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Industrial Maintenance System (IMS) Application Development for Heavy Equipment Inspection and Maintenance Processes at CV. Daya Putra Pratama

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ABSTRACT

This research is motivated by the problem of inventory management and spare parts procurement at CV. Daya Putra Pratama, which is still done manually using spreadsheets and physical documents. This condition causes stock data discrepancies, delays in the procurement process, difficulties in monitoring procurement status, and limited information on spare parts availability for technicians. The resulting impacts include increased heavy equipment downtime, hampered maintenance activities, and decreased operational efficiency. To address these problems, a website-based Industrial Maintenance System application was developed that integrates stock management, purchase requests, purchase orders, inventory inspections, and supplier payment monitoring in one centralized platform. The Rapid Application Development method was used through the stages of requirements planning, design, and implementation. The development results show that the resulting application is able to improve inventory data accuracy, accelerate the procurement process, increase information transparency, and support more effective decision-making. Thus, the developed application can support increased operational efficiency and integrated inventory management and spare parts procurement..

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1. Introduction

The primary objective of heavy equipment repair shop operations is to improve service performance, repair speed, and maintenance process reliability. Therefore, to ensure smooth operations and service quality, continuous improvement efforts are required in inventory management and procurement of heavy equipment spare parts. Problems in the procurement process, such as delays in the process from purchase requests to purchase orders, can be categorized as a form of process inefficiency that impacts operational performance, service quality, and customer satisfaction. In the context of heavy equipment repair shops, delays in spare parts procurement threaten the continuity of the maintenance process because they can lead to significant downtime. Therefore, improvements are needed through a systematic approach to increase the efficiency and sustainability of workshop operations.

CV. Daya Putra Pratama is a company in Palembang that operates in the heavy equipment repair shop sector, specifically in maintenance, repair, and the provision of spare parts to support heavy equipment operations. With intense competition, CV. Daya Putra Pratama is required to efficiently manage operational processes, particularly in inventory management and spare parts procurement. However, in practice, problems persist, such as the stock recording process, which still uses separate files like spreadsheets, often resulting in data that is often out of sync with actual conditions in the warehouse. This leads to stock discrepancies, which result in delays in identifying material needs and reduce the accuracy of inventory planning.

Another problem lies in the procurement process. The flow from purchase requests to purchase orders is still handled through physical documents or informal communication. The approval process is highly dependent on manager presence, often creating bottlenecks that extend lead times. Furthermore, the lack of a tracking system prevents real-time monitoring of application status, complicating coordination and control of the procurement process.

From an operational maintenance perspective, technicians lack visibility into spare parts availability or order status. Excessive stock availability can increase storage costs, while stock shortages can result in an inability to meet customer demand and lower customer satisfaction levels [1]. This also leads to suboptimal work scheduling and frequent delays due to material waiting times. Furthermore, inventory usage and purchase histories are poorly documented, complicating needs analysis, stock planning, and cost control.

Another problem is the lack of data integration for reporting and decision-making. Disparate and decentralized data makes the recapitulation process slow and prone to errors. This condition shows that the existing system does not support efficiency, transparency and the provision of information in real time.

