VTUBER PERSONAS IN DIGITAL WAYANG: A REVIEW OF INNOVATIVE CULTURAL PROMOTION FOR INDONESIAN HERITAGE

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Abstract—*This study investigates the integration of VTuber into Wayang Digital as a strategic initiative to promote Indonesian cultural heritage. By leveraging advanced technologies such as real-time motion capture and artificial intelligence (AI), the project aims to enhance the animation quality and interaction of VTuber, creating a more immersive and engaging experience for audiences. The research focuses on three key aspects: VTuber integration's effectiveness in attracting international audiences, optimizing real-time motion capture for high-quality animation, and applying AI algorithms to create adaptive, responsive interactions between VTubers and their viewers. Through these innovations, the study aims to enrich the narrative and visual appeal of Wayang Digital, making it more accessible and appealing to a diverse global audience. The findings show that integrating advanced technologies enhances Wayang Digital's storytelling, aesthetics, and effectiveness as a powerful tool for cultural promotion. AI-enabled adaptive interactions create a personalized viewer experience, deepening audience connections with the traditional art form. High-quality animation preserves and effectively communicates Wayang's cultural nuances to audiences, enhancing its impact and cultural promotion. This study underscores the importance of continuous technological innovation and strategic implementation in the preservation and globalization of Indonesian heritage through digital media, suggesting that the future of cultural preservation lies in the seamless integration of tradition with cutting-edge technology.*

Keywords: *artificial intelligence, cultural promotion, digital wayang, indonesian heritage, vtuber.*

Intisari—*Studi ini menyelidiki integrasi VTuber ke dalam Wayang Digital sebagai inisiatif strategis untuk mempromosikan warisan budaya Indonesia. Dengan memanfaatkan teknologi canggih seperti real-time motion capture dan kecerdasan buatan (AI), proyek ini bertujuan untuk meningkatkan kualitas animasi dan interaksi VTuber, menciptakan pengalaman yang lebih imersif dan menarik bagi penonton. Penelitian ini berfokus pada tiga aspek utama: efektivitas integrasi VTuber dalam menarik audiens internasional, optimalisasi teknologi real-time motion capture untuk animasi berkualitas tinggi, dan penerapan AI untuk interaksi adaptif antara VTuber dan penonton. Inovasi ini memperkaya narasi dan daya tarik visual Wayang Digital, sehingga lebih mudah diakses oleh audiens global. Temuan menunjukkan bahwa teknologi canggih ini tidak hanya meningkatkan cerita dan estetika Wayang Digital, tetapi juga memperkuat potensinya sebagai alat promosi budaya. Interaksi adaptif yang didukung oleh AI memungkinkan pengalaman menonton yang lebih personal, sehingga menciptakan hubungan yang lebih mendalam antara audiens dan seni tradisional tersebut. Selain itu, penggunaan animasi berkualitas tinggi memastikan bahwa nuansa budaya Wayang terjaga dan efektif disampaikan kepada audiens internasional. Studi ini menekankan pentingnya inovasi teknologi yang berkelanjutan dan implementasi strategis dalam pelestarian dan globalisasi warisan Indonesia melalui media digital, serta menyarankan bahwa masa depan pelestarian budaya terletak pada integrasi tradisi dengan teknologi mutakhir secara harmonis.*

Kata Kunci: *kecerdasan buatan, promosi budaya, wayang digital, warisan indonesia, vtuber.*

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INTRODUCTION

Wayang is one of Indonesia's intangible cultural heritages (Panfili, 2020), and it is recognized by UNESCO (The United Nations Educational, Scientific and Cultural Organization) (Hartono, Nuryani, & Kusumastuti, 2024). This performing art has high aesthetic value and contains moral, philosophical (Muhathir et al., 2023), and spiritual values taught through pic stories such as the Mahabharata and Ramayana (Tiwari, Rout, & Kumar, 2023). Wayang (Puppet) has become an integral part of Javanese culture, including Banyumas in Central Java (Prahmana & Istiandaru, 2021), which has its characteristics and uniqueness in its performance style (Manik, Christanti, & Setiawan, 2024). Wayang Kulit Gagrag Banyumasan is a puppetry style used to maintain ethical, devotional and entertainment values, which are constantly maintained (Cahya Ningsih, 2023). However, amidst globalization and technological advances, the younger generation's interest in traditional arts, such as Wayang, is decreasing. This raises concerns about the sustainability of these performing arts in the future.

