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ENHANCING ONLINE AUTOMOTIVE SPARE PARTS SALES THROUGH A WEB-BASED E-SALES SYSTEM USING RAPID APPLICATION DEVELOPMENT

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Abstract

The rapid advancement of information and communication technology has encouraged business sectors to adopt internet-based systems to improve operational efficiency and competitiveness. In the automotive industry, particularly in the sale of used car spare parts, electronic sales (e-sales) have become an important solution for expanding market reach and facilitating transactions. However, this sector still faces several challenges, including limited product transparency, inconsistent stock management, unclear product conditions, and low consumer trust in online transactions. This study aims to develop a web-based e-sales system for used car spare parts using the Rapid Application Development (RAD) method to improve transaction efficiency, inventory management, and customer trust. The RAD approach was selected because it emphasizes rapid and iterative system development through continuous prototyping and active user involvement, allowing applications to be developed according to user needs in a shorter time. The research method consisted of four stages: requirements planning, user design, construction, and implementation. The resulting system integrates various functionalities, including product management, automatic inventory monitoring, customer registration and login, transaction processing, shipment tracking, website settings, and sales monitoring through an admin dashboard. The implementation results indicate that the developed system effectively improves operational efficiency by reducing manual recording activities and simplifying transaction management. Additionally, the system enhances transparency through detailed product information and transaction monitoring features, thereby increasing consumer confidence in purchasing used spare parts online. Overall, the implementation of the RAD method proved effective in developing an adaptive and efficient e-sales platform that supports digital transformation in the automotive spare parts.

Keywords: e-sales; used car spare parts; rapid application development; web-based system; automotive e-commerce.

1. INTRODUCTION

In the current digital era, the rapid advancement of information and communication technology has significantly transformed business activities across various sectors, encouraging organizations to adopt internet-based systems to improve efficiency and competitiveness. One of the most influential technological implementations is electronic sales (e-sales), which enables the buying and selling process to be conducted digitally through websites, mobile applications, or social media platforms. In the automotive sector, particularly in the sale of used car spare parts, e-sales has emerged as a strategic solution to expand market reach without geographical and temporal limitations. Through e-sales platforms, customers can search for products, compare prices, review specifications, and complete transactions online in a more practical manner [1], [2].

Despite its growing relevance, the implementation of e-sales in the used car spare parts market still faces several challenges. One of the primary concerns is the difficulty in ensuring product quality and reliability because used spare parts often have varying conditions that are difficult to verify through online media alone. Customers frequently hesitate to make purchases due to insufficient product descriptions, unclear images, or the absence of transparent information regarding product condition and functionality[3], [4]. Furthermore, inconsistent pricing, fluctuating stock availability, and the risk of fraudulent transactions reduce customer trust in online sellers. From the business perspective, sellers also encounter difficulties related to inventory management, transaction recording, and logistics coordination, all of which directly influence operational effectiveness and customer satisfaction.

To overcome these issues, the development of a web-based e-sales system using the Rapid Application Development (RAD) method offers a practical and efficient approach. RAD emphasizes fast and iterative software development through continuous prototyping and active user involvement, enabling developers to create applications that closely align with business needs in a relatively short period. In the context of used spare parts sales, an e-sales platform designed with RAD can provide detailed product categorization based on spare part condition, transparent

product information, customer reviews and ratings, real-time inventory monitoring, and secure payment integration. Additionally, the RAD approach facilitates early-stage feedback and rapid modifications, minimizing development risks while improving system relevance and usability. Therefore, applying RAD in developing an e-sales website for used car spare parts can contribute to increasing operational efficiency, strengthening consumer trust, and providing a more reliable and convenient purchasing experience.

