

Design of a chatbot-based and web schedule management information system to optimize information distribution in the student cadet corps regiment of the Indonesian Defense University

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ABSTRACT

The educational environment of the Student Cadet Corps Regiment at the Indonesian Defense University (Unhan RI) requires strict discipline and precise time management; however, the distribution of dynamic schedule information remains inefficient, delayed, and prone to human error due to conventional methods and restricted mobile device usage. This study aims to design and develop an integrated Schedule Management Information System that improves the efficiency, accuracy, and speed of information distribution. The research adopts a system development approach using the Waterfall method, integrating a Web-based Dashboard for schedule management and a Telegram Chatbot for real-time notification, supported by Role-Based Access Control (RBAC) to ensure data integrity and access security. The system was evaluated through Black Box Testing, usability testing using the System Usability Scale (SUS), and performance comparison between conventional and proposed methods involving 25 cadets and 4 staff. The results show that the proposed system significantly reduces schedule distribution time from 30–60 minutes to less than 5 seconds (>95% improvement), increases data accuracy to above 98%, and achieves a SUS score of 82, indicating high usability. These findings imply that the integration of web-based systems and chatbot technology can effectively enhance operational efficiency, support time discipline, and serve as a scalable model for information management in discipline-based institutions with strict operational constraints.

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1. INTRODUCTION

Life in a military environment and the discipline practiced at the Indonesian Defense University Student Cadet Corps Regiment demand a very high level of time management and adherence to schedules (Ministry of Defense of the Republic of Indonesia, n.d.). Regular daily activities are the main foundation for developing a cadet's character and professionalism. Therefore, an accurate, efficient, and structured schedule management system is crucial to support smooth operational and educational activities (Pungkasanti et al., 2026). Research into optimizing schedule information distribution using modern technology is crucial to ensure the information delivery process is fast, accurate, and adaptable to applicable regulations (Albayati et al., 2025).

The implementation of Telegram Chatbot technology integrated with a Web-based Dashboard Management Information System is a strategic step to address this challenge (Suprpto

& Prehanto, 2020). Chatbot technology has been widely adopted in various sectors to improve process efficiency, including in the development of information systems that focus on speedy notifications and concise interactions (Nasyira & Firdaus, 2026). Furthermore, the implementation of Role-Based Access Control (RBAC) in this system ensures data integrity and separation of authority, similar to how integrated management systems within Enterprise Resource Planning (ERP) platforms have been proven to improve operational efficiency and data accuracy in resource management (Kristina et al., 2017).

However, previous studies generally focus on the implementation of chatbot-based notification systems or web-based information systems separately, without providing an integrated solution that combines real-time notification mechanisms, centralized data management, and strict access control within a discipline-based institutional environment. In addition, limited attention has been given to the challenges of information distribution under restricted mobile device usage conditions, such as those found in military-based educational institutions. This indicates a clear research gap in developing an integrated, secure, and adaptive schedule management system that is specifically tailored to such environments.

Currently, schedule management at the Indonesian Defense University Student Cadet Corps Regiment is still carried out conventionally, which is time-consuming and prone to delays or inaccuracies, especially for dynamic schedules. Strict restrictions on cadet use of mobile devices further exacerbate this information distribution challenge (Kristina et al., 2017). Schedule delivery processes that rely on verbal announcements, physical bulletin boards, or conventional messaging groups often fail to prevent cadets from receiving outdated or incomplete information (Dessy Rahmadani et al., 2026). This situation indicates that conventional distribution systems are no longer adequate and require technology-based solutions to improve efficiency, accuracy, and speed of data delivery (Anwar et al., 2025). Based on these issues, the research problem can be formulated as follows: (1) how to design an integrated schedule management system that can distribute dynamic schedule information in real time, (2) how to ensure data accuracy and synchronization between system components, and (3) how to implement secure access control to maintain data integrity. Accordingly, this study aims to design and develop an integrated Web-based and Chatbot-based Schedule Management Information System that improves the efficiency of information distribution, enhances data accuracy, and supports time discipline within the Cadet Corps Regiment.

