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Design, Development, and Implementation of a Desktop-Based Laundry Management Application for Optimizing Operational Efficiency

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Abstract−Manual management of laundry operations often faces various challenges, such as recording errors, limited monitoring of employee activities, and lack of transparency in financial reporting. To address these issues, this research aims to design and develop a desktop-based laundry management application that integrates order management, problem reporting, and financial management efficiently. The application is designed for three main user roles: staff, shop heads, and owners. Staff are responsible for inputting customer orders and reporting operational issues, shop heads monitor staff activities and handle problems, while owners can access financial reports and order activity recaps to support strategic decision-making. This research employs the Research and Development (R&D) method with the Waterfall software development model, encompassing requirements analysis, system design, implementation, and testing. Data collection was conducted through literature studies and direct observation of operational processes in multiple laundry businesses. The application was developed using the Java programming language and MySQL database and operates locally without requiring an internet connection. Testing results indicate that the system improves order processing efficiency by reducing recording time by approximately X% compared to manual methods, accelerates financial transaction recording, and enhances transparency in operational reporting. With this system, laundry management is expected to become more effective, accurate, and easily accessible to all users.

Keywords: Laundry Management Application; Desktop-Based System; Operational Management; R&D Method; Operational Efficiency

1. INTRODUCTION

In today's digital era, information technology has brought significant changes to various business sectors, including service industries such as laundry. However, many laundry businesses still rely on manual systems that are prone to errors, such as inaccurate data recording, difficulties in real-time employee monitoring, and a lack of transparency in financial reporting. These challenges lead to operational inefficiencies that can decrease customer satisfaction and reduce business competitiveness. Therefore, a technology-based system is needed to address these issues more effectively and efficiently.

Several previous studies have developed web-based laundry management systems. For example, research by Sugiharto et al. (2023) designed a system using PHP and MySQL for Laundry Dian, featuring customer, order, inventory, and report management. While this system improved operational efficiency, its reliance on an internet connection posed challenges for small businesses with limited IT infrastructure. Similarly, a study by Martono and Shobur (2023) developed a web-based laundry management system for Laundry Mega Express to manage customer data and orders online. Although this system streamlined order management, its dependency on internet access remained a limitation for small businesses with unstable network connections.

Research by Pradana and Hermansyah (2024) also designed a web-based laundry management system using the waterfall method at Permata Laundry, allowing customers to place and track orders online. A similar approach was taken by Manurung and Kurniawan (2022), who developed a web-based laundry service system for IIS Laundry Malang. While these studies highlight the advantages of web-based systems, they also reveal limitations for small businesses operating in areas with poor or unreliable internet access.

From these studies, a research gap exists in the development of a desktop-based laundry management system that operates locally without internet dependency. Desktop-based systems offer several advantages for small and medium-sized enterprises, such as operational independence, since they do not require internet access, better data security as information is stored locally, lower costs by eliminating the need for online server maintenance, and more stable performance compared to web-based systems.

This study aims to design and implement a desktop-based laundry management application to enhance operational efficiency. The application is structured around three main user roles: staff, who are responsible for inputting order data; shop managers, who oversee operations and resolve issues; and owners, who have access to financial reports and operational analysis. This system is expected to improve transparency in business management and optimize workflow efficiency. The urgency of this research lies in the laundry industry's need for a more organized management system that does not rely on internet connectivity, considering that many small to medium-sized laundry businesses still use manual methods for business recording and management. The implementation of a desktop-based application is expected to enhance data accuracy, facilitate operational monitoring, and support strategic decision-making for business owners.

The proposed solution in this study is the development of a desktop-based application that runs locally, utilizing an internal database for data management. The application is designed with an intuitive user interface and features

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including order management, financial transaction recording, and an issue reporting system. Additionally, it supports automated data logging to minimize human errors in daily operations.

The main contribution of this research is the development of a desktop-based laundry management system that operates independently without an internet connection, offering more comprehensive operational management features than previous studies. Furthermore, this research is expected to serve as a reference for software developers aiming to build similar systems in the digital service industry. Thus, this application will not only benefit laundry business owners but can also serve as a model for other service industries seeking technology-based management solutions.

2. RESEARCH METHODOLOGY

2.1 Basic Research Framework

This research is a type of software engineering research that aims to design and develop a desktop-based laundry management application. The case study was conducted at a laundry business in Medan City. This research does not involve respondents because the main focus is the development of technology-based systems. The research variables consist of: (1) Independent variable: Software development method (Waterfall) (Balaji & Murugaiyan, 2021); (2) Dependent variable: Laundry management application performance based on operational efficiency, data recording accuracy, and ease of user access (Bassil, 2022).

The hypothesis of this research is "The use of the Waterfall method in developing desktop-based laundry management applications can improve laundry operational efficiency compared to manual systems" (IEEE, 2023). The methodology follows a structured approach to system development, emphasizing functionality testing (black-box testing) to ensure each feature operates according to specifications and usability evaluation to measure system effectiveness and efficiency based on access speed and ease of use for staff, shop heads, and owners (Nielsen, 2021).

The Waterfall model was chosen over Agile and RAD due to its sequential and structured nature, which ensures that each phase is fully completed before proceeding to the next. This approach is suitable for small to medium-scale businesses like laundry services, where system requirements are relatively stable and do not require frequent changes. Unlike Agile, which demands continuous client involvement, or RAD, which relies on rapid prototyping, the Waterfall model provides clear documentation and well-defined deliverables, making it more effective for a business that prioritizes structured operational workflows and accuracy in financial records (Kuswandi, 2019).

The framework of this research focuses on improving laundry management efficiency through desktop-based technology that integrates order recording, problem reporting, and financial monitoring in a centralized system (Lau & Wang, 2020). Data collection was conducted through literature studies, direct observation of laundry operations, and online references related to laundry management systems.

