Application of Scrum Methodology in The Design of Micro, Small, and Medium Enterprise Systems: A Case Study on Laundry Services

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Abstract: This study investigates the application of the Scrum methodology in developing systems for Micro, Small, and Medium Enterprises (MSMEs), specifically focusing on laundry service operations. The case study centers on D'Laundry, a laundry service provider, which has traditionally operated with conventional transaction methods. The objective of this research is to develop an MSME system employing the Scrum framework. The system analysis was executed using an Object-Oriented approach, utilizing Unified Modeling Language (UML) for modeling. The development phase employed PHP for application creation, while MySQL was used for the system database. The implementation phase was conducted within a local network, with functional system testing carried out via Black Box testing techniques. Furthermore, the software quality was assessed through a User Acceptance Test, complemented by a questionnaire-based approach. The findings offer insights into the adoption of agile methodologies by MSMEs, emphasizing digital transformation strategies.

Keywords: Information System; D'Laundry; User Acceptance Test; MSME; Scrum Methodology.

1. Introduction

In the era of the digital millennium, the utilization of information technology (IT) has become a cornerstone in reshaping business practices across the globe. The rapid advancement in technology has not only transformed how businesses operate but also has redefined the way they interact with customers and manage internal processes. The significance of IT in the modern business landscape cannot be understated, as it plays a pivotal role in enhancing efficiency, driving innovation, and fostering competitive advantages. The dawn of the information age has seen computers and smartphones become ubiquitous, serving as essential tools for information access and communication. The internet, in particular, has revolutionized the availability and dissemination of information. In the realm of business, this technological evolution has been a driving force in automating processes, optimizing supply chains, and enhancing customer engagement [1]. The speed and accuracy of information retrieval and processing are fundamental in today's

fast-paced business environment. These capabilities empower organizations to make informed decisions swiftly, a crucial aspect in maintaining relevance and competitiveness.

Moreover, the integration of IT in business operations extends beyond mere efficiency. It is about creating value, improving service delivery, and enabling businesses to tap into new markets and opportunities. The strategic use of IT enables businesses to explore innovative business models, tailor services to customer preferences, and engage in data-driven decision-making. In this regard, the application of technology in business has become an indispensable element in the quest for growth and sustainability [2]. However, the transition to technology-centric operations is not without its challenges. Small and medium enterprises (SMEs), in particular, often grapple with the integration of new technologies. Limited resources, lack of expertise, and resistance to change are common barriers. Despite these challenges, the adoption of IT solutions is increasingly seen as a necessary step for SMEs to stay competitive in the digital age.

This brings us to the case of D'Laundry, a laundry service provider, which exemplifies the typical journey of an SME in adopting IT solutions. D'Laundry has traditionally relied on manual processes for managing its operations. This includes conventional methods for recording transactions, creating notes, and managing customer data. These processes, often manual and paper-based, are prone to errors and inefficiencies. Such inefficiencies can manifest in various forms, including inaccuracies in transaction records, challenges in tracking customer information, and delays in service delivery. A survey conducted to understand D'Laundry's operational challenges highlighted the need for a technological overhaul. The reliance on manual systems not only hindered operational efficiency but also impacted customer satisfaction. In an industry where timeliness and accuracy of service are paramount, these challenges could potentially lead to a loss of business and reputation. To address these operational bottlenecks, a web-based information system was proposed. The envisioned system aims to automate transaction recording, note creation, and customer data management. By transitioning to a digital system, D'Laundry could achieve several benefits, including improved accuracy in record-keeping, streamlined processes, and enhanced customer experience. The development of D'Laundry's information system was guided by the Scrum methodology. Scrum, an agile framework, is particularly suited for projects where requirements are expected to evolve over time. It emphasizes iterative development, collaborative decision-making, and flexibility in responding to changing needs. The use of Scrum in this context underscores the need for a dynamic and adaptive approach in developing IT solutions for SMEs.

