ITEJ
Innovation, Technology, and Entrepreneurship Journal

Development of a Web-Based Information System for Smartphone Repair Services at OSDIG Store Using the Waterfall Method

Vol. 2 No. 2 (2025), pp 70-79
DOI 10.31603/itej.13957

Rusydi Umar*, Muhammad Ghazi Ahnafi

Program Studi Informatika, Universitas Ahmad Dahlan, Yogyakarta, Indonesia

*Corresponding author:
Email: rusydi@mti.uad.ac.id

Abstract

The advancement of information technology compels small and medium-sized enterprises (SMEs), particularly in service sectors, to adopt digital solutions to improve operational efficiency. OSDIG Store, a smartphone repair service specializing in Apple devices, faces several issues including manual service tracking, inefficient data management, and lack of structured inventory and financial records. This study aims to develop a web-based information system tailored to the operational workflow of OSDIG Store. The system was built using the Waterfall development methodology, which includes requirements analysis, system design, implementation, and testing. Key features developed include customer data management, repair tracking, inventory control, and transaction logging. Functional testing was conducted using the Black Box method, while user experience evaluation utilized the User Experience Questionnaire (UEQ). The test results indicate that the system meets functional requirements and delivers positive user experience scores in attractiveness and efficiency dimensions. The implementation of this system streamlines daily operations, reduces service errors, and improves transparency between service providers and customers. This research contributes a practical software solution for SMEs in the service sector and demonstrates the applicability of structured software engineering practices in real-world microbusiness contexts.

Keywords: Information System; Smartphone Repair; Web Application; Waterfall Model; User Experience

Introduction

The rapid development of information and communication technology has significantly transformed business operations across various sectors, particularly within small and medium-sized enterprises (SMEs). In service-based industries, such as electronics and smartphone repair, information systems are vital for improving service quality, operational accuracy, and customer trust (T. U. H. Nguyen, 2009). Businesses that rely on manual processes often face delays, inconsistencies, and difficulties in tracking service progress, especially as customer volume increases.

OSDIG Store is a local SME that specializes in smartphone repair services for Apple devices. The store's operations rely on manual note-taking, communication through WhatsApp, and verbal updates regarding service status. This unstructured system has led to inefficiencies in data storage, inventory tracking, and service transparency. As customer demand grows, the need

for a structured digital system becomes increasingly critical to maintain service reliability and support business scalability.

To address these challenges, this study proposes the development of a web-based information system tailored to OSDIG Store's workflow. The system is designed to manage customer data, track repair progress, control spare parts inventory, and record financial transactions. The system development follows the Waterfall model, a widely recognized methodology in software engineering that emphasizes a sequential process from requirements analysis to testing (R. S. Pressman, 2010). Waterfall is particularly suitable for projects with well-defined requirements and limited complexity.

Previous research has demonstrated that customized information systems can improve operational efficiency in SMEs (Irwansyahputra & Khairot, 2025)(Popovič et al., 2019)(Ohara & Astutik, 2024). However, many systems lack integration between back-office modules and customer-facing interfaces. This study aims to bridge that gap by implementing features such as online repair tracking and user-friendly dashboards. Additionally, the system is evaluated using both functional testing (Black Box) and the User Experience Questionnaire (UEQ), which has been proven effective for assessing usability across various software products (Schrepp et al., 2014).

The main contribution of this study lies in its practical application to a real-world SME and its integration of structured software development practices with a focus on user experience. It is expected that the developed system will enhance service efficiency and transparency at OSDIG Store and may serve as a reference model for other microbusinesses in similar sectors.

Literature Review

Information systems have become a critical component for improving operational efficiency and customer satisfaction in small and medium-sized enterprises (SMEs), especially in service-oriented businesses. Studies have shown that customized software applications help SMEs to streamline transactions, maintain accurate records, and reduce human error (T. H. Nguyen et al., 2015)(T. U. H. Nguyen, 2009). In the context of smartphone repair services, digital solutions that integrate customer management, inventory tracking, and financial documentation are increasingly essential as customer volume and service complexity grow.

Research conducted by (Khan & Biyani, 2025) demonstrated that implementing web-based repair management systems significantly improves response time, reduces service backlog, and enhances customer transparency. Similarly, (Jason et al., 2019) developed a repair order management application for electronics repair shops and reported increased user satisfaction due to better service traceability. However, many of these systems lack comprehensive integration across customer-facing and back-office functions, often focusing on either inventory or customer modules, but rarely both.