Several previous studies have demonstrated the effectiveness of web-based information systems developed using structured software development methodologies, particularly RAD and Waterfall models. According to [5], a web-based Management Information System for Micro, Small, and Medium Enterprises (MSMEs) in Bandar Lampung City was successfully developed using a four-stage RAD methodology supported by Laravel 11 and Model-View-Controller (MVC) architecture. The system integrated modules for product management, inventory control, transactions, and reporting, achieving perfect functional testing performance after resolving minor issues. User evaluation also indicated a high level of acceptance, suggesting that RAD can effectively support rapid and adaptive system development. Similarly, research in [6] implemented a web-based sales information system for a culinary MSME using the Waterfall Software Development Life Cycle (SDLC) model. The developed system incorporated multiple user roles, including administrators, kitchen staff, owners, and commissioners, which significantly improved reporting accuracy, minimized data entry errors, and enhanced internal control mechanisms. These findings support the argument that structured development methodologies contribute positively to business process management and organizational effectiveness. In another study, [7] reported the development of a sales information system for a bakery business aimed at overcoming inefficiencies caused by manual transaction recording. By applying the Waterfall model, the resulting system successfully managed products, customer orders, and reporting activities in real time, thereby reducing the risk of data loss and administrative inaccuracies while improving accessibility and service responsiveness. Furthermore, the study conducted in [8] developed a web-based sales reporting information system for a corporate environment using the RAD methodology. The system effectively addressed operational bottlenecks related to report accumulation and inefficient communication workflows. User evaluations demonstrated strong acceptance levels, indicating improvements in data security, reporting speed, and sales monitoring efficiency. These results reinforce the suitability of RAD for environments requiring rapid implementation and iterative refinement. Finally, research presented in [9] combined the RAD method with Design Thinking to develop a web-based Point of Sale (POS) and inventory management system. The integration of both approaches proved successful in accelerating development while ensuring that system functionality and interface design corresponded closely to real operational requirements. The study particularly emphasized the effectiveness of automatic synchronization between inventory and transaction modules in improving operational consistency.

Collectively, these previous studies confirm that web-based information systems developed through structured methodologies, such as RAD and Waterfall[10]–[12], can significantly improve operational effectiveness, minimize human error, and optimize business processes through automation and real-time information management. However, differences in business domains, operational complexity, and workflow characteristics indicate that system development must be customized according to sector-specific requirements. In the context of used car spare parts e-sales, a more specialized system is required to address challenges related to product transparency, inventory variability, and consumer trust. Therefore, this study aims to develop a web-based e-sales system using the RAD approach specifically tailored to the operational characteristics and challenges of the used spare parts market.

2. RESEARCH METHODS

The Rapid Application Development (RAD) method is one approach in software development that emphasizes rapid development and flexibility in responding to changing user requirements. In this sub-section, we will explain how RAD is applied to accelerate the development process while ensuring that the final result can effectively meet the dynamic specifications and needs of users[10], [13]–[15].

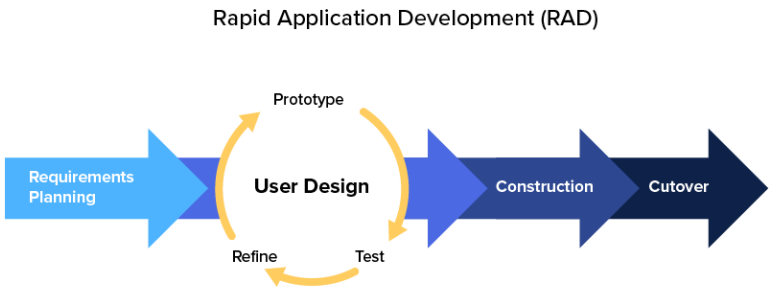

Figure 1. System Development Method

The description of Figure 1 is as follows:

a. Requirements Planning
   At this stage, system requirements were gathered through interviews with used car spare part sellers and buyers. Sellers communicated key obstacles such as difficulty managing stock, manual transaction recording, and limited product promotion. From the buyer's perspective, needs were identified for clear product information, continuously updated product availability, and a secure and easily accessible payment system. The interview results formed the basis for formulating the main system requirements, namely a detailed product catalog, automatic stock management, customer review features, and online payment integration.
b. User Design
   After the system requirements were obtained, the next stage was to design the system with direct user involvement. The initial design was visualized using UML (Unified Modeling Language) in the form of Use Case Diagrams, Activity Diagrams, and Sequence Diagrams to describe the flow of interaction between sellers, buyers, and the system. Based on this design, web interface prototypes were created covering the login page, product catalog, shopping cart, and admin dashboard. The prototypes were then tested by users, who provided feedback for improvements to the interface and process flow. Through the prototyping cycle, the system design was continuously refined until it met user needs.
c. Construction
   The construction stage was carried out by building the web application in accordance with the design results validated in the previous stage. The system was developed using PHP as the programming language, MySQL as the database, and web framework support. The main features implemented include an online-accessible product catalog, automatic stock management directly linked to transactions, transaction and payment modules, and an admin dashboard for monitoring sales. During the construction process, internal testing was conducted to ensure that each feature functioned properly and in accordance with the established specifications.
d. Cutover (Implementation)
   The final stage is the deployment of the built system into the real environment. Spare part data is entered into the system so that sellers can manage products and stock directly through the dashboard. Buyers can access the website to search for products, place orders, and complete payments online. The delivery process is also automatically recorded so that buyers can monitor the status of ordered items. This stage also serves as the final trial to ensure that the used car spare parts e-sales system can run smoothly, improve transaction efficiency, and build consumer trust through information transparency and more professional service.

3. RESULTS AND DISCUSSION

3.1. System Design

This use case diagram illustrates the overall interaction between two main actors, namely Admin and Customer, with the Website system encompassing various functionalities. The Admin is responsible for managing the website, including logging in, managing products, carousel (image slides), pending transactions, completed transactions, and general website settings. On the other hand, the Customer interacts with the system through login, registration, product viewing, and service ordering features. This diagram shows how both actors interact with the various system functions integrated into a single Website subsystem, where each functionality accessed by the Admin and Customer is represented by a use case. The arrow lines connecting actors to use cases indicate direct relationships and interactions between actors and each specific function within the system.

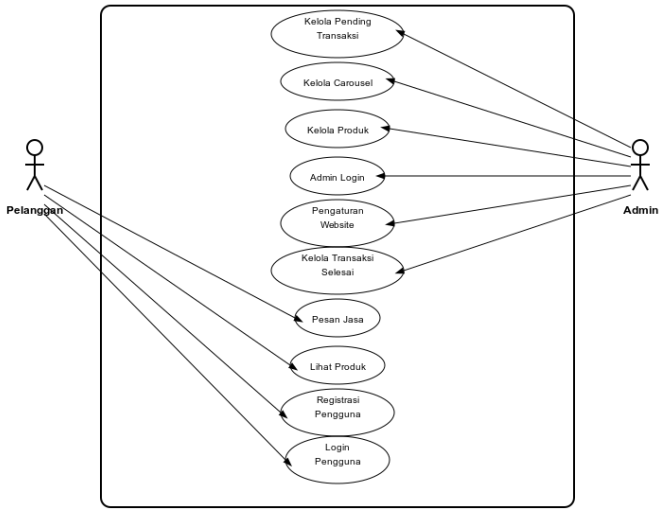

Figure 2. Use Case Diagram

3.2. System Implementation

After completing the research phase, the next step is to implement the system, which consists of several pages each with a specific function. The following is a list of pages to be included in the system:

a. Home Page

This application has a simple and clean interface with a bright green tone on buttons and navigation text. The top of the application displays a user logo on the left, followed by two main navigation options: "Products" and "Services". In the center, there is a search bar with the placeholder "Search", allowing users to search for items within the application. In the upper right corner, there is a "Login" button, indicating the option for users to sign in to their accounts. Overall, the design is minimalist and intuitive, focusing on functionality with an emphasis on easy navigation.