The system analysis and design were carried out using the Unified Modeling Language (UML). UML is a standardized modeling language in the field of software engineering, known for its efficacy in visualizing, specifying, constructing, and documenting the artifacts of a software system. By employing UML, the project team could ensure a clear and coherent design framework, facilitating effective communication among stakeholders and aligning the development process with the project objectives. The implementation of the system utilized PHP, a popular server-side scripting language, and MySQL, a widely-used database management system. This combination of PHP and MySQL was chosen for its reliability, ease of use, and compatibility with a wide range of hosting services. Moreover, these technologies are known for their scalability, making them suitable for businesses like D'Laundry that may need to expand their IT systems as they grow. Lastly, the system's functionality and reliability were assessed through Blackbox Testing. This method of software testing focuses on examining the functionality of an application without delving into its internal structures or workings. Blackbox Testing is effective in identifying discrepancies between expected and actual outputs, thereby ensuring that the system meets its intended purpose. The case of D'Laundry serves as a valuable example of how SMEs can leverage IT solutions to overcome operational challenges and enhance business performance. Through the adoption of a web-based information system, D'Laundry is poised to achieve greater operational efficiency, improved accuracy in record-keeping, and enhanced customer satisfaction. This transition not only represents a significant step forward for D'Laundry but also serves as an inspiration for other SMEs embarking on their digital transformation journey.

2. Research Method

This study, centered on the application of an information system in Micro, Small, and Medium Enterprises (MSMEs) with a case study on laundry services, is an instance of applied research. Applied research tests theories in specific fields, determines empirical relationships with a focus on analytical generalization, and seeks to provide solutions to sector-specific problems [3][4]. The methodology encompasses the Scrum framework, object-oriented analysis and design using Unified Modeling Language (UML), implementation with PHP programming and MySQL database, and system testing using black box testing methods. The outcome is a comprehensive report detailing transaction activities in laundry businesses, encapsulated in a web application addressing the identified challenges.

2.1 Sample Method
The sampling method employed in this study is purposive sampling, a non-probability sampling technique based on specific criteria. This approach selects elements from a population that can help understand the characteristics of the sample, thus enabling the generalization of these characteristics to the population. The criteria for respondent selection include [3].

1) Employment in a relevant role with defined responsibilities.
2) Experience in information technology, particularly in data processing and network technology.
3) A minimum of three years of professional experience.

Respondents include laundry business owners in the Ciledug area and individuals involved in transactional activities. This sample was chosen for its direct involvement in the system, ensuring effective and relevant data collection.

2.2 Data Collection Methods
The data collection methods in this research aim to obtain reliable materials, facts, and information. These include:
1) Observation: Direct observation of the research object, structured with a predefined data and source checklist. It involves studying documents, business processes, existing technology infrastructure, and policies.
2) Interviews: Informal discussions with relevant parties to gather data, guided by a prepared set of questions related to work activities.
3) Literature Review: Analysis of books, journals, dissertations, theses, and other documents related to information systems, reporting systems, and program documentation.

2.3 Instrumentation
The instruments used for data collection in this study are:
1) Observation Tool: Direct observations made by the researcher.
2) Interview Tool: Conducting interviews with laundry business owners about their activities.
3) User Needs Identification and Elicitation: Determining user requirements for system development.

2.4 Analysis, Design, Implementation, and Testing Techniques
The object-oriented analysis approach using Unified Modeling Language (UML) is employed in this study. The analysis process involves:
1) Analysis of the existing system.
2) Functional and non-functional requirements analysis, with functional modeling using use case diagrams.
3) User analysis, focusing on the application's end-users and their functionalities.
4) System behavior analysis, modeled with Activity diagrams.

2.5 System Design Techniques
The system design employs Object-Oriented Design (OOD) using Unified Modeling Language (UML), including:
1) Program design modeled with class diagrams.
2) Database design, detailing data storage, formats, and database design (ER diagram).
3) User interface design (navigation, input forms, output forms).

2.6 System Implementation Techniques
The implementation is based on the analysis and design phases, divided into three parts:
1) Implementation environment including hardware, software, and network.
2) Database implementation using database software.
3) System implementation in the laundry business environment.

