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Design and Development of an E-Commerce Website Using the Waterfall Method with the Laravel Framework

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ABSTRACT

The e-commerce sector has experienced significant growth in Indonesia in recent years. However, many small business owners still rely on manual operations through social media platforms. This study focuses on the design and implementation of an e-commerce website for Comot Langsung, a local thrifting business, using the Waterfall methodology and the Laravel framework. The sequential nature of the Waterfall method is applied through six phases: requirement analysis, system design, development, testing, deployment, and ongoing maintenance. In the analysis phase, several key features were identified, including user registration, product catalog, shopping cart, ordering system, and QRIS payment integration. The design process utilized UML diagrams to clearly and structurally visualize the system architecture and user flow. The results show that all features were successfully implemented, offering high responsiveness and ease of navigation. This website is expected to expand market reach for thrifting entrepreneurs while enhancing the online shopping experience for consumers in selecting and purchasing vintage fashion products efficiently and conveniently.

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1. Introduction

The development of information technology has significantly driven industry growth across various sectors, including the business world. This advancement has reshaped work processes and business strategies, opening new opportunities while introducing new challenges for business players [1]. Information technology enables businesses to conduct transactions online, manage data efficiently, and communicate seamlessly with customers and business partners worldwide [2], [3].

One of the increasingly popular trends is thrifting, which involves purchasing high-quality secondhand clothing at more affordable prices. Thrifting is considered an eco-friendly lifestyle, helping to reduce the growing textile waste [4]. Beyond sustainability, thrifting allows individuals to express their creativity and personal style through unique combinations of vintage and pre-loved items [5]. According to the Ministry of Cooperatives and SMEs, 64.7% of MSMEs in Indonesia have adopted digital platforms. However, only

13.5% have their own e-commerce platform [6]. This highlights a gap in e-commerce technology adoption among Indonesian MSMEs.

Comot Langsung, a thrift clothing business, initially operated manually through Instagram. This approach led to inefficient order and customer data management, especially as transaction volume increased [7]. To address this challenge, an e-commerce website was designed with a focus on online thrift clothing sales, ensuring smoother operations and better scalability.

Several previous studies have explored e-commerce implementation for MSMEs using various approaches. Andarweni et al. [8] designed a website-based e-commerce application using the CodeIgniter framework for Tiara Brand, demonstrating that implementation can enhance transaction efficiency and market reach. Another study by Saputra et al. [9] applied the Agile methodology in e-commerce development for Usaha Kue dan Makanan Minang Kreatif, resulting in improved operational efficiency and expanded market coverage.

The research gap lies in the development of a Laravel-based e-commerce system, specifically designed for the thrifting business using the Waterfall approach. The sequential nature of the Waterfall method allows the development team to focus on one stage at a time, reducing complexity and project failure risks [10]. The Laravel framework is chosen because it supports structured and secure development through the MVC (Model-View-Controller) architecture [11]. Laravel offers various modern features, such as the Blade templating engine for dynamic views, Eloquent ORM for intuitive database management, and the database migration system that helps track schema versioning securely [12]. MySQL is used to manage product, user, and transaction data because it is recognized as a fast, reliable, and user-friendly database management system [13]. As an open-source RDBMS licensed under the GNU General Public License (GPL), MySQL supports multiplatform compatibility, access security, and comprehensive SQL (Structured Query Language) commands [14].

This research aims to design and implement a responsive, secure, and user-centric e-commerce system through a structured software engineering approach. The primary focus includes system requirement identification, architecture and database design, implementation of essential features, and evaluation of website performance and usability. The research findings are expected to contribute to the development of web-based systems for MSMEs in the vintage fashion sector, enhancing operational efficiency and user experience.

2. Research Method

The waterfall method is a software development model that follows a sequential or linear approach [15]. In this method, each development phase must be fully completed before moving on to the next phase. Progress flows downward from one stage to the next, without returning to previous phases, resembling the cascading nature of a waterfall [16].

