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WhatsApp-Based Automatic Notification System Development on SLiMS Library Application of UNWAHA

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ABSTRACT
Modern libraries are required to provide more responsive and efficient services to users, especially regarding notifications related to book return deadlines. However, the notification system in most libraries is still limited to email or manual announcements, which are less effective and often ignored by users. This research aims to develop an automatic WhatsApp-based notification system on Senayan Library Management System, which is one of the most widely used open source library management systems in Indonesia. The main focus of this research is to automatically notify students who are approaching the book loan due date. The method used includes integrating the WhatsApp Aplication Programming Interface through a third-party WhatsApp Gateway service (Wablas) with the system, and adjusting the notification module so that it can run automatically based on due date data using a cron job mechanism. This system was tested using the Black Box Testing method with 5 test subjects. The results showed that the system successfully sent automatic notifications to all tested WhatsApp numbers without functional errors. With this system, library users will receive real-time notifications through WhatsApp, which is faster, more familiar, and easier to access. These results are expected to improve student compliance in returning books on time, strengthen communication between the library and users, and improve overall library service efficiency.

***Keywords**: Senayan Library Management System; WhatsApp Gateway; Automatic Notification; Library; Information System*

INTRODUCTION
The library is one of the important facilities in supporting academic activities in higher education (Hermawan, 2021). As information technology develops, many libraries have begun to utilize digital-based management systems to improve service quality. One of the most popular library management systems used in Indonesia is Senayan Library Management System (SLiMS), an open-source application used by various types of libraries due to ease of installation, completeness of features, and active community support (Manu & Fallo, 2022).

SLiMS has provided various important features in library management, such as collection management, membership, borrowing, and book returns. However, in practice, there are still obstacles in the process of delivering notifications to library users. One problem that frequently occurs is the late return of books by students due to forgetting the return schedule. Currently, late notifications in SLiMS are generally delivered via email, while most students rarely open their email routinely. In contrast, students tend to be more active in using instant messaging applications such as WhatsApp in their daily communication (Alaboud, 2021).

Research conducted by (Khoeriyah et al., 2021) shows that the use of WhatsApp Gateway as a book loan notification medium at the Pekalongan City Library Service was able to significantly reduce the rate of late returns. Similar findings were also conveyed by (Subekti & Pratama, 2024), who noted that nearly 90% of information services at the Puspiptek Serpong Library in 2018 were considered more effective when delivered through WhatsApp compared to email.

WhatsApp is a very popular instant messaging application and is widely used by the public, including students (Hatta & Zia Ulhaq, 2022). Based on interviews with librarians at the University Library of KH Abdul Wahab Hasbullah, the automatic WhatsApp reminder feature integrated with SLiMS is greatly needed in book loan management. Currently, the notification process is still done manually, requiring additional time and effort, and does not guarantee that messages are received on time by borrowers.

Therefore, this research aims to: (1) identify the needs of librarians for an automatic WhatsApp-based notification system on the SLiMS application, (2) produce an automatic WhatsApp-based notification system integrated with the SLiMS application, and (3) test the effectiveness of the automatic WhatsApp-based notification system in improving notification delivery to library users.

METHOD

This research uses the Waterfall development method. This research applies a qualitative descriptive approach focused on system development and functional testing of an automatic notification feature integrated into the SLiMS application. which is a systematic and sequential system development model, starting from needs analysis from requirements analysis to implementation. This model was chosen because its stages are suitable for systems development with requirements clearly defined from the start (Supiyandi et al., 2022). The development was carried out by adding an automatic WhatsApp-based notification feature to the existing SLiMS system without rebuilding SLiMS as a whole.

Research Location and Data Sources

This research was conducted at the Library of Universitas KH. A. Wahab Hasbullah, located at Jalan Garuda No. 9, Tambakberas, Jombang, East Java. Data sources consisted of primary data obtained through semi-structured interviews with librarians and direct observation of the SLiMS system in use, and secondary data from SLiMS documentation, scientific journals, and library policy documents related to loan regulations.