The development of digital technology has brought significant changes in various aspects of life, including in the fields of art and culture. Technology is increasingly playing an essential role in preserving and promoting culture. Technology can present innovation by providing opportunities to develop new media (Degner, Moser, & Lewalter, 2022), that are more interesting and that appeal to the needs and preferences of the younger generation (Saputra, Murjiatiningsih, Hermawan, & Handani, 2022). One exciting innovation is using Digital Wayang with a VTuber integration approach. Wayang, one of Indonesia's cultural heritages, has excellent potential to be introduced to international audiences through digital media. VTuber, or Virtual YouTuber, is a virtual character that uses animation (Ferreira, Regis, Gonçalves, Diniz, & Tavares, 2024) and real-time motion capture technology (Saputra & Setyawan, 2021) to interact with audiences through video platforms such as YouTube (Jiang, Pan, & Lu, 2023). This approach utilizes 2D and 3D animation (Z. Lu, Shen, Li, Shen, & Wigdor, 2021), artificial intelligence (Jhawar, Kumar, & Varshney, 2023), and virtual reality (VR) to create an immersive and interactive experience (Angmo & Mahajan, 2024). The integration of VTuber in Digital Wayang offers a new way to tell traditional stories more engagingly and interactively.

Through the use of advanced technologies, such as real-time motion capture and artificial intelligence (AI), the integration of VTubers in Digital Wayang can provide a more lively and engaging experience for a global audience. This technology allows characters to interact directly with the audience and customize the story to create a more personal and immersive experience. This technology allows every movement of the VTuber character to be recorded live and transmitted in digital form with very low latency. This allows the character to interact with the audience in real time, creating the illusion that the character is alive. Integrating AI in VTubers will enable them to respond to audience input dynamically. Machine learning algorithms can be used to understand and predict audience preferences so that VTuber characters can adapt their dialogue and actions adaptively, increasing audience engagement and satisfaction.

Integrating VTuber with digital Wayang can be an innovative solution to introduce and promote local Indonesian culture, especially Banyumas Wayang, to an international audience. VTuber-based digital Wayang can present wayang performances in a more modern and attractive format for the younger generation, both in 2D and 3D. These digital wayang characters can interact directly with the audience, providing a more personal and immersive experience. Using a digital platform, Wayang can be accessed by audiences worldwide, expanding the reach and impact of this performing art. The VTuber approach to digital Wayang also allows for more dynamic and flexible storytelling. Wayang stories can be adapted to modern contexts without losing their essence and traditional values. This opens up opportunities for innovation in storytelling, such as combining contemporary elements with classic stories or creating new stories relevant to current issues. Digital Wayang can be an effective and exciting educational medium for preserving and developing local culture.

Cultural preservation through digitization also provides other benefits, such as better documentation and archiving (Trček, 2022). With digitization, wayang stories and performances can be recorded and stored permanently (Raimo, De Turi, Ricciardelli, & Vitolla, 2022). This allows broader and easier access for anyone who wants to learn and appreciate Wayang from within and outside the country. Digitization can also protect this performing art from the risk of extinction due to changing times and social conditions (Pandey & Kumar, 2020). However, developing a VTuber-based digital Wayang is complex and requires various resources and support from multiple parties. Investment in technology, training for artists and animators, and collaboration between the government, academics, and cultural practitioners are needed. Another challenge is ensuring that digital Wayang remains authentic and based on original cultural values. Therefore, this

study aims to examine the concept and future of digital Wayang through the VTuber character approach and explore the potential and challenges that exist.

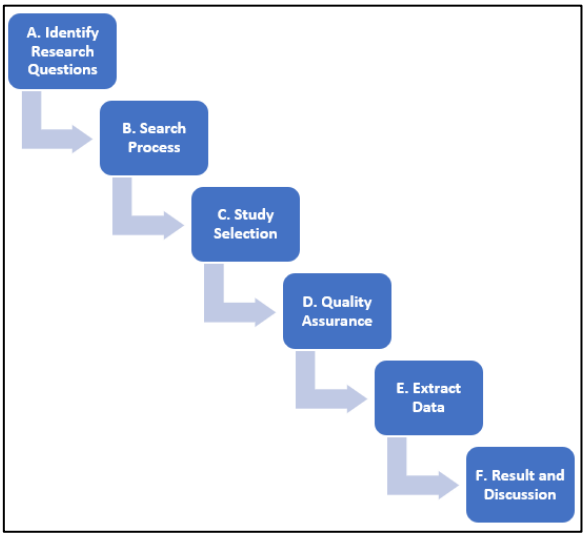
This study will begin with a literature review on the history and evolution of Wayang and an introduction to VTubers in art and culture. It explores the concept of digital Wayang using VTuber characters, covering design, animation, and audience interaction. The study will evaluate the impact of this approach on cultural preservation and promotion, identifying critical success factors. The findings aim to significantly contribute to the development of digital Wayang and the international promotion of Indonesian culture. Additionally, it will serve as a reference for researchers, practitioners, and policymakers in formulating strategies for cultural preservation through technological innovation, ensuring Wayang continues to thrive and provide educational and aesthetic value for future generations.

