

## A Development of Ladies Jeans Enterprise Management System

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**Abstract:** Effective business management is crucial for ensuring business growth and preventing losses. However, Ladies Jeans Enterprise has experienced losses due to their reliance on manual processes, which result in wasted time and energy in today's fast-paced world. Furthermore, these manual procedures have led to a weak inventory management system, worsening the challenges they face. To optimise their business operations and overcome these issues, the Ladies Jeans Enterprise Management System was developed. Built using web technology and a multi-tier architecture, this system incorporates a prototype methodology in its development. The barcode technology and inventory control method implemented in the system also facilitate efficient inventory management system for the enterprise. The aim is to provide a centralised platform that facilitates management work at Ladies Jeans Enterprise, improving efficiency and promoting growth. With its implementation, the system is expected to enhance their overall business management practices and drive success.

**Keywords:** Management System, Web Technology, Barcode Technology, Chart Analysis, Multi-Tier Architecture, Prototyping Model, Digital Technology

### 1. Introduction

Ladies Jeans Enterprise, owned by Madam Yusliza Binti Hassim, has been operating for 13 years. Located in Bazar Karat, Johor Bahru, Johor, the enterprise originally specialised in selling women's jeans. However, in a strategic move to expand their customer base and propel the business forward, Ladies Jeans Enterprise decided to diversify its offerings by introducing new products, including vintage clothing. This decision was made with the aim of attracting a wider range of customers and driving the growth of the business.

Through research and careful observation, it has become evident that Ladies Jeans Enterprise faces a significant challenge in terms of time and effort wastage when it comes to their management tasks. This issue arises from the absence of a computerised system, leading to manual handling of various business management aspects. In addition, their inventory management, including stock control and

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sales recording, is carried out manually. Moreover, all data, such as sales records and inventory information, is stored in physical record books, posing security risks, and making it unreliable for business analysis and referencing.

The objective of developing this system is to help solve the challenges faced by Ladies Jeans Enterprise due to their reliance on manual methods. With the objectives of the system in mind, various features have been integrated to facilitate their business operations. These features encompass employee management, inventory management, promotion management, sales report generation, and stock display. By incorporating these functionalities, the system provides Ladies Jeans Enterprise with a user-friendly platform that facilitates their business management activities. Additionally, the system includes a sales record function that leverages barcode technology, enabling faster and more efficient sales processes and various charts to help them to conduct sales analysis to track their benefit and loss.

This paper consists of five chapters, where chapter one will discuss the project introduction, including the project background, problem statement, objectives, and project scope. Chapter two will discuss the literature review involving technology used in the development of the system and a comparison between existing systems and the proposed system. Chapter three will discuss the methodology, system development workflow and the system architecture used in the development of this system. Next, Chapter 4 will discuss the results and discussion which include the implementation of the system and the test results. Lastly, Chapter 5 will conclude all the items in this paper.

## **2. Related Work**

This section presents the literature review conducted, including the technology used, inventory control methods, and several existing systems that were studied and compared with the proposed system.

### **2.1 Technology Used**

In the development of this system, various technologies were used to help the system achieve its objectives. Some of the technologies used are digital technology, web technology and barcode technology.

Digital technology refers to the use of electronic devices, computers, and digital tools to store, process, and transmit information. This includes various types of devices and systems such as smartphones, computers, and the internet. Digital technology is widely involved in our lives today, such as how we communicate and access information online. Digital technology is closely related to web technology because digital technology serves as the foundation for web technology. Digital technology provides the hardware and software necessary for web technology to operate.

Web technology refers to the way computers or devices communicate with each other using various tools and techniques such as Markup Language (ML) over the internet. In web technology, communication takes place in a medium known as a webpage or website. A webpage or website is a document written in Hyper Text Markup Language (HTML). To access webpages over the internet, a web browser is required. A web browser is a program that can display data, text, images, animations, and videos on the internet. Web technology can be classified into five parts: World Wide Web (WWW), web browsers, web servers, webpages or websites, and web development.

Barcode technology functions using a principle called symbology. In barcode usage, symbology determines the mapping and interpretation of encoded information or data. This programming allows barcode scanners to determine when and where digits or letters in the barcode start and stop. Barcodes are divided into two types: 1D barcodes with UPC numbers and 2D QR codes.

## 2.2 Inventory Control Method

Inventory management plays a crucial role in tracking sales and maintaining stock for small companies, businesses, and vendors [1]. It enables businesses to have a clear understanding of which products have been sold and what remains in stock. By implementing effective inventory management, businesses can ensure that customers always have access to the items they need, ranging from essential business supplies to ongoing stock maintenance. To achieve optimal inventory management, businesses must employ sound inventory control methods. These methods streamline the sales process and facilitate efficient stock management. Several methods were studied, including economic order quantity, reorder point method, and ABC classification method.

The Economic Order Quantity (EOQ) method is an effective approach for determining the optimal order quantity that meets demand while minimising costs associated with ordering, receiving, and holding inventory [2]. By utilising this method, businesses can save time in the delivery and ordering process. It enables them to identify the ideal quantity to be ordered, preventing excess or unused stock that would lead to increased holding costs.

The Reorder Point method is employed to determine the specific inventory level at which reorder is necessary. This method guides managers in making timely decisions regarding stock or inventory reordering, ensuring that business losses are minimised [3]. Reordering should occur at the right moment to avoid situations where excess stock leads to increased holding costs or when no stock is available, resulting in potential sales losses until the ordered stock arrives.

Another valuable inventory control method is the ABC Classification System, which categorises products into three classes (A, B, and C) based on their usage value [4]. The usage value is calculated by multiplying the unit price of a product by its annual demand. By implementing the ABC classification system, management can identify critical products in the inventory in terms of capital cost, allowing them to prioritise resources accordingly.

## 2.3 Study of Existing Systems

A study of existing systems equivalent to the proposed system has been conducted. This study compares the features of three existing systems with the features of the proposed system. The studied existing systems include:

1. Syarikat Kain Bunga Raya Inventory Management System
2. Online Inventory Management System at Bundle Amin Store
3. Syukor Batik Management System Using Mobile Applications

**Table 1: Comparison of Equivalent Systems with the Proposed System**

Features / Systems	Syarikat Kain Bunga Raya Inventory Management System	Online Inventory Management System at Bundle Amin Store	Syukor Batik Management System Using Mobile Applications	Ladies Jeans Enterprise Management System
Application	Web-Based	Web-Based	Android-Based	Web-Based
Login	Available	Available	Available	Available
Registration	Available	Available	Available	Available
Sales Report	Available	Available	Not available	Available
Language	Malay	Malay	Malay	Malay
Inventory Management	Available	Available	Not available	Available
Employee Management	Not available	Available	Not available	Available

Features / Systems	Syarikat Kain Bunga Raya Inventory Management System	Online Inventory Management System at Bundle Amin Store	Syukor Batik Management System Using Mobile Applications	Ladies Jeans Enterprise Management System
Promotion Management	Not available	Not available	Not available	Available
Features / Systems	Syarikat Kain Bunga Raya Inventory Management System	Online Inventory Management System at Bundle Amin Store	Syukor Batik Management System Using Mobile Applications	Ladies Jeans Enterprise Management System
Use of barcode technology	Not available	Not available	Not available	Available
Analysis Chart	Not available	Not available	Not available	Available
Sales Records	Available	Available	Available	Available
Stock Display	Available	Available	Available	Available
Database	MySQL	MySQL	MySQL	MySQL

Based on the information provided in Table 1, it is evident that the Ladies Jeans Enterprise Management system offers a more comprehensive set of features when compared to the existing systems. While the Syukor Batik Management system utilises an Android-based app, it is worth noting that the Ladies Jeans Enterprise system is designed with a responsive interface, allowing it to be accessed seamlessly on mobile platforms as well. Furthermore, the use of barcode technology and the analysis chart features in Ladies Jeans Enterprise Management System sets it apart from the existing systems, in the aspect of facilitating an efficient inventory management system.

