Journal of Artificial Intelligence and Technology Information (JAITI)
Website : https://ejournal.techcart-press.com/index.php/jaiti
E-ISSN 2985-6396
P-ISSN 2985-5306
Volume 4, Number 2, June 2026
https://doi.org/10.58602/jaiti.v4i2.263
Page 217-235

Web-Based E-Commerce Application for MSME in Manado

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Abstract: Digital transformation has opened new opportunities for Micro, Small, and Medium Enterprises (MSMEs) in Manado City to increase market reach and strengthen business competitiveness through online transactions. However, many local MSMEs still have limited access to independent digital platforms, while existing e-commerce systems do not always provide the flexibility needed to handle both physical products and service-based offerings in a localized context. This study aims to design and implement a web-based MSME marketplace for Manado City using the Waterfall software development method. The system was developed with a decoupled architecture consisting of Next.js as the frontend framework, Strapi Headless CMS for backend management, and PostgreSQL as the database. The main features include seller store registration, product and service catalog management, dynamic product variants, map-based location pinning, Live Commerce, Midtrans payment gateway integration, order tracking, and accessibility support. System evaluation was conducted using Black-Box Testing and User Acceptance Testing (UAT) with a five-point Likert scale involving buyer and seller respondents. The Black-Box Testing results show that all tested features functioned as expected. The UAT results produced an average acceptance rate of 89.88% from buyers and 91.38% from sellers. These results indicate that the proposed marketplace is functional, practical, and well accepted by users, making it a suitable digitalization solution for supporting MSMEs in Manado City.

Keywords: E-commerce; MSME Marketplace; Next.js; Map Integration; Information Systems;

1. INTODUCTION

The development of information and communication technology has significantly changed trade and business practices. Buying and selling activities are no longer limited to direct transactions in physical stores, but have expanded to online platforms that allow transactions to be carried out more quickly, conveniently, and efficiently. This shift encourages business actors to adopt e-commerce as a way to remain competitive and reach broader markets [1].

Micro, Small, and Medium Enterprises (MSMEs) have an important role in supporting regional economic growth, creating employment, and strengthening local business activity. Nevertheless, many MSMEs still face difficulties in using digital platforms effectively. The

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main barriers include limited digital literacy, limited technological resources, and the absence of suitable online selling platforms. Previous data also show that, out of 59.2 million MSMEs, only 3.79 million had used digital platforms to market their products [2]. In Manado City, BPS data recorded 5,102 MSMEs in 2022 [3].

Based on these conditions, this research focuses on the limited availability of a localized digital platform that can help MSMEs in Manado improve product visibility, expand market reach, and manage transactions more efficiently. Without an appropriate digital solution, local MSMEs may find it difficult to compete with business actors who are more adaptive to technological change. Therefore, this study designs and implements a web-based e-commerce platform for MSMEs in Manado City using the Waterfall method.

Several previous studies have examined e-commerce development and interface design for MSMEs. However, the reviewed studies still show several limitations, including a focus on only one commodity group, the absence of service-based transactions, limited geospatial features, limited payment gateway integration, and the lack of a multi-seller marketplace environment [4], [6], [7]. This study addresses these gaps by integrating product and service catalog management, map pinning, Live Commerce, Midtrans payment, and role-based workflows for buyers, sellers, and administrators.

Theoretically, this study is based on the concept of a marketplace as a digital platform that connects multiple sellers and buyers, supports product or service discovery, facilitates transactions, and helps sellers manage business activities online. In the context of MSME digital transformation, a marketplace is not only a sales channel but also a tool that supports business visibility, operational efficiency, and customer accessibility. Therefore, an MSME marketplace should be designed with features that match local user needs and business practices.

The novelty of this research lies in the integrated and localized marketplace design for MSMEs in Manado City. Rather than developing a general e-commerce website, this study combines a multi-seller environment, product and service transactions, map-based fulfillment, Live Commerce, seller-managed payment configuration, and accessibility features in one web-based platform. This combination is expected to provide a more relevant digital solution for local MSMEs and users in Manado.

2. RESEARCH METHODOLOGY

The Waterfall method was used as the system development life cycle framework because the system requirements, user roles, and marketplace workflow could be identified clearly at the early stage of development. This method provides a systematic and sequential process consisting of requirement analysis, design, implementation, testing, and maintenance [5]. The development model applied in this research is shown in Figure 1.

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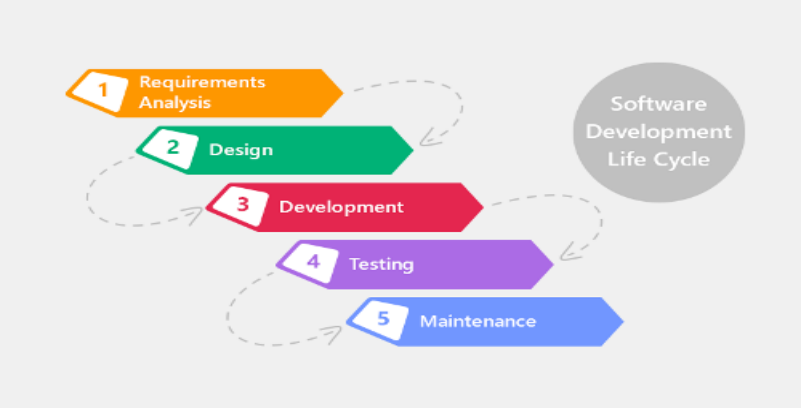

Figure 1. SDLC Waterfall Method

Figure 1 illustrates the sequential stages of the Waterfall model used to guide system development. The complete research procedure is summarized in Figure 2.

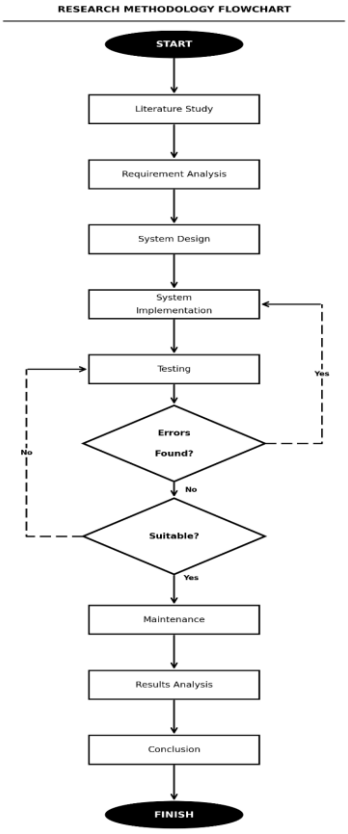

Figure 2. Research Flow

Figure 2 shows that the research began with literature study and requirement analysis, followed by system design, implementation, testing, result analysis, and conclusion.

The business process involving buyers, sellers, and administrators is presented in Figure 3.

