دمج الذكاء الاصطناعي والتراث الرقمي في تصميم المتاحف

Ntegration of Artificial Intelligence and Digital Heritage in Museum Design

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Abstract:

Artificial intelligence has been able to spread throughout life. The research is based on the importance of artificial intelligence and its various applications to protect cultural heritage in museum design. Many images, artifacts, sculptures, or cultural remnants can be preserved and enhanced digitally. Hence, the research demonstrates strategies and results in preserving and digitizing cultural heritage in museums, where history is lost daily due to war, theft, negligent development, and negligence. Great designs can be obtained by applying artificial intelligence to heritage preservation. The research aims to enhance the importance of digital heritage in museum design through artificial intelligence. This leads to a focus on digitally harnessing artificial intelligence's power in museums. Therefore, the research sets out methodologies and rules for a descriptive-analytical approach to describe and analyze digital innovations such as interaction, participation, and storytelling in designing museums to make them more attractive for visitors and combine artistic, historical knowledge, learning, and technology through artificial intelligence. The main concern is to enhance the impact of artificial intelligence on the development of art and interior design. Consequently, it helps restore the history of civilizations, display them digitally in museums, and create new art that keeps pace with the digital age. In conclusion, artificial intelligence is the way to the future, and the research emphasized its role in developing heritage through digital display in museums. The impact of digital displays using artificial intelligence has changed the museum's interior design and attracted many visitors to interact with this technology. Besides, artificial intelligence can reveal new insights into historical and cultural events through a different vision of museum design.

Keywords: Artificial Intelligence, Digital Heritage, Museum Design, Interior Design Interaction.

الملخص

تتمتع كل دولة بثقافة وتاريخ ولغة مميزة وفريدة من نوعها. لقد تمكن الذكاء الاصطناعي من الانتشار طوال الحياة. ويرتكز البحث على أهمية استخدام الذكاء الاصطناعي وتطبيقاته المختلفة لحماية التراث الثقافي في تصميم المتاحف. يمكن الحفاظ على العديد من الصور أو المصنوعات اليدوية أو المنحوتات أو البقايا الثقافية وتحسينها رقميًا. ومن هنا، يعرض البحث الاستراتيجيات والنتائج في الحفاظ على التراث الثقافي ورقمنته في المتاحف، حيث يضيع التاريخ كل يوم بسبب الحرب والسرقة والإهمال. ويمكن أيضًا تجميع المكونات في المتاحف حول العالم باستخدام الذكاء الاصطناعي واكتساب العديد من الأفكار المثيرة للاهتمام، خاصة من النصوص

القديمة. ويمكن الحصـول على تصـميمات رائعة من خلال تطبيق الذكاء الاصـطناعي في الحفاظ على التراث. ويهدف البحث إلى تعزيز أهمية التراث الرقمي في تصـميم المتاحف من خلال الذكاء الاصـطناعي. ولذلك، يؤدي ذلك إلى التركيز على تسـخير قوة الذكاء الاصـطناعي في المتاحف رقمياً. ولذلك يضـع البحث منهجيات وقواعد للمنهج الوصـفي التحليلي لوصـف وتحليل الابتكارات الرقمية مثل التفاعل والمشـاركة والسـرد القصـصـي في تصـميم المتاحف لجعلها أكثر إثارة للاهتمام للزوار والجمع بين المعرفة التاريخية الفنية والتعلم والتكنولوجيا من خلال الذكاء الاصـطناعي. الاهتمام الرئيسـي هو تعزيز تأثير الذكاء الاصـطناعي على تطوير الفن والتصـميم الداخلى. وبالتالي فهو يسـاعد على اسـتعادة تاريخ الحضـارات وعرضـها رقمياً في المتاحف وإبداع فن جديد يواكب العصر الرقمي. وفي الختام فإن الذكاء الاصطناعي هو الطريق إلى المستقبل، وأكد البحث على دوره في تطوير التراث من خلال العرض الرقمي في المتاحف. وقد أدى تأثير شاشات العرض الرقمية باستخدام الذكاء الاصطناعي إلى تغيير التصميم الداخلي للمتحف وجذب العديد من الزوار للتفاعل مع هذه التكنولوجيا. إلى جانب ذلك، يمكن للذكاء الاصـطناعي أن يكشـف رؤى جديدة للأحداث التاريخية والثقافية من خلال رؤية مختلفة لتصـميم المتحف. وأخيرا، يسـتطيع الذكاء الاصـطناعي أن يغير الفراغ الداخلى في العصر الرقمي.

الكلمات المفتاحية: الذكاء الاصطناعي، التراث الرقمي، تصميم المتحف، تفاعل التصميم الداخلي

1. Introduction

Technology makes cultural legacies more accessible to future generations. Museum designs are an effective means of passing down cultures across generations, nations, and civilizations. [١] The use of technology in museums has significantly altered the visitor's experience. It can provide the public with high-definition, three-dimensional, interactive, and virtual experiences. [٢] New concepts for preserving buildings and maintaining exquisite traditional culture have emerged because of the advancement of digital technologies. [٣] [٤]

2. Research Problem

The research proposes various techniques for preserving and digitizing cultural assets in museums, where history is being lost daily because of war, theft, incompetence in development, and negligence. Artificial intelligence can be used in museums worldwide to integrate components and obtain numerous fascinating ideas, particularly from ancient literature. Additionally, many traditional museum exhibits discourage people from visiting them, leading to this heritage's extinction.