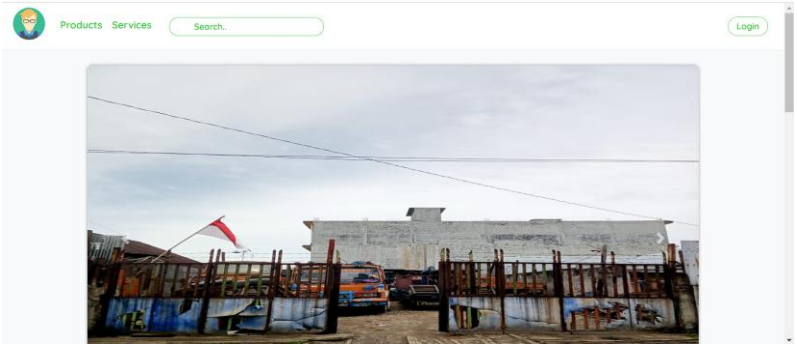

Figure 3. Home Page

b. Product Page

This display shows a list of products sold in the application. At the top is the same main navigation as before, with "Products", "Services", and a search bar. Below it is the "Products" title, followed by several products displayed sequentially. Each product is accompanied by an image, product name, price, and star rating. The products displayed include "Used Tire size 7.50-15", "Colt Diesel Car Rim", "Isuzu Bison Axle", and "Isuzu Bison Engine", each with a listed price and user rating below. The design is simple and makes it easy for users to view and compare products.

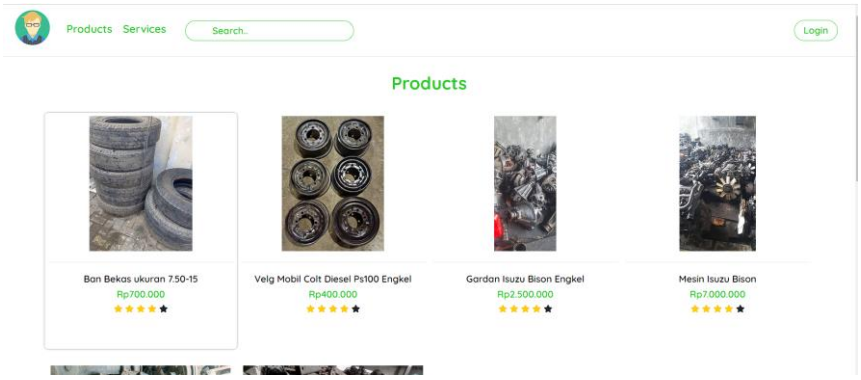

Figure 4. Product Page

c. Service Page

This page displays the "Services" section of the application. At the top, the same navigation is present with "Products", "Services", and a search bar. The "Services" title is clearly visible in the center of the page, but no information or service list is displayed below it, making this section appear empty in the middle. At the bottom of the page, there is a footer providing information about the company, contacts, and support. Bagian "About Us" menyebutkan bahwa Sempurna Jaya adalah portal e-commerce untuk suku cadang used car spare parts. Meanwhile, operational contacts, working hours, and phone numbers are also displayed, along with support links such as how to shop, payment methods, and a help center.