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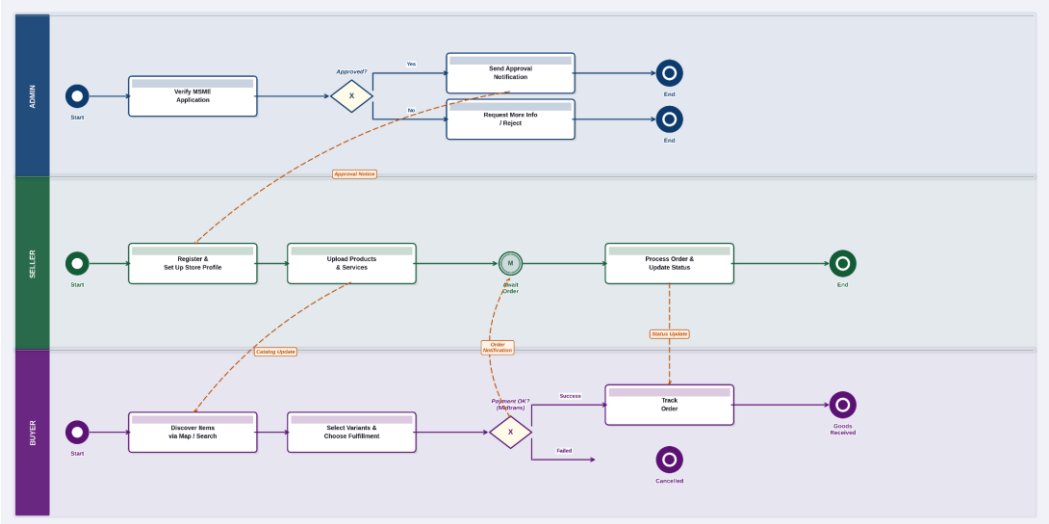

Figure 3. Business Process Model and Notation

Figure 3 describes the flow of seller verification, catalog management, product or service ordering, payment, and order fulfillment in the marketplace.

The application navigation structure is presented in Figure 4.

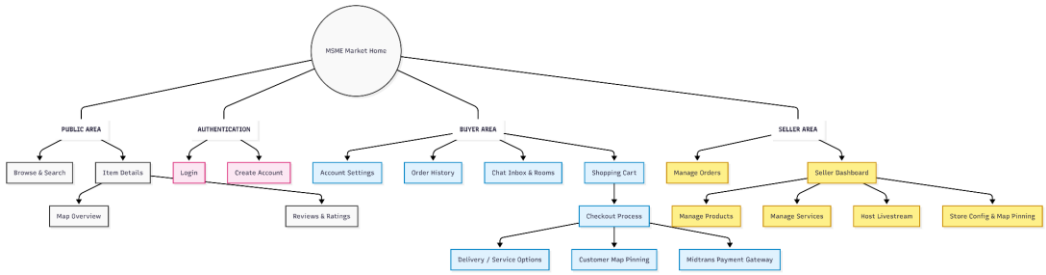

Figure 4. Sitemap

Figure 4 separates the public browsing area, buyer features, seller dashboard, and administrator access, making the overall system flow easier to understand.

The functional scope of each system actor is shown in Figure 5.

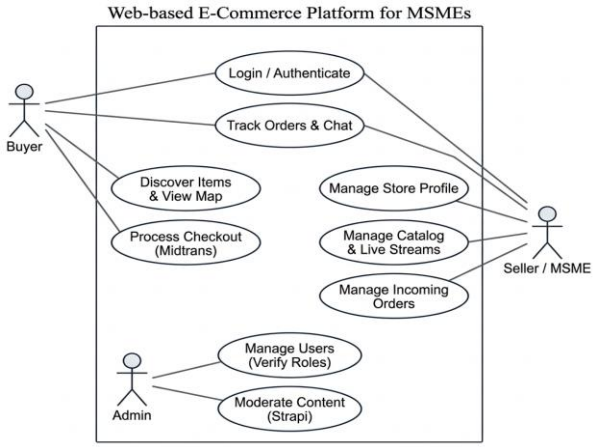

Figure 5. System Component (Use Case Diagram)

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Figure 5 explains the main functions available to buyers, MSME sellers, and administrators based on their roles in the application.

The overall interaction between users and system components is shown in Figure 6.

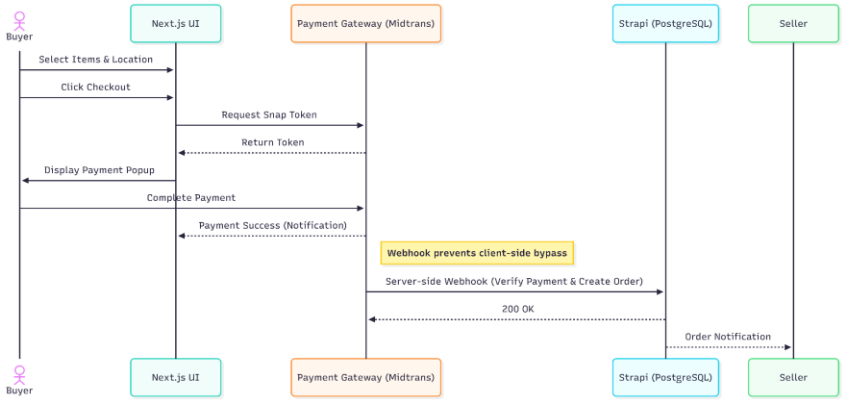

Figure 6. System Flow (Sequence Diagram)

Figure 6 presents the communication flow between the frontend, backend, database, and payment gateway during marketplace operations.

The buyer workflow is shown in Figure 7.

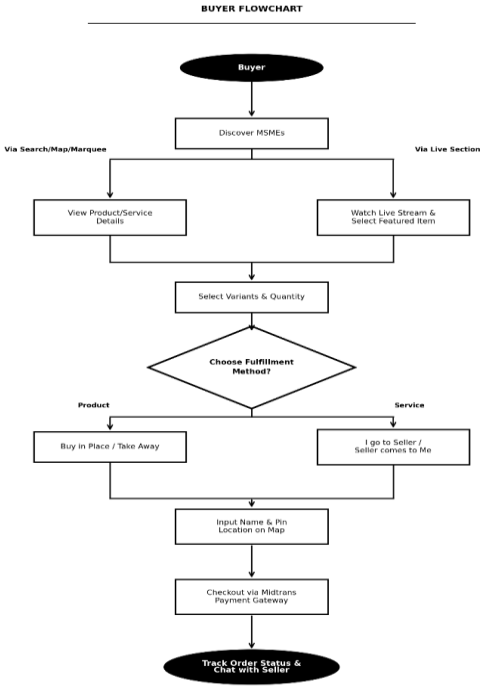

Figure 7. Buyer System Flow

Figure 7 shows how buyers search for items, choose fulfillment options, complete payment, and track their orders.

The seller workflow is shown in Figure 8.