3. Research Aims

The study aims to employ artificial intelligence in digital interior design for museums. The study highlights that artificial intelligence (AI) is the way of the future. The research intends to utilize AI for digital interior design in museums, emphasizing that AI is the future.

4. Research Importance

Artificial intelligence-powered digital displays have designed the museum's interior design and drawn many people who want to engage with this technology.

5. Research Hypotheses

The study assumes that AI has the potential to change the way museums are designed, providing new perspectives on historical and cultural events. In the digital age, artificial intelligence has the power to change space.

6. Research Limits

The study was limited to incorporating artificial intelligence into museum interior design that affects cultural digitization, preservation, and protection. The study offers research approaches that use artificial intelligence (AI) tools for autonomous digitization to investigate cultural heritage.

7. Research Methodology

The research establishes methodologies and rules for the descriptive-analytical approach to describe and analyze digital innovations such as interaction, participation, and storytelling in museum design to make them more attractive for visitors and combine art-historical knowledge with learning and technology through artificial intelligence.

8. A Theoretical Framework for Research

8.1Artificial Intelligence Definision

Artificial intelligence (AI) is a machine that thinks, understands language, and solves problems. It is often a computer system that can perform tasks typically associated with intelligent beings. AI is now commonly defined as a scientific discipline, as the activity that creates machines that can function appropriately and with insight into their environment. The early developers of AI interpreted it as the mechanical processing of logical data and thus, in effect, defined human intelligence as the computation of truth values. [5]

8.2.Types of Artificial Intelligence

The history of AI can be categorized into three alternative approaches: data-driven, logic-driven, and knowledge-driven. [5]

8.3.Artificial Intelligence Technology

Artificial Intelligence Technology (AI) is the development and use of computer systems capable of performing tasks that typically require human intelligence, such as natural language processing, visual perception, speech recognition, decision-making, and language translation. It has applications across various industries, including healthcare, finance, transportation, and entertainment. AI uses algorithms and data to learn from experience, adapt to new inputs, and perform human-like tasks. It is used in various applications, from virtual assistants like Siri and Alexa to complex data analysis and automation. AI aims to mimic human cognitive functions and improve task performance efficiency and accuracy. AI has the potential to revolutionize our lives and work.

8.4.Artificial Intelligence Types

Artificial intelligence (AI) can be classified into four main types: Reactive machines, limited memory, theory of mind, and self-aware AI. Each type has unique characteristics and capabilities, with varying implications for their applications. Reactive machines react to specific situations and have limited

memory. AI can learn from historical data and the theory of mind. AI understands human emotions, and AI has consciousness and self-awareness. Other types exist based on different criteria and are used in various applications.

8.5.Technology and Heritage Preservation

Technology is changing how societies conserve their treasures; examples include digitizing centuries-old texts and scanning historic monuments in three dimensions. Strong influences have changed how we interact with cultural heritage in the digital age. The digital age is revitalizing historical heritage. Heritage can be preserved using virtual tours, digital archives, and three-dimensional reconstructions. [١] Therefore, artificial intelligence cannot comprehend them. Around the world, cultural institutions hold billions of objects, most of which are not digital yet. [٦] [٧] [٨]

Fig. 1,2 Illustrate the Canadian Science and Technology Museum. Designers GSM Project have created three display areas that let visitors learn about breakthroughs and technology through immersive experiences. [٩]

8.6Artificial Intelligence Technology in Museum Design

Artificial Intelligence (AI) revolutionizes museum design by enhancing exhibits, personalizing tours, analyzing visitor behavior, and creating interactive and immersive experiences. AI can analyze visitor data to understand preferences and tailor exhibits, facilitating virtual tours, augmented reality experiences, and interactive displays. It also helps manage crowds, optimize traffic flow, and ensure visitor safety within the museum premises.

AI-powered systems can also help manage crowds, optimize traffic flow, and ensure visitor safety. Overall, AI is revolutionizing museum design by making it more dynamic, inclusive, and educational, making it a valuable tool for museums to engage with visitors.

8.7Artificial Intelligence Application in Museum Design

Artificial intelligence (AI) has the potential to revolutionize museum design by enhancing visitor experiences through personalized tours, detailed information about artworks, and virtual and augmented reality experiences. AI can also help museums analyze visitor data to understand their preferences and tailor exhibits accordingly. This technology can create interactive exhibits, personalized virtual tours, and immersive visitor experiences. AI can also help museums analyze visitor data to optimize exhibits based on visitor preferences and preserve and restore artifacts through

advanced image recognition and restoration techniques. Therefore, AI can create more engaging and inclusive experiences for visitors.

8.8 The Effect of Artificial Intelligence on Museum Interior Design

AI is increasingly used in the arts and culture to attract new audiences and improve museum experiences. Interactive technologies like AR and VR are combined with AI to create immersive learning environments.

