



Development of an E-Commerce Platform for Jembrana Weaving Products Using Augmented Reality Technology

Ni Made Yeni Dwi Rahayu^{1,*}, Putu Agus Murtono¹, and Ni Putu Dewi Eka Yanti¹

¹ Tourism Department, Politeknik Negeri Bali, Bali, Indonesia
yenirahayu@pnb.ac.id

Abstract. The digital transformation of traditional handicraft marketing requires innovative technologies that can provide consumers with a more interactive and realistic online shopping experience. This study aims to develop an Augmented Reality (AR)-based e-commerce platform for Jembrana woven fabrics to support digital marketing and cultural heritage preservation. The system was developed using the prototype method, consisting of requirements analysis, prototype design, development, user evaluation, refinement, and final testing. PHP and MySQL were used for server-side processing and database management, while Three.js and AR.js were implemented to provide interactive 3D product visualization and WebAR functionality. The platform was evaluated by 20 respondents consisting of Jembrana weaving artisans and prospective consumers using a five-point Likert scale. The results showed an overall mean score of 4.16 out of 5.00, with browser accessibility and modern and innovative branding achieving the highest scores of 4.30, followed by product information (4.20), 3D product visualization (4.00), and AR responsiveness (4.00). These findings indicate that the developed platform provides an accessible, interactive, and informative environment for presenting Jembrana woven fabric products. The study demonstrates the potential of integrating e-commerce, WebAR-based 3D visualization, and cultural product information to enhance the digital promotion of traditional textiles while supporting the preservation of Jembrana woven cultural heritage.

Keywords: Augmented Reality, E-commerce, Jembrana Weaving

1 Introduction

Indonesia has a wide variety of traditional textiles, each representing the unique cultural identity of its respective region (Rosady et al., 2024). One of the traditional textiles found in Bali is Jembrana woven fabric, which originates from Jembrana Regency. Woven fabric is a traditional textile produced using hand-weaving techniques and is widely recognized as part of Indonesia's cultural textile heritage due to its significant cultural value (Rahmat, 2022). Indonesian traditional woven fabrics, particularly those produced in Bali, possess profound cultural significance, serving ritual purposes, symbolizing social status and cultural identity, and providing a source of income for local artisans and communities (Adiyanti, 2024). However, artisans continue to face considerable challenges in marketing their products amid the rapid advancement of digital technology. Therefore, preserving woven fabrics as traditional handicrafts

should be accompanied by modern marketing strategies to expand their market reach and enhance their competitiveness (Idin et al., 2023). Based on the weaving equipment used during the production process, Jembrana woven fabrics are classified into two main types: Jembrana songket and Jembrana endek. The uniqueness of Jembrana woven fabrics lies in their production process, which still relies on traditional handlooms, as well as the use of locally sourced natural dyes, resulting in environmentally friendly textile products (Suta Negara & Wardana, 2021).

In the current era of rapid technological advancement and internet development, consumer shopping behavior has shifted from physical stores to digital marketplaces through e-commerce platforms (Arif et al., 2024). The emergence of e-commerce has simplified online buying and selling processes by providing broader market access without geographical limitations, thereby enhancing business competitiveness (Mukhlis et al., 2023). However, traditional handicraft products such as woven fabrics are at risk of falling behind in an increasingly competitive market if they continue to rely solely on conventional marketing methods and local markets. Although e-commerce offers significant opportunities to expand market reach, traditional products such as woven fabrics still face limitations in delivering an authentic product experience to consumers (Sani et al., 2019). Consumers are generally limited to viewing product images and reading descriptions, making it difficult to accurately evaluate the product's size, texture, color, and overall suitability (Iqbal Nafi, 2022). This limitation may reduce consumer trust, weaken purchase intentions, and increase the likelihood of product returns. Traditional textile products such as Jembrana woven fabrics, whose market value heavily depends on the intricate details of their motifs, colors, and textures, face particular challenges in digital marketing. Therefore, a technology capable of bridging the gap between online and offline shopping experiences is needed.

