

# Design and Development of an E-commerce Application Using the Web Information System Development Methodology

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## Article Info

### Article history:

Received February 4, 2025

Revised February 18, 2025

Accepted April 11, 2025

### Keywords:

e-commerce

WISDM

Web-Based Application

## ABSTRACT

The main objective of this research is to design and build an e-commerce application to enhance the competitiveness of micro, small, and medium enterprises in Sumbertaman, Probolinggo City. In the development process, the Web Information System Development Methodology (WISDM) method was used, which consists of the stages of needs analysis, design, implementation, testing, and evaluation. This research began with data collection through interviews and direct observations of local micro, small, and medium enterprises to understand the specific needs related to the e-commerce system. The research results show that the developed application is capable of meeting the needs of micro, small, and medium enterprises in terms of product management, sales transactions, and real-time data reporting. The implementation of this application is expected to provide convenience for micro, small, and medium enterprises to market their products online, improve operational efficiency, and expand market reach. Thus, this WISDM-based e-commerce application significantly contributes to the digitalization of local businesses in the era of digital transformation.

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## 1. INTRODUCTION

The development of information and communication technology has brought fundamental changes in the way humans interact, work, and conduct business [1]. One tangible manifestation of this change is the emergence of e-commerce, which has now become an inseparable part of the modern business world [2]. E-commerce provides convenience for entrepreneurs to market their products more broadly without being bound by geographical and time constraints. In addition, the use of e-commerce also enables operational efficiency, such as inventory management, transaction processing, and automated report generation. Therefore, e-commerce becomes a strategic opportunity, especially for micro, small, and medium enterprises, to remain competitive amidst global market competition [3].

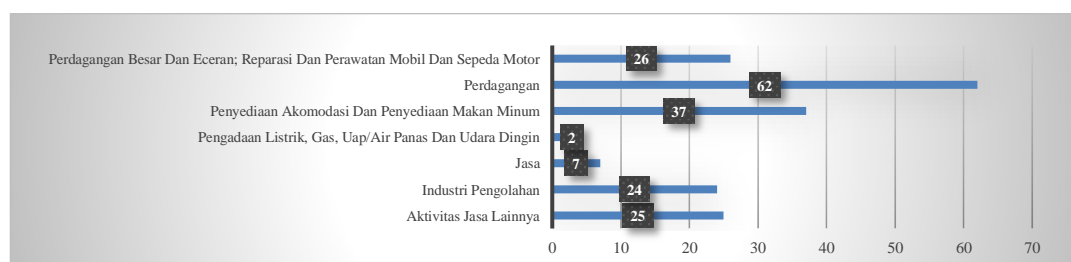


Figure 1. Data on Micro, Small, and Medium Enterprises in Sumbertaman Village, Probolinggo City

Based on the image above, there are 220 micro, small, and medium enterprises in Sumbertaman Village recorded by the Cooperatives, Micro Enterprises, Trade, and Industry Office of Probolinggo City. According to this data, most micro, small, and medium enterprises have not fully utilized digital technology to support their business operations [4]. Factors such as limited human resources, lack of technological understanding, and cost constraints are the main challenges faced by micro, small, and medium enterprises in Sumbertaman, Probolinggo City. This region has significant economic potential with various local flagship products, yet product marketing is still done conventionally. Dependence on traditional methods limits the ability to reach a broader market, thereby preventing the optimal utilization of the growth potential of Micro, Small, and Medium Enterprises [5].

As a solution, an e-commerce application specifically designed to meet the needs of micro, small, and medium enterprises in Sumbertaman is required. The design and development process of this application uses the Web Information System Development Methodology (WISDM). The Web Information System Development Methodology (WISDM) has several advantages compared to other methods in the development of web-based information systems. WISDM is specifically designed for the development of web-based information systems, unlike conventional methods such as Waterfall or RAD, which are more commonly used for various types of systems. The component-based approach in WISDM allows for the reuse of previously developed components, thereby accelerating the development process and increasing efficiency. In addition, WISDM has a more specific structure in addressing web system needs, including user requirement analysis, interactive interface design, and implementation based on more flexible web technology. This method is also more adaptive to changes because it focuses on user needs and the ease of integration with various platforms. With these advantages, WISDM becomes a more effective choice in the development of complex and dynamic web-based information systems. [6].