AI tools are used across industries for applications like customer service automation, data analytics, and creative processes. The AI market is expected to grow as technology matures and becomes more accessible. AI is expected to revolutionize educational content delivery and consumption, and museums will likely adopt it to preserve, analyze, and restore artworks. Museums can provide content in multiple languages, making art accessible to a broader audience. AI can also provide interactive and personalized communication, enhancing visitors' understanding and enjoyment of museums.

Fig. 3 Illustrates the technology of Artificial intelligence in The Quebec National Museum of Fine Arts (MNBAQ).

The Musée national des beaux-arts du Québec is integrating artificial intelligence into its museum experience. Visitors can explore around a dozen artworks using a conversational AI agent, which allows them to engage with the artworks through QR codes. [10]

Fig. 4 Illustrates using technology in museum design. This innovative approach aims to enhance visitor engagement and provide a more meaningful experience. [11]

8.8.1.Description of Canadian Science and Technology Museum

- **The First Exhibit, "Into the Great Outdoors,"** displays over a century of technological advancements, from bicycles to snowshoes, vehicles, canoes, and snowmobiles, all designed to let people explore and conquer vast landscapes. It offers an interactive experience called "Bike Fail," where guests are invited to race bikes from various historical periods to assess the level of technological advancement that has taken place. [٩]
- **The Second Exhibit, "Sound by Design,"** describes earlier attempts to capture and replicate sound. The power of quiet, the GSM Project created a visiting room with nearly no sound. On the other hand, four soundscapes synchronized with visitors' movements can be found in the three-dimensional "Horizons" sound and music environment. [٩]
- **The Third Exhibit, "Steam: A World in Motion,"** honors the golden age of steam-powered rail and maritime transportation. By making complex topics understandable to novices, the design attempts to bring scientific and technological discoveries from many eras to life for visitors. [٩]

Fig. 5,6 illustrate the museum's interior design and visitors' interaction through technology. [١٢]



Fig. 7,8,9 Illustrate engaging visitors through the museum display. Museum displays should be visually appealing and interactive, incorporating multimedia elements like videos and touch screens. Clear signage, interactive activities, and storytelling can further captivate and educate visitors. Various learning opportunities and experiences can make the display memorable and impactful for all ages and interests. By incorporating multimedia elements, museums can effectively communicate their messages and encourage active participation from their audience. [١٢]

8.8.2.Technologies in Museum Design

The creation of display units with varying degrees of immersion and engagement, technological components can be integrated for various uses. However, technological advancements have designed to be more interactive. Additionally, designers are creating unconventional approaches to expressing ideas by using virtual reality and artificial intelligence to represent extremely complicated, impossible geometric structures.

Fig. 10 Illustrates interactive technologies in the Museum of the Future. The Museum of the Future, regarded as the global center for studying and influencing the future, features an interior design representing the most recent developments in artificial intelligence (AI) in the United Arab Emirates. The Museum of the Future showcases innovative technologies like virtual reality exhibits, digital displays, and audio experiences, showcasing how technology shapes the future. This interactive experience is educational and entertaining, making it an engaging and educational destination for all ages. [13]

8.8.3..Description of Artificial Intelligence (AI) in the Interior Design of the Museum of the Future

The Interactive Museum of the Future amplifies technology's influence in creating cutting-edge global settings to solve the problems that future cities will face. The Museum of the Future exhibit is essential for utilizing upcoming technologies, including artificial intelligence (AI), to enhance human existence.

Governments can use it to gather feedback from the public to create plans and regulations. The Museum of the Future offers an integrated environment for idea testing and developing practical models that can be sponsored and promoted within one environment, drawing researchers, inventors, research institutes, enterprises, and financiers to work. [13]

8.9.Impact of Digital Preservation

The study examines technological strategies designers might employ to pique visitors' curiosity and motivate them to explore museums. Digital preservation has a significant impact on the access to cultural heritage. [٦]

8.10.The Role of Digital Archiving and Databases

Databases and digital archiving are the cornerstones of digital heritage preservation. Digitization of photographs, documents, and other items is part of the process. Digital technologies make the widespread dissemination of cultural knowledge possible. [١] Digital archiving and databases are crucial for preserving and organizing information in the digital age. They collect, preserve, and maintain digital materials, ensuring long-term accessibility and facilitating efficient search and retrieval for researchers, historians, and other users.

8.10.1.Digitization of Cultural Artifacts

Many artifacts are delicate, ancient, or decaying, making any handling, including digital scanning, risky. Preserving these elements may require expertise, the right environment, and specialized equipment, which are not always accessible, especially in areas where cultural funding is scarce. High-resolution images and comprehensive digital records require a lot of data storage, which puts pressure on institutional funds, and this is another obstacle. Digitizing heritage involves more than just technological challenges; it involves ethical, financial, and cultural issues that must be carefully considered. [١]

8.10.2.Three-Dimensional Scanning and Heritage Preservation

Preserving cultural heritage through three-dimensional scanning is crucial. Technology can now capture even the most minor details, from the delicate textures of ancient fabrics to complex carvings. Three-dimensional scanning is essential for preserving cultural heritage by documenting and conserving important artifacts, historical sites, and objects. It creates detailed digital replicas for research, education, and restoration, ensuring valuable cultural resources are preserved for future generations. [٦]

