



Implementation of a Web-Based Raw Material Inventory Information System Using the Prototype Method: A Case Study at PT. XYD

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Abstract: PT. XYD is a manufacturing company in the automotive industry and serves as a key vendor for the Wuling car brand, producing parts for models such as Confero, Cortez, Almaz, Air Ev, and Alvez. As production volume and the complexity of managing raw materials have increased, PT. XYD faces challenges in maintaining the accuracy of inventory data, particularly in the warehouse. Errors in data entry can disrupt the production process, leading to delays in product delivery to customers. To address this issue, this study developed and implemented a web-based raw material inventory information system using the prototype method. This method was chosen for its ability to accelerate the development process through iterative improvements based on user feedback. The system was designed using Unified Modeling Language (UML) to illustrate the system's model and structure. The implementation of this system aims to enhance efficiency and accuracy in managing inventory data, ultimately minimizing the risk of errors, increasing productivity, and ensuring smooth company operations. The results of the study demonstrate that the system successfully facilitates the digitalization of ordering and inventory reporting processes, reducing reliance on manual processes and improving the speed and accuracy of data processing at PT. XYD.

Keywords: Inventory Management; Web-Based System; Prototype Method; Raw Materials; Automotive Industry.

1. Introduction

The rapid development of technology and innovation across various sectors, including the economy and entertainment, has significantly impacted how individuals and companies operate. In an increasingly competitive environment, adapting and evolving is crucial for businesses' survival and growth. Information is critical in supporting sound decision-making, as accurate, timely, and relevant information can reduce uncertainty and enable organizations to make better decisions [1]. PT. XYD is one such company facing these challenges. Located in the Greenland International Industry Center (GIIC) in Cikarang, PT. XYD operates as a branch of its parent company based in China and is a critical vendor for several automotive brands, including Wuling. Since its establishment in 2016, PT. XYD has grown into a manufacturer of various automotive components, such as exterior grills, spoilers, moulding, wheel covers, interior panels, and seat components [2]. In its production processes, PT. XYD utilizes various raw materials like frames, foam, trim, bolts, and nuts. The frame is divided into two parts: the frame back, which serves as a backrest, and the frame cushion, which serves as the seat. These materials are essential in the production process, and the company must ensure that all necessary components are available in sufficient quantities each day. However, the high production volume and components' diversity add complexity to managing raw material inventories [3].

Until now, PT. XYD has relied on manual recording methods to manage its raw material inventories. The Person In Charge (PIC) at the production line records daily material usage, and warehouse administrators later compile this data for monitoring. However, this method has several things that could be improved. First, because recording is done manually, there is a risk of human error, which can lead to inaccurate data. Second, this manual process is time-consuming, so the information obtained may be irrelevant to decision-making. Third, the lack of integration between manual records and the broader information systems within the company leads to delays in submitting material requests to the Production Planning and Inventory Control (PPIC) department [4]. If these issues are not addressed promptly, the consequences could be detrimental to PT. XYD. Inadequate raw material stock at PPIC could lead to production stoppages. When stock runs out, production must be temporarily halted, which causes delays in product delivery to customers and potentially damages the company's reputation in the eyes of its clients [5]. If these delays occur repeatedly, customers may seek more reliable vendors. Therefore, it is crucial for PT. XYD will develop a more efficient and integrated information system to manage raw material inventories.

