

Interior Design of Museums Display Through Advanced Technologies in An Attractive Journey for Visitors

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-----ABSTRACT-----

This study explores the transformative potential of integrating advanced technologies, particularly Extended Reality (XR-AR/VR), into the design of museum exhibits. The goal is to redefine user experiences and revolutionize interior museum design. Introducing these advanced technologies into the museum industry is poised to alter future designs significantly. In response to the challenge of attracting and engaging audiences, integrating augmented and virtual reality into museum designs is a promising strategy to foster connections between visitors and concepts, history, and nature. The study employs a descriptive-analytical approach to elucidate and evaluate the transformative impact of advanced technologies on creating compelling visitor experiences that transcend physical location. Many museums strive to provide visitors with interactive experiences, leading to exploring modern technologies and tools within museum settings. These technologies enable museums to present information in a captivating manner, thereby encouraging visitor participation. The research findings suggest that extended reality (XR) can significantly enhance visitor engagement by offering excitement, adventure, gaming, and interaction within the visitor experience. In conclusion, the study asserts that these techniques stimulate visitors' imagination and curiosity, offering a hopeful outlook for the future of museum design. Museums can harness augmented reality and virtual reality applications to enrich their exhibitions.

KEYWORDS; -Extended Reality (XR) Technologies, Augmented Reality (AR), Virtual Reality (VR), Display Technology, Interactive Interior Design for Museums, Visitor Journey Design.

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I. INTRODUCTION

Every human has an instinct to comprehend stories, and from a very young age, humans form specific expectations about the plot and content of traditional stories. Since human perception and learning of objects are influenced mainly by narrative, using narrative as a teaching technique in an educational setting would be beneficial. The research suggests innovative approaches to interactive display layouts in museums to improve work and experience, thinking, and distinctive personal experiences, all of which contribute to long-lasting learning. Museum exhibitions can be categorized into three main types: traditional, interactive, and interactive/narrative/virtual. Mobile devices enable visitors to engage in creating narratives, leading to the emergence of a new realm of virtual museum expansions. Designers can generate numerous exhibition halls with limitless stories tailored to diverse display styles and visitor demographics.[1]In an increasingly digital world, virtual reality (VR) and augmented reality (AR) technologies are revolutionizing how we interact with information and entertainment.[2]Users get an enhanced experience using an XR-enabled phone/tablet or XR smart glasses/headphones. [3] Several essential design strategies and factors motivate visitors to experience the museum. This study determined augmented reality's impact on visitors' experience in museums. Visitors enjoy a greater sense of familiarity and attraction.[4]Advanced museum technologies enable visitors to use smartphones or tablets to interact with displays and watch a static scene come to life. [5]Augmented and virtual reality add worlds to museums by creating engaging and unique experiences for their visitors. By applying these technologies effectively and strategically, designers can deliver unforgettable experiences in the digital age. [6]Today, one of the museums' most significant challenges is getting people to visit and participate. Virtual reality and augmented reality technologies are two examples of potent, incredible, and innovative approaches that help educate, inform, and engage audiences. [7]

The study investigates how virtual and augmented reality might influence visitors' art and museum history knowledge. This article focuses on designing an exciting and engaging journey for visitors. In addition, the study explores the use of different technologies in museums. The study aims to investigate advanced technologies and various tools inside museums and transform the visitor's experience into an enjoyable journey. Moreover, the research studies the importance of virtually displaying artifacts and art inside museums in three-

dimensional form or viewing via smart headphones or phones/tablets that support augmented and virtual reality. Through technology and interactions between visitors and displays, the research highlights the importance of creating a thrilling and alluring experience that encourages visitors to explore more museums. The study employs a descriptive-analytical approach to examine the impact of advanced technologies on visitor experiences, aiming to motivate interaction with various displays.



Figure 1 (illustrates the interaction of visitors in the augmented reality museum display). [8]

Visitors interact with the virtual elements within an augmented-reality museum display. This can involve moving around the exhibit, using AR-equipped devices to view additional information, visualizing historical scenes, or participating in interactive experiences that blend the virtual and physical worlds. The interactive nature of augmented reality enhances the museum experience by providing new ways for visitors to engage with art, history, or other content (Figure 1).

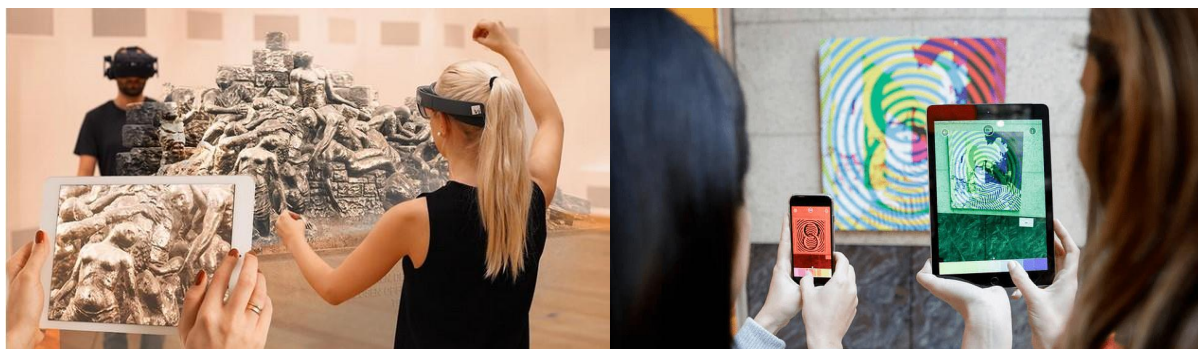


Figure 2,3(illustrates the different augmented reality techniques in museum design. It shows Projection-based AR projects digital content directly onto surfaces within the museum space).[9]