8.10.3.Virtual Reality (VR) and Heritage Preservation

Virtual reality (VR) attempted to enhance the visitor experience of a museum visit by integrating the intrigue of a treasure hunt with the art-historical knowledge and education that define guided tours through digital innovations like gamification and storytelling. [١٤] It plays a significant role in preserving cultural heritage. Producing immersive experiences can educate audiences about intriguing historical events and cultural customs. This interactive learning may help future generations appreciate and comprehend cultural heritage more deeply. [٦]

Fig. 11 illustrates the museum's interior design and displays topics such as virtual reality (VR), augmented reality (AR), touching technology, gestures, and three-dimensional printing. The First Life virtual reality experience is completely immersive. [15]

8.10.4.Artificial Intelligence (AI) for Organizing Catalogs and Collections

One department in the museum is devoted to organizing collections and catalogs. This means that a thorough examination of the pieces is required to attempt and rebuild connections with other collections in the museum and the collections themselves. In the twenty-first century, artificial intelligence (AI) will be crucial for museums to manage enormous amounts of data. AI systems can identify patterns in color or visual features and link them to a specific creative or contemporary expression, resulting in more unified collections and catalogs. [١٤] [16] Furthermore, experts can accurately restore damaged parts thanks to artificial intelligence (AI) restoration algorithms. [١١]

8.11.Artificial Intelligence in Digital Museums

When integrated into digital museums, artificial intelligence can enrich the visitor experience by offering a new way to enjoy art during their museum journey. [١٤] In addition, world heritage can be maintained and protected in both physical and digital spaces by using various tools and technologies, such as artificial intelligence (AI), virtual reality (VR), and augmented reality (AR). [٢]

8.12.Digital Museums and Virtual Tours

Technology, museums, and galleries are attempting to find solutions to conventional methods for preserving and protecting displays. Artificial intelligence techniques can achieve this by using QR codes or substituting traditional audio guides with smartphone applications. [١٤] Museums use digital tools like live broadcast performances and online displays to interact with the public and preserve cultural artifacts. [٣]

8.13.The Power of Artificial Intelligence (AI) in the Digital Museum

Thanks to artificial intelligence (AI), the museum sector has undergone a complete change. AI has also greatly improved visitor experiences and conserved cultural legacy. Some museums have used humanoid robots to create visitor interaction and knowledge sharing. By implementing AI, museums are removing barriers and ensuring that people from different linguistic backgrounds may engage with art. [١٤]

Fig 12 Illustrates using artificial intelligence in museum design. AI is revolutionizing museum design by creating interactive exhibits, personalized tours, and virtual tours. It streamlines operations, preserves valuable collections, and predicts visitor traffic patterns. AI also aids in digitizing artifacts, interpreting them, and developing virtual reality experiences. This integration of AI enhances visitor engagement and provides a more immersive and educational experience for patrons. [17]

8.14Virtual Tours and Artificial Intelligence (AI)

Museums use digital tools like live broadcast performances and online displays to interact with the public and preserve cultural artifacts. [٣]

Fig. 13 Illustrates the Chinese Civilization Exhibition at the Capital Museum; visitors use the Internet to try an interactive digital experience. [3]

8.15Challenges of artificial intelligence (AI) and museum design

Recently, there has been a search for the latest advanced unique experiences in museums and methods to enhance and communicate between cultural heritage and cultural tourism. Now, the main contribution of representation disciplines is related to the potential applications of these technologies and the outcomes of object recognition. The relationship between artificial intelligence (AI) and augmented reality (AR), such as three-dimensional printing and the design of dynamic interactive displays, is illustrated in museums. Artificial intelligence technologies consist of machines that generate comprehensible models while retaining high learning capability. Artificial intelligence and augmented reality technologies are crucial to preserving cultural heritage. These technological advancements have given museums new means to protect artifacts while engagingly disseminating information quickly. The field of museums has access to a wide range of artificial intelligence digitizing tools. [٤]

Fig. 14 Illustrates through mobile devices and cultural heritage, artificial intelligence (AI). Digital transformation in museums: Using augmented reality (AR) and artificial intelligence (AI) as tools to interact with visitors in museum spaces. Virtual reality (VR) and augmented reality (AR) in communicating, disseminating, and promoting cultural heritage have gained global traction. Using three-dimensional virtual models, holograms, and visuals for apps and games is an augmented reality technology tool. [٤] [١٢]

8.15.1.Description of Seoul's New Futuristic Technology Museum

In artificial intelligence (AI), numerous museums depend on investigating innovative interior design concepts related to concept development, space narrative design, activity division and content, space planning, movement, color schemes, materials, multimedia, technology, and lighting. Undeniably, the artificial intelligence (AI) context is highly interdisciplinary. [٤]

Fig. 15,16 Illustrate Seoul's technology museum's interior design. The project aims to demonstrate how technology will innovate our society. The design seeks to understand how technology can improve people's lives and connect rural communities; visitors to the tour engage with various augmented reality technologies. This reflects SK's primary CSR objective of closing the digital divide. [18]

8.15.2.Description of Mont-Saint-Michel of AR Museum

Visitors to the museum can see the island from various perspectives thanks to this experience. [19] Visitors can engage with the virtual and digital world when designing the museum display. By integrating a mixed reality from a Microsoft device with a historical model of the location, visitors can become fully immersed in the history of Mount Saint-Michel in this exhibition that highlights the use of mixed technology in museum interior design. [٤]

Figs. 17,18 illustrate the integration of mixed reality with a historical location model. In this exhibition, visitors can become fully immersed in the history of Mount Saint-Michel, which highlights the use of mixed technology in museum interior design. [19]

Figs. 19,20 illustrate this experience, which allows museum visitors to see the island from various perspectives. Digital technology aims to tell the model's story and the site's history. [19] Visitors can engage with the virtual and digital world when designing the museum display.