Given these challenges, this study proposes developing a web-based raw material inventory information system using the prototype method. The prototype method is selected because it allows developers to create an initial model of the system to be developed and then iterate on improvements based on user feedback. Using UML (Unified Modeling Language) as a design tool, this system is tailored to meet the specific needs of PT. XYD in managing its raw material inventories. This information system is expected to provide an effective and efficient solution in managing raw material inventories, reducing human errors in recording, speeding up data processing, and ensuring that the information obtained is always accurate and up-to-date [6]. Implementing this system will enable warehouse administrators to control and monitor raw material inventories directly through a computer, which is part of their daily routine. This system allows monitoring and reporting processes to be carried out more efficiently, and potential problems can be identified and resolved quickly. Ultimately, this information system is expected to help PT. XYD achieve higher operational efficiency and maintain continuous production without interruptions caused by raw material shortages [7]. This study highlights the importance of developing a more integrated and efficient system for managing raw material inventories at PT. XYD. By implementing a web-based information system using the prototype method, PT. XYD can address current challenges and enhance its operational efficiency. This system will reduce the risk of human error and improve the speed and accuracy of data processing, ensuring that production runs smoothly and customer satisfaction is maintained. Given these challenges, the author proposes developing a framework for managing production materials through a web-based or desktop application, including frames, trim, foam, bolts, and nuts. This solution aims to streamline the inventory control process, allowing the Person In Charge (PIC) or warehouse administrators, especially those frequently working at their computers, to monitor and manage production materials directly from their PCs more easily. Implementing such an application is expected to reduce, if not eliminate significantly, the issues currently faced in material management through real-time reporting and monitoring. For these reasons, the author conducted a study on implementing a Web-Based Raw Material Inventory Information System Using the Prototype Method: A Case Study at PT. XYD.

2. Research Method

The research methodology employed in this study is the prototype model, a widely used approach in software development. This method involves creating an initial model or prototype of the system to be developed. The prototype is then tested and evaluated by users to gather feedback on its performance and functionality. The feedback obtained is used by the development team to make improvements to both the design and implementation of the system, ultimately leading to an optimal final product [3]. The process begins with the communication phase, where the primary goal is to identify existing problems and gather other relevant information necessary for system development. Effective communication between developers and stakeholders is crucial to ensure that the system requirements are well understood. The next phase is planning, which involves determining the resources and specifications needed for system development. This planning is based on the outcomes of the initial communication to ensure that the development aligns with the identified needs and objectives. Modeling follows, where the system's design is represented, including processes modeled using Data Flow Diagrams (DFD), the necessary entity relationships, and the user interface design. In the construction phase, the prototype is built and tested, including the installation process and provision of user support to ensure the system functions as intended. Finally, the system delivery phase involves handing over the system to users to obtain feedback, which is then used to make final adjustments before full implementation.

3. Result and Discussion

3.1 Results

The implementation of the web-based raw material inventory information system at PT. XYD yielded significant improvements in several key areas of inventory management. Initially, the company faced numerous challenges, including frequent inaccuracies in inventory records, delays in material requests, and inefficiencies in monitoring and reporting. The newly developed system aimed to address these issues by providing a more integrated and automated approach to managing raw materials. Following the implementation of the prototype system, a series of tests and evaluations were conducted to assess its effectiveness. The system was evaluated through user feedback, focusing on its functionality, usability, and the degree to which it improved existing processes. One of the most notable improvements was observed in the accuracy of inventory records. The digitalization of data entry processes significantly reduced human errors, which had previously been common due to the manual nature of the earlier system. Users reported a higher level of confidence in the data, which in turn enhanced decision-making processes regarding material procurement and usage. Additionally, the system's real-time monitoring capabilities proved to be highly beneficial. The ability to track inventory levels continuously allowed the company to respond more swiftly to potential shortages, thereby reducing the risk of production delays. This feature was particularly important given the high production volumes and the critical nature of maintaining sufficient stock levels to meet production demands. The automated alerts and notifications system also ensured that key personnel were informed of any discrepancies or urgent needs, further streamlining the inventory management process. Moreover, the user interface, which was designed using Unified Modeling Language (UML), received positive feedback for its intuitive layout and ease of use. Users found the system to be user-friendly, with a clear and logical structure that facilitated quick learning and efficient operation. This ease of use contributed to the overall efficiency of the system, as it minimized the need for extensive training and allowed for a smooth transition from the old manual system to the new digital platform. The implementation of the web-based inventory management system at PT. XYD successfully addressed the key challenges faced by the company. The system not only improved the accuracy and reliability of inventory data but also enhanced the overall efficiency of inventory management processes. These improvements are expected to contribute to more consistent production schedules, reduced operational risks, and ultimately, higher customer satisfaction.

