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Developing Model of Automated Dormitory Management System Using Waterfall Approach to Enhance Efficiency and Minimize Human Error

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Abstract

Dormitory management commonly relies on manual procedures for scheduling cleaning duties, monitoring cleaning supplies, verifying task completion, and supervising resident activities. These processes often lead to inefficiencies, inconsistent data management, and limited coordination among dormitory stakeholders. This paper presents an Automated Dormitory Management System (ADMS) that digitalizes dormitory operations through a centralized platform. The system integrates automated cleaning duty scheduling, supply monitoring, duty report submission, and administrative supervision while utilizing the Waterfall software development model for system development. Firebase Real-Time Database and Firebase Storage are employed to provide secure data management and real-time synchronization across multiple user roles. Functional testing was conducted to evaluate the performance of each module for Residents, Floor Leaders, and Dormitory Directors. The results demonstrate that the automated scheduling module successfully generates balanced cleaning assignments, synchronizes schedules in real time, and correctly implements role-based access control. The supply monitoring module accurately updates inventory information with immediate synchronization, while the duty reporting module reliably stores photographic evidence and reports data. Furthermore, the administrative dashboard effectively consolidates weekly operational reports, inventory status, and resident information into a centralized monitoring interface. Therefore, the proposed system satisfies all functional requirements and improves operational efficiency, transparency, accountability, and coordination in dormitory management through integrated real-time cloud services.

Keywords:
Dormitory, Management System, Duty Scheduling, Waterfall Model

1. Introduction

The rapid advancement of information technology drives organizations to transform manual administrative processes into integrated digital systems. Management systems have become essential tools for improving operational efficiency, reducing administrative burdens, and ensuring data accuracy across various sectors. Previous studies demonstrate that web-based management systems successfully automate business processes, enhance information accessibility, and support more effective decision-making. Organizations that continue to rely on manual procedures often face challenges such as data duplication, delays in reporting, inefficient record management, and increased human error. These issues highlight the need for systematic and technology-driven management solutions that can streamline organizational operations and improve service quality. [1], [3], [5], [7], [9]

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Dormitory management represents one of the administrative domains that still encounters significant operational challenges. Many dormitories continue to manage resident registration, room allocation, attendance records, payment monitoring, maintenance requests, and reporting activities manually using paper documents or spreadsheets. Such practices often result in inconsistent records, slow information retrieval, scheduling conflicts, and difficulties in monitoring resident activities. Similar problems appear in educational administration, recruitment management, internship administration, and thesis supervision systems where manual processes reduce transparency and create inefficiencies. These recurring issues demonstrate the necessity of developing a centralized dormitory management platform that automates routine administrative tasks and improves operational control. [9], [10], [17], [20]

The growing demand for digital transformation in educational and residential environments further strengthens the need for automated dormitory management. Educational institutions increasingly adopt web-based systems to improve service delivery, administrative transparency, and stakeholder communication. Research on student admission systems, learning management systems, and internship information systems shows that digital platforms significantly reduce administrative workload while improving data accuracy and user satisfaction. Dormitories function as an extension of educational institutions and therefore require similar technological support to manage student accommodation effectively. An integrated dormitory management system can facilitate real-time monitoring, structured communication, and efficient resource allocation among administrators and residents. [5], [6], [13], [20]

Another critical issue involves inventory and facility management within dormitory environments. Dormitory administrators must manage room assets, furniture, maintenance schedules, utility usage, and facility reservations. Traditional management approaches often create difficulties in tracking assets and responding promptly to maintenance requests. Studies on warehouse management systems, inventory information systems, and book inventory systems reveal that automated inventory tracking improves operational visibility and minimizes data discrepancies. By applying similar principles, a dormitory management system can provide better control over facilities, ensure accountability, and reduce losses caused by inaccurate records or delayed maintenance activities. [1], [4], [11], [12]

Human error remains one of the most common causes of inefficiency in administrative systems. Manual data entry, paper-based documentation, and repetitive administrative tasks increase the risk of incorrect records, missing information, and inconsistent reporting. Research conducted in clinic management systems, commodity reservation systems, and inventory management systems indicates that computerized systems significantly reduce redundancy and improve process reliability. In dormitory operations, errors in resident registration, room assignments, payment records, and attendance tracking can create operational disruptions and dissatisfaction among residents. Therefore, an automated management system becomes essential to minimize human intervention in repetitive tasks and improve overall service quality. [7], [11], [16], [18]