Museum design incorporates augmented reality techniques to enhance visitor experiences. Marker-based AR triggers virtual content using specific markers; AR uses location or image recognition, and projection-based AR projects digital content onto surfaces. These methods present information innovatively and bring historical artifacts and exhibits to life, bringing museums' collections to life and providing visitors with a dynamic and engaging experience (Figure 2,3).

1.1 Virtual Reality and Augmented Reality Technology in Museums

There is a trend to increase virtual and augmented reality use in museums. Augmented reality applications in museum exhibition spaces enhance the experience by overlaying new information on existing environments, blurring the line between reality and computer-generated information. [5]

1.2 Definition of Augmented Reality Technology

Augmented reality seems suitable for reconciling digital and natural environments, as it visually imposes information directly on the exhibition while the user looks at the screen.[6]There are three characteristics of augmented reality:[4]

1. Integration of real and virtual objects.
2. Collaboration between real and virtual objects.

II. Design Experience and Attractive Journey for Visitors in Museums Design

Virtual and augmented reality can enhance museum experiences by providing lifelike visuals and three-dimensional sculptures. Museums can design engaging experiences using interactive exhibits, immersive storytelling, technology, multisensory experiences, and reflection spaces. These methods create diverse and enriching experiences, providing a deeper understanding of exhibits and enhancing visitors' appreciation of artifacts and information. [10]

1	Storytelling	Creating a captivating narrative about a specific subject attracts large audiences to Augmented Reality (AR) museums.
2	Art Information	Enhancing exhibit content and significance gives visitors a deeper understanding of the narratives associated with the displays.
3	Interactive Environment	We are fostering audience engagement by designing interactive displays to engage them.

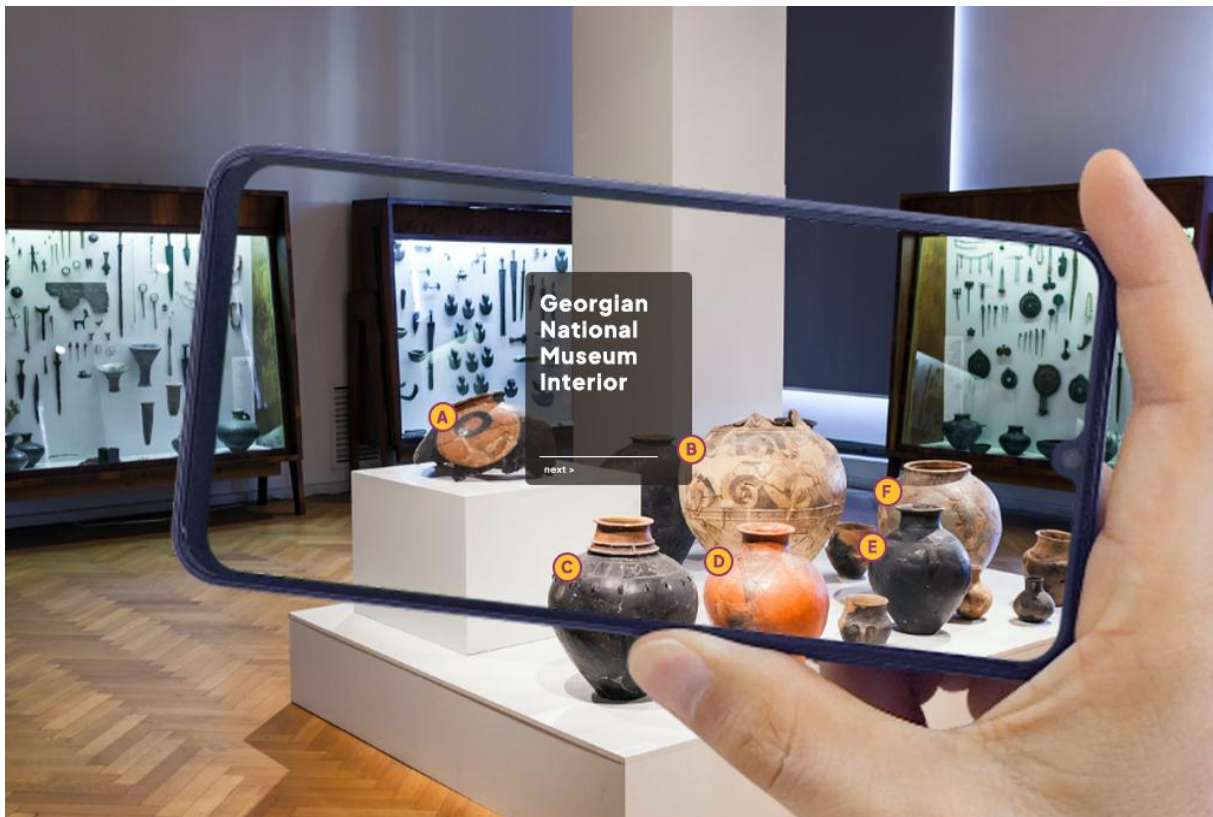


Figure 4 (Illustrates the Augmented Reality technology by scanning the display to get all the information about arts and crafts in music. The interactive nature of augmented reality allows for new and immersive engagement with exhibits). [11]