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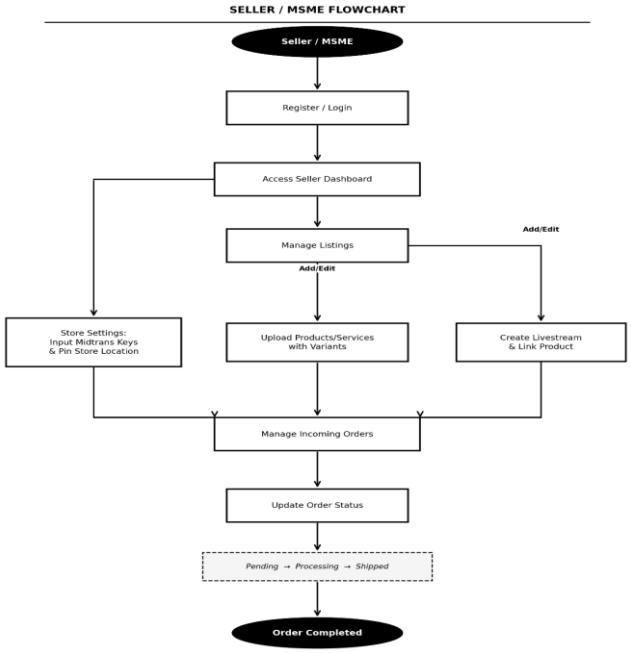

Figure 8. Seller System Flow

Figure 8 shows how sellers register stores, manage products or services, configure payment information, create livestream content, and process orders.

The administrator workflow is shown in Figure 9.

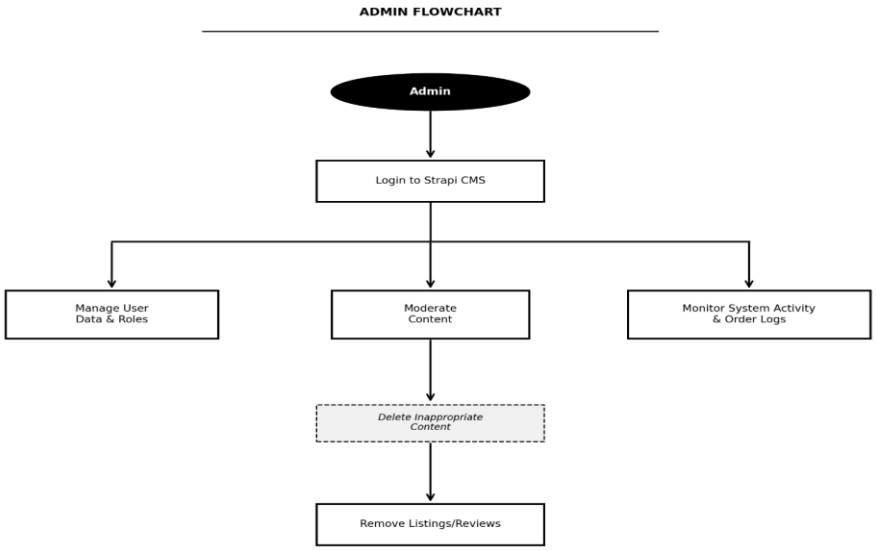

Figure 9. Admin System Flow

Figure 9 explains how the administrator verifies sellers, moderates content, and supervises system activity.

The object-oriented structure of the system is presented in Figure 10.

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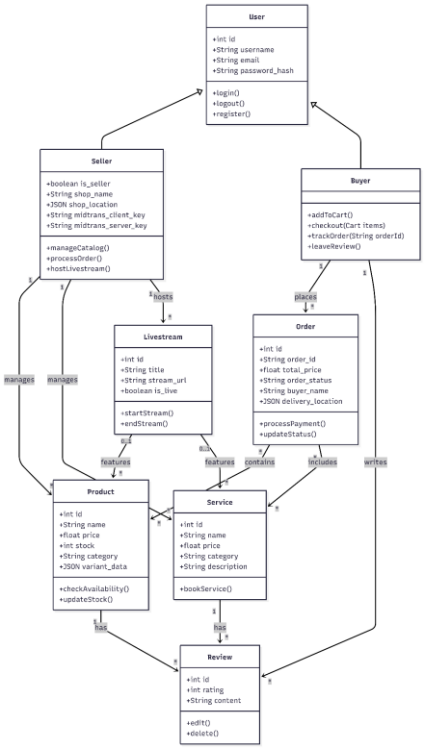

Figure 10. Class Diagram

Figure 10 shows the relationship between users, stores, products, services, variants, livestreams, orders, and payment data.

The database structure is shown in Figure 11.

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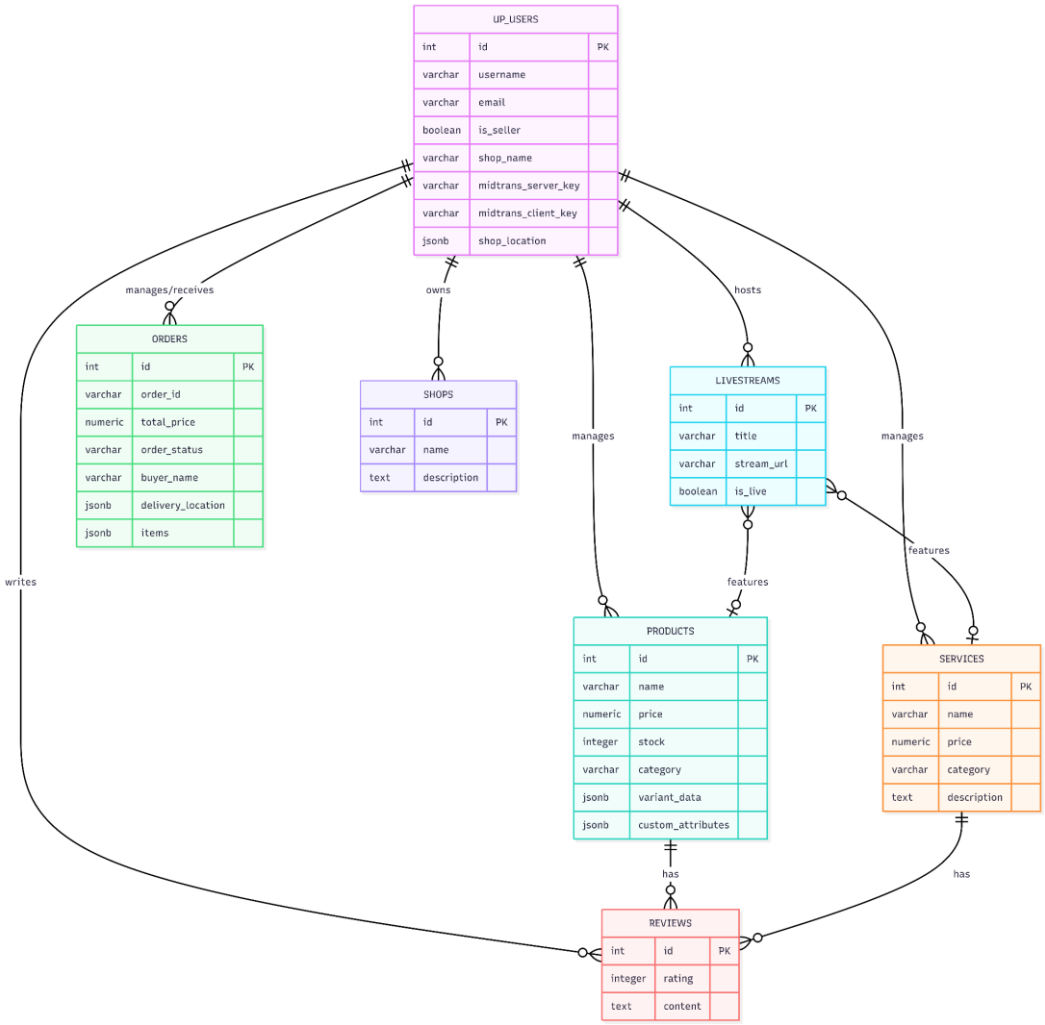

Figure 11. Physical Data Model (PDM)

Figure 11 explains how PostgreSQL tables are connected to support catalog management, transactions, and order tracking.

