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# VEHICLE REPAIR MONITORING INFORMATION SYSTEM FOR OPERATIONAL VEHICLES AT PT SU

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**Abstract**

Rapid developments in information technology have encouraged companies to improve operational efficiency through the implementation of integrated information systems. In transportation and logistics companies, vehicle maintenance management plays an important role in supporting operational continuity. PT SU currently still uses Microsoft Excel to record and monitor vehicle repairs, resulting in several problems such as data duplication, delays in reporting, difficulties in monitoring repair progress, and the risk of data loss. Therefore, this study aims to design and develop a web-based operational vehicle repair monitoring information system using the Web Engineering method. The development process consists of communication, planning, modeling, construction, and deployment stages. Unified Modeling Language (UML) was used to model system requirements, including use case diagrams and Entity Relationship Diagrams (ERD). The system was developed using PHP, MySQL, and Apache server through XAMPP. The developed system provides several features, including vehicle data management, repair requests, repair status monitoring, repair reports, and repair history management. System testing was conducted using black-box testing, performance testing, usability testing, and User Acceptance Testing (UAT). The testing results showed that all system functions operated properly according to user requirements. Performance testing indicated that the average response time was below 3 seconds, while usability testing showed positive results with ease of use reaching 90% and monitoring effectiveness reaching 92%. The developed system successfully improved repair data management, reporting efficiency, monitoring transparency, and coordination between departments at PT SU.

**Keywords**: information systems; monitoring; vehicle repair; web engineering; web-based.

## 1. INTRODUCTION

Rapid developments in information technology have encouraged companies to improve operational efficiency, data accuracy, and transparency through the implementation of information systems [1]. In transportation and logistics companies, operational vehicle maintenance management is one of the important factors that determines the continuity of business processes. Vehicle damage that is not handled properly can cause delays in distribution activities, increased operational costs, and decreased company productivity.

PT SU currently still uses Microsoft Excel to record and monitor operational vehicle repairs. This manual recording process often causes several problems, such as data duplication, delays in repair reporting, difficulties in monitoring repair status, and the risk of data loss[2], [3]. In addition, the manual process also complicates coordination between mechanics, administrators, and management because repair information cannot be accessed directly in real time.

Several previous studies have discussed the implementation of web-based vehicle monitoring systems, [4] developed a truck maintenance information system that improved maintenance recording efficiency and accelerated reporting processes, [5] implemented a web-based operational vehicle monitoring system using the Extreme Programming method, which successfully improved monitoring effectiveness, [6] explained that real-time vehicle monitoring systems based on cloud computing can improve operational control and decision-making processes in logistics companies. Meanwhile. [7], stated that computerized repair recording systems are able to minimize recording errors and improve maintenance management.

Although previous studies have shown that web-based monitoring systems can improve operational efficiency, most studies only focus on system development and feature implementation. Research discussing the integration of monitoring systems with operational decision-making, repair tracking transparency, and repair history management in operational vehicle environments is still limited. In addition, several previous studies have not comprehensively discussed user evaluation and system testing results.

Therefore, this study aims to design and develop a web-based operational vehicle repair monitoring information system at PT SU using the Web Engineering method. The system is expected to improve repair data management, accelerate reporting processes, support real-time monitoring, and assist management in making operational decisions more effectively and accurately. This study contributes by integrating repair monitoring, repair history management, and operational reporting into a centralized system that can be accessed in real time by administrators, mechanics, and management. In addition, the developed system emphasizes transparency in the repair process, systematic documentation of maintenance history, and comprehensive system testing to evaluate functionality and usability. The proposed system provides features such as repair data management, repair status tracking, reporting dashboards, and maintenance history recording, which are expected to reduce manual recording errors, improve coordination among departments, and enhance the efficiency of operational vehicle maintenance management at PT SU.

## 2. RESEARCH METHODS

The method used in this study is Web Engineering, which is a systematic approach to web-based application development through the stages of communication, planning, modeling, construction, and deployment [8]. During the system design phase, the Unified Modeling Language (UML) was used to model system requirements, such as use case diagrams, activity diagrams, and class diagrams [9], [10], [11].

