

Design and construction of website-based e-commerce applications for selling food products in the semarang region with payment gateway integration

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ABSTRACT

Digital transformation has driven a shift in transactions from traditional systems to e-commerce platforms, which have become the cornerstone of the digital economy. However, existing e-commerce platforms often fail to fully meet the needs of SMEs, particularly regarding flexible withdrawal of sales proceeds and consumer education about products. This study aims to design a website-based e-commerce application with the main features of a flexible fund withdrawal system and product education. This system is developed using the Waterfall System Development Life Cycle (SDLC) model. The implementation of the application creation uses the Laravel framework integrated with the Midtrans API for secure and flexible payment management. This application is equipped with various features, such as product catalogs, shopping carts, order tracking, and reviews, with functional testing carried out through black-box testing methods to ensure the application meets user needs. The results of the study show that web-based e-commerce applications are able to support flexible transactions, expand market reach, and strengthen the local e-commerce ecosystem. From this study, it can be concluded that website design plays an important role in answering challenges, especially increasing the security and convenience of direct fund withdrawal transactions for SMEs.

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1. INTRODUCTION

The rapid development of digital technology has had a significant impact on various aspects of life, including the business sector. One of the major transformations that can be seen is the shift in transaction patterns from traditional systems to digital platforms, especially through e-commerce. E-commerce provides a platform for selling products directly while leveraging the internet media for promotion [1]. Despite becoming a cornerstone of the digital economy, business actors continue to encounter several challenges. Common issues include the absence of user-friendly systems, inadequate security features to safeguard transactions, and difficulties in expanding market reach to broader audiences [2]. By utilizing e-commerce, potential buyers can conveniently browse products, access detailed information, and complete transactions without visiting physical

stores. This convenience benefits buyers by saving time and money while enabling sellers to broaden their marketing reach, potentially driving a significant increase in revenue [3]. Despite its numerous advantages, existing e-commerce platforms still fall short in addressing the needs of business owners, particularly regarding the flexibility of withdrawing sales revenue. Many sellers, especially those from small and medium enterprises (SMEs), face challenges in accessing their earnings directly, which can disrupt cash flow and impact operational efficiency. Additionally, the absence of features designed to educate consumers about local products remains a significant drawback, highlighting the need to enhance awareness and appreciation of the value and benefits of local food products.

The product sales system is one example of an information system that can be developed using the System Development Life Cycle (SDLC) methodology. SDLC is a systematic and sequential model in building software [4], [5]. The main function of SDLC is to accommodate user needs related to the system to be developed. System development needs can be in the form of changes or creation of new applications, either modularly or with a new installation process [6].

Previous research by Habibullah et al. in 2023 focused on developing applications that utilize the Midtrans payment gateway system. This system supports various payment methods, including credit cards, bank transfers, digital wallets (eg, GoPay), and retail outlet payments at Indomaret and Alfamart. The implementation shows increased security and convenience for users when making payment transactions. This research contributes to providing safer, more user-friendly, and innovative solutions for online business actors [7]. Research by Ahmad et al. in 2022 developed an e-commerce system for bookstores with a separate payment feature. This feature allows customers to pay by combining various payment methods, such as bank accounts and digital wallets. The innovation in this separate payment feature is relevant to the needs of today's customers who often use various payment methods [8]. Then, research by Armilia et al. in 2024 aims to create a web-based application specifically for selling cosmetics that is connected to the Midtrans payment gateway system. The main feature of this program is the ability to handle financial transactions quickly and safely using various methods, including GoPay, credit cards, and payments at Indomaret and Alfamart. This study emphasizes how Midtrans JSON API facilitates effective payment procedures. The user-friendly application design supports cosmetic industry players in facing market competition while increasing customer convenience and trust [9]. This study not only focuses on payment gateway integration to improve transaction security and convenience, but also offers additional features in the form of flexibility in direct fund withdrawals for SMEs. This feature is relevant to address cash flow issues often faced by small and medium enterprises.

In addition, this application is designed to support consumer education about local products, thereby expanding appreciation of the value and benefits of local products. This combination of features is an innovation that has not been widely implemented in similar studies. To address these issues, this website-based application was designed using the Laravel framework, integrated with the Midtrans API for secure and flexible digital payments, and the RajaOngkir API for delivery services such as JNE, POS, and TIKI, while services such as Grab and Gojek are managed manually. Laravel was chosen because of its efficiency in backend logic, with HTML, CSS, and JavaScript creating a responsive and interactive interface. The MySQL database system is used for reliable data management. Development using the Waterfall method ensures that every stage, from needs analysis to system testing, is carried out systematically. This solution is expected to have a significant impact on business actors.

2. METHOD

The system development method used in building this system is the Waterfall System Development Life Cycle (SDLC) model. This model is often called the sequential linear model or the classic life cycle. This model was chosen because of its structured and sequential approach, which is suitable for developing systems with clearly defined needs from the start [10], [11], [12]. The following are the stages of the waterfall method can be shown in Figure 1.

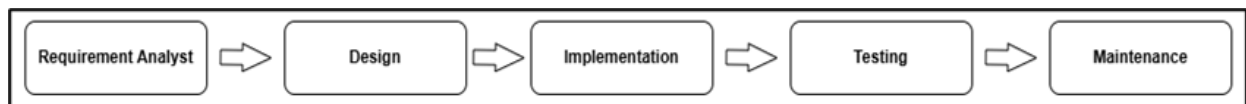


Figure 1. The stages of the waterfall method

Requirement Analyst

At this stage, a system requirements analysis is conducted to determine the complete specifications of the application to be developed. Data is collected through surveys, interviews, and literature studies to identify user needs, including the integration of Midtrans API for payment gateways and RajaOngkir for shipping services.