### 3. Methodology/Framework

The methodology used in the development of this system is the system prototyping model. The prototype model is a software development process model that is closely associated with iteration [5]. This is because the prototype model requires iteration in the analysis, design, and implementation phases to produce a prototype of the system, which is a more simplified version of the proposed system. Throughout the analysis, design, and implementation phases, two prototypes were developed, each representing a simplified version of the proposed system. The purpose is to obtain evaluation and feedback from stakeholders so that the actual system can achieve its objectives and satisfy the stakeholders. Figure 1 illustrates the phases and flow of phases in the prototyping model.

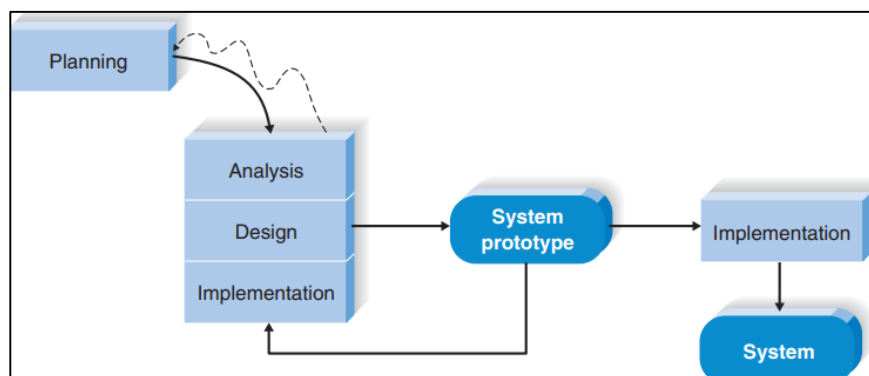


Figure 1: Phases in the Prototyping Model [5]

#### 3.1 System Development Workflow

The prototyping model consists of five phases: planning phase, analysis phase, design phase, prototype implementation phase, and system implementation phase. Table 2 illustrates the tasks and outcomes associated with each phase throughout the system development.

**Table 2: Activities in Each Phase and Their Outcomes**

Phase	Activities	Outcome
Planning	<ul style="list-style-type: none"> <li>Identify project background, scope, objective, and stakeholder.</li> <li>Creating Gantt Chart</li> </ul>	<ul style="list-style-type: none"> <li>System proposal</li> <li>Gantt Chart</li> </ul>
Analysis	<ul style="list-style-type: none"> <li>Conducting interview sessions.</li> <li>Analysing documents related to the project.</li> <li>Conducting field observations in the business area.</li> <li>Creating use case diagrams, activity diagrams, sequence diagrams, and class diagrams.</li> </ul>	<ul style="list-style-type: none"> <li>Literature review.</li> <li>Use case diagrams.</li> <li>Activity diagrams.</li> <li>Sequence diagrams.</li> <li>Class diagrams.</li> </ul>
Design	<ul style="list-style-type: none"> <li>Designing system architecture and defining system components.</li> <li>Designing database structure and data models.</li> <li>Designing user interfaces and user experience.</li> <li>Defining system functionalities and features.</li> </ul>	<ul style="list-style-type: none"> <li>Database structure and data models.</li> <li>System workflows and processes.</li> <li>User interface design and user experience.</li> </ul>
Implementation of Prototype 1	<ul style="list-style-type: none"> <li>Developing Prototype 1.</li> <li>Conducting testing of Prototype 1 with stakeholders and gathering feedback and suggestion from them.</li> <li>Analysing feedback and suggestions from stakeholders.</li> </ul>	<ul style="list-style-type: none"> <li>Prototype 1.</li> </ul>
Implementation of Prototype 2	<ul style="list-style-type: none"> <li>Enhancing Prototype 1 to create final prototype.</li> <li>Conducting testing of final prototype with stakeholders and gather their feedback and suggestion.</li> </ul>	<ul style="list-style-type: none"> <li>Final prototype</li> </ul>
System Implementation	<ul style="list-style-type: none"> <li>Performing system programming.</li> <li>Designing the database.</li> <li>Conducting functional and user acceptance testing.</li> </ul>	<ul style="list-style-type: none"> <li>Final System Product.</li> <li>Test case reports.</li> </ul>

### 3.2 Requirement Analysis

Requirement analysis is a crucial process that aims to identify user expectations and system needs for the development of a system [6]. This analysis is focused on meeting the expectations of stakeholders by understanding their preferences. To ensure that the Ladies Jeans Enterprise Management System meets user expectations and needs, a comprehensive analysis study was conducted. The results of this study were categorised into functional requirements, non-functional requirements, and user requirements as shown in Table 3 until Table 5.

**Table 3: Functional Requirements based on System Functional Module**

Module	Description
Login Module	<ul style="list-style-type: none"> <li>The system should be able to recognise the user.</li> <li>The system should be able to recognise the user's role from the inserted staff ID.</li> <li>The system should be able to redirect the user to the correct homepage based on their role.</li> <li>The system should be able to prevent a login if the staff ID and password is empty.</li> <li>The system should be able to recognise a valid login credential.</li> </ul>

Module	Description
	<ul style="list-style-type: none"> <li>• The system should be able to recognise an invalid login credential and display error message to alert the user.</li> <li>• The system should be able to lock the account from logging in for a certain amount of time if the login fails for more than 3 times.</li> <li>• The system should be able to let the user log out of the system when the logout button is pressed</li> </ul>
Manage Worker Module	<ul style="list-style-type: none"> <li>• The system should be able to store the staff's information in database.</li> <li>• The system should be able to view the data from database.</li> <li>• The system should be able to delete the staff's information based on the selected staff by user.</li> <li>• The system should be able to let the user to update the selected staff's information</li> </ul>
Manage Inventory Module	<ul style="list-style-type: none"> <li>• The system should be able to store the product's information in database.</li> <li>• The system should be able to view the product's data from database.</li> <li>• The system should be able to delete the product's information based on the selected product by user.</li> <li>• The system should be able to let the user to update the selected product's information.</li> <li>• The system should be able to add the product's quantity.</li> <li>• The system should be able to notify the manager if the product's quantity in stock is low.</li> <li>• The system should be able to store category's information entered by the user into the database.</li> <li>• The system should be able to display the category's information from the database.</li> <li>• The system should be able to delete the category's information based on the selected category by user.</li> <li>• The system should be able to let the user to update the selected category's information.</li> <li>• The system should be able to display the registered category in the dropdown list in product's registration and modify page and let the user choose the category from there.</li> </ul>
Manage Promotion Module	<ul style="list-style-type: none"> <li>• The system should be able to store the promotion's information in database.</li> <li>• The system should be able to view the promotion's data from database.</li> <li>• The system should be able to delete the promotion's information based on the selected staff by user.</li> <li>• The system should be able to let the user to update the selected promotion's information.</li> <li>• The system should be able to let the user to change the promotion's status.</li> </ul>
Display Stock Module	<ul style="list-style-type: none"> <li>• The system should be able to display all the product's information from database.</li> <li>• The system should be able to recognise the products from the product's ID and category inserted by the user and filter the table according to the ID.</li> <li>• The system should be able to generate a barcode for the user based on the product's ID.</li> <li>• The system should be able to let the user to print the product's barcode.</li> <li>• The system should be able to display a correct product's information based on the user's selected product.</li> </ul>
Record Sales Module	<ul style="list-style-type: none"> <li>• The system should be able to recognise the products from the product's ID inserted by the user and display the correct product.</li> <li>• The system should be able to identify the active promotion that applicable to the displayed product.</li> <li>• The system should be able to calculate total price of the current product correctly based on the product's price, quantity bought, and promotion applied.</li> <li>• The system should be able to let the user add the products into cart.</li> <li>• The system should be able to correctly calculate the total item in cart and display it.</li> <li>• The system should be able to let the user to remove item from cart or clear the cart.</li> </ul>