### 2.1. Research Design

This study applies the Web Engineering method to develop a web-based information system for monitoring vehicle repairs at PT. SU. The Web Engineering approach is widely used due to its structured and systematic development proces. The research begins with problem identification, where the existing system still uses Microsoft Excel, resulting in inefficiencies and data inaccuracies. The research stages are carried out systematically from problem identification to system implementation, ensuring that the proposed system meets user requirements and operational needs.

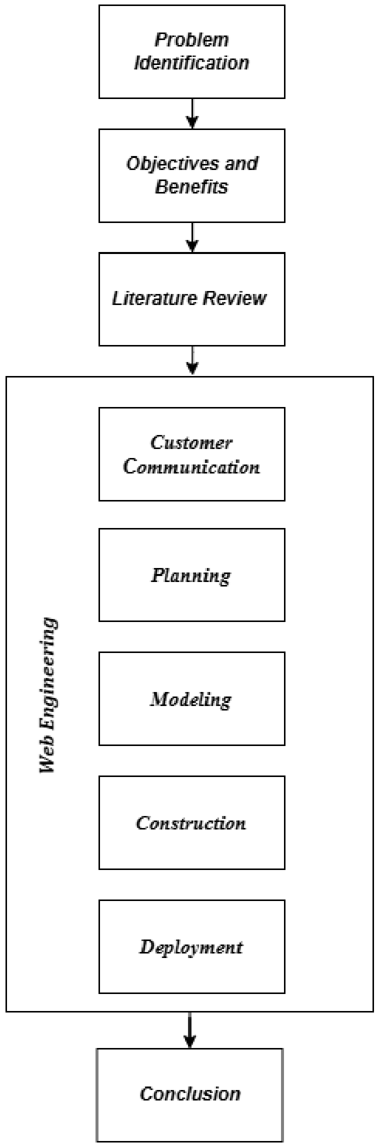


Figure 1. Research Stages

### 2.2. System Development Method

This study employs the Web Engineering methodology as a systematic approach for developing a web-based information system. This method is selected due to its capability to provide a structured development process, ensuring system quality, maintainability, and alignment with user requirements. The development process consists of five main phases [12]–[15].

1. Customer Communication, At this stage, system requirements were gathered through observation and interviews. Observations at PT SU revealed that vehicle repair tracking and monitoring were still being conducted using Microsoft Excel, leading to challenges such as difficulty in monitoring status, delayed reports, and potential recording errors. Interviews with mechanics and administrative staff revealed that the required system must be capable of recording vehicle data, managing the repair process, and displaying repair status in real-time.
2. Planning, During the planning phase, the steps for system development are determined through an analysis of both functional and non-functional requirements. Functional requirements include vehicle data management, repair requests and follow-ups, status monitoring, and report generation. Meanwhile, non-functional requirements include a web-based system accessible online, security through login, and a user-friendly interface. Additionally, during this phase, a development schedule is established, and potential risks are identified, such as data entry errors and technical challenges during the implementation process.
3. Modeling, is conducted to represent the system design using Unified Modeling Language (UML). Various diagrams, such as use case, activity, sequence, and class diagrams, are utilized to describe system

functionality, workflow, data structures, and interactions between system components. This phase serves as a blueprint for system development.

4. Construction, involves the implementation of the system based on the design specifications. The system is developed using PHP as the programming language, MySQL as the database management system, and Apache server through XAMPP. In addition, the user interface is designed to ensure usability and accessibility for different types of users.
5. Deployment, includes system implementation in the operational environment, followed by testing and evaluation. This phase ensures that the system performs according to its intended functionality and meets user requirements. Feedback obtained during this stage is used for further system improvement and refinement.

## 3. RESULTS AND DISCUSSION

### 3.1. System Implementation Results

A web-based vehicle maintenance monitoring information system was successfully developed using Web Engineering methods. This system is designed to facilitate the structured recording, monitoring, and reporting of vehicle repairs.

The developed system has four main user types: admin, chief mechanic, mechanic and manager. Each user has different access rights according to operational needs.

