

Implementation of a Web-Based Management System for Geraifone Store Using the Waterfall Methodology

Fauzan Ilyas Almeyda¹, Miftahus Syifaul Haqqi², Adiyatma Eka Saputra³,
Ahmad Baihaqi⁴

¹²³⁴ Universitas Pembangunan Nasional Veteran Jawa Timur

Abstract

This study presents the development of a sales management website for Geraifone Store, focused on managing mobile phone and accessory transactions. The development process follows the Waterfall methodology, consisting of requirement analysis, system design, implementation, testing, and maintenance stages. The website provides an admin dashboard with several key features, including product management, customer management, sales transaction handling, and sales reporting. The product management feature supports full CRUD operations, allowing the admin to manage product details such as name, brand, specifications, purchase price, selling price, and stock quantity. Customer management enables the storage and maintenance of customer data. The transaction module records sales activities, including product selection, quantity, and payment status. The reporting feature displays comprehensive sales reports, which can be filtered by date range to help monitor daily, weekly, or monthly sales performance. The result of this development indicates that the system effectively supports structured, centralized, and efficient sales management for the store.

Keywords: Sales Management System; Web-Based Application; Product Management; Sales Transactions;

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1- Introduction

1-1- Background

The development of information and communication technology has transformed various sectors of life, including business and trade. In an increasingly competitive global era, the ability to adapt to technology is no longer an option but a necessity for businesses to survive and thrive. The use of technology has proven capable of increasing operational efficiency, expanding market reach, and providing data that supports more accurate decision-making. Nevertheless, many business actors, particularly in the Micro, Small, and Medium Enterprises (MSMEs) scale, still face significant challenges in managing their business operations. Dependence on manual methods and conventional record-keeping often becomes a source of inefficiency. "Manual recording systems have many weaknesses and higher risks compared to computerized recording systems, such as being time-consuming, accountants always being tied to a specific location, and the occurrence of errors in recording and calculation" [1].

Business processes that have not been digitized are also vulnerable to human error, slow in data processing, and make it difficult for business owners to obtain a comprehensive overview of business conditions quickly and accurately. "One of the main factors causing errors in stock management is the delay in recording transactions and the lack of thoroughness when recording the entry and exit of goods, which often occurs in manual systems" [2]. Therefore, a technology-based solution is needed that can help and facilitate the activities of business actors, especially MSMEs, in managing their businesses more efficiently and systematically. One solution that can be applied is the development of a website-based sales management information system integrated with key functions such as product data management, sales transactions, financial reports, and real-time inventory management [3].

To address these issues, this research aims to develop a sales management website for Geraifone Store using the Waterfall method approach. The Waterfall model is one of the oldest SDLC methods that uses a sequential and well-documented software lifecycle approach, starting from analysis, design, coding, testing, to the maintenance stage [4]. The website built must have primary features for managing product, customer,

³ CONTACT: 23081010134@student.upnjatim.ac.id

and sales data, as these features play a crucial role in improving user business activity efficiency. Moreover, according to the case at SKMart, web-based sales and order data management features have proven capable of saving time, facilitating data retrieval, and preventing the loss of important information. This is due to the transformation from a manual ledger-based system, which is prone to errors and data loss, to a computerized system capable of providing real-time and accurate data [5].

1-2- Methodology

The system development method used in this research is the Waterfall method. The Waterfall method is a sequential approach, where system development is carried out in stages and sequentially from one phase to the next [6]. This approach was adopted due to its structured flow and proven effectiveness for projects with a well-defined scope. This characteristic is highly relevant to the Geraifone system development, where all functional requirements have been mapped in detail from the early stages of the research.

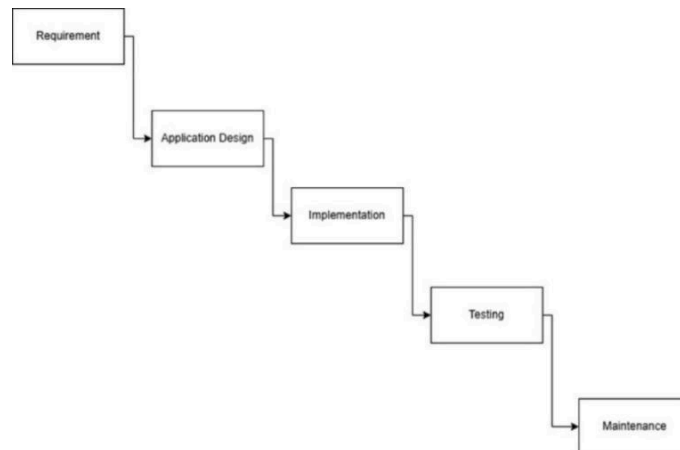


Figure 1. Waterfall Method

The development of this application adopts the Waterfall model, a sequential software development approach consisting of several successive and systematic stages. These stages are explained as follows.

1-2-1- Requirement Analysis

This stage focuses on identifying, collecting, and classifying all functional and non-functional requirements for the mobile phone and accessories sales management application. The analyzed requirements include key features such as:

- Product Management: CRUD (Create, Read, Update, Delete) functionality to manage mobile phone and accessory data, including adding new products, viewing product details, modifying product information (e.g., price or stock), and deleting products. This includes attributes like product name, brand, model, specifications, purchase price, selling price, and stock quantity..
- Customer Management: CRUD functionality to manage customer data, allowing the addition of new customer data, viewing customer lists, updating contact information, and deleting customer data if necessary.
- Sales Transaction Management: CRUD functionality to record every sales transaction, including adding new transactions (entering sold products, quantity, price, and payment method), viewing transaction history, updating transaction details, and canceling transactions.
- Sales Reports: Provision of features to view comprehensive sales reports, with the ability to filter data based on specific date ranges. These reports will display sales summaries, best-selling products, and daily/weekly/monthly transaction details.

The output of this stage is a requirements specification document that will serve as a strong basis for system design.

1-2-2- Application Design

In the design phase, the application's architecture begins to take detailed shape. This process involves creating various modeling diagrams to visualize the system's structure and workflow.