Several previous studies have demonstrated that the adoption of digital technologies can enhance the competitiveness of traditional handicraft products. Research on the digitalization of Micro, Small, and Medium Enterprises (MSMEs) through e-commerce platforms has shown that digital marketing can expand market reach, increase product visibility, and create greater sales opportunities for local artisans (Wahyuni et al., 2024). Furthermore, numerous studies on the implementation of Augmented Reality (AR) in e-commerce have found that interactive product visualization significantly improves the user experience, perceived product quality, consumer trust, and purchase intention (Khaldy et al., 2023). Other studies have also reported that the application of AR in the fashion industry enables consumers to perform 3D product visualization experiences, thereby facilitating more informed purchasing decisions (Kovács & Keresztes, 2024). Beyond commercial applications, AR technology has also been widely adopted as a tool for cultural heritage preservation, including the visualization of historical artifacts, virtual museums, batik, and various forms of regional cultural heritage. These studies have demonstrated that AR can effectively increase public interest and engagement in learning about local culture through interactive digital media (Hakim & Nurjanah, 2020).

Nevertheless, most existing studies have primarily focused on e-commerce implementation in general, the application of Augmented Reality (AR) in modern fashion products, or the use of AR as a medium for cultural heritage education (Hakim & Nurjanah, 2020; Khaldy et al., 2023). To the best of the authors' knowledge, no previous study has specifically integrated an e-commerce platform with Augmented

Reality technology for the marketing of traditional woven fabrics, particularly Jembrana woven fabrics. This represents a significant research gap, considering that woven fabrics possess distinctive visual characteristics that rely heavily on intricate motifs, colors, textures, and the way the fabric is worn or displayed (Rizki et al., 2021). These characteristics cannot be effectively communicated through conventional two-dimensional product images alone. Therefore, there is a need to develop a digital marketing platform that integrates e-commerce functionality with Augmented Reality technology to provide a more realistic, interactive, and immersive product visualization experience for consumers while simultaneously promoting the cultural value of Jembrana woven fabrics.

Augmented Reality (AR) enables consumers to experience online shopping in a way that closely resembles in-store shopping (Safitri & Ayu, 2025). Through AR technology, products can be visualized in three-dimensional (3D) form or virtually tried on, allowing consumers to obtain a more accurate perception of a product's size, motifs, appearance, and overall characteristics before making a purchase (Gian Maharta Putra & Tri Anindia Putra, 2025). Several studies have reported that integrating Augmented Reality into e-commerce platforms enhances users' perceived usefulness of the system, fosters positive attitudes toward the platform, improves user satisfaction, and ultimately increases consumers' purchase intention (Lysander & Setiawan, 2022). For traditional textile products, the integration of AR into e-commerce provides an innovative approach to presenting fabric motifs, colors, textures, and usage in a more realistic and immersive manner (Nandhini et al., 2022). Consequently, such a platform not only enables Jembrana weaving artisans to market their products more effectively at the local and national levels but also creates opportunities to expand their market reach to the international level.

In addition to enhancing digital marketing, Augmented Reality (AR) technology has significant potential to strengthen the image of local cultural products while supporting the preservation of cultural heritage through engaging, interactive, and educational digital media. Beyond serving as a tool for product visualization, AR can also function as a medium for communicating the history, philosophy, symbolic meanings of motifs, production processes, and cultural values embedded in each piece of Jembrana woven fabric. Consequently, consumers not only receive detailed product information before making a purchase but also gain a deeper understanding of the cultural richness associated with the textile. By delivering cultural content through an interactive digital experience, AR is expected to increase public appreciation of local cultural heritage, particularly among younger generations who are more familiar with digital technologies. As a result, cultural preservation can be effectively integrated with technological advancement, ensuring that traditional heritage remains relevant and accessible in the digital era.

