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Implementation of the Economic Order Quantity Method in a Web Based Spare Part Inventory Information System

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Jaya Muncul Spare Parts Store still uses a manual recording system which often causes errors in stock management and delays in ordering. This study aims to design and build a web based inventory information system using the Economic Order Quantity (EOQ) method to assist in decision making for ordering spare parts. The system was developed with the Laravel framework and MySQL database using an Agile approach that allows an iterative development process. Blackbox testing results show that all functions run well, while the User Acceptance Test (UAT) obtained an average score of 89.97% in the "very good" category. The implementation of the EOQ method is proven to help make purchasing decisions, reducing the risk of stockouts and overstock. Integration of the Reorder Point (ROP) feature as a minimum notification, Safety Stock, and prediction of prices, demand, and stock of goods with Simple Moving Average (SMA). This system is considered effective as a tool to determine the number of purchases of goods at Toko Sparepart Jaya Muncul.
Keywords: Inventory System, Inventory Management, Economic Order Quantity, Laravel, Spare Parts Store.

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1. Introduction

In the digital era, industrial development has undergone a significant transformation with the increasing use of technology based systems in inventory management. Spare part stores, both those operating physically and online, face challenges in managing stock efficiently in order to meet customer demand without experiencing overstocking or stockouts. According to a study by [1], the implementation of the EOQ method has been proven to optimize order quantities, reduce storage costs, and improve operational efficiency. In addition, the use of website based systems in inventory management has provided convenience in monitoring and controlling stock in real time [2].

Although the EOQ method has been widely applied in various industries, many retail stores still rely on manual recording systems that are prone to human error and inefficiencies in the ordering and stock storage processes [3]. Several studies show that the use of the EOQ method combined with web based systems can increase inventory management accuracy by up to 20% compared to conventional systems [4].

This limitation reveals an important research gap. Previous studies have rarely integrated multiple inventory management methods including Economic Order Quantity (EOQ), Safety Stock, Reorder Point (ROP), and Simple Moving Average (SMA) forecasting within a single web based decision support system. Consequently, existing systems provide limited support for comprehensive inventory planning, particularly in anticipating demand fluctuations while simultaneously determining optimal ordering policies and reorder timing [5].

Toko Sparepart Jaya Muncul represents this practical challenge. Inventory is still managed manually using notebooks and simple documents, while stock levels are monitored directly by the store owner without computerized support. As a result, the store frequently experiences inventory imbalances, with excessive stock accumulation for slow moving items and stock shortages for products with high customer demand. These conditions reduce operational efficiency and negatively affect customer service [6].

To address these limitations, this study develops a website based inventory management system that integrates EOQ, Safety Stock, Reorder Point (ROP), and Simple Moving Average (SMA) forecasting into a unified decision support platform. Unlike previous studies that focused on a single inventory control technique or merely computerized inventory records, the proposed system combines inventory optimization, safety stock calculation, reorder scheduling, and demand forecasting to support more comprehensive inventory management. Therefore, this study aims to develop and evaluate an integrated inventory management system capable of improving inventory control efficiency, optimizing purchasing decisions, and reducing the risks of stockouts and overstock conditions at Toko Sparepart Jaya Muncul.

2. Methods

Research Design

This study employed a system development research approach using the Agile software development methodology to design, develop, and evaluate a web-based inventory management system for Toko Spare Part Jaya Muncul. The system was designed to integrate the Economic Order Quantity (EOQ), Safety Stock (SS), Reorder Point (ROP), and Simple Moving Average (SMA) methods in order to support inventory planning and purchasing decisions more effectively.

Research Location and Period

The research was conducted at Toko Spare Part Jaya Muncul in Samarinda, Indonesia, from February 2025 until the completion of the study. The study focused on the development and implementation of a web-based inventory management system for automotive spare parts.