These series of problems need to be addressed immediately because they have the potential to affect the operational performance of CV. Daya Putra Pratama, which can ultimately have an impact on the decline in the quality of service to customers. Previous research [2], [3], [4] has offered solutions to inventory management problems through the use of information technology in the form of computerized applications. Another study conducted by Luh et al (2022) focused on the implementation of an Enterprise Resource Planning (ERP) system to support construction project management in Indonesia by implementing ERP through data integration features between divisions, operational process automation, project cost management, material control, work progress monitoring, and real-time report generation. The method used was a literature study by analyzing various articles and scientific journals related to ERP implementation in construction service companies [5]. Another study was conducted by Rihesvar Krishna Putra et al (2024) using a Conceptual Data Model (CDM)-based system development method with Figma implementation to produce goods data management features, real-time monitoring of goods movement, stock tracking and goods position, and submission of goods usage or requests between branches to improve the efficiency of the company's logistics management [6]. Furthermore, research conducted by Romli et al (2023) used the Systems Development Life Cycle (SDLC) method with PHP implementation and a MySQL database to develop an inventory system. The system features incoming and outgoing goods data processing, stock search, and automatic inventory report generation to improve the accuracy and efficiency of inventory management [7]. This series of studies had the same problem as this study, namely in the inventory supply chain, which caused other business processes to be hampered, so a solution was provided using information technology. The novelty of this research compared to previous research lies in the development of an integrated system that not only focuses on inventory management, but also includes the purchase request process, purchase order, inventory inspection, supplier payment monitoring, and real-time procurement tracking to support heavy equipment workshop operations. In addition, this study also provides stock visibility features for maintenance technicians, documentation of item usage history, and reporting data integration to support faster and more accurate decision-making. This study also uses the Rapid Application Development (RAD) method which emphasizes the rapid system development process through the stages of requirements planning, user design, construction, and implementation. The use of the RAD method differentiates it from previous research because it allows for the development of a more flexible, interactive, and user-friendly system through direct user involvement in the system development process. This research aims to answer questions related to how to integrate stock recording, purchase requests, purchase orders, inventory inspections, and supplier payment monitoring into a website-based system. Thus, the final result of this research is an Industrial Maintenance Systems application for CV. Daya Putra Pratama.

2. Research Method

The assistive technology development method used in this research is Rapid Application Development (RAD), a prototyping-based development method that continuously involves users in the application development process until the resulting system can be presented. The main advantage of the RAD

method lies in its ability to simplify the system integration process and accelerate application development time, making it more effective and efficient. [8], [9].

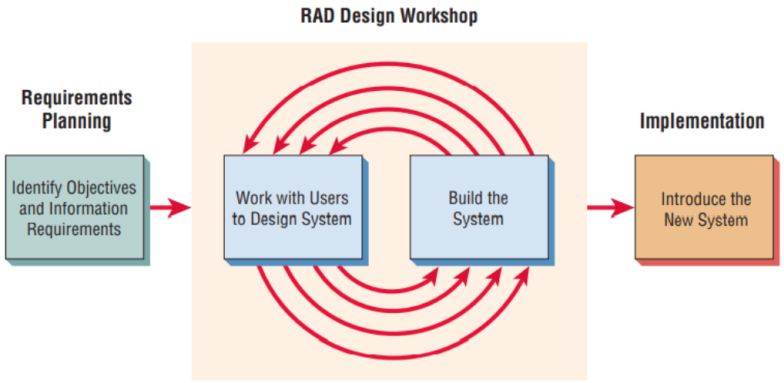


Figure 1. Rapid Application Development Method

The stages involved are as follows:

a. Requirements Planning Stage

In this stage, the requirements for the system to be developed are identified by involving parties involved in the inventory management and spare parts procurement process at CV. Daya Putra Pratama, such as managers, warehouse staff, administrative staff, the purchasing department, and workshop technicians. Data collection is conducted through interviews, direct observation of ongoing business processes, and documentation studies in the form of stock data, purchase request forms, purchase orders, purchase reports, and other related documents.

b. System Design Stage (User Design)

Based on the identified requirements, a system design is conducted, including user interface design, database design, and business process design to be implemented in the system. At this stage, a system model is created using UML diagrams such as use case diagrams and activity diagrams to illustrate the overall system workflow.

c. Construction Stage

After the system design is approved by the user, the next stage is the full system development. This stage involves coding the application using the specified technology, creating a database, and integrating all system modules. The features developed include spare parts stock management, recording incoming and outgoing goods, managing purchase requests and purchase orders, monitoring procurement status, inventory inspection, monitoring supplier payments, and presenting reports in real time.

