# Design and Development of a Web-Based Laundry Management System (Case Study of Yamus Laundry)

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Abstract—Yamus Laundry faces significant operational challenges due to its manual process for recording customer, transaction, and inventory data, which is prone to errors, data loss, and service disruptions. The objective of this research is to design and build a web-based laundry management system to serve as a centralized platform to address these problems. The system was developed using the Rational Unified Process (RUP) method with system modeling based on the Unified Modeling Language (UML), and it was implemented using the PHP programming language and the Laravel framework. The resulting system successfully passed 100% of functional test cases using Black Box testing. Unlike previous systems, this application integrates a real-time low-stock notification algorithm to prevent inventory shortages. The system includes key features such as integrated customer data management, transactions with automatic quota deduction, and an inventory module with low-stock notifications. The implementation of this system has been proven to reduce the risk of recording errors, lighten the staff's workload, and improve data accuracy, allowing all operational activities at Yamus Laundry to run in a more organized and efficient manner.

Keywords—Laundry, Rational Unified Process, Management System, Unified Modeling Language, Web

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## I. INTRODUCTION

As people's lifestyles become increasingly busy, the laundry service business continues to grow and has become an essential part of daily services. To operate properly, such businesses require a systematic management system to handle their various operations, from package systems to per-kilogram calculations. However, many laundry businesses, including the case study of this research, Yamus Laundry, still face challenges in their operational processes [1][2][3].

Currently, Yamus Laundry faces significant operational challenges due to fully manual recording processes. This limitation not only leads to high risks of data redundancy and loss but also hinders real-time inventory monitoring[4], often causing service disruptions when raw material stocks are depleted without early warning. While previous studies by [5] and [6] focused heavily on transactional recording, they neglected the critical aspect of raw material inventory control[7]. This research bridges that gap by integrating transaction data directly with stock levels in real-time using RUP methodology to ensure operational stability.

Therefore, the objective of this research is to design and build a web-based laundry management system that can support the operational needs at Yamus Laundry, by applying the Rational Unified Process (RUP) method[8], [9], [10]. This proposed system will not only manage customer and transaction data, but also include features for staff scheduling and inventory management. This system is expected to be a solution that reduces the risk of recording errors and helps laundry operations run in a more organized and manageable manner.

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## II. RESEARCH METHOD

This research utilizes the Rational Unified Process (RUP) methodology, a systematic and structured software engineering framework [11]. To support the design process, this research also employs the Unified Modeling Language (UML) as a standard language for the process of visually modeling[12], [13], [14], designing, and documenting the entire system [15]. RUP itself is a framework designed by combining the best practices from the software development industry. This framework aims to support all stages of the development cycle, starting from requirements identification, system design, and construction to evaluation and system deployment [16]. The main objective of applying RUP is to create high-quality software that meets user needs while also allowing for more measurable and precise time and cost management [17][18]. The flow of research that applies the RUP stages can be described in the framework in Figure 1 below.