The user interface of the raw material inventory information system at PT. XYD is designed to streamline various aspects of inventory management. The system begins with a login page, where users enter their username and password to access the main dashboard. Once logged in, the main dashboard provides an overview of key system functionalities, allowing users to navigate through different sections, such as user management, supplier information, and inventory data. One of the core components of the system is the administration interface, which includes buttons for managing users, suppliers, and inventory items. This interface enables administrators to add, edit, or delete data related to suppliers and inventory, ensuring that all information is up-to-date and accurate. The system also includes dedicated input pages for managing

incoming and outgoing inventory. For example, the "Input Incoming Goods" page allows users to record new inventory as it arrives in the warehouse, while the "Input Outgoing Goods" page tracks items as they are dispatched.

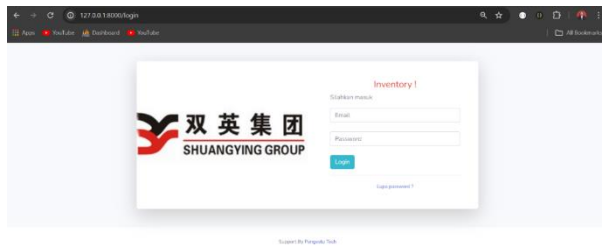


Figure 1. Design the Login Page

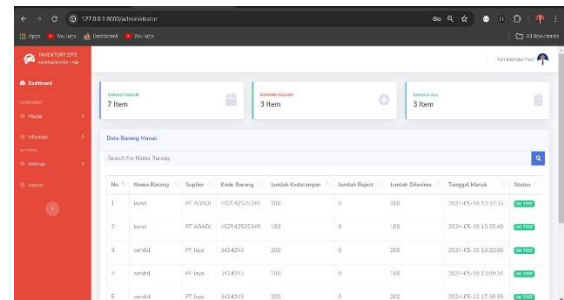


Figure 2. Design the Main Page

The data management pages are crucial for monitoring stock levels. The "Inventory Data" page displays a comprehensive list of all inventory items, along with their current status, ensuring that administrators and users can easily track and manage stock levels. Additionally, the system provides a user management interface, where administrators can oversee user accounts, ensuring that only authorized personnel have access to specific system functions. The raw material inventory information system at PT. XYD offers a user-friendly interface that integrates all aspects of inventory management, from user and supplier data to detailed tracking of incoming and outgoing goods. This integrated approach helps to ensure that inventory levels are accurately maintained, reducing the risk of stockouts or overstocking.