2.7 Validation Testing
Validation testing assesses whether the system/software developed accommodates specified requirements and functions satisfactorily for stakeholders. It ensures that the system meets all informational, functional, and performance requirements before being handed over to the users. In this study, validation testing is conducted to test the first hypothesis using the Black-box testing approach.

3. Result and Discussion

3.1 Results
3.1.1 MSME Menu System Structure
The menu structure in the MSME system functions to arrange and organize various features, functionalities, or different parts of the information system so that they can be accessed easily by users. A good menu structure plays an important role in improving navigation, orderliness, and user efficiency in using an information system. The following is the menu structure of the MSME system that was developed, including:
1) User Admin, consisting of Dashboard Menu, Transaction Menu, Report Menu, User Data Menu, Category Data Menu, Application Settings Menu, Logout Menu.
2) Employee User consists of Dashboard Menu, Transaction Menu, Chat Menu, Report Menu, User Data Menu,

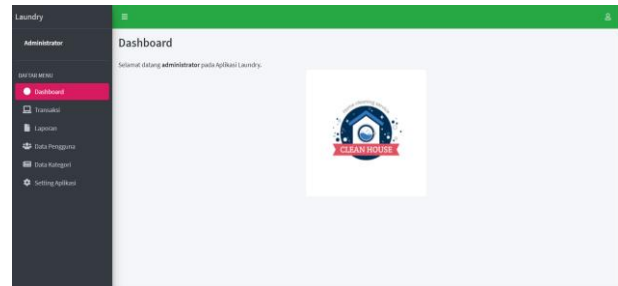Category Data Menu, Logout Menu.

3)   Customer Users consist of Dashboard Menu, Transaction Menu, Chat Menu, Location Menu, Logo Menu
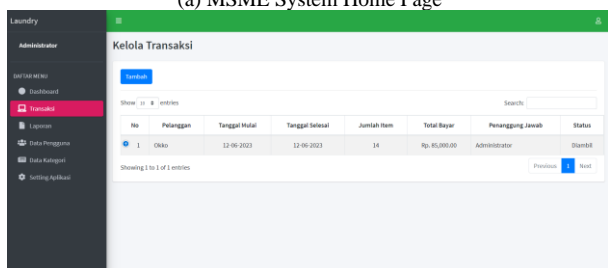
3.1.2 MSME System Interface

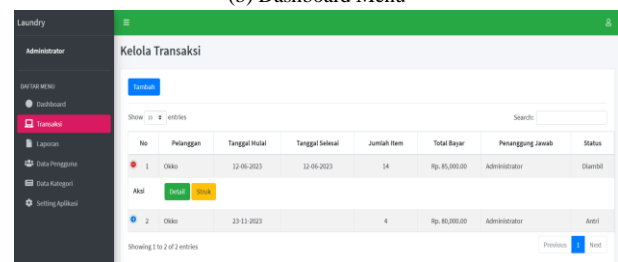In this section, we will explain the menus in the MSME system and how to use them.
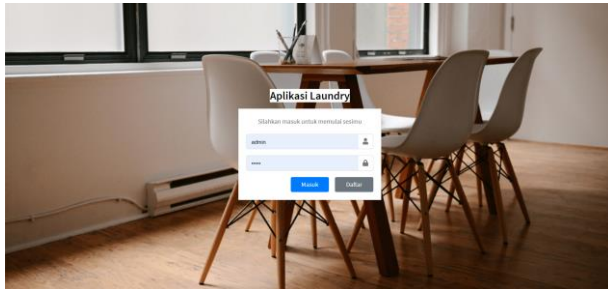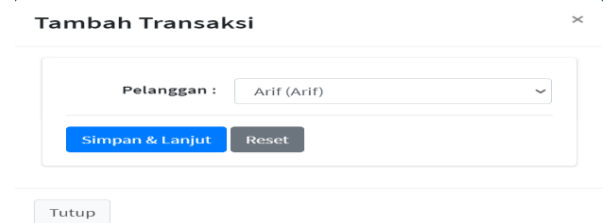
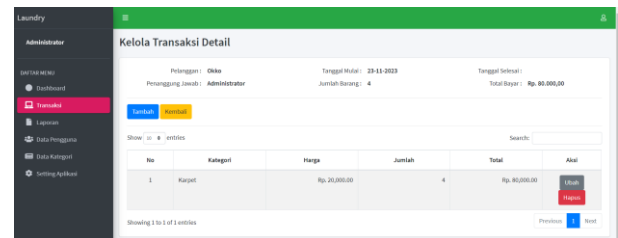(a) MSME System Home Page

