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Virtual Arena for Traditional Arts: Development of a Digital Platform for Cultural Preservation

Hadawiyah Endah Utami[1*], Raden Ary Bhagawan Wijaya[2]

[1] Dance Study Program, Faculty of Performing Arts, Indonesian Institute of Arts Surakarta, Indonesia.
[2] Magelang Cultural Arts Activists, Indonesia.

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Corresponding Author:
Hadawiyah Endah Utami
utamihadawiyah@gmail.com

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Abstract: This article examines the development of Virtual Arena for Traditional Arts, a digital platform designed for the preservation of traditional arts through a technological approach and motion mechanics as elements of digital communication. This research stems from the urgent need to provide an alternative performance space amid the decline of physical stages and the decrease in direct interaction between artists and audiences. The concept of motion mechanics is applied to capture, visualize, and transmit body movements with precision through motion capture technology, so that the aesthetic characteristics of traditional arts remain authentic in virtual format. The digital stage functions as an interactive communication medium that allows the audience not only to observe but also to experience the performance through 3D visualization, dynamic avatars, and virtual reality-based stage design. The research methods included literature studies and system design. The results showed that the integration of motion mechanics with digital stages improved the quality of art representation, expanded the global audience reach, and strengthened real-time user engagement. These findings confirm that virtual arenas have the potential to become a new model of cultural communication in the digital age and an innovative strategy for preserving traditional arts.

Keywords: Arena; Art; Preservation; Traditional; Virtual

Introduction

The development of Virtual Arena is also based on the need to integrate motion mechanics into the digital representation of traditional arts. Motion mechanics is an important component because every movement in traditional arts has a symbolic meaning that must be represented accurately. Studies on the performativity of the body state that the precision of movement determines the authenticity of a dance work when it is transformed into digital media (Yulisetiani, 2022). At the same time, the use of sensory technology is considered to improve the accuracy of motion capture and help preserve the technical details that characterize traditional dance (Rochmah et al., 2025). This integration ensures that the platform is not only a visual space but also a space for the conservation of traditional body techniques.

In this context, the digital stage acts as a medium of cultural communication that can reach a global audience. By combining motion capture, 3D visualization, and interactivity, the digital stage enables real-time dialogue between artists and audiences. Research in the field of digital communication shows that visual immersion can increase audience understanding of cultural contexts (Wijaya, 2026). Meanwhile, studies on performative technology state that virtual stages open up new opportunities for cross-cultural collaboration through digital media (Puluhulawa et al., 2026). This confirms that the integration of motion mechanics and digital stages has great potential to strengthen cultural preservation in the technological era.

The decline of physical stages and waning interest in traditional arts has become increasingly apparent in the last two decades, especially as cultural consumption

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patterns shift to digital spaces. Many studies show that changes in audience preferences are triggered by the expansion of screen-based media, which offer speed and instant access, causing traditional arts to lose their competitiveness among the younger generation (Cao, 2025; Forcier, 2022). This condition is exacerbated by the decline in visits to conventional performance spaces, which, according to cultural behavior studies, is an indicator of the weakening of the community's emotional attachment to local arts (Hidajat, 2022; Qiu, 2025). This change creates a distance between the community and tradition-based arts, requiring more adaptive preservation strategies.

The challenges of modernization also cause limitations in performance spaces, both physically and socially. Many art communities have lost their spaces for expression either due to urban revitalization or changes in the function of public spaces. Studies on arts management show that the pressures of modernization narrow the space for arts that do not have strong economic support (Harrison et al., 2020; Mohyeddin, 2024). In addition, the development of the digital entertainment industry has created increasingly fierce competition, making it difficult for traditional arts to perform on commercial stages. Research on urban culture confirms that these space limitations affect the continuity of art practices that are highly dependent on direct encounters between artists and audiences (Ribeiro et al., 2023; Wang et al., 2024).

In this context, the need for digital platforms as a means of cultural preservation has become increasingly urgent. Digitization enables more comprehensive documentation of movement, sound, and cultural context, in line with findings that technology can expand the reach of cultural representation beyond geographical boundaries (Buragohain et al., 2024; Moon et al., 2026). Furthermore, digital platforms are considered capable of building interactive experiences that increase global audience engagement through multimedia and immersive reality (Nordin et al., 2026; Zhao et al., 2025). Thus, digital transformation is a strategic key to ensuring the sustainability of traditional arts amid the dynamics of modernization.