3. Result and Discussion

3.1. Identify Needs

The following is a list of requirements for the Industrial Maintenance System application presented in Table 1.

Table 1. System Requirements

No.	Role (Actor)	Description
1.	Mechanic	Mechanics need a system that can support heavy equipment maintenance more effectively. Mechanics must be able to log into the system to access all available features according to their access rights. During the maintenance process, mechanics can create Work Orders as the basis for executing work. When creating a Work Order, the system must automatically check the availability of required spare parts. If stock is insufficient, mechanics can add additional spare parts and create a Purchase Request to propose procurement. With this facility, mechanics can ensure that maintenance materials are available on time, thereby reducing work delays.
2.	Admin	Admins need a system that supports integrated procurement and inventory operational data management. Admins must be able to log

		in to access the system and manage master data used in all business processes, such as spare parts, supplier, and user data. Once a Purchase Request is approved, the admin can convert the Purchase Request into a Purchase Order, which serves as the basis for ordering goods from suppliers. Admins are also responsible for recording incoming goods receipts to the warehouse so that inventory can be updated automatically. With this system, admins can ensure that the procurement, goods receipt, and data management processes are more structured, accurate, and well-documented.
3.	Manager	Managers need a system that can help the decision-making process regarding spare parts procurement. Managers must be able to log in to access the system and review each Purchase Request submitted. Based on the evaluation results, managers can accept or reject Purchase Requests according to operational needs and budget availability. Apart from that, managers also need facilities to confirm payments submitted to suppliers. In this process, the system must provide a payment verification feature to ensure that payments made are in accordance with applicable documents and transactions.

3.2. Design

At this stage, the system design is modeled using Unified Modeling Language (UML) diagrams to provide a clear representation of system functionality, user interactions, and business processes. UML modeling helps developers and stakeholders understand system requirements before implementation, reducing the risk of design errors and improving communication among project participants. The primary diagrams used in this phase include use case diagrams and activity diagrams, which describe the system from both functional and process-oriented perspectives.

Figure 2 illustrates the use case diagram of the proposed workshop management system, involving three main actors: the mechanic, the administrator, and the manager. Each actor has specific roles and responsibilities that support the overall operational workflow. The mechanic is responsible for managing work orders, recording maintenance activities, and submitting spare parts requests required for vehicle repairs. The manager oversees strategic processes by reviewing procurement requests, approving purchases, and monitoring payment transactions to ensure operational efficiency and financial control. Meanwhile, the administrator manages master data, including spare parts, suppliers, and employee information. The administrator also handles purchase orders, goods receipt transactions, inventory updates, and other administrative functions. Through the interaction of these three actors, the system supports an integrated workshop operation that improves coordination, data accuracy, inventory control, and overall service quality.

