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# Restaurant Menu Recommendation System Using Hybrid Filtering in a Digital Application

**Ricep Ardiansyah, Rr. Hajar Puji Sejati**
Universitas Teknologi Yogyakarta, Yogyakarta, Indonesia

**ABSTRACT**

The advancement of information technology requires the culinary industry to adapt in order to improve service quality, yet Bhumi Durian Restaurant in Sleman still faces operational challenges such as long queues during peak hours and customer difficulty in selecting menu items due to the wide menu variety. This study aims to design and implement an integrated ordering system based on a multi-platform architecture equipped with an intelligent recommendation feature. The system is developed using React JS for the admin interface, Flutter for the customer mobile application, Golang as the backend API service, and MySQL for database management. Its main feature is the application of the Hybrid Filtering method, which combines Content Based Filtering and Collaborative Filtering to provide personalized and accurate menu recommendations. System functionality is evaluated using Black Box Testing, covering ordering, payment, and recommendation processes. The results show that the system functions properly and meets all testing criteria, demonstrating its effectiveness in improving operational efficiency, accelerating transactions, and enhancing customer satisfaction.

***Keywords:*** *Hybrid Filtering, Recommendation System, Multi-Platform Architecture, Black Box Testing***.**

***Corresponding author***
***Name: Ricep Ardiansyah***
***Email: ricepardiansyah3@gmail.com***

## INTRODUCTION

Advancements in information and communication technology over the past decade have significantly influenced various industrial sectors, including the culinary industry. The rapid adoption of digital platforms in service-based businesses has transformed how restaurants manage operations, interact with customers, and deliver services. Mobile-based food ordering applications, in particular, have evolved from simple transactional tools into intelligent systems capable of supporting menu personalization, customer engagement, and operational optimization (Arya Lukita & Siti Muslikhah, 2025). In addition, digital food-ordering systems have been shown to improve operational efficiency and reduce service time, supporting restaurants in maintaining service quality during high-demand periods (Makanan… et al., 2025; Setya Ningtyas et al., 2025).

This shift reflects the broader digital transformation trend in the culinary sector, driven by increasing customer expectations for convenience, speed, and service personalization. Modern consumers demand seamless digital experiences that integrate ordering, payment, recommendation, and promotional features within a single application interface (Mulyadi et al., 2023).

Bhumi Durian Sleman Restaurant represents a unique culinary destination that offers a wide variety of durian-based products, including premium fresh durian types such as Musang King, Bawor, and Montong, as well as processed foods and specialty beverages. Although the extensive menu provides diverse options, the large number of choices often overwhelms customers, leading to decision fatigue or indecision. This condition is strongly related to the paradox of choice phenomenon, where customers tend to choose the same menu repeatedly or take longer to decide when confronted with too many alternatives (Kosim & Reza Prihandi, 2023). Recent studies also emphasize that recommendation systems can effectively reduce decision overload by presenting personalized item suggestions, enabling customers to make faster and more relevant menu selections (Sutrisno et al., 2024).

In addition, operational issues such as long queues during harvest seasons or peak hours frequently disrupt the ordering process, potentially reducing service quality and customer satisfaction. These challenges indicate an urgent need for an integrated technological solution that not only improves the efficiency of service operations but also enhances customers' decision-making experiences through personalized menu recommendations.

Recommendation systems have been widely adopted as a core technology in modern e-commerce, retail, and digital service platforms to support personalized decision-making. In the culinary context, recommendation systems help users discover new menu items, optimize decision-making time, and align their choices with individual preferences. Several studies have explored different approaches to recommendation systems. Collaborative Filtering has been shown to perform well in identifying menu similarities based on user behavior, as demonstrated by (Ardiansyah et al., 2022). Furthermore, recent research highlights that effective food recommendation models must consider dynamic ordering behavior, preference shifts, and repeated order tendencies to generate relevant suggestions (Sánchez et al., 2023).

Content-Based Filtering, on the other hand, focuses on item attributes, allowing the system to recommend items with similar characteristics to previously selected items. Nonetheless, prior studies tend to adopt a single filtering approach, which has inherent limitations. Collaborative Filtering often suffers from cold-start problems and sparsity of user–item matrices, while Content-Based Filtering struggles to generalize beyond the predefined item characteristics and may produce overly similar recommendations.

Although hybrid recommendation systems combining Content-Based Filtering and Collaborative Filtering have been widely utilized in various domains, their implementation in restaurant-based ordering applications remains limited. Most existing studies focus on web-based platforms, lack multi-platform integration, or do not incorporate a complete

end-to-end system architecture that includes mobile, web, and backend components. Moreover, only a few studies address challenges related to operational scalability, real-time menu management, and consistent user experiences across different devices. Consequently, there is still a gap in the development of a comprehensive hybrid filtering system specifically designed for restaurant menu personalization that integrates multi-platform technologies and supports real-time operational workflows.

To address these limitations, this study proposes the development of a restaurant menu recommendation system using Hybrid Filtering, which integrates Content-Based Filtering and Collaborative Filtering to generate more accurate, relevant, and adaptive menu recommendations. The hybrid approach addresses the limitations of single filtering techniques by combining item characteristic analysis with user behavioral patterns, thereby enhancing the system's ability to handle data sparsity, cold-start scenarios, and dynamic menu variations (Pangemanan et al., 2025; Pratama, 2024). This study also introduces a multi-platform system architecture that integrates React JS for the administrative web interface, Flutter for the customer mobile application, Golang for high-performance backend development, and MySQL for structured data storage. Existing literature demonstrates that React JS supports efficient and dynamic UI rendering suitable for administrative dashboards (Nursaadah et al., 2025), Flutter provides a consistent cross-platform mobile user experience (Widianto et al., 2024), Golang ensures robust performance for concurrent request handling (Harjoseputro et al., 2020), and MySQL offers reliable compatibility with preference-based recommendation systems (Sondakh et al., 2024).

This study contributes to the existing body of knowledge in three major ways. First, it develops an integrated hybrid recommendation model specifically tailored for restaurant menu personalization, bridging the methodological limitations of previous single-approach studies. Second, it introduces a multi-platform system architecture that enhances scalability, processing efficiency, and cross-platform interoperability. Third, it demonstrates empirically how hybrid filtering improves recommendation relevance and decision-making efficiency compared to conventional menu presentation methods. These contributions position the study as both academically significant and practically relevant, particularly in supporting digital transformation initiatives within the culinary service industry.

