



Enhancement Approach for Developing Rich 3D Experience Digital Gallery for Heritage Museums

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Abstract:

With the significant advancements in information technology, the process of digitization has become increasingly diverse and sophisticated. Some well-known museums have created virtual environments by digitizing their collections and offering pre-recorded tours through portable devices. This provides visitors with easier and quicker access, unrestricted by time or location, making it more convenient for them. Thus, a comprehensive examination of virtual museums has the potential to enhance our understanding of the value of resources for preserving cultural heritage. To bridge the gap between visitors and monuments, it is crucial to reinforce the importance of interactive activities and enhance the sense of engagement and presence. Augmented Reality can help achieve this by blending the visitor's experience with real objects and personalized interaction, enhancing the expectations of museum exhibitions. Through emotionally engaging stories, a combination of historical artifacts, characters, and activities can offer a remarkable experience. Our aim is to describe various strategies that can enhance a visitor's virtual experience in museums and art galleries using digital technology.

Key Words

Virtual reality, 3D modeling, cultural heritage,

digital collections, user experience.

1. Background

1.1. Description of problem

To bridge the gap between visitors and cultural heritage, it is essential to reinforce the importance of interactive activities and enhance the sense of engagement and presence. Augmented Reality can achieve this by blending the visitor's experience with real objects and personalized interaction, enhancing the expectations of museum exhibitions. Through emotionally engaging stories, historical artifacts, characters, and activities can offer a remarkable experience even when the cultural site is remote. Our objective is to describe various strategies that enhance a visitor's virtual experience in museums and art galleries through digital technology, improving the virtual medium's effectiveness and engagement using advanced technologies.

[1] Augmented Reality technology can enhance the visitor's experience by blending virtual content with the real world, creating an immersive and interactive environment. This can create a sense of presence and allow visitors to interact with exhibits in a way that was not possible before. By providing



interactive activities and personalized experiences, museums and cultural institutions can attract a broader audience and encourage more engagement from visitors..

Our objective is to outline diverse strategies that can enhance a visitor's virtual experience in museums and art galleries using digital technology. We seek to enhance the virtual medium by utilizing advanced technologies to create a captivating and engaging experience for visitors, with multiple opportunities for delight within museums and art galleries.

1.2. Review of work already done

Preservation involves managing change in a way that preserves, showcases, or enhances cultural and natural values. [2] The main barrier between museums and the public is the lack of interactive activities and events that can effectively engage society. To address this, museums should adopt a social role by offering interactive activities for different segments of society and tailoring their messaging to serve as culturally engaging hubs.

1.3 Rationale of this work

As technology and its societal impact continue to advance, it is important to preserve traditional customs for future generations. This is especially important in the context of museum digitization. The physical environment of traditional spaces serves as a reflection of our culture and history, showcasing how society has evolved and highlighting the communities that shape their identity. [3]

While virtual museums can provide a viewing experience of monuments, our idea aims to provide a real visit to the museum by allowing viewers to take photos, learn about the monuments' historic stories using a chatbot, and experience 3D visualization. With poor viewer participation, it becomes difficult to maintain museums. In contrast, with the advent of virtual museums, maintenance becomes more convenient and offers a realistic experience to viewers, thereby enhancing their convenience. Virtual tours also reduce the logistical complexities associated with traveling to view exhibits, making it more accessible for viewers.

1.4 Relevance to Heritage Science.

In the field of heritage science, a virtual museum plays a crucial role in preserving cultural heritage. Virtual tours offer an immersive experience that allows visitors to experience the originality of monuments and their surroundings. [4] It is important to recognize the significance of cultural heritage as it provides a unique identity for economic development and allows people to feel connected to their heritage, benefiting from its protection. However, the full potential of rich heritage is not being fully utilized by the tourism industry. [5] There are several challenges in the preservation of cultural heritage, including issues with documentation, lack of collaboration between authorities, neglect of intangible heritage, lack of awareness, the insufficient role of museums in promoting heritage, and lack of enforced regulations.