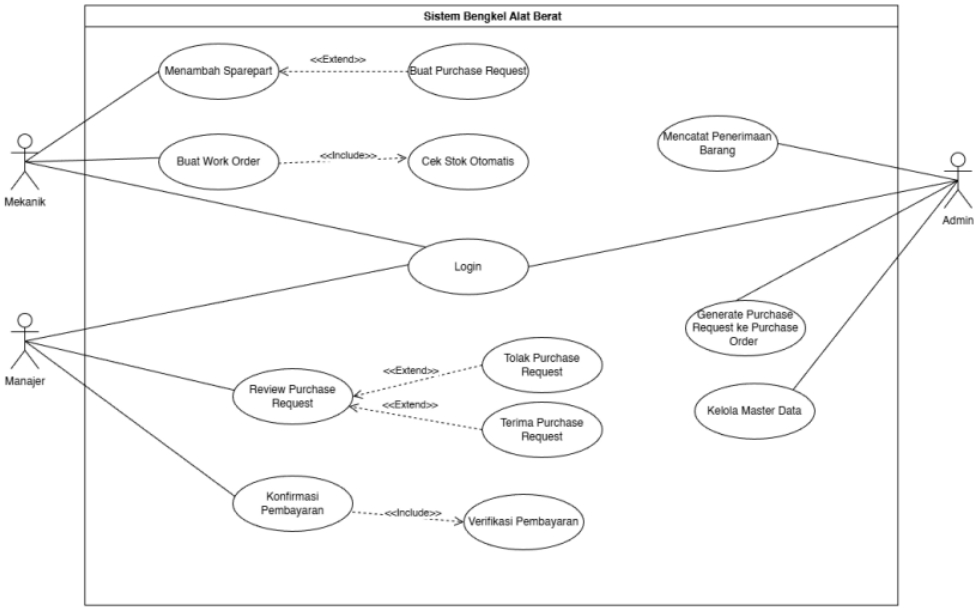


Figure 2. Use Case Diagram

Figure 3 is an activity diagram illustrating the flow of activities in the diagnosis and procurement process.

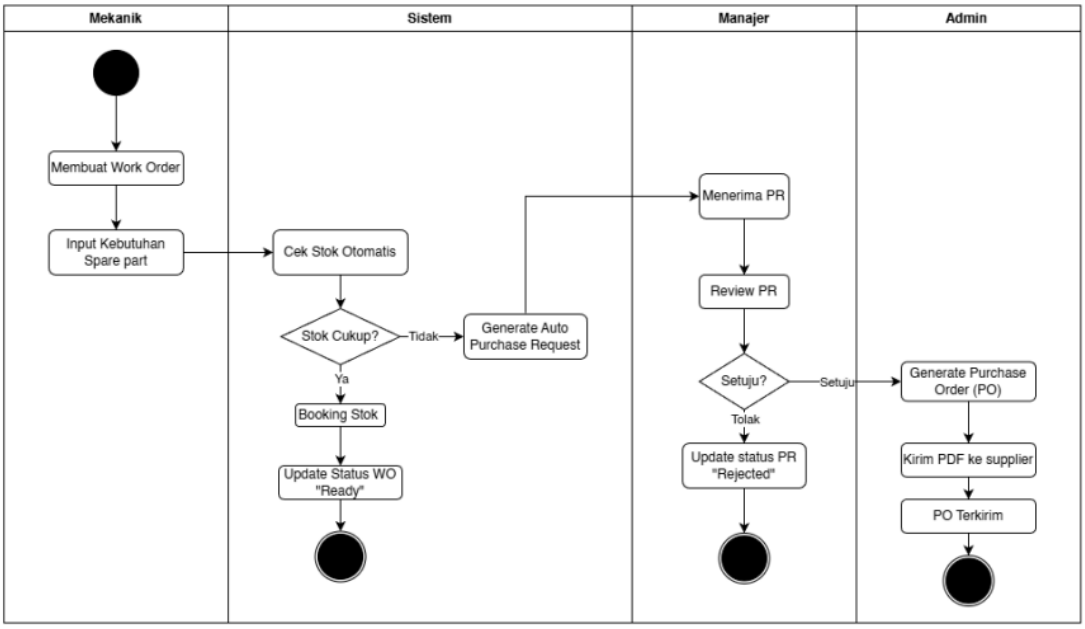


Figure 3 Activity Diagram of the Diagnosis and Procurement Process

Figure 4 is an activity diagram to illustrate the flow of activities in the stock receipt and payment process.