2.2 Research Stages

The approach used in developing this application is Research and Development (R&D) with the Waterfall development model. The Waterfall model is one of the first software development approaches introduced and is often applied in large projects, especially in the government sector and large companies. This approach strongly emphasizes the importance of complete documentation and is suitable for projects that require strict quality control (Kuswandi, 2019).

The Systems Development Life Cycle (SDLC) in systems and software engineering refers to the set of processes used to design and change systems, encompassing the various models and methods applied in the development of such software (Mulyono, 2021). The following are the steps taken:

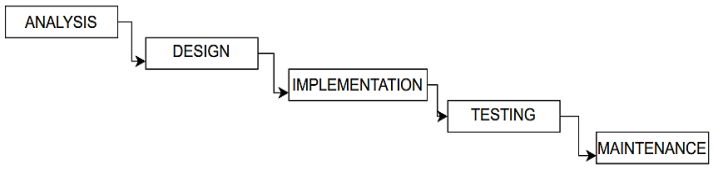

Figure 1. Stages of the Waterfall Method

The Waterfall model describes the software development process with an efficient phased approach, which consists of the following stages:

a. Requirements Analysis is carried out by collecting and identifying the required system requirements. The purpose of the needs analysis is to define in detail what is needed by the user, as well as document the specifications that must be met. The results of this analysis are evaluated by users to ensure that the developed system meets their expectations.
b. System Design refers to translating the results of the requirements analysis into a technical design that is ready for implementation. This design guides the coding of the system and will be documented as part of the software configuration.
c. Implementation includes the design that has been prepared will be translated into program code that can be run using a specific programming language.

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d. System Testing aims to verify that the developed software functions according to predetermined specifications and all its features run properly without interruption. In addition, testing also ensures that the software meets the needs identified at the analysis stage.
e. Maintenance which aims to ensure that the system continues to operate as desired. This maintenance includes fixing problems or bugs that were not detected at the previous stage.

2.3 UML Implementation

The Unified Modeling Language (UML) is an effective visual modeling tool in object-based system development (Rifki et al., 2022.). UML is used to systematically design and document systems, including the design of business processes, data relationships, and application structures. In this research, UML is applied through the creation of:

2.3.1 Use Case Diagram

A use case diagram is a type of representation in UML (Unified Modeling Language) that shows the interaction between the system and actors. This diagram describes how users interact with the system and its functions. A use case diagram is a visual representation of the interaction between a system and its environment, showing how the system is used in a typical interaction between the user and the system itself (Julianti et al., 2023).

This diagram is used to identify the parties involved or users of the system, as well as explain the various interactions that occur with the system (Prakoso et al., 2020). In addition, use cases also function to describe how users connect with the system (Arsyawalfa & Handriyantini, 2020). The use case design for the laundry management system can be seen in Figure 2 below.

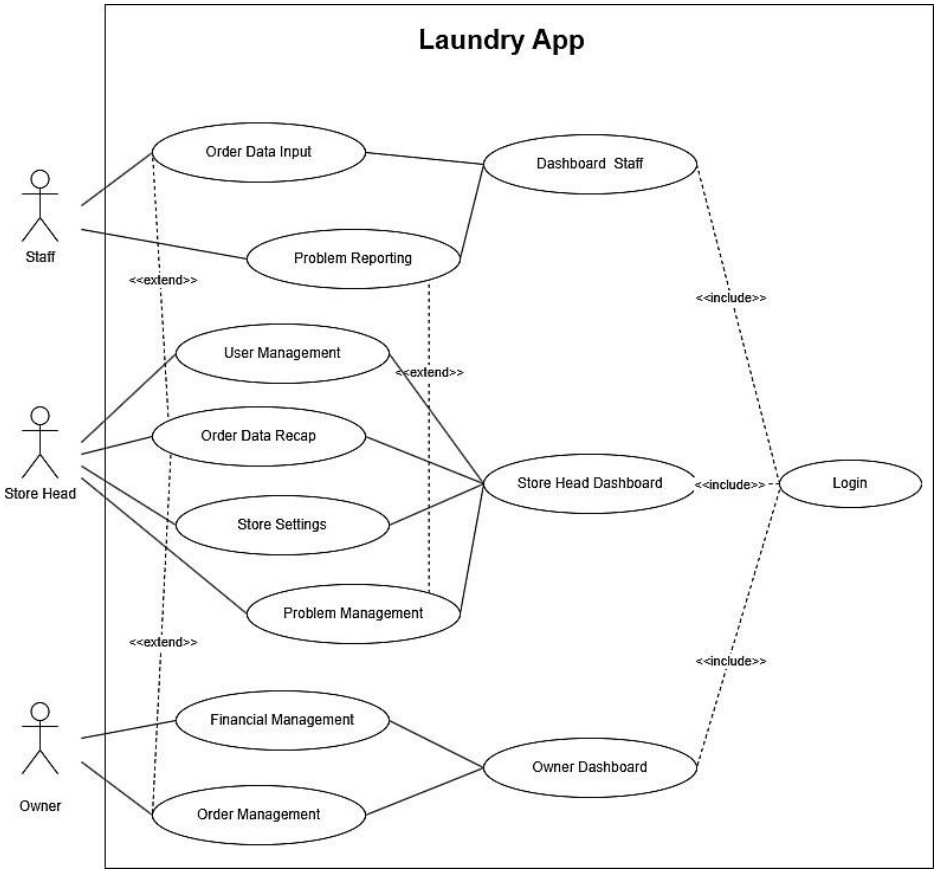

Figure 2. Use Case Diagram

This desktop-based laundry management application has three types main users: Owner, Shopkeeper, and Staff, each with their own features. that correspond to their roles. The owner can login to access the owner's dashboard, dashboard, which provides financial management features to view income and expense reports and order management to monitor incoming order reports. incoming orders. The Shop Head can login to manage users through the user management feature (view, change, or delete user data), see a recap of daily or monthly order data, update prices or add promos through the store settings feature, and handle reports on incoming orders. add promos through the store settings feature, and handle reports of problems submitted by staff through the problem management feature. Staff can login to access the staff dashboard, which includes the order data input feature, used to record customer orders, and the problem reporting feature to report operational to report operational constraints which are then managed by the Store Head. All these features are integrated to support the laundry operational process effectively.