The application designed in this research will have key features such as a product catalog, inventory management, transaction processing, digital payments, and integrated sales reporting [7]. In addition, this application will also be designed with a simple and user-friendly interface, making it easy to adopt quickly by micro, small, and medium enterprises that may have limitations in technological understanding.

The development of this application aims not only to solve the marketing problems faced by micro, small, and medium enterprises but also to build a digital ecosystem that supports their sustainable growth. With this application, micro, small, and medium enterprises are expected to improve operational efficiency, expand market reach, and adapt to the increasingly competitive market dynamics [8].

Through this research, not only is a practical technological solution produced, but also strategic insights regarding the importance of technology adoption in supporting the sustainability of micro, small, and medium enterprises. The implementation of this application is expected to serve as a model that can be replicated in other regions, thereby contributing to the digital transformation of the micro, small, and medium enterprises sector in Indonesia as a whole. This research also serves as an initial step to reduce the technology gap among small business actors, create opportunities for local economic growth, and realize resilient micro, small, and medium enterprises in the digital era [9].

## 2. METHOD

The research method used in this study is the development research method [10]. The advantage of this method lies in its ability to produce products or models that can be directly applied and used in practical contexts. This research focuses on developing solutions for existing problems, such as new devices, methods, or processes that can enhance effectiveness and efficiency. In addition, development research also allows researchers to test and evaluate the developed products or models in real conditions, providing useful feedback for further improvements. This research aims to design and build a web-based e-commerce application for micro, small, and medium enterprises in Sumbertaman, Probolinggo City, using the Web Information System Development Methodology (WISDM) [11]. This research method consists of several in-depth and structured stages, which include analysis, design, implementation, testing, and evaluation.

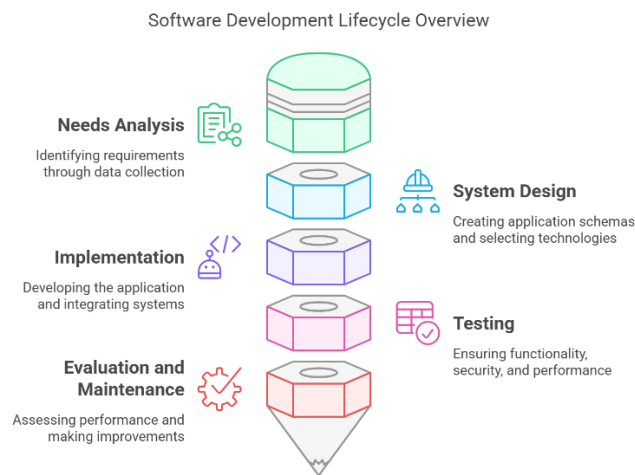


Figure 2. E-commerce Application Development Flow

## 2.1. Research Approach

This research uses a qualitative and quantitative approach. The qualitative approach is used to explore user needs, business processes, and the challenges faced by micro, small, and medium enterprises in running their businesses [12]. The quantitative approach is used to measure the effectiveness of the developed application in improving the performance of micro, small, and medium enterprises, particularly in terms of sales, inventory management, and interaction with buyers [13].

## 2.2. Research Stages

This research consists of five main stages [14] :

### 2.2.1. Needs Analysis:

At this stage, data collection is carried out through interviews with the owners of micro, small, and medium enterprises, direct observation of the operations of micro, small, and medium enterprises, and surveys of buyers and staff involved in the business. The data obtained will be used to identify the functional and non-functional requirements of the application to be built.

### 2.2.2. System Design:

Based on the results of the needs analysis, the system design phase involves creating application schemas, designing user interfaces, and backend design that includes databases and system architecture. At this stage, the technologies to be used (for example, PHP for the backend, MySQL for the database, and HTML/CSS/JavaScript for the frontend) will be selected.

### 2.2.3. Implementation:

At this stage, application development is carried out based on the approved design. This process involves coding, system integration, and the implementation of the application's main functionalities, such as product management, transaction processing, and user account management.

### 2.2.4. Testing:

After the application is completed, the testing phase is conducted to ensure that the system functions properly. Testing includes functionality testing (ensuring each feature works as intended), security testing (ensuring user data and transactions are secure), and performance testing (ensuring the application runs well even under high user load).

### 2.2.5. Evaluation and Maintenance:

After the application is implemented, the evaluation stage is conducted to assess the application's performance, identify areas that need improvement, and obtain feedback from users. Maintenance is carried out periodically to ensure the application remains relevant and functions well over time.