By integrating a mixed reality from a Microsoft device with a historical model of the location, visitors can become fully immersed in the history of Mount Saint-Michel in this exhibition that highlights the use of mixed technology in museum interior design. [٤]

Fig. 21 Illustrates an AI-generated scene of an archaeological museum that uses AI-powered front-end displays to digitally augment displayed artifacts with history, function, and significance. [٢٠]

8.16.The Role of Artificial Intelligence in Restoration

Artificial intelligence can restore damaged cultural artifacts by analyzing data and historical patterns to recommend restorations that align with the artifact's original purpose. Restoration specialists increasingly employ artificial intelligence to reconstruct missing or damaged artwork components. Machine learning algorithms trained on a database of styles and techniques can recommend restoration plans that closely align with the artist's original intentions.

These algorithms can also help analyze materials and pigments, resulting in less invasive and more precise restorations. Artificial intelligence will play a significant role in preserving and restoring cultural heritage in the future. The trend is toward more collaborative and integrated systems that combine the advantages of machine intelligence and human specialists. [١١]

Fig. 22, 23, 24 Illustrate the Saint George on a Bike project and provide contextualization of the events and people, along with a study of the colors utilized. This is done to assist in efficient indexing and enhance the user experience when perusing collection catalogs and accessing collections. Creativity, education, or tourism projects can benefit from these insights. [٢١]

8.16.1.Artificial Intelligence Techniques to Preserve Artworks in Museums

Over the years, artificial intelligence has infiltrated all areas of life. AI networks are trained using a database of many different images. Artificial intelligence can also help preserve paintings in museums to protect cultural heritage.

Images based on artwork can be generated. Many photos, artifacts, sculptures, or cultural remnants can be preserved and enhanced digitally.

Additionally, artificial intelligence can combine the parts in museums worldwide, yielding many fascinating discoveries, mainly from old manuscripts. [١٧]

8.16.2.Creative Artificial Intelligence in the Design of Museums

Predictive artificial intelligence techniques can help understand visitor behavior and concentrate on enhancing museum interior design and technology.

Artificial intelligence (AI) can be integrated into visitor trips, avatars, or narrated characters, leading visitors through the museum based on their areas of interest. AI can add a thrilling new dimension to the interactive aspect of exhibitions.

It can be "trained" to recognize highlights in artwork or artifacts and relevant information in media or multilayered text. Technology is a creative instrument that can achieve various objectives, dreams, and challenges inside a museum environment. [٢٠]