System Design and Implementation

System design was carried out using UML (Unified Modeling Language) modeling covering Use Case Diagrams, Activity Diagrams, Class Diagrams, and System Schema. The notification system was designed to query borrowing data from the SLiMS database, identify users approaching the due date (H-3, H-2, H-1, H+0), and automatically send WhatsApp messages without manual intervention from librarians.

Implementation was carried out by integrating the SLiMS application with the Wablas WhatsApp Gateway API using PHP programming language and HTTP request using cURL. A plugin folder structure was placed in the SLiMS directory containing the main file notif.php for processing loan data and making API calls, and log_api.txt for recording notification delivery activity logs. Message delivery automation was configured using a Cron Job mechanism on the cPanel server, set to run at 07:00 WIB daily.

The tools used in this research include: Visual Studio Code as the development environment, Laragon as the local PHP server, MySQL as the database management system, PHP as the main programming language, Google Chrome browser for interface testing, Wablas WhatsApp Gateway as the message delivery intermediary, Windows Task Scheduler for local scheduling, and cPanel Cron Job for production server scheduling.

Testing Method

System testing was conducted using the Black Box Testing method, which tests system functionality by providing certain inputs and observing the outputs produced without focusing on the internal logic of the program (Mintarsih, 2023). The testing process focused on several core system functions, including due date data retrieval, automatic notification message generation, WhatsApp Gateway integration, automatic scheduling through the cron job mechanism, and error handling during message delivery. Notification testing was carried out using simulated borrowing data representing several loan due date scenarios, including H-3, H-2, H-1, and H+0 conditions. The test results were analyzed descriptively by comparing the expected system behavior with the actual outputs generated during the testing process to determine the effectiveness of the notification delivery functionality.

RESULT AND DISCUSSION

Result

The implementation of the automatic WhatsApp-based notification system on SLiMS was successfully completed using the Waterfall development method. The developed system integrates the SLiMS application with the Wablas WhatsApp Gateway service and a cron job scheduling mechanism to automatically send loan due date reminders to library users. The system was tested to evaluate its functional performance, notification delivery process, and automatic scheduling capability.

Black Box Testing was conducted on five functional aspects of the system. Each test case was evaluated based on the expected output and actual output produced by the system. The complete Black Box Testing results are presented in Table 1.

Table 1. Black Box Testing Results

No	Test Case	Input Condition	Expected Result	Actual Result	Status
1	Due date data retrieval	Borrowing data approaching due date available in database	System retrieves borrower data correctly	Borrower data retrieved successfully	Pass
2	WhatsApp message formatting	Borrower and loan data processed by system	Notification message generated dynamically	Message generated according to database data	Pass
3	WhatsApp Gateway integration	Valid API request sent to Wablas service	Message delivered successfully	API returned successful response	Pass
4	Automatic scheduling execution	Cron Job configured on server	Notification executed automatically based on schedule	Scheduled execution performed successfully	Pass
5	Invalid API Key handling	Invalid API Key used in request	System detects failed request and records error	Error response recorded in system log	Pass

All five test cases produced actual outputs that matched the expected outputs, indicating that the system's core functions work correctly. The system was also able to handle error conditions properly, as demonstrated by test case 5, where an invalid API Key correctly triggered a failure response recorded in the system log.

In addition to functional testing, the system was also tested across four notification scenarios based on the number of days before the loan due date. The results of the notification scenario testing are presented in Table 2.

Table 2. Notification Scenario Testing Results

Scenario	Notification Timing	Notification Type	Delivery Status	System Response
H-3	3 days before due date	Early Reminder	Success	Message delivered automatically
H-2	2 days before due date	Reminder Notification	Success	Message delivered automatically
H-1	1 day before due date	Urgent Reminder	Success	Message delivered automatically
H+0	On the due date	Final Warning Notification	Success	Message delivered

				automatically

Table 2 shows that the notification system successfully handled all reminder scenarios, including H-3, H-2, H-1, and H+0 conditions. Each notification message was delivered automatically according to the configured schedule through the cron job mechanism integrated with the Wablas WhatsApp Gateway service. During testing, all notification scenarios were executed successfully without delivery failures or scheduling errors, indicating that the system functioned properly under the tested conditions.