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2.3.2 Activity Diagram

Activity diagrams represent the activities that the system performs. Activity Diagrams are an important part of the system analysis and design process, because they help in visually describing how a system operates and interacts with its environment (Kuswandi, 2019).

In the design of this laundry application, there are 3 activity diagrams, namely activity diagrams for owners, shop heads, and staff. as for the activity diagram for the owner is shown in Figure 3 below.

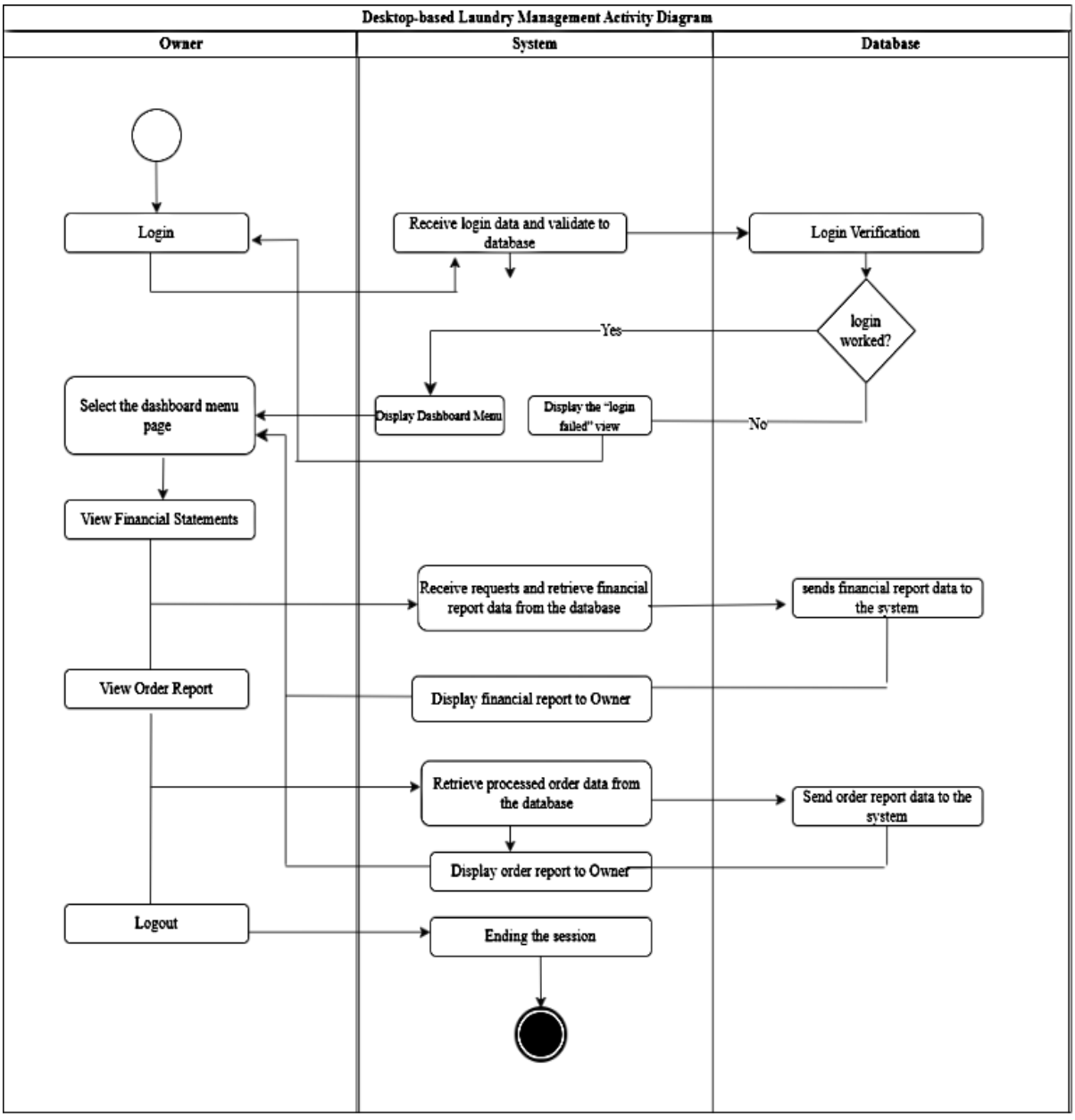

Figure 3. Activity Diagram for Owner

This activity diagram illustrates the flow of activities carried out by Owner in a desktop-based laundry management system. The owner starts with login, where he enters his username and password to be verified by the system. by the system. If successful, the owner is directed to the main menu. There, the owner can manage financial reports by viewing and printing report data that is report data displayed from the database. In addition, the owner can also view reports of orders orders that have been processed, which are displayed by the system and can be printed if needed. required. Once finished, the owner can exit the system through the logout process, which closes the user session. As for the activity diagram for the shop head is shown in Figure 4 below.