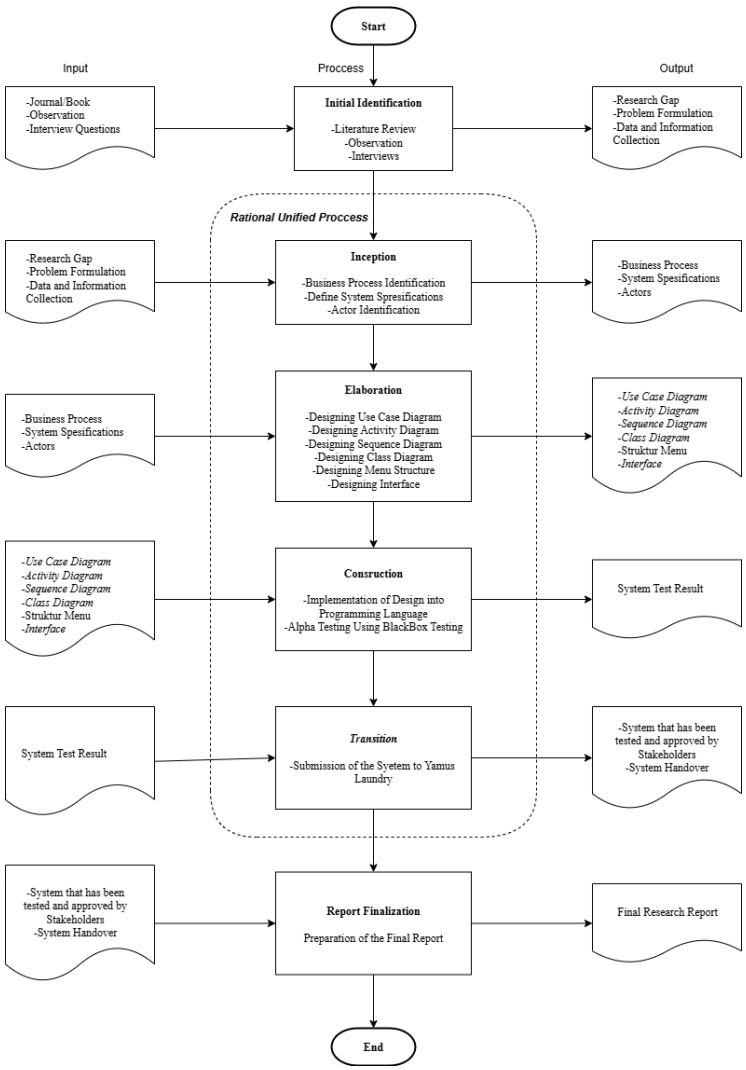


Figure 1 Research Framework

Based on the figure above, the development workflow for this system is comprised of several activity stages, which are organized according to the applied methodology. These include:

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Table 1 RUP Phases and Artifacts Mapping

| Phase | Key Activities | Output |
|---|---|---|
| Inception | Analyzing business processes at Yamus Laundry, defining system scope, and identifying user actors | a. System Requirement Specification (SRS)<br>b. Business Process Flowchart |
| Elaboration | Designing system architecture, database structure, and user interface using UML tools. | a. UML Diagrams (Use Case, Class, Sequence, Activity)<br>b. Database Schema Design<br>c. UI/UX Mockups |
| Construction | Implementing design into code using PHP (Laravel) and conducting initial unit testing | a. Source Code (Laravel Framework)<br>b. Alpha Version Application |
| Transition | Deploying the system to the live environment, user training, and final acceptance testing | a. Final Web Application<br>b. User Manual<br>c. UAT/Black Box Test Report |

Database Design To support the operational needs identified in the Elaboration phase, the database was designed to ensure data integrity and real-time inventory updates. The core database schema consists of five primary tables as presented in Table 2.

Table 2 Database Schema

| Table Name | Primary Key | Description & Function |
|---|---|---|
| users | Id | Stores authentication credentials for Admins and Staff (Officers) |
| pelanggans | Id | Manages customer profiles and laundry service quotas |
| transaksis | Id | Records laundry service activities linked to specific customers and users |
| inventaris | Id | Monitors stock levels, including minimum stock threshold for notifications |
| jadwals | Id | Manages shift schedules for the staff |

Testing Scope The system validation is conducted using Black Box Testing to verify functional requirements without inspecting the internal code structure. The testing scope covers six main scenarios: authentication (login/logout), customer management, transaction processing, inventory updates, schedule management, and notification triggers. The success metric is defined as a 100% pass rate for all test cases.