### 2.3. Data Collection Techniques

Data collection was carried out using the following methods:

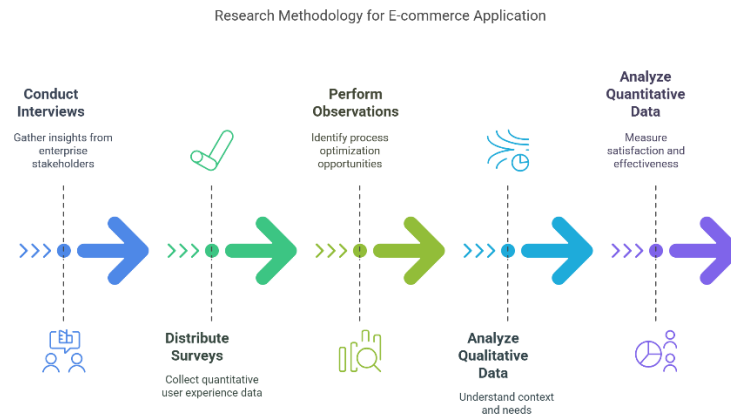


Figure 3. Data Collection Techniques

#### 2.3.1. Interview

In-depth interviews with micro, small, and medium enterprise owners, employees, and buyers to understand system needs and challenges faced.

#### 2.3.2. Survey

The use of questionnaires to obtain quantitative data related to user experiences with the existing system and expectations for the developed e-commerce application.

#### 2.3.3. Observation

Direct observation of the business processes occurring in micro, small, and medium enterprises to identify areas that can be optimized with the use of web-based applications.

#### 2.3.4. Data Analysis

The collected data will be analyzed qualitatively and quantitatively. Qualitative data from interviews and observations will be analyzed using descriptive methods to understand the context, needs, and existing issues. Quantitative data from surveys will be analyzed using descriptive statistical techniques to measure user satisfaction levels and application effectiveness.

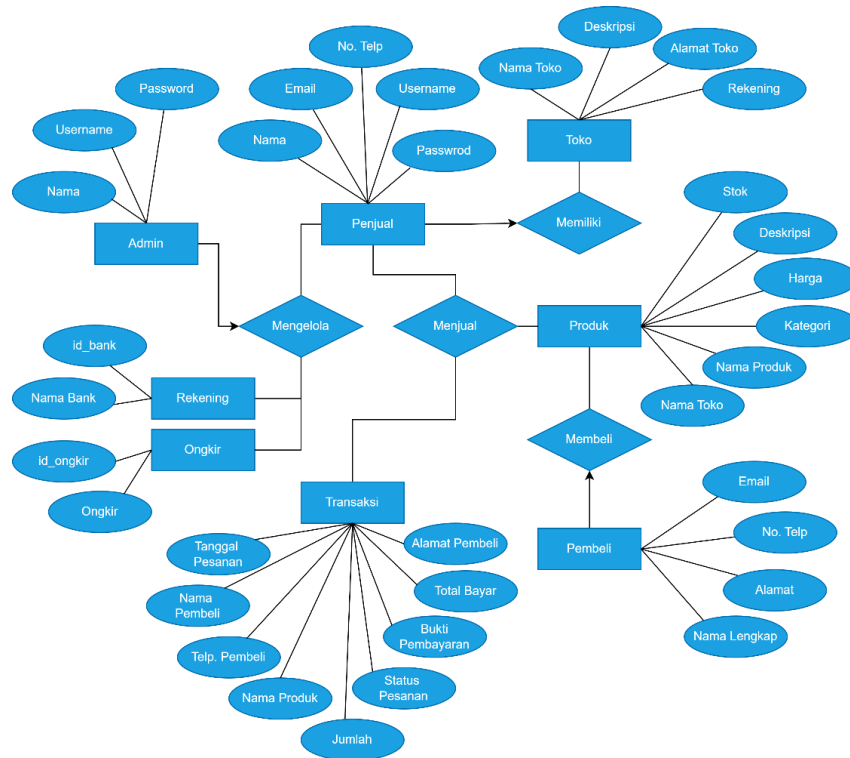
### 2.4. Expected Results

This research is expected to produce a web-based e-commerce application that meets the needs of micro, small, and medium enterprises in Sumbertaman, Probolinggo City, and can improve business operational effectiveness and efficiency, expand market reach, and provide a better shopping experience for buyers. In addition, this research also aims to provide recommendations for the development of e-commerce applications that can be applied to other micro, small, and medium enterprises.