2.1 Augmented Reality Storytelling in Interior Design

The historical museums offer a plethora of captivating narratives associated with the exhibited items. Incorporating interactive animations, simulating the precise scenes or moments from the stories, enriches the storytelling experience, rendering it more lifelike and engaging. [13]Visitors often encounter difficulty navigating expansive museum settings. Consequently, there exists a significant demand for enhanced mobility.

Custom projects can be developed to meet these needs, whether the objective is to employ augmented reality for gaming, storytelling, presentations, or visualization purposes.[12]

On the other hand, augmented reality art galleries are transforming towards digitalization, promoting a new contemporary way of experiencing art. This technology adds visual illusion and 360-degree augmented reality, enhancing the relationship between artists and viewers. Despite physical distances, it improves understanding and evaluation of art and enhances the exhibition experience. Once predominantly associated with gaming, augmented reality has significantly influenced the art world. Its capacity to introduce surprise, entertainment, and heightened visitor engagement has expanded the horizons of artistic expression. Augmented reality facilitates authentic and personalized experiences, a trend expected to progressively supplement and potentially supplant traditional exhibitions within the art world. Established immersive technology can be effectively integrated into art galleries, promising a distinctive and captivating experience for gallery visitors.[9]



Figure 5 (Illustrates the design of storytelling through technology in the museum). [13]

The "design of storytelling through technology in the museum" involves incorporating digital tools like interactive displays, augmented reality, virtual reality, and multimedia installations to enhance the presentation and communication of stories and information in a museum setting. This approach creates dynamic and immersive experiences, enriching visitor engagement and learning opportunities and improving the overall visitor experience.

2.2 Art Galleries with Technology

Augmented reality (AR) technology allows for the simultaneous viewing of multiple artworks and enables free navigation within a given space facilitated by AR glasses. Integrating augmented reality (AR) in art exhibitions presents many advantages within museums or other exhibition settings. AR allows designer to disperse audiences to interact with paintings, with each painting's explanation and character bringing stories to visitors. Artist Rodney Graham's online exhibition offers a close-to-reality experience.[9]

An interdisciplinary team of interior design, science, exhibition design, graphic design, scenography, communications, multimedia, carpentry, taxidermy, and multi-mechanics work together to plan, design, and create exhibitions. In the past, complex visualizations involving Photoshop or templates had to be developed to help make all the critical decisions when organizing an exhibition, from initial planning to execution. However, three-dimensional models are deployed these days to plan and build display cases and exhibitions, and augmented reality (AR) can significantly simplify this process[14].

The study explores the use of augmented and virtual reality in museum design and visitor interaction. It discusses various techniques, storytelling through technology, and the interaction between visitors and museum displays. It touches on integrating technology in art galleries to provide information. The comprehensive exploration of the role of technology in enhancing the museum experience is a collection of ideas related to incorporating technology into the museum and gallery experience (Figure 6,7).