## III. Result s And Discussion

Based on the research conducted, the system development process began with the Inception phase. In this stage, the main focus was placed on modeling the business process and establishing the project scope based on the initial analysis. This stage included the identification of key business processes to be managed through the system, such as the management of customer data, transactions, staff schedules, and inventory. Based on these processes, functional specifications were formulated and then mapped to two user roles:

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Admin, with full access rights, and Petugas (Staff), with access rights more focused on daily operational activities. The main non-functional specifications were also established, stating that the system would be built as a web-based system utilizing the PHP programming language and the Laravel framework.

Next, in the Elaboration phase, the main focus shifts to the in-depth design of the system architecture. This process is realized through system modeling using the Unified Modeling Language (UML), which includes the design of Use Case, Activity, Sequence, and Class Diagrams. As a standard language, UML is used to visualize, design, and document object-oriented systems. In addition to system modeling, the design of the menu structure and user interface is also performed in this stage to serve as a visual reference for the implementation phase.

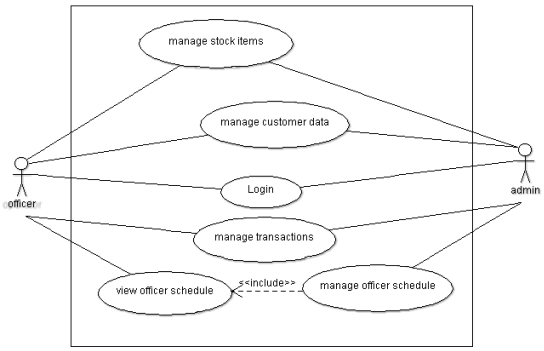


Figure 2 Use Case Diagram

The next stage is Construction, which is the technical implementation phase where the entire design from the previous stage is translated into program code. This system development process is carried out using the PHP programming language and the Laravel framework, while utilizing MySQL as the database, managed through XAMPP.

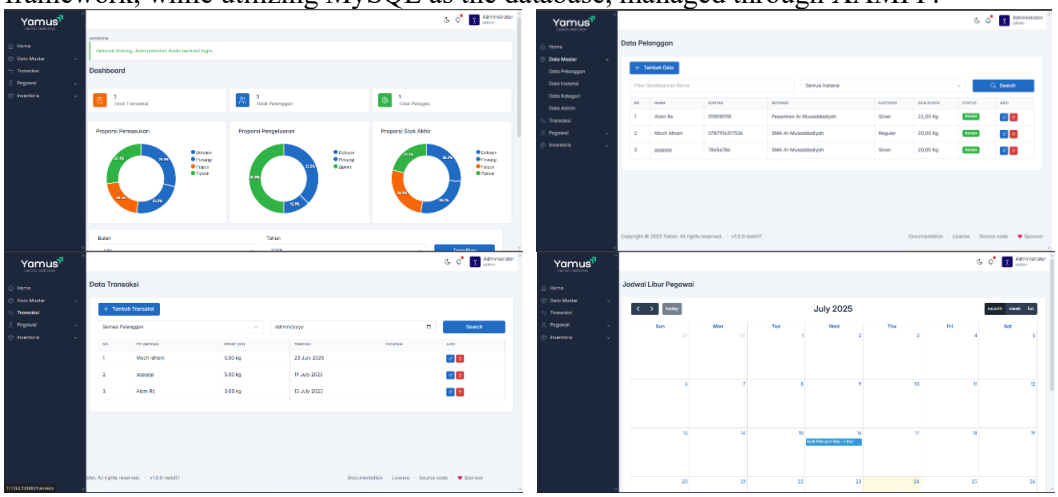


Figure 3 System Page View

System Implementation The resulting system successfully integrates operational modules into a unified web interface. As shown in Figure 3, the Dashboard is designed to provide real-time visibility into business performance, featuring graphical statistics for inventory levels and transaction volume. This design allows the manager to make quick decisions regarding stock replenishment without physically checking the warehouse. Furthermore, the Transaction Interface simplifies the checkout process by automatically calculating costs and deducting quotas from the customer's profile, thereby minimizing human calculation errors.