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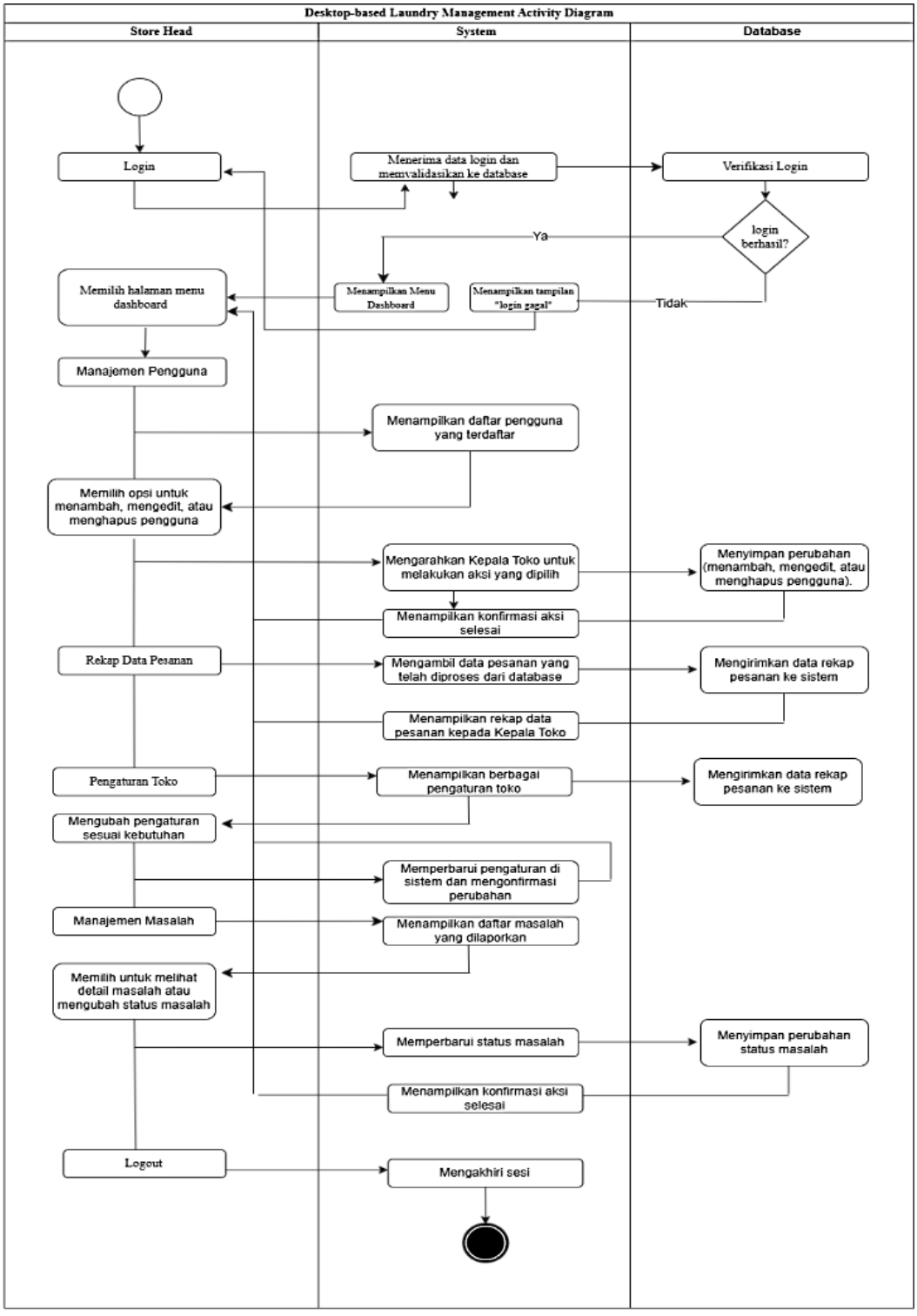

Figure 4. Activity Diagram for Head Store

This activity diagram explains the activities carried out by the Head of Store. The process starts with login, where the Head of Store enters the username and password to be verified by the system. After successfully logging in, the Shop Head is directed to the main menu. In the main menu, the Shop Head can perform various tasks, such as user management (adding or deleting user data such as staff) and order management by reviewing data and user data such as staff) and managing orders by reviewing data as well as updating the order status (e.g. completed or in process). In addition, the Shop Head can also manage user-reported issues by viewing, adding, or updating the status of the issue. All changes made are saved by the system into the database. Finally, the Shop Head exits the system through the logout process. The activity diagram for staff is shown in Figure 5 below.