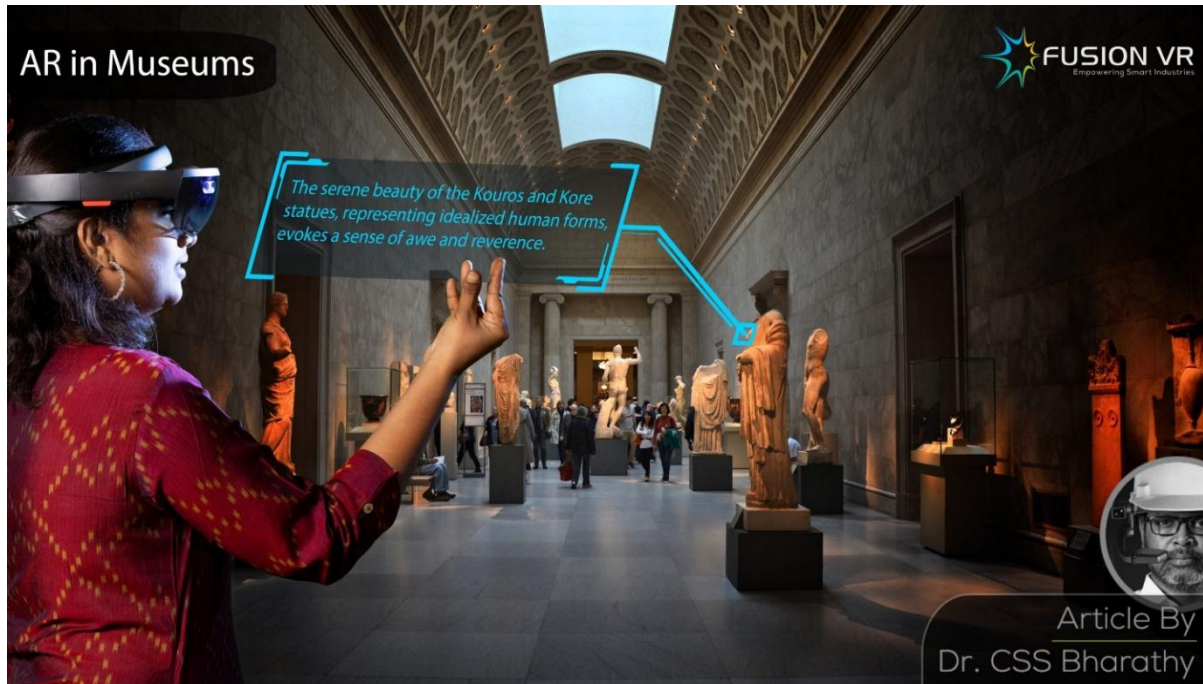


Figure 6 (Illustrates the technology of AR in museums. These techniques present information innovatively and bring historical artifacts and exhibits to life through digital means). [15]



Figure 7 (Illustrates technologies that help bring the museum's collections to life, providing visitors with a dynamic and engaging experience). [16]

2.3 Visitor Engagement Using Interactive Environment

The digital environment can interact with visitors, guide them to the area of interest, or take them to the attraction. This application improves the visitor's experience by efficiently providing contextual information based on their preferences. [3] Maintaining visitor engagement is crucial in designing museum experiences. QR codes and applications that collect random goodies can enhance the visitor experience, and group visits can also improve engagement.

1	Interaction Environment	Virtual and augmented reality overlay natural elements, allowing users to interact with both worlds, while Virtual Reality immerses users in a virtual environment without real-world interaction.
2	Immersion Level	Virtual and augmented reality enhance immersion, connecting users to physical reality through digital elements.
3	Devices	Smartphones and tablets can be utilized for virtual and augmented reality, while helmets or special glasses connected to a computer or used independently are required for virtual reality.

2.3.1 Designing Various Games in the Interior Design of Museums

Emerging technologies are generally introduced into the museum environment in several stages, from displaying textual information about the artwork as virtual labels (digital messages) superimposed on the camera view. It also provides users with information that helps them understand the features of the artwork. Entertainment is a significant factor that museums have adopted. The display hall system offers the following functions: Displaying virtual text to interpret the artwork and displaying a three-dimensional model to enable users to manipulate it.

These practical activities contribute to a more compelling experience in museum design. However, a more comprehensive range of topics is necessary to learn how augmented reality technology can help visitors find objects and navigate museum spaces and how this facilitates or deepens their understanding of artworks. Designers can incorporate augmented reality into the context of storytelling in museums. Advanced technologies are a powerful way to shape the visitor experience. [6]

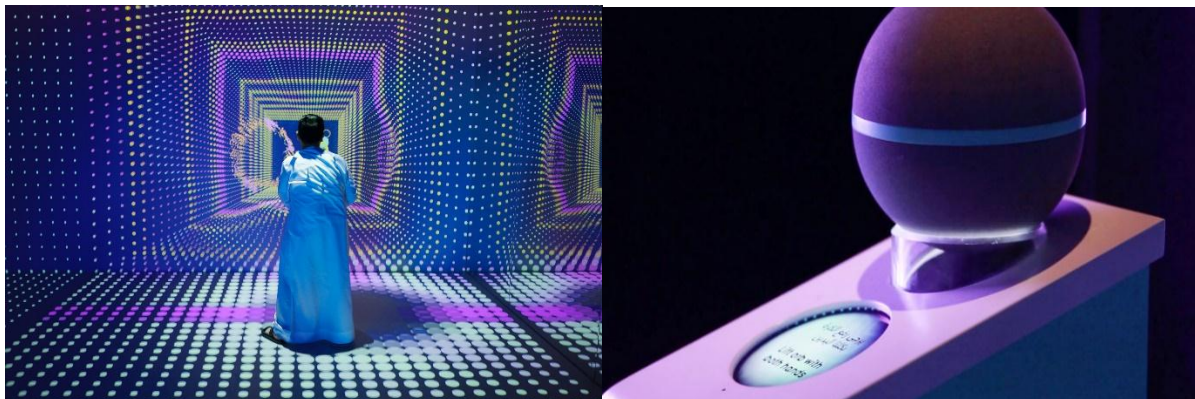


Figure 8,9 (Illustrates Museums can enhance visitor engagement and understanding by designing interactive games, such as scavenger hunts or puzzle challenges, to enhance the experience and appeal to a wide range of visitors, including families and adults). [17]