Based on these objectives, this study aims to design, develop, and evaluate a hybrid-filtering-based restaurant menu recommendation system implemented through a multi-platform architecture consisting of React JS, Flutter, Golang, and MySQL. The outcomes are expected to provide meaningful insights into the implementation of hybrid recommendation models in culinary service applications, as well as offer practical implications for improving operational efficiency, enhancing customer satisfaction, and accelerating digital innovation in the Industry 4.0 era.

## METHOD

### 1. DATA SOURCES

This study utilizes two primary types of data sources, namely primary data and secondary data, which complement each other in supporting the analysis process and the development of a restaurant menu recommendation system based on Hybrid Filtering.

a. Primary Data

Primary data were obtained directly from the main sources with the objective of gaining an in depth understanding of the business processes and user requirements (Nurhayati & Husain, 2024). Data collection was conducted through interviews and direct observation at the research site. Interviews were carried out with internal stakeholders of Bhumi Durian Sleman Restaurant, including the owner or manager and staff members responsible for ordering and cashier operations, to gather information regarding operational workflows, challenges encountered, and expectations for the recommendation system to be developed. In addition, several regular customers were involved as external informants to provide user perspectives related to ordering experiences and preferred menu selections.

Direct observations were also conducted at the restaurant to examine operational activities, customer ordering patterns, interactions between staff and customers, and service conditions during peak hours. The findings from these observations were used to validate system requirements, ensuring that the proposed application design aligns with actual conditions in the field.

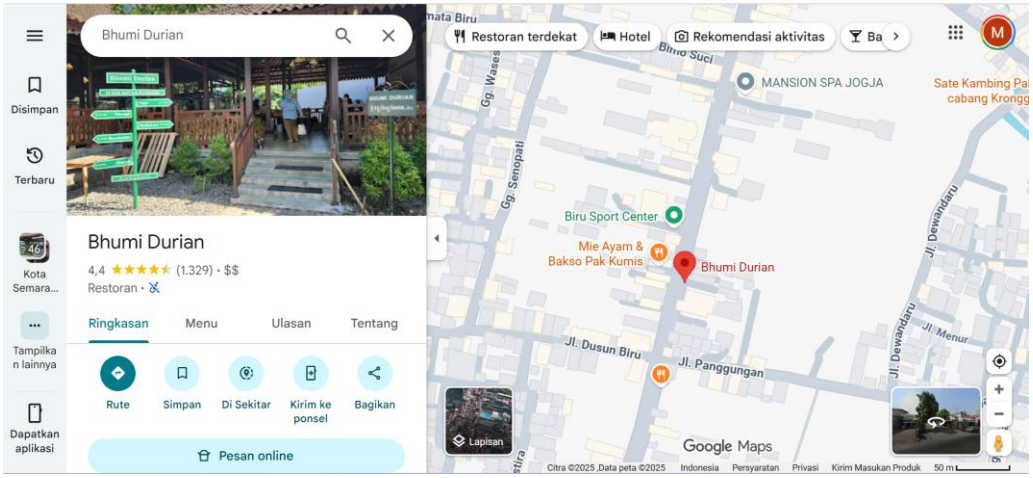


**Figure 1:** Research Location

b. Secondary Data

Secondary data in this study consist of supporting information obtained from various existing documentation and literature sources (Nurhayati & Husain, 2024). These data include product and digital menu information from online platforms such as GoFood and GrabFood, which were used to understand menu variations, pricing,

and customer reviews. Additionally, content from the official social media accounts of Bhumi Durian Sleman Restaurant, particularly Instagram and other digital promotional channels, was utilized to identify promotional strategies and patterns of customer engagement.

The theoretical foundation of this study is strengthened by scientific references obtained from journals, research articles, and publications related to food recommendation systems and Hybrid Filtering. Additional technical documentation regarding digital payment mechanisms, such as QRIS and electronic wallet systems, was also reviewed to understand the integration of transaction processes within the restaurant platform.

## 2. System Development Methodology

The system development method used in this study refers to the Software Development Life Cycle (SDLC) approach. This approach was selected because it provides a systematic framework for conducting requirement analysis, system design, implementation, and system testing (Aznawi et al., 2025). Each stage in the SDLC is carried out sequentially and in a structured manner to ensure that the food e recommendation system developed meets user needs and operates optimally.

### a. System Planning and Requirement Analysis

The initial stage of system development began with planning and requirement analysis. At this stage, user needs were identified from two main perspectives, namely customers and restaurant managers. The requirement analysis consisted of two key categories, functional requirements and non functional requirements (Rifaldi Herikson et al., 2025).

The results of the requirement analysis served as the foundation for preparing system specifications and determining the direction of system design, ensuring that the system aligns with user characteristics and the business processes implemented at Bhumi Durian Sleman Restaurant (Dwi Permatasari et al., 2025).

### b. System Design

The system design stage aims to translate the requirement analysis results into a structured technical design (Dhiya Aula & Tasdik, 2025). The design process includes system architecture, user interface and user experience design, database design using MySQL, and the design of the recommendation algorithm that integrates Content Based Filtering and Collaborative Filtering.

Design diagrams such as the Use Case Diagram, Entity Relationship Diagram (ERD), and System Architecture Diagram were utilized to visualize relationships among system components and user interaction flows. This stage ensures logical consistency, smooth module integration, and ease of implementation during system development.

### c. System Implementation

The implementation stage represents the process of transforming the system design into an operational application. System development was carried out using

several key technologies, including React JS for the restaurant web interface, Flutter for the customer mobile application, Golang (Go) for backend and Application Programming Interface (API) development, and MySQL as the primary database for storing transactions and recommendation analysis results.

At this stage, the recommendation algorithm was implemented using a Hybrid Filtering approach that combines Content Based Filtering and Collaborative Filtering. Component integration was conducted through APIs to ensure synchronized functionality across both web and mobile platforms.

**d. System Testing**

The testing stage was conducted to ensure that the system functions according to specifications and user requirements (Estevani et al., 2025).The testing process employed the Black Box Testing method, which focuses on functional testing without examining the internal structure of the program code (Danti Rosdianti et al., 2025). The evaluation emphasized three main aspects, namely the accuracy of recommendation results, system response speed, and integration across platforms (web and mobile).