Data Sources

This study used both primary and secondary data. Primary data were obtained through direct observation of inventory management activities and semi-structured interviews with the store owner regarding purchasing procedures, lead time, ordering costs, storage costs, and inventory control practices. Secondary data consisted of historical inventory records, purchasing transactions, sales data, and relevant literature related to inventory management methods. The historical demand data used for the EOQ, Safety Stock, Reorder Point, and SMA calculations were taken from the store's inventory records over the analysis period used by the company, namely monthly sales data from the previous 12 months. These data were used as the basis for identifying demand patterns and determining optimal inventory policies.

Data Collection

Data were collected through observation, interviews, and literature review. Observation was conducted to examine the existing inventory management process and identify operational problems in the store. Semi-structured interviews were carried out with the store owner to obtain information about business processes, inventory requirements, and the challenges faced in managing stock. In addition, a literature review was conducted to establish the theoretical foundation for implementing EOQ, Safety Stock, Reorder Point, SMA forecasting, and Agile software development.

System Development Procedure

The system was developed using the Agile methodology through several stages. The first stage was requirement analysis, which was carried out to identify user needs and business processes. The second stage was system design, which involved creating Entity Relationship Diagrams (ERD) and Data Flow Diagrams (DFD). The third stage was system development using the Laravel Framework with the Model–View–Controller (MVC) architecture, MySQL as the database management system, and XAMPP as the local server environment. The fourth stage was system testing using Black Box Testing and User Acceptance Testing (UAT). The fifth stage was system deployment in the operational environment, followed by evaluation and refinement based on testing results and user feedback.

System Implementation Flow

The implementation of the inventory management method in the developed system began with the entry of historical sales and inventory transaction data into the database. After the data were stored, the system calculated future demand using the Simple Moving Average (SMA) method. The forecast demand was then used to calculate the Economic Order Quantity (EOQ). Next, the system calculated Safety Stock based on demand variability and lead time. After that, the Reorder Point (ROP) was determined by combining average demand during lead time with Safety Stock. Based on these calculations, the system automatically generated recommendations for the optimal order quantity and the appropriate reorder timing. Finally, users reviewed the recommendations before placing purchase orders through the web-based system.

System Evaluation

System functionality was evaluated using Black Box Testing, while user satisfaction and system acceptance were assessed using the User Acceptance Test (UAT). These evaluations were conducted to determine whether the developed system met functional requirements and supported effective inventory management.

Ethical Considerations

This research was conducted with permission from the owner of Toko Spare Part Jaya Muncul. Operational data were used exclusively for research purposes, and all business information was treated confidentially throughout the study.

3. Result and Discussion

Needs Analysis

The system requirements analysis was conducted to identify the features that must be available in the web based inventory system to be developed, ensuring that it can effectively resolve the problems faced by Toko Sparepart Jaya Muncul. This analysis was based on direct observation, interviews with the store owner, and a review of transaction documents, including records of incoming goods, outgoing goods, and inventory history. Based on the analysis of the existing system, several main issues were identified:

1. Stock recording is still performed manually using notebooks and Excel files, often resulting in discrepancies between recorded stock and actual physical inventory.
2. There is no implementation of EOQ (Economic Order Quantity) and Reorder Point calculations, causing inventory ordering to rely on estimation rather than efficient and accurate calculations.
3. The preparation of stock and transaction reports is still done manually, making the process time consuming and prone to recording errors.

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System Development

The system development phase is the process of transforming the system design into a functional application. This system was developed using the Laravel framework and Filament as the admin panel, with MySQL as the database. The development process was carried out gradually in accordance with the functional requirements.