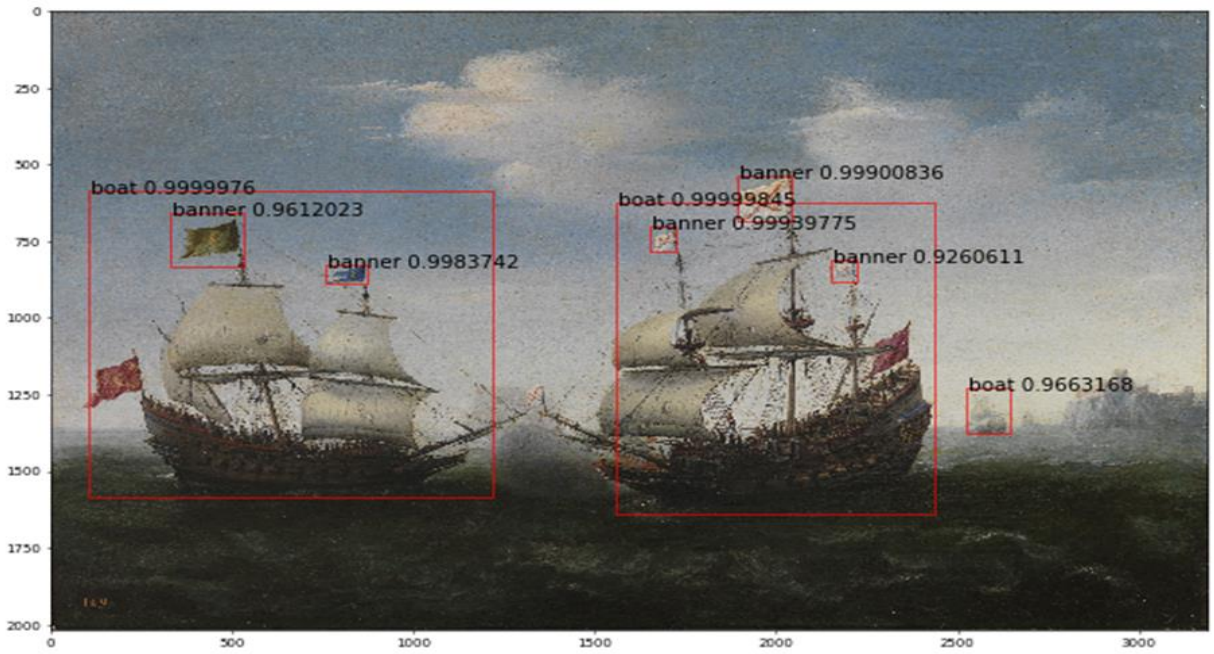

Fig. 25 Illustrates Artificial intelligence using historical artwork and items from the region's cultural heritage. Artificial intelligence is used to analyze and interpret historical artwork and cultural artifacts from an area, identify patterns, analyze styles, and extract information. This technology can expand our understanding of history and art, blending technology and cultural heritage for educational and creative purposes. This innovative approach aims to create AI-generated art inspired by historical pieces. [٢١]

8.17.Description of Future Museum

The vibrant display in the future museum aims to teach visitors about various species, such as mollusks, angiosperms, annelids, and mammals. Teachers, students, and researchers can benefit from the educational display called the Museum of the Future. In this futuristic spa, the Oasis, visitors can benefit from the healing powers of movement and meditation. [22] Some interactive scanners are being used to detect combinations of DNA that can be combined to create new, interwoven species that can survive on Earth as our environment becomes more hostile than ever. In addition, they are employed to investigate the various biospheres developed to contain all the newly generated varieties of plants and animals. Mental health will always be essential to survival, regardless of the year. Within the Oasis section of the museum, visitors are asked to put away their devices, disconnect from the digital world, and reconnect with their minds, bodies, and spirits. [23]

Figs. 26,27 illustrate an entertaining and instructive event covering topics like how to protect ecosystems and jobs on space stations in the distant future. [22]

Fig. 28,29 Illustrate this two-hour event aiming to arouse guests' curiosity and make them consider what they can do now to create a better future. [22]

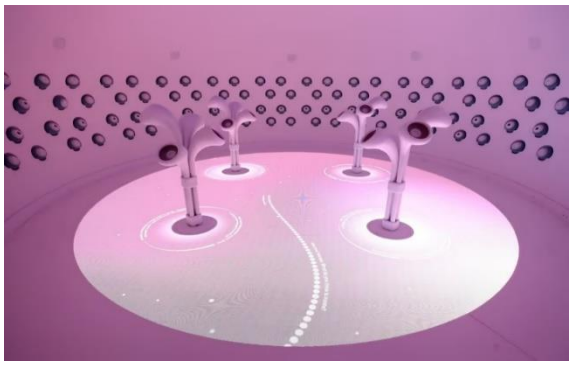
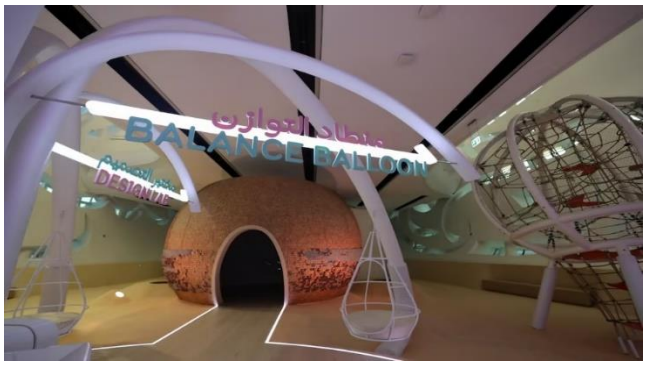

Fig. 30,31 Illustrate a rocket launch exhibit with eye-catching visuals and a DNA library with over 4,500 species, just two examples. [22]


Fig. 32,33 illustrate that the museum uses cutting-edge technology in astounding ways to convey art. [22]


Fig. 34,35 Illustrate the Discovery of what cutting-edge technology will bring to the United Arab Emirates in 2071 by taking a trip to the OSS Hope space station through the Museum of the Future. This interactive project aims to develop a new energy source for Earth by harvesting solar cells from the moon. Visitors can explore space cuisine, virtual space suits, or sit back and take in the magnificent vista of the starry universe. [23]

8.18The application of Artificial Intelligence (AI) in the Museum

Artificial intelligence (AI) is a rapidly growing trend in the museum and interior design industries, potentially revolutionizing these sectors. AI can be used to create interactive exhibits, provide personalized tours, and analyze visitor data to enhance the overall experience. In interior design, AI can assist in space planning and furniture selection and even create virtual 3D models of design concepts. This technology can enhance creativity, efficiency, and customer experience. In museums, AI can analyze visitor behavior and preferences, provide interactive experiences, and offer virtual guides. In interior design, AI can assist in space planning, furniture selection, and creating virtual mock-ups. Overall, AI has the potential to revolutionize how museums are experienced and how interior design is approached, enhancing creativity, efficiency, and customer experience in both spaces.

