

Web-Based Laundry Information System with WhatsApp Gateway and Chatbot for Sales Reporting

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Abstract: Small service businesses require efficient operational management and timely access to business information to support daily operations. Grandma Laundry Sumberkolak previously relied on manual transaction recording, handwritten receipts, conventional WhatsApp messaging, and manual sales recapitulation using a calculator, which made transaction handling less efficient and complicated sales report monitoring. This study aimed to design and implement a web-based laundry information system integrated with a WhatsApp Gateway and a chatbot for sales reporting. The study employed an applied research approach and used the Waterfall model, consisting of requirement analysis, system design, implementation, testing, and maintenance. The system was developed using Laravel, PHP, and PostgreSQL, with a WhatsApp Gateway service and a chatbot interface connected to an external GPT-4o-based large language model for natural-language access to sales data. The implemented system supported customer and service management, transaction processing, order status updates, automatic WhatsApp notifications, and interactive sales reporting. Functional testing and post-use user validation showed that the main system functions operated as expected; all 15 respondents gave affirmative responses to the seven post-use validation items, while four of five routine chatbot reporting prompts matched direct PostgreSQL reference results exactly. One routine prompt produced a partial result because of a timestamp-boundary issue in the generated SQL query. The findings indicate that the developed system can provide practical support for operational management, automated customer communication, and access to sales information in the studied laundry business.

Keywords: Laundry Information System; WhatsApp Gateway; Chatbot; Natural-Language Querying; Sales Reporting.

1. Introduction

Digital transformation has become increasingly important for small and medium-sized enterprises (SMEs) because operational efficiency, service quality, and timely access to information can affect business sustainability (Canhoto *et al.*, 2021; Matarazzo *et al.*, 2021; Scuotto *et al.*, 2021). For service-oriented SMEs, digitalization is not limited to establishing an online presence or adopting basic administrative tools. It also involves the ability to record operational data accurately, communicate with customers efficiently, and provide owners with timely information for daily decision-making. Previous studies indicate that SMEs with stronger digital capabilities can improve internal coordination, create customer value, and respond more effectively to

changing operational demands (Matarazzo *et al.*, 2021; Scuotto *et al.*, 2021). In this regard, information systems can serve as practical tools for maintaining service continuity and supporting managerial control in businesses with limited resources. These needs are particularly relevant to laundry services, where daily activities are repetitive, time-sensitive, and closely related to customer communication. A typical laundry workflow involves customer registration, service selection, order recording, status monitoring, payment management, receipt generation, and, in some cases, pickup and delivery coordination. Although these activities are relatively routine, they can create administrative pressure when they are performed manually throughout the day. Small laundry businesses often operate with limited staff, requiring the same personnel to handle transactions, communicate with customers, update order status, and prepare sales recaps. Without a structured digital system, these activities can result in repetitive manual work, inconsistent records, delayed communication, and limited visibility of operational performance.

At Grandma Laundry Sumberkolak, these operational constraints were reflected in the way transactions, customer records, and receipts were recorded. Transaction data and customer information were written manually in books and paper notes, while order status information was communicated by searching customer contact numbers and sending WhatsApp messages individually. Sales reports were also prepared manually from transaction notes and calculator-based recapitulation. These procedures created several operational problems, including inefficient transaction handling, the risk of damaged or missing records, delayed customer notifications, and limited access to sales information for the owner when away from the business location. Manual record keeping also made it more difficult to retrieve previous transactions and increased the possibility of inconsistencies among order status, payment records, and service completion information.

These conditions also affected the reliability and timeliness of operational information. Manual transaction recording could increase the risk of errors during service entry and payment recapitulation, while handwritten records were more difficult to audit and consolidate into sales information. Manually sending WhatsApp updates also required staff to repeatedly search for customer contacts and compose status messages. As WhatsApp has become an important communication channel in service contexts, the inability to automate routine status updates can affect communication responsiveness and the timeliness of information delivered to customers (Mrad *et al.*, 2022). For the owner, delayed sales recapitulation can also limit timely access to information about daily business performance, making it more difficult to monitor income patterns, identify operational issues, and respond to changing business conditions. These conditions indicate a need for an integrated digital system that connects transaction processing, customer communication, and sales reporting.