2. Challenge & Constraints

2.1 Strengths:

- Increased accessibility: Virtual museums allow people from all over the world to access collections and exhibits without physically visiting the museum.
- Cost-effective: Virtual museums can be developed and maintained at a lower cost than physical museums, making it easier for smaller museums to showcase their collections.
- Greater audience reach: Virtual museums can reach a wider audience and engage people who may not have been interested in visiting a physical museum.
- More interactive: Virtual museums can offer more interactive and engaging experiences, such as virtual reality exhibits and online games.
- Preserves artifacts: Virtual museums can help preserve rare and fragile artifacts that would otherwise deteriorate over time.

2.2 Weakness

- Lack of physical experience: Virtual museums cannot replicate the physical experience of visiting a museum, which can be a disadvantage for people who enjoy the sensory experience of seeing and touching artifacts.
- Limited social interaction: Virtual museums do not provide the same social interaction and engagement as physical museums, which can be a



disadvantage for people who enjoy the social aspect of visiting museums with friends and family.

- Limited access to certain exhibits: Virtual museums may not have access to certain exhibits or artifacts, which can be a disadvantage for people interested in specific collections.
- Technical limitations: Virtual museums are reliant on technology, which can be prone to technical issues such as server outages or slow loading times, affecting the user experience.
- Limited revenue streams: Virtual museums may struggle to generate revenue streams such as ticket sales, gift shop sales, and event hosting, which physical museums rely on to operate and maintain their collections.

2.3 Opportunities and threats:

The following points have been identified as opportunities for implementing this project, along with predicted threats and relevant solutions.

3. Description of Proposed work

3.1 Major Objectives.

- To enhance visitor engagement and create an immersive experience through the implementation of Augmented Reality.
- To provide personalized experiences for visitors by tailoring the content and tour to their interests.
- To incorporate interactive activities and events that engage a diverse range of audiences and promote the social role of museums.
- To use 3D visualization and virtual tours to provide a realistic feel of the museum experience.

3.2 Proposed system Architecture

The architecture of the Virtual Museum System, depicted in Figure 1, consists of multiple modules. The content production module is connected with the UNITY3D authoring tool and empowers educators to create diverse educational resources. It also facilitates the organization of user tasks in a given scenario, which are structured based on a pre-defined decision tree.

The level of realism in the environmental elements of the virtual gallery's spatial design is a significant concern. The virtual environment should be effective and intuitive to use, while also making efficient use of system resources. This paper argues that while using realistic metaphors can aid in transferring knowledge and skills, relying solely on realistic environmental

elements limits the potential of virtual environments to create new and innovative forms, environments, and situations. As a result, the museum design incorporates some generic real-world elements but also explores non-realistic forms and environments to enhance the exhibition experience.

Virtual Reality (VR) is revolutionizing the museum experience by providing immersive and interactive exhibits that enhance storytelling potential. With VR, exhibits can be contextualized, true scales can be illustrated, and an additional dimension can be added to museum exhibitions, creating a more meaningful and genuine connection with viewers. Furthermore, virtual tourism technology offers numerous marketing opportunities, enabling potential visitors to experience a 360-degree view of a property and its facilities. This immersive experience increases the likelihood that viewers will want to visit the property in person and makes it easy to share the virtual offerings with friends and family.

The use of advanced 3D technology has revolutionized the way sellers and marketers engage with their audience. By creating stunning 3D visualizations through interactive maps, 360° views, virtual reality, augmented reality, and 3D virtual tours, businesses are able to captivate new audiences and provide them with an immersive experience accessible from anywhere in the world.

A key factor in the success of virtual tours is the user experience, as the platform must provide a satisfying experience for users. A user-friendly interface is essential, allowing users to easily navigate the website and find the products or services they seek. Interactivity is a crucial element of virtual reality, consisting of three components: speed, range, and mapping. The speed of the virtual world's response to user actions is critical for creating an interactive simulation, as quicker response times enrich the environment.

Data visualization involves creating visual representations of data through charts and graphs to effectively communicate insights and patterns. These visualizations are particularly useful in the realm of business intelligence (BI), where they aid in making informed decisions based on data analysis.



S&T component in the project.