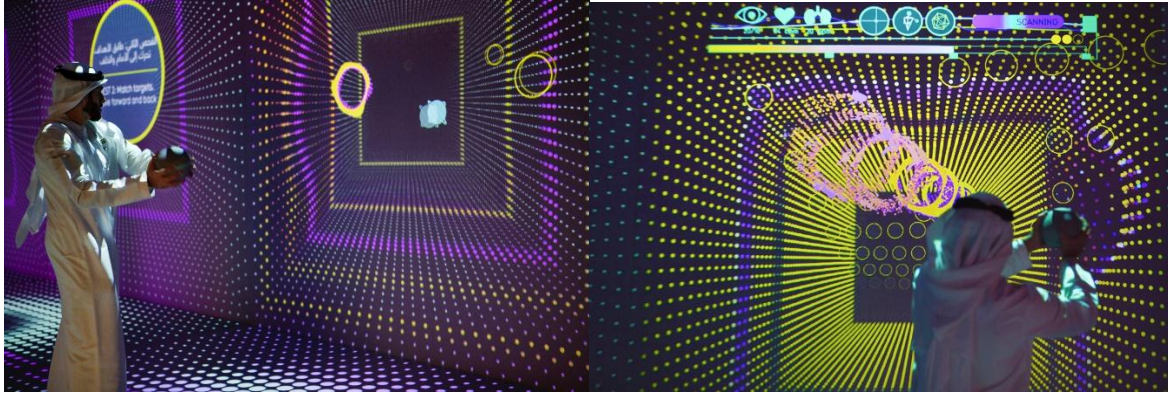


Figure 10,11 (Explores how technology can enhance the museum experience). [17]

2.3.2 Displaying Animation in Interior Design for Museums

One of the most exciting features of technology applications within museums is the three-dimensional modeling and animation of objects. [18]



Figure 12 (Illustrates the 3D dimensions of animation objects to create exciting features of technology applications within museums). [19]

III. Museum Planning and Augmented Reality Technology

AR will enable curators and designers to visualize and experiment with layouts, interactive elements, and storytelling techniques in a virtual space before implementing them in the physical museum. This will enhance visitor engagement and create dynamic educational experiences. Augmented reality museums are likely to gain greater importance in the future. They create visceral realism in exhibits and can also be used to discuss topics of great interest, such as climate change. [10] Therefore, augmented reality can be the best step forward in making museums interactive and exciting environments for all age groups. [7]



Figure 13,14(Illustrates the interior design of the display with emerging technology).[17]

This exhibition displays the UAE's vision for empathetic and proactive government services in a hyper-urban future. The first exhibition was a public-facing government services laboratory where ministries presented prototypes of new services with citizen participation. The Museum represents a significant design-led approach to policy and innovation, using design, prototyping, and insight to create real examples of change by engaging citizens and governments in a new way to address tomorrow's critical issues. [17]



Figure 15,16(Illustrates the interaction between visitors and museum display through technology). [17]

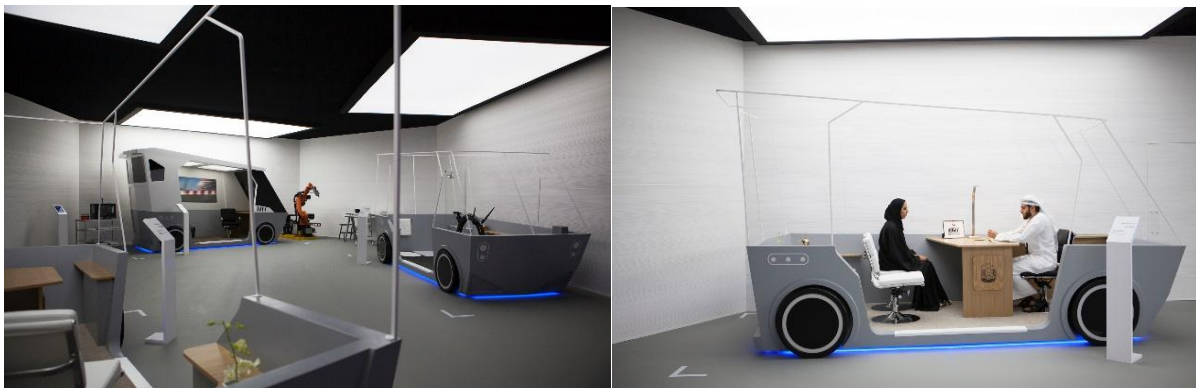


Figure 17,18(Enhances visitor engagement and creates dynamic, exciting, enthusiastic, interactive, educational experiences.). [17]



Figure 19,20(Illustrates designing embracing journey for visitors through museum environment). [17]

3.1 The Main Factors When Applying Augmented Reality in Museums

The main factors that matter when implementing augmented reality are the type of museum and visitor experience. [20] Several factors must be considered to implement augmented reality in museums successfully. These include the technological infrastructure needed, the design of AR content that complements exhibits, accessibility for all visitors, and the educational goals of AR. Cost, maintenance, and user experience should also be considered. By addressing these factors, museums can effectively leverage augmented reality to enhance visitor engagement and educational experiences, ultimately leading to a more engaging and informative experience.