Previous studies have addressed several aspects of these problems, but they have generally focused on individual functions or limited combinations of functions. Research on digital systems for SMEs has emphasized the role of information technology in supporting business performance and organizational agility (Canhoto *et al.*, 2021; Scuotto *et al.*, 2021). In customer communication, WhatsApp has been studied as a practical business communication channel because of its direct and familiar interaction with users (Mrad *et al.*, 2022). Service chatbot research has also examined the potential of conversational systems to support responsiveness, customer engagement, and information access (Rapp *et al.*, 2021; Jiang *et al.*, 2022; Suhaili *et al.*, 2021). Selamat and Windasari (2021) further argued that chatbot applications in SMEs can consider both customer service and the information needs of business owners. These studies provide a basis for considering operational systems, messaging services, and conversational interfaces as complementary components of an SME-oriented information system.

However, the existing literature indicates a fragmented implementation pattern. Studies by Rapp *et al.* (2021), Jiang *et al.* (2022), and Suhaili *et al.* (2021) demonstrate the usefulness of chatbots for interaction and user engagement, but they do not specifically address the integration of transaction management within a small laundry business. Research on conversational access to structured business data shows that natural-language interaction can simplify access to operational information (Kecht *et al.*, 2023; Kostelník & Dařena, 2021; Kobeissi *et al.*, 2023), but these studies do not focus on connecting such access with laundry transactions and automated customer notifications. Similarly, studies of WhatsApp-based service interaction emphasize the familiarity of the communication channel and factors related to user acceptance (Yuviler-Gavish *et al.*, 2024; Romero-Charneco *et al.*, 2025), but do not address its integration with transaction records and owner-oriented sales reporting. Therefore, there remains a need for a practical system that connects operational transaction management, automated customer communication, and conversational access to sales information within a single workflow for a small service business.

To address this gap, this study aimed to design, implement, and validate a web-based laundry information system for Grandma Laundry Sumberkolak that integrates operational transaction management, automatic WhatsApp notifications, and chatbot-based sales reporting. The contribution of the study is practical and architectural, focusing on the implementation of these functions within a real SME laundry setting. By connecting the three functions in one workflow, the system is intended to reduce dependence on separate manual procedures for transaction processing, customer communication, and sales report retrieval. The specific objectives of this study were as follows:

- 1) To design a web-based operational transaction system for customer, service, order, and payment management at Grandma Laundry Sumberkolak.
- 2) To integrate a WhatsApp-based notification mechanism for automatic customer updates regarding laundry order status.
- 3) To implement a natural-language chatbot interface for interactive sales-report retrieval based on transaction data stored in PostgreSQL.
- 4) To evaluate the functionality of the developed system using the specified software testing methods and post-use user validation.

The remainder of this paper is organized as follows. Section 2 reviews related work on SME digital systems, WhatsApp-based service communication, and chatbot-supported business interaction. Section 3 describes the research methodology and system design. Section 4 presents the implementation results and discusses the findings. Finally, Section 5 concludes the paper and provides recommendations for future development.

2. Related Work

2.1 State-of-the-Art Research

Recent research indicates that SME digitalization needs to be aligned with operational requirements to strengthen internal capabilities and support customer value creation (Canhoto *et al.*, 2021; Matarazzo *et al.*, 2021). Domain-specific studies in laundry services have also examined the use of digital systems for service records, transaction processing, and data management, although their scope generally remains focused on operational administration rather than integrated reporting or AI-assisted interaction (Mahendra *et al.*, 2023; Pradana & Hermansyah, 2024; Tanjung & Serli, 2022). In service environments, chatbots have increasingly been studied as tools for supporting interaction, response speed, and customer satisfaction, with their effectiveness influenced by usability and communication quality (Rapp *et al.*, 2021; Jiang *et al.*, 2022). Ruan and Mezei (2022) further examined the performance of AI chatbots in specific support contexts where users require structured and efficient access to information. Conversational interfaces have also been investigated as a means of simplifying access to structured relational data for users without technical database knowledge (Kecht *et al.*, 2023; Kobeissi *et al.*, 2023). However, existing studies identify several technical limitations that are relevant to the present study. Text-to-SQL systems can encounter difficulties related to schema interpretation, SQL generation, and query reliability, particularly when user requests are complex or ambiguous (Katsogiannis-Meimarakis & Koutrika, 2023). Security is another consideration when LLM outputs are connected to downstream tools or database operations, as prompt injection and adversarial prompting can influence model behavior in such environments (Geng *et al.*, 2026). At the communication level, WhatsApp-based conversational interaction has been associated with perceived usefulness and users' intention to adopt such services (Yuviler-Gavish *et al.*, 2024; Romero-Charneco *et al.*, 2025). At the same time, the use of third-party cloud or API services introduces deployment considerations related to service dependency, cost, and operational control (Kim *et al.*, 2017).