The urgency of digitizing traditional arts is growing stronger in line with changing patterns of cultural consumption and increasing public dependence on digital media. Many forms of traditional art face the risk of losing relevance due to the lack of a space that can bridge traditional values with the expectations of modern audiences. Digitization is a key strategy for maintaining the sustainability of works, especially in documenting movements, sounds, and cultural contexts more comprehensively. This approach is in line with the view that digital heritage serves as a preservation effort that places technology as a catalyst for cultural interpretation and sustainability (Agoraki et al., 2024; Khan & El Atmani, 2025; Zhang et al., 2025).

The role of information technology is also very important in opening up global access to traditional arts. Technology enables the distribution of cultural works beyond geographical boundaries, so that performances that were once limited to local spaces can now reach audiences across countries. Digital media creates broader cultural connectivity through streaming, multimedia archives, and interactive platforms. This reinforces the idea that information technology can remove physical barriers and create new bridges between artists and global audiences, as explained in research on the expansion of network-based cultural access (Paul, 2008).

In its development, the emergence of the digital stage has formed a new cultural communication space that is dynamic and participatory. The digital stage not only displays works but also creates a dialogue between artists and audiences through interactive features, avatars, virtual reality, and immersive visualizations. This space allows the public to not only be spectators but also part of the process of creating meaning through real-time interaction. Studies on digital performativity confirm that virtual stages are capable of presenting cultural representation formats that are more adaptive to technological developments and current audience behavior (Glémarec et al., 2022; Takács, 2011).

The concept of movement mechanics in traditional dance is an important basis for understanding aesthetic structures, body rhythms, and symbolic characters built through movement patterns that have been passed down from generation to generation. In the dance tradition of the Indonesian archipelago, each movement functions not only as an artistic expression, but also as a representation of philosophical values embedded in local culture. Analysis of the mechanics of movement helps to clarify the relationship between body technique and cultural meaning, as explained by the fact that traditional body techniques are composed of movement patterns based on rhythmic structures and strict energy control.

The importance of precision of movement in maintaining the authenticity of traditional dance art has become increasingly crucial amid rapid socio-cultural changes. Precision of movement not only ensures the continuity of technique, but also preserves the cultural identity inherent in every detail of hand position, gaze direction, and rhythm of steps. In the context of preservation, accuracy of movement is necessary to prevent distortion of meaning when dances are re-performed or reconstructed in subsequent generations. Research on Nusantara dance confirms that precision of

movement is a key element in maintaining the integrity of traditional artworks amid the tide of modernization (Novaria et al., 2026).

The relevance of motion capture technology in supporting the preservation of traditional dance is gaining increasing academic and practical attention. This technology enables detailed movement documentation through the tracking of body coordinate points, allowing movement patterns to be analyzed and replicated with a high degree of precision. Motion capture opens up new opportunities in dance education, digital archiving, and the development of virtual platforms that display dance with accurate movement representation. Studies on the application of cultural technology in Indonesia show that motion capture is a strategic solution for maintaining the continuity of traditional dance techniques in digital format (Ratmono, 2023).

The main objective of this study is to develop a Virtual Arena for Traditional Arts as an alternative space that supports the preservation of traditional arts in the digital era. The development of this platform not only focuses on creating a virtual performance space but also ensures that cultural values can still be displayed authentically in digital format. Research related to cultural transformation shows that digitization can strengthen the sustainability of traditional arts through increased access and quality of documentation (Rohman et al., 2025). In addition, studies on cultural innovation emphasize the importance of interactive digital platforms in creating a new ecosystem for art performances (Khizar et al., 2025). Thus, the objective of this research is directed at designing a virtual arena that is capable of accommodating cultural expressions in their entirety.

Method

This study uses literature review and conceptual analysis methods to examine the development of Virtual Arena for Traditional Arts as a technology-based cultural communication model. The literature review was conducted by searching reputable journals discussing cultural preservation, virtual technology, and motion mechanics to obtain a strong theoretical foundation. This approach was used to map the relevance of digital stage technology in maintaining the aesthetic value of traditional arts, in line with the view that digital innovation is an important instrument in cultural revitalization in the modern era, as emphasized in Lee et al. (2022) research that digital transformation can expand the space for art conservation through interactive platforms.