Security and data governance also emerge as important considerations in modern management systems. Dormitory management involves sensitive information such as resident identities, financial transactions, accommodation records, and access permissions. The increasing volume of digital data requires organizations to implement secure information management practices that preserve confidentiality, integrity, and availability. Previous studies emphasize the importance of structured system design and access control mechanisms to protect organizational data from unauthorized access and data loss. Integrating these principles into a dormitory management system ensures that administrators can manage information securely while maintaining reliable system performance. [8], [10], [17]

The Waterfall development approach continues to receive widespread adoption in management system development because it provides a structured and systematic framework. Numerous studies successfully utilize the Waterfall model to develop warehouse management systems, recruitment platforms, learning management systems, reservation systems, internship systems, and inventory management applications. The model facilitates clear requirement analysis, systematic design, controlled implementation, comprehensive testing, and effective maintenance. Since dormitory administration typically follows established operational procedures with well-defined requirements, the Waterfall approach provides a suitable methodology for developing a reliable and maintainable dormitory management system. [1], [3], [5], [9], [10], [15], [20]

Based on these challenges and opportunities, developing an Automated Dormitory Management System becomes an important research initiative. Existing studies demonstrate the effectiveness of digital management systems in improving efficiency, transparency, operational control, and service quality across various domains. However, limited research specifically addresses the comprehensive automation of dormitory administration using an integrated web-based platform. This study therefore develops a model of an Automated Dormitory Management System using the Waterfall approach to enhance administrative efficiency, minimize human error, improve data accuracy, strengthen information security, and support more effective dormitory operations. The proposed system is expected to provide a practical framework for educational institutions and residential facilities seeking to modernize accommodation management through digital transformation. [1], [5], [8], [10], [17], [20].

2. Related Works

Several studies developed management information systems using the Waterfall approach to improve organizational efficiency and reduce manual administrative work. Wijaya et al. [1] designed a web-based Warehouse Management System (WMS) using the Waterfall model. The study demonstrated that a structured development process supported clear system implementation and improved warehouse operations. The system utilized UML diagrams and web technologies to manage inventory activities effectively. However, the research focused primarily on warehouse transactions and stock movement. It did not address accommodation management, resident monitoring, or facility allocation, which are critical functions in dormitory environments.

Razali et al. [2] proposed the Networked Integrated Legal Affairs Management System (NILAMs) using a hybrid Agile-Waterfall approach. The system improved collaboration and information sharing among legal affairs stakeholders. The study showed that structured development and system integration enhanced process efficiency and coordination. The research highlighted the importance of centralized information management across multiple users. However, the system targeted legal administration and lacked features related to residential management, room assignment, attendance monitoring, and dormitory operations. Therefore, its application remained limited for accommodation management scenarios.

Several researchers developed management systems to automate operational processes and reduce human errors. Pangesty and Wibowo [3] implemented a web-mobile Laundry Management System using the Waterfall method. The system automated customer management, transaction processing, inventory tracking, and order monitoring. Black-box testing confirmed that all functions operated correctly. Similarly, Nugroho and Devi [9] developed a Recruitment Management Information System that streamlined applicant management, interview scheduling, and evaluation activities. Both studies demonstrated that automation improved efficiency, data accuracy, and process transparency. Nevertheless, neither study addressed resident administration, room management, or accommodation services that characterize dormitory operations.

Research in educational management systems also provided valuable insights into structured system development. Agstriningtyas et al. [5] developed a Student Admission Information System using Laravel and the Waterfall model. The system automated registration, document verification, and selection processes. Doni et al. [10] designed an Online Thesis Management System that improved transparency and communication between students and supervisors. Sanjaya and Khotimah [20] created an Internship Information System that enhanced monitoring and reporting activities. These studies confirmed that digital platforms improved administrative efficiency and reduced manual workload. However, their scope focused on academic processes rather than accommodation and residential management.

Learning Management Systems (LMS) also contributed relevant findings regarding user-centered administration and information accessibility. Almonte et al. [6] developed a culture-based Learning Management System using the Waterfall methodology. The study emphasized requirement analysis and stakeholder feedback during development. Sulianta et al. [13] implemented a Moodle-based LMS that supported online learning, assignment submission, and transparent academic monitoring. Both studies demonstrated that centralized digital platforms improved communication and service delivery. However, they focused on educational content management and lacked operational features required for dormitory administration, such as room occupancy tracking and facility maintenance management.