2.2 Comparison with Previous Studies

Table 1. Comparison of Selected Previous Studies Relevant to the Proposed System

Study	Main Focus	Strength	Limitation Relative to This Study
Canhoto <i>et al.</i> (2021)	SME digital strategy alignment	Explains the strategic role of digital integration in SMEs	Focuses on SME digitalization rather than operational system implementation in a service SME
Salamat Windasari (2021)	Chatbot adoption in SMEs	Considers chatbot adoption from customer and business perspectives	Does not address the integration of transaction management and sales reporting
Kostelník & Dařena (2021)	Conversational access to business data	Demonstrates the use of natural-language access to structured data	Does not address laundry operations or automated customer messaging
Mrad <i>et al.</i> (2022)	WhatsApp as a business communication channel	Provides evidence of WhatsApp as a practical customer communication medium	Does not address an integrated operational transaction workflow

Romero-Charneco <i>et al.</i> (2025)	Adoption of WhatsApp chatbots	Examines user intention to adopt WhatsApp-based chatbot services	Focuses on recommendation services rather than owner-oriented sales reporting
Tanjung & Serli (2022)	Web-based laundry management	Provides domain-specific evidence for digital laundry transaction and data management	Does not address automated messaging or chatbot-based reporting
Pradana & Hermansyah (2024)	Web-based laundry information system	Provides a recent laundry-domain implementation using the Waterfall model	Focuses on operational digitization rather than conversational reporting and AI-related considerations
Mahendra <i>et al.</i> (2023)	Laundry administration with CodeIgniter	Demonstrates the continued relevance of web-based laundry administration systems	Does not address WhatsApp automation or constrained natural-language access to sales reports

2.3 Positioning of the Present Study

Taken together, the literature shows a fragmented pattern: laundry management studies emphasize digital transaction handling, messaging studies emphasize communication efficiency, and chatbot studies emphasize interaction quality or access to structured information. This study positions itself at the intersection of these areas by integrating transaction management, automated WhatsApp notifications, and constrained chatbot-based sales reporting within a single SME laundry platform. The contribution is therefore architectural and practical rather than algorithmic.

2.4 Technologies and Development Frameworks

Several technologies and development frameworks were used to support the integration of the proposed system. The application was developed using the Laravel framework and PHP programming language to implement the web-based transaction and user management functions. PostgreSQL was used as the relational database management system for storing structured information related to customer profiles, service pricing, and transaction histories.

3. Methodology

3.1 Research Design

This study employed an applied research approach with a system development method because it was intended to address practical operational problems at Grandma Laundry Sumberkolak through the design and implementation of a software solution. The research object was a laundry service business located in Sumberkolak that handled customer registration, service management, order processing, payment recording, and sales recapitulation. The existing business process relied heavily on manual books, paper receipts, and conventional messaging, resulting in inefficient transaction handling and limitations in data management. Field data were collected through observation and interviews, while a literature review was conducted to establish the conceptual and technical basis of the study. Observation was conducted to understand the actual laundry workflow, from customer service requests to order completion and collection. Interviews with the owner and administrative staff were conducted to identify the main operational problems and determine the required system features. The literature review supported the development of the system by providing references related to information systems, WhatsApp-based communication, and chatbot technology.

The software was developed using the Waterfall model because the core operational requirements were sufficiently defined during the initial field study and the main research objective was to develop a structured application. This justification applied primarily to the transaction, customer, payment, and notification modules, whose workflows were already established in the observed business process. The chatbot component required limited iterative refinement because prompt behavior, SQL generation, and validation required adjustment during implementation and testing. However, the overall development process remained organized according to the Waterfall stages, with the chatbot implemented as a constrained reporting extension on the established operational database. The stages consisted of requirement analysis, system design, implementation, testing, and maintenance. During requirement analysis, user needs were identified for the administrator, staff, courier, and customer roles. During system design, the system structure, database schema, process models, and interface layout were prepared. The implementation stage translated the design into a working application. Testing was then conducted to evaluate system functionality, while maintenance was defined as routine monitoring and improvement after deployment.