Module	Description
	<ul style="list-style-type: none"> <li>The system should be able to calculate the total price from all the item in cart correctly.</li> <li>The system should be able to redirect the user to payment page when the user is done adding item in cart.</li> <li>The system should be able to display all the information from cart in the payment page such as products bought, quantity, total price, and total cart's price.</li> <li>The system should be able to calculate the balance money for the user based on the inserted "accepted money" from the user.</li> <li>The system should be able to record the sales in database with correct time.</li> <li>The system should be able to prevent user to proceed to payment if the cart is empty.</li> </ul>
Generate Sales Report Module	<ul style="list-style-type: none"> <li>The system should be able to display all the sales recorded in database.</li> <li>The system should be able to filter the sales report table based on the product's ID and date user entered.</li> <li>The system should be able to generate the report in PDF format for user to download.</li> <li>The system should be able to calculate correctly daily total sales and display it in graph for the user to make sale analysis.</li> </ul>

**Table 4: System's nonfunctional requirements**

Requirement	Description
Performance	<ul style="list-style-type: none"> <li>System should score above 70% in Google Lighthouse evaluation.</li> <li>System should have a response time of less than 7 seconds.</li> </ul>
Usability	<ul style="list-style-type: none"> <li>System should be accessible through modern web browsers such as Google Chrome, Mozilla Firefox, Microsoft Edge, etc.</li> <li>System should have a responsive design that adapts to different screen sizes, including smartphones.</li> </ul>
Operability	<ul style="list-style-type: none"> <li>System should have an intuitive workflow to ensure smooth operation.</li> <li>System should have an attractive and user-friendly interface</li> </ul>
Security	<ul style="list-style-type: none"> <li>System should protect stored information from unauthorised access.</li> <li>Login module should prevent unauthorised access to the system.</li> <li>System should have different interfaces based on user roles to prevent unauthorised access and modification of protected data.</li> </ul>
Integrity	<ul style="list-style-type: none"> <li>System's database should be well-maintained and safeguarded against corruption and inaccurate data.</li> <li>Database should be protected to prevent data loss or damage.</li> </ul>
Availability	<ul style="list-style-type: none"> <li>System should be consistently available for use at all times.</li> </ul>
Maintainability	<ul style="list-style-type: none"> <li>System should be stored in GitHub for easy maintenance without compromising performance.</li> <li>Maintenance tasks should be carried out within specified time intervals to minimise system failures and enhance performance.</li> </ul>

**Table 5: User Requirements**

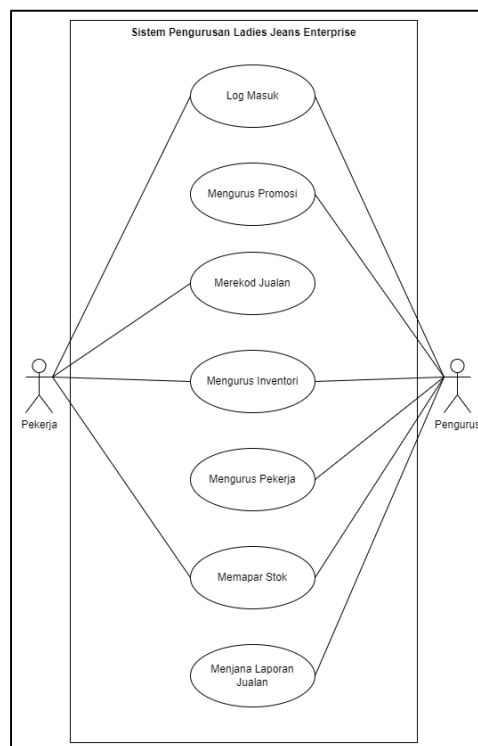
No.	User Requirements
1	All users should be able to enter their ID and password to log into the system.
2	All users should be able to log out of the system.
3	Managers should be able to create IDs and passwords for employees for login purposes.
4	Managers should be able to manage employee information.
5	Managers should be able to manage stock information.
6	Managers should be able to manage sales information.
7	Managers should be able to manage promotional information.
8	Employees should be able to view product descriptions such as product name and price.
9	Employees should be able to enter the quantity of products sold.
10	Employees should be able to enter the amount of cash received from customers.
11	Employees should be able to enter the quantity of stock received to be added to the database.

12	Managers should be able to select the desired time period for sales reports.
13	All users should be able to enter the product ID they want to search for.
14	Managers should be able to select product categories for stock display purposes.
15	Employees should be able to select product categories for inventory management purpose

### 3.3 System Analysis

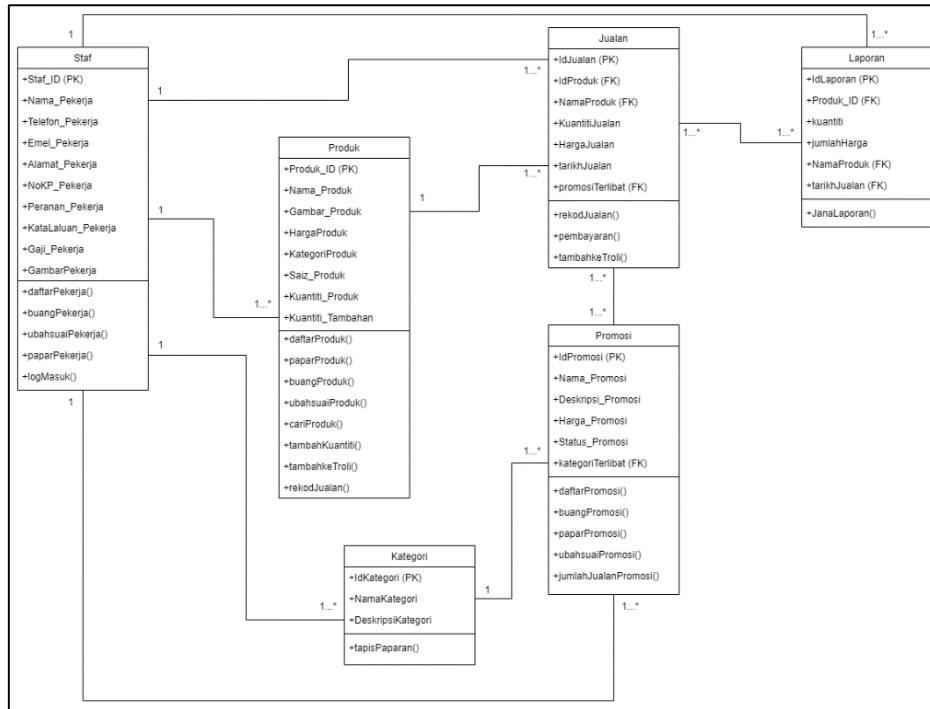
The system analysis encompasses the examination of system structure and behaviour, represented through UML diagrams [7]. The Use Case diagram illustrates the system's behaviours and actor interactions, while the Class diagram presents the system's object-oriented structure and relationships between classes. Additionally, the Architecture diagram provides an overview of the system's high-level components and their interactions. These diagrams offer valuable insights into the system's design and functionality.