Design

At this stage, the system is designed based on the requirements specification by including the design of a MySQL relational database, an MVC-based architecture using Laravel, and a responsive interface with HTML, CSS, and JavaScript. Design documentation is done through flowcharts, ERDs, and UML (Use Case, Activity, Sequence) diagrams to ensure the fulfillment of functional requirements in a structured manner.

Implementation

The implementation phase involves backend development using Laravel and frontend with HTML, CSS, and JavaScript. Key features developed include Midtrans API integration for payments, RajaOngkir API for shipping, flexibility in fund withdrawals, and local product education features that provide information and stories behind the process.

Testing

The testing phase of this system is carried out using the black box testing method to ensure that each function in the application runs according to the requirements specifications without checking the internal code. This approach focuses on testing the input and output of each main feature that has been implemented.

Maintenance

The maintenance phase is carried out to fix bugs, improve performance, and add new features based on user feedback. The system is also monitored regularly to ensure its security is maintained, especially regarding payment transactions and customer data.

3. RESULTS AND DISCUSSIONS**Flowchart of Website-Based E-Commerce Application For Selling Food Products**

Flowcharts are used to describe the workflow or process in a system systematic and structured manner. This tool serves to explain various aspects of the information system in a clear, accurate, and logical manner [13], [14]. The following is a flowchart that visualizes the workflow in a Website-Based E-Commerce Application for Selling Food Products in the Semarang Area that has been integrated with the Payment Gateway.

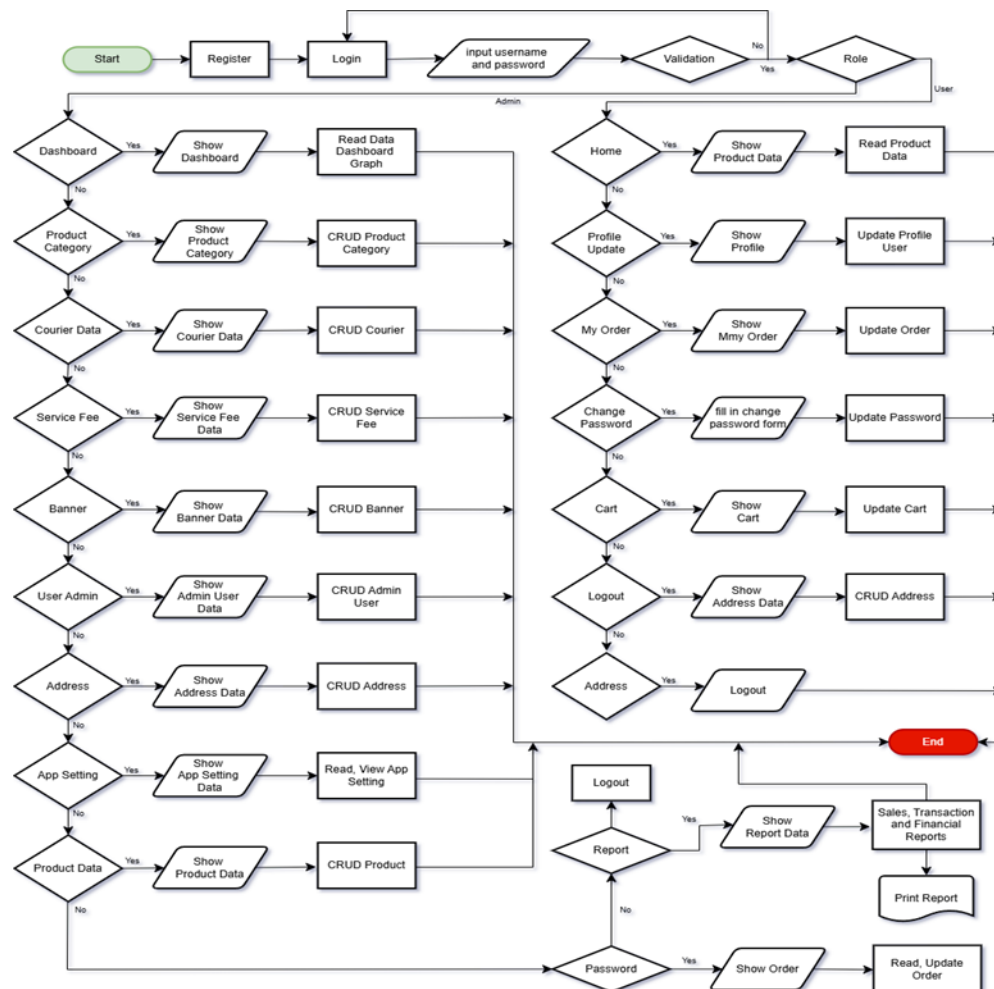


Figure 2. Flowchart of website-based e-commerce application for selling food products

Figure 2 explains the process flow of a website-based e-commerce application. Users who access the website will be directed to the Semarang Online Market landing page as the main page. From the landing page, users can proceed to their account to manage personal data or to the order cart to complete the transaction. On the dashboard, users have the flexibility to update their profile, add or edit shipping addresses, view order status and history, and change their password to maintain account security. Meanwhile, admins who log in will be directed to the admin dashboard, which is designed to manage the system efficiently. Admins can set product categories, couriers, and service fees through Master Data; add, edit, or delete products through Manage Products; and monitor the ordering process from checkout to completion through Manage Orders. In addition, admins can create sales, transaction, and financial reports, as well as manage various system settings such as banners, admin users, and application information through Master Settings. These features ensure optimal user experience and efficiency in managing e-commerce applications.