Inventory-oriented systems offered useful concepts for asset and facility control. Dewy et al. [4] proposed an AI-based Smart Warehouse Management System that integrated inventory monitoring with advanced decision support capabilities. Hermawan et al. [11] developed a warehouse inventory management system that improved stock accuracy and operational efficiency. Mardiyati et al. [12] designed a book inventory management system that reduced administrative workload and improved reporting accuracy. These studies demonstrated the effectiveness of automated inventory tracking and real-time information management. However, they concentrated on asset management and did not provide mechanisms for managing residents, accommodation services, or dormitory activities.

Studies on reservation and facility management systems shared stronger similarities with dormitory operations. Abdulkadir et al. [7] developed an Integrated Food Commodities Reservation and Management System that automated reservations, inventory management, and user tracking. Anggraini et al. [17] implemented a digital accommodation reservation system that improved transparency and financial accountability. Suhadi et al. [15] designed a Smart Classroom Booking System that prevented scheduling conflicts through automated reservations and real-time availability monitoring. These studies demonstrated that reservation systems improved resource utilization and operational control. However, they focused on short-term reservations and resource allocation rather than long-term resident accommodation management and dormitory supervision.

Security and data governance emerged as important considerations in management system development. Isnan et al. [8] proposed a Dataset Management System based on the Confidentiality, Integrity, and Availability (CIA) framework. The study emphasized secure information handling, access control, and reliable system design. Meanwhile, Rathod et al. [18] developed a Clinic Management System that reduced data redundancy and accelerated information retrieval through computerized processes. Both studies highlighted the importance of secure and accurate data management. Despite their contributions, they did not address the specific challenges of dormitory administration. Existing studies generally focused on inventory management, academic systems, reservation platforms, or organizational administration. Limited research developed an integrated Automated Dormitory Management System that combines resident registration, room allocation, attendance monitoring, facility management, reporting, and secure data administration within a single platform [8], [18].

3. Proposed Method

This study develops an Automated Dormitory Management System (ADMS) using the Waterfall software development model. The proposed system automates dormitory operations, including resident registration, room allocation, attendance monitoring, payment processing, maintenance management, and report generation. The development process follows a sequential Waterfall framework consisting of requirements analysis, system design, implementation, testing, deployment, and maintenance.

A. Requirements Analysis

The system requirements are collected through observations, interviews, and document reviews. The complete requirement set is represented as:

$$R = \{r_1, r_2, \dots, r_n\},$$

where R denotes the set of functional and non-functional requirements, and r_i represents the i-th requirement.

B. System Design

The system architecture is modeled using UML diagrams and Entity Relationship Diagrams (ERDs). The primary data entities are defined as:

$$E = \{U, Ro, P, M\},$$

Where U denotes resident records, Ro represents room data, P denotes payment transactions, and M represents maintenance records.

C. Room Allocation Module

The system assigns residents to available rooms according to room capacity constraints. The room occupancy rate is computed as:

$$OR = \frac{N_o}{C_r} \times 100\%, \quad (1)$$

where N_o denotes the number of occupants and C_r denotes the maximum room capacity.

D. Attendance Monitoring Module

Resident attendance is recorded electronically and evaluated using the attendance percentage:

$$AP = \frac{A_p}{A_t} \times 100\%, \quad (2)$$

where A_p denotes the number of attended sessions and A_t denotes the total scheduled attendance sessions.

E. Payment Management Module

The total dormitory fee is calculated as:

$$T_P = F_m \times D_s, \quad (3)$$

where F_m denotes the monthly dormitory fee and D_s denotes the duration of stay (in months).

The outstanding balance is then determined by:

$$O_B = T_P - P_A, \quad (4)$$

where P_A denotes the cumulative amount paid by the resident.

F. Maintenance Management Module

The efficiency of maintenance handling is evaluated through the maintenance completion rate:

$$MCR = \frac{M_c}{M_t} \times 100\%, \quad (5)$$

where M_c denotes the number of completed maintenance requests and M_t denotes the total maintenance requests submitted.

G. System Testing

The developed system is validated using Black-Box Testing. The testing success rate is calculated as

$$TSR = \frac{T_p}{T_c} \times 100\%, \quad (6)$$

where T_p denotes the number of successfully passed test cases and T_c denotes the total number of test cases executed.