The main contribution of this study lies in the contextual integration of web-based Augmented Reality and e-commerce for the digital representation and marketing of Jembrana woven fabrics. Unlike conventional e-commerce platforms that primarily rely on two-dimensional images, the proposed platform combines online transaction functions, interactive 3D product visualization, and cultural product information within a single web-based environment. Although the study does not propose a new AR algorithm, it provides an applied framework demonstrating how WebAR can be utilized

to address the visualization limitations of traditional textile products while simultaneously supporting digital marketing and cultural heritage preservation.

2 Methodology

The prototype method was employed in this study as the development approach for an Augmented Reality (AR)-based e-commerce platform for Jembrana woven fabric products. This method was selected because it provides a high degree of flexibility throughout the system design and development process, enabling an initial version of the platform to be developed as a prototype and evaluated directly by prospective users, including both artisans and consumers. Through this approach, user feedback can be collected at an early stage of development, allowing improvements to the platform's features, user interface, and overall functionality to be implemented iteratively and systematically (Mukhamad Fatkhur Roji & Wildan Mualim, 2024). In addition, the prototype facilitates the early implementation and visualization of the platform's key features, including the product catalog, three-dimensional (3D) visualization of Jembrana woven fabrics, 3D product visualization functionality, and e-commerce transaction processes. The stages of system development using the prototype method are presented by Figure 1.

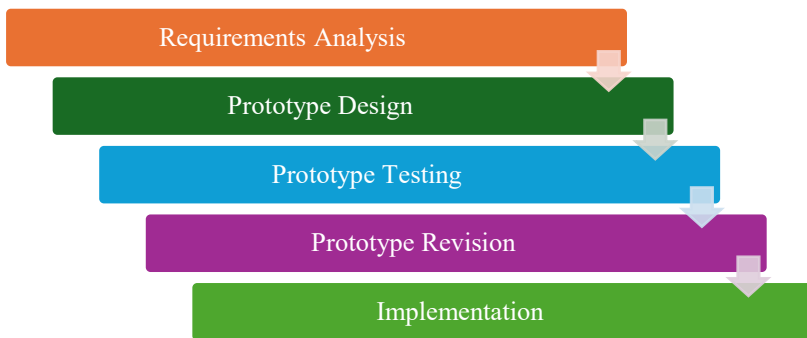


Figure 1. Stages of the Prototype Development Method

The prototype development process began with a requirements analysis conducted through observations, interviews, and a literature review to identify the functional and non-functional requirements of an Augmented Reality (AR)-based e-commerce platform for Jembrana woven fabrics. Based on the identified requirements, an initial prototype was developed, including the user interface, database, navigation structure, 3D woven fabric models, and AR integration for interactive product visualization. The prototype was then evaluated by weaving artisans and prospective consumers to assess usability, feature completeness, visual quality, and AR performance. Feedback from the evaluation was used to refine the interface, navigation, system performance, and 3D visualization before implementing the final system. The completed platform was subsequently tested across various devices and web browsers to ensure compatibility and stability, with the overall goal of providing an interactive online shopping

experience, increasing consumer confidence, expanding digital marketing opportunities, and promoting the preservation of Jembrana woven cultural heritage.

The e-commerce platform was developed using PHP and MySQL for server-side processing and database management. The 3D and Augmented Reality (AR) features were implemented using Three.js and AR.js. Three.js was used to render and manipulate the 3D models of Jembrana woven fabric products, while AR.js enabled web-based AR visualization through the device camera. This WebAR-based approach allows users to access the AR features directly through supported web browsers without installing an additional application. The integration enables users to rotate, zoom, and visualize 3D woven fabric products interactively in a real-world environment.