Use Case Diagram

A Use Case Diagram shows the interaction between actors and systems, used to map how actors complete certain tasks through the system. This diagram is one of the techniques in software and information system development that aims to identify the functional needs of the system [15]. In designing a Website-Based E-Commerce Application for Selling Food Products in the Semarang Area with Payment Gateway Integration, a Use Case Diagram is used to describe the relationship between users (such as customers or admins) with the main functions of the application.

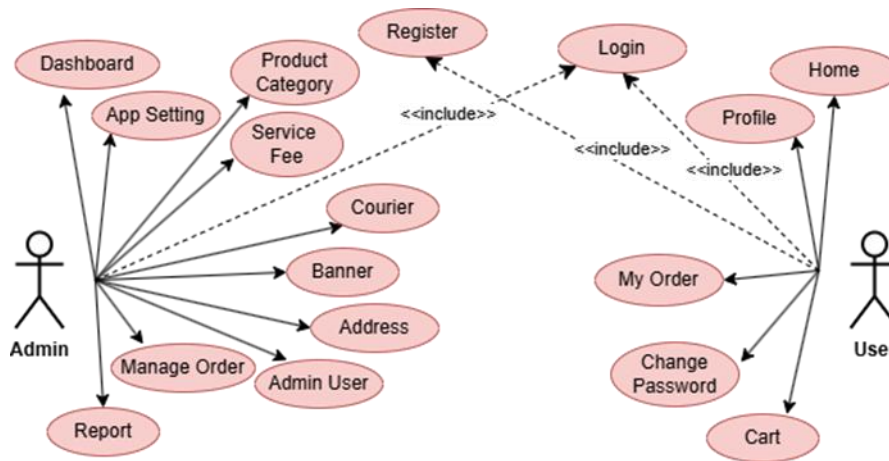


Figure 3. Use case diagram

In Figure 3, two main actors can interact with the application, namely Admin and User, with access adjusted based on their respective roles. Admin has full access to manage the system, including setting master data such as product categories, couriers, and service fees, as well as managing products by adding, editing, or deleting them. In addition, admins can monitor and process order status, from incoming orders to completion, as well as manage sales, transactions, and financial reports. Admins are also responsible for application settings, such as managing banners, office addresses, application information, and adding or managing other admin accounts. Meanwhile, Users have access to use the main features of the application, such as viewing product catalogs, selecting categories, adding products to carts, checking out, and completing payments. Along with managing their accounts, users may check transaction history, watch the progress of current purchases, and update their addresses, passwords, and profile information. By meeting the unique requirements and functions of every user, these features guarantee that the e-commerce system runs efficiently.

Activity Diagram

Activity diagrams show the workflow or processes in a system by emphasizing the order of tasks without going into depth about the actors' behaviors. They also show how the system flow begins, the various decisions that may occur, and how the flow ends.

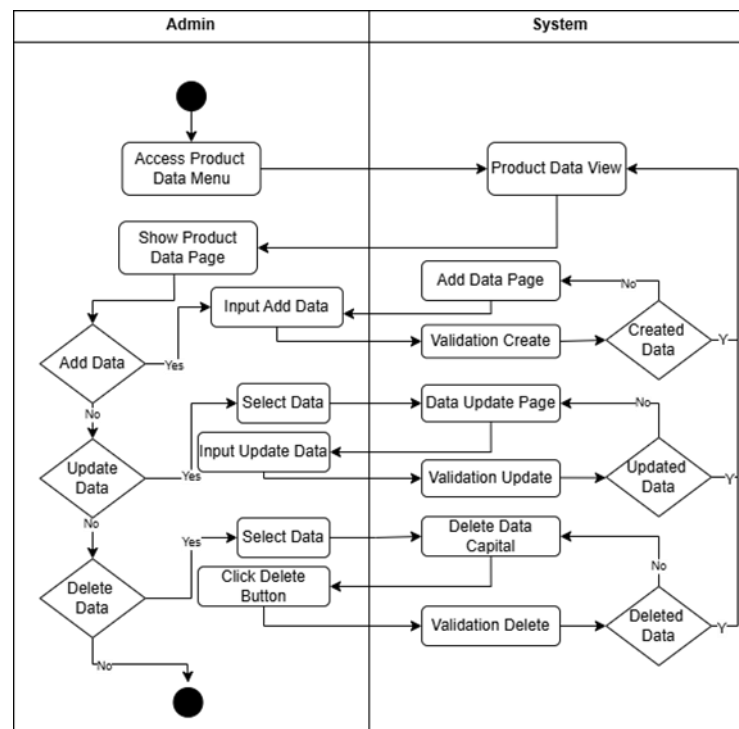


Figure 4. Activity diagram product admin

Figure 4 explains the process of managing product data by the admin in the e-commerce system. The admin can add, update, or delete product data through the Product Data menu. For each action, the system provides data validation to ensure that the inputted information is correct. If the validation is successful, the data will be processed, and the admin will return to the main page. This feature ensures that product data management is carried out easily, safely, and in a structured manner.

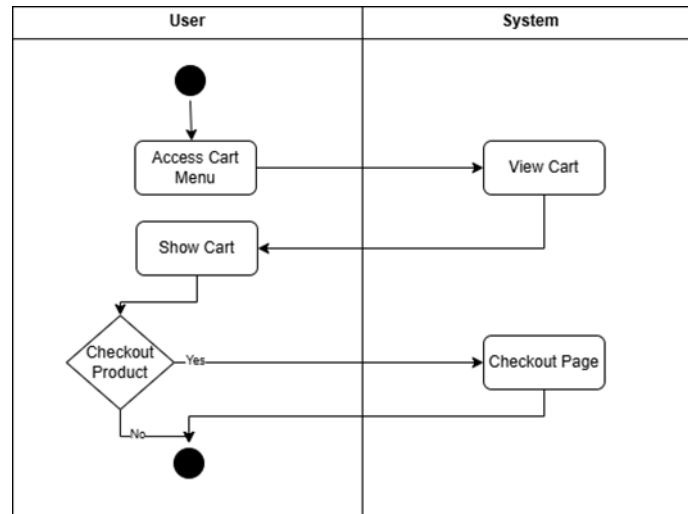


Figure 5. Activity diagram user order cart

Sequence Diagram

A sequence diagram is a visual representation that illustrates the interaction between objects in a Use Case. This diagram shows the flow of messages sent and received and the duration of each object's existence during the process. Its preparation requires identifying related objects and methods implemented by classes that have been defined in the class diagram.