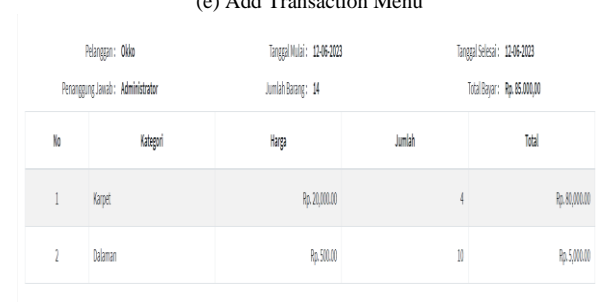(b) Dashboard Menu

(c) Transaction Menu
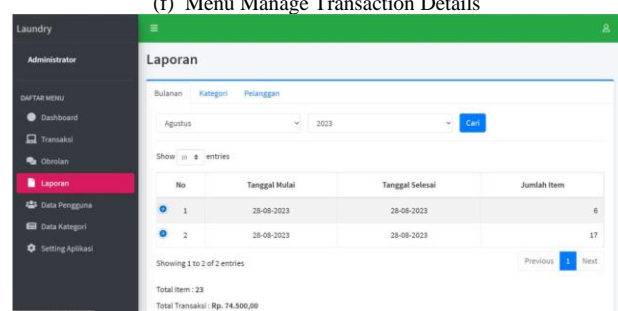
(d) Manage Transactions Menu
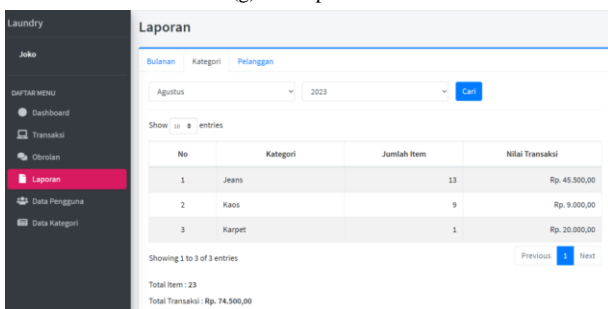
(e) Add Transaction Menu

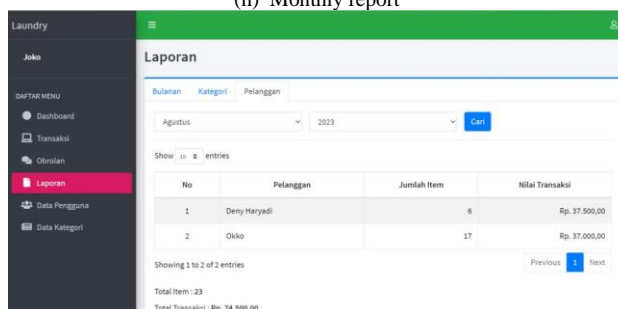(f) Menu Manage Transaction Details
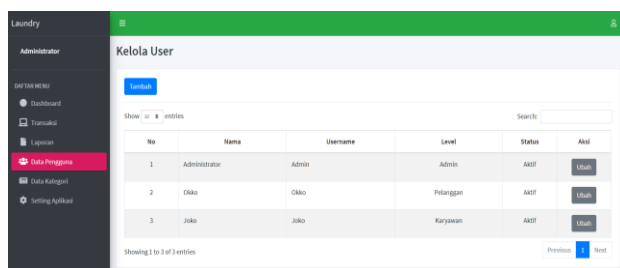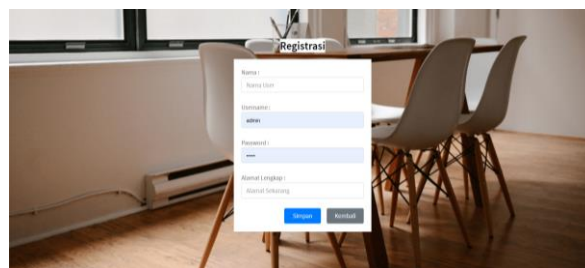
(g) Receipt Menu