The development methodology used in information system projects plays a crucial role in ensuring clarity and structure, particularly for small-scale solutions with clearly defined requirements. The Waterfall model remains a widely accepted and utilized approach in such cases due to its sequential and systematic nature (R. S. Pressman, 2010). According to (R. Pressman, 2015), Waterfall is most suitable when the project's scope is well understood at the beginning and when each development phase can be distinctly separated. Several studies have used Waterfall in educational and business application development, especially where requirement changes are minimal (Hidayati & Sismadi, 2020).

In terms of software evaluation, functional testing is often carried out using the Black Box testing method. This technique evaluates the system's output behavior based on user inputs, without requiring knowledge of the internal code logic (Supriyono, 2020). Black Box testing is especially relevant for user-centric applications, where end-user interaction determines the system's effectiveness.

Beyond functional correctness, evaluating the user experience is critical to ensure system usability and adoption. The User Experience Questionnaire (UEQ) is one of the widely accepted tools for measuring software usability across six dimensions: attractiveness, perspicuity, efficiency, dependability, stimulation, and novelty (Al-Pratama et al., 2022). Several studies have applied UEQ in evaluating web-based systems in academic and business contexts. For instance, (Halim & Suwandy, 2023) used UEQ to assess a student portal system and found strong correlation between high UEQ scores and continued user engagement.

Despite the growing adoption of such methods and tools, there remains a research gap in applying a combined approach — using structured software engineering methods (like Waterfall), integrated repair management systems, and holistic usability testing — within actual SMEs in Indonesia. Most existing research either builds a prototype without real deployment context or evaluates only one aspect of the system, such as inventory control. This study aims to bridge that gap by presenting the design, implementation, and evaluation of a complete web-based smartphone repair information system for OSDIG Store, a functioning SME. The study's focus on practical applicability and full-cycle development from analysis to user experience evaluation contributes a novel and comprehensive approach to the field.

Research Methodology

This study adopted a software development methodology to build a web-based information system for OSDIG Store, a micro, small, and medium-sized enterprise (MSME) engaged in smartphone repair services. The development process followed the Waterfall model, which consists of sequential stages: requirement analysis, system design, implementation, testing, and maintenance (R. Pressman, 2015)(R. Pressman, 2015). This model was chosen because the project requirements were clearly defined from the outset and relatively stable throughout development.

3.1 Object of Study

OSDIG Store is a Yogyakarta-based business that provides service and repair solutions specifically for Apple devices such as iPhones, iPads, and MacBooks. Prior to system development, data collection was carried out through field observation, interviews with store operators, and questionnaires distributed to customers. These instruments aimed to identify the store's operational problems and user expectations for a service system.

3.2 Data Collection Techniques

Three techniques were employed to gather system requirements:

- Observation, to understand daily workflows and bottlenecks in manual service tracking.
- Interviews, to gather insights from store administrators regarding service entry, inventory, and transactions.
- Questionnaires, to explore customers' preferences, especially regarding real-time repair tracking and transparency.

3.3 System Design

The system design stage included use of Unified Modeling Language (UML) tools such as Use Case Diagrams, Activity Diagrams, and Entity-Relationship Diagrams (ERD). These diagrams were created to define system actors, processes, and data relationships clearly. Additionally, the system architecture was designed based on MVC (Model-View-Controller) principles using the CodeIgniter framework.

3.4 Implementation

The system was implemented using PHP (CodeIgniter) for the backend, MySQL as the database, and HTML/CSS/JavaScript for the frontend. The system runs on a local web server using XAMPP during the development and testing phase.

3.5 Testing and Evaluation

Functional testing was performed using the Black Box testing method, which checks whether system outputs match expected results without examining internal logic (Supriyono, 2020). In addition, usability evaluation was carried out using the User Experience Questionnaire (UEQ), a standardized tool designed to measure six dimensions of user experience: attractiveness, perspicuity, efficiency, dependability, stimulation, and novelty (Schrepp et al., 2014).

Results and Discussion

This section presents the outcomes of the development and evaluation processes of the smartphone repair service information system implemented at OSDIG Store. The discussion is divided into three sub-sections: system implementation, functional testing, and user experience evaluation.