- Use Case Diagram

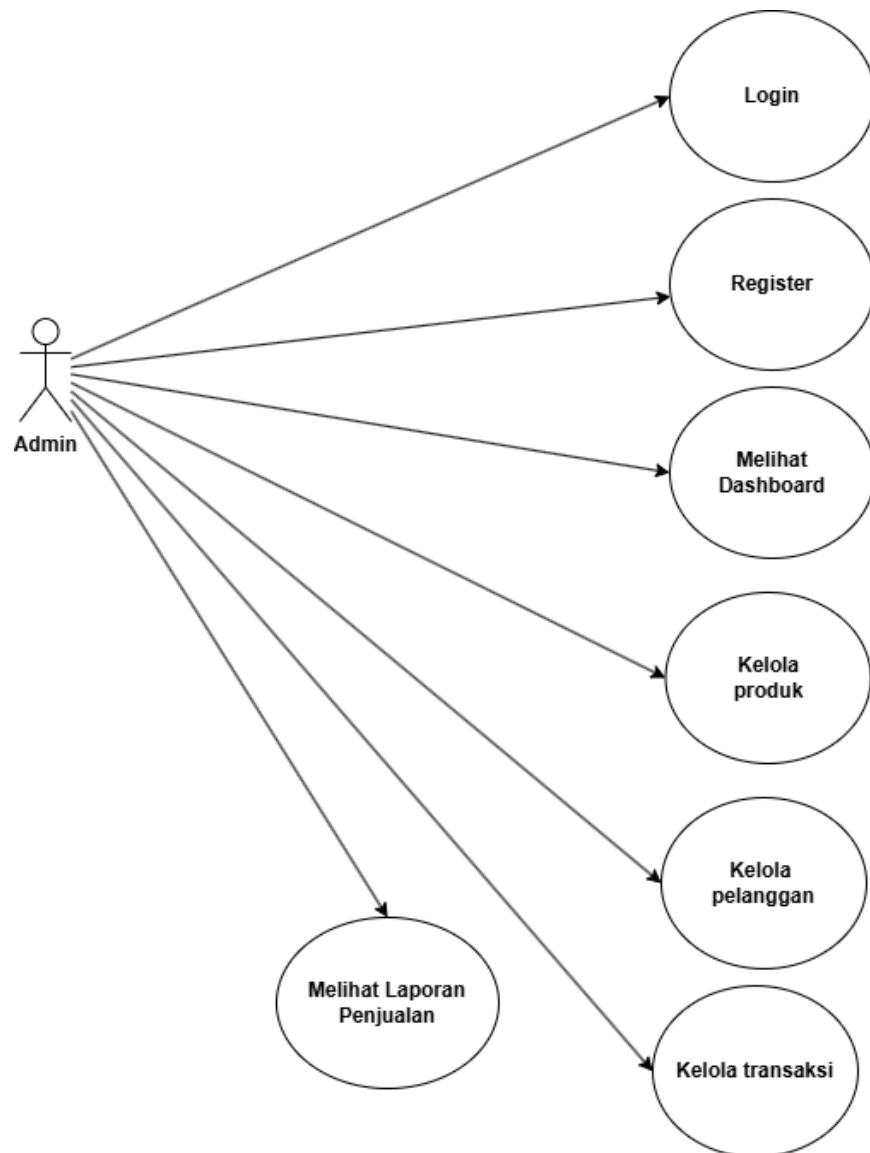


Figure 2. Use Case Diagram

The developed website includes several key features accessible to its users, namely the Admin. The first feature is Login, which allows the Admin to enter the system using a registered account, and Register for creating new accounts. After successfully logging in, the Admin will be directed to the dashboard, the main display providing a summary of product, customer, and transaction data. Additionally, the Admin is authorized to manage products, including adding, modifying, and deleting product data. The Admin can also manage customer data by recording and updating customer information for purchases. Another important feature is transaction management, where the Admin can record sales processes and verify payments. To complete the system, it also provides a sales report menu that displays transaction data periodically, which can be used for analyzing sales performance

- Activity Diagram

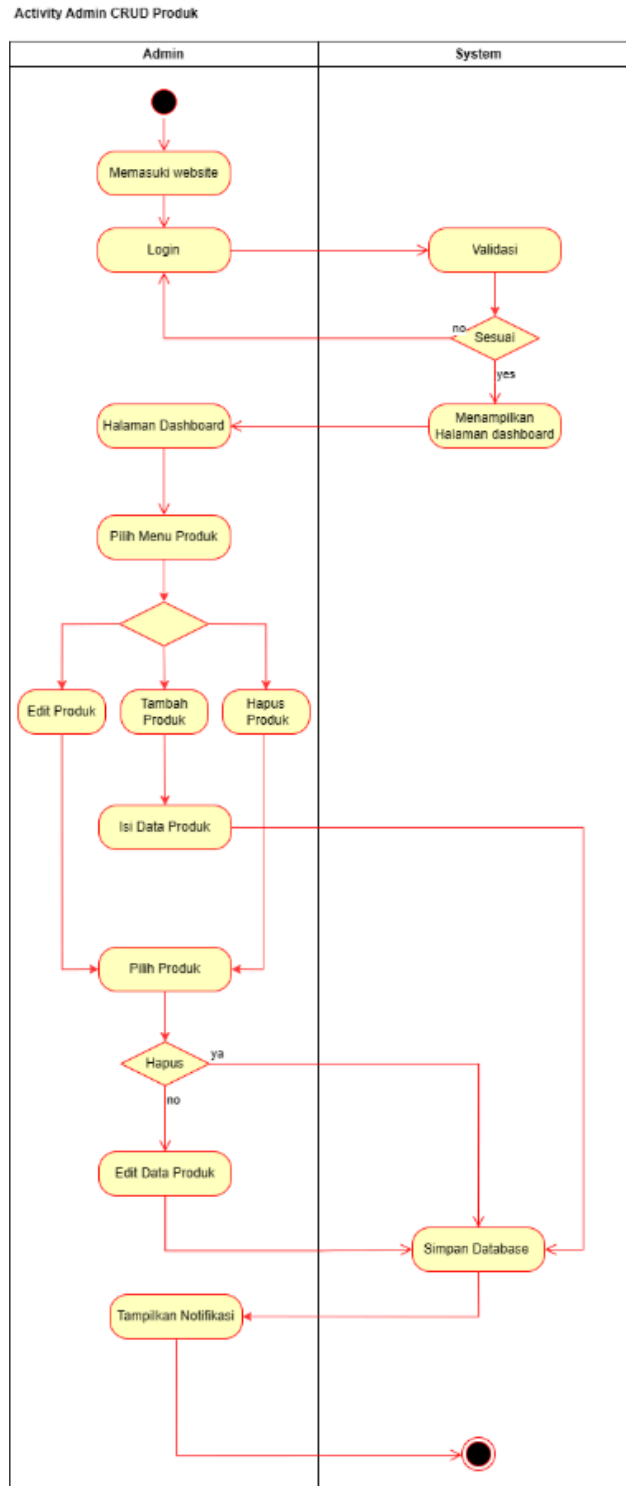


Figure 3. Product Activity Diagram

In the design phase, the user's interaction flow with the system is modeled using an activity diagram. The image above (referring to the one you'd place in your journal) illustrates the activity diagram for the Admin's product management process (Product CRUD). This process begins when the Admin accesses the website and logs in, which the system then validates. After a successful login, the Admin is directed to the dashboard and can select the 'Product' menu. From this menu, the Admin has options to add, edit, or delete products. If adding a product, the Admin will input new product data. If editing or deleting, the Admin needs to select the product first. Every change or addition of data will be saved to the database, and the system will provide a success notification to the Admin. This diagram ensures that each step in product management is clearly defined, from authentication to data updates.