This method is chosen because system development is carried out in a structured and orderly manner [17], facilitating a systematic development process from start to finish. The stages of the Waterfall method applied in this study include:

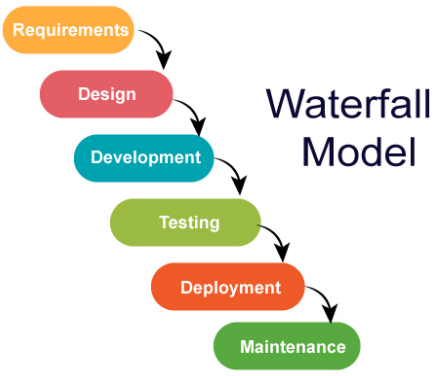

Figure 1. Waterfall Method

2.1. Requirements

At this stage, the process of identifying and gathering system requirements from stakeholders is carried out [18]. Information is collected through observations, interviews, and literature studies. The

outcome of this phase is a system requirements document that includes key features such as product catalog, shopping cart system, checkout, and transaction management.

2.2. Design

This stage focuses on system modeling using Unified Modeling Language (UML) to systematically depict structure and workflow. The diagrams used include use case diagrams to represent actor relationships and functionalities, as well as user flow diagrams. This modeling ensures that the system is built according to requirements and has a clear architecture before being developed with Laravel [19].

2.3. Development

This stage involves the implementation process, where the system design is translated into code [20]. Development is carried out using the Laravel framework to build the website's core functionalities, including user registration, product management, checkout process, and payment system.

2.4. Testing

Testing is conducted to ensure that all functions operate as expected [21]. The testing method used is black box testing, which evaluates each feature without examining the internal code structure [22]. The testing focuses on input validation, page navigation, transaction processes, and system security.

2.5. Deployment

Once the system is deemed stable and ready for use, the deployment process to the production server is carried out [23]. The website is uploaded to a hosting service that supports Laravel and configured to ensure public accessibility for users.

2.6. Maintenance

The final phase is system maintenance, which includes bug fixes, adjustments based on user feedback, and additional feature development when needed [24]. Maintenance is carried out regularly to ensure the system remains optimal and responsive to user needs [25].

3. Result and Discussion

Comot Langsung is an online platform that offers a curated collection of vintage clothing, seamlessly blending the aesthetics of the past with the convenience of modern digital shopping. This website is designed to appreciate the uniqueness and authenticity of fashion across different eras, catering especially to vintage fashion enthusiasts.

The development of Comot Langsung follows the Waterfall methodology, which consists of six main phases: Requirement, Design, Development, Testing, Deployment, and Maintenance. Each phase is executed sequentially, serving as a foundation for the next stage.

3.1. Requirement

The Requirement phase begins with a needs analysis process conducted through literature reviews, observations of similar systems, and internal discussions. Its primary goal is to formulate the functional and non-functional requirements that Comot Langsung must have as an e-commerce platform.

Several key features identified in this phase include user registration system, product catalog, shopping cart, ordering process, and QRIS-based payment system.

3.2. Design

In the Design phase, a Use Case Diagram is created to illustrate the relationship between actors and system features. This diagram includes key activities such as registration, login, product search, cart management, order placement, payment proof submission, and order history access.

Additionally, the Admin role is modeled to handle payment verification and product management. With this diagram, system requirements can be clearly mapped from both the user and administrator perspectives. Here is the Use Case Diagram for the Comot Langsung website, showing the interactions between Guest, User, and Admin with system functionalities:

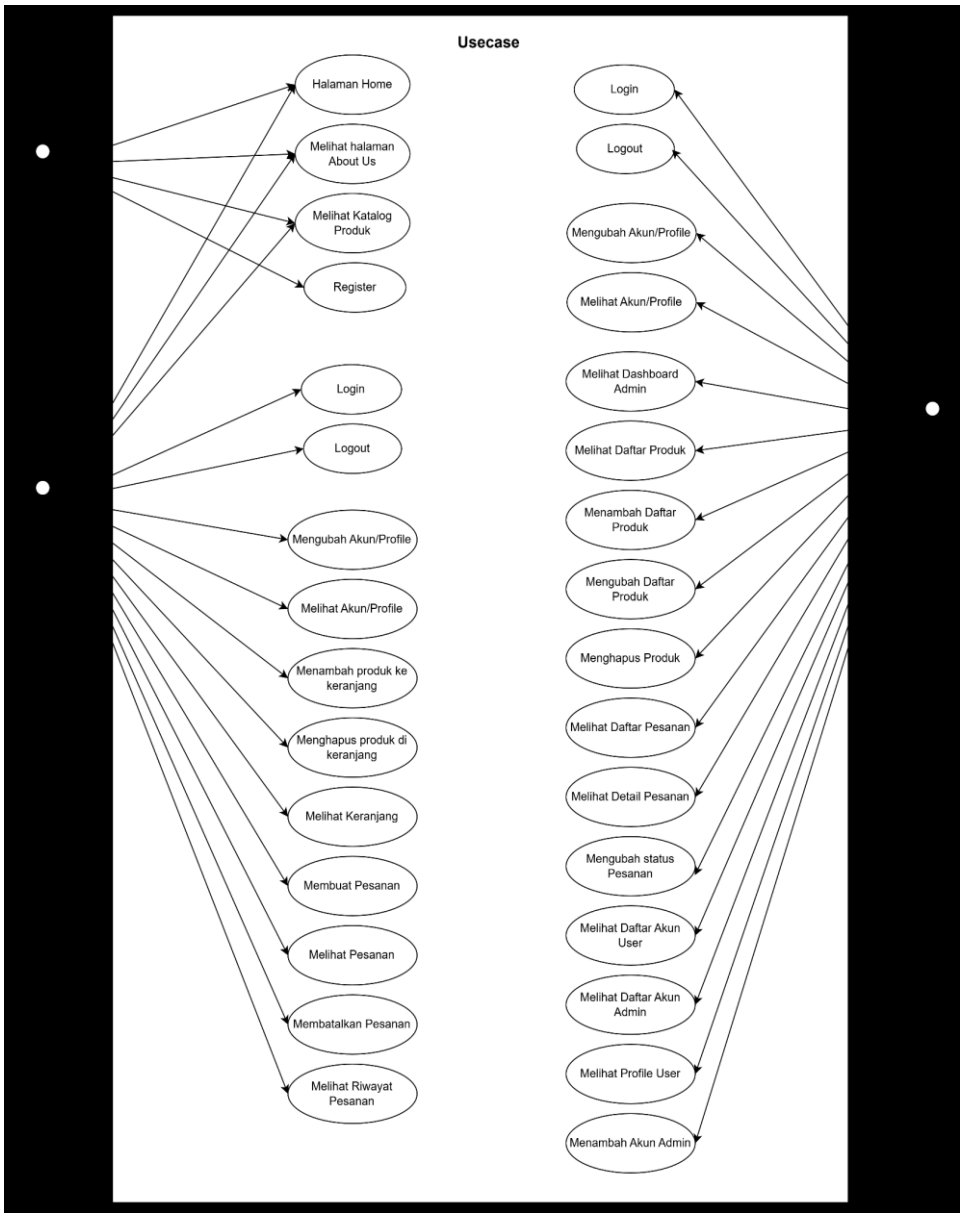

Figure 2. Usecase Diagram

Meanwhile, User Flow is used to depict the navigation path taken by users when interacting with the website. From accessing the homepage, selecting products, filling in order details, to completing the payment process, each step is visualized to ensure that the user experience remains logical and efficient, aligning with the objectives of the Comot Langsung platform. Here is the User Flow for the Comot Langsung website.

In the context of digital product development, a well-defined User Flow is an essential instrument that allows developers, designers, and stakeholders to understand how users proceed from one stage to another while performing specific tasks. The User Flow implemented in the Comot Langsung platform aims to map real user behavior, reduce friction during navigation, and eliminate unnecessary steps that could potentially hinder users from completing their intended actions. This visual representation also functions as a diagnostic tool to identify inefficiencies or bottlenecks that may disrupt the overall usability of the system.