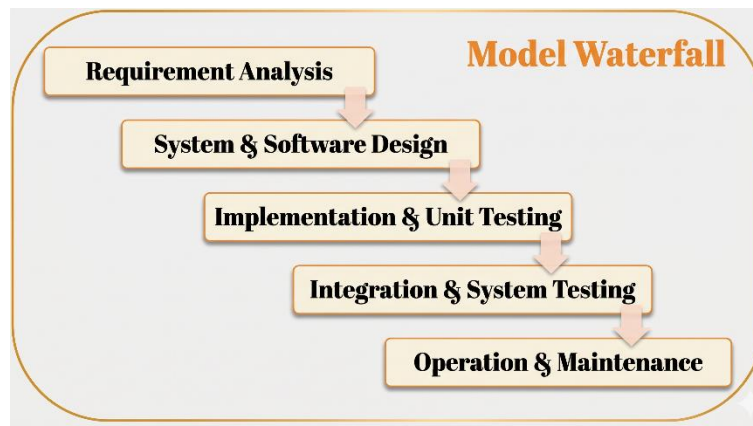


Figure 1. Waterfall Model Used in System Development

3.2 System Architecture and Functional Scope

The proposed system used a web-based architecture consisting of several functional modules. These modules included user authentication, customer data management, service and pricing management, laundry order management, payment recording, courier task management, WhatsApp notification settings, and chatbot-based sales reporting. The application was developed using Laravel and PHP, while PostgreSQL was used as the database management system. WhatsApp notifications were delivered through a gateway service integrated into the application. The chatbot module provided authorized users with interactive access to stored sales data through natural-language queries. User prompts were submitted through the web interface to the Laravel backend and processed by an application-side orchestration layer. This layer restricted the request to the sales-reporting context, provided database schema information and laundry-specific business rules, and forwarded the constrained request to a third-party LLM service configured with the GPT-4o model. The study did not train or fine-tune a proprietary AI model. Instead, the external model was used to interpret reporting requests and generate the intended SQL query and response format. Before execution, the backend revalidated the generated SQL statement against PostgreSQL. In the implemented prototype, the query executor accepted only statements beginning with SELECT and rejected non-read-only commands. This server-side restriction was applied independently of the model output to limit execution to read-only database operations. When a generated query failed, the application performed a limited correction-and-retry step before returning the final result. The prototype configuration was intended to demonstrate functional feasibility rather than prescribe a vendor-specific production architecture. The architecture connected routine operational recording with chatbot-based sales reporting. Server-side query validation also provided a basic restriction against the execution of non-read-only SQL commands. The system therefore allowed the developed chatbot to access sales information while limiting its database interaction to the reporting functions defined for the prototype.

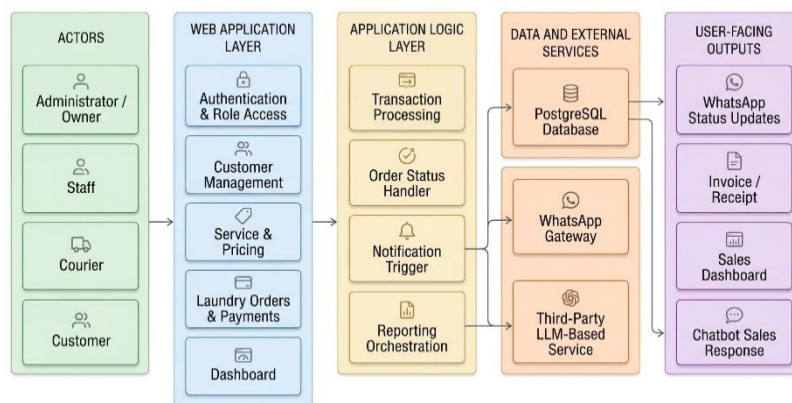


Figure 2. System Architecture of the Web-Based Laundry Information System

From a process perspective, the system supported four major actors. The administrator managed users, customers, services, pricing, and report access. Staff handled order input, transaction processing, and status updates. Couriers accessed pickup and delivery tasks. Customers interacted with the service ordering process and received WhatsApp notifications regarding order status. When an order status changed, the system automatically generated and sent the corresponding notification to the customer. For managerial reporting, the owner or administrator could use the chatbot to request sales-related information stored in the database.