Overall, this study highlights the importance of innovation in preserving traditional culture in the digital era, with the scientific contribution of developing an innovative approach to cultural promotion by integrating VTuber characters in Wayang Digital. By utilizing advanced technologies such as real-time motion capture and artificial intelligence (AI), this study enriches the literature on cultural preservation by showing how digital technology can preserve and disseminate Indonesian traditional culture's nuances on the international stage. In addition, this study provides practical guidance to improve the quality of animation and interactivity of digital content and promote a deeper understanding of the use of technology for cultural preservation. With the support of various parties and the right approach, Wayang Digital, based on VTuber, has excellent potential to become a powerful tool in preserving and introducing Indonesian cultural heritage to the international world while providing practical implications for academics and practitioners in developing more effective cultural promotion strategies in the era of globalization. However, this great opportunity is also accompanied by challenges in terms of cost, technology, and maintaining cultural authenticity, which need to be addressed through cross-disciplinary collaboration and continuous innovation.

MATERIALS AND METHODS

This study was conducted systematically by following several stages, from the collection process to the analysis of selected studies (Saputra, Hatta, Kamila, & Wijono, 2023), namely on the use and approach of VTubers in Digital Wayang to promote Indonesian culture at the international level. We discussed the findings and answered the research questions raised in this systematic literature review.

Furthermore, a search strategy was carried out, including identifying information sources, determining inclusion and exclusion criteria, selecting relevant and quality documents, and extracting data to produce output in this study. The final stage presents the conclusions of the systematic literature review and explains the benefits, weaknesses, and implications for future research. These stages are presented in Figure 1.



Source: (Hermawan et al., 2023)

Figure 1. Methodical Phases of This Study

The steps in this literature review aim to ensure that the research conducted can provide a comprehensive and in-depth picture of the integration of VTubers in Wayang Digital as a promotional tool for Indonesian culture on the international stage.

Research Questions

This study has three main research questions (RQ) formulated sequentially to help understand the focus of the study. These research questions aim to collect the necessary data and form the contribution of this paper. The research questions raised are as follows:

a. RQ1: How effective is the integration of VTubers in Wayang Digital in attracting international audiences to Indonesian cultural heritage?
b. RQ2: How can real-time motion capture technology be optimized to improve the quality of VTuber animation and interaction in Wayang Digital?
c. RQ3: How can AI algorithms be used to develop adaptive interactions between Wayang Digital VTubers and audiences?

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These research questions are designed to explore various aspects of the use of VTuber technology in the context of Wayang Digital, from its effectiveness and appeal to global audiences to the challenges that may be faced in its development, as well as its potential contribution to the strategy of promoting Indonesian culture internationally.

Research Design

The study search process was carried out by following a specific strategy using the identification of relevant terms and applied to the research, such as "VTuber," "Digital puppetry," "Wayang," "Cultural promotion," and "Indonesian Heritage." The use of research questions is a reference in developing this strategy. The database selection includes reputable digital library sources: Scopus, Google Scholar, and IEEE Xplore. The search process was done by searching for information based on the title, keywords, abstract, introduction, results, discussion, conclusion, and relevant research topics from 2019 to 2024. The process is presented in detail in Table 1.

Table 1. The Database Search Process

Searching Index	Content-Specific
Database	Scopus, Google Scholar, and IEEE Xplore
Article Type	Technical or scientific papers published in reputable peer-reviewed journals, conferences
Search Strings	"VTuber," "Digital Puppetry," "Wayang," "Cultural Promotion," "Indonesian Heritage."
Period	2019 – 2024
Screening Procedure	The research topic is relevant to each article's title, abstract, introduction, discussion, and conclusion

Source: (Research Results, 2024)

The study selection process began with an initial screening based on the titles and abstracts of the articles found. Articles that appeared relevant were then examined in depth through full-text reading. Inclusion and exclusion criteria were applied to ensure that only appropriate and quality studies were included in the review. Data extracted from the selected studies included bibliographic information, research methods, key findings, and cultural and technical contexts. The extracted data were then analyzed qualitatively to identify key themes, trends, and gaps in the literature.