The flow begins when the user reaches the homepage, which serves as the primary gateway to all features offered by Comot Langsung. This page is designed to present essential menus, product recommendations, category filters, and promotional information in a concise and intuitive manner. The arrangement of elements on the homepage plays a pivotal role in shaping the first impression and guiding users toward the next path they are likely to explore. A well-structured homepage ensures that users can immediately recognize what the platform offers and how they can start interacting with available features.:

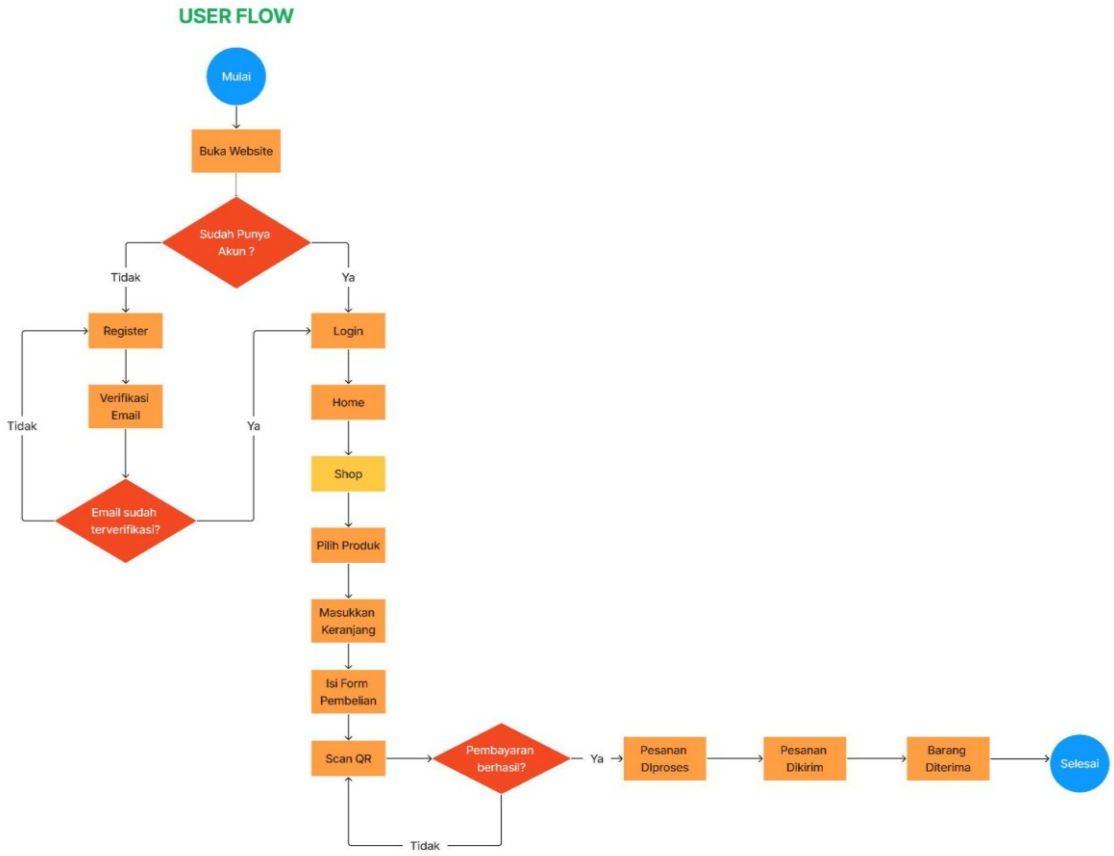

Figure 3. User Flow

3.3. *Development*

The Development phase is carried out using the Laravel framework as the main foundation for backend development. The process includes creating models, controllers, and views, along with implementing key features such as user authentication system, product data management, order processing, and payment proof submission. All functionalities are developed based on the system design established in the previous phase. The outcome of this process is a website interface that presents the fully implemented features.

3.3.1. *Registration Page*

The registration page allows new users to create an account by providing personal details such as full name, email, and password. This serves as the initial step for users to gain access to exclusive features within the website, as shown in Figure 4.