Software development kits (SDKs) offer developers a

3D Object Trackingtools

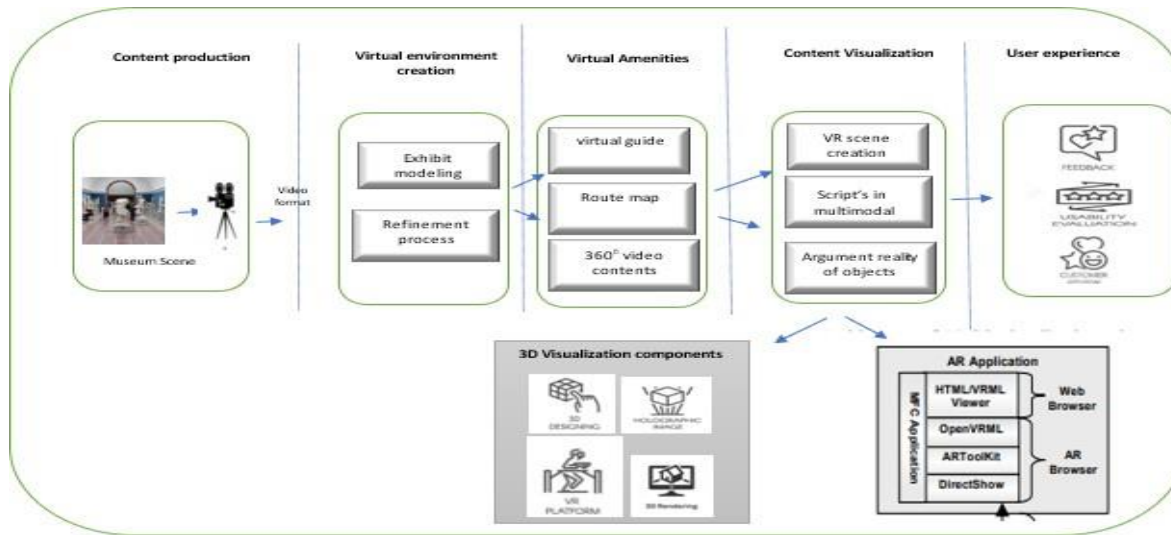
Opportunities	Threats	Resolved By
Imagine a virtual encounter that integrates the advantages of visiting a traditional museum.	Complete digitalization	Augmented reality techniques
Incorporation of personalization.	confront the issues of privacy	Granting personalized login credentials.
Navigation video content in 360 Degree	Diverse 3D viewpoints.	Graphical algorithm
detailed history in text form	Text summarization	wiki function and message boards
Exhibit of Historical artefact in an effective way	Providing access to the relevant site	Pleasant experience about cultural heritage through storytelling and videos
Guidance through Bot	Creating highly trained bot and lack of network connection	Chatbot- for queries, Route map for navigation
Recommendation system based on feedback and survey [6]	Validating historical information. of views, Predicting viewers interest.	Devising prediction Algorithm.
Creation of Virtual Museum for disseminating our cultural heritage	Due to N number of visitors may be a bandwidth drop, delay in loading images, poor image quality	Limiting the users with time slots.
Fund for museum welfare association	Payment Transaction failure	Secure transaction via Proper payment channel
Frequent updation through the curatorial staff [7]	Challenges related to data integrity, replication, and outdated information.	Spirit of innovative technology

range of pre-designed solutions and shortcuts to speed up the development process. This approach saves time and allows for a more efficient use of resources in developing augmented reality simulations, which can be a complex undertaking. With VR technology, training can be conducted in a simulated environment, offering many of the benefits of physical training without the inherent safety risks. If a trainee becomes overwhelmed or uncomfortable, they can easily remove the headset or adjust the experience to their comfort level.

- open source augmented reality software. - GADS, Kamisha Soft,Mixare ,Holokit
- SLAM (Simultaneous Localization and Mapping) Support
- Augmented Reality Software includes Unity, ARKit, ARCore
- Virtual Reality Software includes 3ds Max Design, Unity and Maya
- Digital Transformation Tool - APACHE HADOOP

Fig 1: System architecture of AR/VR based system

Table 1: Opportunities and threats of A R/VR based Applications



atabase
connectivity
ategorization
of content
igital
archives
& libraries
Module

-2 : Visualization module

- Rendering in 3D modelview
- Graphics and animations
- Morphing – Interactive 3D graphics
- Multimedia views