The results were validated through cross-checking by independent researchers, discussions to resolve differences in interpretation, and review by experts in related fields. The data analysis and synthesis results were compiled in a systematic and structured report, including an introduction, methods, key findings, discussion, and conclusions and recommendations for future research and implementation. With this systematic approach, the study is expected to provide a comprehensive and in-depth review of the potential and challenges in using the VTuber approach for Digital Wayang as a promotional tool for Indonesian culture at the international level.

Study Selection

This study's selection process was carried out through several systematic stages to ensure that only relevant and high-quality literature was included. After the search results were obtained, an initial selection was made based on the title and abstract of the articles. Articles that appeared relevant were then examined in depth through full-text reading. Studies that did not meet the relevance criteria or did not have adequate methodological quality were excluded from further analysis. Table 2 shows the inclusion and exclusion criteria formulated to select relevant articles related to the research topic.

With this approach, the research is expected to provide a comprehensive and in-depth review of the integration of VTuber characters in Digital Wayang as a promotional tool for Indonesian culture at the international level.

Table 2. Inclusion and Exclusion Criteria

Criteria	Description
Inclusion	Articles from journals or conferences, with content in the English and discussing the use of VTuber and Wayang
Exclusion	Articles before 2018, from secondary sources
	Articles duplicated in other databases and do not discuss or not related
	Articles which only mention the terms "VTuber," "Digital Puppetry," "Wayang," "Cultural Promotion," and "Indonesian Heritage" without applying the research.

Source: (Research Results, 2024)

Quality Assurance and Extract Data

At this stage, the quality of the included or excluded articles is assessed and evaluated by considering the previously determined inclusion and exclusion criteria. The selection process is carried out carefully to ensure that the selected articles are of adequate quality and by the research focus. Relevant and quality articles will be the basis for further data analysis. This systematic approach is expected to produce an in-depth and objective literature review on using VTubers in Digital Wayang to promote Indonesian culture on the international stage.

The quality assessment process includes an evaluation of the research methodology, the validity of the findings, and the relevance of the topic to the research objectives. Each selected article is critically reviewed to ensure it contributes significantly to understanding VTuber integration in Digital

Wayang. Data extracted from the articles includes information on animation techniques, real-time motion capture technology, AI algorithms, and their impact on audiences and cultural promotion. The validated data is then analyzed to identify key themes, trends, and gaps in the existing literature. With this approach, this study is expected to provide comprehensive and in-depth insights into the role of technology in developing and promoting Digital Wayang using the VTuber approach.