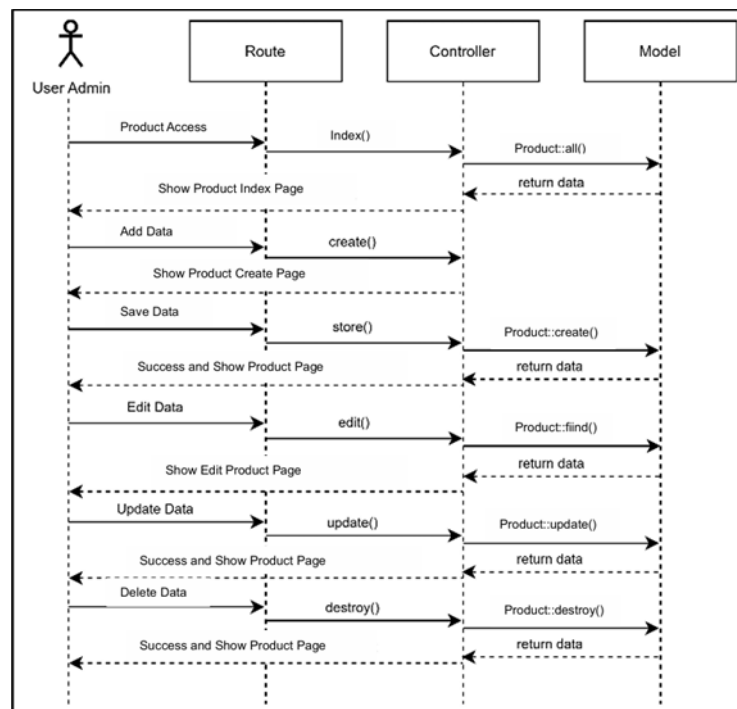


Figure 6. Sequence diagram product admin

Figure 6 illustrates the process of managing product data by the admin in the system, including product access, adding data, editing data, deleting data, and displaying product-related pages. This interaction includes the flow between the admin, route, controller, and model.

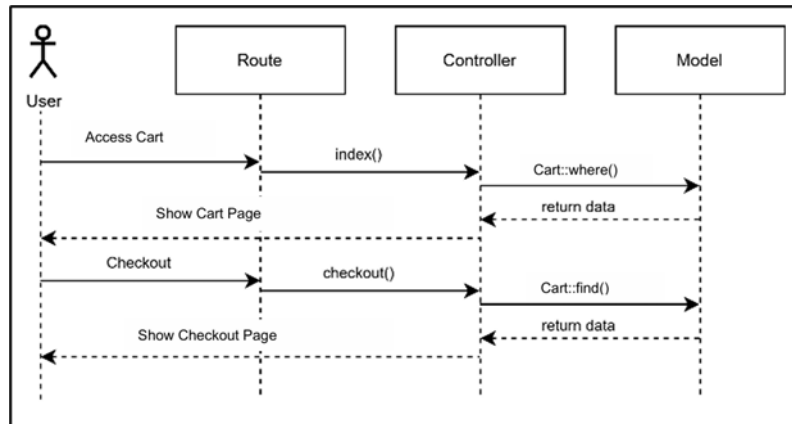


Figure 7. Sequence diagram user order cart

Figure 7 illustrates the process of user interaction with the shopping cart in the system, starting from accessing the cart, displaying the cart page, to the checkout process. This diagram visualizes the communication flow between the user, route, controller, and model.

Entity Relationship Diagram (ERD)

ERD is a visual representation that shows the relationship between tables in a database, including the columns (fields) they have. Each database consists of one or more tables that contain several columns to store data. Typically, tables in a database have certain relationships or associations, known as relations. The following is the proposed system ERD:

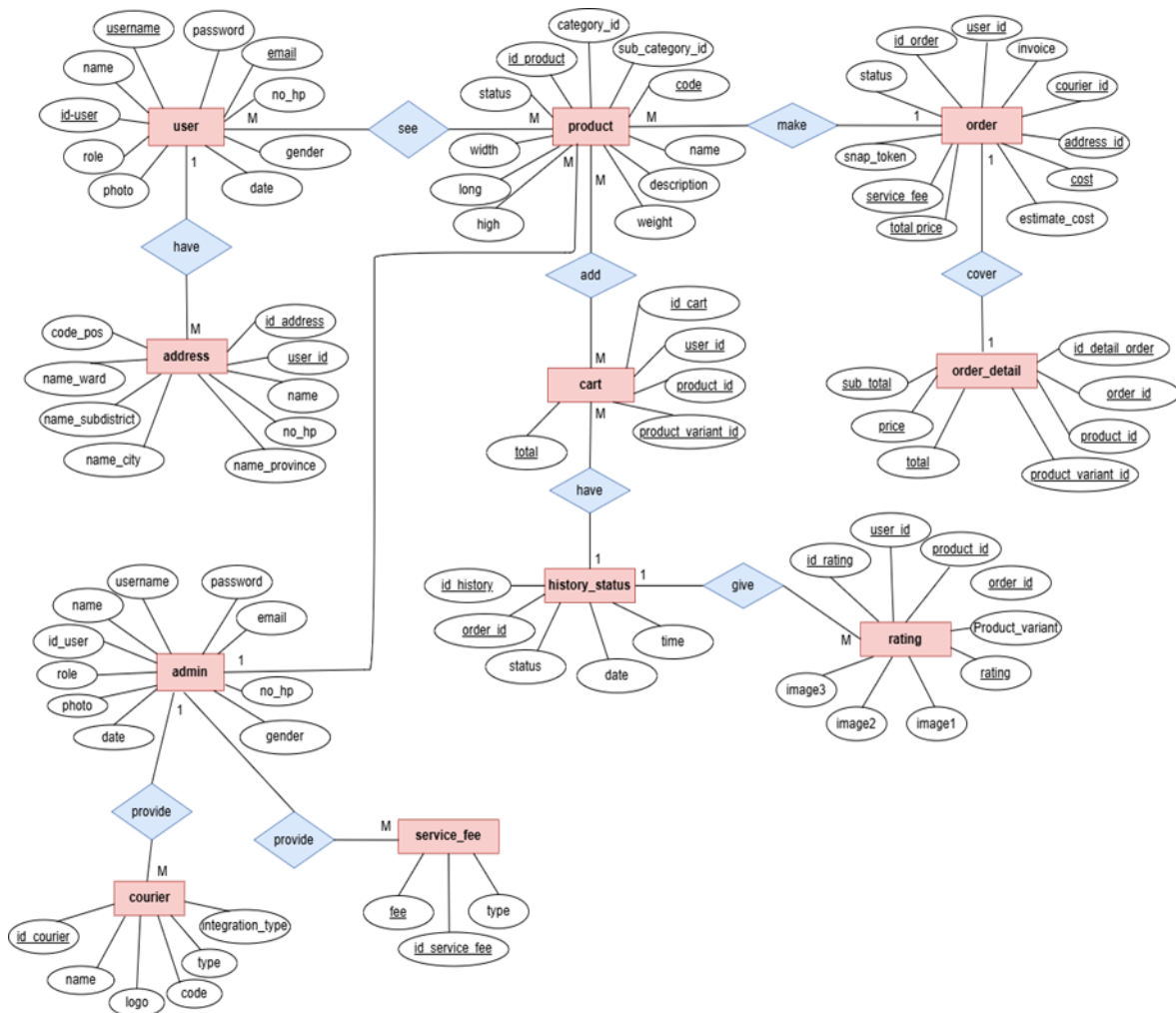


Figure 8. Entity relationship diagram

Figure 8 there is an ERD diagram that describes the relationship between tables consisting of 11 entities and 9 relations, namely the user entity, which has 10 attributes, including id_user, name, username, password, email, no_hp, jenis_kelamin, tanggal_lahir, foto, and role. Address relations can be done through the id_user attribute as a foreign key in the address table, which connects it to the user entity. This relationship illustrates that each user can have one or more addresses stored in the system. This relationship is one-to-many, where one user entity can have many address entities.

Implementation

Admin dashboard page

The admin dashboard page presents a summary of application activities, such as total orders, revenue, customers, and products, complete with statistical graphs of sales, products, and orders. This page runs smoothly without bugs, with a response time of 3 to 5 seconds after logging in with 1 click. User feedback indicates easy navigation, a user-friendly interface, and efficient access to information. This feature helps admins monitor system performance, evaluate transactions, and user feedback to support data-based decision making. The page of admin dashboard can be seen in Figure 9.

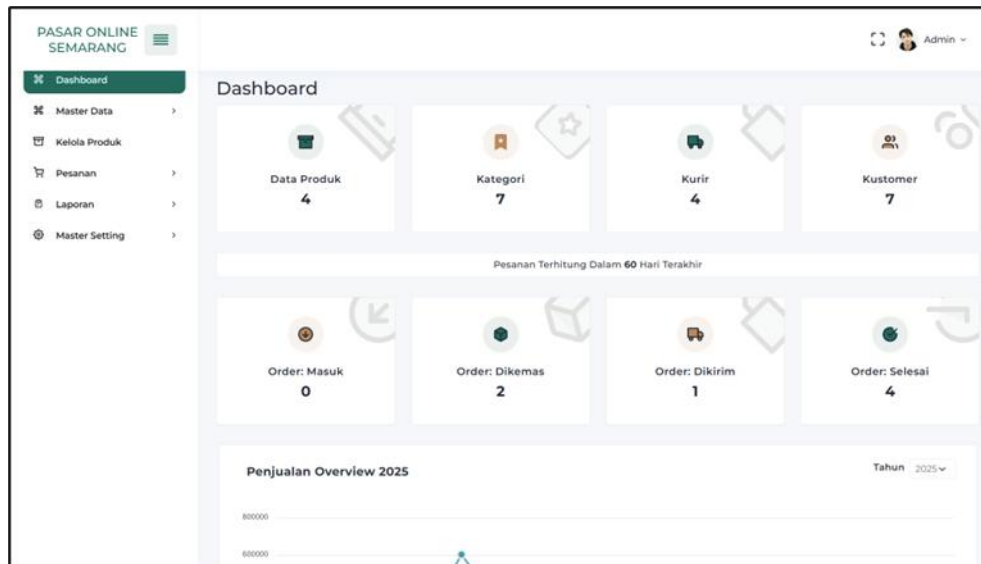


Figure 9. Admin dashboard page

Admin order page

The order page includes a list of user orders, from unpaid, in progress, to completed. Admin can monitor order status, manage shipping receipt numbers, and handle cancellations or returns. The page runs smoothly without bugs, with a response time of 3 to 5 seconds, with just 1 click. Trial transactions were successful more than 10 times with various scenarios. User feedback shows an easy-to-use interface and high efficiency, ensuring transparent and effective order management. The page of admin order, can be seen in Figure 10.