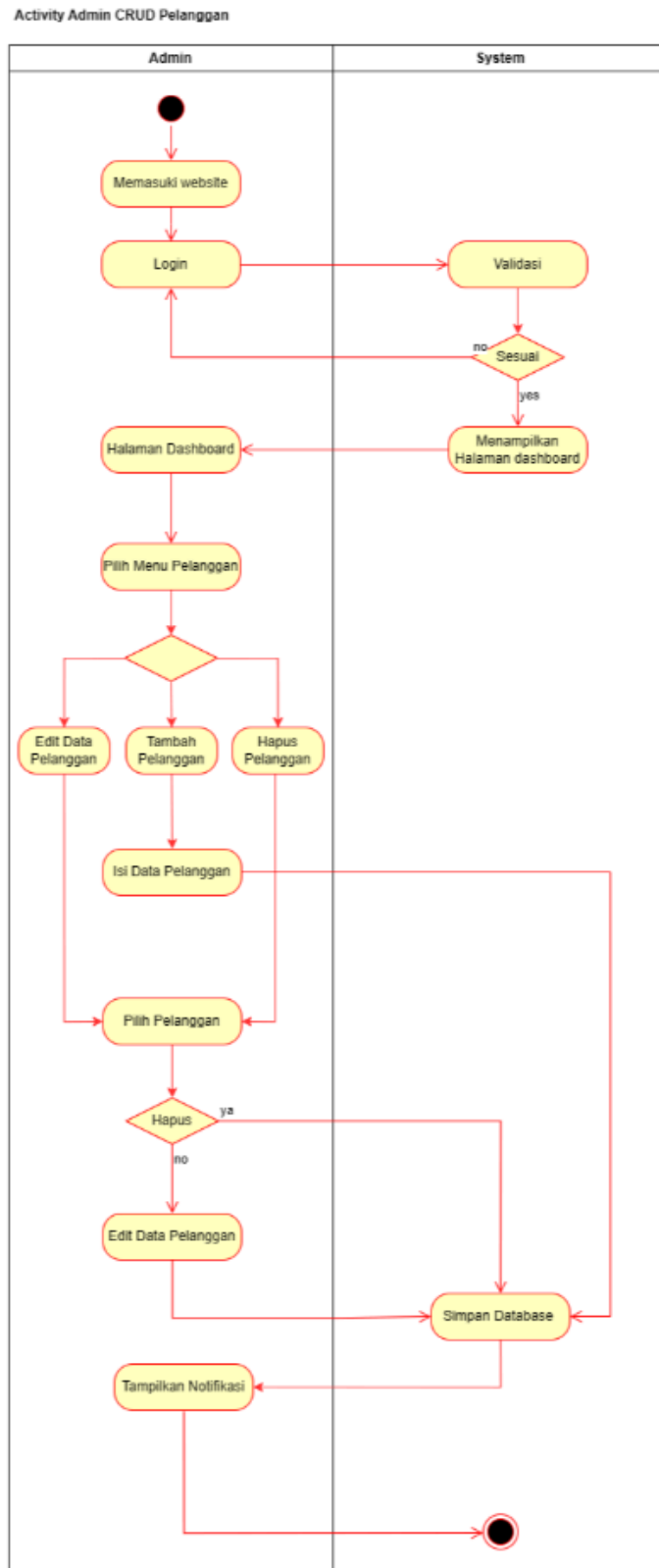


Figure 4. Activity Diagram of the Customer

In addition to product management, the application also supports customer data management. The first image (referring to the one you'd place in your journal) presents the activity diagram for the Admin's Customer CRUD process. This flow is similar to product management, starting with the Admin logging in and the system's validation. Once on the dashboard, the Admin can select the 'Customer' menu and then choose to add, edit, or delete customer data. Every action involving data changes will go through a data entry or selection process, and then be saved to the database, followed by a notification to the Admin. This

diagram outlines systematic steps to ensure integrity and ease in managing customer information.

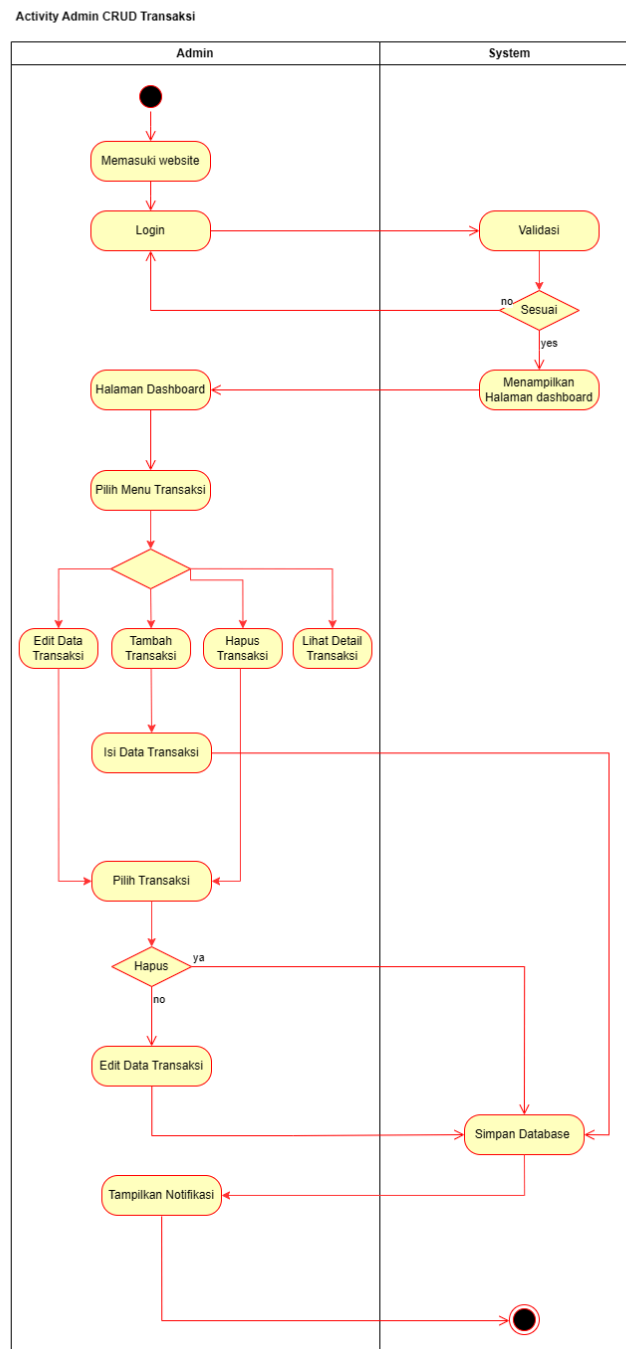


Figure 5. Activity Diagram of the Transaction

To ensure accurate sales recording, the application is equipped with transaction management functionality. The image above (referring to the one you'd place in your journal) illustrates the activity diagram for the Admin's Transaction CRUD process. This flow is similar to product and customer management, starting with the Admin login process. From the dashboard, the Admin can access the 'Transaction' menu and has options to add, edit, delete, or view transaction details. For addition operations, the Admin will input new transaction data. For other operations, the Admin needs to select the target transaction. Every change to transaction data will be saved to the database and confirmed via a notification. This process defines the steps necessary for effective transaction data management.