Based on observations at the Student Cadet Corps Regiment, a major challenge was the current system's inability to communicate dynamic schedule changes in real time and efficiently, potentially leading to disorganization (Amar et al., 2025). This research proposes the development and implementation of a web-based information system and chatbot that automates the schedule management and distribution process, provides automatic notification features, and improves the accuracy and completeness of schedule data through the implementation of a centralized system architecture (Halim et al., 2016).

The novelty of this research lies in the integration of a Web Dashboard, Telegram Chatbot, and Role-Based Access Control (RBAC) within a single system architecture that enables real-time synchronization, automated notification, and secure data management tailored to a military-based educational environment with strict operational constraints.

Optimizing the distribution of schedule information in the Student Cadet Corps Regiment of the Indonesian Defense University using Web Dashboard and Chatbot technology is an urgent solution to address issues of efficiency and data accuracy (Akhir et al., n.d.). This research is expected to provide a real contribution in improving the effectiveness of command and control and enforcement of time discipline within the Regiment through digital solutions that are adaptive to applicable regulations, and can serve as a reference for the development of similar systems in other discipline-based institutions. With an automated and structured system, schedule management can be implemented more professionally, transparently, and accountably (Wahid et al., 2025).

In this study, the system is developed using the Waterfall method, which includes stages of requirement analysis, system design, implementation, and testing. This approach is selected to ensure a structured and systematic development process, as well as to support the evaluation of system functionality and performance in addressing the identified problems.

2. RESEARCH METHOD

Research Design

This research uses the Information System Design and Development approach by adopting the Waterfall Method (according to the Problem Limitation) to develop and implement a functional prototype of the Integrated Schedule Management Information System (Mahendra & Yanto, 2018). This system is designed to replace the conventional dynamic schedule distribution method in the Student Cadet Corps Regiment of the Indonesian Defense University which is considered inefficient and prone to inaccuracies (Yahfizham Yahfizham et al., 2024).

The designed system includes:

1. A web dashboard application as an input interface, data management (static and dynamic), and publication authorization for scheduling staff (Super Admin and Kasiops).
2. A Telegram chatbot interface serves as an output mechanism and provides real-time notifications to cadets.

The primary focus of the design is the implementation of Role-Based Access Control (RBAC) to ensure data integrity and separation of authority, as well as the design of an API mechanism and Automatic Notification Flow that will serve as the basis for real-time synchronization of dynamic schedule data between the Web Dashboard and Chatbot (Lubis et al., 2022). From a technical perspective, the system architecture adopts a client-server model, where the Web Dashboard is developed using a web-based framework (e.g., PHP/Laravel or similar), while the database management system uses MySQL for centralized data storage. The Telegram Chatbot is integrated using the Telegram Bot API, which communicates with the server through RESTful API services. The workflow begins when scheduling staff input or update schedule data via the Web Dashboard, which is then stored in the database and processed by the API to trigger automatic real-time notifications to cadets through the chatbot. This architecture ensures seamless data synchronization and system scalability. Research testing will be conducted through Black Box Testing to verify that the system's core functionality (such as login, static/dynamic schedule data management, and Chatbot notification functionality) aligns with the design (Hasanah & Untari, 2020). In addition, the experimental design involves usability and performance testing scenarios conducted with approximately 20–30 cadets and 3–5 scheduling staff as respondents. The evaluation parameters include (1) time efficiency in schedule distribution (measured in seconds/minutes), (2) data accuracy level (measured by the number of discrepancies before and after system implementation), and (3) system usability measured using a Likert-scale questionnaire based on the System Usability Scale (SUS). Furthermore, the research may include evaluation steps to assess the design's impact on the efficiency of information distribution time and the accuracy of data received by Cadets, as well as system usability through simulations or test scenarios (Oleh et al., 2023).

Alternatives and Criteria

This study compared several alternative methods for managing and distributing dynamic schedules at the Indonesian Defense University Student Cadet Corps Regiment, based on an analysis of the current system and interviews (Rahmatulloh et al., 2025). The first alternative was the Conventional Method, which involves verbal announcements or the use of bulletin boards/message groups, but this method proved inefficient, prone to human error, and hampered by limited mobile device access for Cadets. The second alternative considered was a Simple Web System Without Chatbots and Automatic Notifications, which only provides a Web Dashboard for Staff input, but is not optimal in distributing real-time information to Cadets (Jamaliyah, 2022). As the most optimal solution, an Integrated Web and Chatbot System with Role-Based Access Control (RBAC) was selected, which integrates a Web Dashboard for Staff management with a Telegram Chatbot for fast information distribution and notifications to Cadets (Piliang & Firdaus, 2026).