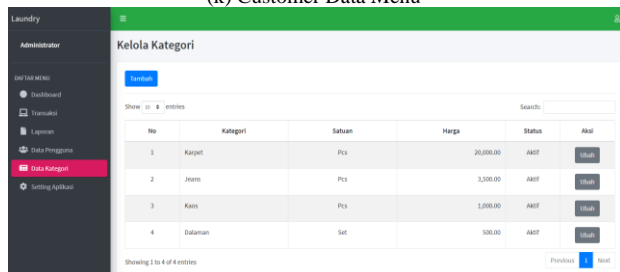(h) Monthly report

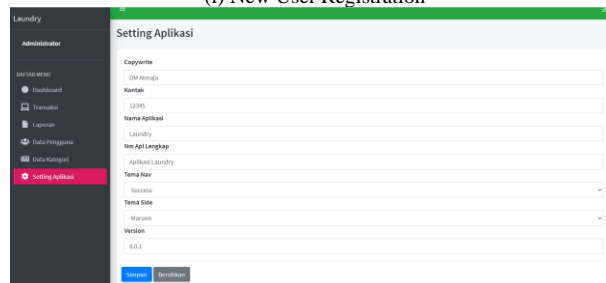(i) Report By Category

(j) Reports by Customer

(k) Customer Data Menu

(l) New User Registration

(m) Category Data Menu

(n) Application Settings Menu

Figure 1. MSME System Interface

The start page of the MSME system contains a username and password form, please enter the username and password that have been previously registered in the system or select the register menu if the user does not have an account (figure 1.a). Display the Dashboard page which contains a list of menus, user accounts and the logout menu in the upper right corner. The list of menus displayed includes the transaction menu, chat menu, report menu, user data menu, category data menu and application settings menu (figure 1.b). This is a transaction page that contains records of ongoing customer transactions or transactions that have been completed. Transaction status in this system is divided into 6, namely Queuing, Washing, Drying, Ironing, Completed, and Picked Up. The status of transactions that are still in the queue can be deleted and changed if there is an error in the data input process, however, if the transaction status has entered wash status, then the transaction cannot be deleted or cancelled, it can only be changed. Transactions that have been completed can be seen in the system. Apart from that, on this page there is a search feature which functions to make it easier for employees to search for transaction data based on the customer's name or ID (figure 1.c-g). Report page that can be accessed by administrators and employees. The report menu provides information about how many transactions have been completed, report data can be displayed in the form of month, category, and customer. The report menu displays data on total items and total transactions in the last month (figure 1.h-j). Display of the user management page. Admin can add new employees and new customer data (figure 1.k-i). Category data page containing information about item name, unit, price, and status. Admins and employees can add category data and change category data in accordance with applicable regulations (figure 1.m). Application settings menu page that can only be accessed by admins. The application settings menu includes copywrite, contact, latitude, longitude, application name, full application name, nav theme, side theme and version (figure 1.n).

3.1.3 System Testing
1) Blackbox Testing
The Blackbox testing method is a system testing method used to find errors and demonstrate application functionality when running or operational. This testing includes whether the input is received correctly, and the output produced is as expected. The results of black box testing on the MSME system will be described in more detail in the following table:

Table 1. Test Results

Testing Items	Testing Details	Test Type	Expected Results	Test Results
Login Menu	Username	Blackbox	Users cannot log in if the username and password are incorrect	OK
	Password	Blackbox	Users cannot log in if the username and password are incorrect	OK
Registration	Add	Blackbox	Employees and admins can add user data	OK
	Validation	Blackbox	Employees and admins can validate user data	OK
User Data Menu	Add	Blackbox	Employees and admins can add user data	OK
	Modify	Blackbox	Employees and admins can modify user data	OK
Category Data Menu	Add	Blackbox	Users can add category data	OK
	Modify	Blackbox	Users can modify category data	OK

Report Menu	View	Blackbox	Users can view transaction data by month, category, and customer name	OK
	Print	Blackbox	Users can print transaction data	OK
Transaction Menu	Add	Blackbox	Users can add transaction data	OK
	Modify	Blackbox	Users can modify transaction data	OK
	Print Receipt	Blackbox	Users can print receipts	OK

Based on the test results using the black box testing method, it can be concluded that the MSME system is running well, with test results of 100% or all modules in the system are running according to their function.