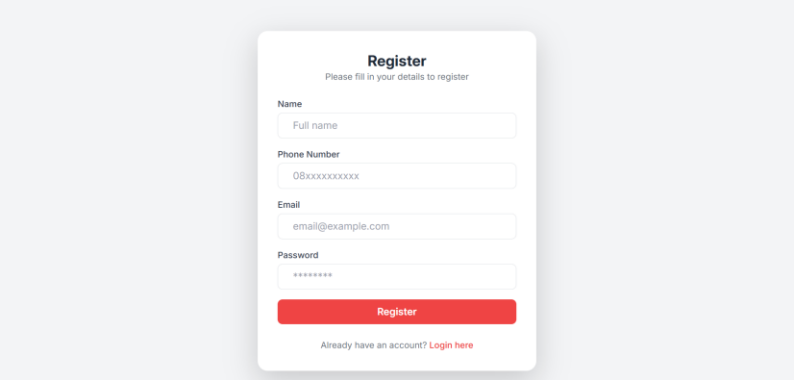

Figure 4. Register Page

3.3.2. *Login Page*

After registering, users can log into their accounts through the login page. Figure 5 displays the login page, where users are required to enter their registered email address and password. This page is designed to ensure secure access while maintaining ease of use, allowing users to quickly authenticate their identity and proceed to the main features of the Comot Langsung platform.

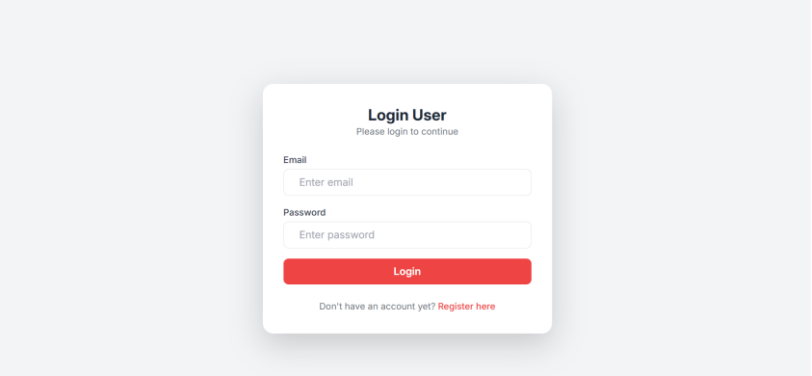

Figure 5. Login Page

3.3.3. *Home Page*

The home page is the first screen users see after successfully logging in. Figure 6 displays general information about the store, special offers, and the main navigation menu, which includes Shop, Cart, About, Contact, and Profile. This page serves as the central hub, providing quick access to essential features and guiding users toward available products and services efficiently.

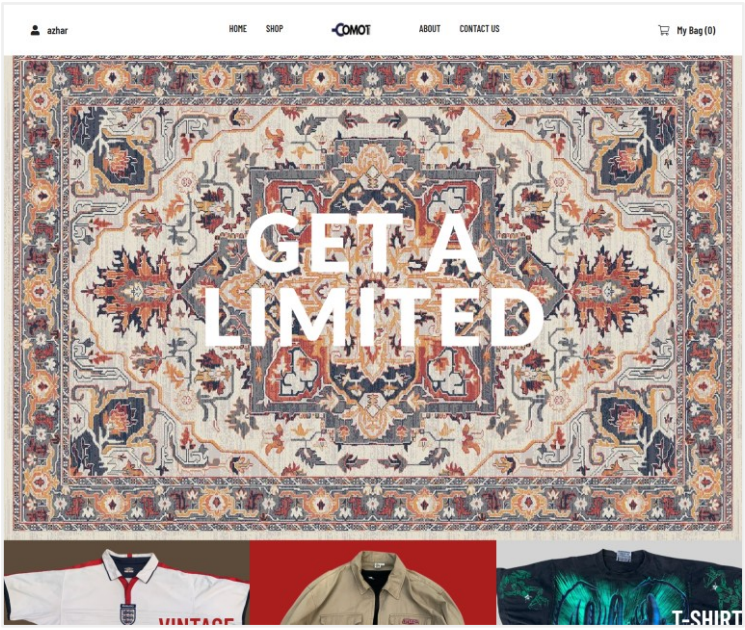

Figure 6. Home Page

3.3.4. *Shop Page*

The Shop page is where users can browse the entire collection of available products. Figure 7 illustrates that products are displayed in card format, featuring an image, name, and price to help users quickly identify items of interest. To enhance convenience, the page also provides category-based filters such as outerwear, t-shirts, and jerseys, allowing users to narrow down their search efficiently. This filtering system ensures that users can find specific products without needing to scroll through the entire catalog. Additionally, the layout is designed to be clean, responsive, and easy to navigate, supporting a smooth shopping experience across different devices. Overall, the Shop page functions as a central browsing area that helps users explore and select products with clarity and ease.