Figure 1. Login Page

Figure 2. Dashboard Page

Figure 3. Product Data Page

Figure 4. Purchase Page

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Figure 5. Sales Page

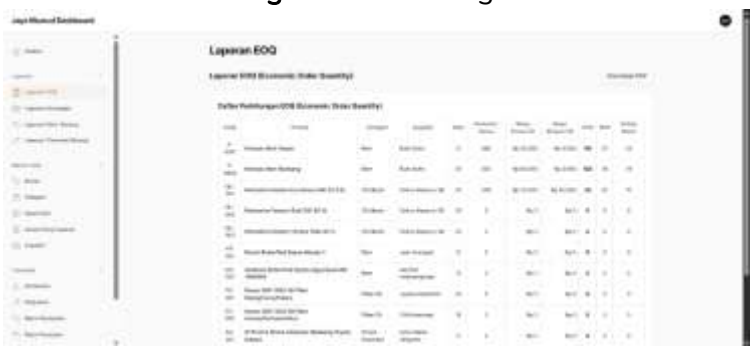

Figure 6. EOQ Report Page

System Testing

System testing is an essential stage in the software development lifecycle aimed at ensuring that all developed functions operate properly, meet user requirements, and are free from logical and interface errors. In this phase, two testing methods were applied: Black Box Testing and User Acceptance Testing (UAT) [7].

Black Box Testing

Black Box Testing was conducted to evaluate the functionality of various features within the developed system, ensuring that each feature operates as expected. This testing focuses on verifying whether system functionalities align with the defined requirements, such as login processes, product data management, transaction processing, EOQ calculations, and report generation.

Table 1. Black Box Testing

No	Function	Success Indicator	Description	
			Yes	No
1	Login	The system can display the login page for users	✓	
2	Dashboard	The system can display the dashboard page	✓	
3	Spare Part Data	The system can display the spare part data page	✓	
	Add Spare Part	The system can add spare part data	✓	
	Edit Spare Part	The system can edit/update spare part data	✓	
	Delete Spare Part	The system can delete spare part data	✓	
4	Purchase Data	The system can display the purchase data page	✓	
	Purchase Information	The system can display detailed purchase data	✓	
	Add Purchase	The system can add purchase data	✓	
	Edit Purchase	The system can edit/update purchase data	✓	
	Delete Purchase	The system can delete purchase data	✓	
5	Sales Data	The system can display the sales data page	✓	
	Sales Information	The system can display detailed sales data	✓	

No	Function	Success Indicator	Description	
			Yes	No
	Add Sales	The system can add sales data	✓	
	Edit Sales	The system can edit/update sales data	✓	
	Delete Sales	The system can delete sales data	✓	
6	Purchase Return Data	The system can display the purchase return data page	✓	
	Add Purchase Return	The system can add purchase return data	✓	
	Edit Purchase Return	The system can edit/update purchase return data	✓	
	Delete Purchase Return	The system can delete purchase return data	✓	
7	Sales Return Data	The system can display sales return data	✓	
	Add Sales Return	The system can add sales return data	✓	
	Edit Sales Return	The system can edit/update sales return data	✓	
	Delete Sales Return	The system can delete sales return data	✓	
8	EOQ Report	The system can display the EOQ report page	✓	
	Print Report	The system can generate reports in PDF format	✓	
9	Financial Report	The system can display the financial report page	✓	
	Report Filter	The system can filter reports (daily, weekly, monthly, and custom dates)	✓	
	Print Report	The system can generate reports in PDF format	✓	
10	Return Report	The system can display the return report page	✓	
	Report Filter	The system can filter return reports (daily, weekly, monthly, and custom dates)	✓	
	Print Report	The system can generate reports in PDF format	✓	
11	Item Transaction Report	The system can display item transaction reports	✓	
	Report Filter	The system can filter transaction reports (daily, weekly, monthly, and custom dates)	✓	
	Print Report	The system can generate reports in PDF format	✓	
12	User Management	The system can display the user management page	✓	
	Add User	The system can add user data	✓	
	Edit User	The system can edit user data	✓	
	Delete User	The system can delete user data	✓	
13	Logout	The system can log out and return to the login page	✓	

Based on the results of Black Box Testing conducted on all features of the inventory system, it can be concluded that all main functions ranging from the login process, master data management, purchase and sales transactions, return handling, EOQ calculations, to report generation operate in accordance with the defined functional requirements. Each test scenario indicates that the system is capable of producing accurate outputs based on the given inputs, with no errors found in either the process flow or the interface [8]. Additionally, supporting features such as report filtering, PDF document generation, and user management function properly and consistently. These results demonstrate that the system meets functional requirements and is ready for implementation, as no functional failures were identified during testing [9].