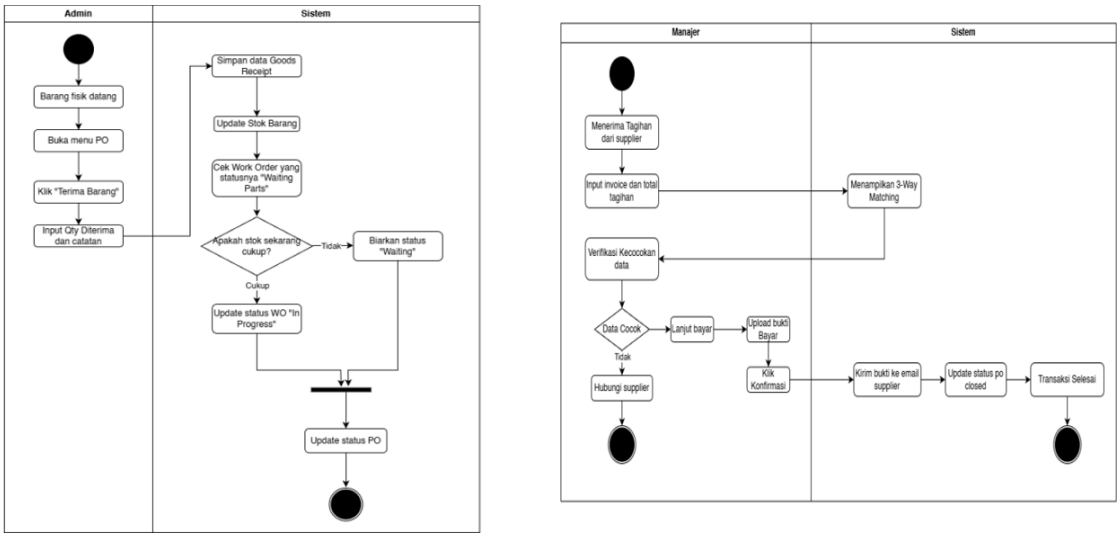


Figure 4. Activity Diagram of the Stock Receipt and Payment Process

3.3. Application Results

This stage focuses on the implementation of the system through coding, testing, and integration of all application components. During development, each module is programmed according to the system design and functional requirements identified in the previous stages. After coding, testing is conducted to ensure that every feature operates correctly and meets user expectations. The application is then integrated into a unified system ready for deployment and operational use. The developed system includes several key features required by workshop personnel, such as creating work orders, submitting purchase requests, verifying procurement requests, generating purchase orders, managing goods receipt processes, and processing payments efficiently to support daily workshop operations.

a. Work Order Page

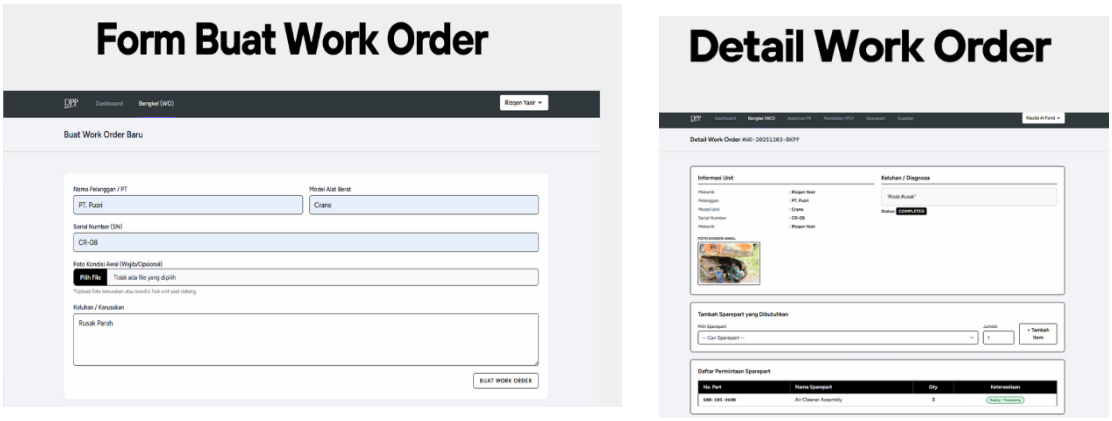


Figure 5 Work Order Page

The Work Order List is a page used to manage and monitor all heavy equipment maintenance and repair work. This page displays important information, such as the Work Order number, unit and customer, reported complaints, job status, and access to job details and spare parts requirements. Additionally, there's a new WO creation feature that allows mechanics to add new jobs to the system.

b. Purchase Request Page

When a mechanic creates a Work Order, the system automatically checks the availability of the spare part to be used. If the spare part is out of stock, the mechanic enters the Purchase Request stage, which displays the following screen..