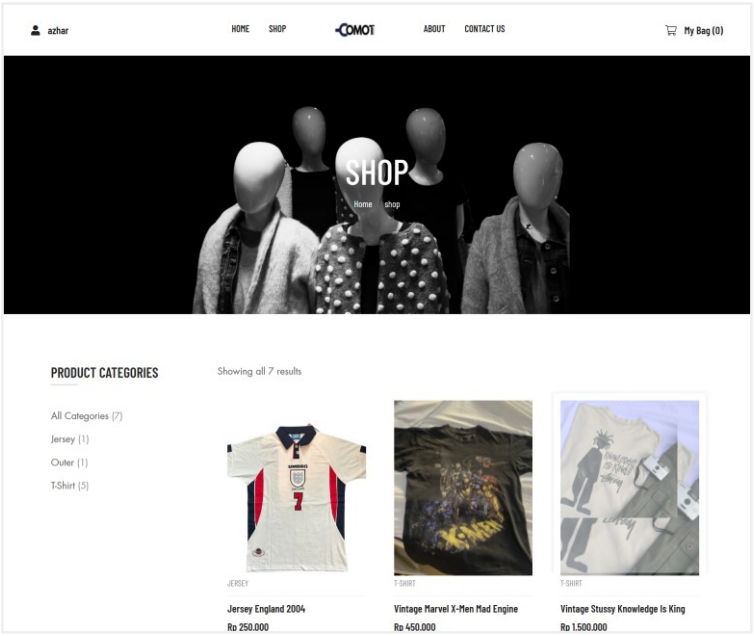

Figure 7. Shop Page

3.3.5. *Cart Page*

After selecting a product, users can view the list of items added to their shopping cart. Figure 8 displays the cart page, where users can review product quantities, remove items, or make adjustments before proceeding to checkout. This page is designed to give users full control over their selections, ensuring accuracy and convenience. By allowing quick edits and clear visibility of all chosen items, the cart page supports a smooth transition toward the final purchasing steps and helps reduce potential ordering errors.

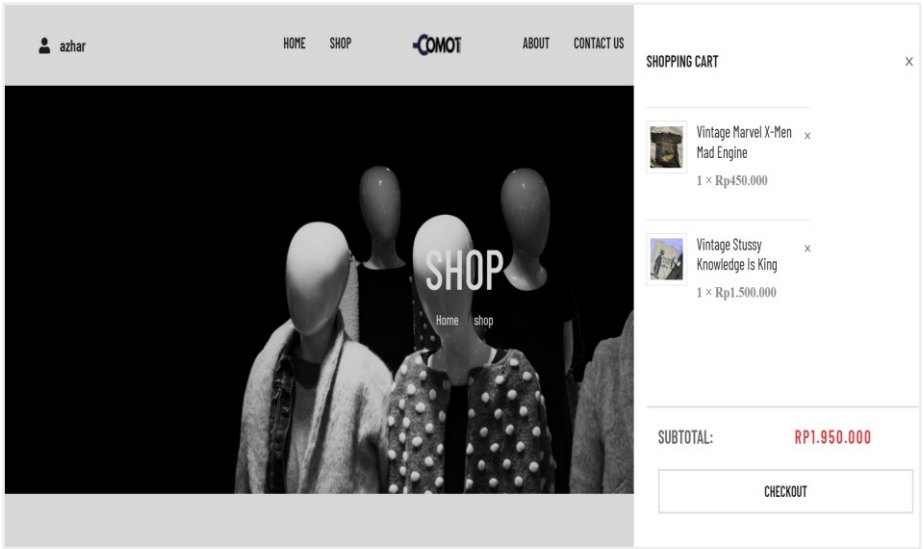

Figure 8. Cart Page

3.3.6. *Order Detail Page*

Figure 9 displays the form that users must fill out, including essential details such as the recipient's name, WhatsApp number, postal code, and complete shipping address. This stage is designed to ensure that all delivery information is accurate and clearly recorded. Users are encouraged to review every field carefully to avoid errors that could affect the order fulfillment process. By providing a structured and easy-to-navigate form, the system helps users confirm their data with confidence before moving on to the payment page, ensuring a smooth and reliable checkout experience.