#	Nama	Alamat	Kurir	Produk	Total	Status	Actions
1	Salsabila	Salsabila (+62) 879564123589 Jl Mangga 1 Rt 19 Rw 03 Robayan, Kalinyamatan, JEPARA, JAWA TENGAH, 59462	JNE Reguler Ongkir : Rp 11.000 Estimasi : 3-6 Hari	Timun Lokal x1 Variasi: Hijau, 25 Rp 12.000	Rp 26.000	Selesai	✓
2	mawar eva	Mawar Eva (+62) 87965412369 Jl Pemuda No 4 Kalirejo, Undaan, KUDUS, JAWA TENGAH, 59372	Tiki Ongkir : Rp 10.000 Estimasi : 2 Hari	Daging Sapi (Grade Premium) x1 Variasi: Merah, 10 Rp 150.000 Bayam x2 Variasi: Hijau, 25 Rp 5.000 Apel Merah x3	Rp 257.000	Selesai	✓

Figure 10. Admin order page

Admin report page

The report page compiles comprehensive financial, transaction, and sales data into a clear and simple table. Using data visualizations like transaction reports and sales graphs, administrators can keep an eye on the performance of their applications. Data may be exported in PDF format for additional analysis or documentation. With a reaction time of 3 seconds to load reports with a single click, the program runs smoothly and without any issues. The system's stability was confirmed by successful testing that was carried out five times in a variety of settings. According to user reviews, this page provides quick access to important information. The information offered assists strategic corporate decision-making and helps administrators analyze the functioning of applications. The page of admin report, can be seen in Figure 11.

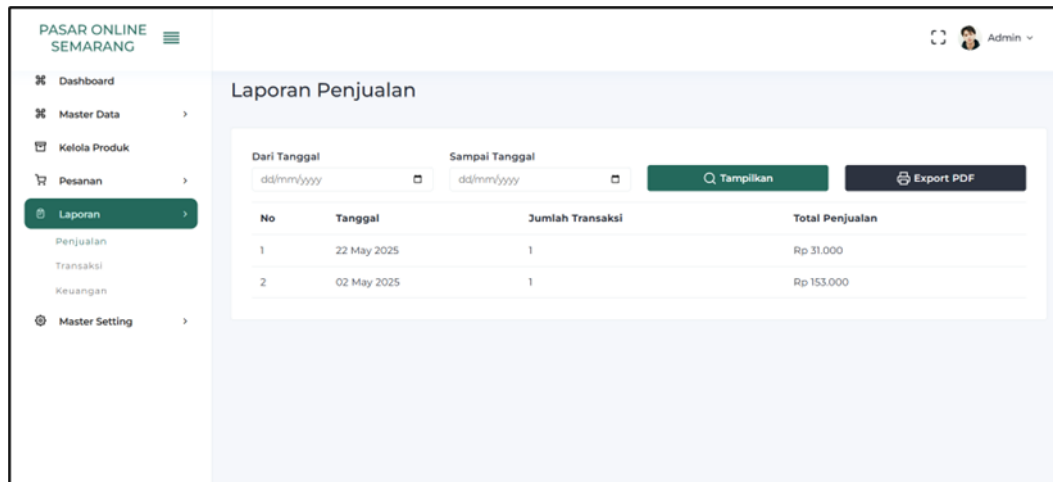


Figure 11. Admin report page

User landing page

When users first enter the program, they are presented with the landing page. In order to grab visitors' attention, it is made to be both aesthetically pleasing and educational, providing succinct information about the newest goods, sales, and discounts. The page loads all items with a single click in around two seconds, and it functions perfectly and without any issues. The landing page is a good starting point for an interesting user experience within the program since user feedback emphasizes how simple it is to access pertinent information. The page of user landing, can be seen in Figure 12.

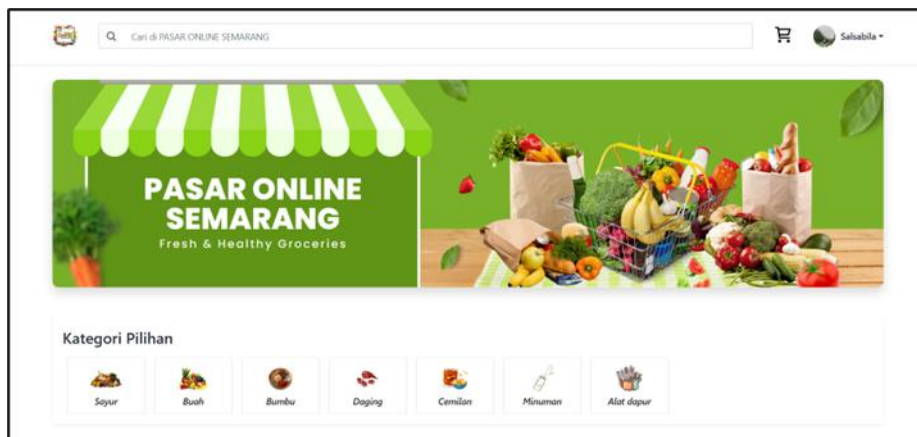
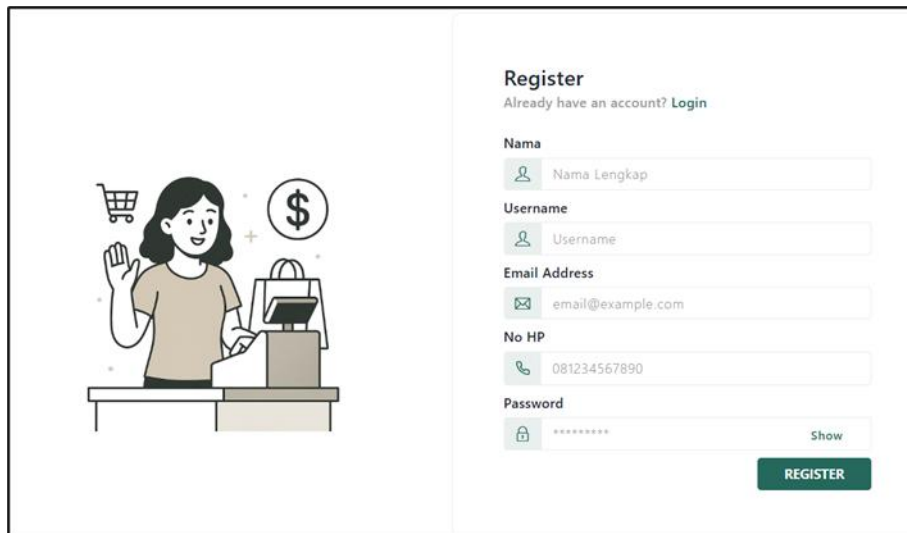