The next stage is system design, which includes the design of a virtual stage structure, the integration of motion capture technology, and the development of 3D avatars that function to represent body movements authentically. This design is based on the principles of motion mechanics to ensure harmony between movement data and digital visualization. The design process also involves arranging the flow of interaction between performers and audiences in virtual space. This approach is relevant because, according to dos Santos et al. (2024), immersive environment-based system design can improve the quality of user experience through motion and visual responsiveness.

The final stage of the research is prototype functionality testing, which is conducted to assess technical feasibility, motion representation quality, and the effectiveness of digital interaction in supporting artistic communication. The evaluation is carried out through internal testing using virtual performance scenarios and system performance observation. The test results were analyzed descriptively to assess visual stability, motion accuracy, and audience engagement. This evaluative approach is important because, as noted by Zhang et al. (2025), prototype testing is a crucial stage in ensuring the readiness of digital systems before they are implemented on a large scale.

Figure 1. Virtual Arena Development Cycle Diagram

The Circular Innovation Model illustrates the development of the Virtual Arena for Traditional Arts as a continuous and iterative process. The cycle begins with the Theoretical Foundation (Deep Blue), where literature review and conceptual analysis establish principles of cultural preservation, virtual technology, and motion mechanics. These foundations guide the System Design phase (Emerald), which constructs the virtual stage, integrates motion capture, and develops interactive 3D avatars. The process advances to Prototype Testing (Purple), ensuring functional integration and simulation performance. It concludes with User Evaluation

(Amber), assessing feasibility, motion accuracy, and engagement. The evaluation results feed back into theory and design, forming a sustainable innovation loop.

Result and Discussion

The development of Virtual Arena for Traditional Arts presents a new approach to preserving traditional arts, which are increasingly threatened by the decline in physical performance spaces and the decrease in direct interaction between artists and audiences. The presence of a virtual arena is a response to changes in art consumption patterns in the digital age, where audiences are increasingly turning to dynamic and easily accessible online visual platforms. In this context, the integration of technology serves to create a space for artistic representation that not only accommodates physical limitations but also opens up possibilities for transforming the performance experience. This process of digitizing art is in line with Murray (2022) view that digital platforms are capable of creating alternative cultural ecosystems that expand public access while enriching the medium of traditional artistic expression.

The concept of motion mechanics is a fundamental component in the development of virtual stages because it allows traditional body movements to be recorded, translated, and reproduced without losing aesthetic details. In traditional art, movement is not only a technical aspect but also a representation of symbolic values and cultural identity whose authenticity must be preserved. Therefore, motion capture technology is used to capture body gestures with precision so that they can be processed into digital visualizations that retain their original quality. The use of motion mechanics is relevant to the findings of Zeng et al. (2021), who state that motion capture systems play a significant role in maintaining the authenticity of movement expressions when transferred to digital formats.

The application of 3D visualization, dynamic avatars, and virtual reality (VR)-based stages provides a multisensory experience for the audience. VR technology not only creates an immersive visual space but also allows the audience to feel an emotional closeness to the artist's performance. This makes the virtual stage not just a display medium but a medium of cultural communication that facilitates two-way interaction. Thus, the audience is not merely passive spectators but has the potential to participate in the performance process. This interactive approach is supported by Hulusic et al. (2023) research, which emphasizes that VR enhances the user experience through its ability to reconstruct art spaces in a more realistic and responsive manner.

The integration of technology in traditional art also raises questions about how to maintain authenticity in the process of translating it to a digital medium. Traditional art generally has a social and ritual context that is attached to physical spaces and indigenous cultural communities. Therefore, the development of virtual arenas needs to consider representation mechanisms that not only copy the external form but also preserve the cultural context and meaning contained in the art. This culturally sensitive approach is in line with Isa et al. (2019) idea, which highlights the importance of minimizing cultural meaning loss in efforts to digitize cultural heritage.