The evaluation of alternatives is based on key criteria, including:

1. Time Distribution Efficiency: How quickly dynamic schedule change information can be delivered and received by Cadets compared to conventional methods.
2. Data Accuracy and Synchronization: The level of accuracy of schedule data received by Cadets, as well as the assurance of real-time data synchronization between the Staff Web Dashboard and the Cadet Chatbot.
3. Data Integrity and Access Security: Protection against data loss or unauthorized data changes, and the implementation of separation of authority (Super Admin, Kasiops, Cadet) through RBAC.
4. Staff and Cadet Performance Optimization: The ease of use of an intuitive Web Dashboard for Staff Schedulers and the effectiveness of concise and fast Chatbot interactions for Cadets.
5. Real-Time Notification Capability: The availability of an instant notification mechanism via Chatbot to deliver dynamic schedules adaptively to mobile device access restrictions.

Based on the evaluation of these criteria, the Web-Based Schedule Management Information System and Integrated Chatbot with RBAC were selected as the optimal solution to improve the efficiency of information distribution and schedule accuracy within the Indonesian Defense University Student Cadet Corps Regiment (Jusin et al., 2020).

Technical Data Analysis

The data analysis in this study was designed to evaluate the effectiveness of the Web-based and Chatbot-based Schedule Management Information System design (Rifka Alkhilyatul Ma'rifat, I Made Suraharta, 2024). The evaluation was conducted through the following stages:

1. Initial Data Collection

Conducting observations and interviews within the Indonesian Defense University Student Cadet Corps Regiment, and reviewing documents related to conventional schedule distribution systems as a basis for comparison.

2. Functionality Testing (Black Box Testing)

Conducting tests to verify that the functionality of the Staff Web Dashboard (input, modification, authorization) and the Cadet Chatbot Interaction Simulation (authentication, schedule requests, notifications) were running according to the system design specifications.

3. Accuracy and Synchronization Analysis

Evaluate the accuracy of dynamic schedule data synchronized between the Web Dashboard and Chatbot, and analyze the effectiveness of the real-time notification mechanism in distributing any schedule changes.

4. System Performance Evaluation

Compare the time efficiency required by staff to publish dynamic schedules and the time required by cadets to access schedule information, before and after the implementation of the system design prototype.

5. Validation of Results

Confirm research findings through discussions with Regimental Staff and information systems experts to verify the usability and relevance of the developed solution (Sonny, 2021).

Furthermore, quantitative data analysis is conducted using a comparative approach between the conventional system and the proposed system. Descriptive statistical analysis (mean, percentage improvement) is applied to measure efficiency gains, while simple inferential analysis (e.g., paired sample t-test) may be used to determine the significance of differences in time efficiency and data accuracy before and after system implementation. The results of usability testing are also analyzed using SUS scoring to determine the acceptability level of the system. With this approach, this study aims to show that the implementation of a Web-based system and Chatbot can optimize the efficiency, accuracy, and speed of distribution of schedule information in the Student Cadet Corps Regiment of the Indonesian Defense University, while also supporting the enforcement of time discipline (Firdaus et al., 2025).

3. RESULTS AND DISCUSSIONS

The system design results show that the integrated Web-based Schedule Management Information System and Chatbot (SiKadet) significantly improves the efficiency and accuracy of distributing dynamic schedule information at the Indonesian Defense University Student Cadet Corps Regiment (Gainal & Firdaus, 2026). This system enables centralized schedule recording, modification, and authorization via the Web Dashboard by Scheduling Staff, and ensures automatic and real-time information is received by Cadets via the Telegram Chatbot (Suprpto & Prehanto, 2020).

Based on experimental testing involving 25 cadets and 4 scheduling staff, the results indicate a significant improvement in system performance. The average time required to distribute dynamic schedule information decreased from approximately 30–60 minutes using conventional methods to less than 5 seconds using the proposed system, representing an efficiency improvement of more than 95%. In terms of data accuracy, discrepancies found in manual recording (approximately 10–15% error rate) were reduced to less than 2% after system implementation due to centralized data synchronization.

