the remaining feed data are displayed during each feeding session. For example, if the feed level at the beginning of the morning session is 100% and 53% of the feed has been dispensed, the remaining 53% is recorded and stored in the database. This recorded value subsequently becomes the initial feed data for the afternoon session, and the same mechanism applies to the evening session [1].

III. MATERIALS AND METHODS

The research methodology employed in this study adopts the waterfall model, as illustrated in Figure 1.

- The proposed system involves the design and development of a remote-controlled vannamei shrimp feeder as a preventive measure to avoid delays in feeding. The system utilizes an HX711 load cell sensor as the input component and is controlled by a NodeMCU microcontroller.

- The study begins with an analysis of the problems experienced by pond owners in monitoring feed usage, including the adverse impacts of excessive feeding when preventive measures are not implemented to control feed distribution. Overfeeding can lead to feed waste accumulation, deterioration of water quality, and reduced growth performance.
- The automatic shrimp feeding device was designed as a preventive measure to avoid delays in feed distribution. The system workflow was modeled using a flowchart to clearly define the operational sequence and control logic of the device. The hardware components utilized in this design include an HX711 load cell sensor for feed weight measurement, a Real-Time Clock (RTC) module for scheduling feeding times, an MG996R servo motor as the actuator for feed dispensing, and a NodeMCU microcontroller as the main control unit. In addition, PHP was employed for the development of the web-based monitoring system and database integration, enabling real-time data visualization and remote system access.
- The results of this study will be evaluated through real-world testing of the developed prototype to assess the performance and reliability of the automatic shrimp feeding system as a preventive solution against delayed feeding and overfeeding in shrimp ponds. The testing phase aims to determine the system's operational effectiveness, accuracy, and stability under actual field conditions. Any identified errors, malfunctions, or performance deviations will be analyzed and corrected through iterative improvements. Subsequently, the validated system after necessary refinements will be formally implemented for operational use in shrimp pond management.

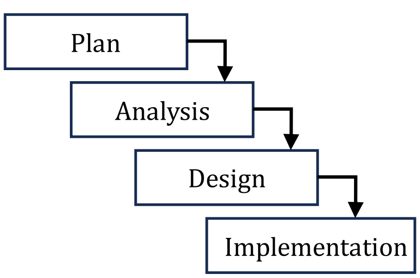

Fig 1. The research procedures employed in this study

Data collection techniques

- Observation
  Field observations were conducted directly at the shrimp pond site. The findings revealed that vannamei shrimp farmers frequently experience delays in feeding schedules and continue to rely on manual feeding methods by manually dispersing feed into the pond. Such practices may lead to uneven feed distribution and potential overfeeding, which can negatively affect pond water quality.
- Interviews
  Interviews were conducted with several shrimp pond owners, including Mr. Azis, who manages both a shrimp pond and onion farming activities. Due to time constraints associated with managing multiple agricultural operations, he reported difficulties in providing shrimp feed on schedule.
  The interview findings indicate that shrimp cultivation requires consistent and routine maintenance, particularly in feeding management. For pond owners who concurrently engage in other agricultural activities, maintaining regular pond supervision becomes challenging. In addition, effective shrimp farming requires continuous monitoring of feed distribution to ensure proper growth and prevent adverse impacts on pond conditions.
- Literature review
  References were collected from various online sources related to the design and development of remote-controlled vannamei shrimp feeding systems. Academic journals constituted the primary source of reference, as they provide validated methodologies, experimental results, and technical analyses relevant to system development.
  In particular, the researcher reviewed several journal articles as foundational references, including studies authored by Denny Khairullah Amurullah et al. (2022) and Denny Khairullah Amurullah (2022). These publications were used to support the conceptual framework, system design considerations, and technological implementation of the proposed remote shrimp feeding system.

IV. RESULTS AND DISCUSSION

This section presents the results of the hardware implementation of the previously designed remote-controlled vannamei shrimp feeding system, developed as a preventive measure against feeding delays in vannamei shrimp ponds.

This phase represents the deployment stage of the monitoring and control system to the actual operational environment. The implemented system is capable of dispensing feed according to predetermined schedules and operating automatically based on programmed parameters.

Furthermore, system data and operational information can be accessed through a web-based monitoring platform. The system transmits data in real time, enabling users to remotely monitor feeding activities and ensure proper feed management within the shrimp pond.

Fig 2. Feed Container and Frame as the Main Components

Fig 3. Sensor and ESP8266 installation

Results

The testing phase was conducted to determine whether the hardware components operated properly in accordance with the designed system specifications. The load cell sensor and RTC module functioned as intended, successfully reading measurement data and executing scheduled operations. The collected data were transmitted and stored in the database, and system information was displayed through the web interface in real time without significant operational errors.

Based on the test results, the developed system performed in accordance with the expected design objectives. The automatic shrimp feeding device operated effectively, demonstrating stable hardware functionality, accurate data acquisition, and reliable real-time monitoring. Therefore, it can be concluded that the system is capable of functioning properly and meets the intended performance requirements.