H. Waterfall Development Framework

The overall Waterfall process is formally represented as:

$$W = \{\text{A,D,I,T,}D_p\text{,M}\},$$

where A denotes Requirements Analysis, D denotes System Design, I denotes Implementation, T denotes Testing, D_p denotes Deployment, and M denotes Maintenance.

The development workflow can therefore be expressed as:

$$A \rightarrow D \rightarrow I \rightarrow T \rightarrow D_p \rightarrow M,$$

indicating the sequential execution of each phase in accordance with the Waterfall methodology.

4. Result and Analysis

This main feature of ADMS is the automated cleaning duty scheduling including the duty schedule page and Floor Leaders. The proposed Automated Dormitory Management System (ADMS) was evaluated through functional testing to verify the correctness of each module under different user roles, namely Resident, Floor Leader, and Dormitory Director. The evaluation focused on the automated scheduling mechanism, inventory management, duty report submission, and administrative monitoring. Fig. 1 depicts automatic dormitory system using Waterfall model.

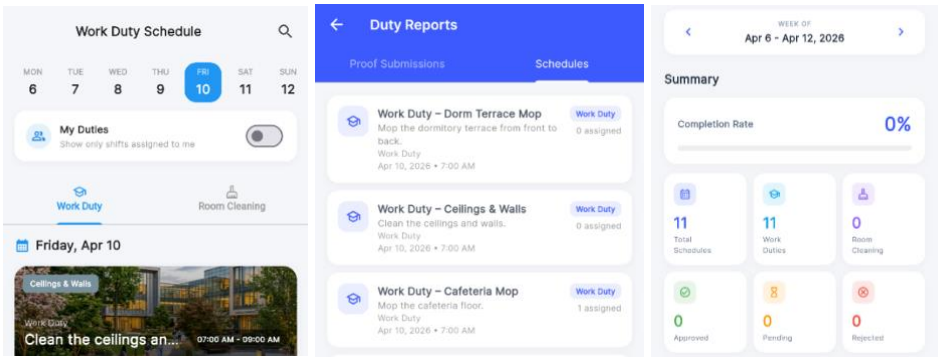

Fig. 1 Automatic Dormitory System using Waterfall model

A. Automated Cleaning Duty Scheduling

The automated cleaning duty scheduling module enables Floor Leaders to organize and distribute cleaning assignments among dormitory residents efficiently. Before schedule generation, the system verifies whether an existing schedule is available. If no schedule exists, the system activates the **Generate Schedule** function, which retrieves resident information from the Firebase database and automatically allocates duties based on the number of registered residents. The generated schedule includes resident names, assigned dates, and duty descriptions before being stored automatically in the database and synchronized across all users in real time.

In addition to automatic scheduling, the system provides a manual scheduling option that allows Floor Leaders to create or modify schedules whenever necessary. Residents access their assigned duties through the **My Duties** interface, which filters task information according to the authenticated user account. Functional testing confirmed that each resident could only view his or her assigned duties, indicating that the role-based filtering mechanism operated correctly and prevented unauthorized access to other residents' schedules.

Table 1. Functional Validation of the Automated Scheduling Module

Test Scenario	Expected Result	Testing Result	Status
Generate cleaning schedule	Schedule generated automatically and stored in database	Successfully generated balanced schedules	✓ Passed
Manual schedule creation	New schedule added successfully	Schedule displayed immediately	✓ Passed
Resident duty filtering	Display only assigned duties	Correctly filtered by logged-in user	✓ Passed
Real-time synchronization	Schedule visible to all users	Successfully synchronized via Firebase	✓ Passed

B. Supply Monitoring Module

The supply monitoring module supports Floor Leaders in managing dormitory cleaning supplies, including detergents, disinfectants, and cleaning equipment. The interface displays current inventory levels and allows authorized users to modify stock quantities through an editing form. After updating an inventory record, the system immediately synchronizes the latest stock information using Firebase Real-Time Database. Functional testing verified that inventory updates were reflected instantly across all connected users without requiring manual page refreshes. Residents could view the updated stock

information immediately after modification, demonstrating successful real-time data synchronization and consistency between client devices.

Table 2. Functional Validation of the Supply Monitoring Module

Test Scenario	Expected Result	Testing Result	Status
Display inventory	Current stock displayed	Successfully displayed	✓ Passed
Update stock quantity	Inventory updated	Successfully updated	✓ Passed
Real-time synchronization	Changes visible to all users	Immediate synchronization	✓ Passed

C. Duty Report Submission

After completing their assigned duties, residents submit proof of completion through the duty reporting module by uploading photographic evidence. The uploaded image is stored in Firebase Storage, while the corresponding report information is recorded in the Firebase database. Testing demonstrated that the upload process completed successfully, after which the system generated a confirmation notification indicating successful submission.