4.1 System Implementation

The information system was developed using the CodeIgniter framework (PHP) and MySQL as the relational database. The system comprises several modules, including customer data management, repair order entry, spare part inventory, repair tracking, and transaction recording.To ensure comprehensive system design, the development process began with modeling system requirements using Unified Modeling Language (UML). The Use Case Diagram (see Figure 1) describes the interaction between the actors (Admin and User) and the system. The diagram outlines key functionalities such as creating repair orders, updating repair statuses, viewing customer information, and managing inventory.

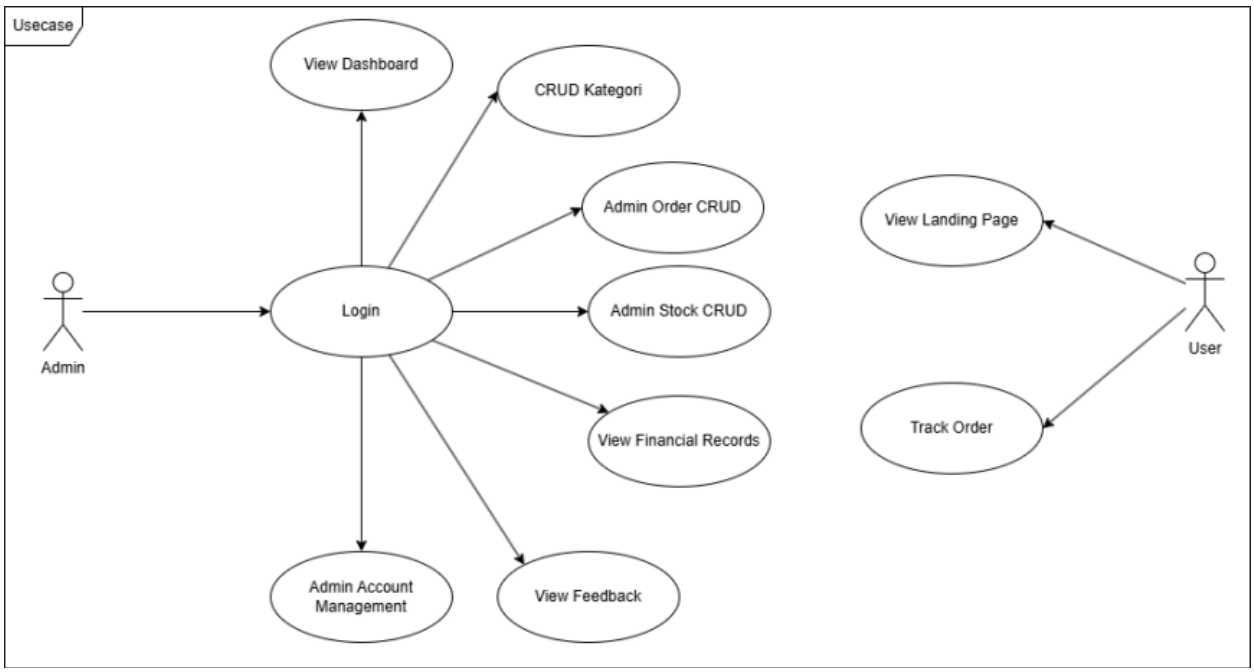

Figure 1. Use Case Diagram of the Repair Service System

The Activity Diagram (Figure 2) illustrates the flow of repair service processes, starting from customer registration, device diagnosis, repair execution, to payment and pickup. It serves to validate the business process logic and identify potential bottlenecks.