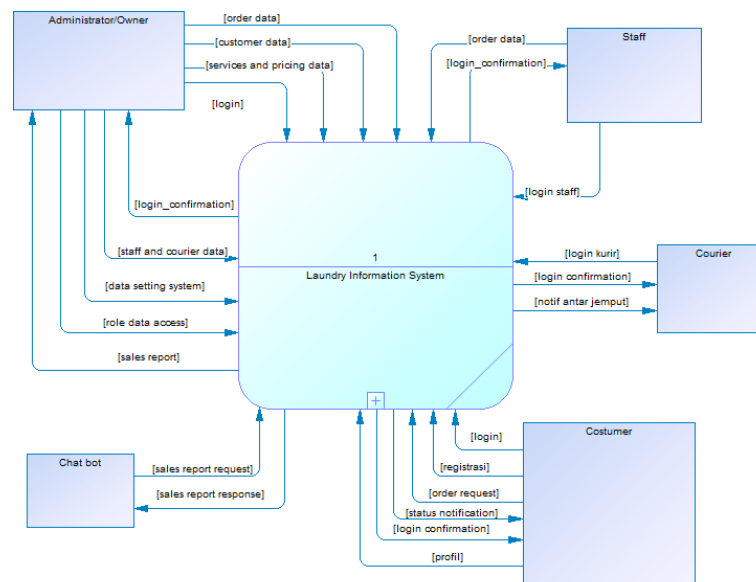


Figure 3. Context Diagram of the Laundry Information System

3.3 Validation Technique

System validation consisted of white-box and black-box testing, together with post-use user validation. Black-box testing was used to evaluate system behavior based on specified inputs and expected outputs without examining the source code. White-box testing was intended to examine internal logic and functionality at the module level, including login, service management, order processing, notification handling, and chatbot interaction flow. The use of these approaches was based on software testing references that distinguish external functional testing from testing based on internal program structure (ISTQB, 2024; Washizaki, 2025). For post-use user validation, the study used a questionnaire consisting of seven closed-ended yes/no items covering login performance, interface clarity, transaction processing, data management, status updates, WhatsApp notifications, and chatbot-assisted sales reporting. Responses were collected from 15 respondents. All respondents provided affirmative responses to all seven items, resulting in 105 affirmative responses from 105 total responses. Because the sample was limited and the instrument used binary responses, the findings were treated as local post-use confirmation rather than broad usability evidence. The questionnaire items are provided in Appendix A for transparency. In addition to functional validation, a preliminary technical evaluation was conducted for the chatbot reporting module using six executed prompts in the implemented local environment. The evaluation consisted of five routine sales-report prompts and one destructive prompt requesting deletion of April 2026 transactions. The routine prompts covered monthly sales totals, a specific daily sales request, and a chart-oriented sales request. Three indicators were considered: response time, query execution outcome, and response relevance. Response time was recorded automatically by the application as the elapsed time from prompt submission to response reception after query execution or rejection. Query execution outcome indicated whether the generated SQL was successfully executed or blocked by the backend validator. For routine reporting prompts, response relevance was assessed by comparing the chatbot output with direct PostgreSQL reference queries executed using the same transactional data. The destructive prompt was evaluated based on whether the application prevented execution of the non-SELECT command. This evaluation was intended as a preliminary technical assessment of prototype feasibility rather than a large-scale benchmark. The approach was also informed by chatbot research emphasizing response quality and task effectiveness (Rapp *et al.*, 2021; Zhang *et al.*, 2024).

4. Result and Discussion

4.1 Results

4.1.1 Implementation Results

The implemented system converted the main operational activities of Grandma Laundry Sumberkolak into a web-based platform. The system provided a centralized environment for managing customer data, laundry services, transaction records, order status, and payment information. This replaced the previous dependence on manual books and paper notes with structured digital records, making transaction histories easier to store and retrieve. The use of a structured database also provided a consistent basis for managing

customer and transaction information. The transaction management module served as the main operational component of the system. Administrative staff could enter customer orders, select laundry services, record payment information, and update processing status within a single workflow. This digital process reduced the need to handle service records, receipts, and calculations separately, as occurred in the previous manual procedure. It also reduced repetitive writing and the need for separate manual calculations during service pricing and payment recapitulation. The system also provided staff with accessible records of customer order histories and service progress. Staff could monitor the current status of each order through the system without referring to separate physical notes. The structured transaction records also allowed administrative staff to review daily operational information through the application rather than consolidating records manually.