User Acceptance Test (UAT)

User Acceptance Testing (UAT) was conducted to evaluate the level of user acceptance of the developed system. The participants involved in this testing included the Admin, Cashier, and the Owner of Toko Sparepart Jaya Muncul. The testing process was carried out by allowing users to directly interact with the

system, followed by completing a questionnaire assessing usability, feature completeness, and system usefulness.

Table 2. UAT Table

No	Question	Score				
		1	2	3	4	5
Interface						
1	Is the system interface easy to remember?					
2	Is the system interface user friendly?					
3	Is the system interface clear and easy to understand?					
Information Quality						
4	Is the stock information easy to understand?					
5	Is the EOQ calculation information easy to understand?					
6	Is the information on minimum stock levels accurate and easy to understand?					
System Functionality						
7	Does the system function properly?					
8	Is the system developed according to store needs?					
9	Does the incoming goods (purchase) transaction feature function properly?					
10	Does the outgoing goods (sales) transaction feature function properly?					
11	Does EOQ calculation assist in decision making for spare part inventory?					
12	Can EOQ, Financial, Return, and Transaction reports be displayed and printed (PDF)?					

To facilitate the assessment of the level of agreement with the information presented, each response is assigned a score. This study uses five levels of responses: Strongly Agree (5), Agree (4), Neutral (3), Disagree (2), and Strongly Disagree (1).

Table 3. UAT Scale Value Table

Level of Agreement	Score
Strongly Agree	5
Agree	4
Neutral	3
Disagree	2
Strongly Disagree	1

The questionnaire was developed and distributed to respondents consisting of the store owner, admin, and cashier of Toko Spare Part Jaya Muncul. Based on the analysis, a total of 7 respondents completed the questionnaire, and the calculation was performed using the overall average of all questions. After collecting responses from all participants, further analysis was conducted to evaluate the performance of the developed system.

Table 4. List of Respondents' Answers

Respondent	R1	R2	R3	R4	R5	R6	R7
Q1	4	5	5	5	5	5	4
Q2	4	5	5	4	5	4	4
Q3	4	4	5	5	5	5	4
Q4	5	5	5	5	5	5	4
Q5	3	4	3	3	3	4	3
Q6	4	4	4	4	4	5	4
Q7	4	4	4	4	4	4	4

Respondent	R1	R2	R3	R4	R5	R6	R7
Q8	5	4	4	4	4	4	5
Q9	4	5	3	4	4	4	3
Q10	4	5	5	4	5	4	5
Q11	4	4	4	4	4	4	3
Q12	3	5	5	5	5	5	5

After obtaining respondents' answers, calculations were carried out for each statement item to determine the total score for each aspect by summing all scores from the 7 respondents per aspect. Example Calculation:

$$\text{Total Score (Interface Aspect)} = (4+5+5+5+5+5+4)+(4+5+5+4+5+4+4)+(4+4+5+5+5+5+4)=96$$

Before calculating the final percentage per aspect to determine whether the system falls into a good category, the overall score must first be computed. The final result is then categorized using the Likert scale interval. The interval is calculated as follows:

$$I = \frac{100}{number\ of\ answer\ choices}$$

$$I = \frac{100}{5} = 20$$

Where:
I = Likert scale interval

Table 5. Likert Scale Interval Assessment

Percentage (%)	Category
0% 20%	Very Poor / Very Dissatisfied
20,1% 40%	Poor / Less Satisfied
40,1% 60%	Fair / Moderately Satisfied
60,1% 80%	Good / Satisfied
80,1% 100%	Very Good / Very Satisfied