2) Conclusion of Testing Results and Proving Hypothesis
Based on the results of software testing, namely the grocery store electronic information system, that researchers carried out, the hypothesis regarding system testing achieved expectations, namely "good".

3) Overall Test Results
From the results of the tests carried out, the results obtained are outlined in the following table.

Table 2. Average Value of Test Results

No	Question	Actual Score	Ideal Score	Percentage
1	Is the information provided by the system easy to understand?	46	75	61.33%
2	Is the existing menu easy to operate or use?	56	75	74.67%
3	Can the system predict user data needs effectively?	46	75	61.33%
4	Is the system comfortable to use?	51	75	68.00%
5	Is the designed system overall satisfying for users?	58	75	77.33%
6	Does the application meet the required needs?	57	75	76.00%
7	Is the application easy to learn?	63	75	84.00%
8	Does using the system facilitate easier access to information?	47	75	62.67%
9	Is it easy to avoid mistakes when operating the application?	59	75	78.67%
10	Does the system provide benefits to laundry business owners and customers?	63	75	84.00%
11	Is the menu interface easy to recognize?	49	75	65.33%
12	Does the application have the capabilities and functions as expected?	57	75	76.00%
Total		652	900	72.44%

Based on the above data, it can be concluded that the developed MSME system is well-received by the staff of Medika Lestari Hospital with a good score of 72.44%.

3.4 Discussion
   The results from the testing phase of the MSME system provide insightful revelations about its functionality and user experience. The systematic use of Blackbox testing confirmed the robustness and reliability of various system components. Each element, from the login process to transaction management, performed as expected, underscoring the system's technical competence. Notably, the system's ability to prevent login with incorrect credentials, manage user data effectively, and handle transaction details accurately reflects a well-designed architecture that prioritizes security and user efficiency. Furthermore, the overall test results paint a comprehensive picture of the system's user experience. The feedback, quantified in the Average Value of Test Results table, reveals areas where the system excels and aspects that could benefit from further refinement. For instance, the relatively lower scores in understanding the system's information and ease of avoiding operational mistakes highlight opportunities for enhancing the user interface and instructional clarity. Conversely, high scores in areas such as the application's learning curve and the benefits it provides to laundry business owners and customers underscore the system's practical value and user-friendly design. The aggregate score of 72.44% is indicative of a positive reception from the staff of Medika Lestari Hospital. This outcome not only validates the system's efficacy in meeting its intended objectives but also serves as a testament to its potential in streamlining operations in MSME settings. However, the discrepancy between actual and ideal scores in certain areas suggests a need for ongoing improvements. Addressing these gaps could involve refining the interface for better intuitiveness, enhancing the clarity of provided information, and perhaps introducing more user training or support materials. Such iterative enhancements are essential in evolving the system to meet user needs more precisely and to further elevate the user experience. The analysis of the test results provides valuable insights for future iterations of the system. It underscores the importance of continuous user feedback in the development process, ensuring that the system not only meets technical specifications but also aligns closely with user expectations and requirements.