Activity Admin Melihat Halaman Dashboard

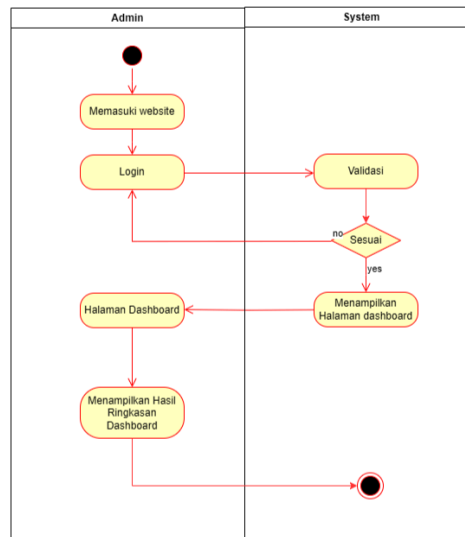


Figure 6. Activity Diagram of the Dashboard

To provide an overview of system performance and status, the application offers an informative dashboard page. The image above (referring to the one you'd place in your journal) illustrates the activity diagram for the Admin's flow in viewing the dashboard page. The process begins with the Admin accessing the website and logging in, which is then validated by the system. After a successful login, the system will display the dashboard page containing various summary information vital to mobile phone and accessory sales. This diagram shows the user's initial access steps to the system and how summary information is presented.

Activity Admin Melihat Laporan Penjualan

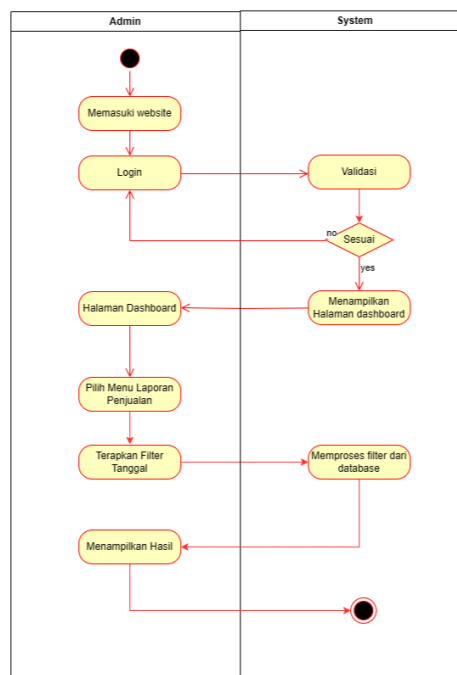


Figure 7. Activity Diagram of the Sales Report

This sales management application provides a flexible reporting feature to monitor business performance. The second image (referring to the one you'd place in your journal) illustrates the activity diagram for the Admin's process in viewing sales reports. After the Admin successfully logs in and accesses the dashboard, they can select the 'Sales Report' menu. On the report page, the Admin can apply date filters as needed. The system will then process the filter request by retrieving data from the database based on the selected date range, and then display the sales report results to the Admin. This diagram highlights the system's ability to provide specific sales data analysis based on the desired time period.

- Class Diagram

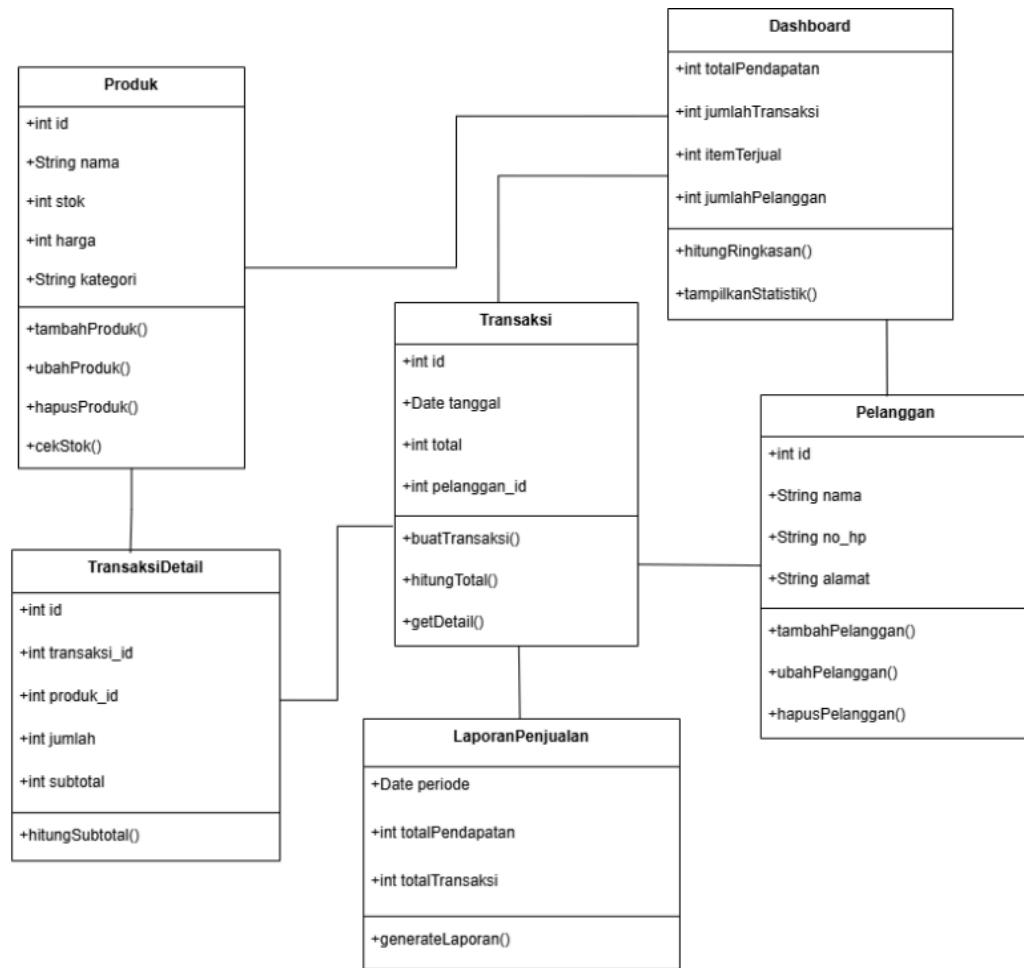


Figure 8. Class Diagram

In the design phase, the logical structure of the mobile phone and accessories sales management system is illustrated through a class diagram, presented in the image above. This diagram identifies six main classes: Product, Customer, Transaction, TransactionDetail, Dashboard, and SalesReport. Each class has attributes representing the data it stores and operations it can perform. The relationships between classes indicate how these entities interact; for example, one Transaction can be associated with many TransactionDetail instances and one Customer, while TransactionDetail refers to the Product purchased. The Dashboard and SalesReport classes are responsible for aggregating and presenting data from Transaction, TransactionDetail, and Customer to provide comprehensive summaries and analyses. This design forms the foundation for the database implementation and functional modules within the application.