Module -3 : AI Interface

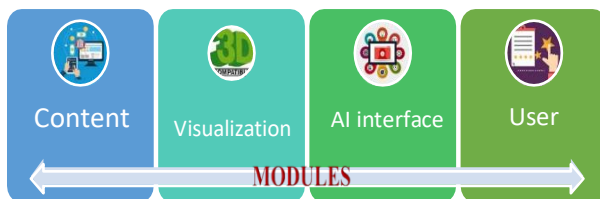
- Creating living background
- Interaction and interfacing
- Communication and dialogue

Module -4 : User Experience

- Collecting feedbacks
- Generating recommendation system
- Monitoring performance review
- Report analysis

3.4 Methodology detailing stepwise activities and sub-activities.

Fig 2: List of modules of AR/VR based



system

Module -1 : Content production

- Digitalization – resource collections

4. Impact and Risk Analysis

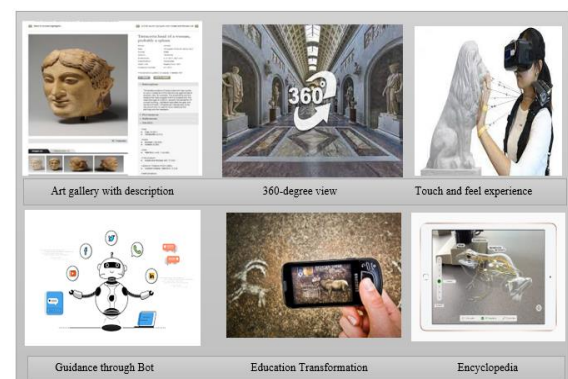


Fig 3: Enhancement features of Virtual Museum [8]



[9]

4.1 The effects of social and economic factors of Virtual Museum:

- Utilizes digital technology to deliver an immersive experience
- Allows for convenient virtual visits without the constraints of physical travel
 - Enhances access to information and reduces time constraints for visitors
 - Provides cost efficiency, reduced crowding, and promotes social distancing
 - Protects heritage assets from physical damage through virtual visits
 - Contributes to the education system and enhances cultural awareness
 - Expands the reach of cultural heritage to a global audience through virtual visits
 - Offers leisurely and satisfying experiences without time constraints, leading to memorable experiences

4.2 Identified Risk Analysis:

Planning and initiation

Planning VR projects can be a difficult task, given the wide range of content that can be involved. However, a good starting point is to identify the latest VR trends, set clear milestones and due dates, determine resource requirements, and outline the project's scope. [11]

Defining requirements

Defining the essential requirements involves clarifying the goals of the project, agreeing on specifications, listing the tasks that need to be accomplished, and assigning responsibilities to team members.

Project execution

The successful execution of a project involves several crucial stages, including:

- Planning the user experience and designing the user interface
- Developing 3D designs
- Creating the Virtual Reality experience and developing for mobile devices
- Providing weekly project status updates
- Ensuring quality assurance
- Performing user acceptance testing to verify that the end product meets the user's needs and expectations.

Launch and iteration

After successfully launching the initial experience, the next stage involves ongoing iteration and improvement based on user data capture and feedback. This phase comprises various essential elements including several important components such as project deployment, client training, post-project review and feedback, measurement and reporting, and iteration. During project deployment, the experience is made available to the public or the intended audience. Client training may be necessary to ensure that the client can operate and manage the experience effectively. Post-project review and feedback provide an opportunity to reflect on the project's success and areas for improvement. Measurement and reporting involve gathering and analyzing data on user engagement and satisfaction to inform future iterations. Finally, ongoing iteration allows for the continuous improvement of the experience based on user feedback and data analysis.

Top of Form

4 Conclusions

In summary, this paper presented a more immersive and interactive experience for visitors, making the online museum a more engaging and informative platform for learning about history and culture. By incorporating these visualization technologies and components, the Virtual Museum website can deliver a rich and convenient experience to visitors, reducing time complexity and providing a more cost-effective and environmentally friendly alternative to physical museum visits. Moreover, the use of virtual reality and augmented reality technologies can also contribute to the education system and spread cultural heritage to a wider audience. The project planning, execution, and testing stages are crucial for ensuring the successful launch of the virtual museum, followed by ongoing iteration and user data capture to continuously improve the user experience.

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