These digital innovations can include virtual reality experiences, interactive touchscreens, augmented reality features, and multimedia installations. They aim to bring exhibits to life and provide a more enriching and interactive learning experience. By leveraging technology, museums can create dynamic and memorable experiences that appeal to a broader audience, making the museum-going experience more dynamic and unforgettable.

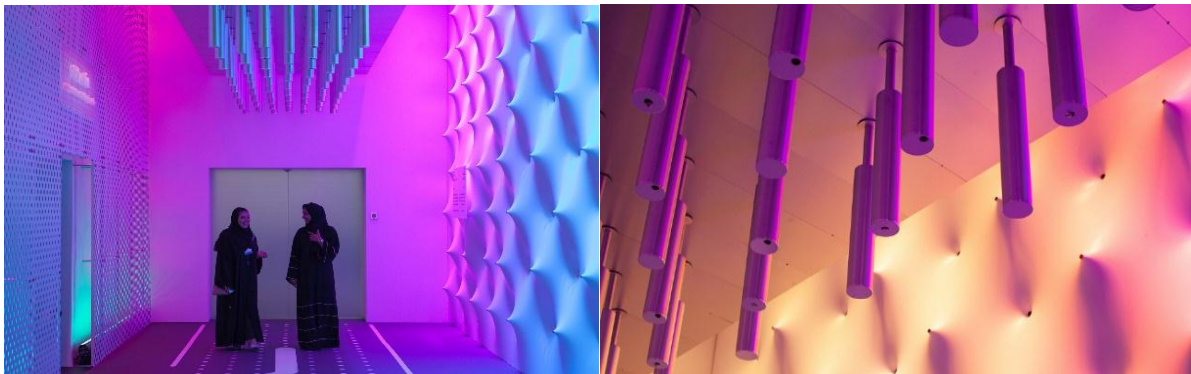


Figure 21,22(Illustrates enriching and interactive learning experience). [17]

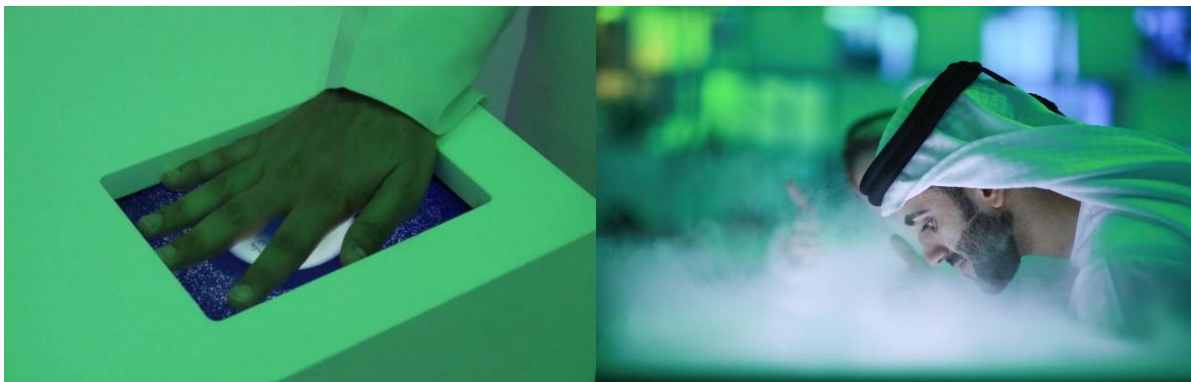


Figure 23,24(Illustrates leveraging technology to create dynamic and memorable experiences that appeal to a broader audience). [17]



Figure 25,26(illustrates the interior design of display through fostering the technology). [17]



Figure 27,28(illustrates an interactive display to present the information to visitors in an exciting way). [17]



Figure 29,30(illustrates the dynamic technology in display design). [17]



Figure 33,34(illustrates 5G technologies integrated into museum interior design to attract visitors). [13]

The Augmented Reality (AR) application can leverage existing models, avoiding the need for additional production work involving complex Photoshop visualizations. [14] The design is an experiential and interactive technology museum featuring virtual, augmented reality, artificial intelligence, and 5G technologies. SK Telecom is a South Korean wireless telecommunications company with an experiential and interactive technology museum. Designed using the most advanced technologies, the interior designer invites visitors to experience the innovative changes that 5G technology will soon bring to their lives, as well as many future technologies that have the potential to address problems that humanity may face. [21]

Interior Planning Using Virtual Objects in the Real World involves using virtual or augmented reality technologies to plan and visualize interior design elements in museum spaces. This approach allows designers, architects, and clients to experience and interact with virtual furniture, display, decor, and other design elements in the actual environment. It will enable them to experiment with different layouts, styles, and colors, ultimately leading to a more accurate understanding of the final design.



Figure 35,36(illustrates augmented reality technologies to plan and visualize interior design elements). [13]

3.2 Museum Display Design Trends in the Digital Age

Many museums, such as art museums, natural history museums, and science and technology museums, can integrate technology and provide great experiences for visitors. They can also use new mobile technology to attract and engage visitors. Immersive experiences in museums increase visitors' effectiveness in learning. New technologies have changed the type of experience for visitors.