3 Result and Discussion

3.1 Result

At this stage, the Augmented Reality (AR)-based e-commerce platform was developed by implementing core e-commerce features, including product management, product catalogs, shopping carts, user management, and online transactions, followed by the integration of AR technology for interactive 3D product visualization. A responsive user interface and detailed product information were also incorporated to enhance usability and provide a realistic, informative online shopping experience while supporting the digital promotion of Jembrana woven fabrics.

3D Product Visualization. Three-dimensional (3D) models of Jembrana woven fabric products were integrated into the e-commerce platform using Three.js for interactive web-based visualization (Figure 2). AR.js was used to provide Augmented Reality functionality, allowing users to visualize the 3D products in a real-world environment through the device camera. Users can rotate, zoom, and examine product details, including motifs, colors, textures, and dimensions, providing a more interactive and informative online shopping experience.



Figure 2. 3D Visualization of Jembrana Woven Fabric Products

User Interface. The user interface of the Augmented Reality (AR)-based e-commerce platform was designed to be simple, responsive, and user-friendly, enabling artisans and consumers to easily browse products, access detailed information, and use AR visualization features across multiple devices (Figure 3). This user-centered design enhances usability, improves the online shopping experience, and increases consumer engagement with Jembrana woven fabric products.

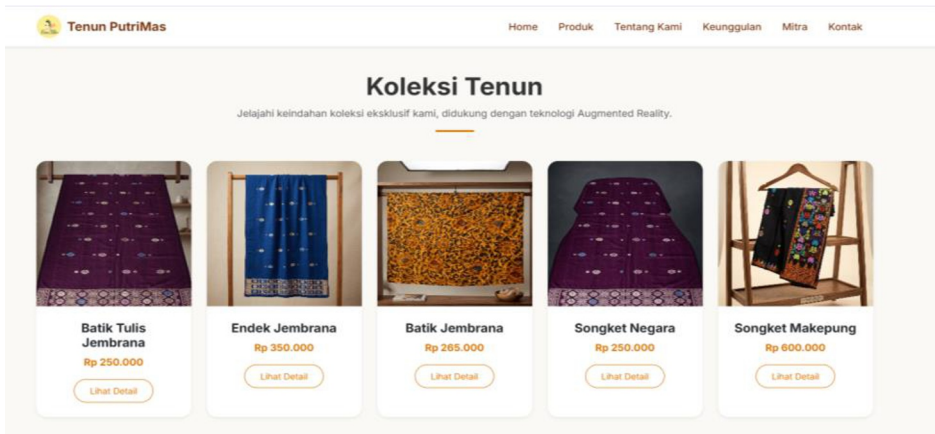


Figure 3. Product Collection Interface of the Jembrana Woven Fabric E-Commerce Platform

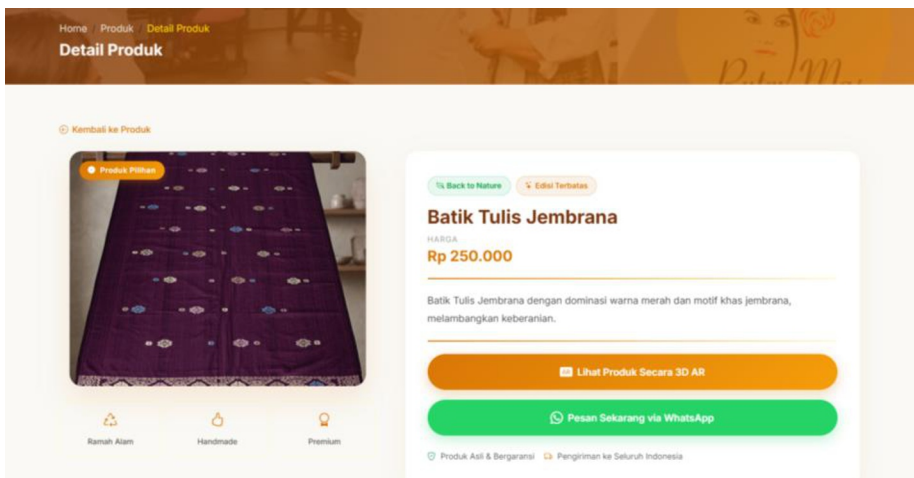


Figure 4. Product Details with the Augmented Reality (AR) Feature

AR Feature Interface. After selecting a product (Figure 4), users are directed to the Augmented Reality (AR) interface, where they can interact with a three-dimensional (3D) model by rotating and zooming to examine the product from different angles (Figure 5). The interface also provides detailed product information, including motifs,