Figure 2 illustrates the interaction between users and the system. There are two types of users: Worker and Managers, and seven modules: login, manage promotions, record sales, manage inventory, manage worker, display stock, and generate sales reports. The manager can perform all the activities in the use case except for record sales, while Workers can perform login, record sales, manage inventory, and display stock. Even though worker has access to manage inventory use case, they are limited to only performing adding quantities that require Manager approval before updating the database.



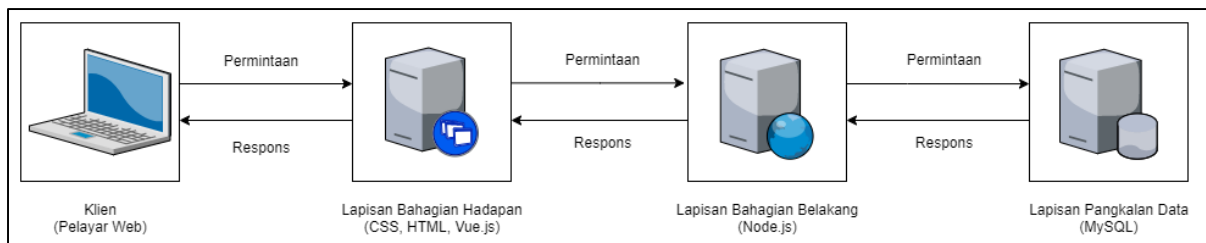
**Figure 2: Use Case Diagram for Ladies Jeans Enterprise Management System**

Figure 3 shows the Class Diagram, which provides an overview of the class structure employed in the system development process. It is also showing the static view of the structure of the system and how the system components interact with each other. This diagram depicts six key classes: Staf, Produk, Jualan, Laporan, Promosi, and Kategori. Each class is defined by its specific attributes and have relationships with other classes. The Class Diagram are created based on the object-oriented principles can be a tool or guide applicable throughout the various phases of the software development life cycle. By visualising the class relationships and attributes, the Class Diagram aids in understanding the data model and facilitates effective system design and development.



**Figure 3: Class Diagram for Ladies Jeans Enterprise Management System**

Figure 4 illustrates the multi-tier architecture, which is the selected architecture for system development. This system development will utilise a three-tier architecture consisting of the presentation layer or front-end layer, the processing layer or back-end layer, and the data management layer, which is the database layer.



**Figure 4: Multi-Tier Architecture (Three-Tier Architecture)**

The database is designed to hold and manage the data of the system. The database schema which describes the entities that hold the different data in the database is shown as below:

- i. **Staf** (Staf\_ID, Nama\_Pekerja, Telefon\_Pekerja, Emel\_Pekerja, Alamat\_Pekerja, NoKP\_Pekerja, Peranan\_Pekerja, KataLaluan\_Pekerja, Gaji\_Pekerja, GambarPekerja)
- ii. **Produk** (Produk\_ID, Nama\_Produk, GambarProduk, Harga\_Produk, Deskripsi\_Produk, kategoriProduk, Saiz\_Produk, Kuantiti\_Produk, Kuantiti\_Tambahan)
- iii. **Kategori** (idKategori, Nama\_Kategori, Deskripsi\_Kategori)
- iv. **Promosi** (idPromosi, Nama\_Promosi, Deskripsi\_Promosi, Harga\_Promosi, Status\_Promosi, kategoriTerlibat)
- v. **Jualan** (idJualan, idProduk, NamaProduk, KuantitiJualan, HargaJualan, tarikhJualan, promosiTerlibat)
- vi. **Laporan** (idLaporan, Produk\_ID, kuantiti, jumlahHarga, NamaProduk, tarikhJualan)

## 4. Results and Discussion

### 4.1 Implementation

The Ladies Jeans Enterprise management system is developed as a web-based application. The front end of the system is developed using HTML, Tailwind CSS, JavaScript and Vue JS as its framework. As for the backend of the system, it is developed using JavaScript, MySQL, and Node JS. This section will be discussing its main interfaces and its code segments.

The first one is the login module, this module is developed for user authentication. The login interfaces are separated into two separate interfaces to differentiate the authentication for worker and manager. The user must enter a valid staff ID and password according to their role to log in. If the staff ID and password are matched, the login is successful. Otherwise, the log in will fail and the system will display an error message according to the error. Figure 5 shows the interface for the login form for worker and Figure 6 shows the validation code segment for the log in process.



**Figure 5: Login Interface for Worker**

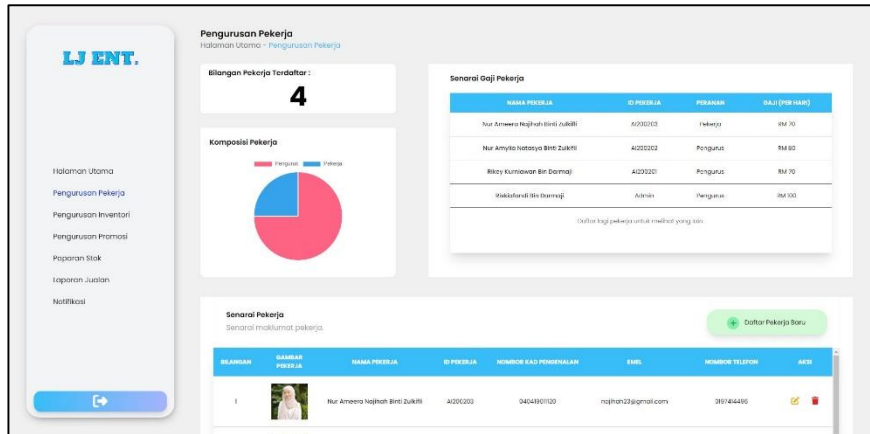
```

1  axios.post('https://lje-ms-backend.onrender.com/login', credentials)
2  .then(response => {
3    // Store user's name in session storage
4    sessionStorage.setItem('stafID', this.idPekerja);
5    setTimeout(() => {
6      this.$router.push('/pekerja/utama');
7    }, 2000);
8    const message = 'Log Masuk Berjaya';
9    const status = 'Berjaya';
10   this.$refs.toast.toast(message, status, 'success');
11  })
12  .catch(error => {
13    console.log('Login failed:', error.message);
14
15    if (error.response && error.response.status === 403) {
16      const message = 'Maaf, hanya pekerja yang boleh log masuk';
17      const status = 'Gagal';
18      this.$refs.toast.toast(message, status, 'error');
19    } else {
20      const message = 'ID Pekerja atau Kata Laluan Salah';
21      const status = 'Gagal';
22      this.$refs.toast.toast(message, status, 'error');
23    }
24  });