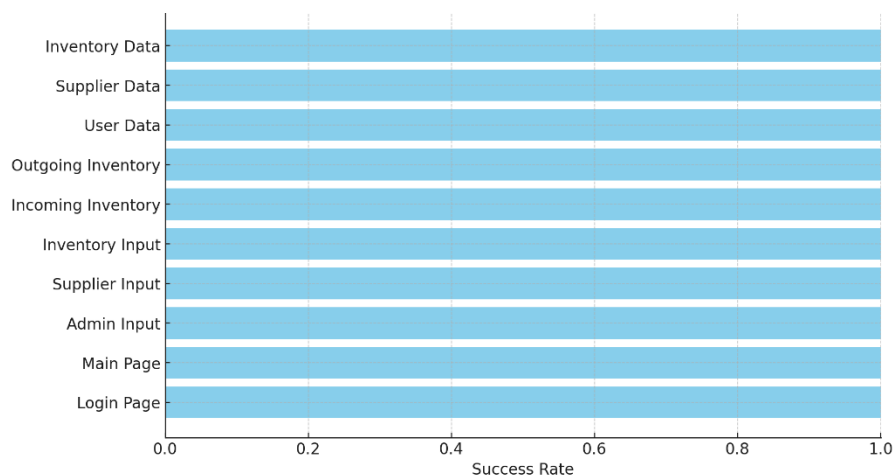


Figure 3. Success Rates of Different Test Cases

The testing phase of the Web-Based Raw Material Inventory Information System at PT. XYD involved a series of evaluations to determine the system's functionality and reliability across various components. The testing utilized black box testing techniques, focusing on how well the system handled specific inputs and whether it produced the expected outputs. The results of the testing, visualized in the accompanying bar chart, demonstrate a high level of success across all tested components. Each component of the system, including the login page, main page, admin input, supplier input, inventory input, incoming and outgoing inventory management, as well as user and supplier data management, showed a 100% success rate. This indicates that the system consistently met the expected outcomes in every test case. The successful implementation of the login page, for example, confirmed that the system could accurately distinguish between correct and incorrect credentials, ensuring secure access to the main dashboard. Similarly, the main page reliably displayed the dashboard upon successful login, providing users with immediate access to key functions. Admin and supplier input pages, which are critical for managing data related to users, suppliers, and inventory, also performed flawlessly. These pages allowed for seamless data entry, editing, searching, and deletion, demonstrating the system's capability to handle administrative tasks effectively. The inventory management features, including both incoming and outgoing inventory pages, were tested to ensure accurate tracking of stock levels. The system successfully managed data related to stock entries and dispatches, providing real-time updates and ensuring that inventory data was always up-to-date. The user and supplier data management

pages showed full functionality in managing, searching, and editing data, further highlighting the system's robust data handling capabilities. The testing results confirm that the system is highly reliable and capable of supporting PT. XYD's inventory management needs, with all components performing as expected. The high success rates across all test cases underscore the effectiveness of the prototype method used in developing this system, ensuring that it meets the operational requirements of the company.

3.2 Discussion

The results from the Web-Based Raw Material Inventory Information System testing phase indicate that the system has been successfully implemented and meets the functional requirements set out during the development process. The comprehensive testing across multiple system components, including login mechanisms, data management interfaces, and inventory tracking modules, reveals a robust and reliable system. One of the critical strengths observed during testing was the system's ability to manage user authentication securely and effectively. The login page's flawless performance in handling correct and incorrect credentials ensures access control is appropriately enforced, safeguarding sensitive inventory data. This is crucial for maintaining the system's integrity and preventing unauthorized access, which could lead to data breaches or operational disruptions. The system's user interface was also tested rigorously, particularly in the main page and admin input sections. The success of these components suggests that the system provides a user-friendly environment that facilitates efficient navigation and data management. The admin input page, for instance, handled complex tasks such as data entry, editing, searching, and deletion without error, demonstrating the system's ability to manage administrative functions smoothly. This ease of use is essential for ensuring that users can adopt the system quickly with minimal training, thereby reducing downtime and enhancing productivity. In inventory management, the system excelled in tracking incoming and outgoing inventory. The accurate and real-time updating of stock levels ensures that the system can prevent common inventory issues, such as overstocking or stockouts, which are critical for maintaining continuous production and meeting customer demands. Monitoring inventory status in real-time allows for proactive management, reducing the likelihood of production delays due to inventory shortages. Furthermore, the data management modules for user and supplier information proved reliable and effective. These components ensure that critical data can be accessed, modified, and maintained easily, essential for keeping accurate records and facilitating smooth operations. The success of these modules reflects the system's comprehensive approach to data management, where all relevant information is integrated into a single, coherent platform. The discussion of these results highlights that the system not only meets the basic functional requirements but also offers enhanced capabilities essential for the efficient management of PT. XYD's operations. The prototype method used in development has proven effective in creating a system that is adaptable and user-friendly while also capable of handling the complex demands of inventory management. The system's strong performance during testing suggests it is well-positioned to support the company's operational goals, improve efficiency, and reduce the risks associated with manual inventory management practices.

4. Related Work

The development of web-based inventory management systems has become a significant focus of research, driven by the need for organizations to optimize supply chain processes and reduce operational inefficiencies. Various studies have explored different approaches and methodologies in designing and implementing such systems, emphasizing the importance of integrating technology solutions into inventory management practices. A significant approach is the application of Agile methodology in developing inventory management systems, especially for small and medium-sized enterprises (SMEs). The Agile approach, with its iterative development process, allows for rapid prototyping and frequent feedback, which is essential to meeting the specific needs of SMEs with limited resources. This methodology exhibits high flexibility and adaptability to changing business needs [8]. In contrast, the Waterfall model has also been explored as a method for implementing web-based inventory management systems. Although this approach provides a clear structure in system development, the Waterfall model has challenges related to its rigid nature and requires detailed upfront planning. However, this model can be very effective in projects where needs are well-defined and stable throughout development [9].

