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PAPER

Web-Based Multi-Tenancy Point of Sale (POS) Information System Using Rapid Application Development Method

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ABSTRACT

The development of information technology encourages business actors to manage sales transactions more effectively and integrated. However, most available Point of Sale (POS) systems still have limitations in supporting the management of many tenants on one platform. This research aims to develop a web-based Multi-Tenancy Point of Sale (POS) Information System capable of managing data and transactions from several tenants separately in one system. The method used in the development of the system is Rapid Application Development (RAD), which covers the stages of planning needs, planning, construction, and implementation. The research results show that the developed system can function according to user needs, including product management, sales transactions, and presentation of reports. The implementation of this system is able to increase operational efficiency, simplify business management, and effectively support the business digitalization process. Thus, the proposed system can be the right solution for web-based multi-tenant business management.

KEYWORDS

Point of Sale (POS); Multi-Tenancy; Information System; Web-Based Application; Rapid Application Development (RAD)

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1. INTRODUCTION

The development of information technology has brought significant changes in various sectors of life, including business and trade. Digital transformation encourages business actors to utilize technology in supporting operational activities in order to be more effective, efficient, and integrated. One form of technology utilization is the use of the Point of Sale (POS) system which functions to help the sales transaction process, manage goods data, record stock, and prepare reports more quickly and accurately [1]. In addition, the use of a web-based information system makes it possible to manage business data in a more flexible, integrated, and accessible from various devices so as to support the store's operational needs more effectively [2].

In the trade sector, especially wholesale stores, the management of sales transactions and inventory of goods is an activity that has an important role in maintaining the smooth operation of the business. Many business actors still face various obstacles in the data management process, such as errors in recording transactions, inconsistencies in stock data, delays in compiling reports, as well as difficulties in searching for information. These problems can cause a decrease in operational effectiveness and hinder the decision-making process. Therefore, the use of computerized information systems is an important need to help manage businesses in a more structured and accurate manner. Previous research shows that web-based information systems are able to improve the efficiency of data management and support business processes more optimally. A web-based inventory information system can help users monitor the availability of goods in real-time and produce more accurate reports to support decision-making [3]. In addition, the implementation of a web-based Point of Sale system is proven to be able to speed up the sales transaction process and minimize data recording errors [4]. The results show that the utilization of information technology provides a positive contribution in improving the quality of business management. The implementation of a website-based sales information system can improve the effectiveness of transaction management and support a more integrated business process [5]. Despite this, most Point of Sale systems currently available are still designed to be used by one store or one business entity (single tenant). This condition causes each store to use a different system so that data management becomes decentralized. In addition to increasing the cost of system implementation and maintenance, the condition also complicates the process of monitoring and data management when business owners have more than one store. As a result, the information needed to support decision-making cannot be obtained quickly and integrated.

Several studies have developed a web-based Point of Sale system to help manage sales transactions and inventory data. Research by Mulyana and Rusmawan succeeded in developing a web-based Point of Sale system that supports the

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sales transaction process more effectively. Other research conducted by Kumaini et al. [6] also showed that the web-based Point of Sale system is able to help manage sales data and stock in grocery stores. However, these studies still focus on the use of the system by one store and have not applied the concept of Multi-Tenancy. Meanwhile, Ahmadi and Surachman [7] explained that the Multi-Tenancy concept allows one application to be used by many tenants while maintaining the separation of each user's data. This approach provides efficiency in the use of system resources and simplifies the centralized application management process.

Based on previous research, there is a gap (gap analysis) in the form of a lack of web-based Point of Sale system development that integrates the Multi-Tenancy concept to support the use by many stores in one platform. In fact, the need for a system capable of serving many users simultaneously continues to increase along with the development of businesses and digital transformation. Therefore, a system is needed that is not only able to manage sales transactions and product data effectively, but can also be used by many stores while maintaining the security and separation of each user's data.

To overcome these problems, this research developed a web-based Multi-Tenancy Point of Sale (POS) Information System. The system developed allows several stores to use the same application with data that remains isolated according to their respective tenants. This system provides features for product data management, sales transactions, sales reports, store activity monitoring, as well as management of active system usage time. In addition, this research applies the concept of Software as a Service (SaaS) so that users can take advantage of application services through a subscription mechanism without having to develop or manage the system independently.

The method used in system development is Rapid Application Development (RAD). This method was chosen because it can speed up the software development process through a prototyping approach and a shorter development cycle than conventional methods [8]. In addition, the active involvement of users during the development process allows for direct feedback so that the developed system can be better suited to operational needs and user expectations [9]. User involvement allows for direct feedback so that the developed system can be better suited to operational needs and user expectations.

The main advantage of the proposed system compared to previous research lies in the application of the concept of Multi-Tenancy and Software as a Service (SaaS) in a web-based platform. This approach makes it possible for many stores to use the same application without mixing data, simplifies centralized system management, reduces implementation costs, and provides flexibility of use through a subscription service mechanism. Thus, the developed system not only functions as a transaction recording tool, but also as a digital solution capable of supporting business management in a more efficient, integrated, and sustainable manner.

Based on the description, the purpose of writing this article is to develop a web-based Point of Sale (POS) Multi-Tenancy Information System using the Rapid Application Development (RAD) method to help manage sales transactions, product data, and reports more effectively and enable the use of the system by many stores in one platform with secure and structured data separation.

2. METHOD

2.1 Stages of System Development

This research uses the Rapid Application Development (RAD) method in the development of a web-based Multi-Tenancy Point of Sale (POS) Information System. The RAD method was chosen because it can speed up the software development process through a prototype approach and involve users actively in each stage of development [10]. With this method, system planning that involves the process of needs analysis and testing can gradually help produce applications that are more in line with user needs [11]. The system development stage using the Rapid Application Development (RAD) method consists of four main stages, namely Requirements Planning, User Design, Construction, and Implementation. Each stage has an important role in producing a system that suits the needs of the user.

The first stage is Requirements Planning. At this stage, identification of system needs is carried out through observation and interviews at Deli Maju Wholesale Store. Analysis is done on ongoing business processes, particularly in the management of goods data, sales transactions, stock of goods, and the preparation of sales reports. The result of this stage is in the form of functional and non-functional needs that will be used as a basis in the development of the system.

The second level is User Design. At this level, system planning is done using Unified Modeling Language (UML) which covers Use Case Diagram, Activity Diagram, and Entity Relationship Diagram (ERD). In addition, the planning of the database structure as well as the user interface (user interface) was also carried out to provide an overview of the system to be developed. Planning is done by considering the needs of users so that the developed system is easy to use and fits the ongoing business process.