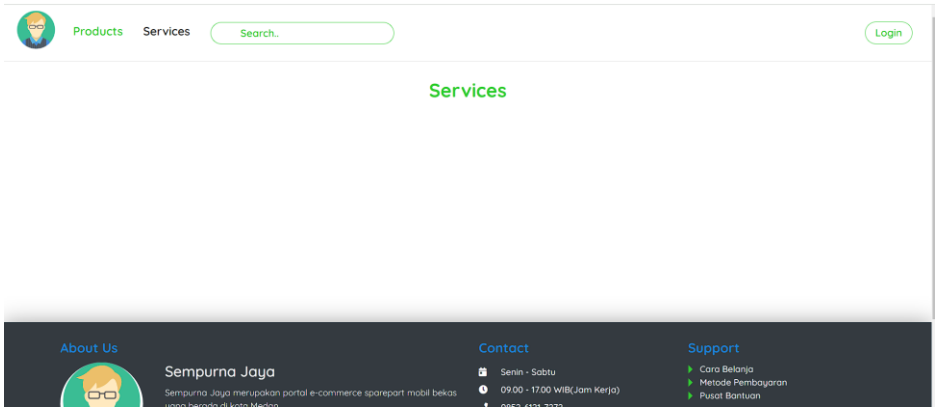

Figure 5. Service Page

d. Login Page

This display shows a simple and easy-to-use login form. Users are asked to enter their email address and password in the provided fields. Below the email field, there is an example of the correct email format ("example@example.com") as a guide. A prominent green "Login" button is located at the bottom to help users proceed with the sign-in process. If the user does not yet have an account, there is a link labeled "Register Here" at the bottom, directing users to create a new account.

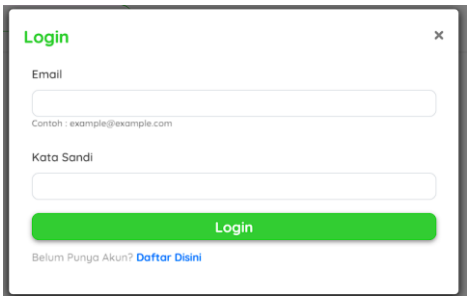

Figure 6. Login Page

e. Register Page

This display shows a new account registration form. Users are asked to fill in several details such as full name, email, password, and phone number. Each field is accompanied by an example of the correct format to assist users, such as the email and phone number format. At the bottom, there is a large green button labeled "Register" to proceed with the registration process. If the user already has an account, there is a "Back to Login" link directing them back to the login page.

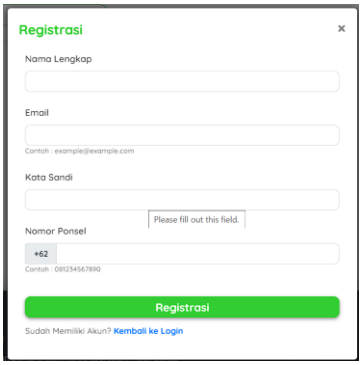

Figure 7. Register Page

f. Dashboard Page

This display shows the administrator dashboard of the Sempurna Jaya application. On the left side, there is a navigation panel containing several options such as "Dashboard", "Users", "Website Settings", "Product", "Menu", "Panel", and "Sale". Each navigation option has an icon to help users navigate the available features. In the center of the screen, the main dashboard area displays important statistics such as the number of new orders (New Orders), bounce rate, number of new user registrations (User Registrations), and the number of visitors (Visitors). Each statistic is shown in a colored box with access to further information. Below it, there is a sales chart showing sales data, although at this time the chart is still empty.

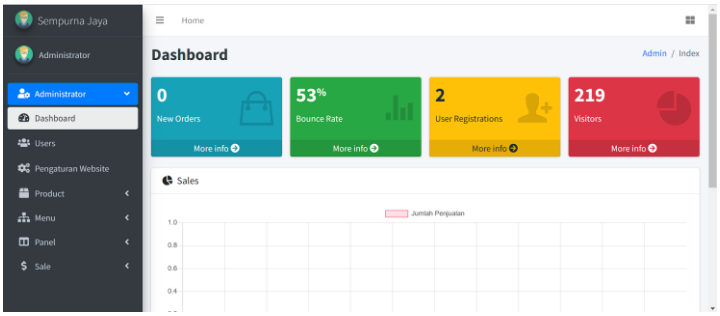

Figure 8. Dashboard Page

g. User Management Page

This display shows the "User Data" page, which presents a list of users in a table format. The table contains columns such as serial number, name, email, phone number, and actions that can be performed on user accounts. In this example, there is only one user, namely "Administrator" with the email "admin@gmail.com" and a registered phone number. In the action column, several buttons are available for "Details", "Reset Password", and "Delete" to help the admin manage user accounts.

