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Integration of Virtual Reality to Preserve Nigeria's Cultural Heritage Using Technology Acceptance Model and Constructivism Learning Theory

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Abstract

Nigeria's cultural heritage, encompassing rich traditions, historical landmarks, and intangible practices, faces threats from urbanization, globalization, and inadequate preservation efforts. Virtual Reality (VR) offers an innovative solution for documenting, preserving, and promoting this heritage by creating immersive and interactive experiences. This paper explores the application of VR in preserving Nigeria's tangible and intangible cultural heritage, including oral traditions, traditional festivals, and historical landmarks like the Sukur Cultural Landscape and Osun-Osogbo Sacred Grove. While VR has gained traction globally in cultural heritage preservation, its adoption in Nigeria remains limited due to challenges such as high costs, limited accessibility, and lack of localized content. By addressing these gaps, VR can enhance cultural awareness, engage younger generations, and boost cultural tourism. This study highlights existing works in VR applications for cultural preservation globally and identifies opportunities for tailored VR solutions in the Nigerian context. The findings emphasize the importance of collaborative approaches involving technologists, researchers, and cultural custodians to ensure effective VR integration. Ultimately, the study advocates for leveraging VR to safeguard Nigeria's cultural legacy, offering innovative pathways to promote its heritage on a global scale while ensuring intergenerational continuity.

Keywords: *virtual reality (VR), technological acceptance model, constructivism learning theory, cultural heritage*

1. INTRODUCTION

Nigeria, often referred to as the "Giant of Africa," is a nation with a rich and diverse cultural heritage [1]. This heritage is a vital part of the country's identity, encompassing historical artifacts, sacred sites, traditional festivals, oral traditions, and indigenous knowledge systems [2]. However, this wealth of cultural heritage is under significant threat [3].

Modernization, urbanization, and globalization have led to the erosion of traditional practices, while poor preservation efforts, coupled with inadequate funding and infrastructure, have left many historical sites and artifacts in a state of neglect [4]. These challenges necessitate innovative solutions to safeguard and promote Nigeria's cultural heritage. One such solution is Virtual Reality (VR), a transformative technology that has shown great promise in cultural heritage preservation globally [5].

VR offers immersive experiences that allow users to engage with cultural and historical content in ways that traditional methods cannot [6]. It enables the digital reconstruction of historical sites, the creation of virtual museums, and interactive storytelling [7]. Through VR, cultural artifacts and practices can be documented, preserved, and made accessible to global audiences [8]. While this technology has been adopted for cultural heritage preservation in several parts of the world, its application in Nigeria remains in its infancy [9].

Globally, VR has been employed to preserve and promote cultural heritage in various innovative ways [10]. For example, in Europe, VR has been used to digitally recreate iconic landmarks such as the Roman Colosseum and the Parthenon in Greece, offering users immersive, three-dimensional experiences [11]. In Asia, VR has been utilized to document and showcase ancient temples and traditional festivals, attracting tourists and educating future generations [12]. Similarly, in Africa, nascent efforts are being made to harness VR for cultural preservation [13]. For instance, South Africa has leveraged VR to digitize heritage sites, while East African countries are using it for interactive storytelling and cultural documentation. In Nigeria, however, the use of VR in cultural heritage is still emerging [14]. For instance, limited efforts have been made to digitally document landmarks such as the Sukur Cultural Landscape and the Osun-Osogbo Sacred Grove, which are UNESCO World Heritage Sites [15]. Despite these initiatives, the application of VR in Nigeria's cultural heritage remains sporadic and fragmented, with significant challenges and gaps limiting its widespread adoption.

One key gap is the limited scope of VR applications. Most existing efforts focus on digitizing

static landmarks, neglecting the dynamic aspects of Nigeria's culture, such as festivals, traditional dances, and oral storytelling [6]. Additionally, there is a lack of localized VR solutions tailored to Nigeria's unique cultural context, as most technologies are developed externally[16]. Accessibility challenges also pose a significant barrier; the high cost of VR equipment and limited infrastructure restrict the reach of these technologies, particularly in rural areas where much of Nigeria's cultural heritage resides.

Moreover, there is an absence of collaboration among stakeholders**,** including cultural custodians, technologists, and researchers, to create comprehensive strategies for VR-based preservation [17]. Documentation gaps further exacerbate the problem, with many aspects of Nigeria's intangible cultural heritage, such as indigenous knowledge systems and oral traditions, remaining unrecorded [9]. Finally, VR has not been effectively integrated into educational frameworks**,** missing an opportunity to engage younger generations and instill a deeper appreciation for Nigeria's heritage [18].