RESULTS AND DISCUSSIONS

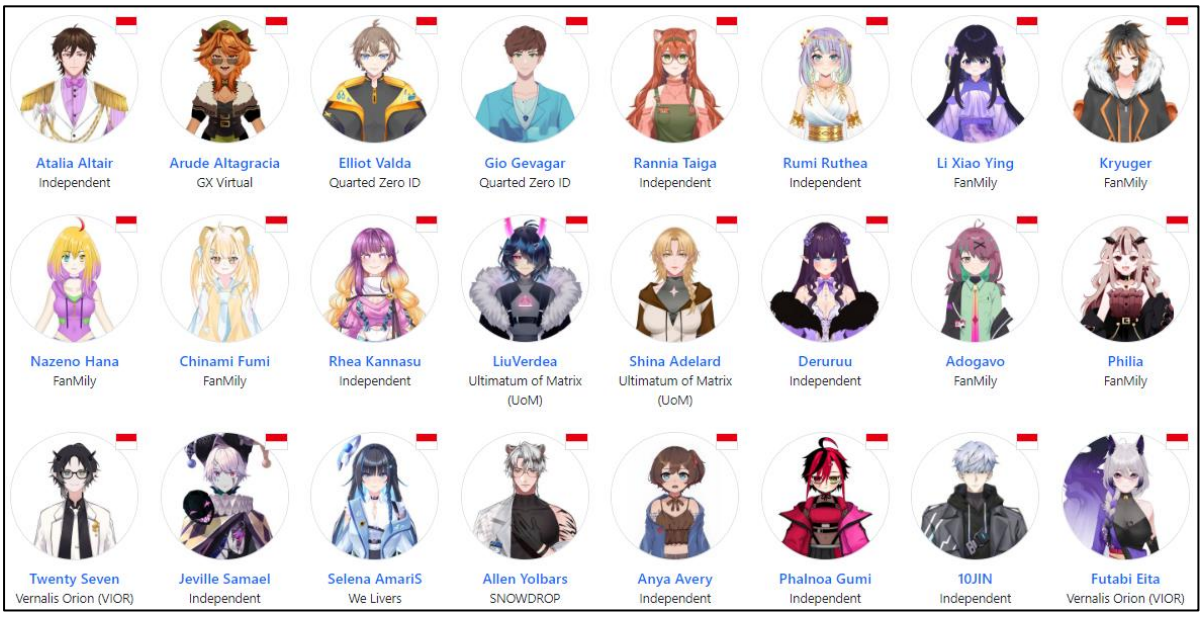
This section presents findings and discussions on the three research questions formulated in this systematic literature review. The main objective of this study is to explore how the integration of VTubers in Wayang Digital can attract international audiences to Indonesian cultural heritage. By analyzing various relevant studies and data, this study aims to reveal the effectiveness, technical challenges, and roles of VTubers in promoting culture globally. The results obtained from this analysis are expected to provide in-depth insights into the use of advanced technology in preserving and promoting traditional culture in the digital era.

Effectiveness of VTuber integration in Wayang Digital in attracting international audiences to Indonesian cultural heritage

The integration of VTubers in Wayang Digital shows excellent potential in attracting international audiences to Indonesian cultural heritage. This effectiveness can be seen from several aspects, including increasing audience engagement, global accessibility, and innovation in traditional storytelling.

First, VTubers can attract audiences through more dynamic and personal interactions (Tang, Zhu, & Popescu, 2021). They can respond in real-time to audience input and reactions, creating a more immersive and engaging experience (Budiwaspada & Fadilah, 2021). Studies show that this direct interaction increases audience engagement, especially among the younger generation, who are more familiar with digital technology. Second, the use of digital platforms allows for wider global accessibility. Integrated with VTuber, Wayang Digital can be broadcast through various social media and streaming platforms, such as YouTube, Bilibili, TwitCasting, and Twitch (Yu, Gong, & Zhang, 2024). This allows international audiences to access and enjoy Wayang performances without geographical limitations (Udayana & Dwijendra, 2022). Studies from various sources indicate that cultural delivery through digital media can reach a broader and more diverse audience (Noviani, Handayani, & Jamil, 2023), increasing appreciation for Indonesian culture.

The innovation in storytelling through VTuber technology provides a new dimension to wayang performances. VTuber development can use advanced animation technology and real-time motion capture to present more lively and exciting movements and expressions (W.-T. Lu, Huang, Hung, Hsiao, & Liu, 2024). Research shows that high visual quality and realistic animation (Saputra, Manongga, & Hendry, 2021) can increase audience interest in cultural content because they feel more connected to the characters and stories (Liu, 2022). This effectiveness can also be seen in the positive



Source: (Hololist, 2024)

Figure 2. Several VTubers from Indonesia

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response of international audiences to the animation with VTuber characters. Various comments and reviews from viewers on social media platforms on VTuber characters such as Lily Miralana, Melyn Sundae, Roffi Daijoubu and many others show high appreciation for this innovation, Figure 2. Combining modern technology and traditional stories creates a unique educational experience.

The integration of VTuber characters in Wayang Digital has not only succeeded in attracting the interest of international audiences but also contributed to preserving and promoting Indonesian culture on the global stage. This technology can introduce Indonesia's rich and diverse cultural heritage to new generation's worldwide, strengthening cultural identity and encouraging broader cross-cultural dialogue.

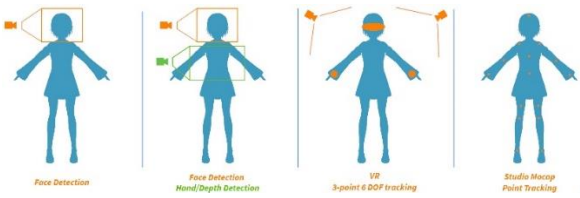
Real-time motion capture technology can be optimized to improve the quality of VTuber animation and interaction in Wayang Digital

Real-time motion capture technology is crucial in developing VTuber character animation in Wayang Digital. This technology enables realistic and interactive animation, significantly improving the quality of the audience experience. Several aspects can be optimized to achieve better results.