```

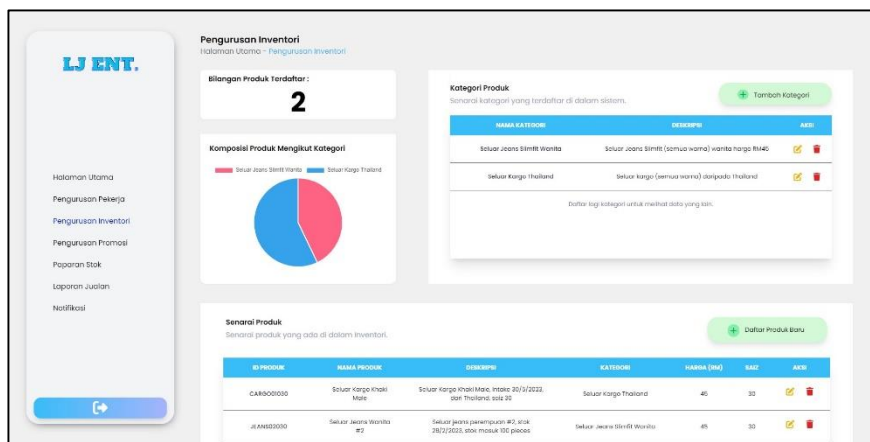
**Figure 6: Code Segment for Login Validation**

The "Manage Worker" module is designed for managers to handle their workers' information. This module allows managers to perform tasks such as registering new workers, viewing their details, editing their information, and deleting worker records. Figure 7 shows the user interface for the main page of the module that provides a simple and accessible way for managers to carry out these worker management processes.



**Figure 7: Main Page of the Manage Worker Module User Interface**

The "Manage Product" module is developed to assist managers in handling their product inventory. This module provides managers with the ability to perform various tasks, including adding new products, viewing product information, editing product details, and removing products from the inventory. Figure 8 shows the user interface for the main page of the module that is designed to be intuitive and user-friendly, enabling managers to easily navigate and perform these product management processes. In addition, the main page of the module also includes a helpful pie chart. This chart assists managers in conducting a quick analysis of the product quantities in stock, enabling them to make informed decisions regarding reordering. The visual representation of the pie chart simplifies the process for managers to assess the distribution of product quantities according to its category and determine if any products are running low, prompting them to take appropriate action.



**Figure 8: Main Page of the Manage Product Module User Interface**

The "Manage Promotion" module is designed to empower managers in overseeing promotional activities for their products or services. This module provides managers with the capability to create new promotions, view existing promotions, modify promotion details, and remove promotions when necessary. Managers can easily set and modify the status of each promotion, whether it is active or not active, giving them full control over the promotional campaigns. Figure 9 illustrates the user interface of the main page within this module, which is thoughtfully designed to ensure ease of use and accessibility. This enables managers to seamlessly navigate and execute various promotional management tasks.

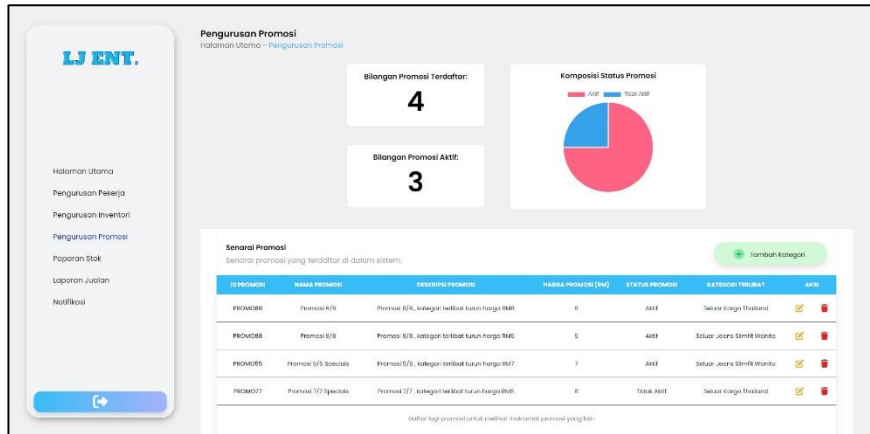


Figure 9: Main Page of the Manage Promotion Module User Interface

The "Display Stock" module provides managers with a comprehensive view of the product inventory. It offers search functionality by product ID, allowing managers to quickly locate specific items. Additionally, managers can filter products by category, simplifying inventory analysis. The module also includes a feature to generate barcodes based on product IDs, facilitating accurate labelling, and streamlined tracking. As shown in Figure 10 until Figure 11 the user interface provides user with detailed product data, such as name, id, quantity, price, description, category, and product's image, providing managers with a comprehensive overview.

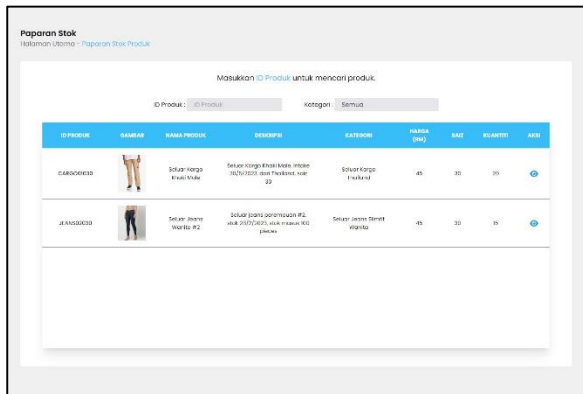


Figure 10: Search or Filter Product Page of Display Stock Module

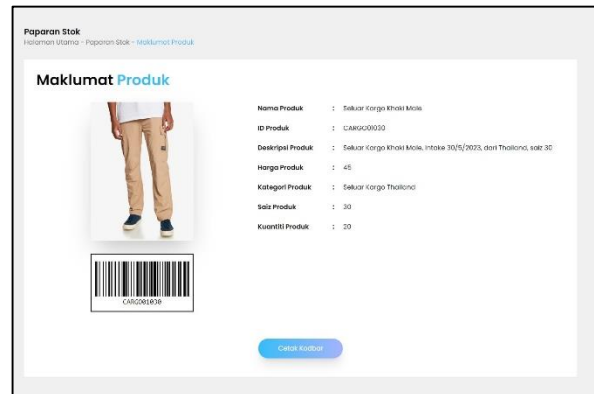
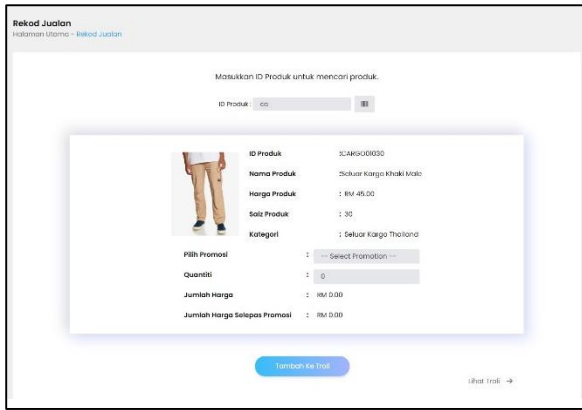
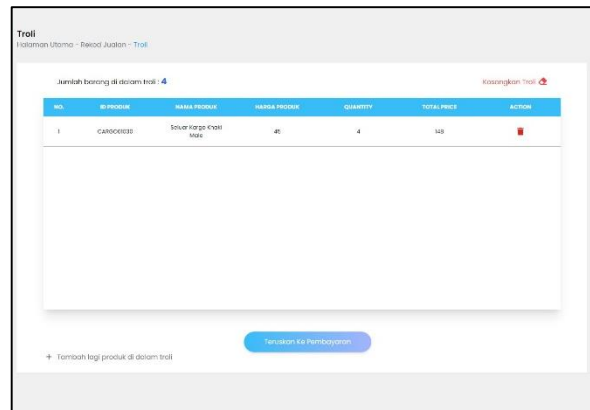