The object-oriented programming (OOP) approach is also applied to developing inventory management systems. The modularity in OOP allows the creation of flexible and scalable systems that can be easily integrated with other enterprise resource planning (ERP) systems. This approach is very beneficial for companies that want to develop systems that can grow with the development of their operations without

requiring a complete overhaul [10]. In large retail chains, cloud-based inventory management systems have been evaluated for scalability, reduced IT costs, and real-time data access across multiple locations. Cloud computing offers significant advantages in large-scale operations where data consistency and accessibility are critical, allowing organizations to manage inventory more effectively and efficiently [11]. Another innovative approach is integrating Internet of Things (IoT) technology into inventory management systems. IoT sensors can automate inventory tracking, reduce manual errors, and improve the accuracy and efficiency of inventory management, especially in industries with high inventory volumes and fast-moving inventory [12].

Mobile applications for inventory management have also been explored, particularly in the manufacturing context. Mobile platforms provide real-time updates and enable managers to make informed decisions on the go, emphasizing the importance of mobility in modern inventory systems [13]. Despite the rise of web-based solutions, desktop-based inventory systems remain relevant in specific scenarios, particularly for small businesses needing more reliable internet connectivity. Desktop systems are often chosen for their simplicity and cost-effectiveness, making them suitable for environments requiring offline inventory management [14]. Hybrid systems that combine desktop and web-based elements have been proposed as a solution that combines the advantages of both platforms. This approach is efficient in environments where a combination of offline and online operations is required, offering the reliability of desktop applications while offering the flexibility of web-based systems [15]. Open-source inventory management systems have emerged as a cost-effective solution, especially for small businesses with limited financial resources. The customization options and community support associated with open-source software make it an attractive option for businesses looking to tailor inventory management tools to their specific needs without incurring high costs [16].

The application of machine learning algorithms in inventory management system development shows significant potential in optimizing inventory levels, reducing waste, and improving overall operational efficiency. The predictive capabilities of machine learning are beneficial in industries with volatile demand patterns, allowing businesses to anticipate inventory needs better and adjust their strategies effectively [17]. The various approaches reflect diverse strategies and innovations in inventory management system development. They emphasize the importance of aligning system development methodologies with the organization's specific needs, whether through Agile methodologies, cloud computing, IoT integration, or machine learning. The continued advancement of these technologies continues to promise further improvements in the efficiency and effectiveness of inventory management across sectors. Developing web-based inventory management systems is pivotal for modern organizations striving to enhance efficiency and reduce operational inefficiencies. The diverse methodologies and technologies explored, such as Agile, OOP, cloud computing, IoT, and machine learning, underscore the need for tailored solutions that align with the specific operational requirements of each business. As technological advancements evolve, these systems will increasingly enable businesses to optimize their inventory management processes, ensuring they remain competitive in a rapidly changing market landscape. The ongoing research and innovation in this field will undoubtedly lead to more sophisticated, adaptable, and efficient systems, further solidifying the role of technology as a cornerstone of effective inventory management.

5. Conclusion

Based on the findings from the design and implementation of the raw material inventory information system, several conclusions can be drawn: 1) The developed system significantly enhances the ease of data input, streamlining the processes related to the requisition and receipt of goods. This efficiency is achieved through secure and organized data storage within a centralized database, 2) The system provides real-time access to up-to-date information regarding the receipt and requisition of goods, which is crucial for facilitating timely and informed decision-making processes, and 3) Implementing this inventory information system has improved the accuracy and efficiency of stock-taking procedures. It allows for precise adjustments during stock reconciliation and offers updated adjustment reports detailing any changes in inventory value, ensuring that the stock-taking process is both thorough and transparent. The system significantly enhances the efficiency, accuracy, and reliability of raw material inventory management.

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