Discussion

Based on the analysis of the research results, the automatic WhatsApp-based notification system developed successfully addressed the main problem identified during the needs analysis stage. Before the system was developed, the library loan due date reminder process at Universitas KH. Abdul Wahab Hasbullah was still carried out manually by librarians through personal messages or announcements, which was considered less effective and efficient, especially when the number of active borrowers increased.

The successful integration of the Wablas WhatsApp API with SLiMS confirms the findings of previous studies showing the effectiveness of WhatsApp as a notification medium in library information systems. (Khoeriyah et al., 2021) reported that implementing the WhatsApp Gateway notification service (SINOPI) at the Pekalongan City Archives and Library Service was able to reduce late book returns by up to 20 copies per day. This finding is in line with the results of this research, where the automatic notification system successfully sent reminder messages to all library users approaching the loan due date.

The results of this study also complement the research of (Satria, 2023), who developed an academic service notification system based on WhatsApp social media in a university environment. In that study, WhatsApp was chosen as the primary medium because of its high readability rate and ease of access by students. The same approach is applied in this research, by integrating WhatsApp as the primary notification channel in the SLiMS library management system. The choice of WhatsApp as a notification medium is also strengthened by the research of (Teknologi et al., 2024), which states that nearly 90% of information services are considered more effective when delivered through WhatsApp compared to email.

The Waterfall development method used in this research allowed for a structured and systematic development process. Each stage was carried out sequentially: needs analysis through interviews and observations, system design using UML, implementation using PHP and API integration, testing using Black Box Testing, and system deployment at the library. This approach ensured that each stage was completed properly before moving to the next stage, resulting in a stable and functional system. The Black Box Testing results presented in Table 2 indicate that all core system functions operated according to the expected outcomes, including borrower data retrieval, automatic message generation, API integration, scheduling execution, and error handling functionality.

This research also contributes to the development of library information systems by implementing an automated reminder mechanism directly integrated with the SLiMS platform using cron job scheduling and WhatsApp Gateway technology. Unlike previous studies that mainly discussed the effectiveness of WhatsApp communication in general library services, this study focuses on the technical implementation of a real-time automatic notification feature in a university library environment. This implementation demonstrates that SLiMS can be extended with additional automation features to improve service responsiveness and operational efficiency.

The cron job mechanism as an automatic scheduling tool proved effective in running the notification process regularly without requiring manual intervention from librarians. As shown in Table 3, the system successfully executed all notification scenarios, including H-3, H-2, H-1, and H+0 reminders. Each notification was delivered automatically according to the configured schedule, indicating that the system can consistently support loan reminder activities in the library environment.

Despite the successful development and testing, this system still has some limitations. The system is still dependent on a third-party internet connection and WhatsApp Gateway service. If the Wablas service has an expired subscription, messages will not be sent and the system will only receive a failed status. Additionally, the current system only supports one-way notifications and does not yet support two-way communication between the system and library users. Nevertheless, these limitations can serve as a direction for improvement in future research.

CONCLUSIONS

This research has successfully developed an automatic WhatsApp-based notification system integrated with the SLiMS library application at Universitas KH. A. Wahab Hasbullah. The system was developed using the Waterfall method, integrating the Wablas WhatsApp Gateway API with the SLiMS system through a PHP plugin and automatic scheduling mechanism using a cron job. The implementation of the automated notification mechanism demonstrates that the SLiMS platform can be extended with real-time communication features to support more responsive and efficient library services in higher education environments. Testing using the Black Box Testing method showed that the system was able to detect loan data meeting notification criteria, generate dynamic notification messages according to configured templates, and deliver notifications automatically without functional errors. The system successfully sent notifications in various scenarios: H-3, H-2, H-1 and H+0 before the book return due date.

From this research, it can be concluded that the automatic WhatsApp-based notification system has met the functional requirements established in the research, has been successfully implemented according to the formulated objectives, and has the potential to improve librarian work efficiency and has the potential to support librarians in improving service efficiency and encouraging users to return books on time. For future research, it is recommended to develop two-way communication features via WhatsApp, add automatic fine calculation and notification features, and consider using the official WhatsApp Cloud API to reduce dependence on third-party services.

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