## RESULTS AND DISCUSSION

### 1. System Architecture

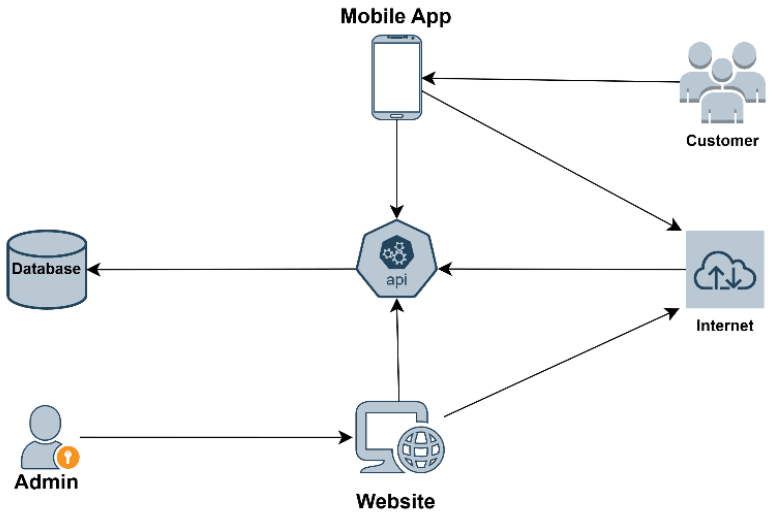


**Figure 2:** System Architecture

The system architecture illustrated in Figure 2 describes the communication flow between the main components of the restaurant menu ordering system. The system involves two categories of users, namely administrators and customers. Administrators access the system through the web based admin interface, while customers use the mobile application.

Both platforms are connected to the API Server through an internet network. The API Server functions as the primary intermediary between the applications and the database, responsible for processing every user request, including both data retrieval and data storage operations. With this architecture, all transaction processes and data management activities can be carried out in a centralized, efficient, and integrated manner, thereby supporting optimal and consistent system performance across multiple platforms.

## 2. System Design Diagram

The system design stage aims to translate the results of requirement analysis into a structured technical specification. This process ensures that the system developed is capable of meeting both functional and non functional requirements identified in the previous analysis phase. System design includes modeling user interactions through a use case diagram, visualizing business process flows using a flowchart, and defining database structure through an Entity Relationship Diagram (ERD).

### a. Use Case Diagram

The Use Case Diagram is utilized to describe the interactions between users (actors) and the system based on the defined functional requirements. This diagram illustrates the primary roles of users as well as the activities they are allowed to perform within the system.

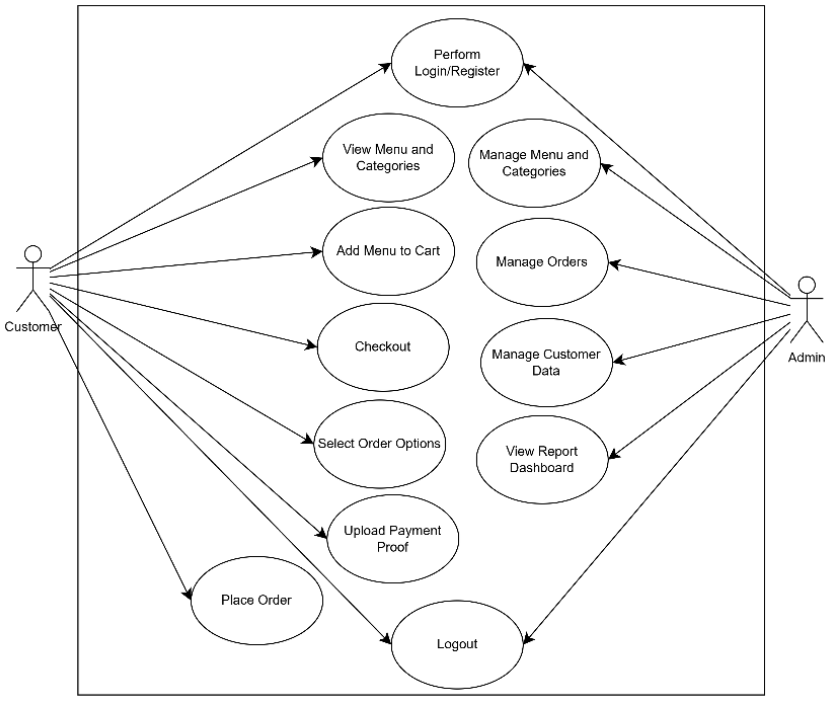


**Figure 3:** Use Case Diagram

Customers serve as service users who interact directly with the application. Their functions include logging in or registering, viewing menus and product categories, adding items to the cart, performing checkout, selecting the ordering method (pickup, dine in, or delivery), and uploading proof of payment.

Administrators function as system managers with full access rights to operational data. Administrators are able to manage menus and product categories, process orders, update customer information, and monitor transaction reports through the dashboard.

**b. Flowchart System**

The flowchart is used to represent the logical process flow of the system as a whole. This diagram helps visualize the sequence of steps carried out by both the user and the system, starting from the authentication process to the completion of the transaction. There are two primary flows illustrated in the flowchart, namely:

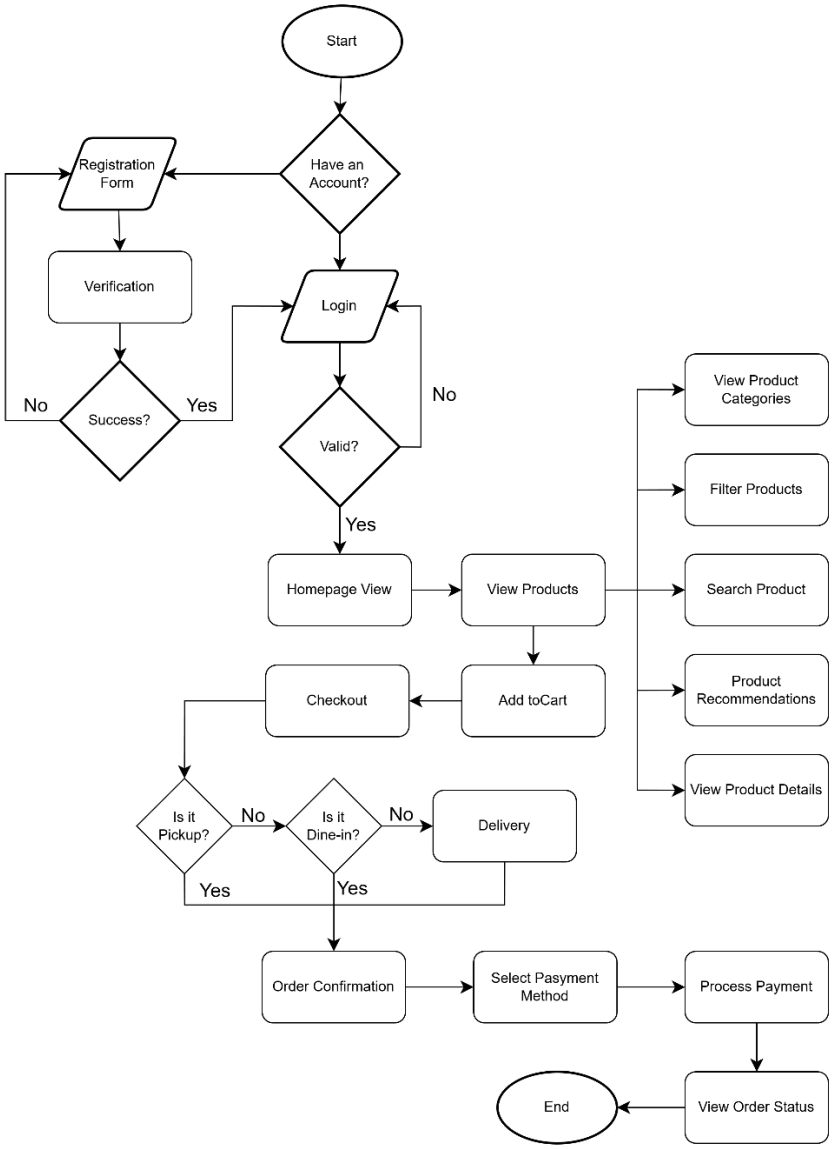


**Figure 4:** Flowchart Customer

The customer flowchart illustrates the processes performed by users, starting from login or registration, viewing menus, adding products to the cart, proceeding to checkout, selecting the ordering option, and finalizing the payment transaction. This flow ensures that users can place orders through an efficient and intuitive sequence of steps.

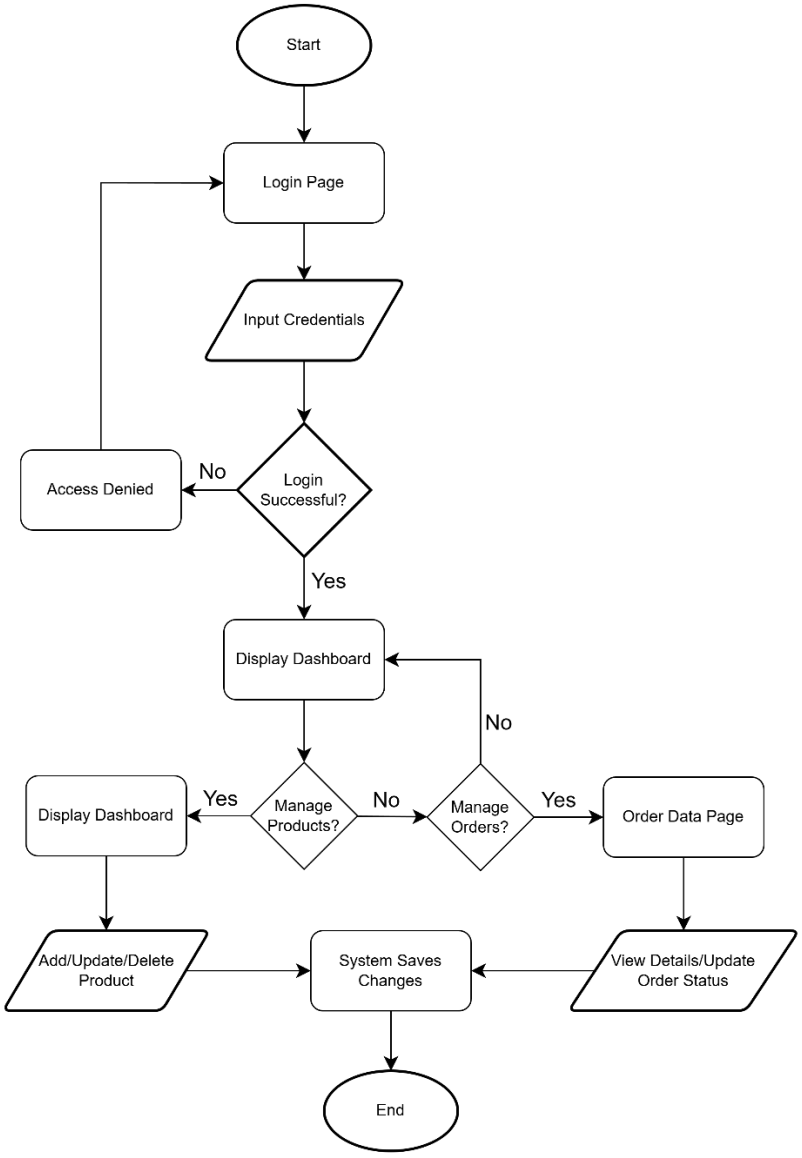


**Figure 5:** Flowchart Admin

The admin flowchart describes the processes carried out by administrators, beginning with logging into the system, managing product and order data, and saving updates to the database. This flowchart reflects the administrator's full control over restaurant operational management and the monitoring of transaction activities.

**c. Entity Relationship Diagram (ERD)**

In this section, MySQL is implemented as the Relational Database Management System (RDBMS) to support structured data management through table relationships. The database architecture is designed by applying normalization principles and utilizing foreign keys to maintain data integrity. Each primary entity is

represented as a table with systematically defined attribute schemas. The database design visualization is presented using an Entity Relationship Diagram (ERD) to facilitate the understanding of table relationships.