Table 3. Functional Validation of the Duty Report Module

Test Scenario	Expected Result	Testing Result	Status
Upload duty proof	Image uploaded successfully	Successfully uploaded	✓ Passed
Store report data	Report saved to database	Successfully stored	✓ Passed
View submitted reports	Reports displayed correctly	Successfully displayed	✓ Passed

D. Dormitory Director Dashboard

The Dormitory Director dashboard provides centralized supervision over dormitory activities through aggregated operational reports. Following successful authentication, the Director can access weekly summaries containing generated schedules, completed duties, submitted reports, inventory status, and resident information. Functional testing confirmed that the weekly report accurately reflected data previously entered by Floor Leaders and Residents.

Table 4. Functional Validation of the Director Dashboard

Test Scenario	Expected Result	Testing Result	Status
Weekly report generation	Weekly summary displayed	Successfully displayed	✓ Passed
Inventory monitoring	Updated stock information displayed	Successfully synchronized	✓ Passed
Resident management	Resident information editable	Successfully updated	✓ Passed

The functional evaluation demonstrates that all system modules satisfy their intended operational requirements. The integration of Firebase Real-Time Database and Firebase Storage enables immediate synchronization of scheduling, inventory, reporting, and administrative data among different user roles. Consequently, the proposed system improves operational efficiency, enhances transparency in task management, and provides reliable administrative supervision for dormitory operations.

5. Conclusion

This paper developed and evaluated an ADMS using the Waterfall software development model to improve the management of dormitory operations through a centralized digital platform. We integrated automated cleaning duty scheduling, supply monitoring, duty report submission, and administrative supervision into a single system supported by Firebase Real-Time Database and Firebase Storage. Functional testing verified that all implemented modules operated according to their design specifications. The automated scheduling module successfully generated balanced cleaning assignments, synchronized schedules in real time, and correctly restricted residents to viewing only their assigned duties through role-based access control.

The evaluation also confirmed the reliability of the supporting operational modules. The supply monitoring module enabled Floor Leaders to update inventory information, and the changes were immediately synchronized across all users without manual refresh. Similarly, the duty reporting module successfully stored photographic evidence and report data, allowing Floor Leaders to verify completed cleaning activities efficiently. Furthermore, the Dormitory Director dashboard accurately consolidated weekly operational reports, inventory status, and resident information, demonstrating effective integration of data generated by different user roles. The functional validation results showed that every testing scenario achieved the expected outcome, indicating that the proposed system satisfies its operational requirements.

Therefore, this paper demonstrates that the proposed ADMS provides an effective and reliable solution for modern dormitory management. We utilized real-time cloud synchronization to improve communication, transparency, and coordination among Residents, Floor Leaders, and Dormitory Directors while reducing manual administrative tasks. The successful implementation and validation indicate that the proposed system can enhance operational efficiency and accountability in dormitory environments. Future work may incorporate intelligent scheduling optimization, notification services, predictive inventory management, and analytical dashboards to further improve system performance and support data-driven decision making.

References

[1] V. Wijaya, V. Joeanca, H. Yap, and S. Lim, “Methodical Approach: Building a Web-Based Warehouse Management System Using the Waterfall Method,” *International Journal of Computer Science & Information Technology (IJCSIT)*, 2024.

[2] S. Razali, N. S. K. Bashah, S. Abdul-Rahman, N. S. M. Yusop, H. N. M. Hashim, and H. Dziyauddin, “Collaborative Platform of Networked Integrated Legal Affairs Management System (NILAMs) using Hybrid Agile-Waterfall Approach,” in *Proc. IEEE International Conference on Computing (ICOCO)*, 2021.

[3] S. S. A. Pangesty and A. Wibowo, “Penerapan Laundry Management System Web-Mobile Menggunakan Metode Waterfall dengan Evaluasi TAM dan Blackbox Testing,” *TIN: Terapan Informatika Nusantara*, 2025.

[4] C. K. Dewy, Y. Prambudia, and I. Kumalasari, “Design of Inventory Information System Model on Smart Warehouse Management System (WMS) Based on Artificial Intelligence (AI) with Integration of Waterfall Method and Design Thinking to Optimize Inventory Accuracy,” *Eduvest - Journal of Universal Studies*, 2025.