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After the system design is complete, the next stage is the system testing process utilizing the Black Box Testing method. Black Box Testing is a software testing approach that does not consider the internal structure or source code of the application. This testing focuses on the system's functionality from a user's perspective. Typically, this method is used during the alpha testing phase by the development team before the system is released to end-users. The testing process is usually organized in a tabular format to ensure that every feature functions according to the specified requirements [19][20]. This testing aims to identify any bugs or discrepancies that may exist in the system and to verify that the system operates in line with its expected functions.

Table 3 Black Box Testing

| No | Aktivitas | Test Case | Test Scenario | Expected Result | Result |
|---|---|---|---|---|---|
| 1 | Login | Performing a login | Input email and password | Login is successful and redirects to the dashboard page | Pass |
| 2 | Customer data | Adding customer data | Add a new customer with a quota filled according to their category | Data is saved with the quota automatically filled based on the category | Pass |
| 3 | Transaction | Adding a transaction | Record a transaction according to the customer's quota | The transaction is recorded, and the customer's quota is automatically reduced | Pass |
| 4 | Officer Schedule | Adding an officer schedule | Record an officer's schedule and display itu on the corresponding date on the page | The schedule is recorded and appears on selected date | Pass |
| 5 | Inventory | Item restock notification | Perform stock withdrawals until the minimum stock limit is reached | The system provides a "low stock" notification when accessing the dashboard | Pass |
| 6 | Logout | Performing a logout | Select the logout button in the system | The user is logged out of the account | Pass |

After confirming the system functionality through Black Box testing, the evaluation focused on performance metrics. Meanwhile, beyond functional validity, the system's impact on operational efficiency was evaluated by comparing the time required to process a single transaction manually with that required when using the system. The results of these observations are presented in Table 4.

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Table 4 Operational Efficiency Comparison

| Process Metric | Manual Method | Proposed System | Improvement |
|---|---|---|---|
| Transaction Recording | ±180 seconds/trans | ±20 seconds/trans | 88% faster |
| Data Retrieval (Search) | ±300 seconds | < 5 seconds | 98% faster |
| Stock Update | End of day (Batch) | Real time (Auto) | Instant |

As indicated in Table 4, the proposed system significantly reduces transaction processing time by approximately 88%. This efficiency gain is attributed to the automation of quota calculations and inventory deductions, which were previously performed manually.

The results further validate that the RUP methodology effectively addresses the complexity of integrating inventory management with laundry transactions. This finding significantly contrasts with the study conducted by [21], which focused primarily on customer data management but lacked integrated stock controls. Furthermore, by implementing the 'Low-Stock Notification' feature, this system proactively prevents service disruptions—a critical capability that was not present in the system proposed by [5].

From a methodological perspective, the benefits of the chosen approach are evident. While [6] utilized the Waterfall method for similar laundry systems, the adoption of RUP in this research allowed for iterative refinement of the 'Quota Deduction' logic during the Elaboration phase. Consequently, this approach resulted in a more robust final product compared to the linear development models used in previous studies.

## IV. CONCLUSION

Based on the research results that have been described, it can be concluded that the web-based Laundry management system has been successfully designed and developed for Yamus Laundry using the Rational Unified Process (RUP) method. The system addresses the existing problems by providing a centralized solution to replace the error-prone manual record-keeping process. Through its interconnected main features ranging from customer data and transactions to inventory management, this system can ease the staff's workload. Thus, they can work more accurately, making the entire operational activities at Yamus Laundry run more systematically. Furthermore, the system has undergone a testing phase utilizing the Black Box method to ensure that every functionality operates in accordance with the specifications. The conducted tests indicate that all main features function well and meet user expectations, therefore the system is ready to be used optimally in daily operations.

However, this study has limitations. The system currently lacks a customer-facing mobile interface and relies solely on dashboard alerts without instant messaging integration (e.g., WhatsApp). These features remain as key areas for future development.

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