The database structure of the Bhumi Durian Sleman restaurant system consists of several key entities, detailed in Table 1 below:

**Table 1: Database Entity Description**

| No | Nama Tabel | Deskripsi |
|---|---|---|
| 1. | Users | Stores user account information for both customers and admins. Attributes include user_id (PK), username, email, password, profileImage, role, address, phone_number, created_at, and updated_at. |
| 2. | Products | Stores information on available restaurant menus, covering product_id (PK), name, description, price, category, image_url, rating, stock, created_at, created_by, and updated_at. |
| 3. | Orders | Stores order transaction data, including order_id (PK), user_id (FK), order_date, payment_method, order_status, payment_proof, total_price, order_type, shipping_address, created_at, and updated_at. |
| 4. | Order_Items | Stores details of each product ordered in a single transaction, with attributes order_item_id (PK), order_id (FK), product_id (FK), quantity, price, created_at, and updated_at. |
| 5. | Reservations | Stores dine-in table reservation data, covering reservation_id (PK), order_id (FK), table_number, reservation_time, guest_count, special_request, created_at, and updated_at.. |

Entity relationships are designed using a one-to-many model between Users–Orders, Orders–Order Items, and Orders–Reservations. This model ensures data integrity and simplifies the process of querying transactions and generating operational reports. The relationships between entities within the database are visualized in Figure 6, illustrating the relational structure between tables and their interconnectivity in supporting system data integration.

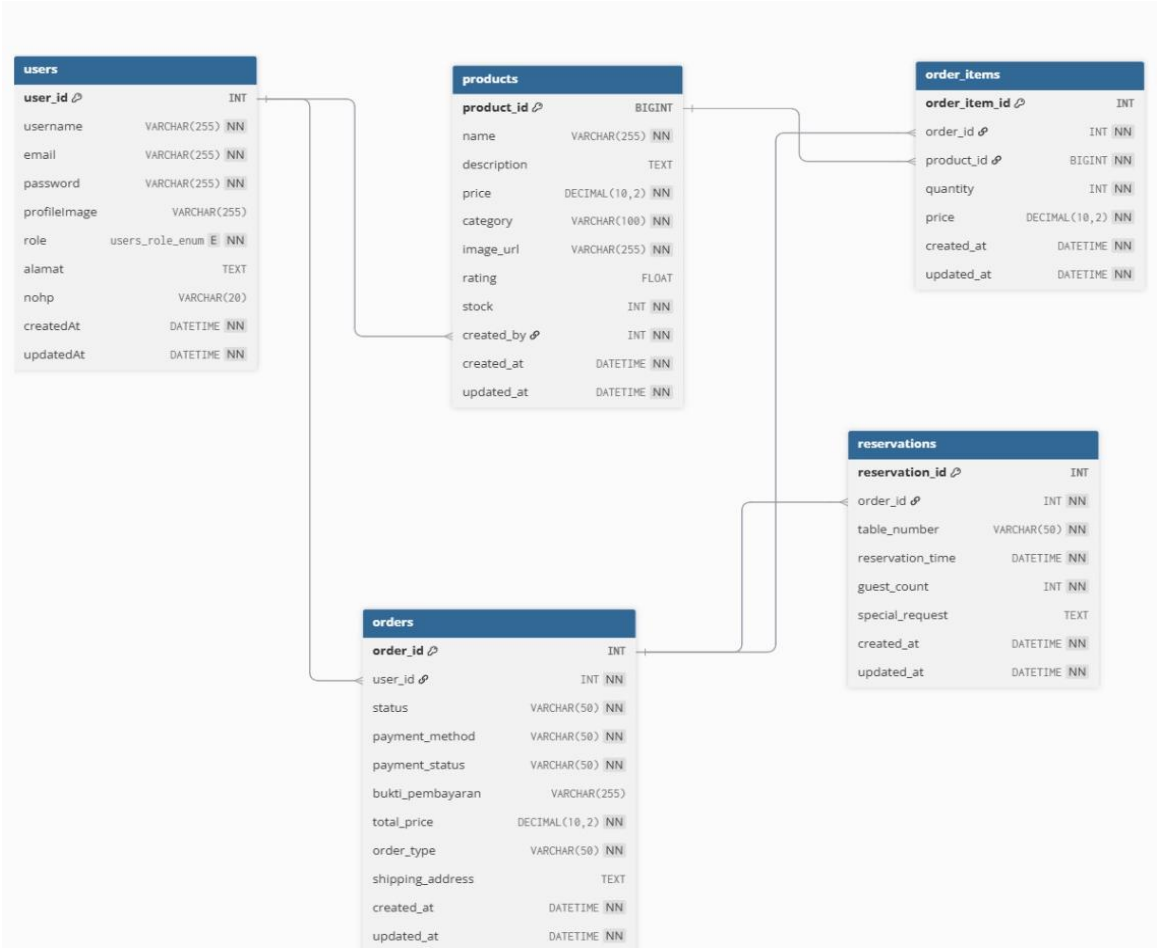


**Figure 6:** ERD System

## 3. Application Interface

The developed application consists of two main interfaces: a web-based admin interface and a mobile-based customer interface. Each interface is designed with principles of usability, design consistency, and feature accessibility to ensure an optimal and seamless user experience..

a. Web Interface (Admin)

The admin web interface functions as the central platform for managing system data, including transaction data, product information, and user records. The Admin Login Page (Figure 7) functions as the entry point that governs the authentication process for the backend management system. The interface is designed with careful consideration of security and usability principles, requiring administrators to enter valid credentials consisting of an email address and a password before they are granted access to the system.

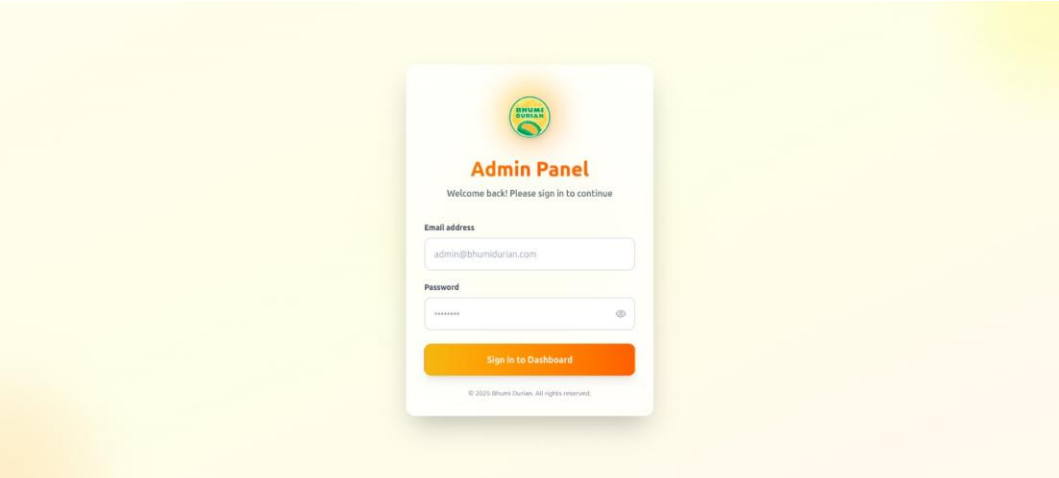


**Figure 7:** Login admin

The Admin Dashboard (Figure 8) presents a summary of business activities, including total revenue, number of orders, total products, and total customers. Additionally, the dashboard provides interactive sales data visualizations that assist administrators in conducting real-time performance analysis.