8.18.1.AI in Museum Mediation

AI in museums can enhance visitor engagement by providing personalized experiences based on interests and preferences. It offers transformative potential for museum education, department management, content creation, visitor engagement, and central theme in discussions and exhibitions, ensuring a more immersive and interactive experience for visitors. [24]

8.18.2.Visitor Engagement in Museum Design

Interactive museums foster playful engagement, impacting museum contemplation. Chatbots and AI-powered image generators are popular in museums, enhancing engagement and understanding. [24]

Fig. 36,37,38 Illustrate the interior design of interactive museums that encourage playful engagement by allowing visitors to participate in exhibits, fostering exploration and discovery actively. These hands-on experiences cater to diverse learning styles, making educational content more accessible and engaging for diverse audiences, including children and adults, and fostering a deeper appreciation for the subject matter. [24]


Fig. 39 ,40 illustrate that museums' AI can boost visitor engagement by offering interactive and personalized experiences. AI-powered virtual tour guides provide detailed exhibit information, answer questions, and deliver immersive learning. AI can tailor exhibits and programs to meet audience interests by analyzing visitor behavior, resulting in more engaging and enjoyable museum visits. [24]

8.18.3.Data Analytics in Museum Design

AI has significantly transformed museum mediation since the early 21st century. It analyzes and organizes vast data to predict visitor behavior and provide personalized recommendations. Chatbots offer services like sharing exhibition details, answering queries, and recommending tours. AI also connects visitors with social and environmental initiatives, facilitating dialogue and promoting future improvements. [24]

8.18.4..Robotics and AI in Musemes

Museums are utilizing robotics technology to improve visitor engagement and information sharing. The Deutsche Museum Bonn introduced RHINO in 1997, which significantly increased attendance and is now controlled by thousands worldwide. [24]

Fig. 41 Illustrates Design AI Museum: More Than Human is an interactive exhibition that delves into the creative and scientific advancements of artificial intelligence, bringing together artists, scientists, and researchers to explore its potential. [25]

8.18.5.Data Analytics and AI in Museum

AI enables museums to analyze vast data, identify patterns, and predict future events, providing valuable insights for educators to enhance educational offerings, plan events, and predict visitor behavior. [24]

8.18.6.Visitor Behavior Prediction in Museum Design

Museums utilize AI to predict visitor behavior by analyzing historical data, identifying patterns, and planning future events based on visitor demographics and movement patterns. AI can enhance virtual reality experiences by curating content based on visitor profiles, providing a deeper understanding of exhibits. Museums can use AI data to plan events around specific themes and optimize program timing. AI can also increase accessibility by reducing language barriers by rephrasing, aggregating, and contextualizing content for particular interest groups. [24]

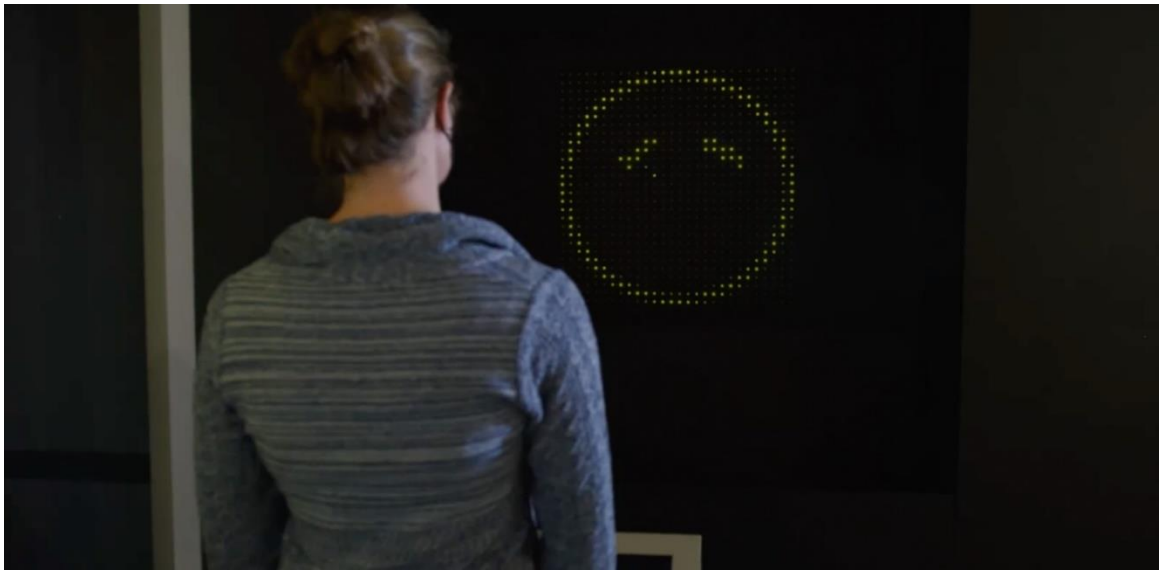

Fig. 42 Illustrates that AI can enhance museum experiences by creating personalized and engaging experiences. Museums, known for their diverse collections, can use AI to analyze these collections, identify patterns, and automate categorization. This helps visitors appreciate the museum's mission and brand. AI can also allow visitors to explore interconnected objects and the museum's creative spirit. Museums can also help visitors unleash their creativity by suggesting and building on their ideas. As AI becomes more important in our lives, museums are educating visitors about its inner workings. 3D projections visualize AI operations in real time, allowing visitors to understand its operations better. This innovative approach to museum technology creates an immersive and engaging visitor experience, enhancing accessibility and connecting ideas. By catering to visitors' unique interests and abilities, AI can provide a more enriching and fulfilling museum experience. [26]