4. Related Work

In the field of information systems development, recent research and publications have made significant contributions to the understanding and application of various methodologies and technologies. Arafat (2022) exemplifies this in his work regarding the design and development of an online ordering system for Sriwijaya Multi Graphic printing, utilizing a website-based platform to improve business operations [5]. This approach is in line with the insights of Dennis, Wixom, and Tegarden (2010), who emphasize the importance of system analysis and design, especially with the use of the Unified Modeling Language (UML) [6]. Exploring further the use of agile methodology, Hadji, Taufik, and Mulyono (2020) applied the Scrum method in the development of a website-based delivery order application for Lombok Idjo Semarang, a case study that underlines the effectiveness of Scrum in practical applications [7]. Likewise, Hidayah and Yani (2019) demonstrated the practicality of PHP and MySQL in developing a website for SMA PGRI Gunung Raya Ranau, demonstrating the versatility and reliability of this technology in an educational environment [8]. Kristanto (2018) provides a broader perspective on information systems design and its applications, offering a comprehensive view of the field [9]. The importance of a structured and goal-oriented approach in software engineering is also highlighted by Pressman (2010), who advocates a practitioner approach in software engineering [10]. The ever-evolving landscape of digital business concepts, as described by Purwaningtias, Nasihin, and Arizona (2020), increasingly illustrates the dynamic nature of e-business in the digital era [11]. Raharja (2017) exploration of Agile Methodology in information systems development offers an in-depth explanation of this flexible and responsive approach [12]. Rosa and Shalahudin (2019) contributed to the discussion with their insights on structured and object-oriented software engineering [13], while Rosyida and Riyanto (2019) applied these concepts to develop a data management system for the Bekasi Laundry House [14]. Setiawan *et al*. (2021) demonstrated the application of the Scrum methodology in monitoring Body Mass Index via a mobile application, further proving the adaptability of this method in various sectors [15]. Simargolang and Nasution (2018) developed a web-based service application for Pelangi Laundry Kisaran, providing practical insight into the application of web technology in the service industry [16]. Liang and Hartanto (2022) introduced an innovative approach by implementing a Bug Tracking System using the Scrum methodology and the Cosine Similarity algorithm, which features the integration of advanced algorithms in an agile framework [17]. Wibowo (2021) work on e-business presents a modern understanding of digital business operations, highlighting the transformative impact of technology in commerce [18]. The current research project, focusing on the development of an MSME system using Scrum methodology and object-oriented analysis with UML, shares several similarities with previous studies in the realm of information systems and software development, while also exhibiting distinct differences.

Methodologically, this research aligns with the works of Hadji, Taufik, and Mulyono (2020) and Liang and Hartanto (2022), who also employed the Scrum methodology, indicative of a broader trend favoring agile frameworks in software projects that demand adaptability and continuous feedback. The choice of PHP and MySQL as technological tools mirrors the approach taken by Hidayah and Yani (2019), reflecting these technologies' popularity for their reliability and versatility in web-based applications. Additionally, the use of UML for system analysis and design, as practiced in this research, parallels the approach of Dennis, Wixom, and Tegarden (2010), highlighting its effectiveness in software documentation and visualization. However, the research diverges from previous works in its focus and application. Unlike studies concentrated on specific service industries like laundry services, this research aims at developing a system for a broader range of MSME operations, thus addressing a wider spectrum of business needs. The integration of various technologies and frameworks within an MSME context marks a unique blend, differing from studies with more specific application domains, such as Setiawan *et al* (2021) health monitoring mobile application. Furthermore, this study's emphasis on user acceptance and feedback, echoing Pressman (2010) suggestions, presents a holistic approach to system development that balances technical robustness with user satisfaction. While sharing common grounds in methodology and technology with earlier research, this study distinguishes itself through its application scope, unique technological integration, and its equal focus on both technical efficacy and user experience.

5. Conclusion

Based on the identified problems, literature review, research overview, examination of the research object, and the research process model in the development of the MSME system, the following conclusions can be drawn:

1) The research aimed to develop an MSME system using the Scrum methodology. The system analysis was conducted using an Object-Oriented approach, utilizing Unified Modeling Language (UML) for system design. The development of the application employed PHP as the programming language, with MySQL serving as the database for the system. This approach ensured a robust and scalable framework for the MSME system, aligning with current technological standards and practices.

2) The system was implemented on a local network, which allowed for a controlled and secure environment for both development and testing. Functional testing of the system was carried out using Blackbox testing methods, providing an effective way to evaluate the system's functionality without needing to delve into the internal workings. Additionally, the software's quality was assessed using a User Acceptance Test approach, supplemented by

questionnaire methods. This dual approach to testing ensured a comprehensive evaluation of the system from both technical and user-centric perspectives.

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