The visit is no longer passive and has become engaging and interactive. It is not based solely on observing the discoveries or works on display but also on the opportunity to choose the content they experience and experience it with their knowledge. [22]

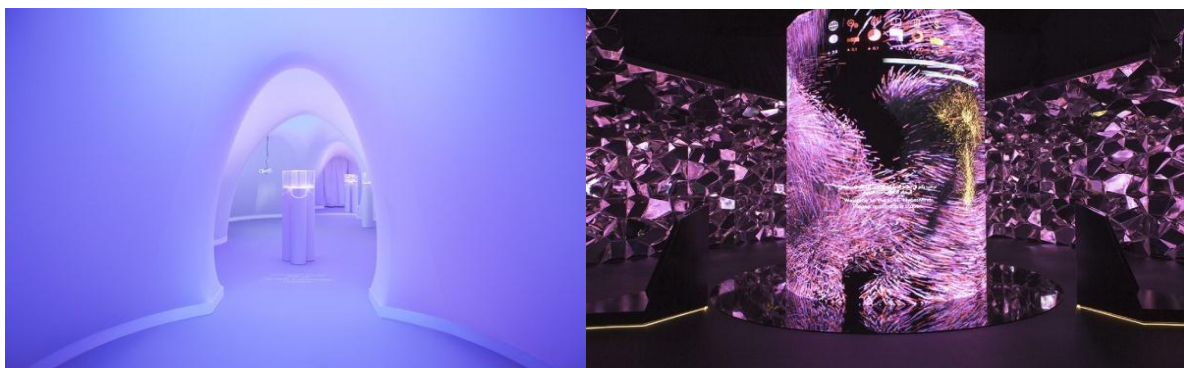


Figure 37,38(illustrates the interior design of Future Museum in Dubai). [23]

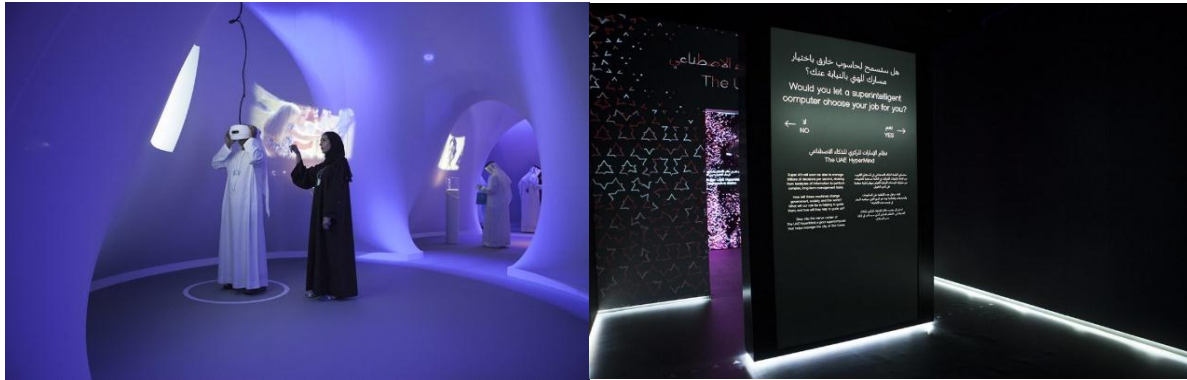


Figure 39,40(Illustrates the technology of future museums). [23]

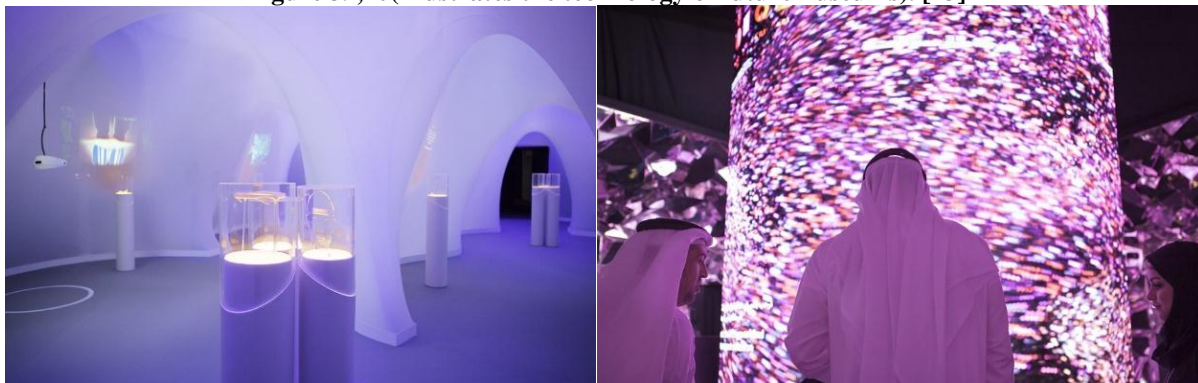


Figure 41,42(Illustrates interactive display in the future museum). [23]

IV. RESULTS

Museum exhibitions can be categorized into three main types: traditional, interactive, and interactive/narrative/virtual. New technologies have changed the visitor experience. Advanced technologies can powerfully shape the visitor experience. One of the most exciting features of technology applications within museums is the three-dimensional modeling and animation of objects. Augmented reality can integrate real and virtual objects. Museum design incorporates augmented reality techniques to enhance visitor experiences. Immersive experiences in museums increase visitors' effectiveness in learning. Finally, the study highlighted the importance of creating a thrilling and alluring experience that encourages visitors to explore more museums.