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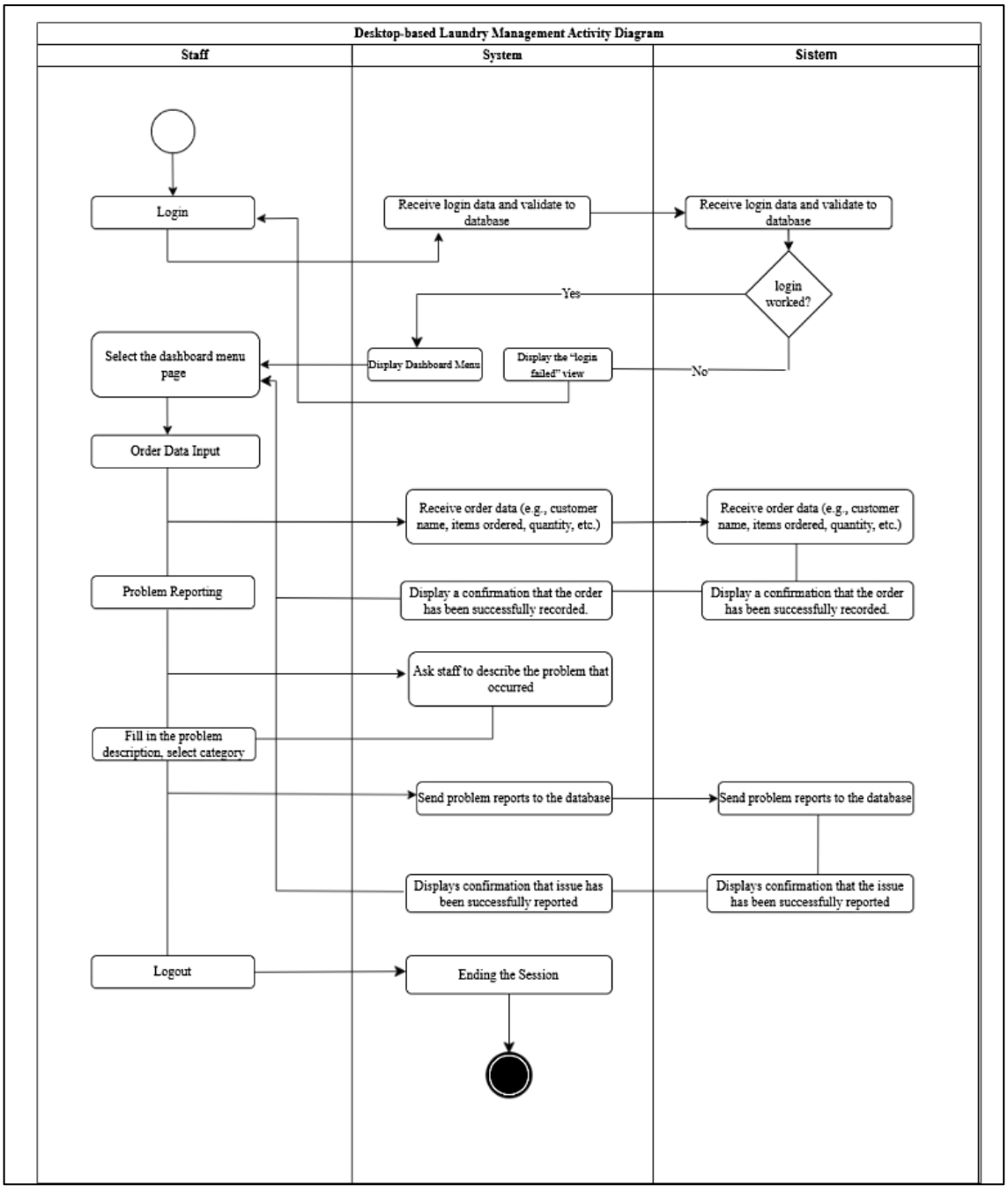

Figure 5. Activity Diagram for Staff

This activity diagram illustrates the flow of Staff activities in the system. Staff starts with login, where he enters his username and password to be verified by the system. verified by the system. If successful, the Staff is directed to the main menu. In system, Staff can perform various tasks, such as inputting and processing orders from customers. orders from customers. The order is recorded into the database by the system, and the Staff can update the order status according to the work progress. If there is an obstacle or problem, the Staff can report it through the system, and the problem will be recorded by the system for review by the Head. the problem will be recorded by the system for the Head of Store to review. After finished carrying out the task, the Staff exits the system by logging out, which ends the user session. ends the user session.

2.3.3 Entity-Relationship Diagram (ERD)

This ER diagram illustrates the relationship between entities in the store management system. There are several main entities, such as Store Settings (manages the store configuration), Problems (records operational problems), Users (representing the owner, shopkeeper, or staff), Orders (documenting customer transactions), Goods Stock (managing data on goods in the shop), and Financial Statements. transactions), Goods Stock (manages data on goods in the store), and Financial Statements (records the store's income and expenses). (records store income and expenses). The main relations include: Users manage store settings, report problems, create orders, and record financial statements. Orders

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include stock items, while financial statements may include relevant item data. data. This diagram is designed to support core store functions such as user management, transactions, issues, and financial reports. The Entity-Relationship Diagram (ERD) can be seen from Figure 6 below.