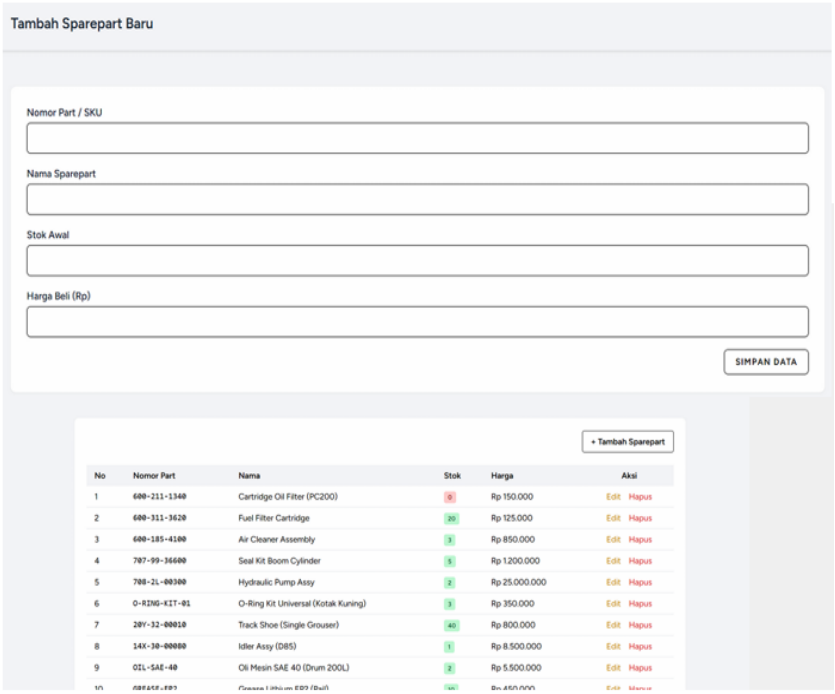
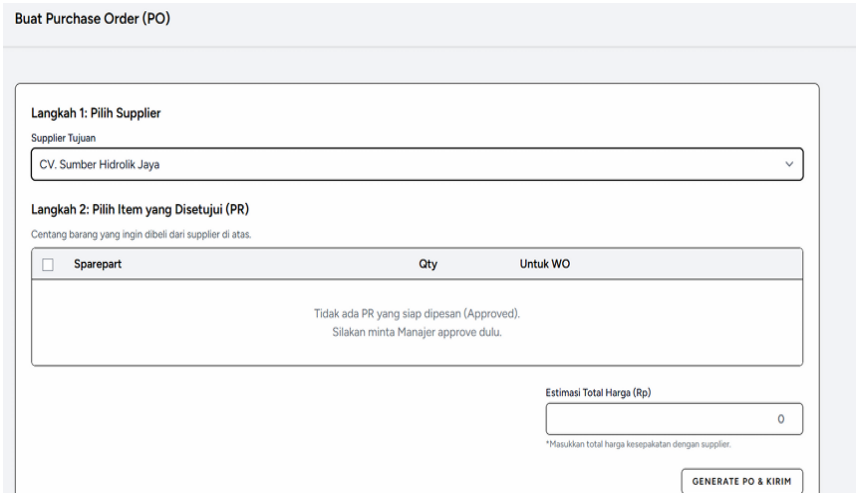


Figure 6 Purchase Request Page

c. Purchase Order Page

This stage is carried out by the admin, if the purchase request process has been carried out by the mechanic.



d. Purchase Order verification page

On this page, managers can verify purchase orders. This speeds up the spare part purchasing process, reducing downtime during machine repairs.