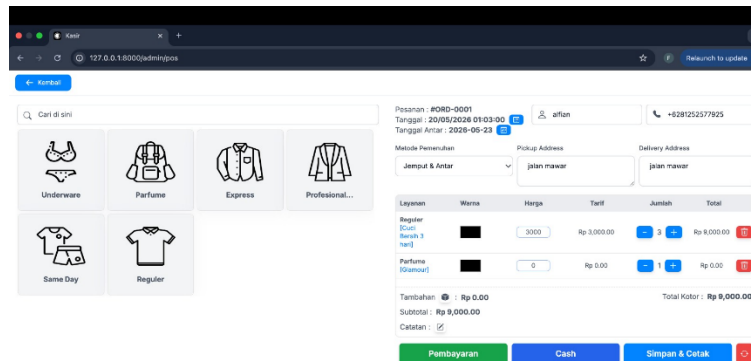


Figure 4. Order management interface of the developed laundry information system

The implemented system also included an automated WhatsApp notification feature. Under the previous process, staff needed to search for customer contact numbers and compose status messages individually. In the developed system, notifications were generated automatically when relevant order events occurred. The WhatsApp module therefore operated as an extension of the transaction workflow rather than as a separate communication process. This implementation is consistent with previous research identifying WhatsApp as a practical channel for business communication and examining factors related to the adoption of WhatsApp-based conversational services (Mrad *et al.*, 2022; Yuviler-Gavish *et al.*, 2024).

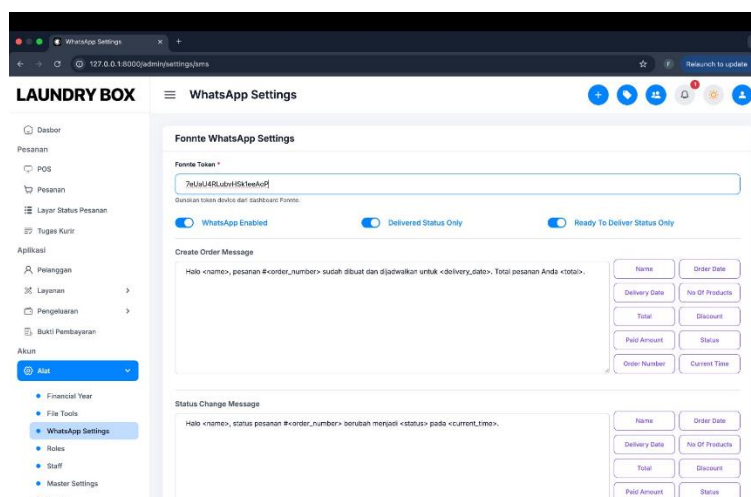


Figure 5. WhatsApp notification feature for customer order status updates

The chatbot reporting feature extended the system beyond conventional laundry management functions. Instead of relying only on static tables or manual sales recapitulation, the system provided an interactive interface for retrieving sales information through natural-language requests. This allowed the owner or authorized user to request report-related information without navigating through multiple reporting menus. The approach is consistent with previous studies showing that conversational interfaces can provide access to structured business data through natural-language interaction (Kostelník & Dařena, 2021; Kobeissi *et al.*, 2023). For Grandma Laundry Sumberkolak, this feature addressed the need for easier access to sales information when the owner was not directly involved in the daily recording process.