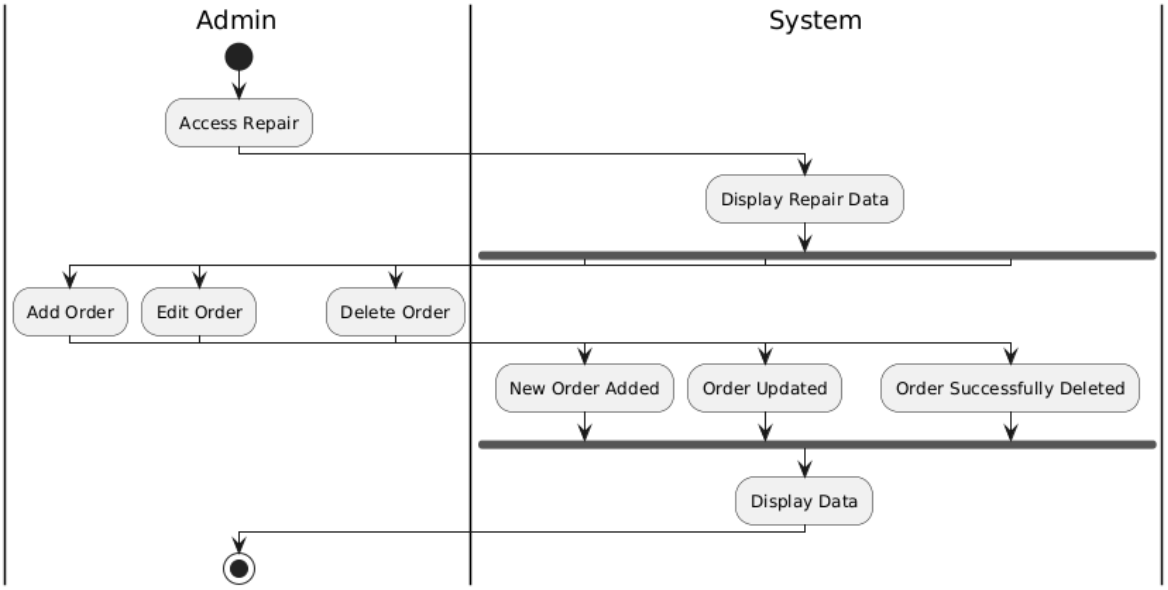

Figure 2. Activity Diagram of Repair Workflow

A detailed Entity Relationship Diagram (ERD) (Figure 3) was created to map the data structure of the system, covering entities such as customers, technicians, repair orders, items, and transactions. This ERD guided the implementation of the database schema.

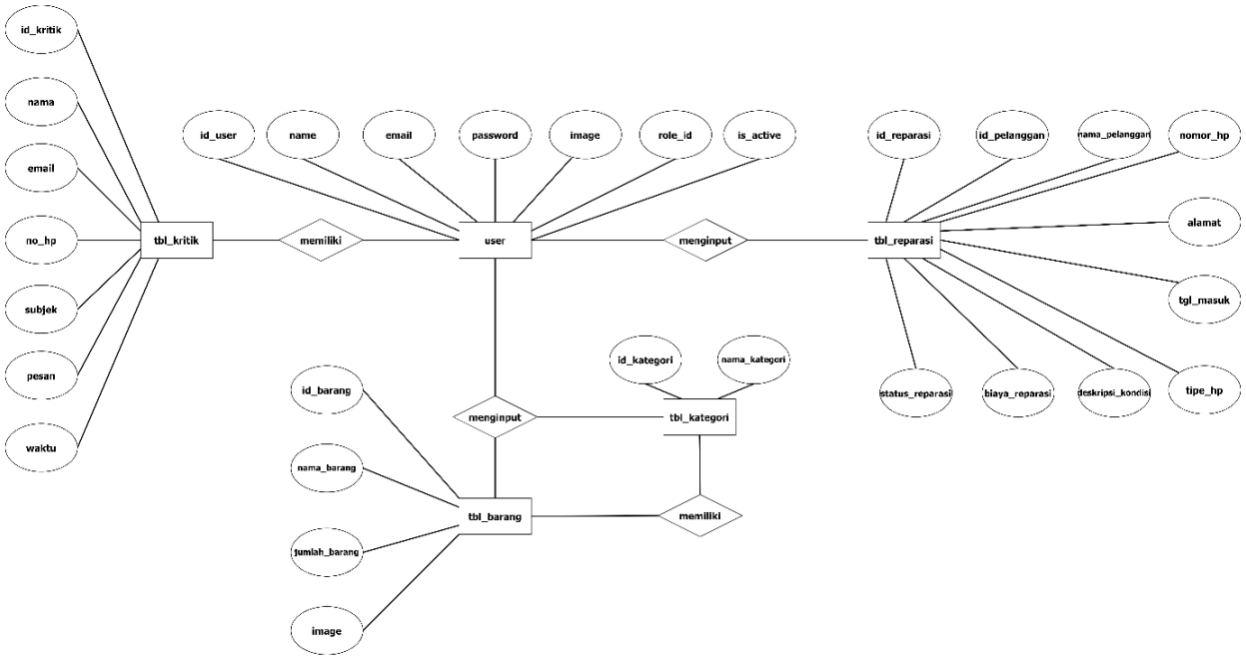

Figure 3. Entity Relationship Diagram

In terms of interface design, the system provides a clean and user-friendly dashboard for administrators and technicians. Key features include:

- A real-time repair order list with status tracking
- Inventory management for spare parts and tools
- Transaction summary with printable receipts
- A public-facing repair status check page accessible using a repair ID

The administrator interface (see Figure 4) features a dashboard that summarizes key metrics such as active repair jobs, available inventory, and pending payments. The dashboard also includes access points to modules such as customer registration, service entry, inventory control, and transaction history. The interface was designed with usability and clarity in mind to facilitate daily operational use by non-technical staff.

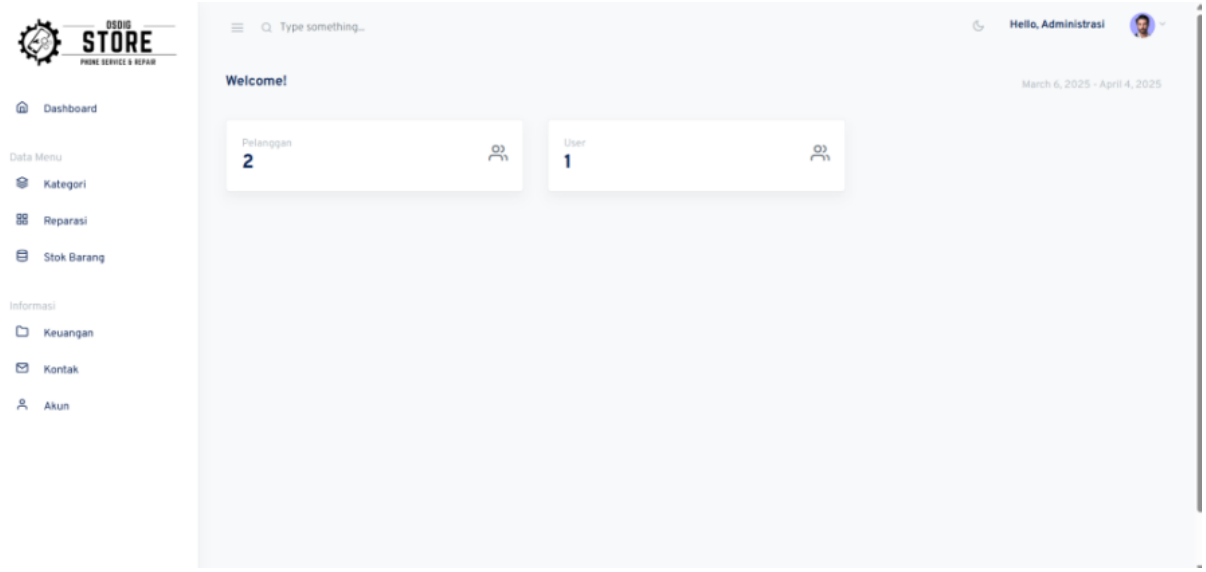

Figure 4. Admin Dashboard Interface

For customers, a simple web page is provided to check the status of their repair orders using a unique repair ID (see Figure 5). This feature increases transparency by allowing customers to independently verify the progress of their service request without needing to contact store personnel directly.