On the other hand, the presence of digital performance models expands the reach of global audiences without geographical limitations, giving traditional arts the opportunity to become more widely known. Digital distribution mechanisms allow international communities to access performances in real time or asynchronously. This provides a space for cultural promotion that was previously difficult to achieve through physical performances. In addition, digital platforms provide opportunities for younger generations to get to know traditional arts through a medium that is close to their daily lives. This concept is in line with Saud et al. (2023) findings, which state that the digitization of art increases the participation of young audiences because it suits their media consumption habits.

The research and development process for the virtual arena also included prototype testing to assess system stability, interaction intensity, and the suitability of visualization with the characteristics of the art. Through this testing, researchers were able to assess the extent to which motion capture technology and VR systems were able to translate the movements and atmosphere of the physical stage into virtual space. The results of these functionality tests provide a basis for refining the system design to be more responsive and better able to facilitate the needs of artists and audiences. This evaluative stage is reinforced by the views of Abdel-Razek (2020), who explain that prototype evaluation is an important step to ensure the technical performance of digital platforms before they are implemented on a large scale.

In addition, the virtual arena provides artistic experimentation opportunities for artists who want to explore new forms of performance. Artists can utilize avatar features and digital stage spaces to create visual variations that would be impossible on a physical stage. This flexibility also enables cross-cultural and cross-disciplinary collaboration without spatial limitations. This creates a new hybrid form of art, which is a combination of tradition and technology. This

phenomenon is in line with Shanshan (2024) view that digital spaces create opportunities for creative innovation through the combination of traditional symbols and cutting-edge visual technology.

The existence of digital stages also has the potential to revitalize traditional arts that are beginning to be abandoned by society. With more attractive and interactive visualizations, traditional arts have a greater opportunity to be repackaged to be relevant to the contemporary context. This effort not only targets preservation but also the re-actualization of culture in modern life. This re-actualization strategy is in line with Ng et al. (2024) thinking, which emphasizes that cultural revitalization requires creative adaptation in order to survive in a changing social ecosystem.

The development of virtual arenas also creates opportunities for cultural education activities through digital platforms. Educational institutions can utilize virtual stages as interactive learning media that allow students to observe various traditional arts from different regions without having to travel. The integration of motion capture and digital avatars provides students with the opportunity to learn body movements in greater detail and accuracy. The implementation of this technology is in line with Chen & Chu (2024) idea that VR-based learning media enhances student understanding through multisensory learning experiences.

Finally, the integration of motion mechanics, motion capture, 3D visualization, and virtual stages demonstrates that digital arenas can serve as innovative models for cultural communication in the digital age. This platform not only functions as a repository for preserving traditional arts but also as a space for transformation where artists and audiences can build new relationships within the digital arts ecosystem. Thus, the development of the Virtual Arena for Traditional Arts illustrates how technology can be an important mediator between tradition and modernity. This conclusion is reinforced by Basty et al. (2024) statement that the digital art ecosystem enables broader cultural interactions that are not limited to physical space.

Conclusion

The fusion of traditional art with digital technology demonstrates that cultural expression is no longer limited to physical spaces, but can evolve through hybrid virtual performative environments. The integration of various technologies such as motion capture, 3D visualization, and interactive platforms enables richer representations without losing the symbolic essence of traditional art. The hybrid cultural expression, which offers new creative opportunities through collaboration between traditional aesthetics and digital technology. In addition, the importance of cultural sensitivity in the digitization process, the technological innovation must continue to respect the values and meanings of the original culture. Thus, digital transformation is not only a medium for expansion, but also an adaptive and relevant means of preservation within the contemporary art ecosystem. Furthermore, the adoption of digital technology in cultural performances encourages the expansion of audience reach, especially among younger generations who are more familiar with the digital media ecosystem. The digital platforms are capable of increasing the engagement of young audiences through more interactive forms of cultural communication. At the same time, the evaluation of prototypes and technical tests, ensures that digital performative systems can function effectively and provide a stable immersive experience. The view on the importance of the digital cultural ecosystem in the future of traditional arts and is reinforced contribution regarding the accuracy of motion reconstruction through motion capture. Overall, these developments point to a more inclusive and sustainable model of cultural preservation that is capable of bridging tradition with the dynamics of modern technology.

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The authors declare no conflict of interest.

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