Hence, it is important to address these gaps to present an opportunity to revolutionize cultural heritage preservation in Nigeria through integration of VR technology to safeguard Nigeria's rich cultural legacy, making it accessible to a global audience while ensuring its sustainability for future generations. This study seeks to explore the potential of VR in Nigeria's cultural heritage, bridging the gap between traditional preservation methods and modern technological innovations. According to research in [19], they explored VR's role in cultural education, highlighting its application in reconstructing historical sites and enabling global access to cultural assets. The study emphasized VR's effectiveness in preserving intangible heritage such as rituals and oral traditions.

Work done in [20] reviewed software tools for creating fully immersive virtual heritage experiences. The study identified discrepancies between available technologies and their adoption for cultural heritage, emphasizing the need for user-friendly solutions. A comprehensive review by [21] examined virtual museums' potential to democratize access to cultural heritage, citing examples like the Louvre's VR galleries and interactive exhibitions.

According to research in [19], they explored VR's role in cultural education, highlighting its application in reconstructing historical sites and enabling global access to cultural assets. The study emphasized VR's effectiveness in preserving intangible heritage such as rituals and oral traditions. Also, work done in [20] reviewed software tools for creating fully immersive virtual heritage experiences. The study identified discrepancies between available technologies and their adoption for cultural heritage, emphasizing the need for user-friendly solutions. A comprehensive review by [21] examined virtual museums' potential to democratize access to cultural heritage, citing examples like the Louvre's VR galleries and interactive exhibitions.

Investigated VR's use in preserving African oral traditions was introduced in [22]. The study demonstrated how immersive storytelling captures cultural nuances while engaging younger generations. Studies by [23] reviewed VR applications in archaeology, highlighting projects that recreate lost cities and ancient monuments for research and public interaction.

Furthermore, study in [24] reviewed how VR has boosted tourism by creating virtual tours of historical landmarks, such as Angkor Wat and the Taj Mahal, increasing global accessibility. Also, [25] explored barriers to VR adoption in cultural heritage, including high costs, technical limitations, and insufficient collaboration between technologists and cultural custodians. A study by [26] analyzed VR's role in digitizing cultural festivals. It concluded that VR fosters international cultural exchange while preserving traditions for future generations.

Technology Acceptance Model (TAM) clarifies how consumers embrace and make use of technology depending on two main criteria: perceived usefulness (PU) and perceived ease of use (PEOU) was introduced in [27]. While perceived ease of use shows the perception that using a system is simple, perceived usefulness is the belief that utilising a system improves work performance.

Integrating VR technologies into cultural heritage settings can greatly improve user experiences by creating immersive surroundings that encourage interaction with historical locations. Studies reveal that people are more inclined to embrace VR if they believe it will help them grasp cultural legacy. Users' willingness to interact decreases, though, if they run against technical problems or complicated interfaces. Fostering adoption so depends on creating simple VR experiences. Applying TAM to VR in cultural heritage emphasises, in the end, the requirement of addressing both perceived utility and simplicity of use to increase user involvement and successful application of VR technologies.

Constructivist Learning Theory is quite pertinent for including virtual reality (VR) in cultural heritage education since it stresses active participation and knowledge building. Authors in [28] claims that VR technology improves the learning process using immersive settings that support interaction and simulation, therefore fostering greater knowledge and creativity among students.

Moreover, work done in [29] underlines how VR helps students close the gap between theoretical knowledge and practical experience, improving motivation and self-efficacy within a constructivist perspective. This correlation implies that VR not only promotes experience learning but also helps critical thinking and problem-solving abilities necessary to negotiate challenging cultural narratives. Offering

dynamic, context-rich environments that enable meaningful interaction with history and culture, including VR in cultural heritage education can therefore greatly enhance the learning process.

2. METHOD

This study will employ a qualitative research methodology to explore the role of Virtual Reality (VR) in preserving and promoting Nigeria's cultural heritage. Semi-structured interviews will be conducted with key stakeholders, including cultural heritage experts, VR developers, museum curators, and policymakers. These interviews will focus on their perspectives on the feasibility, challenges, and potential of using VR for cultural preservation. Focus group discussions will be organized with Nigerian youth, educators, and cultural practitioners to gather their views on VR's potential impact on cultural engagement and education. Relevant reports, articles, and studies on VR applications in cultural heritage, especially those focused on Nigeria, will be analyzed to understand existing practices and gaps.

Data Sampling: Purposive sampling will be used to select participants who have relevant experience or expertise in Nigerian cultural heritage or VR technology. This will include cultural institution staff, technology developers, and academic researchers.

Data Analysis: Thematic analysis will be used to identify recurring themes, patterns, and insights from the interview and focus group transcripts. This will involve coding responses to uncover perceptions on VR's role in cultural preservation, its accessibility challenges, and its potential for fostering cultural tourism.