- Database

For the purpose of system database design, the database is meticulously planned through a modeling phase to achieve a more efficient and well-structured database, both physically and functionally. In building the Geraifone website database, modeling was done by creating a Conceptual Data Model (CDM) and a Physical Data Model (PDM).

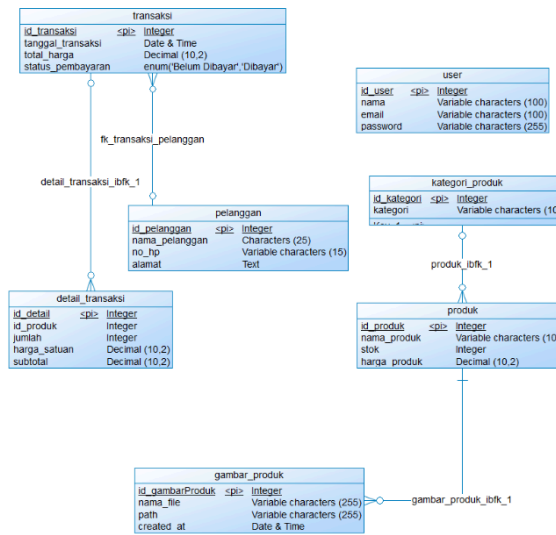


Figure 9. CDM

CDM (Conceptual Data Model) is the initial stage in database design that describes the logical structure of data abstractly and independently of the DBMS (Database Management System). At this stage, the design focuses on identifying entities, attributes, and relationships that align with the system's information requirements, without considering the technical implementation or database platform to be used. The database model design stage for the Geraifone website begins with creating a conceptual data model that includes relationships, entities, and attributes, tailored to the business processes and workflows of the designed website, such as managing product data, transaction/sales data, and customer data.

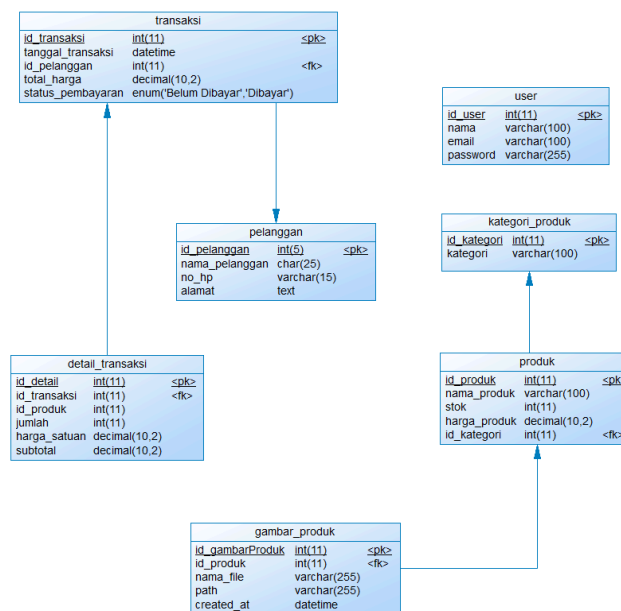


Figure 10. PDM

PDM (Physical Data Model) is a subsequent stage in database design that describes how data will be physically stored within a specific database system (DBMS). The PDM is implementative and technical, and it is specific to the database platform used. For the Geraifone web, the MySQL database platform is utilized. A PDM can be directly generated from the previously created CDM.

Table	Action	Rows	Type	Collation	Size	Overhead
detail_transaksi	Browse Structure Search Insert Empty Drop	4	InnoDB	utf8mb4_unicode_ci	48.0 KiB	-
gambar_produk	Browse Structure Search Insert Empty Drop	11	InnoDB	utf8mb4_unicode_ci	32.0 KiB	-
kategori_produk	Browse Structure Search Insert Empty Drop	6	InnoDB	utf8mb4_unicode_ci	16.0 KiB	-
pelanggan	Browse Structure Search Insert Empty Drop	11	InnoDB	utf8mb4_unicode_ci	16.0 KiB	-
produk	Browse Structure Search Insert Empty Drop	9	InnoDB	utf8mb4_unicode_ci	48.0 KiB	-
transaksi	Browse Structure Search Insert Empty Drop	3	InnoDB	utf8mb4_unicode_ci	32.0 KiB	-
user	Browse Structure Search Insert Empty Drop	12	InnoDB	utf8mb4_unicode_ci	32.0 KiB	-
7 table(s)	Sum	56	InnoDB	utf8mb4_unicode_ci	224 KiB	0 B

Figure 11. Database PhpMyAdmin

The Geraifone website database includes entities such as detail_transaksi (transaction_details), gambar_produk (product_images), pelanggan (customers), produk (products), transaksi (transactions), and user (users). This database has been tailored to the backend system of the website, ensuring that data is stored in tables appropriate for their functionality. It also features inter-entity relationships within the database, allowing the system to operate in an integrated manner where data changes in one table can affect other related tables. This plays a crucial role in maintaining data consistency and accuracy, and supports the smooth flow of business processes such as transaction recording, inventory management, and customer data monitoring. With a well-organized database structure, the system can present information efficiently and more accurately. "Database systems are designed to manage large amounts of information. This data can then be processed through appropriate analysis to become useful in the decision-making process" [7]. Furthermore, a good database design also facilitates analysis and decision-making processes because the generated data is real-time. Therefore, this database system is a crucial component in supporting the overall functions of the website, especially in managing sales, products, and customer data as the primary features of this website.

1-2-3- Implementation

The implementation stage is the realization of the design created in the previous phase. This mobile phone and accessories sales management application was developed using the PHP programming language. The user interface (UI) was built to be simple yet elegant to create an interactive, informative, and easy-to-use display for store staff to perform CRUD operations and view reports. Concurrently, the designed MySQL database structure was implemented to store and manage all application data, including product details, sales records, and customer information. This process aims to ensure that the application functions according to the established planning and specifications.