The third level is Construction. At this stage, the system development process is carried out based on the results of the analysis and planning that has been made previously. The system was developed using the PHP Native programming language and MySQL database. The concept of Multi-Tenancy is applied so that one application can be used by several stores in one platform while maintaining the separation of each tenant's data. Features developed include tenant management, item data, sales transactions, sales reports, sales monitoring, as well as management of active system usage time.

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The last stage is Implementation. At this stage, system testing is done using the Black Box Testing method. Testing is done on all the main features of the system to ensure that the available functions work in accordance with the needs of the user. After the entire testing process is completed and the system is declared to be running well, the system is then implemented and ready for use by users.

The use of the Rapid Application Development (RAD) method is widely applied to the development of information systems because it is able to speed up the application development process through a prototype approach and the active involvement of users in the development process.

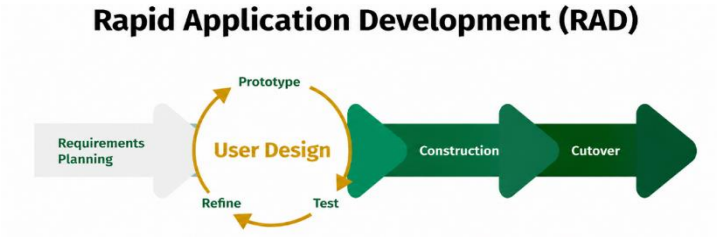

Figure 1. Stages of the Rapid Application Development (RAD) Method

Based on Figure 1, the Rapid Application Development (RAD) method consists of four main stages, namely Requirements Planning, User Design, Construction, and Cutover. At the level of Requirements Planning, system requirements are identified. The User Design stage is carried out by planning the system through the process of prototype, testing, and improvement according to the needs of the user. The Construction stage is an application development process using PHP Native and MySQL. Further, the Cutover stage is performed for system testing using the Black Box Testing method as well as system implementation for users.

2.2 System Requirements Analysis

System needs analysis is done to identify user needs and determine the functions that should be available on the web-based Multi-Tenancy Point of Sale (POS) Information System. The analysis process is carried out through observation and interviews at the Deli Maju Wholesale Store to find out the problems that occur in the running system.

Based on the results of the analysis, there are two main actors who use the system, namely Super Admin and Store Admin (Tenant). Super Admin has access rights to manage tenant data, manage the active time of system use, and monitor all registered tenants. Meanwhile, the Store Admin has access rights to manage item data, sales transactions, and sales reports in accordance with their respective tenant data.

Needs analysis is an important stage in system development because it can help developers understand user needs and determine the features that will be implemented in the system [12].

The functional requirements of the system obtained from the results of the analysis are shown in Table 1.

Table 1. System Functional Requirements

No	Functional Requirement
1	The system can perform the login process
2	The system can manage tenant data
3	The system can manage item data
4	The system can manage sales transactions
5	The system can display sales reports
6	The system can monitor sales
7	The system can manage the tenant's active time

Based on Table 1, the developed system must be able to support all business processes related to store management, starting from the management of product data to the creation of sales reports. In addition, the system must also support the Multi-Tenancy concept so that each tenant can only access the data they own.

The system's non-functional requirements include ease of use of the system, security of user data, availability of web-based access, as well as the system's ability to manage multiple tenants simultaneously without disrupting application performance. These requirements form the basis of the system planning and development process.

2.3 Perancangan Sistem

The use of Unified Modeling Language (UML) can help the system visualization process so that it makes it easier for developers to describe the functional and structural needs of the system to be developed [13].

2.3.1 Use Case Diagram

System planning is a stage that is carried out after the needs analysis process is completed. This level aims to provide an overview of the system structure, process flow, as well as the interaction between users and the system to be developed. In this research, system planning is done using Unified Modeling Language (UML) to simplify the process of visualizing

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system needs before entering the implementation stage. Use Case Diagrams are used to describe the interaction between actors and systems so that functional needs can be identified more clearly [14].

One of the diagrams used is the Use Case Diagram. This diagram is used to illustrate the relationship between the actors and the functions available in the web-based Multi-Tenancy Point of Sale (POS) Information System. Through this diagram it is possible to know the access rights owned by each user as well as the activities that can be performed on the system.

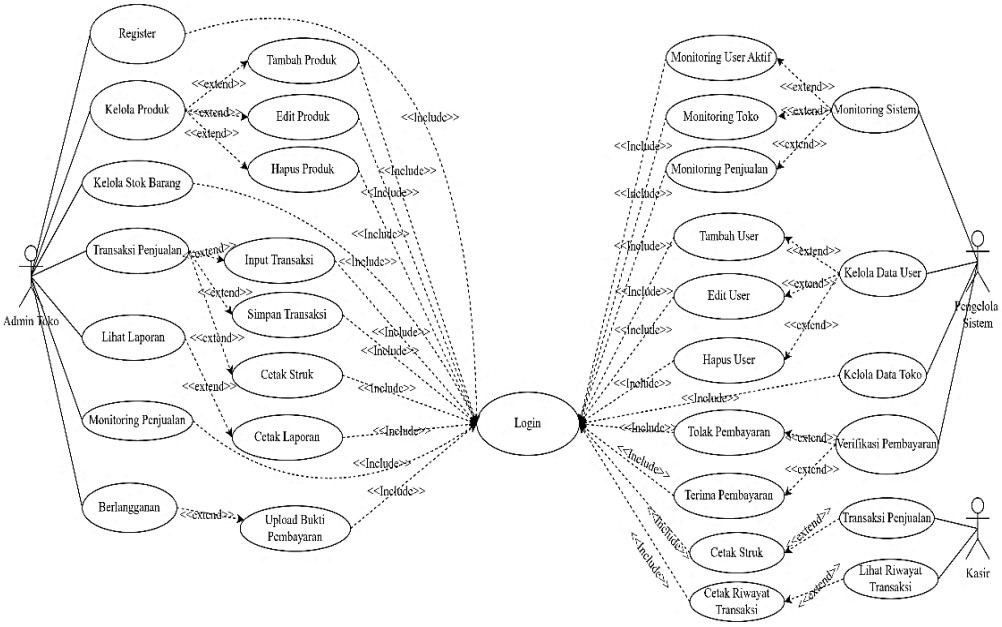

Figure 2. Use Case Diagram

Based on Figure 2, there are three main actors who interact with the system, namely Store Admin, System Manager (Super Admin), and Cashier. The three actors have different access rights according to their duties and responsibilities in using the system.