materials, dimensions, and cultural significance, creating an immersive shopping experience while promoting appreciation of Jembrana woven cultural heritage.

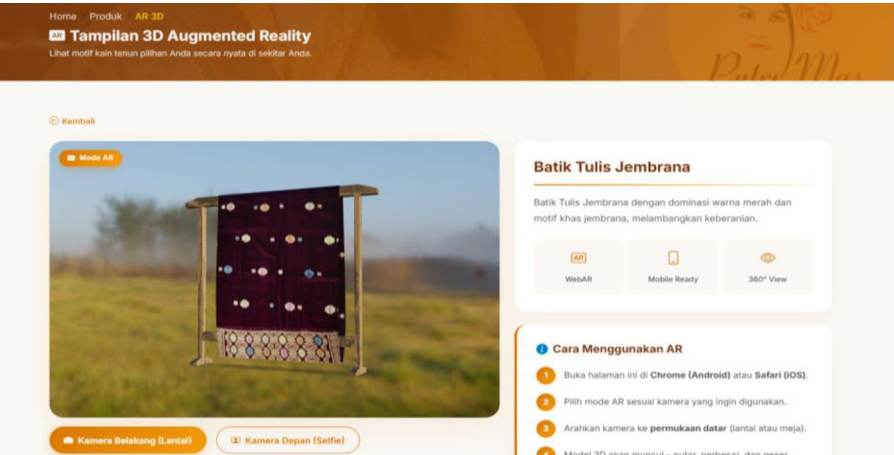


Figure 5. Augmented Reality (AR) Visualization of Jembrana Woven Fabric Products

Prototype Testing. Prototype testing was conducted with 20 respondents, consisting of Jembrana weaving artisans and prospective consumers, to evaluate the functionality, usability, and user satisfaction of the Augmented Reality (AR)-based e-commerce platform. Participants were asked to explore the main features of the platform, including product browsing, detailed product information, interactive 3D visualization, and AR-based product visualization. After testing the platform, respondents completed a questionnaire using a five-point Likert scale, ranging from 1 (very poor) to 5 (very good). The evaluation covered five aspects: browser accessibility, 3D product visualization, product information, AR responsiveness, and modern and innovative branding. The collected responses were analyzed using percentage distributions and mean scores to quantitatively assess users' perceptions of the developed platform.

Table 1. Summary of Respondents' Evaluation Scores for Prototype Testing

Evaluation Aspect	Score 5	Score 4	Score 3	Score 2	Score 1	Mean
Browser Accessibility	50%	30%	20%	0%	0%	4.30
3D Product Visualization	30%	40%	30%	0%	0%	4.00
Product Information	40%	40%	20%	0%	0%	4.20
AR Responsiveness	30%	40%	30%	0%	0%	4.00
Modern and Innovative Branding	50%	30%	20%	0%	0%	4.30
Overall Mean						4.16

Based on the prototype evaluation results as shown in Table 1, the developed AR-based e-commerce platform received positive evaluations across all assessed aspects, with an overall mean score of 4.16 out of 5.00. Browser accessibility and modern and innovative branding achieved the highest mean scores of 4.30, followed by product

information with 4.20. Meanwhile, 3D product visualization and AR responsiveness each obtained a mean score of 4.00. Furthermore, none of the respondents assigned scores of 1 or 2 to any evaluation aspect. These results indicate that the platform was positively perceived in terms of accessibility, visualization quality, product information, AR responsiveness, and digital branding. The findings also suggest that the integration of e-commerce and AR provides an interactive and user-friendly environment for supporting the digital promotion of Jembrana woven fabric products.