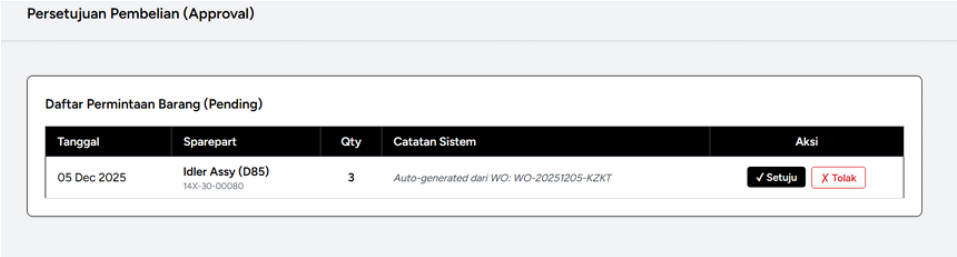


Figure 8 Purchase Request Verification Page

e. Payment Page

This stage is carried out if the manager has agreed to purchase spare parts. The admin will create an invoice that must be paid to the supplier if the spare parts purchased have been received by the mechanic.

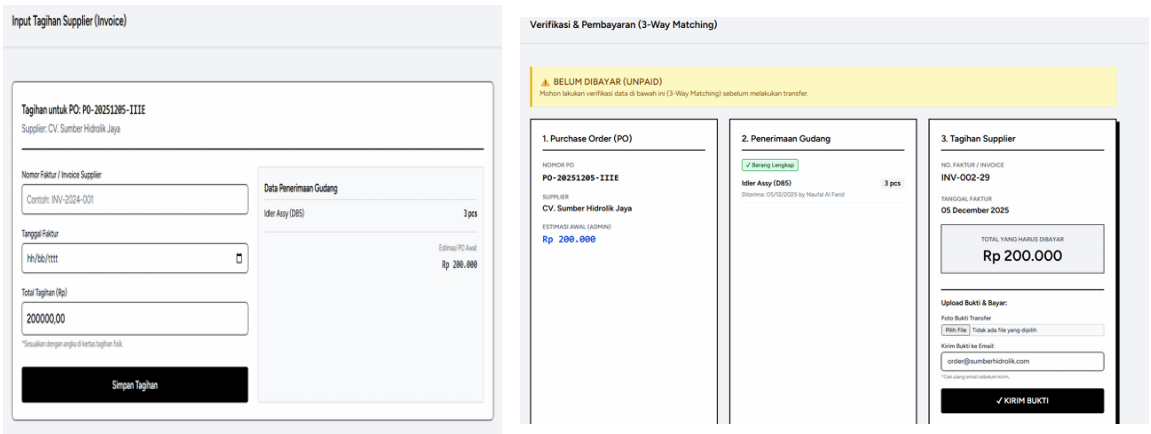


Figure 9. Payment Page

The Verification and Payment feature uses a 3-Way Matching method to ensure accurate payments to suppliers. The system matches Purchase Order (PO) data, warehouse receipt data, and supplier invoices. Payment can only be processed if all three documents match, reducing the risk of payment errors and increasing transparency in the procurement process.

4. Conclusion

Based on the results of the development of the spare parts inventory and procurement information system at CV. Daya Putra Pratama, it can be concluded that the proposed system is able to improve the effectiveness and efficiency of the company's operational processes. This system provides the main benefit of increasing time efficiency by accelerating the spare parts procurement process and reducing waiting time for maintenance activities. In addition, the system is able to improve data accuracy and integrity through integrated recording, thereby minimizing human error and maintaining the conformity of stock data with actual conditions. In terms of cost control, the implementation of a structured approval mechanism and transaction monitoring helps the company control expenses, prevent unnecessary purchases, and reduce the risk of payment errors to suppliers. Thus, the developed system can support the management of spare parts inventory and procurement in a more integrated, transparent, and real-time manner, thereby improving the quality of service and the company's overall operational performance.

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