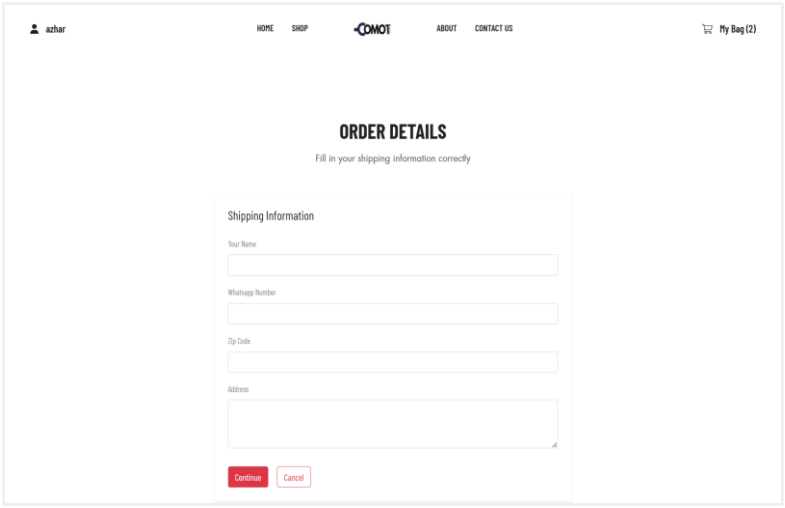

Figure 9. Order Detail Page

3.3.7. *Payment Page*

After confirming the order, users are redirected to the payment page, as shown in Figure 10. On this page, users are required to complete the transaction by transferring the payment using the provided QRIS code and then uploading proof of payment. The interface presents the QRIS destination code image clearly, along with an upload form that allows users to submit their payment evidence directly through the system. This approach is implemented as an alternative to an automated payment gateway, enabling the platform to manage payments through manual verification conducted by the admin. Although the process is manual, the layout is designed to remain simple, intuitive, and efficient, ensuring that users can complete their payments without confusion and proceed smoothly to the final confirmation stage.

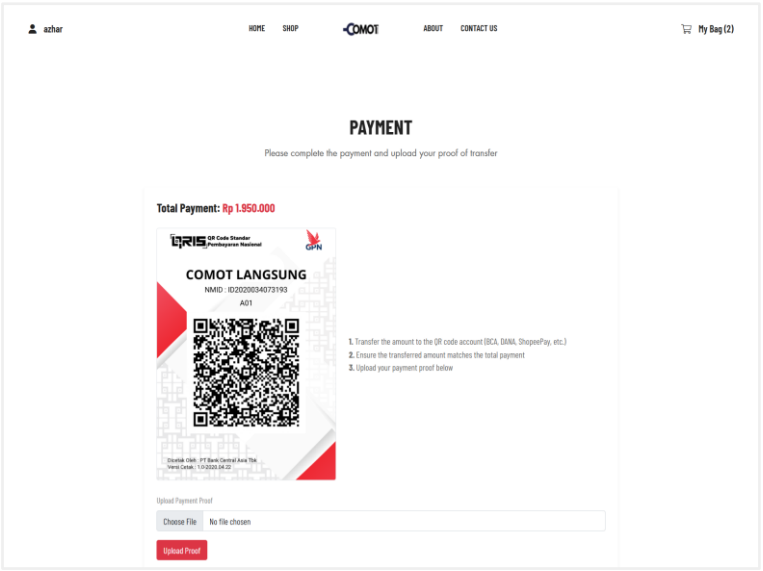

Figure 10. Payment Page

3.3.8. *Order History Page*

Figure 11 illustrates the transaction history page, where users can review their past transactions. The displayed information includes order number, date, total payment, and order status, allowing users to clearly understand the progress and outcomes of each purchase. This page is designed to provide transparency and convenience by presenting all transaction records in an organized and easy-to-read format. Users can revisit previous orders, verify payment details, and monitor whether their items are being processed, shipped, or completed. By offering complete access to historical data, the transaction history page helps users manage their purchasing activities more efficiently and ensures that every interaction within the platform remains traceable and accountable..