Table 1. Testing Scenarios

No.	Tested Feature	Action/Input	Expected Output
1	User Authentication	Register or log in using email and password.	System verifies credentials and redirects users by role.
2	Store & Location Setup	Seller inputs store description, Midtrans API keys, and map pin.	Configuration is saved and map pin is displayed publicly.
3	Product & Service Upload	Seller uploads item with variants and images.	Item is stored, variant images are linked, and catalog is displayed.

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4	Cart & Fulfillment	Buyer adds item, selects fulfillment, and pins location when needed.	Total price is calculated and map pin is conditionally required.
5	Payment Gateway	Buyer checks out using mock digital payment.	Midtrans Snap.js appears and an order record is generated.
6	Live Commerce	User opens featured broadcast.	Embedded YouTube video plays and linked product is clickable.
7	Order Pipeline	Seller updates order status.	Database and buyer tracking status are updated.
8	Accessibility Engine	User toggles high contrast, dyslexia-friendly fonts, and text-to-speech.	CSS updates without layout errors and Indonesian text is read accurately.

Black-Box Testing was used to evaluate the application functions without examining the internal code structure. UAT was then conducted as the final validation by intended users. Respondents completed a five-point Likert scale questionnaire consisting of Strongly Agree (5), Agree (4), Neutral (3), Disagree (2), and Strongly Disagree (1). The UAT evaluation covered usability, functionality, interface design, and overall satisfaction.

3. RESULT AND DISCUSSION

3.1 Requirement Analysis and Architecture

The functional requirements allow sellers to register stores independently, manage products and services, create variant types, configure Midtrans payment keys, and process orders. Buyers can search for items, filter categories, view MSME locations on an interactive map, use Live Commerce, choose fulfillment methods, complete payments, and track order status. The non-functional requirements emphasize accessibility, secure payment processing, and responsive interface behavior.

The system was developed using a decoupled architecture to separate the user interface from backend content and data management. Next.js was selected for the frontend because it supports component-based development, responsive interfaces, and efficient page rendering. Strapi Headless CMS was used to manage content and API services, while PostgreSQL was selected to store structured marketplace data. This technology combination supports scalability, easier maintenance, and clearer separation between frontend and backend responsibilities.

3.2 Implementation Results

The implementation produced several major modules. The user interface, product discovery, and mapping module includes a dynamic Infinite Marquee carousel on the homepage and an interactive map using Leaflet.js and the OpenStreetMap API. The StoreMap component retrieves latitude and longitude data from the Strapi backend and displays registered MSME locations as map pins centered on Manado City.

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The main user interface developed in this research is shown in Figure 12.

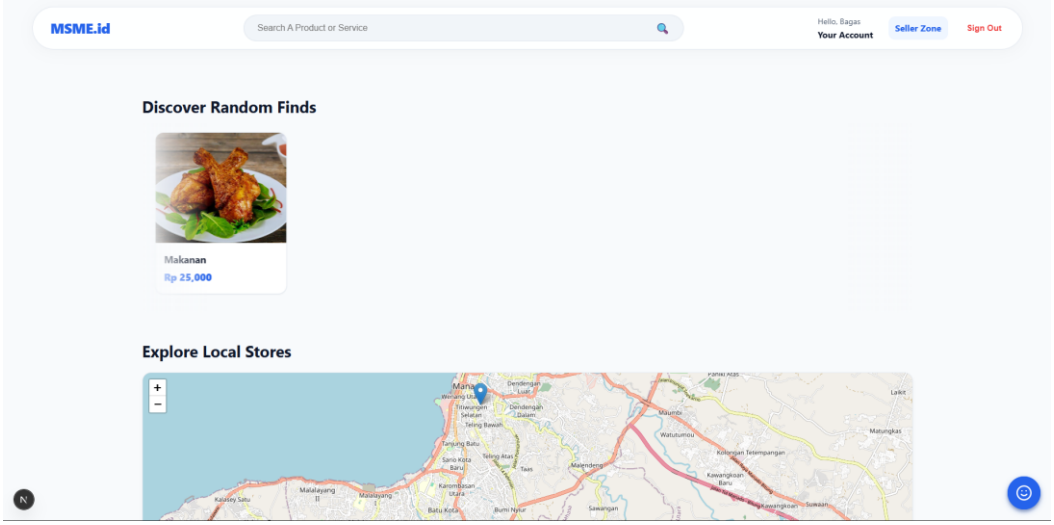

Figure 12. Main Page

Figure 12 displays the homepage used for product discovery, service discovery, and navigation to the main marketplace features.

The location-based feature is shown in Figure 13.

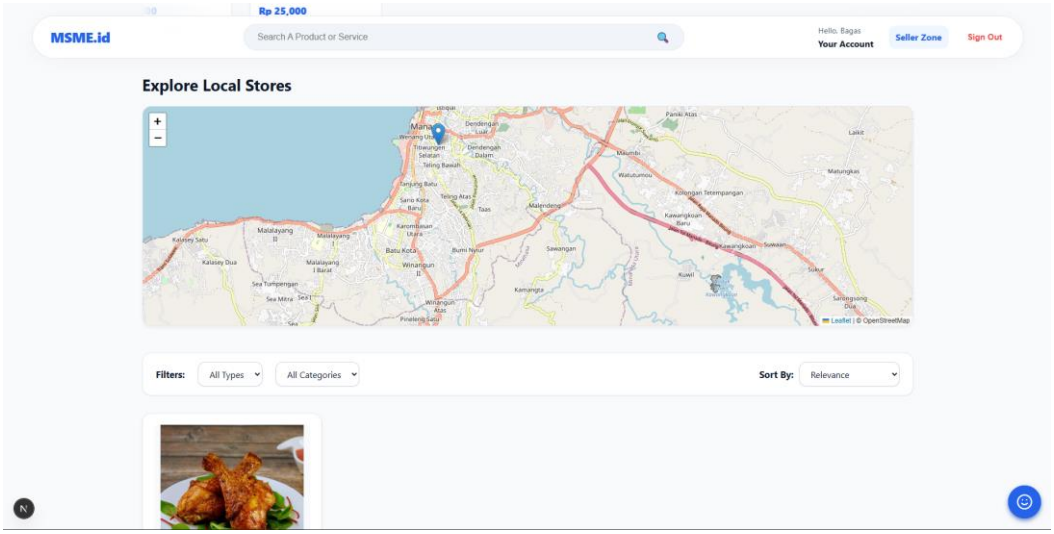

Figure 13. Mapping Module

Figure 13 demonstrates how MSME locations are displayed as map pins to support store discovery and fulfillment decisions.