First, optimizing the hardware and software (Zheng, 2023) used in real-time motion capture can improve animation quality. More sophisticated and accurate motion capture sensors can capture movements with high precision (Hu, Liang, Min, Li, & Xiao, 2020), making the animation smoother and more realistic (Park et al., 2024). The software to process motion data must manage and transfer data efficiently without significant latency. This is important to ensure that the movements displayed on the screen are in sync with the actual actions of the actor or performer. Second, integrating AI in motion capture technology can optimize the interaction between VTuber characters and the audience (Zhang et al., 2023). AI algorithms can process motion data in real-time and adjust character responses according to audience interactions (Budach & Sharoyan, 2020). For example, AI can predict and respond to audience movements or comments during a performance (X. Chen et al., 2023), creating more dynamic and personalized interactions (Oh & Kong, 2022). Studies have shown that AI in animation can increase audience engagement and satisfaction by providing more natural and responsive interactions (D. K. Singh, Kumar, Sharma, & Arora, 2023).

Proper training and calibration of the motion capture system are essential to ensure the accuracy and quality of the animation. Performers must be trained to use the motion capture equipment effectively, and the system must be calibrated regularly to maintain precision (Pan et al., 2022). This allows complex movements to be captured more accurately, creating more realistic and immersive animations (H. Wang, Sharma, & Shabaz, 2022). Studies have shown that frequent calibration and proper training can reduce errors and improve the overall quality of the animation (A. Singh, 2023).

Improvements in data processing algorithms can also optimize real-time motion capture technology, such as that shown in Figure 3. Face detection is a technology with computer algorithms that identify and track faces (Alqahtani, Banks, Chandran, & Zhang, 2020), allowing for application to character animation (Hasan, Ahsan, Abdullah-Al-Mamun, Newaz, & Lee, 2021). Hand/Depth Detection involves using sensors to detect the position of the hands (Johnson, Damian, & Tzanetakis, 2020), allowing for more natural and accurate interactions (Zhu, Lu, Gan, & Hou, 2021). VR 3-point tracking refers to VR technology that tracks three main points on the body (Yaqoob, Salah, Jayaraman, & Omar, 2023), usually the head and both hands to create a realistic and immersive experience (Kwiatkowski et al., 2022). Mocap (Motion Capture) Point Tracking Studio is a technique that uses several sensors placed on the actor's body to capture detailed movements (Mathis, Schneider, Lauer, & Mathis, 2020) and translate them into a digital model to produce highly realistic movements (Cai, Dong, Wang, & Song, 2022). All of these technologies can contribute to the development of interactive and immersive VTuber Wayang Digital applications. More efficient algorithms can reduce processing time and increase response speed, which is especially important in live or streaming performances (Lam et al., 2022). These algorithms can include filtering techniques to remove noise from the motion data and compression techniques to reduce the data size without losing quality. This allows the animation to run more smoothly and respond to real-time input.



Source: (Jamali et al., 2022)
Figure 3. Motion capture technology for VTubers

In conclusion, real-time motion capture technology has great potential to improve the quality of VTuber animation and interaction in Wayang Digital. By optimizing hardware and software, utilizing AI, conducting proper training and calibration, and improving data processing

algorithms, Wayang Digital can offer a more immersive and engaging experience for international audiences. This optimization will improve the show's technical quality and enrich how Indonesian traditional culture is conveyed to the world.

AI algorithms can be used to develop adaptive interactions between Digital Wayang VTubers and audiences

AI algorithms in Digital Wayang with VTubers can significantly improve the interaction between characters and audiences. AI provides the ability to develop adaptive interactions, allowing VTubers to respond to audiences more personally and dynamically. This can improve audience engagement and overall experience.