The Store Admin acts as the main manager of the store who has access rights to register accounts, manage product data, manage stock, conduct sales transactions, view sales reports, monitor sales, and perform system subscription processes. In addition, Store Admins can also add, change, and delete product data available in their respective stores. The System Administrator (Super Admin) has access rights to manage all data in the system. Activities that can be done include user data management, store data management, customer payment verification, as well as monitoring system activity. The available monitoring features allow Super Admin to monitor active users, store activities, and sales data of all tenants registered in the system. Meanwhile, Cashiers have access rights focused on operational sales activities. The cashier can perform sales transactions, print transaction receipts, and view transaction history. This restriction of access rights is applied to maintain data security and ensure that each user can only access features according to their role. To clarify the role of each actor, the description of user access rights can be seen in Table 2.

Table 2. System Actor Description

Akcor	Access Rights
Store Admin	Manage products, stock, transactions, reports, and subscriptions
Super Admin	Manage users, stores, payment verification, and system monitoring
Cashier	Perform sales transactions and view transaction history

Based on the Use Case Diagram that has been planned, the system is able to accommodate the needs of sales transaction management, product management, store activity monitoring, and tenant management in one Multi-Tenancy based platform. This planning becomes the basis in the system implementation process so that all functional needs can be realized in accordance with user needs.

2.3.2 *Activity Diagram*

Activity Diagram is used to describe the flow of activities performed by users in the web-based Point of Sale (POS) Multi-Tenancy Information System. This diagram shows the sequence of processes that occur in the system based on the access rights and functions owned by each user. Activity Diagram helps to visualize the flow of business processes and the sequence of activities that occur in the system so as to facilitate the process of implementation and evaluation of the system [15]. Through the Activity Diagram, the business process running on the system can be understood in more detail, thus simplifying the implementation and testing of the system.

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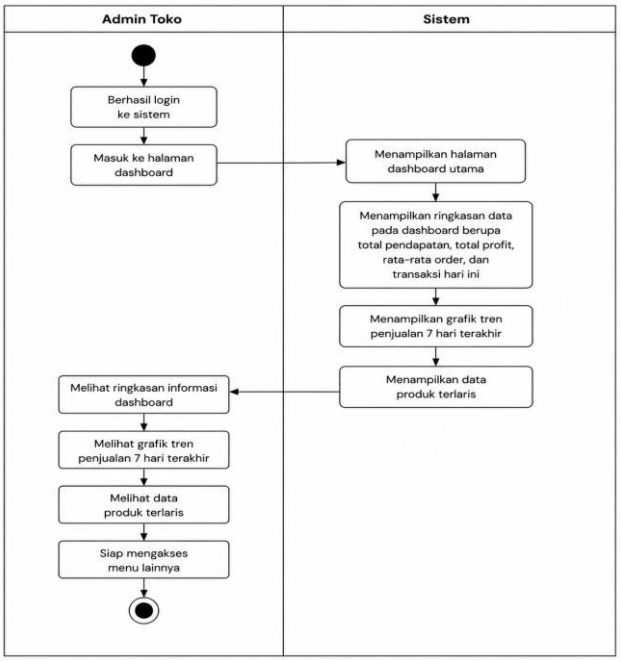

Figure 3. Shop Admin Activity Diagram

Based on Figure 3, the process begins when the Store Admin successfully logs in and enters the main dashboard page. The system will display a variety of important information such as total income, total profit, average transaction, sales trend graphics for the last seven days, as well as best-selling product data. Through the dashboard page, Store Admin can access various main features available on the system. In addition to viewing information on the dashboard, the Store Admin can also manage products by adding, changing, and deleting product data. Users can update the stock of goods according to the available inventory conditions and see the results of the updates that have been made. All inputted data will be processed and stored by the system into the database.

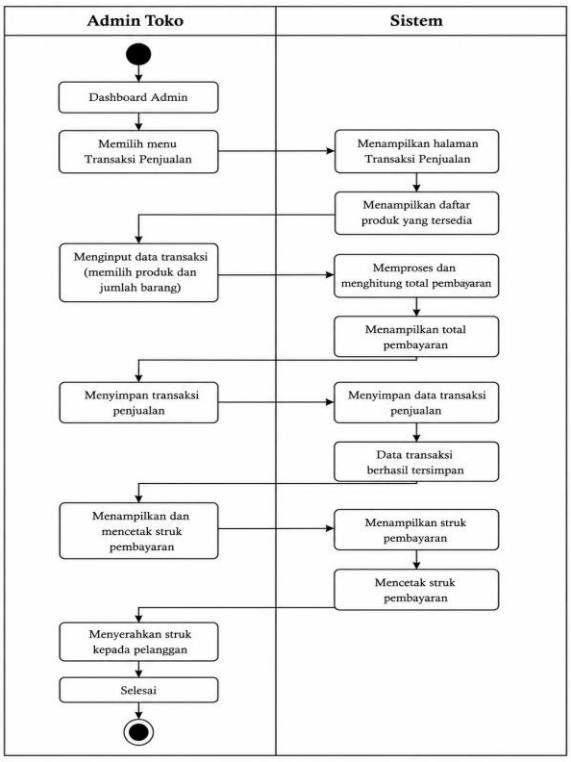

Figure 4. Activity Diagram Sales Transaction Cashier

Based on Figure 4, the Cashier has access rights to perform sales transactions and view the transaction history that has been performed. The cashier can select the product the customer bought, process the payment, print the transaction receipt, and view the transaction data that has been done before. Cashier access rights are limited only to sales operational activities so that system data security can be maintained.