3.2 Discussion

The results demonstrate that the proposed Augmented Reality (AR)-based e-commerce platform provides a more interactive and informative online shopping experience than conventional e-commerce by enabling consumers to visualize Jembrana woven fabrics in three-dimensional (3D) form before making purchasing decisions. The platform received positive evaluations for browser accessibility, modern branding, 3D visualization quality, product information, and AR functionality, indicating that it improves consumer confidence, reduces uncertainty, and enhances the overall user experience. Respondents also suggested enriching the platform with additional cultural information, such as the philosophy, history, and traditional production techniques of Jembrana woven fabrics.

Although the AR feature performed well on most devices, several limitations were identified, including longer loading times on lower-specification devices and reduced visualization stability under certain lighting conditions, highlighting the need for further system optimization. Overall, the study shows that integrating AR with e-commerce not only strengthens digital marketing and product branding but also supports the preservation and promotion of Jembrana woven fabrics as cultural heritage. By combining interactive technology with cultural education, the platform increases the competitiveness of traditional handicraft products while contributing to the sustainability of Indonesia's culture-based creative industries.

Table 2. Comparison of the Proposed Platform with Existing Approaches

Approach	E-Commerce	3D/AR	Cultural Information	Traditional Textile Focus
Conventional e-commerce	✓	–	Limited	General
AR-based modern fashion platforms	✓	✓	–	–
AR cultural heritage applications	–	✓	✓	Limited
Proposed Platform	✓	✓	✓	Jembrana woven fabrics

To further demonstrate the contribution and distinctive characteristics of the proposed platform, a comparison with existing approaches is presented in Table 2. The comparison focuses on the integration of e-commerce functionality, 3D and Augmented Reality (AR) visualization, cultural information, and the application domain of traditional textiles. This comparison highlights the positioning of the proposed platform

in relation to conventional e-commerce, AR-based fashion platforms, and AR applications for cultural heritage preservation.

Compared with the categories of existing solutions discussed in the literature, the proposed platform combines features that are commonly implemented separately. Conventional e-commerce supports online transactions but generally relies on two-dimensional product presentation, while AR-based fashion applications emphasize interactive visualization and cultural heritage applications primarily focus on education and preservation. The proposed platform integrates e-commerce, interactive 3D/AR visualization, and cultural product information specifically for Jembrana woven fabrics. Therefore, its contribution lies primarily in contextual and functional integration rather than the development of a new AR algorithm.

4 Conclusion

This study successfully developed an Augmented Reality (AR)-based e-commerce platform for Jembrana woven fabrics by integrating conventional e-commerce functionality with interactive 3D product visualization using Three.js and AR.js. The WebAR-based approach enables consumers to explore woven fabric products interactively through supported web browsers without requiring additional applications. The evaluation involving 20 respondents showed positive results across all assessed aspects, with an overall mean score of 4.16 out of 5.00. Browser accessibility and modern and innovative branding achieved the highest mean scores of 4.30, followed by product information at 4.20, while 3D product visualization and AR responsiveness each obtained 4.00.

The findings demonstrate that integrating e-commerce and AR provides an interactive and informative digital environment for presenting Jembrana woven fabrics, while supporting broader digital marketing and cultural heritage promotion. The main contribution of this study lies in the contextual integration of e-commerce, WebAR-based 3D visualization, and cultural product information for traditional textile products. However, limitations remain in loading performance on lower-specification devices, AR stability under certain lighting conditions, and the limited number of evaluation participants. Future research should optimize system and AR performance, involve larger and more diverse user groups, enrich cultural information, and evaluate the platform's impact on consumer trust, purchase intention, actual purchasing behavior, and the economic benefits for local weaving artisans.

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