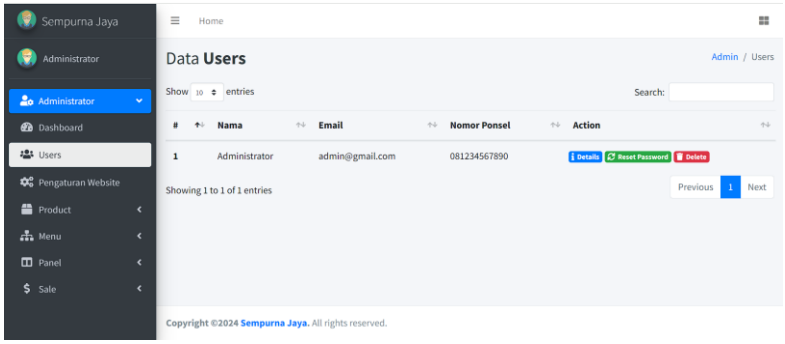

Figure 9. User Management Page

h. Settings Page

This display shows the website settings page where the administrator can edit important information related to the site. The administrator can enter the website name, website description, upload a logo, and fill in the address contact, opening hours, phone number, and email to be displayed on the site. Each field is marked with a red asterisk, indicating that all this information is mandatory. At the bottom of the page, there are two buttons: "Close" to close without saving changes, and "Save changes" to save the changes made.

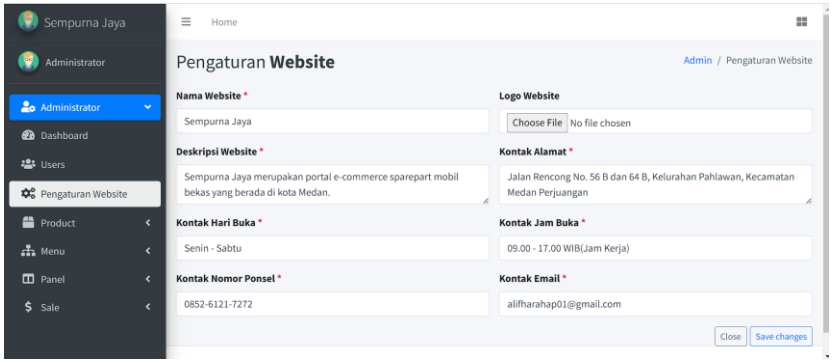

Figure 10. Settings Page

i. Product Page Admin

This figure shows the dashboard page of a product management application. In the main section of this page, there is a table displaying a list of products. The table columns contain serial number, product name, type (Type), price, and action (Action). In the Action column, there are two buttons, namely Details to view product details and delete to delete a product. Above the table, there is an option to create a new product with the Create a New Product button and a search box (Search) to help users find specific products.