Key features available in the system include:

a. Vehicle data management
b. Mechanic and driver data management
c. Vehicle repair requests
d. Repair follow-up process
e. Repair status monitoring
f. Repair reports and history

With these features, processes that were previously performed manually are now more integrated and easier to control.

### 3.2. System Design (UML)

This section presents the results of the system design using UML as the basis for system development.

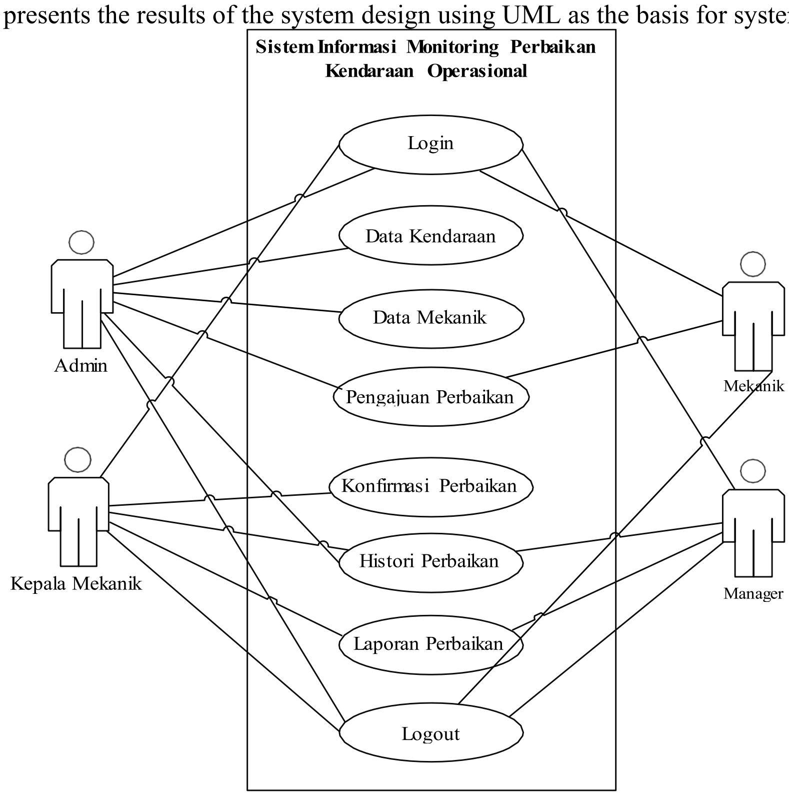


Figure 2. Use Case Diagram of Proposed System

Explanation of Figure 2:

The use case diagram illustrates how the proposed system supports operational activities at PT SU. The system involves four main actors, namely administrator, chief mechanic, mechanic, and manager, each of whom has different responsibilities according to company business processes.

a. The administrator is responsible for managing master data such as vehicle data, mechanic data, and user accounts. This function helps ensure that operational data is stored centrally and can be accessed consistently by all related departments.
b. The chief mechanic and mechanics use the system to input repair requests, update repair progress, and confirm repair completion status. Through this mechanism, every repair activity can be monitored directly without relying on manual communication or paper-based reports.
c. Managers use the monitoring and reporting features to supervise repair activities and evaluate vehicle conditions. The dashboard and reporting features enable management to identify repair delays, monitor vehicle availability, and make operational decisions more quickly based on current repair data.

Thus, the use case diagram not only describes system functionality but also reflects the operational workflow of vehicle maintenance activities at PT SU.

### 3.3. Database Design (Entity Relationship Diagram)

The database design is developed using an Entity Relationship Diagram (ERD) to represent the structure and relationships between data entities in the system. The ERD is used to ensure that the data is organized systematically and supports the system's functional requirements. The main entities in the system include vehicle, mechanic, repair data, and user. Each entity is interconnected to support the process of recording, monitoring, and reporting vehicle repairs. The relationships between these entities are designed to minimize data redundancy and ensure data consistency. The ERD of the proposed system is shown in Figure 3.