Figure 11: Display Product Information of Display Stock Module

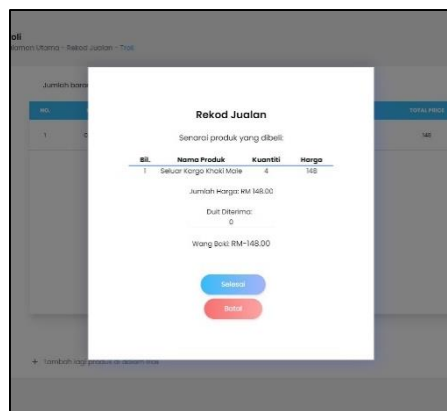
The "Record Sales" module is designed for workers to efficiently document sales transactions. Figure 12 shows the user interface of the module, where workers can search for products by ID, select applicable promotions for automatic price calculation, and add items to the cart for checkout as shown in Figure 13 and Figure 14. The module ensures accurate pricing and simplifies the process of recording sales, enabling workers to effectively manage multiple products within a single transaction. The user-friendly interface enhances the overall experience, allowing workers to record sales easily and effectively.



**Figure 12: Select Product, Promotion and Quantity Page of The Record Sales Module**

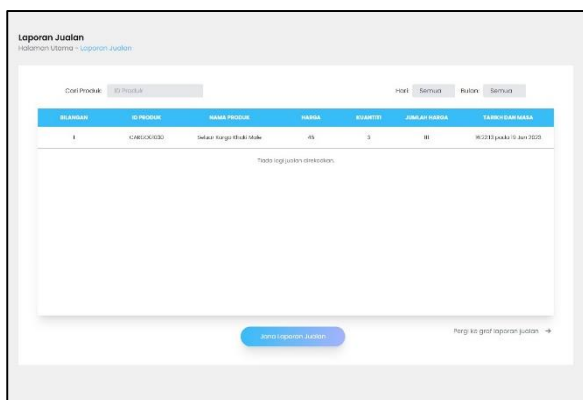


**Figure 13: Cart Page of The Record Sales Module**

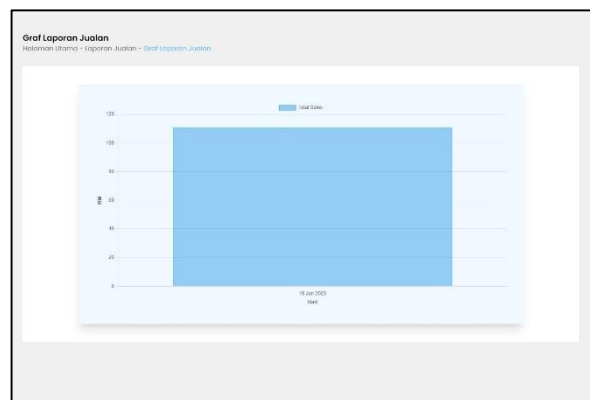


**Figure 14: Payment Page of The Record Sales Module**

The "Sales Report" module provides managers with a comprehensive tool to access and analyse sales data. Managers can filter sales data by product ID and date, allowing them to focus on specific products or analyse sales trends over time as shown in Figure 15. The module also includes graphical representations which is graphs, to track sales performance visually. Additionally, Figure 16 shows the user interface of the module, which enables managers to download sales reports based on applied filters, facilitating offline analysis and data sharing. The user interface is designed for ease of use, ensuring managers can effortlessly navigate and gain valuable insights from the sales data.

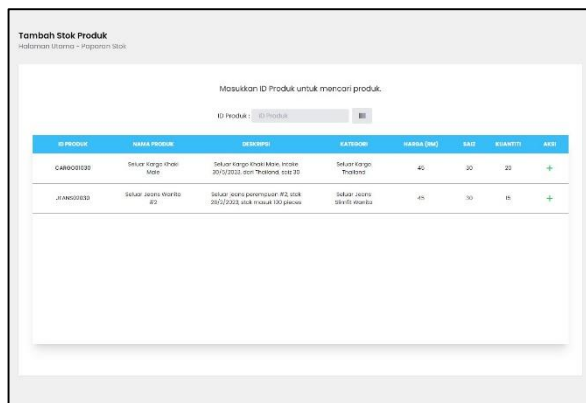


**Figure 15: View and Filter Sales Record Page of The Sales Report Module**

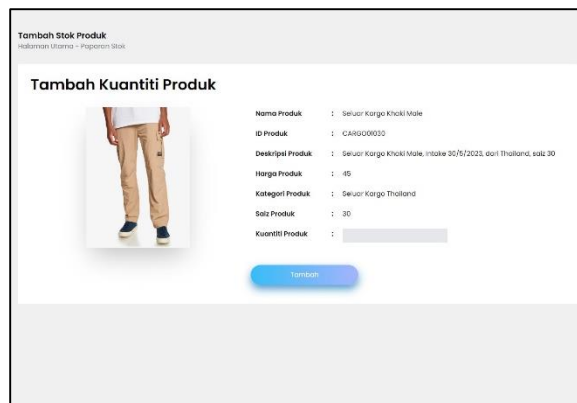


**Figure 16: Sales Graph of The Sales Report Module**

The "Add Stock" module simplifies the process for workers to addition the quantity of stock items. Figure 17 shows the user interface of the module, where workers can easily search for products by ID, select the desired product for stock replenishment. While Figure 18 shows the user interface for workers to send a request for confirmation for the addition of product's quantity to the manager. The user interface is designed to be user-friendly, enabling workers to navigate through the module effortlessly. By utilising this module, workers can efficiently initiate stock addition requests, ensuring accurate and controlled stock management within the organisation.



**Figure 17: User Interface for Searching Products to Add**



**Figure 18: User Interface for Sending Request to Add Product Quantity**

## 4.2 Testing

Two types of testing are conducted for this Ladies Jeans Enterprise Management System which are functionality testing and user acceptance testing.

### 4.2.1 Functionality Testing

Functionality testing involves deriving test cases from the determined functional requirements [8]. The requirement traceability matrix (RTM) presented in Table 6 illustrates the connection between system requirements and specifications. This matrix is particularly valuable during testing to verify whether the system requirements have been fulfilled. It aids in tracking and confirming that all requirements are adequately tested.