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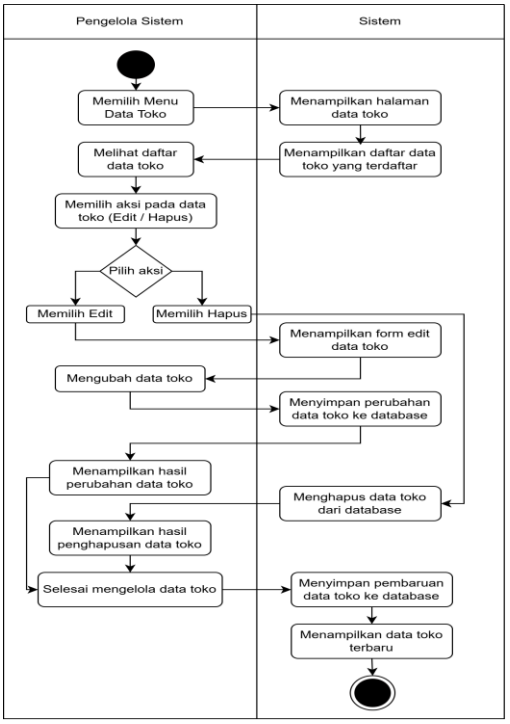

Figure 5. Activity Diagram Manage Store Data

Based on Figure 5, the process begins when the System Manager selects the store data menu. The system then displays a list of stores that have been registered on the application. Furthermore, the System Manager can choose an action to manage store data, namely change (edit) or delete store data. When the user selects the edit menu, the system will display a store data change form that can then be updated as needed. Once the changes are saved, the system will update the data in the database and display the updated store information. Meanwhile, when the user selects the delete menu, the system will delete the selected store data from the database and display the data deletion results. Through the process, the System Manager can manage all store data registered in the system centrally so that store information remains accurate and consistent.

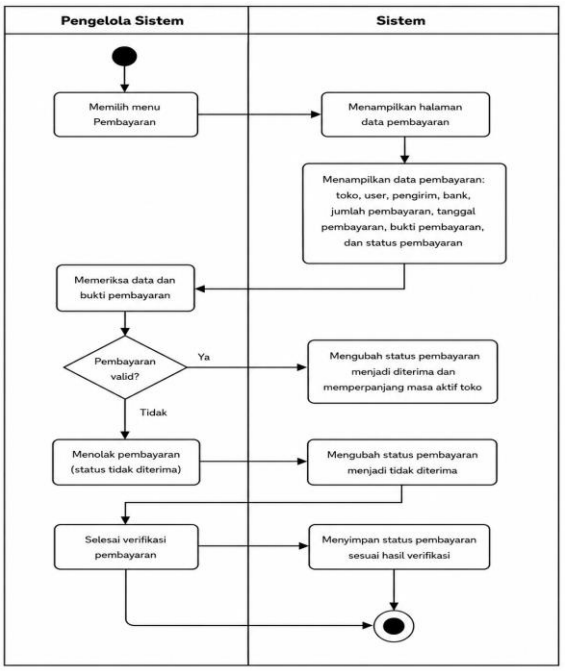

Figure 6. Payment Verification Activity Diagram

Based on Figure 6, the process begins when the System Manager selects the payment menu to view the payment data that has been sent by the user. The system then displays payment information that includes store data, user, sender, destination bank, payment amount, payment date, proof of payment, and payment status.

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Further, the System Manager checks the data and proof of payment that has been uploaded by the user. After the inspection process is completed, validation is done to determine whether the payment made is in accordance with the applicable provisions. When the payment is declared valid, the system will change the payment status to accepted and automatically extend the active time of the store account according to the selected subscription package. On the other hand, when the payment is invalid, the system will change the payment status to not accepted so that the user has to make a re-payment or re-upload the correct proof of payment. Once the verification process is complete, the system will save the payment status based on the results of the inspection performed by the System Manager. This process aims to ensure that every incoming subscription payment transaction has been properly verified so that the security and accuracy of the data in the system is maintained.

2.3.3 *Entity Relationship Diagram* (ERD)

Entity Relationship Diagram (ERD) is used to describe the structure of the database and the relationship between entities in the web-based Point of Sale (POS) Multi-Tenancy Information System.

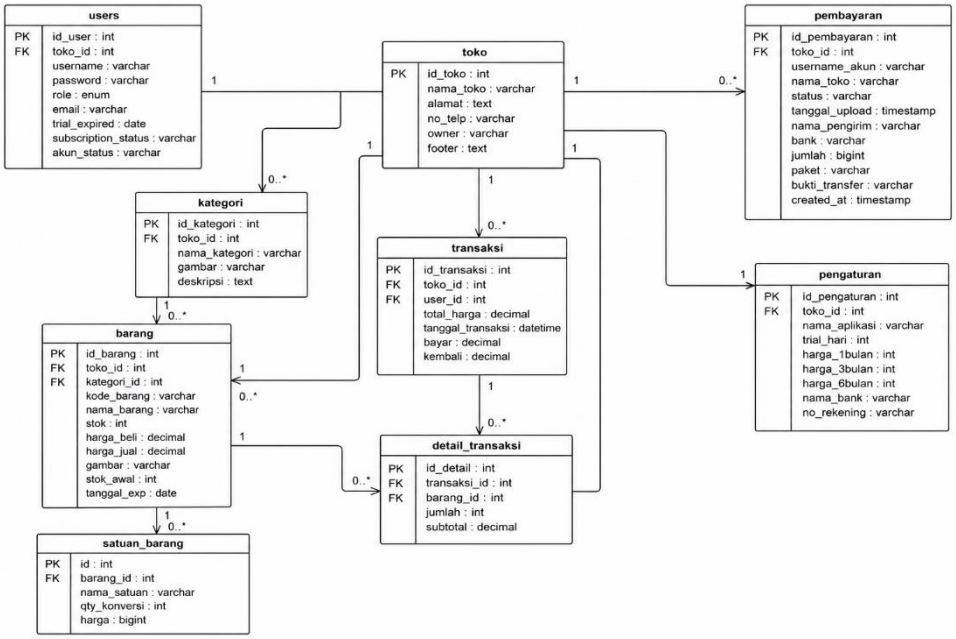

Figure 7. Entity Relationship Diagram (ERD)

Based on Figure 7, the system consists of several main entities, namely users, stores, categories, goods, units of goods, transactions, transaction details, payments, and arrangements. The store entity acts as the main identity of each tenant so as to support the application of the Multi-Tenancy concept. Each store can have many users, product categories, items, transactions, and payment data. Item entities are related to category entities and are used to store product information sold by each store. Further, the sales process is represented through the transaction entity and transaction_detail, where a transaction can have several details of the goods purchased by the customer. In addition, the payment entity is used to store subscription payment data that will later be verified by the System Manager. The planning of this database allows all data to be stored in a structured, integrated, and separate manner based on the identity of each store so that the security and consistency of the data can be well maintained.

Good database planning plays an important role in maintaining data consistency, reducing data redundancy, and supporting integration between modules in the information system [16].