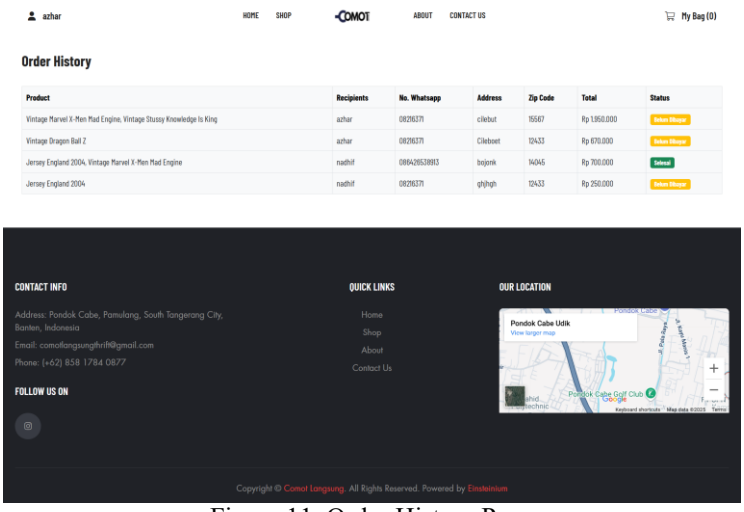

Figure 11. Order History Page

3.4. *Testing*

The testing phase is a crucial step in the Waterfall software development methodology, ensuring that the system functions according to the specified requirements and expectations. In this study, the black box testing method is applied to evaluate system functionality, focusing on testing outputs based on given inputs, without inspecting the internal structure of the code.

Black box testing is chosen as it aligns with the end-user perspective, assessing whether each feature delivers the expected results. Testing is conducted on several key features, including registration, login, payment processing, order details, and order history display.

Table 1. Testing Result

No	Feature Tested	Test Scenario	Expected Result	Actual Result	Status
1	Register	User fills in the form correctly and clicks the "Register" button	Account is successfully created and redirected to the login page	As Expected	Passed
2	Login	User enters valid email and password	User successfully logs in and is redirected to the main dashboard	As Expected	Passed
3	Payment	User completes payment via QRIS and waits for admin verification	Payment status is updated manually by admin after verification	As Expected	Passed
4	Order Detail	User fills in recipient's name, WhatsApp number, postal code, and address, then reviews data	All input fields are displayed correctly, and user can proceed to payment page	As Expected	Passed

5	Order History	User opens the order history page	A list of previous orders is displayed with current statuses	As Expected	Passed

Based on the testing results, all key system features have demonstrated performance aligned with the designed test scenarios. No issues or bugs were encountered during the testing process, indicating that the system has a high level of functionality and meets the criteria for deployment and end-user implementation.

3.5. Deployment

The Deployment phase is the process of deploying the system to a hosting environment, making it accessible to the public via the internet. The Comot Langsung website has been uploaded to a hosting service that supports the Laravel framework, with database configuration and basic security settings such as access protection and input validation to ensure system stability online.

The website can be accessed through the following link: comotlangsung.sgp.dom.my.id, representing the final implementation of the designed system.

3.6. Maintenance

The Maintenance phase is the final stage, carried out to fix bugs that may be discovered after the system is in real-world use. Additionally, this phase includes adjustments or improvements based on user feedback, as well as the development of additional features for future updates.

4. Conclusion

Based on the Waterfall methodology applied throughout the development process from requirements analysis to testing it can be concluded that the design and development of the Comot Langsung e-commerce website have been successfully executed. The system was built using the Laravel framework and tested through the black box approach, with results confirming that all features function as expected. This website facilitates online vintage clothing shopping, offering key features such as user registration, login, product catalog, order details, payment processing, and order history. The developed website is accessible via comotlangsung.sgp.dom.my.id and is expected to provide an efficient shopping experience while supporting the promotion of vintage products to a wider audience.

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