**Table 6: Summary of Test Cases**

Test Case ID	Functional Requirement ID	Test Case Description	Test Result (Pass/Fail)
TC01	FR-01	Login	-
TC01-01	FR01-01	The system should be able to recognise the user.	Pass
TC01-02	FR01-02	The system should be able to recognise the user's role from the inserted staff ID	Pass
TC01-03	FR01-03	The system should be able to redirect the user to the correct homepage based on their role	Pass
TC01-04	FR01-04	The system should be able to prevent a login if the staff ID and password is empty	Pass
TC01-05	FR01-05	The system should be able to recognise a valid login credential	Pass

Test Case ID	Functional Requirement ID	Test Case Description	Test Result (Pass/Fail)
TC01-06	FR01-06	The system should be able to recognise an invalid login credential and display error message to alert the user	Pass
TC01-07	FR01-07	The system should be able to lock the account from logging in for a certain amount of time if the login fails for more than 3 times	Pass
TC01-08	FR01-08	The system should be able to let the user log out of the system when the logout button is pressed	Pass
TC02	FR02	Manage Worker	-
TC02-01	FR02-01	The system should be able to store the staff's information in database	Pass
TC02-02	FR02-02	The system should be able to view the data from database	Pass
TC02-03	FR02-03	The system should be able to delete the staff's information based on the selected staff by user	Pass
TC02-04	FR02-04	The system should be able to let the user to update the selected staff's information	Pass
TC03	FR-03	Manage Inventory	-
TC03-01	FR03-01	The system should be able to store the product's information in database	Pass
TC03-02	FR03-02	The system should be able to view the product's data from database	Pass
TC03-03	FR03-03	The system should be able to delete the product's information based on the selected product by user	Pass
TC03-04	FR03-04	The system should be able to let the user to update the selected product's information	Pass
TC03-05	FR03-05	The system should be able to add the product's quantity	Pass
TC03-06	FR03-06	The system should be able to notify the manager if the product's quantity in stock is low	Pass
TC03-07	FR03-07	The system should be able to store category's information entered by the user into the database	Pass
TC03-08	FR03-08	The system should be able to display the category's information from the database	Pass
TC03-09	FR03-09	The system should be able to delete the category's information based on the selected category by user	Pass
TC03-10	FR03-10	The system should be able to let the user to update the selected category's information	Pass
TC03-11	FR03-11	The system should be able to display the registered category in the dropdown list in product's registration and modify page and let the user choose the category from there	Pass
TC04	FR04	Manage Promotion	-
TC04-01	FR04-01	The system should be able to store the promotion's information in database	Pass

Test Case ID	Functional Requirement ID	Test Case Description	Test Result (Pass/Fail)
TC04-02	FR04-02	The system should be able to view the promotion's data from database	Pass
TC04-03	FR04-03	The system should be able to delete the promotion's information based on the selected staff by user	Pass
TC04-04	FR04-04	The system should be able to let the user to update the selected promotion's information	Pass
TC04-05	FR04-05	The system should be able to let the user to change the promotion's status	Pass
TC-05	FR-05	Display Stock	-
TC05-01	FR05-01	The system should be able to display all the product's information from database	Pass
TC05-02	FR05-02	The system should be able to recognise the products from the product's ID and product's category inserted by the user and filter the table according to the ID	Pass
TC05-03	FR05-03	The system should be able to generate a barcode for the user based on the product's ID	Pass
TC05-04	FR05-04	The system should be able to let the user to print the product's barcode	Pass
TC05-05	FR05-05	The system should be able to display a correct product's information based on the user's selected product	Pass
TC06	FR06	Record Sales	-
TC06-01	FR06-01	The system should be able to recognise the products from the product's ID inserted by the user and display the correct product	Pass
TC06-02	FR06-02	The system should be able to identify the active promotion that applicable to the displayed product	Pass
TC06-03	FR06-03	The system should be able to calculate total price of the current product correctly based on the product's price, quantity bought, and promotion applied	Pass
TC06-04	FR06-04	The system should be able to let the user add the products into cart	Pass
TC06-05	FR06-05	The system should be able to correctly calculate the total item in cart and display it	Pass
TC06-06	FR06-06	The system should be able to let the user to remove item from cart or clear the cart	Pass
TC06-07	FR06-07	The system should be able to calculate the total price from all the item in cart correctly	Pass
TC06-08	FR06-08	The system should be able to redirect the user to payment page when the user is done adding item in cart	Pass
TC06-09	FR06-09	The system should be able to display all the information from cart in the payment page such as products bought, quantity, total price, and total cart's price	Pass

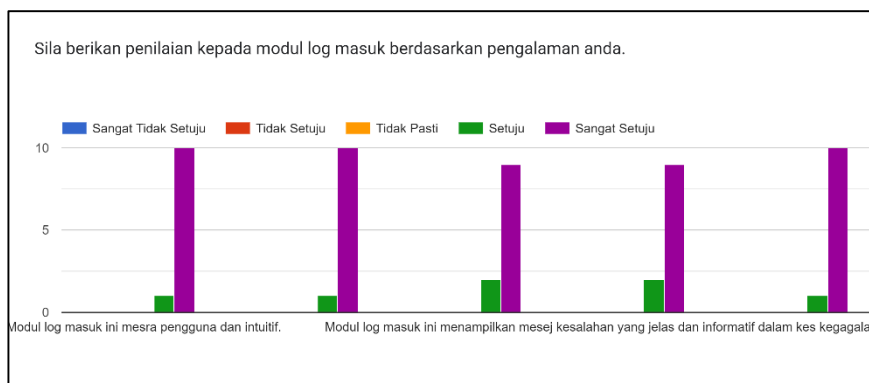
Test Case ID	Functional Requirement ID	Test Case Description	Test Result (Pass/Fail)
TC06-10	FR06-10	The system should be able to calculate the balance money for the user based on the inserted "accepted money" from the user	Pass
TC06-11	FR06-11	The system should be able to record the sales in database with correct time	Pass
TC06-12	FR06-12	The system should be able to prevent user to proceed to payment if the cart is empty	Pass
TC07	FR07	Sales Report	-
TC07-01	FR07-01	The system should be able to display all the sales recorded in database	Pass
TC07-02	FR07-02	The system should be able to filter the sales report table based on the product's ID and date user enter	Pass
TC07-03	FR07-03	The system should be able to generate the report in PDF format for user to download	Pass
TC07-04	FR07-04	The system should be able to calculate correctly daily total sales and display it in graph for the user to make sale analysis	Pass

Table 6 shows that all 49 test cases have passed. This indicates that the system can perform all the functionalities expected to meet the system's functional requirements.

#### 4.2.2 User Acceptance Testing

User acceptance testing, involving stakeholders, has been conducted to assess the functionality, usability, and user interface design of the system. The satisfaction of the users is evaluated based on the system's modules, and their acceptance and satisfaction with the modules or the system [9]. Figure 19 to Figure 25 show the graph representation of the user acceptance.

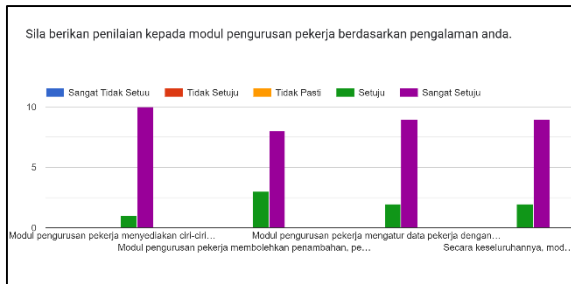
User acceptance testing is carried out using a questionnaire, requiring users or testers to provide feedback after testing the system. The questionnaire is distributed to eleven tester or user via Google Form, and the responses are collected and visualised in a bar chart. The questionnaire includes statements related to the functionality and satisfaction of each module, and users are asked to rate their agreement on a scale ranging from "strongly disagree" to "strongly agree". This approach allows for gathering user opinions and assessing their perception of module functionality and satisfaction levels.