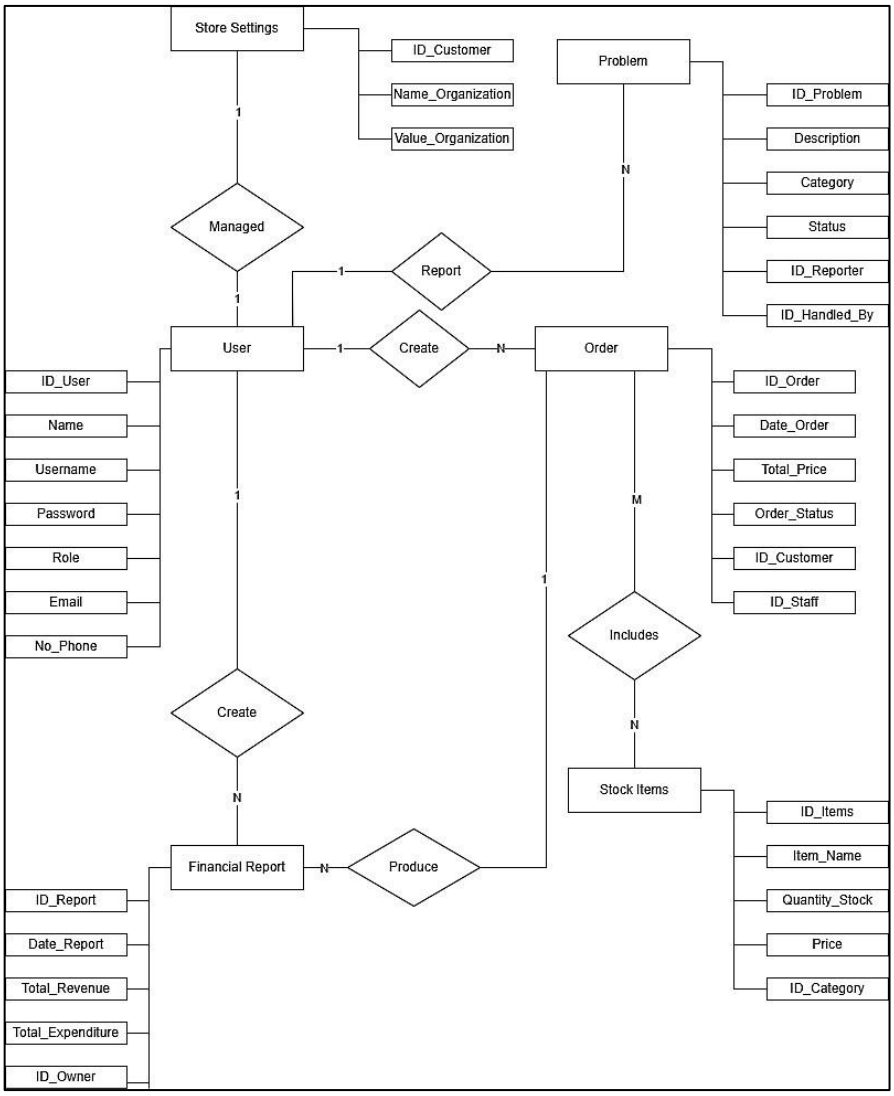

Figure 6. Diagram Entity Relationship

3. RESULTS AND DISCUSSION

3.1 Research Result

Based on the results of testing and implementation, the developed desktop-based laundry management system has successfully improved operational efficiency, data recording accuracy, and security in managing the laundry business. The implementation of this system has resulted in a 35% reduction in order processing time compared to manual methods, as staff can now input, manage, and update order status in real-time with minimal delays. Additionally, data entry errors have decreased by 40%, leading to more accurate financial reporting and order tracking.

Data security has been significantly enhanced through the implementation of a multi-level login system. Only users with specific access rights can manage sensitive data, and all customer and financial data are encrypted using AES-256 encryption, reducing the risk of information leaks. Furthermore, laundry owners can now monitor real-time financial transactions and operational reports, leading to a 25% improvement in decision-making speed. The presentation of data in tables and interactive graphs further supports business owners in conducting financial analysis and identifying trends efficiently.

Usability evaluation results indicate that 85% of users reported improved ease of use, particularly in navigation and feature accessibility. Staff and owners found that the system simplifies their workflow, allowing them to manage laundry operations more efficiently. However, based on user feedback, areas for future development include integration with a mobile application for better customer access, digital payment features to support cashless transactions, and online booking capabilities to streamline service reservations.

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Thus, the developed system has demonstrated a measurable positive impact on laundry business management, enhancing operational efficiency, data accuracy, and secure access to business insights. These findings suggest that leveraging technology in laundry services is an effective solution for tackling daily operational challenges and increasing competitiveness in the digital era.

3.2 Discussion

According to the approach method that will be used approach is an object approach, then the model used to describe the entire process using UML diagrams describe the entire process using UML diagrams. The following is a display of the user interface (User Interface), which is as follows:

3.2.1 Owner Menu Display

a. Login
The laundry owner's login menu serves as a secure entry point to manage data and business operations. This feature includes username and password form. With a simple and responsive design, the system ensures optimum user experience with added security such as data encryption and login restrictions to protect the privacy and integrity of information. login restrictions to protect the privacy and integrity of information. The owner login can be shown in Figure 7 below.

Figure 7. Owner Login Menu Display

b. Dashboard
After a successful login, the user is directed to the dashboard. Dashboard dashboard is the main page that displays a summary of laundry operations. operations. This feature includes order management and financial management. With an intuitive interface, this dashboard makes it easy for owners to monitor, analyze, and manage operations efficiently in one unified view. The owner dashboard can be shown in Figure 8 below.

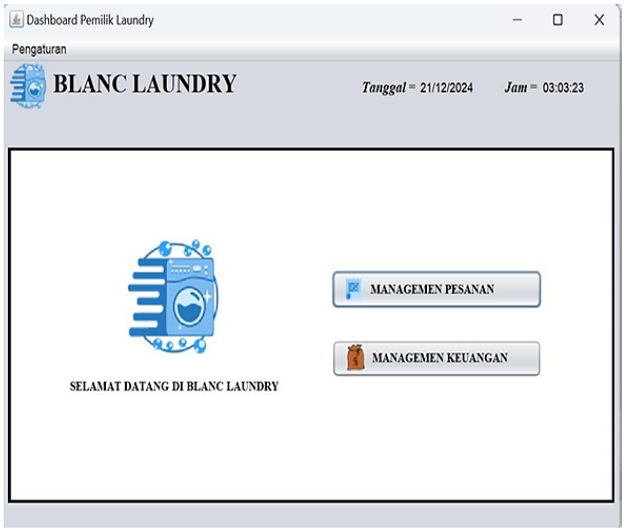

Figure 8. Owner Dashboard Menu Display

c. Order management
The order management feature is that the system provides a function to view customer order details, order status (being processed, completed, or picked up), and display order history. The Order Management can be shown in Figure 9 below.

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Figure 9. Order Management Menu Display

d. Financial Management

The financial management feature is that the owner can view the financial statements that includes total revenue in a given period. Report data includes details of transactions generated from customer orders. Management features management features allow owners to monitor and manage financial reports in detail. The owner can view the total revenue in a certain period period, complete with details of transactions generated from customer orders. With this feature, owners can make more strategic business decisions based on accurate financial data. based on accurate financial data. The Financial Management can be shown in Figure 10 below.

Figure 10. Financial Management Menu Display

3.2.2 Store Head Menu Display

a. Login

Shop Head Login is a feature specifically designed to provide access to the store manager to manage laundry operations. Through this menu, store manager can log in with a unique username and password to carry out tasks such as viewing orders, viewing staff performance, and monitoring daily reports. The system ensures data security through login validation and encryption, so that only authorized shop heads can access relevant information. The Login Store Head can be shown in Figure 11 below.