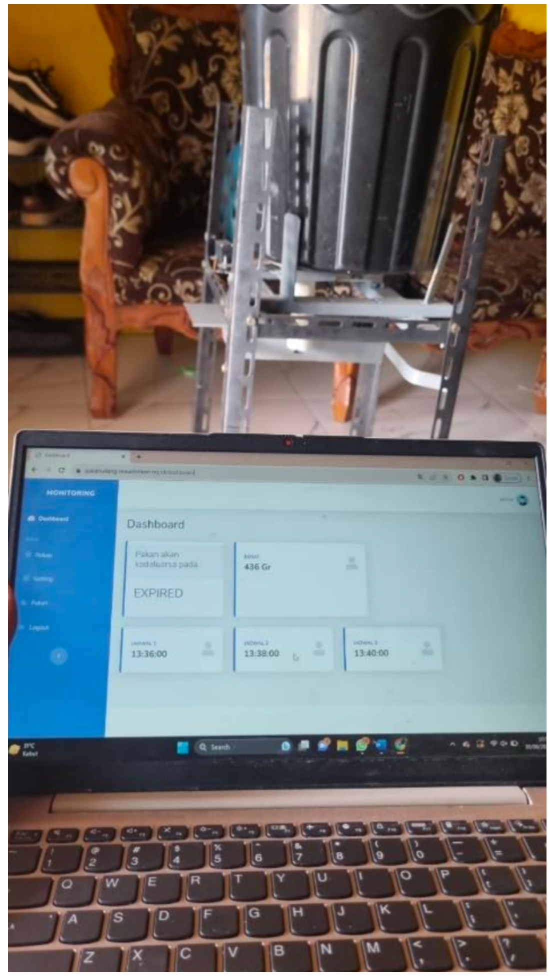

Fig 4. The results displayed on the website interface

V. CONCLUSIONS

Based on the testing results, several conclusions can be drawn:

The design and development of the remote-controlled vannamei shrimp feeding system, as a preventive measure against delayed feeding and overfeeding in shrimp ponds, can be successfully implemented in real-world conditions. The experimental results indicate that the developed device operates effectively and in accordance with the intended design objectives.

The system is capable of detecting feed weight using the load cell sensor and dispensing feed through the MG996R servo motor mechanism, with validation performed by comparison to an analog scale. For a feed discharge setting of 1 gram, the system achieved a measurement accuracy of approximately 99%.

Furthermore, operational data are successfully transmitted to a database and can be monitored through a web-based interface in real time, demonstrating reliable system integration between hardware, microcontroller processing, and IoT-based monitoring.

ACKNOWLEDGMENT

The author expresses sincere gratitude for the assistance and contributions of all parties involved, which have enabled this research to be conducted successfully.

REFERENCES

[1] Miftahul Reski Putra Nasjum, “Rancang bangun kontrol dan monitoring pakan otomatis,” Kaos GL Derg., vol. 8, no. 75, pp. 147–154, 2020, [Online].

[2] Menggunakan Metode Quality Functio Deployment Pada Pt . Esaputlii Prakarsa Utama Kabupaten Tugas Akhir Qayyim 18 Tia 411 Diajukan untuk memenuhi sebagai persyaratan guna menyelesaikan program Diploma Tiga Jurusan / Program Studi ,” 2021.

[3] Rahayu deny danar dan alvi furwanti Alwie, A. B. Prasetio, R. Andespa, P. N. Lhokseumawe, and K. Pengantar, “Tugas Akhir Tugas Akhir,” *J. Ekon. Vol. 18, Nomor 1 Maret201*, vol. 2, no. 1, pp. 41–49, 2020.

[4] R. S. Saputri, “Rancang Bangun Alat Pemberi Pakan Udang Vaname (Semi Automatic Feeder) Berbasis Iot (Internet of Things) Bangka Belitung Tahun 2019,” 2019.

[5] F. Asmana, M. Kamal, and A. Finawan, “Rancang Bangun Prototype Sistem Pemberi Pakan Udang Otomatis Berbasis IoT,” J. Tektro, vol. 06, no. 01, 2022.

[6] D. Eridani, E. D. Widianto, and N. Kholid, “Rancang Bangun Sistem Monitoring Dan Controlling Tambak Udang Windu Dengan Konsep Internet Of Things Menggunakan Protokol Message Queuing Telemetry Transport,” *CESS (Journal Comput. Eng. Syst. Sci.*,vol. 5, no. 1, p. 137, 2020, doi:10.24114/cess.v5i1.14718.

[7] P. Tambak and U. Berbasis, “EINSTEIN (e-Journal) Jurnal Hasil Penelitian Bidang Fisika,” 2020

[8] S. Lia, “Rancang Bangun Pakan udang Otomatis,” Jurnal, no. 8.5.2017, pp. 2003–2005, 2022, [Online]. Available: https://www.who.int/news-room/fact-sheets/detail/autism-spectrum-disorders

[9] A. Geofmi Putra, W. M. Faizal, and P. Negeri Bengkalis, “Politeknik Negeri Bengkalis,” 2022.

[10] MIFTAHUL RESKI PUTRA NASJUM, “Rancang bangun pemberi makan udang,” Kaos GL Derg., vol. 8, no. 75, pp. 147–154, 2020,