The Live Commerce module allows sellers to create livestream listings using a YouTube embed URL and a linked product or service document ID. Active streams are displayed in a dedicated video player, and the linked product or service appears below the stream so buyers can continue the purchasing process without leaving the broadcast page.

The Live Commerce feature is shown in Figure 14.

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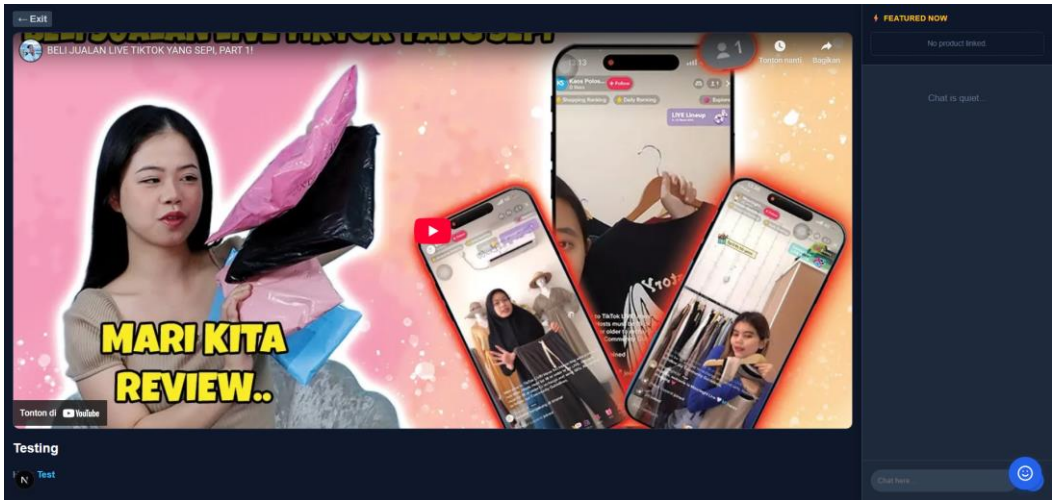

Figure 14. Livestream Menu

Figure 14 displays the livestream page where users can watch embedded video content and access the linked product or service.

The Seller Dashboard enables MSME sellers to configure store and payment details, upload products or services, manage variants, create livestream listings, and update order statuses through a visual order management pipeline. The order status moves from Pending to Processing, Ready to Ship, Shipped, and Completed.

The seller product management page is shown in Figure 15.

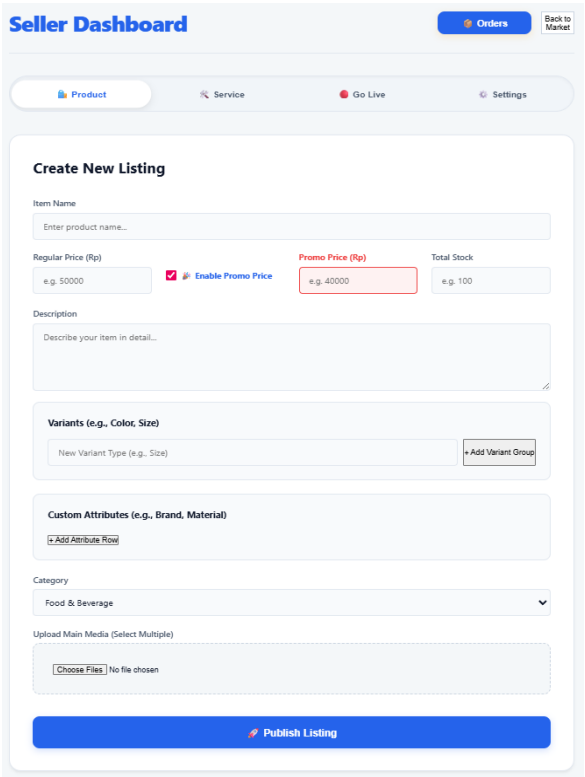

Figure 15. Seller Dashboard (Product Page)

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Figure 15 demonstrates how sellers can add, edit, and manage product data through the dashboard.

The seller livestream management page is shown in Figure 16.

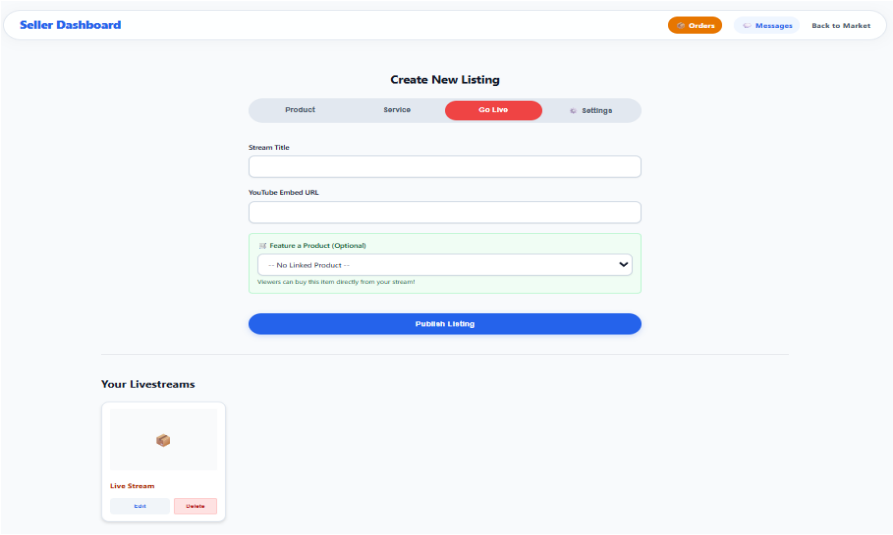

Figure 16. Seller Dashboard (Live Page)

Figure 16 shows how sellers can create and manage Live Commerce content linked to marketplace items.

The store and payment configuration page is shown in Figure 17.

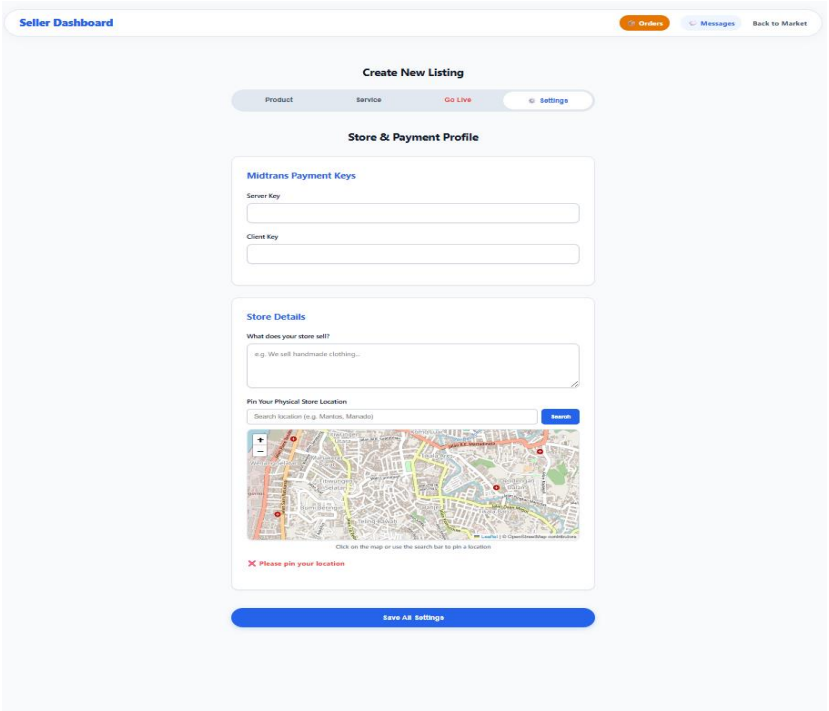

Figure 17. Seller Dashboard (Store & Payment Page)

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Figure 17 shows how sellers manage store identity, location data, and Midtrans payment configuration in one dashboard section.