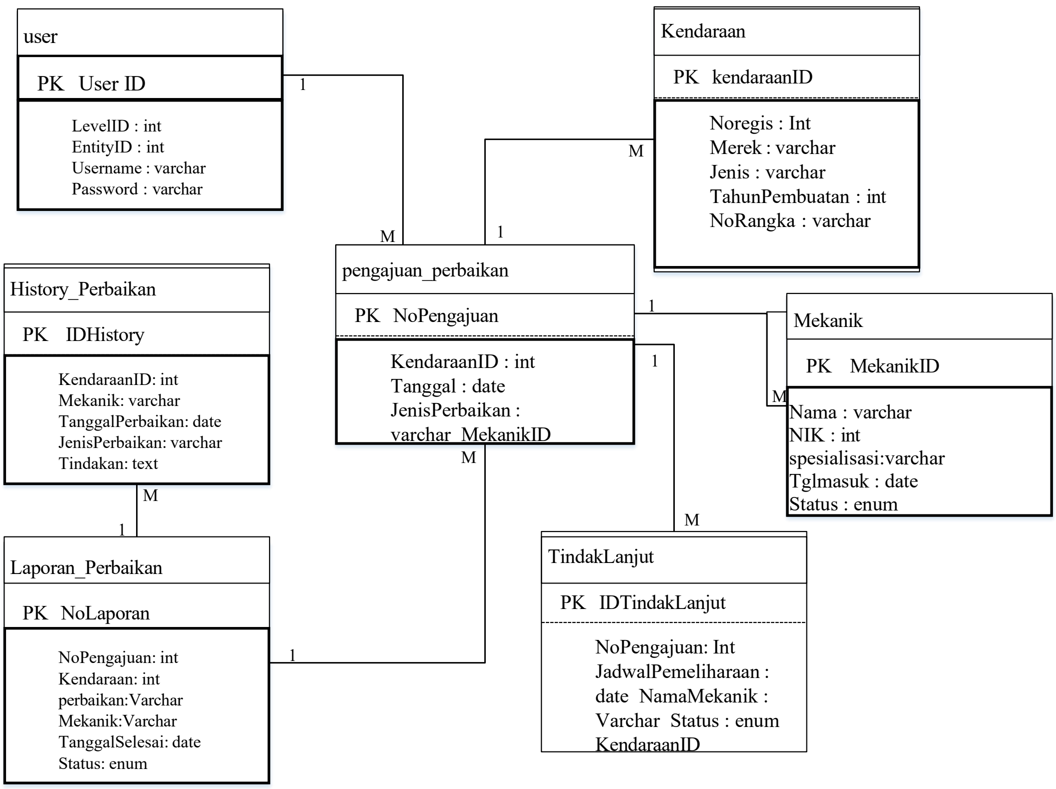


Figure 3. Entity Relationship Diagram of the System

Explanation of Figure 3:

The Entity Relationship Diagram (ERD) is designed to support the operational vehicle repair process at PT SU by integrating all repair-related data into a centralized database system.

a. The vehicle entity becomes the core entity because every repair activity is associated with a specific operational vehicle. This relationship allows the company to track the repair history and maintenance status of each vehicle systematically.

b. The repair submission and follow-up entities are used to record repair requests and repair handling activities performed by mechanics. Through this relationship, the system can monitor the progress of repairs from submission to completion.

c. The mechanic entity stores mechanic information and is connected to repair activities to ensure accountability for every maintenance process performed. Meanwhile, the repair history entity stores completed repair records, allowing management to evaluate vehicle performance, repair frequency, and maintenance effectiveness over time.

This database structure supports operational activities at PT SU by reducing data redundancy, improving data consistency, and simplifying repair monitoring and reporting processes.

### 3.4. System Interface Implementation

This section describes the interface of the system that has been developed.

a. The login page serves as the entry point to the system. Users must enter their username and password according to their respective access rights.