Table 3. System Database Table

Table	Total Fields	Function
Users	11	Store system user data
Shop	7	Store store information
Goods	11	Store product data
Unit of Goods	7	Store unit data and item conversion
Category	4	Store product category data
Transaction	9	Store sales transaction data
Transaction Details	8	Store transaction details
Payment	12	Store subscription payment data
Arrangement	11	Saves application configuration

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Based on Table 3, the database used in the Multi-Tenancy Point of Sale (POS) Information System consists of nine main interrelated tables. The users table is used to store system user data, while the store table stores information for each tenant. Tables of goods, categories, and units_of goods are used to support the management of products and stock of goods. In addition, the transaction table and transaction_detail are used to record sales activities, while the payment and arrangement tables are used to support subscription features and system configuration. The database structure is designed to support the application of the Multi-Tenancy concept so that each store's data can be stored separately and well organized.

2.4 System Implementation

System implementation is the level of applying the results of analysis and planning that have been done in the previous level. The web-based Multi-Tenancy Point of Sale (POS) Information System was developed using PHP Native programming language and MySQL database. The development process is done by utilizing some software that supports application development, database management, and system planning.

The use of PHP as a server-side programming language is widely applied in the development of web-based applications because it has high flexibility and supports dynamic system development [17]. Structured data management through a good database can support operational effectiveness and decision-making in a business [18].

The software used in the development of the system is shown in Table 4.

Table 4. Software Used

No	Software	Function
1	PHP Native	Application programming language
2	MySQL	Database
3	XAMPP	Web Server and local database manager
4	Visual Studio Code	Program code editor
5	Draw.io	System diagram planning
6	Google Chrome	Testing and running applications

Based on Table 4, all software is used to support the application development process from planning, coding, to system testing. Implementation is done by integrating all system components so that it is able to support product management, sales transactions, sales reports, system monitoring, as well as subscription management in a Multi-Tenancy environment.

2.5 System Testing

System testing is done to ensure that all the functions available in the web-based Multi-Tenancy Point of Sale (POS) Information System can run according to user needs. The testing method used is Black Box Testing. The Black Box Testing method is used to test system functionality based on input and output produced without paying attention to the structure of the program code used [19]. This method focuses on testing the function of the system by providing input and observing the output produced without paying attention to the structure of the program code used. Testing is done on the main features of the system, such as the login process, product management, stock management, sales transactions, sales reports, store data management, and payment verification. The test results are used to find out if the available functions have run according to the system plan made.

Table 5. System Testing Results Using Black Box Testing

No	Testing Scenario	Expected Results	Testing Result	Status
1	User login	The system displays a dashboard page	Successfully display the dashboard	Succeeded
2	Adding product data	Product data is saved to the database	Data saved successfully	Succeeded
3	Change product data	Product data successfully updated	Data updated successfully	Succeeded
4	Delete product data	Product data is deleted from the system	Data deleted successfully	Succeeded
5	Adding stock items	The stock of goods increases according to the input	Stock successfully updated	Succeeded
6	Conduct sales transactions	Transaction data is saved and receipts are printed	The transaction was successfully processed	Succeeded
7	View sales reports	The system displays sales reports	The report was successfully displayed	Succeeded
8	Manage store data	Store data can be changed and saved	Data updated successfully	Succeeded
9	Payment verification	The payment status changes according to the verification result	Data updated successfully	Succeeded

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No	Testing Scenario	Expected Results	Testing Result	Status
10	System monitoring	The system displays user activity data	Data updated successfully	Succeeded

Based on Table 5, all the features that were tested show the results as expected. No functional errors were found that caused the system to fail to run. The test results show that the web-based Multi-Tenancy Point of Sale (POS) Information System has been able to carry out all the main functions well and in accordance with user needs. Therefore, the system is declared suitable for use in supporting store operational activities and the management of Multi-Tenancy based services.

3. RESULT AND DISCUSSION

3.1 System Implementation Results

In this research, a web-based Multi-Tenancy Point of Sale (POS) Information System has been successfully developed using the Rapid Application Development (RAD) method. The system developed aims to help manage sales transactions, product data, product stock, sales reports, and subscription management in one platform that can be used by many stores simultaneously. The implementation of the system is based on the results of the needs analysis and planning that have been explained in the previous chapter.

The application of the Multi-Tenancy concept allows several stores to use the same application without causing data to be mixed between users. In addition, the system also applies the concept of Software as a Service (SaaS) so that users can use the application through a subscription mechanism as needed.

Presenting information in real-time through a dashboard can help business owners monitor and make decisions more quickly and accurately [20].

3.1.1 Landing Page

The main page (landing page) is the first page displayed when users access the NexPOS website. This page serves to provide information about the system, available features, as well as subscription packages that users can choose from.

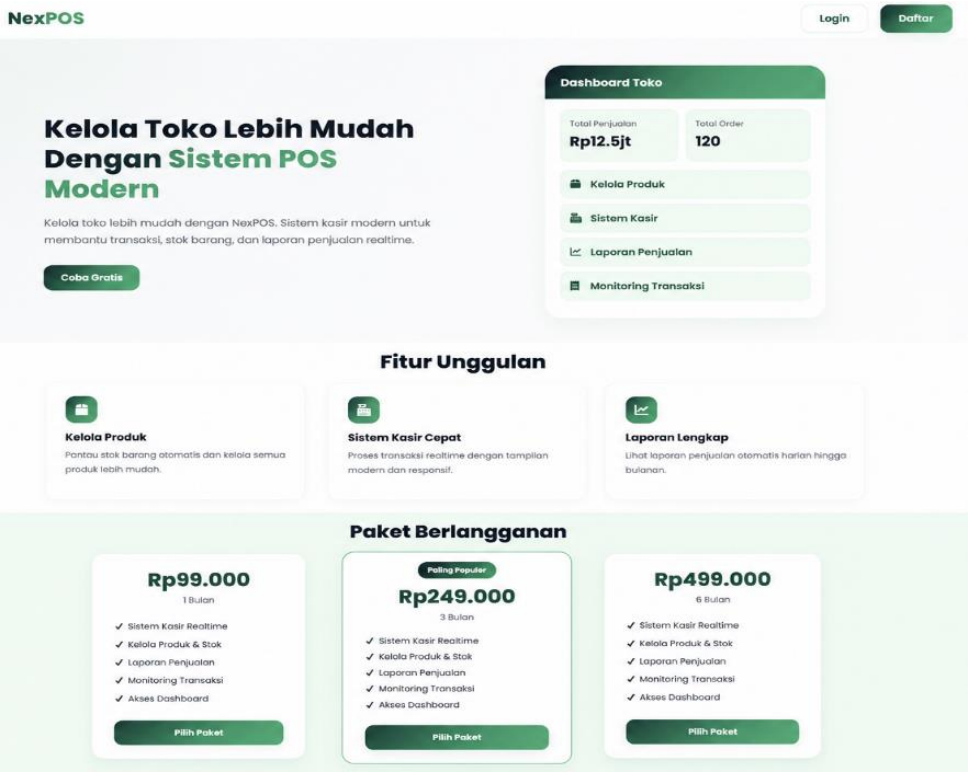

Figure 8. Home Page (Landing Page)

Based on Figure 8, the system displays information about featured features such as product management, cashier system, sales reports, and available subscription packages. In addition, there is a Login and Register menu that users use to access or register an account on the system.