9. Discussion

The museum sector has completely changed thanks to artificial intelligence (AI), dramatically improving visitor experiences and conserving cultural legacy. Integrating technology and cultural heritage preservation offers hope for protecting our past inside museums. Compared to conventional methods, artificial intelligence can identify damage to artwork and old designs more precisely when it comes to restoration and preservation of heritage. Artificial intelligence can reveal new insights into historical and cultural events through a different vision of museum design. Besides, it can reveal new insights into historical and cultural events through a different vision of museum design. When integrated into digital museums, artificial intelligence can enrich the visitor experience by offering a new way to enjoy art during their museum journey.

The relationship between artificial intelligence (AI) and augmented reality (AR), such as three-dimensional printing and the design of dynamic interactive displays, is illustrated in museums. Artificial intelligence technologies consist of machines that generate comprehensible models while retaining high learning capability. Some museums have used humanoid robots to create visitor interaction and knowledge sharing. Museums are removing barriers and ensuring that people from different linguistic backgrounds may engage with art by implementing artificial intelligence (AI). Finally, the research described and analyzed digital innovations such as interaction, participation, and storytelling in museum design to make them more attractive for visitors and combine art-historical knowledge with learning and technology through artificial intelligence. In addition, with the use of various tools and technologies, such as artificial intelligence (AI), virtual reality (VR), and augmented reality (AR), world heritage can be maintained and protected in both physical and digital spaces. Integrating artificial intelligence (AI) in museums has significantly improved visitor experiences and cultural heritage preservation. AI can accurately identify damage in artwork and historical designs, contributing to heritage restoration and conservation. It also offers a creative perspective on museum design, uncovering new insights into historical and cultural events. AI and augmented reality (AR) technologies, such as three-dimensional printing and interactive displays, are exemplified in museum environments. AI technologies also break down language barriers, enabling diverse linguistic backgrounds to engage with art. Research has explored integrating digital innovations into museum design, enhancing visitor appeal, and combining art historical knowledge with learning and technology. Integrating AI and digital representations of cultural heritage can improve visitor engagement, provide personalized experiences, and offer new ways to preserve and share cultural heritage. By creating immersive and educational environments that appeal to a diverse audience, museums can contribute to preserving and interpreting heritage artifacts and stories. This intersection of technology and cultural preservation has the potential to transform the way we interact with and learn from our heritage, making it an exciting and transformative approach to museum design.

10. Conclusion

In conclusion, the research concluded that technology in museum interior design significantly contributes to the preservation of cultural heritage. Museums may utilize artificial intelligence to narrate history and tell stories. Technology is crucial, providing new ways to preserve, document, and share cultural heritage globally. The impact of digital displays using artificial intelligence has changed the museum's interior design and attracted many visitors to interact with this technology. There are technologies such as three-dimensional scanning, digital archiving, and virtual reality (VR) for heritage preservation. Artificial intelligence and augmented reality technologies are crucial to conserving cultural heritage. These technological advancements have given museums new means to preserve artifacts while engagingly disseminating information quickly. The field of museums has access to a wide range of artificial intelligence digitizing tools. Finally, designers can create a variety of techniques inside interior design that enable visitors to have more personalized and immersive cultural experiences. It is feasible to develop a creative museum experience. Integrating artificial intelligence and digital heritage in museum design is a strategic approach that aims to enhance visitor experience and preserve cultural heritage in museums. This can involve interactive exhibits, virtual reality experiences, and AI-guided tours. By incorporating AI and digital representations of cultural heritage, museums can create immersive and educational experiences for visitors while innovatively preserving and presenting cultural artifacts and historical information. This innovative approach to

leveraging technology enriches the presentation and understanding of cultural heritage in museum settings. AI can enhance the visitor experience by recommending activities based on interests, moods, language skills, or age group, thereby increasing museum engagement and satisfaction.

11. Recommendations

- Artificial intelligence is the way to the future, and the research emphasized its role in developing heritage through digital display in museums. Hence, it is essential to integrate technology and museum design in the future. Technology can be incorporated into aspects of preserving cultural heritage since artificial intelligence has the potential to enhance these efforts significantly.
- Interior designers must enhance technology to attract users from space planning in interior design, design movement, display, units, materials, colors, and interactive screens.
- Designers can create unconventional approaches to expressing ideas by using virtual reality and artificial intelligence to represent extremely complicated, impossible geometric structures.
- When creating and designing museums, designers should develop creative ways to apply artificial intelligence and convey cultural heritage across civilizations.
- Cultural and environmental conservation institutions must continually keep up with the latest developments in three-dimensional scanning, digital archiving, and virtual reality (VR) to effectively utilize these tools in museum design and heritage preservation.
- Museums should leverage AI to enhance visitor experience by reducing barriers, personalizing experiences, and offering engaging activities while enhancing sustainability through data analysis.
- AI can enhance museums' mission of making art and culture accessible to diverse audiences, ensuring sustainability and relevance, and serving as a valuable resource for local communities.

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