Figure 12. User landing page

User account registration page

On the user registration page of the program, new users can create an account. It was designed to be simple and easy to use, and it employs input validation to ensure that the data submitted is accurate and secure. After completing the registration procedure, users are seamlessly directed to the login page. This function works well and reacts swiftly to give the greatest possible user experience. The page for user account registration, displayed in Figure 13.



Register
Already have an account? [Login](#)

Nama

Username

Email Address

No HP

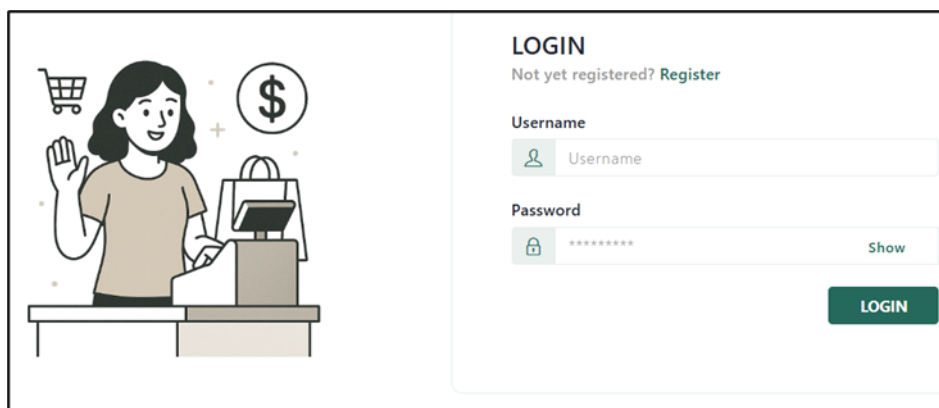
Password
 [Show](#)

REGISTER

Figure 12. User account registration page

User and admin login page

By entering their email address and password on the login screen, users and administrators may more readily access their accounts. Its simple, user-friendly design ensures a quick and secure authentication process. The system may notify users of errors, such as incorrect passwords or unregistered accounts, since input validation is integrated into the system. Before going to the next screen, the page waits five seconds to react. The page for user and admin login, displayed in Figure 14.



LOGIN
Not yet registered? [Register](#)

Username

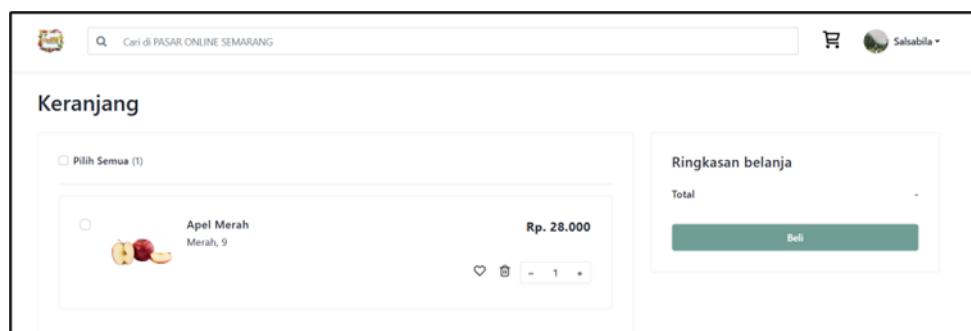
Password
 [Show](#)

LOGIN

Figure 14. User and admin login page

User cart page

On this page, users can browse the list of items they intend to purchase, add or remove items from their basket, and then continue to the payment process. With a single click, the page loads all of the information in around five seconds, and it runs without a hitch. Customers may efficiently manage their shopping carts thanks to this function, which allows for a convenient and organized shopping experience. The page of user cart, displayed in Figure 15.



Keranjang

☐ Pilih Semua (1)

☐  **Apel Merah**
Merah, 9 **Rp. 28.000**

Ringkasan belanja

Total

Beli

Figure 15. User cart page

Payment user page

A secure and flexible digital payment option is made possible by the payment page's integration with the Midtrans API. A range of payment methods, including bank transfers, credit cards, and e-wallets, are available to customers. The page loads in 3 to 5 seconds with a single click and functions well. This feature ensures that transactions may be performed safely and promptly, which enhances the user experience. The page for payment can be seen in Figure 16.