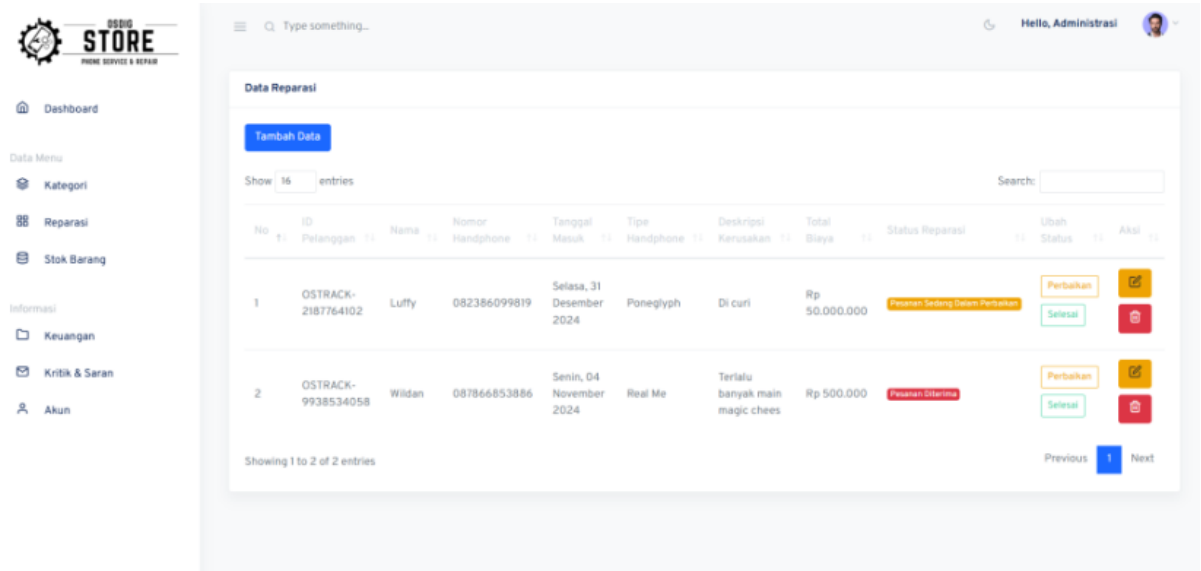

Figure 5. Customer Repair Status Tracking Page

These implementations aim to digitize the previously manual processes used by OSDIG Store, enhancing efficiency, reducing data loss, and improving service transparency.

4.2 Functional Testing

To verify whether the system functions as expected, Black Box Testing was conducted. Each major feature was tested using input–output validation, without accessing internal code structures (Desyani et al., 2022). Table 1 summarizes the results of the functional testing. All modules, including customer registration, repair order entry, repair status updates, inventory operations, and invoice generation, passed the tests successfully.

Table 1. Summary of Black Box Functional Testing Results

No.	Feature Tested	Expected Output	Result	Status
1	User Login	Redirect to dashboard upon correct credentials	As Expected	Passed
2	Customer Data Entry	Data saved and shown in customer list	As Expected	Passed
3	Repair Order Creation	Order recorded, appears in repair list	As Expected	Passed
4	Repair Status Update	Status changes reflected in system	As Expected	Passed
5	Inventory Item Addition and Update	Items appear and can be updated in stock table	As Expected	Passed
6	Transaction Recording and Invoice Printing	Transaction saved and printable invoice generated	As Expected	Passed
7	Repair Status Tracking by Customer (Public)	Status displayed correctly based on Repair ID	As Expected	Passed
8	Logout Function	User redirected to login page	As Expected	Passed

Each function yielded the expected outputs when provided with valid inputs. For example, creating a new repair order resulted in an entry in the repair table, which could then be tracked by both admin and customer. Invalid or incomplete inputs were handled using appropriate error messages, preventing system failure or data corruption. This confirms that the developed system fulfills the basic functional requirements defined during the requirement analysis phase.

4.3 User Experience Evaluation

To evaluate system usability and user satisfaction, the User Experience Questionnaire (UEQ) was administered to a sample of five users: three store staff and two test customers. The UEQ consists of 26 items grouped into six dimensions: Attractiveness, Perspicuity, Efficiency, Dependability, Stimulation, and Novelty (Schrepp et al., 2014). The results of the UEQ evaluation are shown in Table 2 and visualized in Figure 6.

Table 2. Average UEQ Scores for Each Dimension

No.	UEQ Dimension	Mean Score	Variance	Interpretation
1	Attractiveness	1.683	1.47	Positive
2	Perspicuity	1.775	0.82	Positive
3	Efficiency	1.888	0.51	Strong Positive
4	Dependability	1.563	0.47	Positive
5	Stimulation	1.163	0.86	Moderate Positive
6	Novelty	1.150	0.75	Moderate Positive