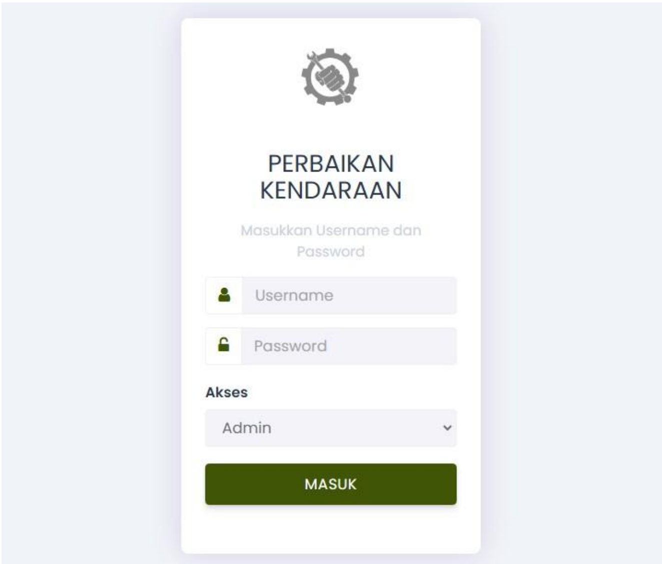


Figure 4. login page

b. The dashboard displays a summary of vehicle data, the number of repairs, and the vehicle's status. This page helps users view the overall condition of the system.

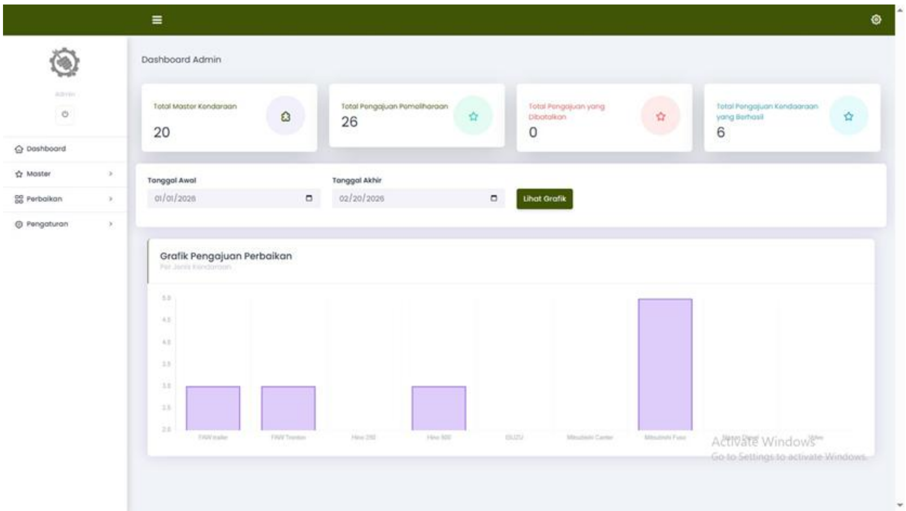


Figure 5. System Dashboard

c. The monitoring page is used to track the progress of vehicle repairs. The repair status is displayed in real time, making it easy to monitor.