The seller order management page is shown in Figure 18.

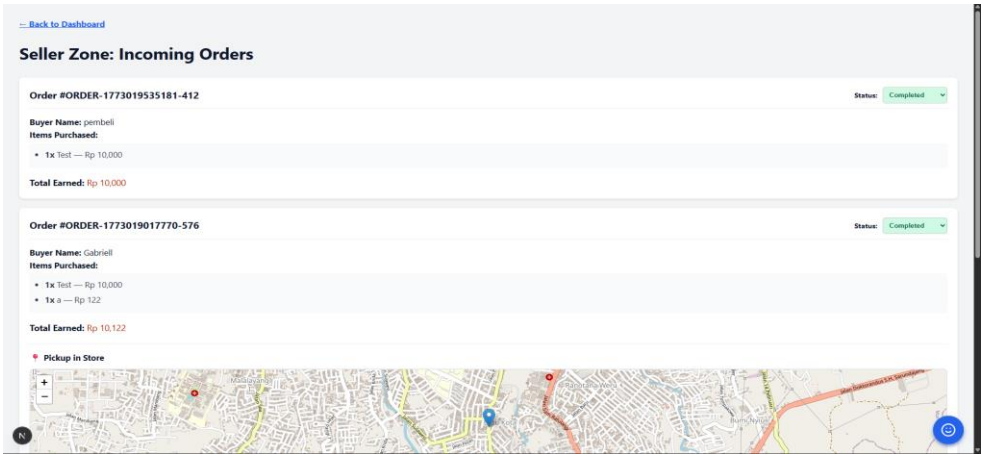

Figure 18. Seller Dashboard (Orders Page)

Figure 18 displays the order pipeline used by sellers to update transaction status and support buyer tracking.

The checkout process was customized based on item type. For products, the system provides Buy in Place and Take Away options. For services, the system provides I go to Seller and Seller comes to Me options. When a location-based fulfillment option is selected, the buyer must place a map pin to record exact coordinates. The Midtrans Snap.js popup is then invoked using the seller client key, and a successful payment creates an order record in Strapi. The payment process is shown in Figure 19.

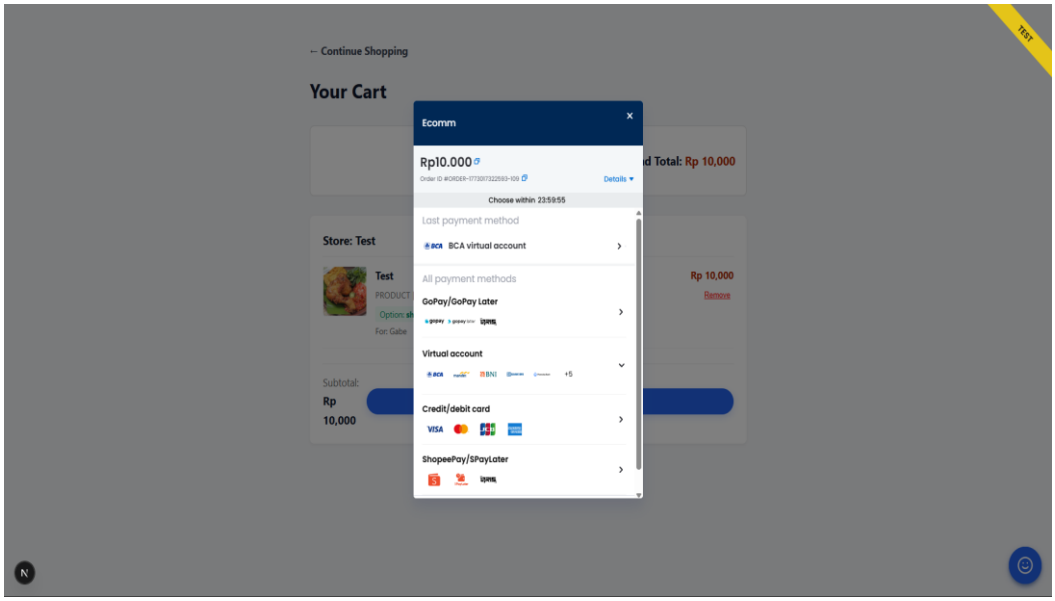

Figure 19. Payment Method

Figure 19 shows the Midtrans payment interface displayed during checkout.

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The successful payment result is shown in Figure 20.

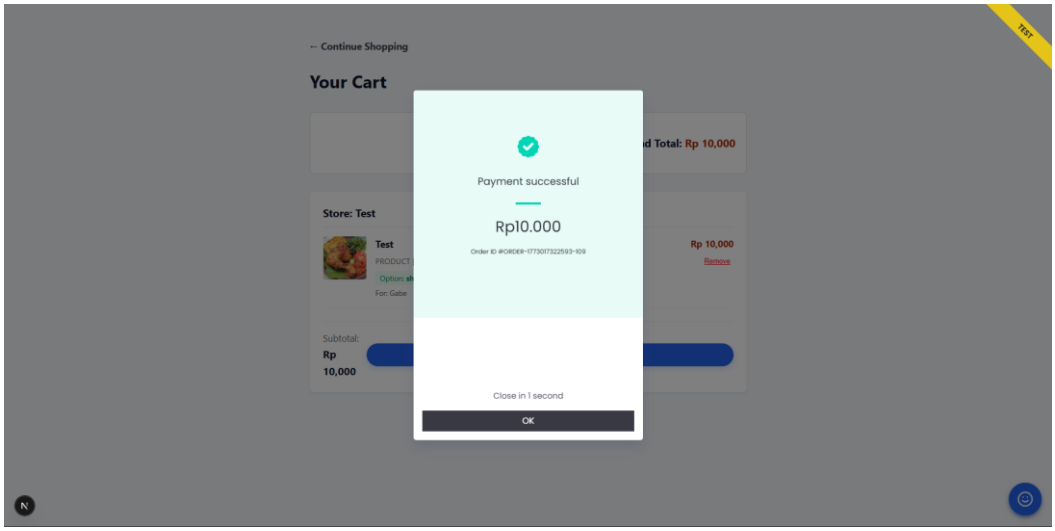

Figure 20. Successful Payment

Figure 20 confirms that a completed payment generates transaction confirmation and order data in the system.