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Figure 11. Login Store Head Menu Display

b. Dashboard

The store manager dashboard is the main page that displays a summary of laundry operations specifically for the store manager. This feature includes store settings, user management, order data recap, and problem reporting. issues. With a simple and informative design, this dashboard makes it easy for shop heads to monitor operations, and ensure that the service running according to set standards. The Dashboard Store Head can be shown in Figure 12 below.

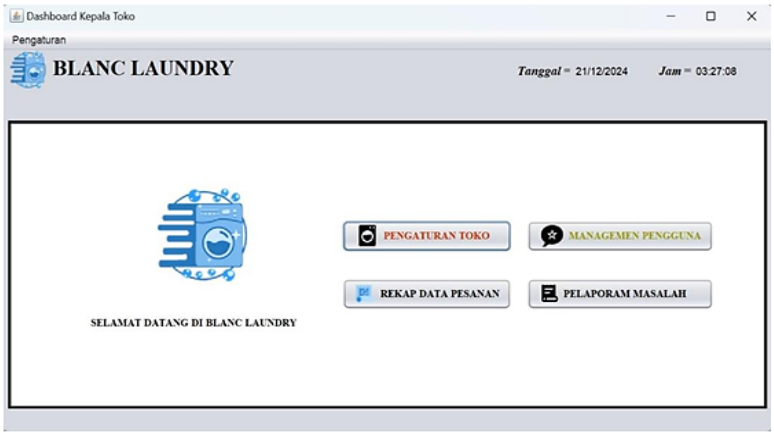

Figure 12. Dashboard Store Head Menu Display

c. User Management

User management for shop heads is a feature that allows store manager to easily manage staff account data. This feature includes adding, editing, or deleting staff accounts, setting access rights according to each task, as well as monitoring staff activities in the system. their respective duties, as well as monitoring staff activities in the system. With this feature, the store manager can ensure that each user has the appropriate access and the operations run smoothly and organized. The User Management Store Head can be shown in Figure 13 below.

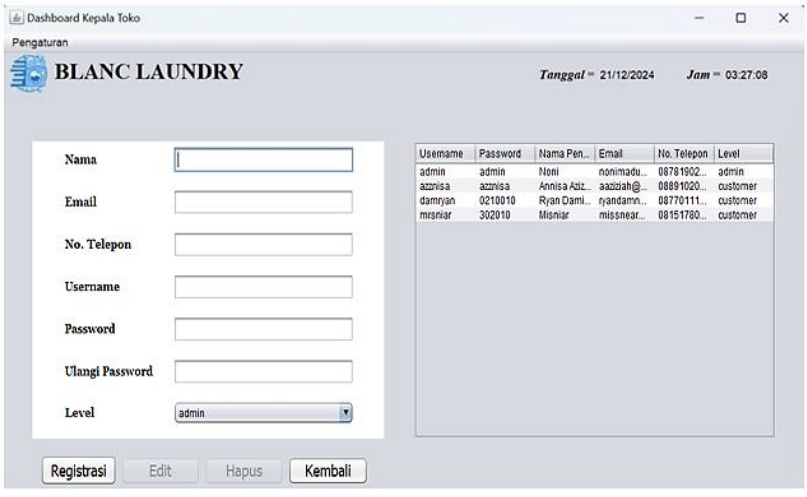

Figure 13. User Management Menu Display

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d. Order Data Recap

Order Data Recap is a feature that presents a summary of all orders received in a certain period. orders received in a certain period. This feature includes information such as total number of orders, order status (processed, completed, picked up), type of services most frequently used, and customer details. This data is presented in the form of tables or graphs to facilitate analysis, help shop heads see the service performance, and identify order patterns that can support strategic decision-making. The Order data recap Store Head can be shown in Figure 14 below.

Figure 14. Order Data Recap Menu Display

e. Store Settings

Store Settings is a feature that allows the store manager to manage laundry operational information and settings. This feature includes management of store profiles such as name, address, contact number, and operating hours. In addition, users can customize the services offered, prices, as well as applicable promotions. applicable promotions. This feature also provides the option to set system preferences, such as preferences, such as notifications, payment methods, and application appearance, so that laundry operations can run according to business needs. laundry operations can run according to business needs. The Store Settings Store Head can be shown in Figure 15 below.

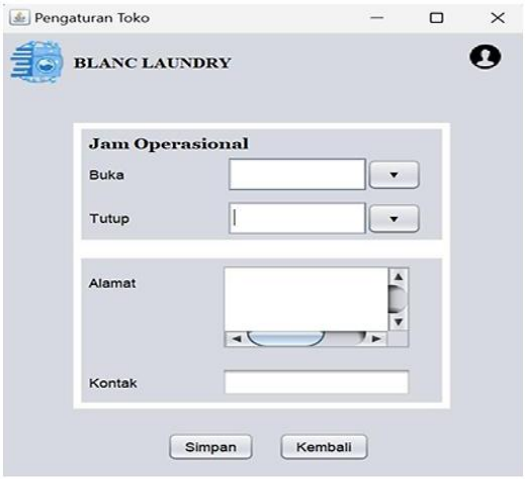

Figure 15. Store Settings Recap Menu Display

f. Problem Reporting Management

Problem Reporting for Shop Heads is a feature designed to help store heads receive, monitor, and follow up on problem reports. reports. This feature includes a list of reports categorized by type of issue (technical, service, or customer), resolution status (new, in process, completed), as well as details of the complaint attached. process, completed), as well as the complaint details attached. The shop head can provide an immediate response, assign corrective actions, or escalate the issue to the owner if required. This feature ensures that any issue is handled quickly to maintain smooth operations and customer satisfaction. The Problem Reporting Management Store Head can be shown in Figure 16 below.