3.1.2 Login Page

The login page is the initial page that users use to access the system. Users are required to enter the registered username and password to perform the authentication process.

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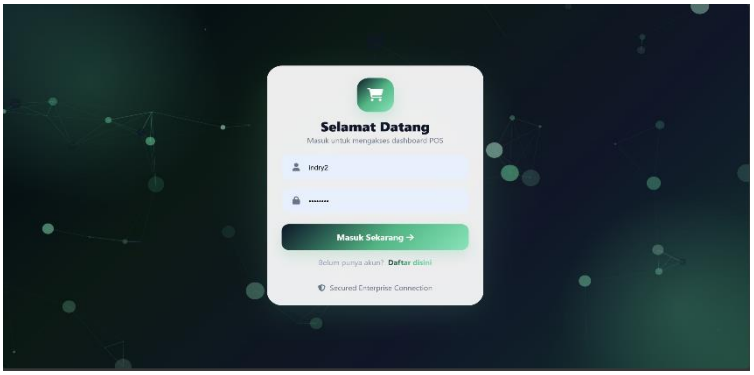

Figure 9. Login Page

Based on Figure 9, the system provides a login form that is used to validate user data before entering the system. Once the authentication process is successful, the user will be directed to the main page according to the access rights they have.

3.1.3 Dashboard Page

The dashboard page is the main page that is displayed after the user successfully enters the system.

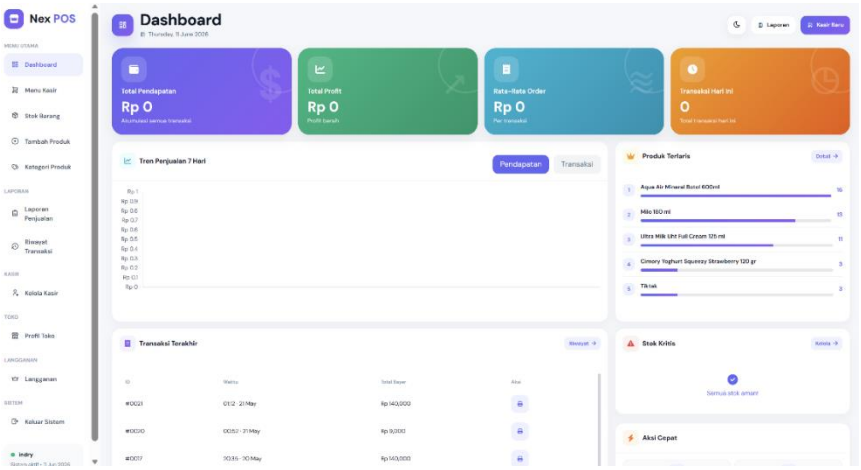

Figure 10. *Dashboard Page*

Based on Figure 10, the dashboard page displays important information such as total income, total transactions, total profit, sales graphics, and best-selling products. The information is presented in real-time to make it easier for users to monitor business progress.

3.1.4 Add Product Page

The add product page is used to add new product data to the system. Users can fill in the information of the product to be sold so that it can be managed and used in the sales transaction process. Structured product data management can increase the effectiveness of the sales process and simplify the handling of inventory.

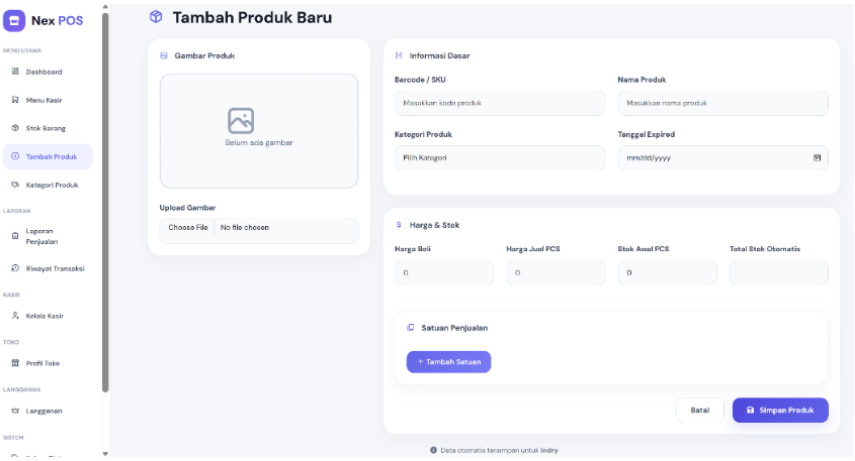

Figure 11. Add Product Page

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Based on Figure 11, users can enter product information such as product code, product name, product category, expiration date, purchase price, selling price, initial stock, and product images. In addition, the system also provides a sales unit setting feature to support product management with various types of units. Once the data is filled in, the user can save the product until the data is saved into the database and ready to be used in the sales transaction process.

3.1.5 Manage Inventory Stock Page

The manage stock page is used to manage the amount of inventory available on the store.