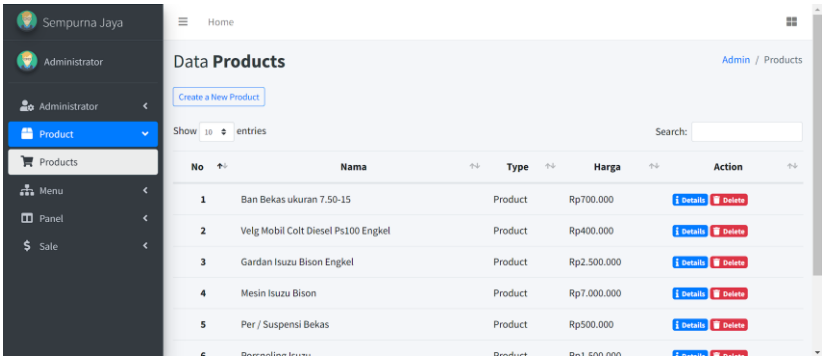

Figure 11. Admin Product Page

j. Carousel Page

This figure illustrates the carousel feature in the admin panel of the website. At the top of the page, there is a "Create a New Carousel" button for creating a new carousel. Below it, there is an option to select the number of entries displayed, as well as a search field to help users find specific entries. Each entry in the table has columns for Image, Caption, Priority, and Action. The Image column displays the photo used in the carousel, Caption shows a short descriptive text of the image, Priority determines the display order of images in the carousel, and Action contains Edit and Delete buttons that allow users to modify or remove a carousel entry.

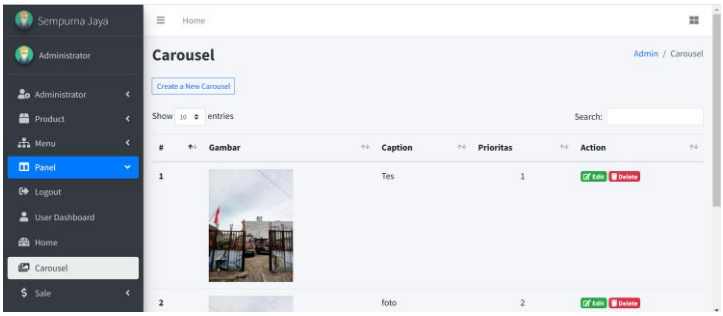

Figure 12. Carousel Page

k. Transaction Page

The display above shows the "Pending Transaction" page, which lists transactions currently being processed. In the table, there is information about two transactions including their ID numbers, user emails, total transaction amounts, status, and action options. The status of both transactions is "Being Processed", indicating that the transactions are in the processing stage. There are two action buttons for each transaction: a green "Input Tracking Number" button to enter the shipping tracking number, and a red "Delete" button to remove the transaction.

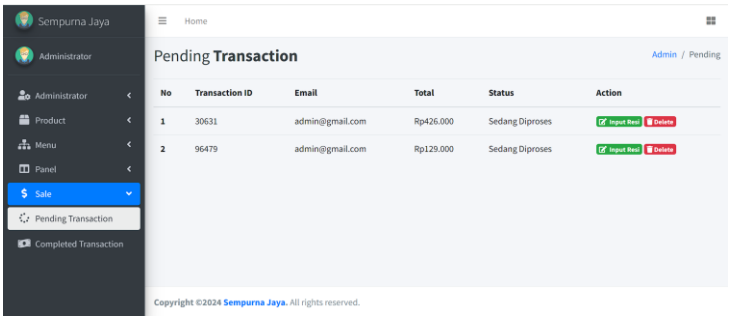

Figure 13. Pending Transaction Page

Furthermore, for managing completed transactions, the figure displays the ‘Completed Transaction’ page, which lists all successfully completed transactions. This table contains information such as serial number, transaction ID, user email, total payment, and the status of each transaction. All transactions in this list have a ‘Completed’ status, indicating that they have been successfully processed and finalized. The transactions also vary in total payment amounts, ranging from IDR 217,000 to IDR 9,740,000.