1-2-4- Testing

After implementation is complete, the testing phase is conducted thoroughly and systematically. The primary goal of testing is to verify whether the application functions according to the initial design and meets all defined functional and non-functional requirements. Testing includes:

- **CRUD Functionality Validation:** Ensuring that every Create, Read, Update, and Delete operation for products, customers, and transactions functions correctly and consistently.
- **Report Testing:** Verifying that sales reports can be generated accurately and that the date filter function works as expected.
- **Integration Testing:** Ensuring that different modules (e.g., sales module with stock module and report module) can interact smoothly.
- **Performance Testing:** Evaluating the application's response speed when conducting transactions or loading large amounts of data.
- **Stability Testing:** Ensuring the application can run without crashes or errors in various usage scenarios.

This testing is essential for identifying and fixing bugs or inconsistencies before the application is widely used.

1-2-5- Maintenance

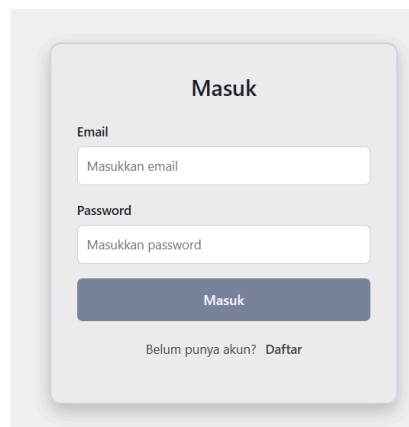
The maintenance phase is an ongoing stage after the application has been delivered and is in use. Activities in this stage include:

- **Application Performance Monitoring:** Observing and ensuring the application continues to run optimally.
- **Bug or Error Fixing:** Addressing issues or bugs that may arise during operational use.
- **Updates and Adaptations:** Adapting to changes in business requirements (e.g., adding new product categories, discount policy changes) or changes in the operating environment (e.g., operating system updates).

This maintenance is essential to ensure the mobile phone and accessories sales management application remains relevant, functions well, and continuously provides added value.

1-3- Results and Discussion

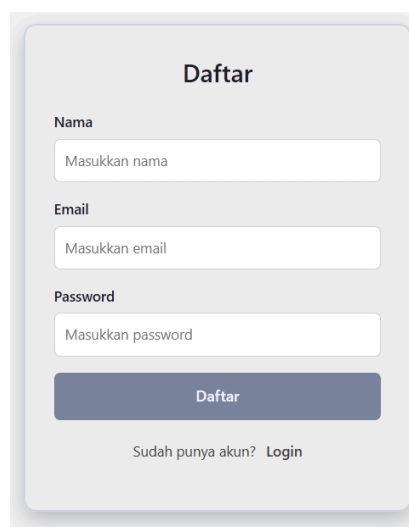
1-3-1- User Interface and System Features



The screenshot shows a login form titled "Masuk". It contains two input fields: "Email" with the placeholder text "Masukkan email" and "Password" with the placeholder text "Masukkan password". Below the fields is a dark blue button labeled "Masuk". At the bottom, there is a link that says "Belum punya akun? [Daftar](#)".

Figure 12. Login Page

The picture above is the initial display when accessing the Geraifone website. On this page, the administrator is required to enter the previously registered email address and password. After pressing the "Masuk" button, the system will validate the email and password. If the data entered is valid, the admin will be directed to the main dashboard page. This page also provides a "Daftar" link if you do not have an account.



The screenshot shows a registration form titled "Daftar". It contains three input fields: "Nama" with the placeholder text "Masukkan nama", "Email" with the placeholder text "Masukkan email", and "Password" with the placeholder text "Masukkan password". Below the fields is a dark blue button labeled "Daftar". At the bottom, there is a link that says "Sudah punya akun? [Login](#)".

Figure 13. Register Page

The image above is a view of the register page, which can be accessed through the "Daftar" link

on the login page. Admins are required to fill in the form with the requested data, namely name, email, and password. After pressing the “Daftar” button, the system will process the data to create a new account.

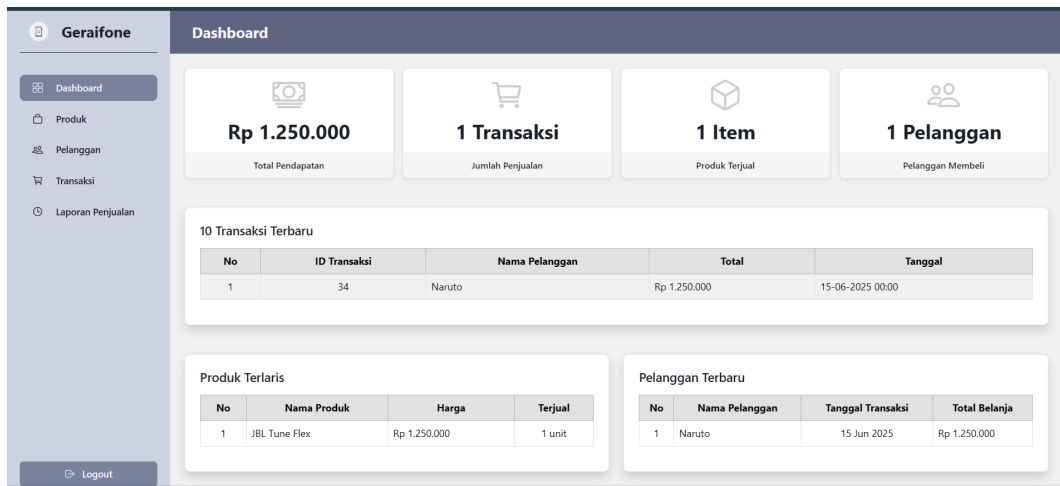


Figure 14. Dashboard Page

Upon successful authentication, an admin is greeted with the Dashboard page. This page provides an overview of business performance, starting with aggregate data at the top: "Pendapatan", "Jumlah Penjualan", "Produk Terjual", and "Jumlah Pelanggan Membeli". A table of the "10 Transaksi Terbaru" follows, detailing recent sales activity. The page concludes with two informational panels: "Produk Terlaris," showcasing the top-selling items, and "Pelanggan Terbaru," listing the most recent customers.