3. RESULTS AND DISCUSSION

Using thematic content analysis which is a qualitative approach most suited for spotting trends in narrative data. This method encouraged thorough investigation of focus group conversations on including virtual reality (VR) in the preservation of cultural legacy. A strong basis for the study came from content analysis, first established by Stone in 1996 as a method for methodically spotting features inside a text. Examining participants' insights required their rigidity and validity. Additionally, theme was defined as content analysis as a method for explicit pattern and theme encoding of qualitative material. To include all pertinent stories, the study followed inclusive and exhaustively guidelines [30]. The categorization was led by theoretical models from Literature reviews, including Constructivist Learning Theory and the Technology Acceptance Model, therefore ensuring that results were set within the body of current research.

3.1. Steps in the Analysis

The analysis followed these steps include selection of subtext, definition of categories, sorting into categories, drawing conclusions. These are further explained in following sections.

Selection of Subtext: Key narratives on VR integration in cultural heritage were identified from the focus group transcripts.

Definition of Categories: Themes were predefined using theoretical frameworks but refined as new patterns emerged during analysis.

Sorting into Categories: Relevant sentences and quotations were allocated to themes.

Drawing Conclusions: The categorized data were descriptively analyzed, generating an understanding of the opportunities and challenges of VR integration.

3.2. Themes Identified

The analysis yielded four main themes which include perceived benefits of VR integration, challenges to implementing VR solutions, cultural awareness through technology future directions for VR in cultural heritage.

3.2.1. Perceived Benefits of VR Integration

Participants highlighted several advantages of VR for cultural heritage such as:

Enhanced Educational Experiences: VR creates immersive, engaging learning environments. As one participant noted, "*Using VR allows students to experience our culture firsthand without leaving their classrooms."*

Increased Accessibility: Virtual tours expand access to cultural sites globally. A participant stated, "*Imagine visiting Nigeria's historical sites virtually; it opens up our culture to the world."*

Global Outreach: VR fosters cross-cultural understanding. One participant remarked, "*VR can bridge gaps between cultures, showcasing our heritage internationally."*

These results fit research stressing VR's ability to improve tourism and education by means of technology immersion. While [31] ***shows how immersive technology increases ties with cultural narratives, hence enhancing travel experiences,*** [32] ***observes that digital technologies improve cultural preservation by involving learners.***