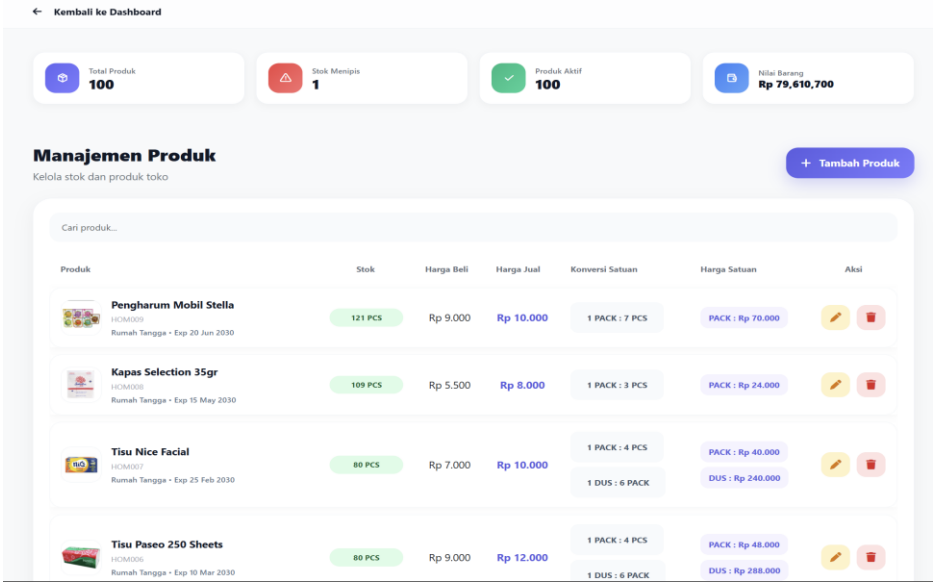

Figure 12. Manage Inventory Stock Page

Based on Figure 12, the system allows users to update the amount of stock according to the existing conditions. Every change made will be saved automatically so that the inventory data is always updated and corresponds to the actual condition.

3.1.6 Sales Transaction Page

The sales transaction page is used to perform the process of selling goods to customers.

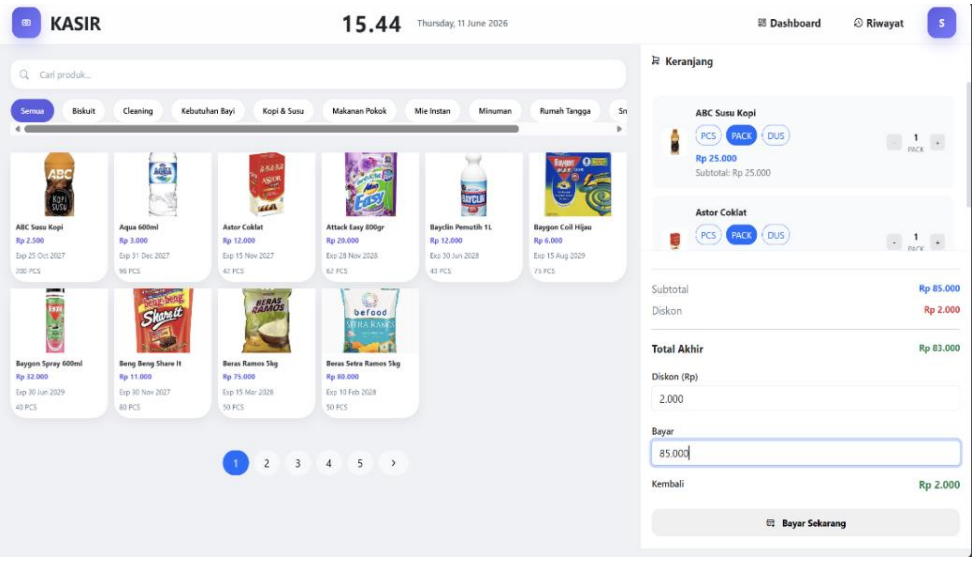

Figure 13. Sales Transaction Page

Based on Figure 13, the user can select the product the customer purchased, determine the purchase amount, calculate the total payment, and print the transaction receipt. The system also automatically stores transaction data into the database to simplify the reporting process.

3.1.7 Sales Report Page

The report page is used to display transaction information that has been done during a certain period.

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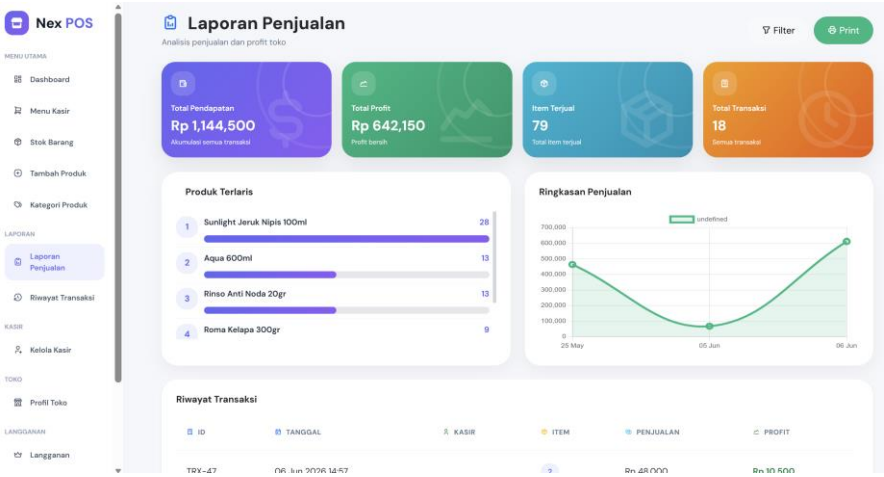

Figure 14. Sales Report Page

Based on Figure 14, the system displays a sales report that can be filtered based on a specific date range. The information displayed includes the amount of transactions, total sales, and details of transactions that have been done so as to help store owners in evaluating their business.

3.1.8 System Monitoring Page

The monitoring page is used by System Managers to monitor the activities of all stores that use the application.

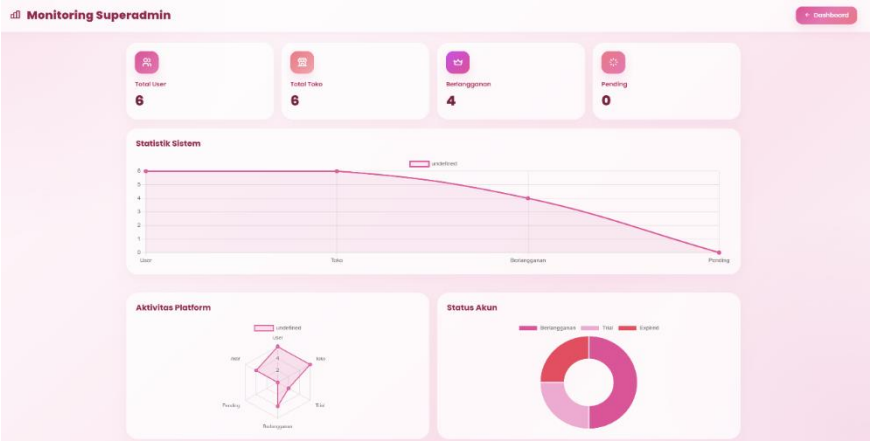

Figure 15. System Monitoring Page

Based on Figure 15, the system displays information about the number of active users, the number of active stores, subscription status, and system usage activities. This feature helps the System Manager in monitoring all registered tenants.