[5] S. Agstriningtyas, M. Ifan, A. D. Yana, and B. Wijaya, “Digital Transformation of Student Enrollment: Building a Robust SPMB System for SMPN 1 Yosowilangun with Laravel and Waterfall Approach,” *Journal of Information Systems Management and Digital Business*, 2025.

[6] R. G. Almonte, A. M. Montiano, P. B. C. Salili, L. M. Garcia, and R. R. Hipolito Jr., “Design and Development of Culture-Based Learning Management System for City College of Calamba: A Qualitative Approach,” in *Proc. 8th International Conference on Education and Multimedia Technology*, 2024.

[7] S. Abdulkadir, A. Hussaini, Y. Ango, and R. Mohammed, “Development and Implementation of an Integrated Food Commodities Reservation and Management System for the Kasu Majlis Cooperative Society Using Structured Approach,” *The Scientific World Journal*, 2024.
[8] M. Isnan, G. N. Elwirehardja, D. Ariansyah, R. Rahutomo, and B. Pardamean, “Confidentiality, Integrity, and Availability (CIA) Approach for Private Dataset Management System Design,” in *Proc. 9th International Conference on Information Technology and Digital Applications (ICITDA)*, 2024.
[9] D. Nugroho and P. A. R. Devi, “Design and Construction of a Recruitment Management Information System for Prospective Employees Using the Waterfall Method,” *Jurnal Nasional Komputasi dan Teknologi Informasi (JNKTI)*, 2025.
[10] W. Doni, Darwel, M. P. Ningsih, A. Ponda, E. Sugriarta, and D. Susanti, “Design and Implementation of an Online Thesis Management System Using the Waterfall Model at a Health Polytechnic in Indonesia,” *Indonesian Journal of Learning Education and Counseling*, 2026.
[11] M. T. Hermawan, F. Hasan, and A. Y. Kuntoro, “Implementation of Warehouse Inventory Management System at CV Cahaya Karunia Mulia,” *Jurnal Kesehatan, Sains, dan Teknologi (JAKASAKTI)*, 2025.
[12] S. Mardiyati, U. Pauziah, and D. Sutrisno, “Design and Creation of Book Inventory Management System in School Library,” *RIGGS: Journal of Artificial Intelligence and Digital Business*, 2025.
[13] F. Sulianta, F. Rumaisa, Y. Puspitarani, S. Violina, and A. Rosita, “Membangun Learning Management System di SDN 162 Warung Jambu sebagai Media Belajar di Era Digital Berbasis Moodle,” *Abdimas Galuh*, 2025.
[14] K. Pamudji, T. B. Chandrawati, and S. I. S. Dewi, “IoT-Based Smart Bin Waste Management System with Real-Time Capacity Monitoring,” *SISFORMA*, 2025.
[15] Suhadi, Parman, K. Adilla, M. Fernanda, F. Khoiri, Y. A. Asim, M. Romadon, R. Maemunah, R. H. Sa’diyah, R. Injani, B. Lingga, and S. Suci, “Design of Web-Based Smart Classroom Booking System Using Waterfall Method,” *Journal of Applied Informatics Science*, 2025.
[16] Y. Pratama and I. R. I. Astutik, “Design of a Clothing Sales Information System Based on JAVA NetBeans Using the Waterfall Method,” *Journal of Artificial Intelligence and Digital Economy*, 2025.
[17] D. Anggraini, K. Ariawan, and A. Asropi, “Implementation of a Digital-Based Accommodation Reservation System for Optimization of PNBP at the Bekasi Hajj Dormitory,” *Al Qalam: Jurnal Ilmiah Keagamaan dan Kemasyarakatan*, 2025.
[18] P. Rathod, S. Jadhav, K. Gadre, and J. Khawale, “Clinic Management System,” *International Journal for Research in Applied Science and Engineering Technology*, 2024.
[19] G. Kalağan and S. Saydam, “A Review on the Problems of Contracted Staff in the Public Staff Management System: The Case of Higher Education Credit and Dormitory Institution,” *Oğuzhan Sosyal Bilimler Dergisi*, 2022.
[20] T. M. Sanjaya and K. Khotimah, “Web-Based Internship Information System at SMK Nusantara 1 Kotabumi Using the Waterfall Method Approach,” *International Journal of Health Engineering and Technology*, 2026.