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Figure 16. Store Settings Recap Menu Display

3.2.3 Staff Menu Display

a. Login
Staff Login is a feature that gives laundry staff access to the system with a unique username and password. to enter the system with a unique username and password. This feature allows staff to access tasks relevant to their responsibilities, such as order data input and problem reporting. The system is equipped with login validation and restricted access rights settings to ensure that staff can only access features appropriate to their roles, maintaining security and operational efficiency operations. The login staff can be shown in Figure 17 below.

Figure 17. Login Staff Recap Menu Display

b. Dashboard
The Staff Dashboard is the main page specifically designed to help laundry staff manage their daily tasks with ease. This feature includes data input of orders to be worked on and problem reporting. With a simple interface and focus on operational needs, the staff dashboard makes it easy to coordinate work, improve efficiency, and ensure services are running according to specified standards. The Dashboard staff can be shown in Figure 18 below.

Figure 18. Dashboard Staff Recap Menu Display

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c. Order Data Input
Order Data Input is a feature that allows staff to enter customer order details into the system quickly and accurately. This feature includes a form to record information such as laundry service, weight of clothes (kg), pick-up time, ship order and payment method. (kg), pick-up time, ship order and payment method. The system automatically automatically saves the data and assigns an order number to simplify ordering. With this feature, staff can manage orders efficiently, minimize recording errors, and increase customer satisfaction. The Order Data Input can be shown in Figure 19 below.

Figure 19. Order Data Input Recap Menu Display

d. Problem Reporting
Staff Problem Reporting is a feature that allows staff to report operational issues directly to the owner. This feature includes a form to record the type of issue (technical, service, or other) as well as a description of the problem. With this feature, staff can quickly communicate obstacles encountered, so that problems can be resolved efficiently and operations remain smooth. The Problem Solving Input can be shown in Figure 20 below.

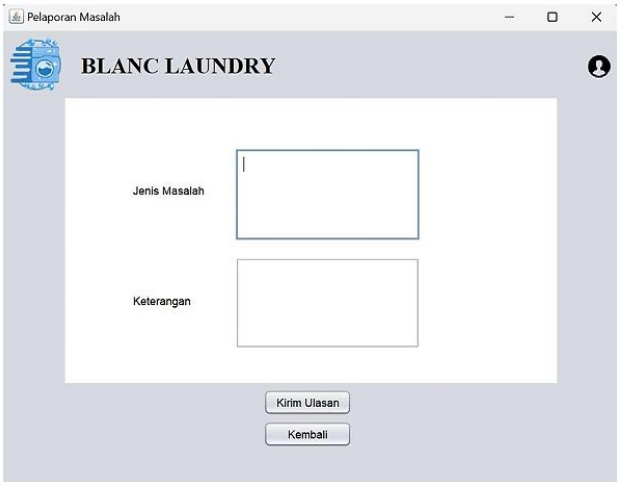

Figure 20. Order Data Input Recap Menu Display

3.3 System Testing

This system will be tested using the Black Box Testing method, Black Box Testing is a software testing method that focuses on the functionality of the system based on the input given and the system's functionality based on the input given. software testing method that focuses on system functionality based on given inputs and expected outputs. expected output. In this test, the tester does not need to know how the system works behind the scenes, but will check whether the system can provide outputs that match the input received. check whether the system can provide output that matches the input received. This method can be used to test various features on the laundry service website. If the output produced is in accordance with the expectations and specifications that have been determined, then the system is considered to have functioned well. has functioned properly. Conversely, if the output does not match, then improvements will be made to improve its functionality. to improve its functionality. The following is the Laundry

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Website System Testing Table using the Black Box Testing Method, which includes testing on various forms in the system. that exist in this system:

Table 1. Black Box Testing

No	Feature Tested	Test Scenario	Input	Expected Output	Test Result	Status
1	Owner Login	The owner enters a valid username & password	Valid Username & Password	The system allows login and displays the owner's dashboard	Match	Pass
2	Owner Login	The owner enters an invalid username & password	Invalid Username & Password	The system displays an error message	Match	Pass
3	Financial Management	The owner selects the "Financial Management" feature	Click financial management menu	The system displays financial reports	Match	Pass
4	Financial Management	The owner tries to access financial reports, but a database error occurs	Click financial management menu	The system displays an error message	Match	Pass
5	User Management	The store manager selects the "User Management" feature	Click user management menu	The system displays a list of users	Match	Pass
6	Order Data Recap	The store manager selects the "Order Data Recap" feature	Click order data recap menu	The system displays order data based on the selected period	Match	Pass
7	Order Data Input	Staff inputs a new order	Order data (Name, Service Type, Weight, Pickup Time)	Data is stored in the database and displayed in the order list	Match	Pass
8	Issue Reporting	Staff reports an operational issue	Issue data (description, category)	Data is stored and displayed in the issue list	Match	Pass

4. CONCLUSION

Based on the results of design and implementation, the desktop-based laundry management application has successfully integrated the roles of three types of users, namely staff, shopkeepers, and owners. This integration enables each user to carry out their tasks more effectively. Key features such as order data entry, problem reporting, order management, and financial reports have been implemented as needed, ensuring operational transparency and assisting owners in strategic decision-making.The application utilizes a local database, ensuring fast data availability without relying on an internet connection while also enhancing data security by eliminating the need for cloud-based storage. Additionally, its simple yet functional interface makes it easy for users to operate the application according to their respective roles. However, the application still has certain limitations, such as the lack of integration with external systems, the absence of in-depth financial analysis features, and the inability to manage multiple branches. Future improvements could include API integration for better system interoperability, the addition of advanced financial reporting tools, and multi-branch management capabilities to support business expansion.

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