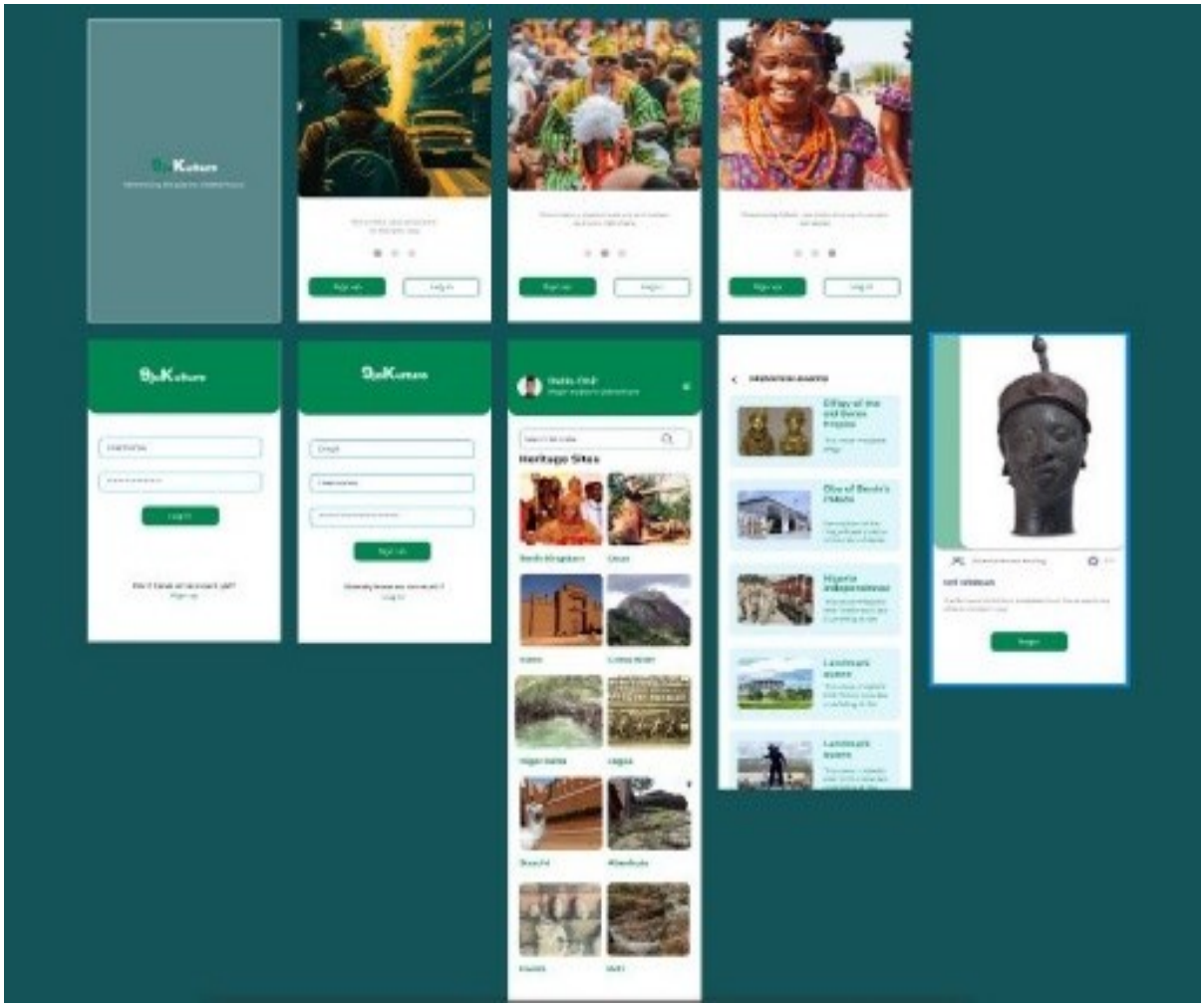

Figure 1. Prototype design for the "9jaKulture" VR application, showcasing an interface for cultural exploration

3.2.2. Challenges to Implementing VR Solutions

Despite its potential, participants identified significant barriers:

High Costs: Financial constraints limit adoption. "*The technology is great, but who will fund it?" a participant asked.*

Technical Limitations: Infrastructure gaps hinder effective deployment, especially in underserved areas. "*Not every community has access to high-speed internet or modern equipment," another participant noted*.

Training Needs: A lack of skilled personnel poses challenges for content development. "*We need training programs for local talent," a participant emphasized.*

These difficulties mirror global VR adoption hurdles but are more pronounced in Nigeria's socioeconomic setting, which calls for focused solutions like low-cost VR gear and government-private sector cooperation. While* [31] *underlines how fast urbanisation affects local customs,* [32] *underlines how much money for cultural institutions is sorely lacking, therefore hindering efforts for preservation. Strategic alliances help to address these problems, therefore enhancing the acceptance of VR technology and increasing cultural involvement in Nigeria.

3.2.3. Cultural Awareness Through Technology

VR's potential to enhance cultural awareness was a recurring theme:

Interactive Learning Platforms: Participants emphasized that VR can make cultural learning engaging. One participant stated, "*Interactive experiences make learning about our culture fun and meaningful."*

Promoting Local Heritage: Leveraging technology, VR can spotlight Nigeria's cultural diversity. A participant remarked, *"We have so much diversity; VR can help share our stories globally."*

These results complement the body of knowledge already in publication on how technology may both preserve and advance legacy and entertain younger, foreign viewers. While* [31] *shows how immersive technologies like VR encourage deeper interaction with cultural narratives, making them more relevant

to younger generations,* [32] *argues that digital technologies improve cultural preservation by improving accessibility.

3.2.4. Future Directions for VR in Cultural Heritage

To create creative VR apps, participants underlined the need for cooperative collaborations between technology businesses and cultural institutions. App concepts like Xplor show how immersive platforms might offer virtual tours, improve accessibility, and raise cultural understanding as shown in Figure 1.

Using pilot projects, testing such prototypes will improve user experiences and evaluate the success of VR projects, therefore guaranteeing culturally accurate and powerful solutions

4. CONCLUSION

This paper emphasizes how virtual reality (VR) may help to preserve and advance cultural legacy. VR can create immersive learning opportunities, improve world access to cultural locations, and promote cross-cultural understanding. These features set VR as a transforming tool for presenting Nigeria's great cultural variety. Still, there were major issues noted including poor technological infrastructure, high implementation costs, and a scarcity of qualified workers. These obstacles draw attention to the need for strategic investments, better infrastructure, and capacity-building projects to maximize VR in cultural preservation.

Funding for VR projects should be given top priority by governments and cultural organizations; they should also look for private-sector alliances to draw money. Especially in underprivileged communities, improving technology infrastructure including high-speed internet and VR-compatible gadgets is vital. Including VR in the curriculum helps to improve technological knowledge and cultural sensitivity.

Policies should support cooperation between tech companies and cultural organizations to produce original, real-world virtual reality solutions. Furthermore, stakeholders have to cooperate to create interesting VR content and set training courses to foster local content development knowledge. Focusing on easily available cultural places to show VR's potential, pilot projects can assess the success of VR initiatives and improve tactics for more general adoption.

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