The buyer order tracking feature is shown in Figure 21.

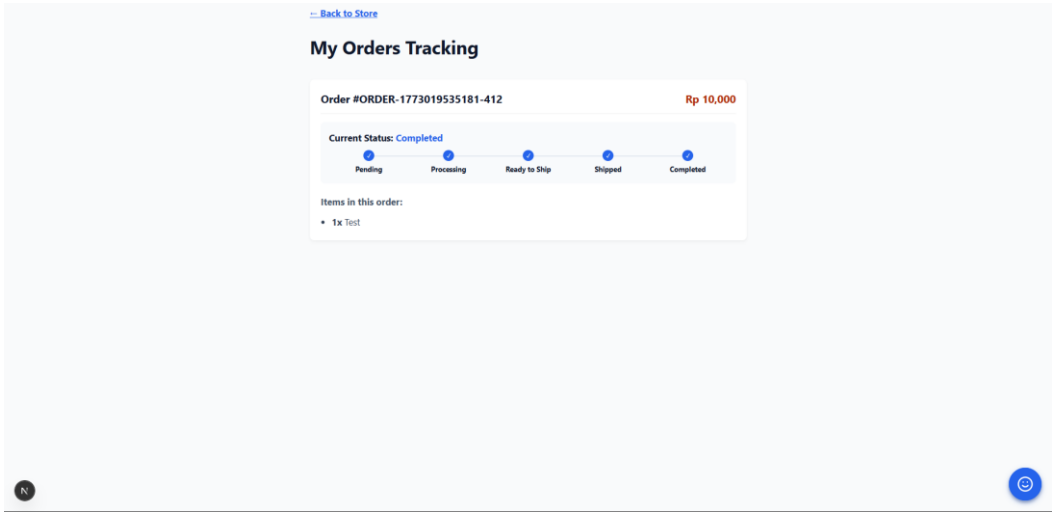

Figure 21. Buyer Orders Tracking

Figure 21 allows buyers to monitor order progress after payment has been completed.

The accessibility engine provides visual adjustment and text-to-speech support. The widget uses browser localStorage to save user preferences and dynamically applies CSS override classes to the HTML body. The text-to-speech feature uses the browser Web Speech API with Indonesian language pronunciation set to id-ID. The accessibility feature is shown in Figure 22.

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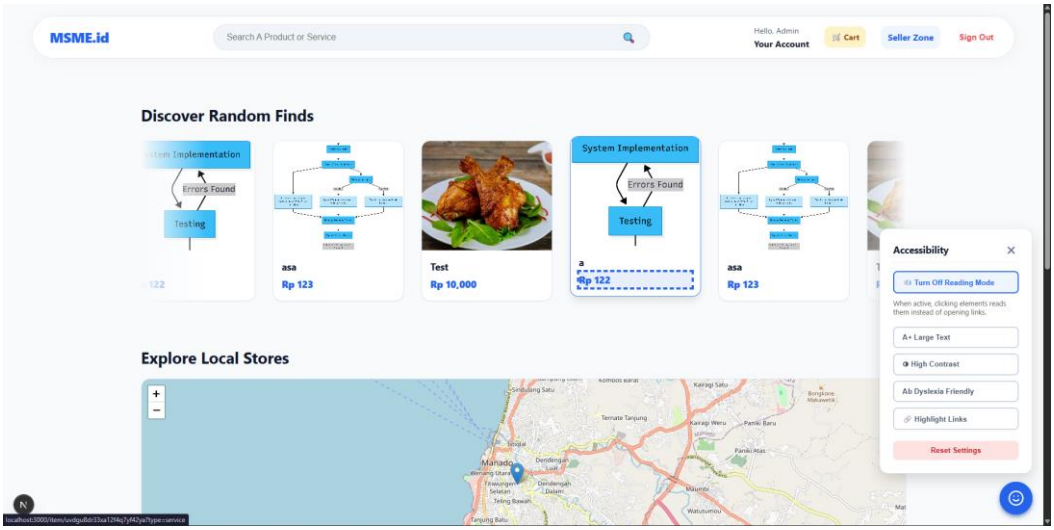

Figure 22. Text-to-Speech

Figure 22 demonstrates the text-to-speech function, which helps users listen to Indonesian page content through the browser.

3.3 Testing Results

Black-Box Testing was conducted on eight main feature scenarios. Each scenario compared the actual system response with the expected output listed in the testing scenario table. A feature was considered valid when the application produced the expected result without functional errors. The tested features included authentication, store and location setup, product and service upload, cart and fulfillment selection, payment gateway integration, Live Commerce, order management, and accessibility support.

Table 2. Black-Box Testing Results

No.	Tested Feature	Status
1	User Authentication	Valid
2	Store & Location Setup	Valid
3	Product & Service Upload	Valid
4	Cart & Fulfillment Selection	Valid
5	Payment Gateway (Midtrans)	Valid
6	Live Commerce Integration	Valid
7	Order Management Pipeline	Valid
8	Accessibility (A11y) Engine	Valid

The UAT results show that the buyer acceptance rate reached 89.88%, while the seller acceptance rate reached 91.38%. The acceptance rate was calculated by comparing the total weighted score with the maximum possible score and converting the result into a percentage. This calculation was used to measure how well the system was accepted by its intended users.

For buyer respondents, the evaluation focused on ease of product or service search, checkout clarity, fulfillment selection, payment smoothness, map accuracy, Live Commerce

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E-ISSN 2985-6396
P-ISSN 2985-5306
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usability, accessibility support, and overall satisfaction. For seller respondents, the evaluation focused on store setup, catalog management, variant management, payment configuration, livestream management, order processing, dashboard usability, and overall satisfaction.