After determining the Likert interval, the final percentage score for each aspect is calculated to measure the level of user satisfaction with the system. The three evaluated aspects include interface satisfaction, information quality satisfaction, and overall system functionality. The formula used is:

$$\text{Final Score (\%)} = \frac{Total\ Score\ per\ Aspect}{Maximum\ Score} \times 100\%$$

$$\text{Maximum Score} = 5 \times Number\ of\ Questions \times Number\ of\ Respondents$$

Example Calculation:

$$\text{Maximum Score} = 5 \times 3 \times 7 = 105$$

$$\text{Final Score (\%)} = \frac{96}{105} \times 100\% = 91{,}4\%$$

Table 6. Final Score Calculation Results

Aspect	Number of Questions	Total Score	Final Score (%)
Interface Satisfaction	3	96	91,4%
Information Quality Satisfaction	3	94	89,5%
System Functionality Satisfaction	6	187	89%

After obtaining the final results, they are then matched with the Likert scale interval in Table 6 to determine the level of system quality. The results are as follows:

1. The interface satisfaction score of 91.4% falls into the *very good* category, indicating that users are highly satisfied with the system interface implemented in the inventory system at Toko Spare Part Jaya Muncul.
2. The information quality satisfaction score of 89.5% also falls into the *very good* category, showing that users are highly satisfied with the clarity and usefulness of the information provided by the system.
3. The system functionality satisfaction score of 89% is categorized as *very good*, indicating that users are highly satisfied with how well the system functions overall.

These results demonstrate that the developed inventory system has achieved a high level of user acceptance and is considered highly effective in supporting operational activities at Toko Spare Part Jaya Muncul.

System Implementation

We have achieved the desired final results after collaborating with Toko Spare Part Jaya Muncul to complete the evaluation stages. Requirements analysis, development, system testing, and system improvement are part of this evaluation process [10]. To ensure that the solution meets the expectations and requirements of Toko Spare Part Jaya Muncul, the final product incorporates their feedback and comments. As a result, this project can be implemented in the workplace of Toko Spare Part Jaya Muncul. The following is the final display of the web based inventory system with EOQ integration at Toko Spare Part Jaya Muncul.

Owner (Store Owner)

The Owner page is a page that can only be accessed by the store owner to perform all activities in the system. On this page, the store owner can manage spare part data, users, generate and view reports, and perform all other activities within the system [11].

Figure 7. Login

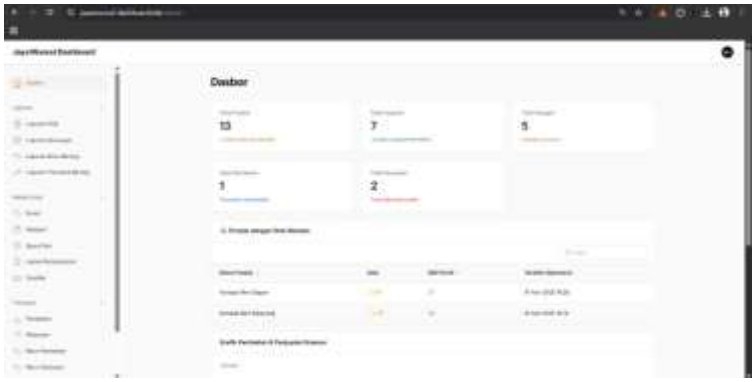

Figure 8. Dashboard

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Figure 9. Spare part

Figure 10. Purchases

Figure 11. Sales

Figure 12. EOQ Report

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Figure 13. Financial Report

Figure 14. Goods Return Report

Figure 15. Goods Transaction Report

Figure 16. Owner User Management

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Admin

The Admin page is a page that can only be accessed by the admin to manage spare part data, purchases, and other activities in the system except for sales and sales returns.