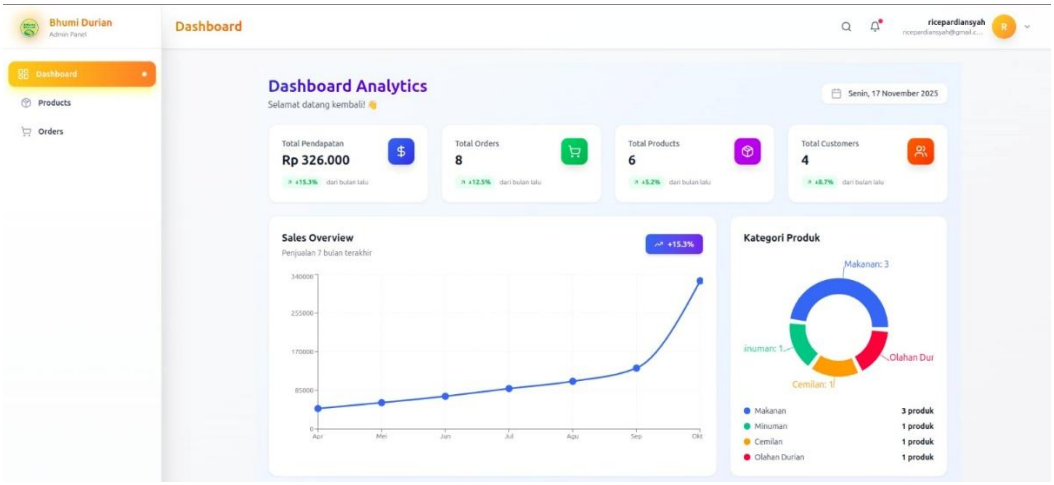


**Figure 8:** Admin Dashboard

The Product Page (Figure 9) is designed to facilitate efficient product data management. Through this page, administrators can add, modify, delete, and categorize products as needed.

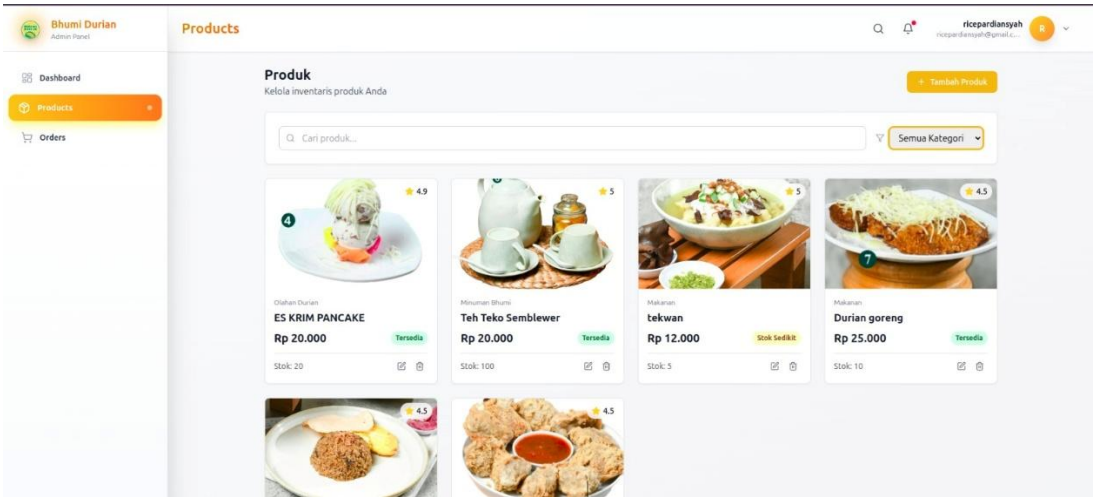


**Figure 9:** Product Page

The Order Page (Figure 10) displays a list of customer transactions in a tabular format containing key information such as Order ID, User ID, order status, payment method, total price, order type, address, and transaction date. The page is equipped with a Refresh button to update the data and a View button on each row to display detailed order information. Color-coded status indicators help administrators identify pending or unverified orders, while the structured table layout enables faster, more accurate, and efficient monitoring of the order process up to payment confirmation.

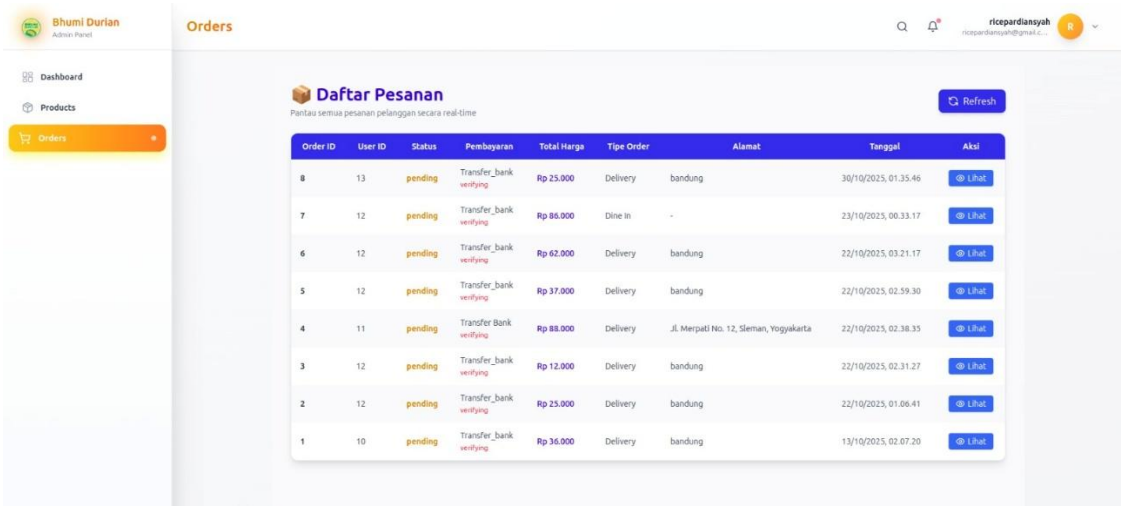


**Figure 10:** Order Page

b. Mobile Interface (Customer)