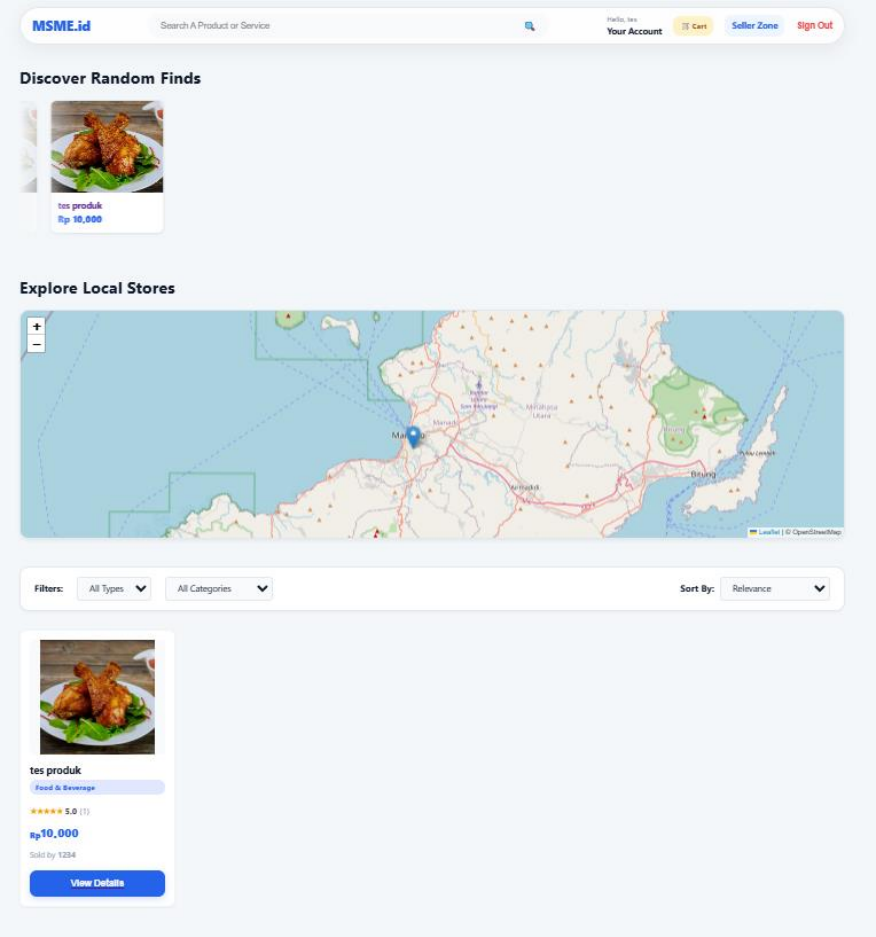
Because both buyer and seller acceptance rates were above 80%, the system can be interpreted as highly accepted by its intended users. These results indicate that the application is usable, functional, and suitable for supporting MSME digital transactions in Manado City.

Table 3. UAT Summary

Respondent Role	Evaluation Dimensions	Average Acceptance Rate
Buyer	Usability, Functionality, Design, Satisfaction	89.88%
Seller	Usability, Functionality, Design, Satisfaction	91.38%

3.4 Supporting Implementation Figures

The following figures are included as supporting implementation evidence. They show the application website, Strapi CMS, source-code context in Visual Studio Code, respondent evidence, and the Midtrans dashboard used during development and testing. Additional implementation evidence is shown in Figure 23.



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Journal of Artificial Intelligence and Technology Information (JAITI)
Website : https://ejournal.techcart-press.com/index.php/jaiti
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P-ISSN 2985-5306
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Figure 23. Main Page Website

Figure 23 presents the final website interface as supporting evidence of the developed application.

The backend content management interface is shown in Figure 24.

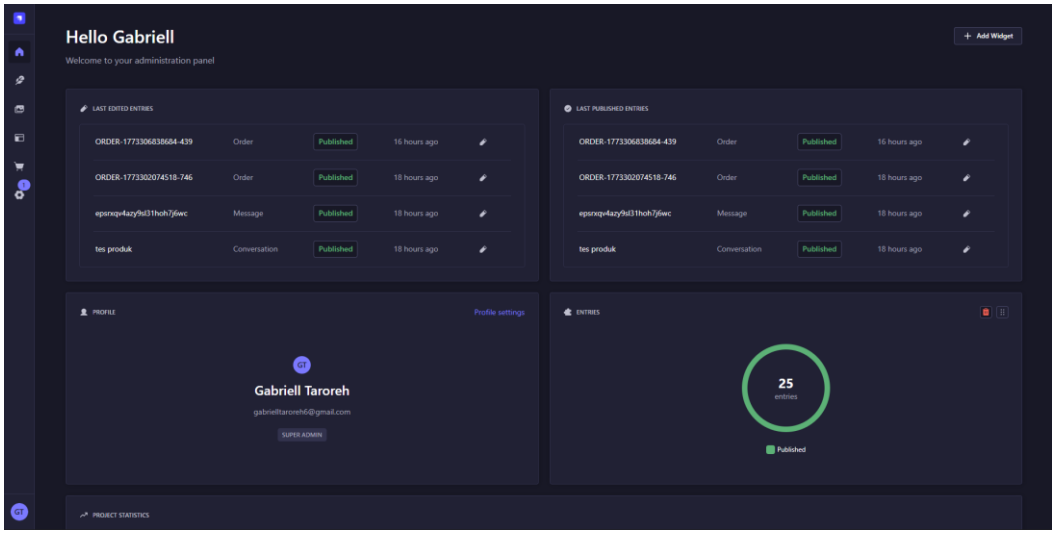

Figure 24. Strapi CMS Main Page

Figure 24 shows the Strapi CMS dashboard used to manage application data and content.

The payment gateway dashboard is shown in Figure 25.

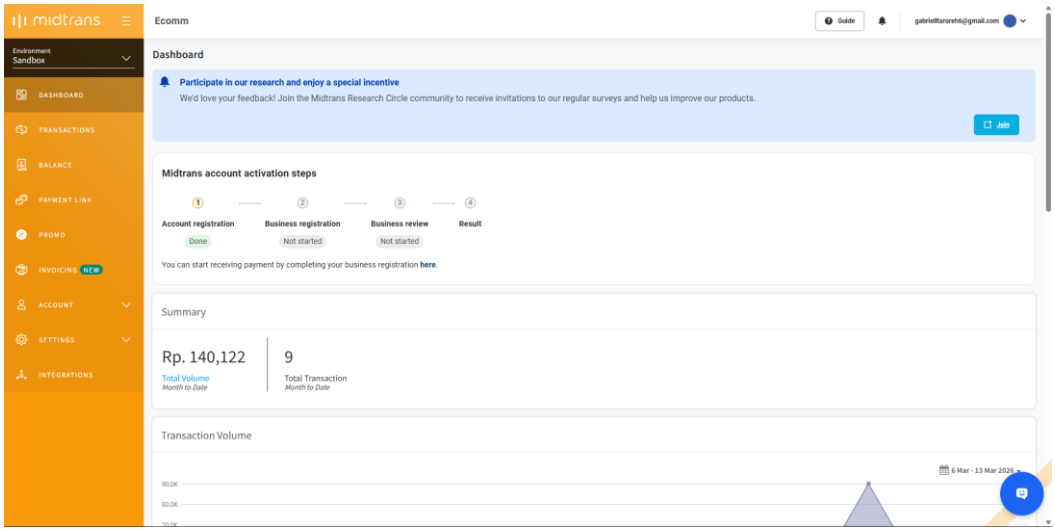

Figure 25. Midtrans Dashboard

Figure 25 shows the Midtrans dashboard used to support payment integration and transaction monitoring.

4. CONCLUSION

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Based on the research, system development, and testing results, a web-based e-commerce application for MSMEs in Manado City was successfully designed and implemented. The system uses Next.js for the frontend, Strapi for the backend, and PostgreSQL for the database. It supports physical products and services through store registration, catalog management, dynamic variants, map pinning, Live Commerce, Midtrans payment, order tracking, and accessibility features.

The results of Black-Box Testing and UAT show that the developed system works according to its functional requirements and is well accepted by both buyers and MSME sellers. The main contribution of this research is the development of a localized marketplace model that integrates multi-seller management, service-based transactions, geospatial support, Live Commerce, payment gateway integration, and accessibility features to support MSME digital transformation in Manado City.

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E-ISSN 2985-6396
P-ISSN 2985-5306
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