Figure 17. Admin Login

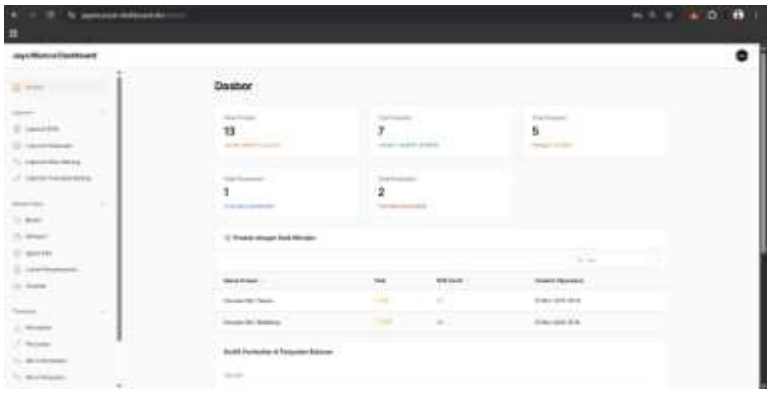

Figure 18. Admin Dashboard

Figure 19. Admin Spare Part Data Page

Figure 20. Brand Data Page

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Figure 21. Category Page

Figure 22. Storage Location Page

Figure 23. Supplier Page

Figure 24. Admin Purchase Page

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Figure 25. Purchase Return Page

Figure 26. Admin User Management Page

Cashier

The Cashier page is a page that can only be accessed by the cashier to manage sales data and sales returns.

Figure 27. Cashier Login Page

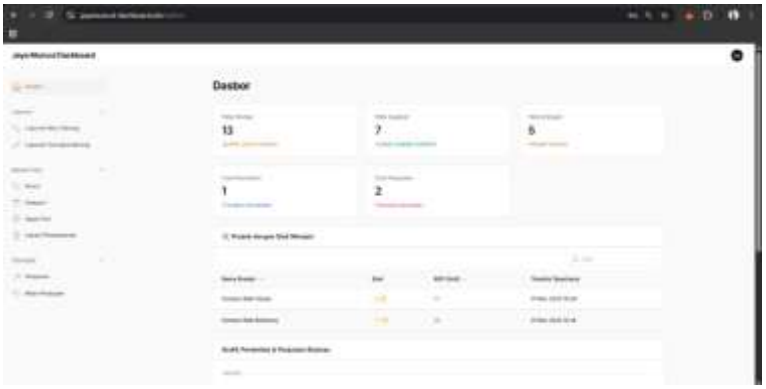

Figure 28. Cashier Dashboard Page

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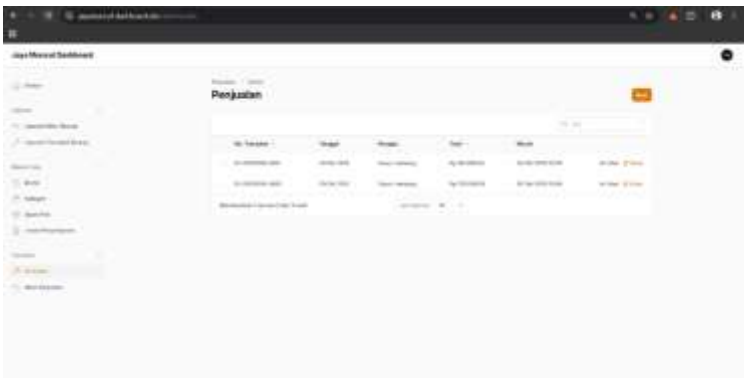

Figure 29. Cashier Sales Page

Figure 30. Sales Return Page

System Evaluation

At this stage, another evaluation is carried out, namely system evaluation. Users evaluate whether the software or system is in accordance with expectations or not. If it is appropriate, then the system is ready to be used. If not, repeat or return to the system development and system testing stages [12].

User Acceptance Test (UAT) Analysis

The User Acceptance Test produced an overall acceptance score of 89.97%, indicating that users considered the developed system highly acceptable and suitable for operational use. This result suggests that the system successfully met users' functional requirements, provided an intuitive interface, and simplified inventory management activities [13].