V. CONCLUSION

AR will enable curators and designers to visualize and experiment with layouts, interactive elements, and storytelling techniques in a virtual space before implementing them in the physical museum. Therefore, augmented reality can be the best step forward in making museums interactive and exciting environments for all age groups. By leveraging technology, museums can create dynamic and memorable experiences that appeal to a broader audience, making the museum-going experience more dynamic and unforgettable. The study explored the types of digital tools used in museums and the use of augmented and virtual reality in museum design and visitor interaction. In conclusion, the study discussed various techniques, storytelling through technology, and the interaction between visitors and museum displays. These techniques stimulate visitors' imagination and curiosity, offering a hopeful outlook for the future of museum design. Museums can harness augmented reality and virtual reality applications to enrich their exhibitions. Virtual and augmented reality technologies embrace museum experiences, visuals, and three-dimensional displays to engage visitors using interactive exhibits, immersive storytelling, technology, and charming experiences in interior spaces.

REFERENCE

- [1]. Kahr-Højland, A.J.N.M., *Museums and Learning*. 2007(1): p. 3-3.
- [2]. Nivelics. *Virtual and Augmented Reality*. 2024; Available from: <https://www.nivelics.com/en/blog/virtual-and-augmented-reality-what-it-is-and-how-to-apply-it-to-my-business>.
- [3]. XRPractices. *The Reality of Museum*. 2022; Available from: <https://medium.com/xrpractices/extending-the-reality-of-museum-eb953a2f35c9>.
- [4]. Chen, C.-A. and H.-I.J.S.P. Lai, *Augmented Reality in Museums*. 2021. 104(3_suppl): p. 00368504211059045.
- [5]. Ding, M.J.M., a.r.A.c.o.e.f.t.a. management, and t. laboratory, *Augmented Reality 2017*: p. 1-15.
- [6]. Ghouaïel, N., et al., *Mobile Augmented Reality in Museums*. 2017. 17(1): p. 21-31.

- [7]. ROY, A. Augmented Reality. 2019; Available from: <https://www.redappletech.com/how-augmented-reality-helps-in-transforming-museums/>.
- [8]. Valeri, F. AR Technology. 2018; Available from: <https://www.linkedin.com/pulse/picture-augmented-reality-as-a-service-boosting-museum-fabio-valeri>.
- [9]. Technologies, I. Art Galleries. 2024; Available from: <https://www.inglobetechnologies.com/art-galleries-meet-augmented-reality/>.
- [10]. Plugxr. Augmented Reality Museums. 2023; Available from: <https://www.plugxr.com/augmented-reality/augmented-reality-museums/>.
- [11]. Assemblrworld. AR for Museums. 2023; Available from: <https://www.assemblrworld.com/blog/augmented-reality-for-museum>.
- [12]. Assemblrworld. Augmented Reality for Museums. 2023; Available from: <https://www.assemblrworld.com/blog/augmented-reality-for-museum>.
- [13]. Foundation, D.F. Museum of The Future: Climate Change Reimagined. 2017; Available from: <https://frameweb.com/project/museum-of-the-future-climate-change-reimagined>.
- [14]. Ergon. Augmented Reality. 2019; Available from: <https://www.ergon.ch/en/news/2019/augmented-reality-exhibition-planning-made-easy>.
- [15]. Dr. CSS Bharathy, F.F.V. AR 2023; Available from: <https://www.fusionvr.in/blog/2023/06/05/these-uses-of-ar-in-these-museums-will-shock-you/>.
- [16]. Freekteunen. Vision At Museum. 2024; Available from: <https://www.wintor.com/post/utilizing-apple-vision-pro-at-a-museum>.
- [17]. Prime Minister's Office, U. Prototyping the future city. 2017; Available from: <https://www.tellart.com/projects/mofgs-2015>.
- [18]. SA, A.S. Heraklion Museum AR. 2023; Available from: <https://fourthdesign.gr/en/portfolio/augmented-reality-apps-heraklion-archaeological-museum/>.
- [19]. Romano, C. Museums Experimenting 2020; Available from: <https://immerse.news/how-are-museums-experimenting-with-immersive-technology-f52612504e2>.
- [20]. Morozova, A. Augmented Reality in Museums. 2024; Available from: <https://www.jasoren.com/how-to-use-augmented-reality-in-museums-examples-and-use-cases/>.
- [21]. Mitchell, B., T.um, an experiential and interactive technology museum, features VR, AR, AI, and 5G. 2017.
- [22]. Wang, S., D. Zhao, and S. Lu, design reshape the relationship between museum collections and visitors in the digital age. 2023.
- [23]. Tellart, Museum of the Future Dubai, UAE. 2016.
- [24]. Foundation, D.F. Our future life with intelligent machines. 2017; Available from: <https://www.tellart.com/projects/museum-of-the-future-machinic-life>.