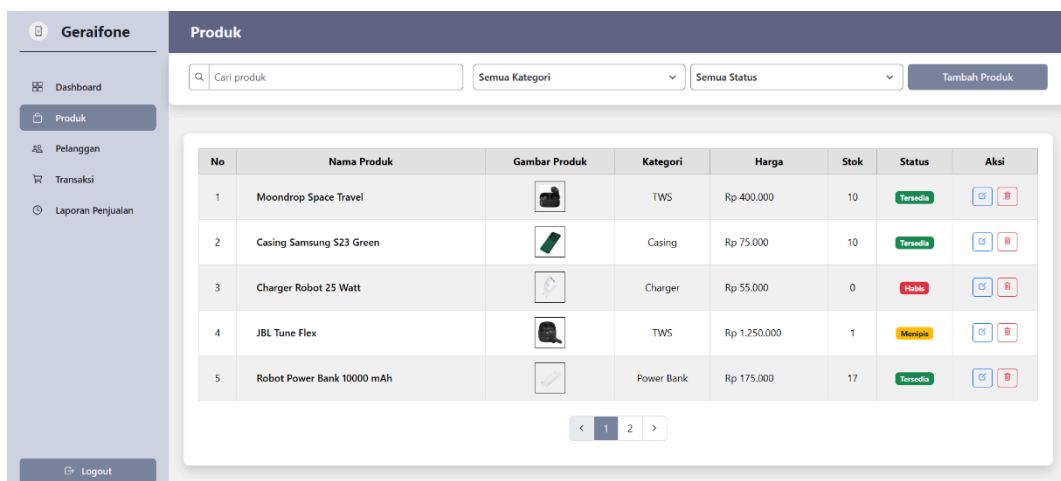


Figure 15. Product Page

The picture above is the product page, which functions as a control center for admins to manage all product inventory data in the Geraifone system. This page provides complete CRUD (Create, Read, Update, Delete) functionality.

Product information is presented in a structured table format, displaying important details such as product name, image, category, price, stock quantity, and availability status. The system uses colored visual indicators in the “Status” column—such as ‘Available’ (green), ‘Running low’ (yellow), and ‘Out of stock’ (red)—to facilitate quick stock monitoring.

At the top of the table, there are features to make data management easier, namely the “Cari Produk” (Search Produk) column for quick searches, as well as filters by category and status. Admins can add new products by pressing the “Tambah Produk” button. Meanwhile, on each product row in the “Aksi” column, there are buttons to edit and delete individual product data. To handle large amounts of data, this page is also equipped with a pagination feature at the bottom of the table.

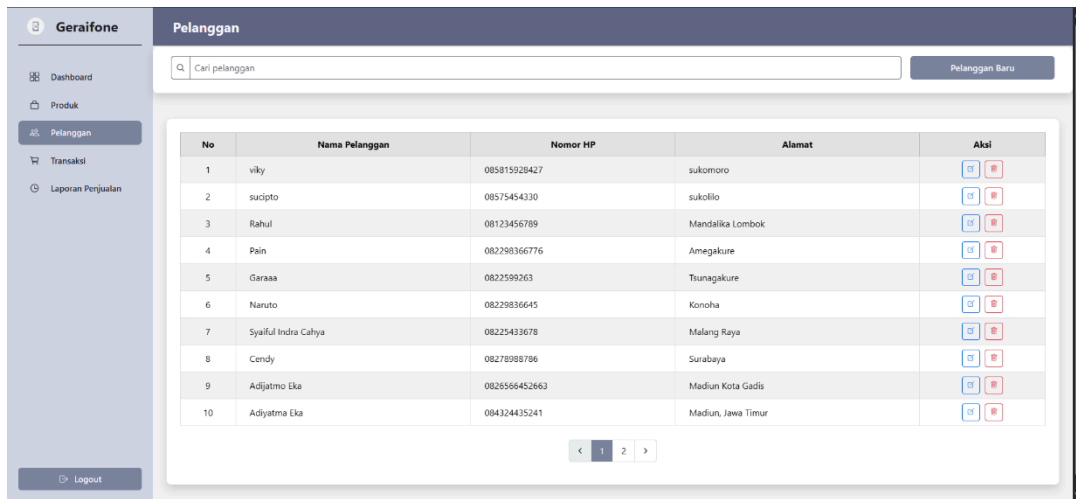


Figure 16. Costumer Page

The image above is the customer page that serves as a data center for all customers who have transacted or registered in the system, which is a crucial component in customer management. Customer data is presented in a neat table format, displaying essential information such as customer name, mobile number, and address. At the top of the page, there is a “Cari Pelanggan”(Search customers) search feature that allows admins to quickly find specific customer data.

Admins can register new customers by using the “Tambah Pelanggan” button. Similar to the previous page, each row of data is equipped with a button in the “Aksi” column that serves to change (edit) or delete (delete) customer data. To accommodate large amounts of data, this page has also been equipped with pagination functionality. Overall, this page provides full CRUD (Create, Read, Update, Delete) functionality for customer data.

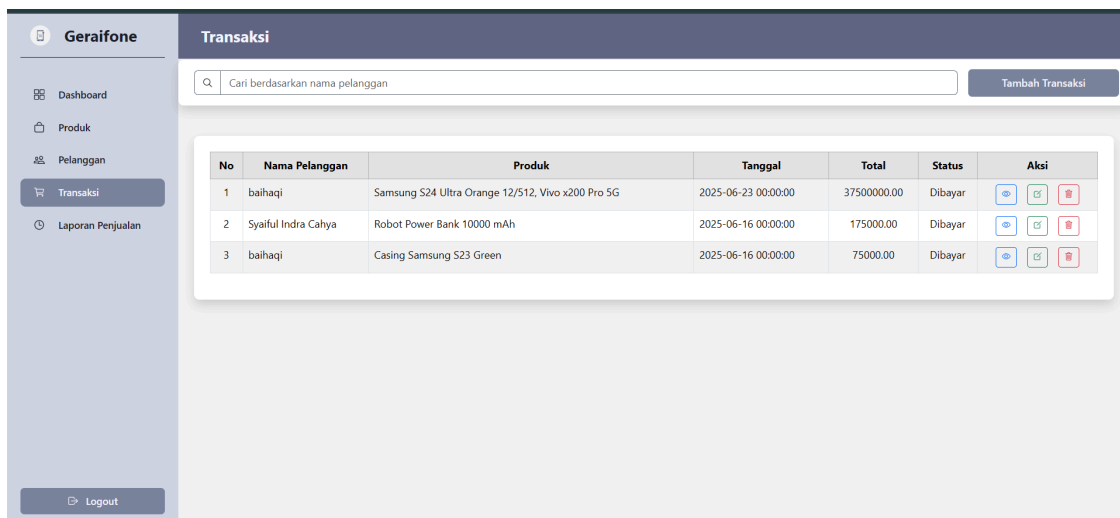


Figure 17. Transaction Page

The image above is the transaction management page, which serves to record and manage the entire sales history, as well as being the link between customer and product data. Each transaction record is presented in an informative table format, displaying details such as customer name, product purchased, date, total payment, and transaction status. At the top, admins can use the “Cari berdasarkan nama pelanggan” feature to browse through a specific transaction history.

Admins can create a new transaction record by pressing the “Tambah Transaksi” button. On each row in the “Aksi” column, there are three functional buttons to view details, edit, and delete transaction data. This page provides essential functionality to maintain sales data integrity and serve as the basis for report generation.