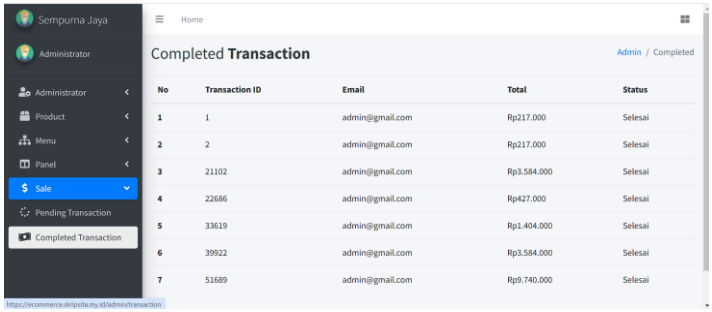

Figure 14. Completed Transaction Page

3.3. Discussion

The implementation of the web-based e-sales system for used car spare parts using the Rapid Application Development (RAD) method demonstrates that a structured yet iterative development approach can effectively address operational challenges in the automotive spare parts business. The system developed in this study successfully integrates essential functionalities, including product management, transaction processing, user management, website settings, and inventory monitoring into a unified digital platform. This integration enables sellers to manage operational activities more efficiently compared to conventional manual methods, particularly in stock monitoring and transaction recording. Through the admin dashboard, business operators can access sales information, manage products, and supervise transactions in real time, thereby reducing administrative workload and minimizing data management errors.

The implementation results indicate that the developed system supports greater transparency in online transactions, which is one of the major concerns in the used spare parts market. Product information is presented in a more organized and detailed manner through the product catalog feature, allowing customers to review spare parts based on price, ratings, and product descriptions before making purchasing decisions. This contributes to improving consumer confidence, especially considering that uncertainty regarding product quality and condition is a major obstacle in online used spare part transactions. Furthermore, the availability of login, registration, and transaction tracking features supports a more secure and accountable purchasing process for customers. From the administrative perspective, the system provides considerable benefits through integrated stock management and transaction handling mechanisms. The product management page enables administrators to add, update, or remove products efficiently, while the carousel and website settings features improve website appearance and promotional flexibility. Additionally, the transaction management module distinguishes between pending and completed transactions, allowing sellers to monitor the status of orders more systematically. The inclusion of tracking number input for ongoing transactions further enhances delivery transparency and customer service quality. This finding aligns with previous studies indicating that web-based information systems can improve operational effectiveness and support business digitalization.

The application of the RAD methodology also proved effective in accelerating the system development process while maintaining alignment with user requirements. Through stages such as requirements planning, user design, construction, and implementation, users were actively involved in providing feedback throughout development. This iterative process allowed system modifications to be performed quickly according to operational needs, thereby minimizing the risk of mismatched functionalities. Compared to traditional development approaches, RAD offers flexibility that is particularly beneficial for dynamic business environments such as e-commerce for used automotive spare parts, where market conditions and user expectations may change rapidly.

Overall, the findings of this study demonstrate that the developed e-sales system not only improves transaction efficiency and inventory management but also strengthens consumer trust through better transparency and accessibility. However, there are still opportunities for future improvements, such as integrating digital payment gateways, implementing recommendation systems for related products, enhancing security mechanisms, and developing mobile-based accessibility to further improve user experience and business competitiveness in the automotive e-commerce sector.

4. CONCLUSION

Based on the results and discussion of this study, it can be concluded that the implementation of a web-based e-sales system for used car spare parts using the Rapid Application Development (RAD) method has been successfully carried out and effectively addresses several operational challenges in the used automotive spare parts business. The RAD approach proved effective in accelerating the system development process through iterative prototyping and active user involvement, allowing the resulting application to better align with user needs and business requirements. The developed system successfully integrates important functionalities, including product management, inventory monitoring, transaction processing, user account management, and website administration into a centralized platform.

These features contribute to improving operational efficiency, reducing manual recording errors, and simplifying the management of product availability and sales activities. Furthermore, the implementation of transaction status monitoring and shipment tracking supports a more organized and transparent transaction process. From the customer perspective, the system enhances convenience and trust in purchasing used car spare parts online by providing clearer product information, easier product searching, and more structured transaction management. The availability of account registration, login authentication, and completed transaction records also contributes to improving user experience and accountability in online transactions. Overall, this research demonstrates that the application of the RAD method in developing an e-sales platform for used car spare parts can improve business effectiveness, strengthen customer trust, and support digital transformation in the automotive spare parts sector. For future development, the system may be enhanced by integrating secure online payment gateways, mobile application support, recommendation systems, and stronger security features to further optimize service quality and business competitiveness.

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