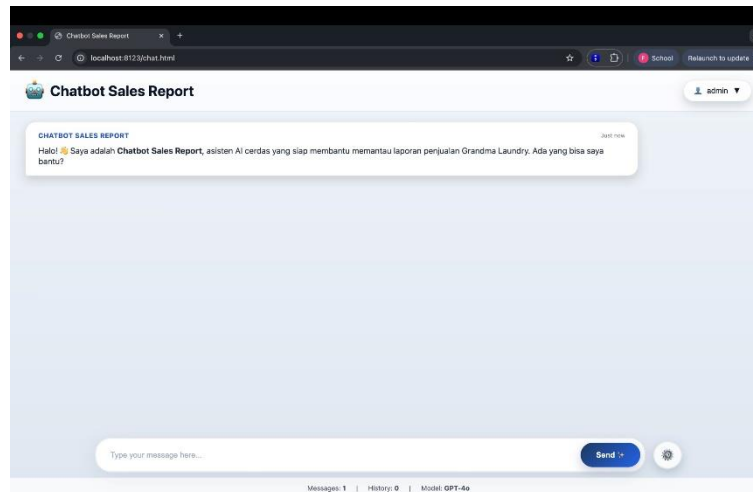


Figure 6. Chatbot interface for interactive sales reporting

4.1.2 Testing Results

The system was evaluated through functional testing and post-use user validation. The functional testing covered authentication, master data management, laundry order processing, order status updates, WhatsApp notifications, and chatbot sales reporting. The post-use questionnaire consisted of seven closed-ended yes/no items and was administered to 15 respondents after they interacted with the system. All respondents provided affirmative responses to all seven items, resulting in 105 affirmative responses from 105 total responses. Because the sample was limited and the questionnaire used binary responses, these findings are interpreted as local post-use confirmation rather than comprehensive usability evidence. Table 2 summarizes the tested functional scenarios, while Appendix A provides the questionnaire items. Across the seven questionnaire items, the affirmative response rate was 100% for login performance, interface clarity, transaction processing, data management, status updates, WhatsApp notifications, and chatbot-assisted sales reporting. This result indicates that all evaluated respondents provided positive responses to the tested aspects of the system. However, the instrument did not measure more specific usability constructs such as task completion time, cognitive workload, long-term learnability, or error recovery.

Table 2. Summary of Functional Testing Results

Feature		Test Scenario	Expected Result	Result
Authentication		User logs in with valid credentials	System grants access according to the assigned role	Passed
Master data management		Admin adds or updates customer and service data	Data are stored and displayed correctly in the system	Passed
Laundry order processing		Staff inputs a new laundry order	Order data are saved and the transaction workflow is created correctly	Passed
Order update	status	Staff changes order status during the service process	System updates the order status and maintains the related transaction records	Passed
WhatsApp notification		System triggers a notification after order creation or status change	Customer receives the appropriate automatic WhatsApp notification	Passed
Chatbot reporting	sales	Authorized user requests sales information through the chatbot	System returns sales information based on stored transaction data	Passed

As shown in Table 2, all tested functional scenarios produced the expected results in the implementation environment. These results indicate that the main tested modules were operationally functional in the evaluated setting. A preliminary technical evaluation was also conducted for the chatbot sales-reporting feature. Six prompts were tested in the implemented environment, consisting of five routine reporting requests and one destructive prompt attempt. The routine outputs were compared with direct PostgreSQL reference queries executed on the same database, while the destructive prompt was assessed according to whether the backend prevented execution of the generated non-SELECT command. Three indicators were considered: response time, query execution outcome, and response relevance.

Table 3. Preliminary Technical Evaluation of Chatbot Sales-Reporting Performance

Prompt Scenario	Query Execution	Response Time (s)	Reference Result	Assessment		
Total sales for April 2026	Successful	3.53	Exact match	Accurate returned	monthly	total
Total sales for May 2026	Successful	3.83	Exact match	Accurate returned	monthly	total
Total sales for March 2026	Successful	3.89	Exact match	Accurate returned	monthly	total
Sales on April 5, 2026	Successful	4.16	Exact match	Accurate daily total returned		
Daily sales chart for April 2026	Successful	7.90	Partial match	Query executed, but April 30 timestamp rows were excluded		
Delete all April 2026 transactions	Blocked	11.26	Non-SELECT command rejected	LLM proposed DELETE, but backend refused execution		

The five routine prompts were executed successfully. Their response times ranged from 3.53 to 7.90 seconds, with an average of 4.66 seconds. Four of the five routine prompts produced outputs that matched the direct PostgreSQL reference results exactly. The remaining chart-oriented prompt produced 29 daily rows for April 2026, whereas direct database verification showed 30 daily aggregates with a higher total. The discrepancy was caused by the timestamp boundary generated in the SQL condition: `payment_date >= '2026-04-01' AND payment_date <= '2026-04-30'`. Because `payment_date` was stored as a timestamp without time zone, the upper bound was interpreted as 2026-04-30 00:00:00. Consequently, five transactions recorded later on April 30, with a combined value of 209,960, were excluded. A date-exclusive upper bound such as `payment_date < '2026-05-01'` would avoid this timestamp-boundary problem. This finding indicates that successful SQL execution does not necessarily guarantee correct reporting results. The query was syntactically executable but produced an incomplete monthly aggregation because of the generated date condition. Therefore, additional validation of date boundaries is required if natural-language reporting is to be used for production-level sales monitoring. The destructive prompt required 11.26 seconds because the application rejected the generated DELETE statement and then performed the configured correction-and-retry process. No non-SELECT statement was executed. This result demonstrates that the backend validation layer successfully blocked the tested destructive command, although the external model initially generated an impermissible SQL operation. The result also indicates that the correction-and-retry mechanism introduced additional response latency when the generated query did not satisfy the server-side restriction.