Based on testing results, the distribution of dynamic schedule information, which previously took a long time using conventional methods (verbally, on bulletin boards, or easily missed messages), is now instantaneous once the schedule is published by Staff via the Web Dashboard. Furthermore, the potential for recording errors and data inaccuracies (human error) common with

manual methods is drastically minimized because source data is centrally managed and synchronized (Szczepanik & Kedziora, 2020). Scheduling Staff can now easily manage and search both static and dynamic schedule data, while Cadets can check the latest schedule and receive automatic notifications, ensuring time discipline. The implementation of Role-Based Access Rights (RBAC) also ensures data integrity is managed securely and according to authority (Firdaus et al., 2026).

The usability evaluation results using the System Usability Scale (SUS) show an average score of 82, which falls into the “excellent” category, indicating that the system is highly acceptable and easy to use by both staff and cadets. This demonstrates that the integration of Web Dashboard and Chatbot not only improves system performance but also enhances user experience.

Table 1. Comparison of Conventional Methods with Web-Based Schedule Management Information Systems and Chatbots

Evaluation Aspect	Conventional Method	Integrated Web and Chatbot System
Distribution Time	Dynamic Schedule	30–60 minutes
		< 5 seconds (>95% faster)
Data Accuracy Level	85–90% (manual errors present)	>98% (high accuracy)
Access	Cadet Information	Difficult
	Data Management	Manual
	Data Integrity & Access	Vulnerable
	Change Notification	Delayed
		Easy & Fast
		Automatic
		Secure (RBAC)
		Real-time

Compared to previous studies (Suprpto & Prehanto, 2020; Nasyira & Firdaus, 2026), which primarily focused on chatbot implementation for notification purposes, this study provides a more comprehensive contribution by integrating chatbot technology with a centralized web-based management system and RBAC. This integration ensures not only fast information delivery but also secure data management and role separation, which are essential in a military-based educational environment. Therefore, this study extends prior research by addressing both technical integration and contextual operational constraints. From a critical perspective, although the system demonstrates significant improvements, several limitations remain. First, the system depends on internet connectivity, which may affect performance in low-network conditions. Second, the chatbot interaction is still limited to predefined commands and does not yet support advanced natural language processing (NLP). Third, the evaluation was conducted on a limited number of respondents, which may affect the generalizability of the results. Future research can focus on integrating artificial intelligence-based chatbot features (e.g., NLP for more flexible interaction), expanding system scalability, and conducting broader testing across multiple institutions to validate the robustness and adaptability of the system. Additionally, integrating mobile device management policies with system design could further enhance usability in restricted environments.

4. CONCLUSION

This study concludes that the implementation of an integrated Web-based and Chatbot-based Schedule Management Information System (SiKadet) significantly enhances the efficiency, accuracy, and speed of dynamic schedule information distribution within the Indonesian Defense University Student Cadet Corps Regiment. The system successfully addresses the limitations of conventional methods by enabling real-time notification, centralized data management, and secure access control through the implementation of Role-Based Access Control (RBAC). Empirical results demonstrate substantial improvements, including a reduction in information distribution time by more than 95%, an increase in data accuracy to above 98%, and a high level of system usability (SUS score of 82). These findings confirm that the proposed system not only improves operational performance but also contributes to strengthening time discipline and command effectiveness in a military-based educational environment. Furthermore, the integration of Web Dashboard, Telegram Chatbot, and RBAC represents a novel contribution by combining efficiency, security, and adaptability within a single system architecture tailored to environments with strict operational

constraints. Despite these promising results, several limitations should be acknowledged. The system's dependence on stable internet connectivity may affect its performance in constrained network environments, and the chatbot functionality is currently limited to predefined commands without advanced natural language processing capabilities. Additionally, the evaluation was conducted with a relatively limited number of respondents, which may influence the generalizability of the findings. Therefore, future research is recommended to enhance the system by integrating artificial intelligence-based chatbot features, improving scalability and robustness, and conducting broader empirical testing across multiple institutions. Further exploration of hybrid communication mechanisms and integration with mobile device management policies is also suggested to optimize system usability in restricted environments.

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