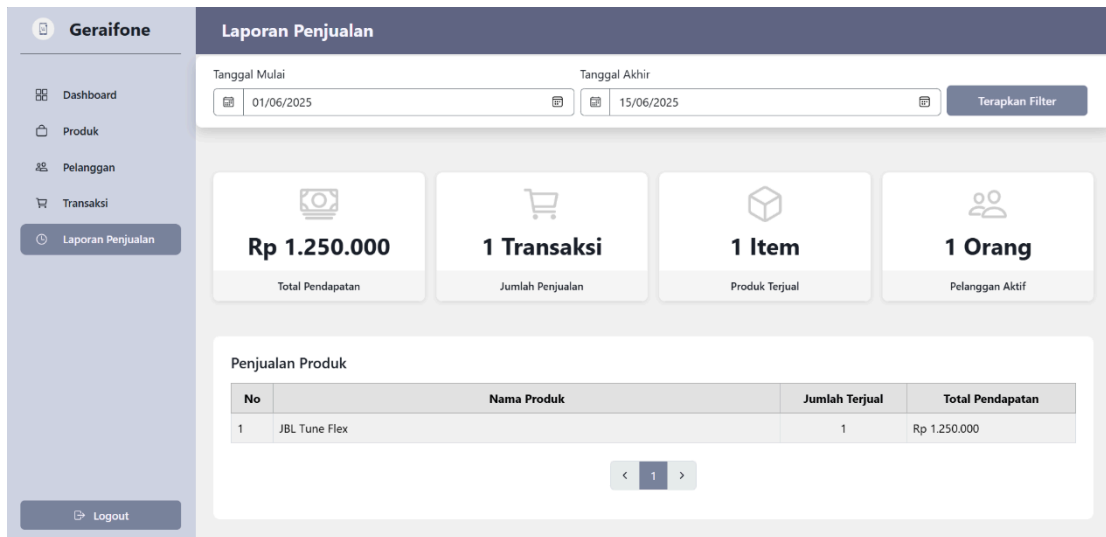


Figure 18 Sales Report Page

The image above is the sales report page, which serves to present a recapitulation of transaction data within a certain period. This page is designed to help admins or owners analyze business performance and make strategic decisions based on historical data.

The main feature on this page is the filter by date range, namely “Tanggal Mulai” and “Tanggal Akhir”, which allows the admin to select the desired report period. After applying the filter by pressing the “Terapkan Filter” button, the system will display four main information cards that summarize the data for that period: Total Pendapatan, Jumlah Penjualan, Total Produk Terjual, and Jumlah Pelanggan Aktif. Below the summary, a “Penjualan Produk” table is presented, detailing which products were sold in the selected period, along with the number of units and total revenue per product. The functionality on this page is essential for tracking product sales trends and analyzing revenue on a regular basis.

1-3-2- System Testing Results

To validate the functionality of the developed website and ensure that each feature operates as intended, a Black-box testing method was implemented. The primary objective was to identify any bugs or non-functional features that might disrupt the admin experience. The results of the testing process are summarized in the table below.

Table 1. System Testing Results

No	Featured Tested	Expected Result	Status (pass/fail)
1	Access login and register page	Login form is displayed to the admin	Pass
2	Access dashboard without login	Admin is redirected to login page	Pass
3	Submit login form with valid credentials	Admin is logged in and redirected to dashboard	Pass
4	Login with incorrect password	Error message: “Password salah.”	Pass
5	Login with unregistered email	Error message: “Email tidak ditemukan.”	Pass
6	Submit empty fields on register and login page	Error message: “Semua field wajib diisi.”	Pass
7	Register with invalid email format	Error message: “Format email tidak valid.”	Pass
8	Register with short password	Error message: “Password minimal 6 karakter”	Pass
9	Register with existing email	Error message: “Email sudah terdaftar”	Pass
10	Click each navigation link in the sidebar	Admin is redirected to the correct page	Pass
11	Click the “Logout” button on each page	Admin session is terminated and redirected to the login page	Pass

12	Access dashboard page, product page, customer page, transaction page, and sales report page	Every page is displayed and data from the database is shown correctly	Pass
13	Click the "Tambah Produk" buttons on product page	A popup form appears allowing the admin to input new product data including product image. After submission, the new product is displayed in the product table.	Pass
14	Click the edit and delete icons in the action column of the product table	If the edit icon is clicked, a popup form appears allowing the admin to update the product data. After submission, the updated data is reflected in the product table. If the delete icon is clicked, a confirmation popup appears. If confirmed, the product data is deleted and removed from the product table.	Pass
15	Use search, category filter, and status filter in the product table	The table updates dynamically to show products matching the search keyword, selected category, and selected status filter	Pass
16	Click the "Pelanggan Baru" buttons on customer page	A popup form appears allowing the admin to input new customer. After submission, the new customer is displayed in the product table.	Pass
17	Click the edit and delete icons in the action column of the customer table	If the edit icon is clicked, a popup form appears allowing the admin to update the customer data. After submission, the updated data is reflected in the customer table. If the delete icon is clicked, a confirmation popup appears. If confirmed, the customer data is deleted and removed from the customer table.	Pass
18	Use the search function on the customer page	The table displays only customers matching the entered keyword	Pass
19	Click the "Tambah Transaksi" button on the transaction page	A popup form appears allowing the admin to select a customer, choose one or more products with quantities, set payment status (dibayar/belum dibayar), and upon submission, the transaction appears in the transaction table	Pass
20	Click the "view" (eye) icon in the action column of the transaction table	A popup appears displaying detailed information about the selected transaction	Pass
21	Click the edit and delete icons in the action column of the transaction table	Clicking the edit icon opens a popup form to modify transaction data. Clicking the delete icon removes the transaction and updates the table view accordingly	Pass
22	Use the search function on the transaction page	The transaction table displays only records associated with the customer name matching the entered keyword	Pass
23	Use the date filter on the sales report page	The report displays only sales data within the selected date range	Pass

2- Declarations

2.1- Author Contributions

Introduction, A.E.S. and F.I.A.; methodology, A.B. and M.S.H.; requirement analysis, A.E.S. and M.S.H.; application design, A.B. and F.I.A.; implementation, M.S.H.; testing, F.I.A.; user interface and system features, A.B; front-end developing, A.B. and A.E.S.; back-end developing, F.I.A. and M.S.H.; system flow, A.E.S.; writing—review and editing, A.E.S.; All authors have read and agreed to the published version of the manuscript.

2.2- Data Availability Statement

The source code, sample data, and related project files presented in this study are openly available for access in GitHub at: <https://github.com/ahmadbyhq/Geraifone.git>.

2.3- Funding

Funding information is not available.

2.4- Acknowledgements

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2.5- Institutional Review Board Statement

Not Applicable

2.6- Informed Consent Statement

Not Applicable

2.7- Conflicts of Interest

The authors affirm that there are no conflicts of interest related to the publication of this manuscript. Furthermore, all ethical considerations—including plagiarism, informed consent, research misconduct, data fabrication or falsification, duplicate submission or publication, and redundancy—have been thoroughly addressed and complied with by the authors.

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