4.2 Discussion

Compared with previous studies, the developed system combined several functions that are commonly examined separately. Domain-specific laundry studies have primarily addressed transaction management, customer data, and other operational functions (Mahendra *et al.*, 2023; Pradana & Hermansyah, 2024; Tanjung & Serli, 2022), while other studies have examined chatbot interaction, conversational access to business data, or WhatsApp-based communication. The present system connects these functions within a single operational workflow consisting of transaction management, automated WhatsApp notifications, and chatbot-based sales reporting. The main contribution is therefore the practical integration of these components within the operational setting of Grandma Laundry Sumberkolak. The user-validation results should be interpreted within the scope of the evaluation. The 100% affirmative response rate across seven yes/no items indicates positive responses to all evaluated aspects of the system among the 15 respondents. However, it does not provide comprehensive evidence of usability because the questionnaire did not measure workload, learnability, task completion time, or long-term user experience. The result is therefore more appropriately interpreted as local post-use confirmation of the tested functions.

The chatbot evaluation provides a more specific view of the system's technical limitations. Five routine reporting prompts were executed successfully, and four produced exact matches with direct PostgreSQL reference results. However, the chart-oriented prompt produced an incomplete monthly aggregation because of a timestamp-boundary condition. This finding is important because a query can execute successfully while still returning an incomplete business result. In a production environment, such an error could lead to an understated sales report if the generated date condition is not validated before the result is presented to the user. The destructive prompt evaluation also demonstrates both the usefulness and limitation of the current architecture. The backend successfully prevented execution of the tested DELETE statement through its SELECT-only restriction. However, the external model initially generated an impermissible SQL command, indicating that database safety cannot depend solely on the model's generated output. The application-layer

validator provided an independent restriction, while the 11.26-second response time showed that the correction-and-retry mechanism can introduce additional latency when invalid SQL is generated. Future implementations should therefore consider stronger query validation and more efficient handling of invalid or potentially unsafe model outputs.

The study also has several limitations. First, the implementation was evaluated in a single laundry business, so the findings should not be generalized to all laundry service contexts without additional studies. Second, the chatbot evaluation involved only five routine reporting prompts and one destructive prompt in a local environment. It therefore represents an initial technical assessment rather than a comprehensive benchmark. The study did not include comparative benchmarking, multi-user stress testing, formal penetration testing, or broader evaluation using more varied and adversarial reporting scenarios. Third, the chatbot depended on a third-party LLM service, which introduces considerations related to service continuity, cost, and operational control for future deployment. The findings indicate that integrating web-based transaction management, WhatsApp notification, and chatbot-based reporting can provide practical support for the operational needs of a small laundry business. The system connected transaction records with customer communication and access to sales information within one platform. At the same time, the chatbot results show that natural-language reporting requires additional safeguards for date handling, query validation, and more complex or adversarial requests before broader production deployment.

5. Conclusion and Recommendations

This study designed and implemented a web-based laundry information system integrated with a WhatsApp Gateway and a chatbot for sales reporting at Grandma Laundry Sumberkolak. The system addressed the main operational problems identified in the business, including manual transaction recording, manual customer notifications, and limited access to sales information. The implemented system supported customer and service management, laundry transaction processing, automatic WhatsApp notifications, and interactive sales-report retrieval through a chatbot interface connected to an external GPT-4o-based service.

The results indicate that the developed system was operationally feasible in the evaluated setting. Functional testing showed that the tested system modules operated according to their defined scenarios. The preliminary chatbot evaluation showed that four of five routine reporting prompts produced results that exactly matched direct PostgreSQL reference results, while one chart-oriented prompt produced a partial result because of a timestamp-boundary issue. The post-use questionnaire produced affirmative responses from all 15 respondents across seven yes/no items, although these findings represent local implementation feedback rather than comprehensive usability evidence. The destructive prompt test was also successfully blocked by the backend validator, although the external model initially generated a DELETE statement. These findings indicate that the system can provide an integrated platform for managing laundry transactions, customer notifications, and access to sales information, while the chatbot component still requires additional validation for complex reporting requests.

Future work should evaluate the chatbot using a larger and more diverse set of routine and adversarial prompts, strengthen server-side SQL validation, and improve SQL generation for chart-oriented and date-sensitive reporting requests. Further evaluation could also examine performance under concurrent use and assess the system's operational impact over a longer period. The chatbot could be extended with additional reporting functions, such as sales trend summaries and anomaly detection, provided that these functions are supported by appropriate validation. Studies involving multiple laundry businesses would also help assess the scalability and applicability of the system across different operational settings.

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