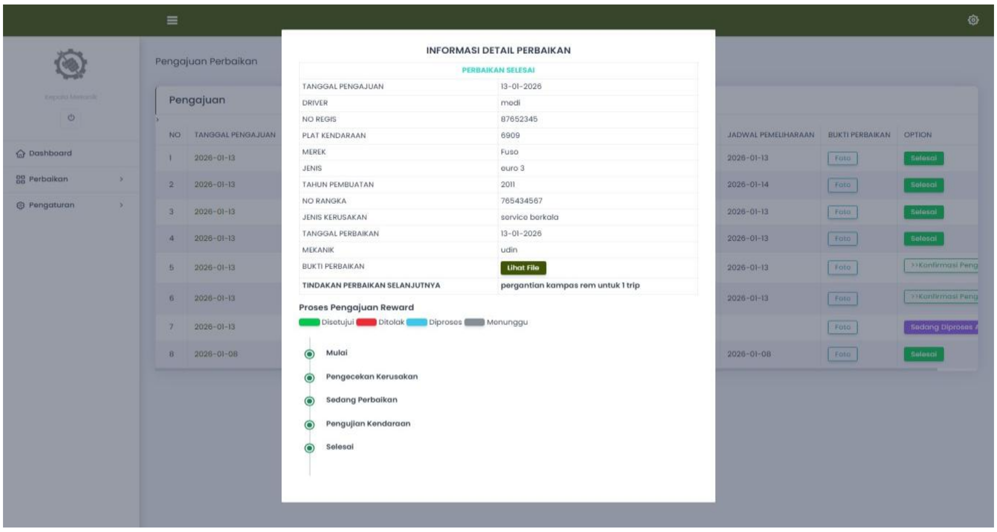

Figure 6. Repair Tracking Page

d. Repair Report Page

The report page displays data on vehicle repairs that have been performed. This report can be used by management for evaluation purposes.

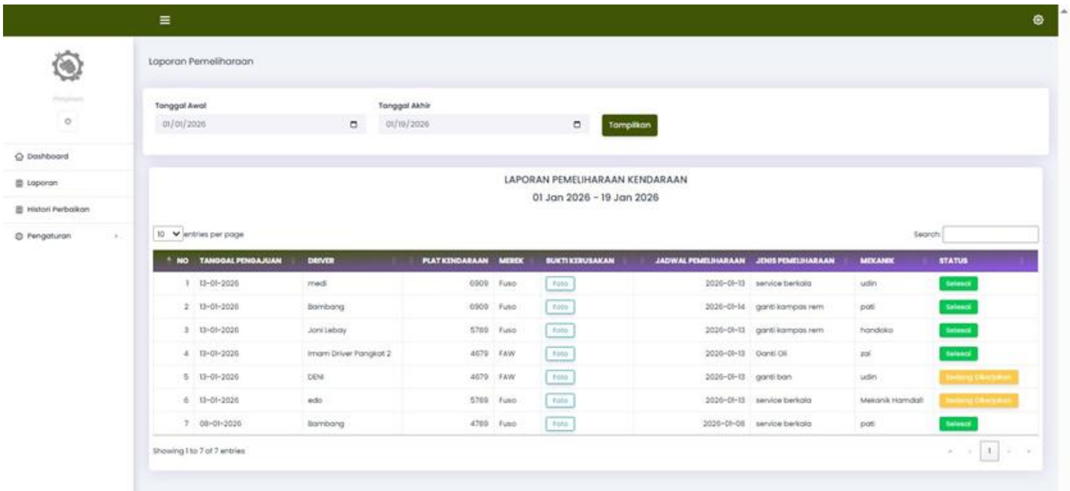

Figure 7. Repair Report Page

## 3.5. System Testing

System testing was conducted to ensure that the developed system operated properly according to user requirements. The testing process included black-box testing, performance testing, and usability testing. These tests were carried out to evaluate system functionality, system performance, and user convenience in operating the application.

a. Black-Box Testing

Black-box testing was conducted to verify whether each system feature functioned correctly based on the expected output. The testing focused on the main functionalities of the system without examining the internal program code.

Table 1. Black-Box Testing Results

| No | Feature Tested | Expected Result | Test Result |
|---|---|---|---|
| 1 | Login | User can log in successfully | Valid |
| 2 | Vehicle Data Management | Vehicle data can be added and updated | Valid |
| 3 | Repair Submission | Repair data can be stored properly | Valid |
| 4 | Repair Monitoring | Repair status can be displayed correctly | Valid |
| 5 | Report Generation | Repair reports can be generated automatically | Valid |

Based on the black-box testing results, all system functions operated successfully according to system requirements. The testing results indicate that the developed system is capable of supporting operational activities effectively without significant functional errors.

b. Performance Testing

Performance testing was conducted to measure the response time of the system during operation. This testing aimed to ensure that the system could process requests efficiently under normal operating conditions.

Table 2. System Response Time Results

| Activity | Average Response Time |
|---|---|
| Login Process | 1.2 seconds |
| Open Dashboard | 1.8 seconds |
| Save Repair Data | 2.1 seconds |
| Generate Report | 2.5 seconds |

The testing results showed that the average response time of the system was below 3 seconds. This indicates that the system performs efficiently and is capable of supporting operational activities in a responsive manner.

c. Usability Testing

Usability testing was conducted to evaluate the ease of use and user experience when operating the system. The testing involved several users consisting of administrators, mechanics, and managers.