The high UAT score also indicates that integrating EOQ, Safety Stock, Reorder Point, and SMA forecasting into a single web-based application enhanced users' confidence in making purchasing decisions [14]. Rather than performing manual calculations, users were able to obtain inventory recommendations automatically, thereby reducing calculation errors and improving decision consistency [15].

These findings are consistent with previous studies reporting that web-based inventory management systems improve operational efficiency and inventory accuracy through automated inventory control processes [16]. Similarly, studies investigating EOQ-based inventory systems have shown that automated inventory calculations support more accurate purchasing decisions while reducing inventory-related costs [17]. The present study extends these findings by integrating multiple inventory control methods within a single decision-support system rather than implementing only one inventory optimization technique [18].

Impact of System Implementation

Implementation of the developed system generated several practical benefits for inventory management at Toko Spare Part Jaya Muncul. First, the integration of SMA forecasting enabled inventory planning based on historical demand trends rather than subjective estimation. Second, EOQ calculations optimized purchasing quantities, helping reduce excessive inventory while maintaining product availability. Third, the Safety Stock and Reorder Point features enabled timely replenishment decisions, thereby minimizing the probability of stockouts during supplier lead time [19]. Collectively, these features improved inventory visibility, purchasing efficiency, and consistency in inventory control [20].

Advantages and Limitations

The developed system offers several advantages. It integrates demand forecasting, inventory optimization, safety stock calculation, and reorder scheduling within a single web-based platform [21]. Automated calculations reduce manual errors, improve decision accuracy, and provide real-time inventory information for users. Furthermore, the use of the Laravel framework enables flexible system maintenance and future scalability [22]. However, several limitations remain [23]. The accuracy of inventory recommendations depends on the quality and completeness of historical sales data. The forecasting module currently employs the Simple Moving Average method, which may be less effective under highly fluctuating demand conditions [24]. In addition, the system was evaluated in a single retail store; therefore, its performance may differ in businesses with different operational characteristics. Future studies should evaluate the system across multiple retail environments and compare SMA with more advanced forecasting techniques, such as Exponential Smoothing or machine learning-based forecasting models [25].

4. Conclusion

Based on the planning, development, and testing processes conducted, it can be concluded that the web-based Inventory Information System with Economic Order Quantity (EOQ) integration at Toko Spare Part Jaya Muncul was successfully developed according to the identified requirements and effectively addressed the research objectives. The system is capable of managing spare part data, purchase and sales transactions, inventory reports, and EOQ reports, while achieving an overall User Acceptance Test (UAT) score of 89.97%, which falls into the "Very Good" category.

The primary contribution of this research lies in the integration of the EOQ method into a web-based inventory management system, enabling purchasing decisions to be made in a more optimal, systematic, and measurable manner. By automatically calculating the optimal order quantity and combining EOQ with Safety Stock, Reorder Point (ROP), and Simple Moving Average (SMA) forecasting, the system provides comprehensive decision support that reduces reliance on manual estimation, improves inventory planning, and minimizes the risks of stockouts and overstocking. This integrated approach enhances inventory control efficiency and supports more consistent purchasing decisions.

Nevertheless, this study has several limitations. First, the system was developed and evaluated using operational data from only a single spare parts store, which may limit the generalizability of the findings to other business environments with different operational characteristics. Second, although the system demonstrated high user acceptance, this study did not directly evaluate its impact on inventory cost efficiency, such as reductions in ordering costs, holding costs, or total inventory costs after implementation.

Future research is recommended to validate the proposed system across multiple retail businesses with diverse inventory characteristics. In addition, more accurate forecasting techniques, such as Exponential Smoothing, ARIMA, or machine learning-based forecasting models, could be integrated to improve demand

prediction accuracy. Furthermore, the system can be enhanced by incorporating automatic notification features through mobile applications or push notifications, enabling users to receive real-time alerts when inventory reaches the reorder point and facilitating faster and more responsive purchasing decisions.

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