The customer mobile application interface was developed using Flutter to ensure consistent visuals and responsive performance across various devices. Figure 11 presents the sequence of initial application screens, which include the Splash Screen, Login page, and Create New Account page as part of the primary user interaction flow. The Splash Screen displays the “Bhumi Durian” visual identity as the brand representation when the application is first launched. Subsequently, the Login page provides an authentication mechanism using email and password, complemented by supporting features such as session storage and account recovery to enhance user convenience. For users who are not yet registered, the Create New Account page offers a data entry form consisting of Username, Email, Address, Phone Number, and Password, all of which are validated before being stored in the MySQL database. These three interfaces are designed to ensure that the user onboarding process runs efficiently, securely, and in alignment with the operational needs of the system

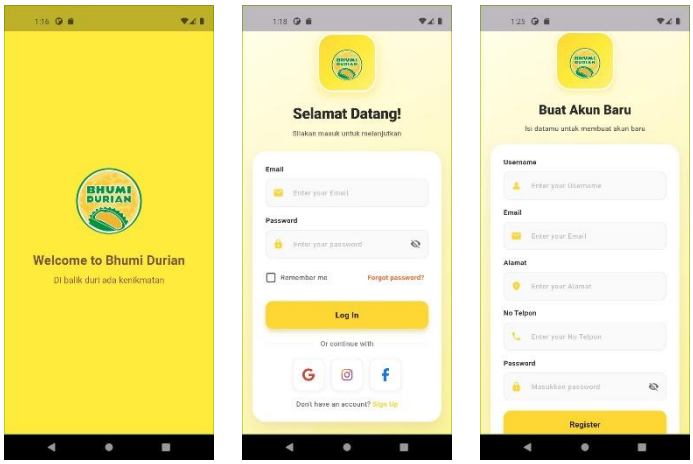


**Figure 11:** Interface the Splash Screen, Login page, and Create Account page.

The Home Screen on the customer application serves as the main navigation hub that presents various ordering features in an informative and responsive manner, as shown in Figure 12, which represents the primary interface of the mobile application. At the top of the page, a user greeting and a search bar are displayed, both connected to the API to enable real-time menu searches. Below this section is a promotional banner in the form of a carousel that displays active promotions, which can be updated through the admin dashboard. Next, the menu categories are arranged in a grid layout, allowing customers to browse products more quickly based on their types. The menu list section showcases the Bhumi Durian menu in a horizontal scroll format, equipped with images, prices, and a quick-order button. All components on this page are integrated with a Golang-based API, ensuring that

product data, promotions, and user interactions are consistently updated, resulting in a more intuitive, fast, and efficient customer exp.

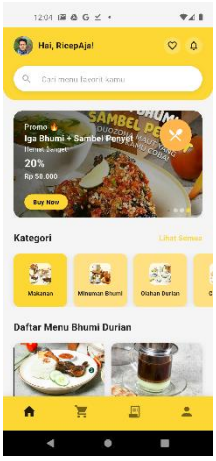


**Figure 12**: Customer Home Screen Interface.

As shown in Figure 13, the product detail page displays complete information about the Nasi Ayam Bakar menu along with a list of Similar Recommendations that automatically presents other menu items with characteristics and user preference patterns that are relevant. This recommendation section serves as a direct representation of the implementation of Hybrid Filtering, presented through an interface that adjusts the recommendations based on the context of the product currently being viewed.


**Figure 13:** Product Detail Page with Hybrid Filtering Recommendation.

As shown in Figure 14, the cart page displays a summary of the user's order in the form of a neatly arranged item list, complete with menu photos, product names, unit prices, and plus–minus buttons that allow users to adjust the quantity directly. Every quantity change is updated in real time for both the total items and the

total price displayed at the bottom of the page, enabling users to monitor the estimated payment accurately before proceeding to the Checkout process.

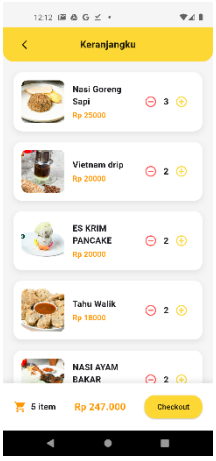


**Figure 14:** Shopping Cart Management Interface.

The Order Confirmation page (Figure 15) is designed adaptively to accommodate three main service preferences, namely Delivery, Pickup, and Dine In (Reservation), with an interface that adjusts to the data requirements of each method. In the Delivery and Pickup modes, the system guides users to verify their order details, review the estimated total price, and upload digital payment proof, while the Delivery option also provides an integrated address input field for entering shipping information. Meanwhile, the Table Reservation interface displays an interactive restaurant layout that allows customers to select available table numbers in real time, set the arrival schedule, determine the number of guests, and include any special requests. All of these processes lead to a final confirmation button that sends the transaction data to the server for validation by the admin, ensuring that each order is recorded accurately according to the selected service type.