## 3. RESULTS AND DISCUSSION

### 3.1. Design Entity Relationship Diagram

From the data collection instruments, data is then obtained and subsequently normalized into a database in the form of interrelated tables. These related tables are arranged in the form of an Entity Relationship Diagram [15]. The entity relationship diagram in this research includes the following:

Figure 4. Entity Relationship Diagram *E-commerce*

### 3.2. Access Rights Level

This e-commerce application has 3 levels of access rights, including:

#### 3.2.1. Admin Level

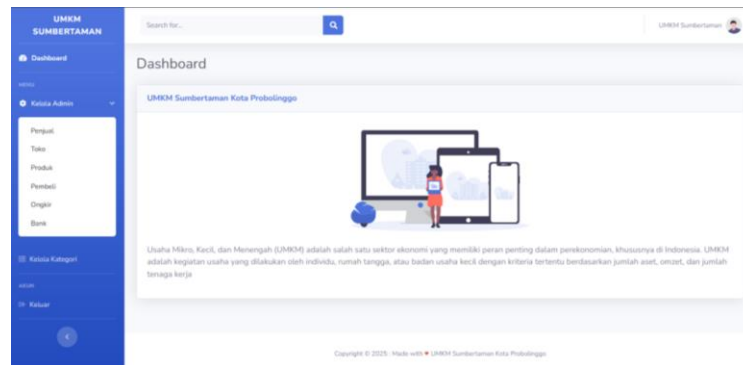


Figure 5 Admin Level Dashboard View

The first level in this application is the admin level, which is the highest level. If you log in with this level, you can access all the features available in the application, including seller data, stores, buyers, products, stock, accounts, and various other features.

### 3.2.2. Seller Level

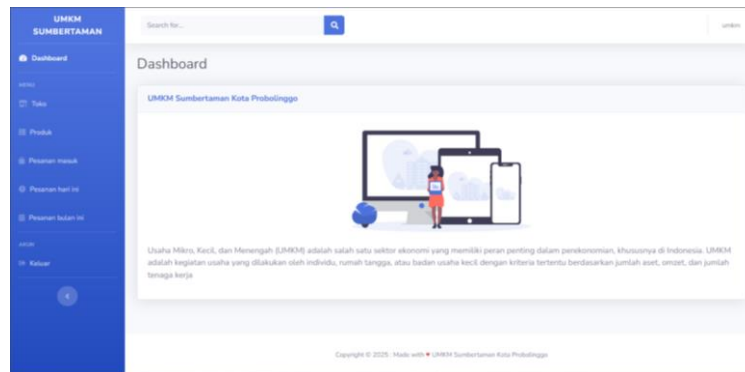


Figure 6 Seller Level Dashboard View

The next level is the seller level; at this level, sellers can add store data and products and view incoming orders. Sellers also have the right to check the transaction status, which includes unpaid, paid, shipped, canceled, and completed.

### 3.2.3. Buyer Level

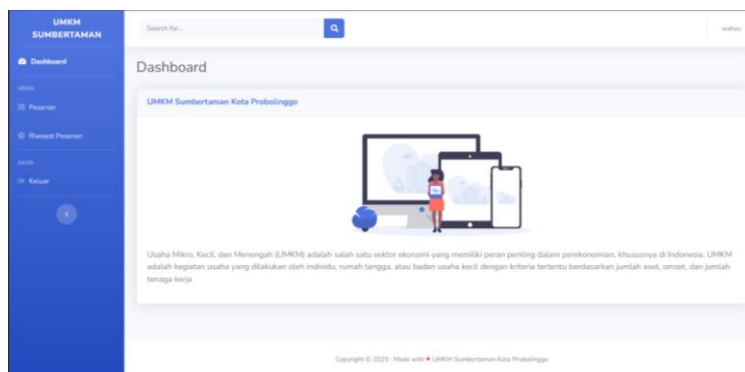


Figure 7. Buyer Level Dashboard View

The final level is the buyer level, where buyers can make transactions for the desired products. Additionally, buyers can also view the purchase status and their previous purchase history.