First, AI can analyze audience interaction data in real-time. With Natural Language Processing (NLP) algorithms, VTuber characters can understand and respond to audience comments, questions, and reactions during the performance. For example, suppose an audience asks a question about the Wayang story being performed. In that case, the VTuber character can provide a relevant and informative answer, creating an interactive dialogue that increases audience engagement. Research shows that using NLP in digital interactions can increase audience satisfaction and make them feel more connected to the content presented (Sun, Zhang, Choo, Hu, & Wang, 2021). Second, machine learning algorithms allow VTuber characters to learn audience preferences and interaction patterns over time. By collecting and analyzing interaction data, AI can identify trends and patterns that can be used to optimize content and character responses (R. Chen, Hsiao, & Yang, 2023). For example, if data analysis shows that viewers prefer specific segments of a wayang performance, AI can adjust the script and character interactions to emphasize those elements in the future. Research has shown that machine learning can improve the personalization of digital content (Saputra & Manongga, 2021), which in turn can increase audience satisfaction and engagement (B. Wang & Shi, 2023).

AI can optimize motion capture technology in VTuber character animation. With advanced motion recognition algorithms, AI can adjust character movements based on audience reactions and participation (Campbell, Sands, Ferraro, Tsao, & Mavrommatis, 2020). For example, if the audience shows an enthusiastic response to a particular movement, AI can direct the character to repeat or modify the movement according to the audience's response (Pataranutaporn et al., 2021). This technology allows for more interactive and dynamic performances, creating a more immersive experience for the audience. AI can also be used to manage and coordinate multi-channel interactions. In Digital Wayang performances broadcast live through various platforms such as YouTube, Twitch, and other social media, AI can help manage interactions from multiple sources simultaneously. AI algorithms can filter and categorize comments, provide relevant responses, and ensure that all viewers feel cared for and engaged, regardless of their platform (Riyaz et al., 2023). This is crucial to expanding the reach and impact of cultural performances globally.

Applying AI algorithms in Digital Wayang with VTuber characters offers an excellent opportunity to improve the quality of audience interaction and engagement. By developing responsive and personalized adaptive interactions, AI helps preserve and promote Indonesian cultural heritage and creates a more immersive and satisfying experience for international audiences.

The analysis of the three RQ revealed a significant impact of integrating VTuber characters in Wayang Digital for promoting Indonesian culture. This integration has proven effective in attracting global audiences to Indonesian cultural heritage, the more dynamic and personal interactions offered by the VTuber characters. The optimization of real-time motion capture technology and the application of AI algorithms play an essential role in improving the quality of animation and the interaction between VTuber characters and the audience. Using advanced technology in Wayang Digital enriches the audience's experience and expands the reach of promoting Indonesian culture worldwide.

Real-time motion capture technology dramatically contributes to creating more realistic and interactive animations. With optimized hardware, software, and AI algorithms, Wayang Digital can present a more lively and responsive performance to audience interaction. This improves the technical quality of the performance and strengthens audience engagement. On the other hand, using AI to develop adaptive interactions allows VTuber characters to respond to the audience in a more personal and dynamic way, ultimately improving the overall audience satisfaction and experience.

While this study provides valuable insights, there is still room for further research. The following steps involve empirical studies to test the effectiveness of implementing this technology in real-world situations and more in-depth research into the factors that influence the success or failure of VTuber integration in Wayang Digital. With continued development and implementation, the role of advanced technology in promoting Indonesian cultural heritage can continue to be strengthened and renewed, creating new ways to

preserve and spread Indonesia's rich culture worldwide.

CONCLUSION

The integration of VTuber characters in Wayang Digital shows excellent potential in promoting Indonesian cultural heritage internationally. This study highlights three main aspects that support this effectiveness: the appeal of VTubers in attracting a global audience, the optimization of real-time motion capture technology for more realistic animation, and the use of AI algorithms to enhance adaptive interactions between characters and viewers. Wayang Digital can offer a more immersive and dynamic experience, enriching entertainment and cultural education for international audiences through this approach.

Real-time motion capture technology has been shown to improve the quality of VTuber character animation in Wayang Digital. More sophisticated sensors and efficient data processing software enable smoother and more realistic animations, increasing audience engagement. In addition, AI plays a significant role in developing adaptive interactions, where VTuber characters can respond personally and dynamically to audience interactions, creating a more engaging and satisfying experience and strengthening audience appreciation for Indonesian cultural heritage.

This study provides valuable insights, but there are still challenges and opportunities for further research. Empirical studies are needed to test the effectiveness of this technology in the real world and understand the factors that influence the success or failure of VTuber integration in Wayang Digital. Future research can focus on further technological innovations and more effective cultural promotion strategies. In conclusion, this study makes a scientific contribution by enriching the literature on the use of advanced technology for cultural preservation and promotion while offering a practical approach that can be applied to expand the reach and impact of Indonesian culture on the global stage.

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