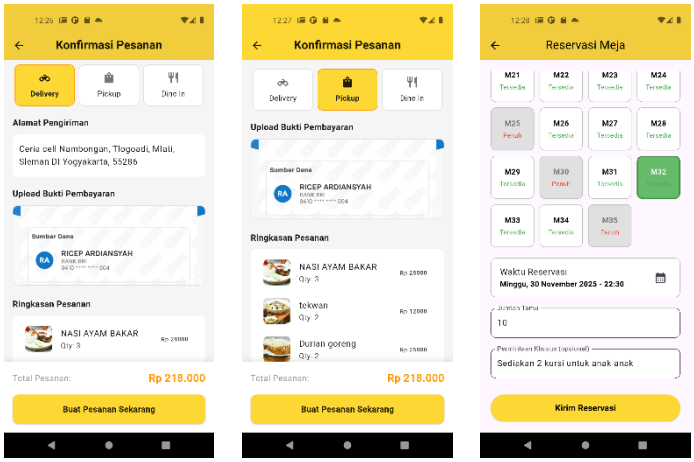


**Figure 15:** Order Confirmation Modes: (a) Delivery, (b) Pickup, and (c) Table Reservation

The Order History page (Figure 16) is designed to provide transparency and convenience for users in monitoring the status of their completed transactions. On this page, all user orders are displayed in a card list format that contains essential information, including the order number, a summary of the ordered menu items, the transaction time, and the total payment. Each card is equipped with an order status label that is updated automatically according to the verification process carried out by the admin on the server side. In addition, an action button is available to allow users to view specific details of each transaction, ensuring that they have full access to the complete record of their purchasing activities within the application.

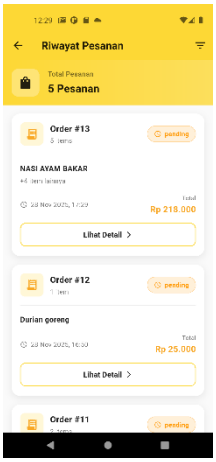


**Figure 16:** Order History Display

## 4. Black Box Testing Results

The testing process focused on eight primary scenarios that represent the core functionalities of the application, covering both the web and mobile interfaces. The results indicate that all scenarios were executed successfully, as evidenced by system outputs that consistently matched the expected results. The summary of the testing outcomes is presented as follows:

**Table 2: Black Box Testing Result Table**

| NO | Testing Scenario | Testing Result | Status |
|---|---|---|---|
| **1** | Displaying the Admin Dashboard | A summary of revenue, total products, total customers, and the sales chart is displayed correctly. | Succes |
| **2** | Product Management (Add/Edit/Delete Products) | Product data is saved, updated, or deleted in the database, and the product list is updated in real time. | Succes |
| **3** | Displaying the Order List | The order table displays complete information, including Order ID, User ID, | Succes |

| | | | |
|---|---|---|---|
| | | status, total price, payment method, address, and transaction date. | |
| **4** | Mobile Splash Screen Page | The “Bhumi Durian” logo appears when the application is first launched. | Succes |
| **5** | Customer Login | Users can log in with valid email and password, and are rejected if the data is invalid. | Succes |
| **6** | Customer Account Registration | Complete account data (username, email, address, phone number, password) is stored in MySQL after validation. | Succes |
| **7** | Displaying Customer Home Screen | The Home Screen displays the user greeting, the search bar functions seamlessly with the API, promotional banners appear in a carousel, menu categories are fully displayed, and the product list loads in real-time. | Succes |
| **8** | Displaying Product Details & Similar Recommendations | Product information is displayed completely (image, description, price). The ""Similar Recommendations"" list appears automatically based on the Hybrid Filtering algorithm. | Succes |
| **9** | Displaying & Modifying Cart Items | All order items are displayed correctly. The increase/decrease buttons function properly, and the total price updates in real-time according to quantity changes. | Succes |
| **10** | Order Confirmation (Delivery) | The delivery address input form is available and functional. The confirmation button successfully sends the delivery order data to the server. | Succes |
| **11** | Order Confirmation (Pickup) | The confirmation interface is concise without an address field. The confirmation button successfully processes the pickup order data. | Succes |
| **12** | Order Confirmation (Dine In / Reservation) | The interactive table layout visualization is displayed, table number selection and reservation time features function smoothly, and reservation data is successfully saved to the database. | Succes |
| **13** | Displaying Order History | All user orders are displayed in a card list format containing transaction summary, time, total price, and order status which | Succes |

| | |
|---|---|
| | updates automatically based on admin verification. |

## DISCUSSION

The findings of this study indicate that the integration of Hybrid Filtering within the digital restaurant ordering application enhances the relevance of menu recommendations and supports faster decision making for users. The combination of React JS, Flutter, Golang, and MySQL contributes to efficient data processing and consistent user experiences across platforms. These results are consistent with the work of (Pratama, 2024), who reported that hybrid approaches help overcome the cold start problem and improve the adaptability of recommendation systems in dynamic environments.

The tests conducted in this study also demonstrate that the system successfully handles essential ordering functions such as product management, transaction processing, and delivery of personalized recommendations. The integration of content based and collaborative filtering methods supports the generation of menu suggestions that reflect both user interaction history and individual preferences. This observation is aligned with the study by (Pangemanan et al., 2025), which emphasizes that combining these two techniques produces more stable and personalized recommendations in culinary applications.

In addition, this research supports earlier findings by (Ardiansyah et al., 2022), who demonstrated that Collaborative Filtering models in culinary tourism recommendation systems are effective in identifying user behavior patterns and producing relevant suggestions that match similar user groups. However, their study did not include the application of hybrid techniques and was not integrated into a restaurant ordering system. Therefore, the present study provides an additional contribution by demonstrating the effectiveness of adaptive recommendation methods within a multi platform restaurant service environment.

## CONCLUSION

The results of this study demonstrate that the multi-platform restaurant ordering system equipped with a Hybrid Filtering recommendation model is able to operate effectively and consistently across the web and mobile interfaces. The explanation regarding the integration of Content Based Filtering and Collaborative Filtering has been clarified to emphasize their complementary roles in overcoming the weaknesses of single method recommendations, producing menu suggestions that are more relevant, adaptable, and aligned with user preferences. System evaluations carried out through Black Box Testing confirm that all core functionalities including ordering, payment verification, product management, and recommendation delivery operate according to specifications.

In addition, the proposed system contributes to improving operational efficiency at Bhumi Durian Sleman Restaurant by reducing customer decision time, streamlining the ordering flow, and supporting more structured transaction management for administrators. The description of the technological stack has been refined to highlight the effectiveness of

React JS, Flutter, Golang, and MySQL in building a scalable and integrated architecture capable of handling real time data processing and cross platform synchronization.

Overall, this research provides academic and practical implications for the implementation of hybrid recommendation systems in the culinary industry. The system not only enhances user experience through personalized recommendations but also supports digital transformation efforts by improving service quality, accelerating transaction processes, and increasing customer satisfaction. A more detailed direction for future development has been added, encouraging exploration of behavioral context, real time preference learning, and advanced analytics to further optimize recommendation accuracy.

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