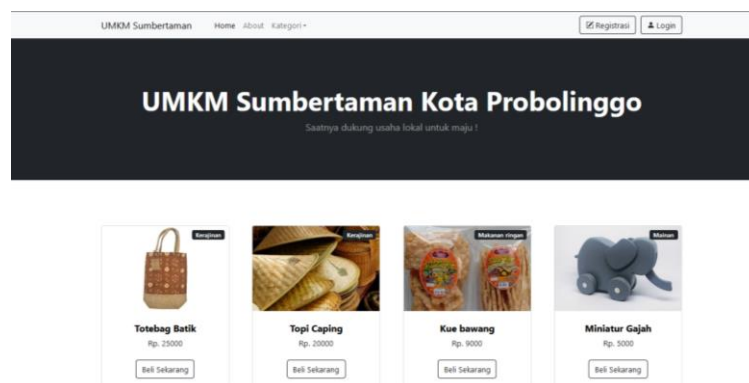


Figure 8. Front view of e-commerce page

On the front page of the e-commerce application, products sold by several sellers in the micro, small, and medium enterprises of Sumbertaman, Probolinggo City, are displayed.

### 3.3. System Test Results

System testing is conducted using the black box testing method. Testing using the black box testing method is conducted with the aim of ensuring that all system functionalities align with user requirements. The testing is focused on the function of each menu available in the system. Here are the results of the system testing using the black box testing method:

Table 1. Testing on admin

Test description	Expected results	Test Results
Login to e-commerce application	Can enter the application with username and password	Successful
Press seller menu	Displays data of all sellers in UMKM Sumbertaman, Probolinggo City	Successful
Press shop menu	Displays all store data from each seller	Successful
Press product menu	Displays all product data from sellers	Successful
Press buyer menu	Displays all buyer data in UMKM	Successful
Press shipping menu	Displays and makes arrangements for shipping costs	Successful
Press bank menu	Displays and creates bank names for the purchasing process	Successful

Based on the testing results on the admin, it can be stated that all the functions tested in the e-commerce application have functioned well according to the predicted outcomes. The testing comprises application login, display of seller data, stores, products, and buyers, as well as the creation of shipping prices and banks for the purchasing process. All tests showed a "successful" status, indicating that the system has been running according to the expected parameters.

Table 2. Testing on sellers

Test description	Expected results	Test Results
Login to e-commerce application	Can log in to the application with username and password	Successful
Press the store menu	Display store data	Successful
Press the product menu	Display product data	Successful
Press the order menu	Display incoming order data from buyers	Successful

Based on the test results on the sellers, it can be stated that all the functions tested in the e-commerce application have functioned successfully as planned. The testing involves application login, display of store data, products, and receiving orders from buyers. All tests showed a "successful" status, indicating that the system has been running according to the expected parameters.

Table 3. Testing on buyers

Test description	Expected results	Test Results
Login to e-commerce application	Can log in to the application with username and password	Success
Press order menu	Displays order data that is still in process	Success
Press order history menu	Displays all order data that has been completed	Success

Based on the results of testing on purchasers, it can be stated that all the functions tested in the e-commerce application have functioned successfully as planned. The testing involves application login, order data display, and presenting all finished order data. All tests showed a status of "Successful," indicating that the system has been running according to the expected requirements.

Based on the results of testing that has been carried out on the functions in the system, it was found that the entire system successfully ran 100% as expected.

## 4. CONCLUSION

This research successfully designed and developed a web-based e-commerce application using the Web Information System Development Methodology (WISDM) method with a case study on Micro, Small, and Medium Enterprises in Sumbertaman, Probolinggo City. The resulting application is specifically designed to



meet the needs of micro, small, and medium enterprises in marketing products, managing inventory, and serving customer transactions digitally.

Through the implementation of the application, micro, small, and medium enterprises can improve operational efficiency and market access so that they are able to compete in the digital era. The features developed, such as product management, payment system integration, and sales reports, have been proven to support the digital transformation of micro, small, and medium enterprises practically and at low cost. Application testing shows a high level of user satisfaction, indicating that this application is in accordance with the needs and preferences of micro, small, and medium enterprises.

Thus, this research offers innovative and adaptive solutions to answer the challenges of the digitalization of micro, small, and medium enterprises while providing significant contributions in supporting the growth of the creative economy through information technology. The adoption of this application is expected to be a model that can be applied widely to support the development of micro, small, and medium enterprises in Indonesia.

### ACKNOWLEDGEMENTS

The author extends sincere gratitude to all individuals and entities that contributed to the development of this publication. Profound gratitude is expressed to the micro, small, and medium enterprises of Sumbertaman Village, Probolinggo City, for the resources and opportunity afforded in this research.

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