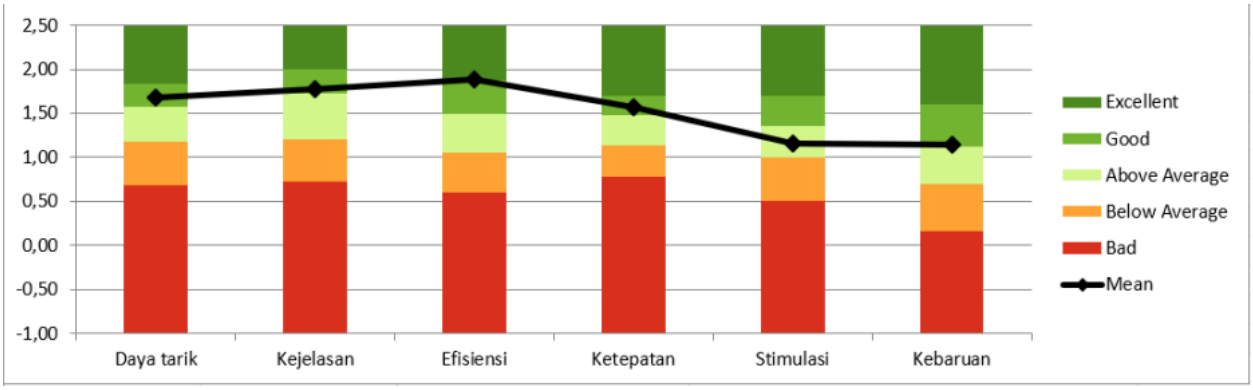

Figure 6. UEQ Benchmark Comparison Graph

The system's usability was assessed using the User Experience Questionnaire (UEQ), which evaluates six dimensions of user experience on a scale from −3 (most negative) to +3 (most positive). Table 2 presents the mean scores and variances obtained from five respondents, comprising both administrative users and test customers.

As shown in Table 2, the Efficiency dimension received the highest mean score of 1.888, indicating that users perceived the system as highly effective in helping them complete tasks with minimal effort. Perspicuity (1.775) and Attractiveness (1.683) also received strong positive ratings, suggesting that the interface was easy to understand and visually appealing.

The Dependability dimension, which reflects perceived security and consistency, scored 1.563, indicating that users felt the system behaved predictably and reliably. Stimulation (1.163) and Novelty (1.150) received slightly lower scores, reflecting that while the system was engaging, its features and design were seen as more conventional rather than innovative.

Overall, all dimensions scored well above the neutral threshold (0.8), indicating that users had a positive perception of the system across functional and emotional aspects. These results suggest that the system is not only operationally effective but also aligns well with user expectations in terms of usability and satisfaction. Overall, the UEQ results suggest that the system offers a positive user experience in terms of usability, effectiveness, and aesthetic appeal.

4.4 Discussion

The implementation of the web-based repair service system at OSDIG Store successfully addressed the issues identified during the initial problem analysis. Previously, the store relied on manual note-taking and informal communication channels, which frequently led to data inconsistency, missing records, and inefficient tracking. The digital system introduced structured workflows, centralized data storage, and real-time tracking, significantly improving the store's service quality.

From a technical perspective, the use of the Waterfall model proved effective for this project. Each phase was executed in order, ensuring that requirement specifications were fully understood before moving to design and implementation. This aligns with previous findings that Waterfall remains a viable choice for small-scale projects with fixed requirements (Kollmorgen et al., 2024).

The inclusion of UEQ in the evaluation process adds a novel aspect compared to similar systems reported in prior studies, many of which only assess functional performance (Khanza Pangestu et al., 2023). By measuring user perception across multiple experience dimensions, this study presents a more holistic view of the system's success.

Despite these strengths, limitations remain. The evaluation sample size was relatively small, and the system has not yet been deployed on a live web server. Future work may include cloud deployment, role expansion (e.g., cashier), and integration with digital payment gateways.

Conclusion

This study has developed and evaluated a web-based information system designed to support the smartphone repair operations of OSDIG Store, a microbusiness specializing in Apple device servicing. By applying the Waterfall development model, the system was built in a structured manner, encompassing customer management, repair tracking, inventory control, and transaction recording. Functional validation through Black Box testing confirmed that the system meets expected performance standards. Additionally, the usability assessment using the User Experience Questionnaire (UEQ) demonstrated positive user perception across key dimensions such as efficiency, attractiveness, and dependability.