3.1.9 Payment Verification Page

The payment verification page is used to process subscription payments made by users.

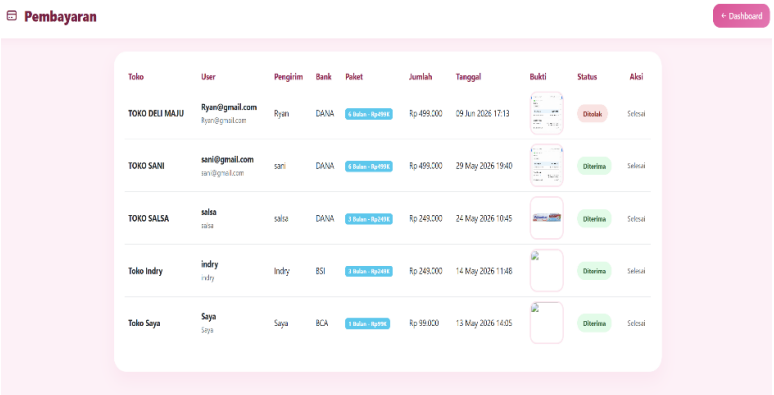

Figure 16. Payment Verification Page

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Based on Figure 16, the system displays the payment data that has been uploaded by the user along with proof of transfer. The System Manager can verify the payment and extend the active time of the user's account according to the selected package.

3.2 Discussion

3.2.1 Multi-Tenancy Implementation Analysis

The concept of Multi-Tenancy is one of the main components in the developed system. Through this concept, one application can be used by many stores simultaneously without causing data to be mixed between users. Each store has its own identity that is used as a differentiator of data in the database. Thus, transaction data, products, users, and reports can only be accessed by the store in question.

The implementation of Multi-Tenancy provides efficient use of system resources because all users use the same application. In addition, the system maintenance and development process becomes easier because it is done centrally. This concept also allows the system to be developed into a service that can be used by more users without having to create a new application for each store.

3.2.2 Analysis of Software as a Service (SaaS) Implementation

The developed system applies the concept of Software as a Service (SaaS) which allows users to use applications through a subscription mechanism. Users can choose subscription packages according to their needs and make payments through the features that have been provided in the system.

The application of the SaaS concept provides benefits for users because there is no need to spend large costs to develop their own applications. In addition, users can directly use the application without having to do complicated installation or configuration. From the developer's side, this concept allows the system to be used by many users at the same time and provides convenience in the maintenance and update process of the application.

3.2.3 System Advantages

The developed system has several advantages compared to manual sales management processes and conventional systems.

a. Supports use by many stores in one application through the concept of Multi-Tenancy.
b. Providing product management features, stock of goods, sales transactions, and reports in one integrated system.
c. Display sales information in real-time through the dashboard page.
d. Implement the concept of Software as a Service (SaaS) so that users can use the application through a subscription system.
e. Providing payment monitoring and verification features that help manage services in a centralized
f. manner.Reduce the risk of transaction recording errors and increase the efficiency of data management.

3.2.4 Development Constraints

During the development process of the system there are several obstacles encountered. One of the main obstacles is the application of a data separation mechanism between tenants so that each store's data remains secure and cannot be accessed by other users. In addition, the arrangement of access rights based on user roles also requires special attention because each user has a different function in the system.

Another obstacle found is the subscription payment verification process that requires validation by the System Manager. However, these obstacles can be overcome through good database planning, the use of accurate table relationships, and the application of access rights based on user roles.

3.2.5 Comparison with Previous Research

This research has similarities with the research done by Mulyana and Rusmawan (2023) and Kumaini et al. (2025) who developed a web-based Point of Sale (POS) system to help manage sales transactions, inventory, and business reports. The results of the research show that the application of a web-based POS system can improve the effectiveness of data management and speed up the transaction process compared to manual recording.

In addition, this research is also in line with research by Ahmadi and Surachman (2024) who apply the concept of Multi-Tenancy to web-based applications. The results of the research show that the application of Multi-Tenancy can increase the efficiency of the use of system resources as well as simplify the management of centralized applications without reducing the security of each user's data.

The main difference between this research and previous research lies in the integration of Point of Sale (POS), Multi-Tenancy, and Software as a Service (SaaS) concepts in one platform. Most of the previous research only focused on the management of sales transactions and inventory of goods for one store (single tenant), whereas the system developed in this research allows many stores to use the same application with the separation of data that remains awake.

In addition to providing product management features, stock of goods, sales transactions, and reports, this system is also equipped with subscription management features, payment verification, store monitoring, and account active time monitoring. Thus, the developed system not only functions as a web-based POS application, but also as a Software as a Service (SaaS) service that can be used by many stores simultaneously through an integrated platform.

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4. CONCLUSION

This research succeeded in developing a web-based Multi-Tenancy Point of Sale (POS) Information System using the Rapid Application Development (RAD) method. The developed system is able to support the management of product data, stock of goods, sales transactions, sales reports, store activity monitoring, as well as subscription management in one integrated platform. The application of the Multi-Tenancy concept allows many stores to use the same application simultaneously while maintaining the separation and security of each tenant's data. In addition, the application of the concept of Software as a Service (SaaS) provides convenience for users to take advantage of application services through a subscription mechanism without having to install or manage the system independently. Based on the results of implementation and testing using the Black Box Testing method, all the main features of the system can run according to user needs. The features of product management, stock management, sales transactions, sales reports, system monitoring, and payment verification managed to function properly without any errors being found that interfered with the operational process. Thus, the purpose of the research to develop a web-based Multi-Tenancy POS system capable of supporting the management of many stores in one platform was successfully achieved. However, this research still has some limitations. The subscription payment verification process is still done manually by the System Manager so it takes extra time in the payment validation process. In addition, the system is not yet equipped with advanced business analysis features such as sales predictions, product stock recommendations, and integration with automatic payment services (payment gateways). Therefore, further research can develop the integration of automatic payments, real-time notifications, mobile-based applications, as well as the application of artificial intelligence technology to support data analysis and more optimal business decision-making. The expansion is expected to improve the quality of service, ease of use, as well as the sustainability of the system in supporting digital transformation in the trade sector. The system successfully integrates POS, Multi-Tenancy, and SaaS one platform. Further research add integration payment gateways and mobile applications.

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