Table 3. Usability Testing Results

| Evaluation Aspect | Percentage |
|---|---|
| Ease of Use | 90% |
| Interface Appearance | 88% |
| Monitoring Effectiveness | 92% |
| Reporting Efficiency | 89% |

Based on the usability testing results, most users stated that the system was easy to understand and operate. The monitoring and reporting features were considered helpful in supporting repair management activities and improving work efficiency.

### 3.6. User Acceptance Testing (UAT)

User Acceptance Testing (UAT) was conducted to evaluate user satisfaction and ensure that the developed system met operational requirements at PT SU. The testing involved 10 respondents consisting of administrators, mechanics, chief mechanics, and managers.

The evaluation was carried out using a questionnaire based on several aspects, including ease of use, interface appearance, system functionality, monitoring effectiveness, and reporting efficiency.

The UAT results showed that:

1. 90% of users stated that the system was easy to use,
2. 88% stated that the monitoring features helped accelerate repair supervision,
3. 92% agreed that the reporting feature simplified report generation,
4. 89% stated that the system improved coordination between departments.

Based on these results, it can be concluded that the developed system has been well accepted by users and is capable of supporting operational activities more effectively.

### 3.7. Discussion

Based on the implementation results, the developed system provides significant improvements compared to the previous manual recording system used at PT SU. Previously, repair data was stored separately using Microsoft Excel files, which often caused data duplication, reporting delays, and difficulties in monitoring repair progress. Through the developed system, all repair data is now stored centrally in a database, making data management more structured and consistent[2]. The implementation of the monitoring feature also improves operational efficiency because repair status can be updated and accessed in real time. This allows administrators, mechanics, and managers to monitor repair progress directly without waiting for manual reports[4]. As a result, coordination between departments becomes faster and more effective.

In terms of reporting, the automatic report generation feature reduces the time required to prepare repair reports and minimizes human error during data recapitulation[1]. The system also improves transparency because management can monitor repair activities and vehicle conditions more accurately.

From the operational perspective, the developed system helps reduce delays in maintenance reporting and improves decision-making processes related to operational vehicle availability. The availability of repair history data also supports evaluation activities and preventive maintenance planning.

The testing results indicate that all system functions operate properly according to user requirements. Black-box testing showed that all features ran successfully, while usability testing demonstrated that users were able to operate the system effectively. These findings are consistent with previous studies that stated web-based monitoring systems can improve operational efficiency and monitoring effectiveness [6].

## 4. CONCLUSION

Based on the results of this study, it can be concluded that the web-based operational vehicle repair monitoring information system developed using the Web Engineering method was successfully implemented and able to support vehicle maintenance management activities at PT SU more effectively. The developed system integrates repair data management, repair monitoring, reporting, and maintenance history into a centralized database system that can be accessed in real time by administrators, mechanics, chief mechanics, and managers. The implementation results showed significant improvements compared to the previous manual recording system using Microsoft Excel, particularly in reducing data duplication, accelerating reporting processes, improving coordination between departments, and increasing transparency in monitoring repair progress. The testing results also demonstrated that the system operated properly according to functional requirements. Black-box testing confirmed that all features worked successfully, while performance testing showed that the system response time remained efficient with an average response time below 3 seconds. In addition, usability testing and User Acceptance Testing (UAT) indicated that most users considered the system easy to use and effective in supporting operational activities. Therefore, the developed system can assist management in making operational decisions more accurately and efficiently.

Future research can further develop the system by integrating mobile applications to support repair monitoring through smartphones and implementing notification features using email or instant messaging services. In addition, the integration of Internet of Things (IoT) technology and GPS tracking can be explored to support real-time vehicle condition monitoring and predictive maintenance. Future studies may also apply data analytics or machine learning techniques to analyze repair history data and predict potential vehicle damage, thereby improving preventive maintenance planning and operational efficiency.

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