The practical contribution of this research lies in its real-world applicability to the workflow of an operating SME, making it a concrete implementation rather than a prototype-only solution. The integration of structured software engineering practices with usability evaluation provides a balanced approach to both functionality and user-centered design. Future enhancements may include cloud-based deployment, integration with payment gateways, and expansion of user roles. Broader user testing and longitudinal studies could also help assess the system's adaptability over time and in different business contexts.

References

Al-Pratama, A., Faroqi, A., & et al. (2022). Evaluation of User Experience in Integrated Learning Information Systems Using UEQ. *Journal of Information Systems and Informatics*, *4*(4), 1020–1030.

Desyani, T., Ramadhan Chaniago, R., Iswanto, H., Suroso, E., & Surya Hermanto, T. (2022). Pengujian Aplikasi Sistem Informasi Akademik Berbasis Website Menggunakan Teknik Equivalence Partitioning dan Metode Black Box. *Jurnal Informatika Universitas Pamulang*, *7*(1), 2622–4615.

Halim, F., & Suwandy, R. (2023). Evaluasi User Engagement dan User Experience pada Aplikasi Satu Sehat. *Journal of Information System Research (JOSH)*, *5*(1). https://doi.org/10.47065/josh.v5i1.4346

Hidayati, N., & Sismadi, S. (2020). Application of Waterfall Model In Development of Work Training Acceptance System. *INTENSIF: Jurnal Ilmiah Penelitian Dan Penerapan Teknologi Sistem Informasi*, *4*(1), 75–89. https://doi.org/10.29407/intensif.v4i1.13575

Irwansyahputra, M., & Khairot, F. (2025). *Digital Transformation: The Role of Information Systems in Enhancing Efficiency*. *3*(2), 41–45.

Jason, N., Santos, G., Jansen, P., Magcalas, P., Roosevelt, V., Siy, L., & Venes, R. P. (2019). DEVELOPING A REPAIR MANAGEMENT SYSTEM WITH AN INTEGRATED PARTS INVENTORY STOCK HANDLING SYSTEM THROUGH THE USE OF AGILE METHODOLOGY. *Innovatus*, *2*(1).

Khan, Z., & Biyani, Y. A. (2025). *VEHICLE SERVICE AND REPAIR MANAGEMENT SYSTEM*. *03*, 7435–7437.

Khanza Pangestu, K., Lathif, T., Suryanto, M., & Pratama, A. (2023). User Experience Questionnaire (Ueq) Sebagai Metode Pengukuran Evaluasi Pengalaman Pengguna Virtual Campus Tour Upn. *442 Journal of Information System, Applied, Management, Accounting and Research*, *7*(2).

Kollmorgen, J., Hinderks, A., & Thomaschewski, J. (2024). Selecting the Appropriate User Experience Questionnaire and Guidance for Interpretation: The UEQ Family. *International Journal of Interactive Multimedia and Artificial Intelligence*, *In press*(In press), 1. https://doi.org/10.9781/ijimai.2024.08.005

Nguyen, T. H., Newby, M., & Macaulay, M. J. (2015). Information technology adoption in small business: Confirmation of a proposed framework. *Journal of Small Business Management*, *53*(1). https://doi.org/10.1111/jsbm.12058

Nguyen, T. U. H. (2009). Information technology adoption in SMEs: An integrated framework. *International Journal of Entrepreneurial Behaviour and Research*, *15*(2). https://doi.org/10.1108/13552550910944566

Ohara, M. R., & Astutik, W. S. (2024). *Digital Marketing Innovation and the Role of Information Systems in Enhancing MSME Market Expansion*. *13*.

Popovič, A., Puklavec, B., & Oliveira, T. (2019). Justifying business intelligence systems adoption in SMEs: Impact of systems use on firm performance. *Industrial Management and Data Systems*, *119*(1). https://doi.org/10.1108/IMDS-02-2018-0085

Pressman, R. (2015). Software Engineering Seventh Edition. *Metode Waterfall*.

Pressman, R. S. (2010). Software Quality Engineering: A Practitioner's Approach 7th. In *McGraw-Hill, New York.*

Schrepp, M., Hinderks, A., & Thomaschewski, J. (2014). Applying the user experience questionnaire (UEQ) in different evaluation scenarios. *Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*, *8517 LNCS*(PART 1). https://doi.org/10.1007/978-3-319-07668-3_37

Supriyono. (2020). Software Testing with the approach of Blackbox Testing on the Academic Information System. *International Journal of Information System & Technology*, *3*.