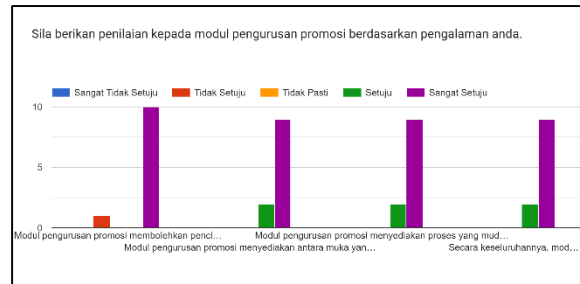
**Figure 19: Result of User Acceptance Testing for Login Module**

According to Figure 19, users express a high level of satisfaction with the login module. The graph indicates that a significant majority of users rated the module positively, with most responses falling

within the "agree" and "strongly agree" categories. This suggests that users find the login module to be effective, user-friendly, and visually appealing. Overall, the graph illustrates that the login module has successfully met user expectations and garnered positive feedback in terms of functionality, usability, and user interface design.



**Figure 20: Result of User Acceptance Testing for Manage Worker Module**

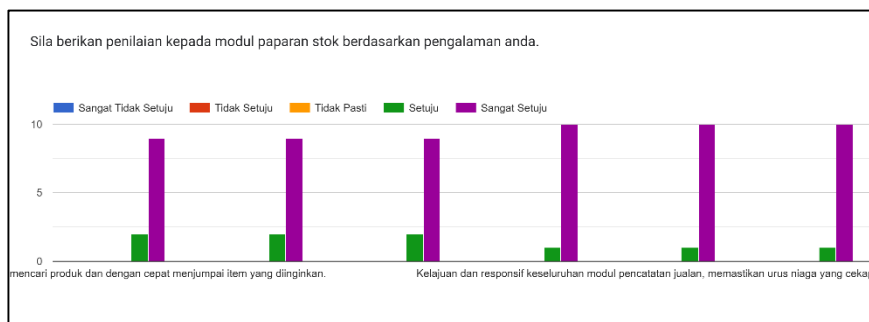


**Figure 21: Result of User Acceptance Testing for Manage Promotion Module**



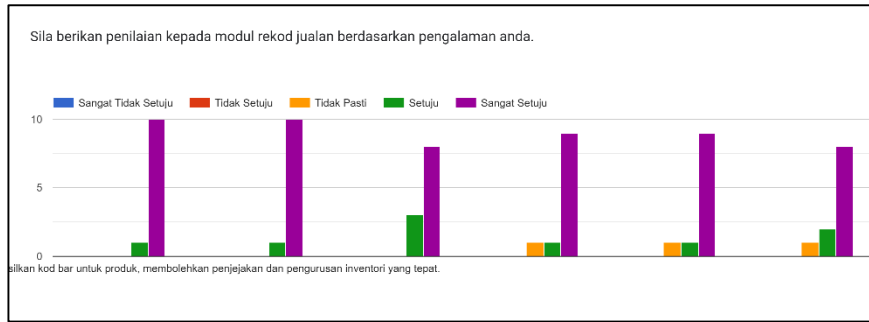
**Figure 22: Result of User Acceptance Testing for Manage Inventory Module**

According to Figure 20 until Figure 22, users are also highly satisfied with the functionality, usability, and user interface design of the manage worker, product, and promotion module. The graph depicts a significant number of users providing positive ratings for this module, with most users choosing "agree" and "strongly agree" as their answer to the questionnaire. This indicates that users find the manage worker, product, and promotion module to be efficient, easy to use, and visually well-designed. The graph highlights that the module has successfully met user acceptance in terms of functionality, usability, and user interface design, eliciting favorable feedback from the users.



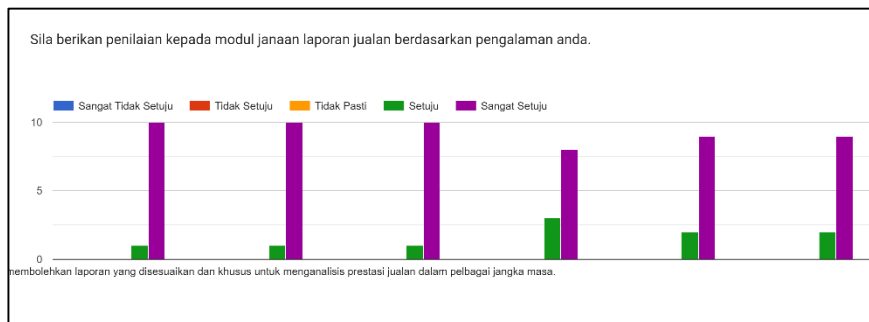
**Figure 23: Result of User Acceptance Testing for Display Stock Module**

According to Figure 23, users show a satisfactory level of satisfaction with the display stock module. The graph depicts a high number of users rating the module positively. This indicates that users find the display stock module to be effective in presenting stock information, easy to use, and has an appealing user interface design. The graph highlights that the module has successfully met user expectations and garnered positive feedback regarding its functionality, usability, and user interface design.



**Figure 24: Result of User Acceptance Testing for Record Sales Module**

According to Figure 24, the graph shows that most of the users rated the module positively. This indicates that users find the manage record sales module to be effective in recording sales records, easy to navigate and use, and visually appealing. Overall, the graph illustrates that the record sales module has successfully met user expectations and gained positive feedback in terms of its functionality, usability, and user interface design.



**Figure 25: Result of User Acceptance Testing for Sales Report Module**

According to Figure 25, users show a positive level of satisfaction with the functionality, usability, and user interface design of the sales report module. This indicates that users find the sales report module to be effective in providing valuable insights and facilitating their reporting needs. Overall, the graph reflects the successful implementation of the sales report module, meeting user expectations and acceptance in terms of functionality, usability, and user interface design.

Overall, the results of the user acceptance testing have shown that all the users are very satisfied with the functionality, usability, and user interface design of the Ladies Jeans Enterprise management system. This indicates that all the user requirements have been achieved and the user's acceptance has been obtained. This also indicates that the objectives of the project have been achieved.

## 5. Conclusion

The Ladies Jeans Enterprise management system is a web-based application accessible through any web browser. Its primary purpose is to enhance the management processes of Ladies Jeans Enterprise and includes additional features to optimise various aspects of their business operations. The conducted functionality testing returns positive results, indicating that the system effectively fulfils the expected user functionalities. Furthermore, the user acceptance testing received highly favourable feedback from users, confirming that the system meets the user requirements and gains their acceptance. These achievements validate the successful accomplishment of the project objectives.

However, it's important to note that the system's web-based nature requires an internet connection for access. Without an internet connection, the system cannot be accessed or utilised. Furthermore, there is an opportunity to improve the system's responsiveness, ensuring flawless content adaptation across different screen sizes. Enhancing the system's responsiveness will enable it to dynamically adjust its

content to provide a smooth user experience across various devices and screen resolutions. By addressing this aspect, the system can offer an even more user-friendly interface and accommodate the needs of users accessing it from different devices.

### Acknowledgements

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