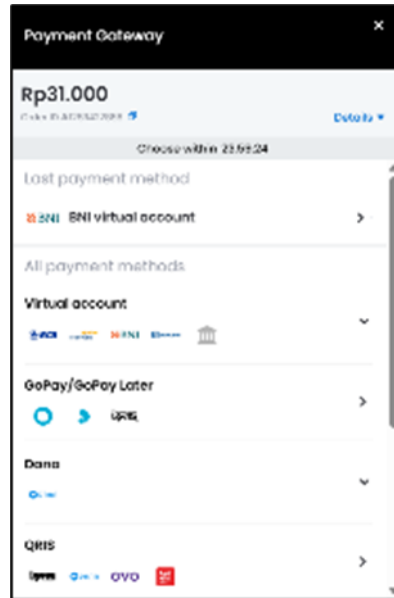


Figure 16. Payment user page

User order tracking page

Using the issued tracking number, users may monitor the delivery status of their orders in real-time, from processing to fulfillment. With a response time of around three to five seconds each click, this page functions flawlessly and without any issues. Over ten experimental transactions in a variety of scenarios with varying levels of complexity were successfully processed by the system. As consumers keep an eye on their orders till delivery is finished, this function guarantees them ease and transparency. The page of user order tracking, can be seen in Figure 17.

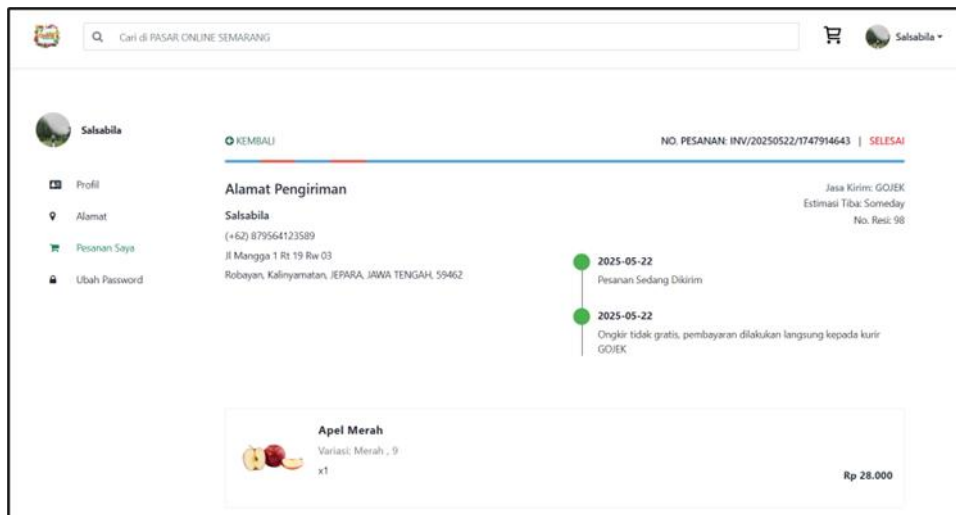


Figure 17. User order tracking page

User product rating page

Users can choose to rate and evaluate the goods after placing an order. With a 5-second response time, the page runs well. This feature aids other users in making informed purchasing decisions while offering valuable feedback to sellers to enhance the quality of their products and services. The page of user product rating, displayed in Figure 18.

Figure 18. User product rating page

Blac Box Testing

System testing is carried out using the black box testing method to test various functions in the system, such as adding, changing, deleting, and displaying information as expected. This method ensures that the system has been designed correctly and can operate according to expected conditions, and helps detect potential errors in the application. Testing was carried out by the author together with one of the sources, namely the owner of the Semarang Online Market account. The test results were analyzed to ensure that the system functions properly and meets the needs that have been set. Through this method, researchers can more easily ensure that the application is free from errors or bugs [16], [17].

Table 1. Admin system testing

Features tested	Test scenario	Expected results	Results
Dashboard	The dashboard displays a summary of application statistics and a navigation menu	Successfully displays information correctly	Successfully
Master Data	Add, edit and delete product categories, couriers, service fees	Data is successfully executed without error	Successfully
Manage Products	Add, edit, and delete product data to be uploaded	Data is successfully executed without error	Successfully
Orders	Manage orders including processing, packing, shipping, and completing	Order process runs smoothly and status is updated	Successfully
Reports	Display complete sales, transaction, and financial reports	Report data is displayed accurately	Successfully
Reports Setting	Add or edit application settings such as banners, admins, and addresses	Changes are successfully saved and applied	Successfully

Table 2. User system testing

Features tested	Test scenario	Expected results	Results
Register Page	Users can register a new account	New account successfully created	Successfully
Login Page	Users can log in to an existing account	Login successful and redirected to landing page	Successfully
My Account Page	Edit, delete, view profiles, addresses, order history, and change passwords	Changes successfully saved and displayed	Successfully
My Order Page	View details of all orders that have been paid, unpaid, processed, shipped, packed, completed	All orders are displayed according to their status	Successfully

Cart Page	Display products that have been added to the shopping cart	Products are displayed correctly in the cart	Successfully
Checkout Page	Choose a shipping method and ensure the checkout process runs smoothly	Checkout process successfully completed	Successfully

4. CONCLUSION

The development of a web-based e-commerce application in this study successfully addresses key challenges faced by SMEs in the digital economy, particularly in terms of flexible fund withdrawal and consumer product education. A website-based E-Commerce application for selling food products in the Semarang area with payment gateway integration has been successfully developed using the Midtrans and RajaOngkir APIs. With the Waterfall approach, this application meets user needs, facilitates flexible transactions, expands the market, and provides local product education features. For further development, it is recommended to integrate artificial intelligence for rating analysis, analytical dashboards for MSMEs or farmers, and expand to mobile applications to increase accessibility and benefits.

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