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Optimization Design of Urban Tourism Systems Based on MR Interactive Technology and Artificial Intelligence

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Abstract. With the continuous development of digital technology, public expectations for an immersive travel experience have significantly increased. Currently, digital technology has become an indispensable component of high-quality development in the tourism industry. Among these technologies, Extended Reality Recognition (XR) has been widely adopted in the tourism industry. Within the XR technology category, AR technology is the most widely used, but significantly lacks interactivity. Therefore, this study explores the optimization design of MR interactive technology in the tourism industry, focusing on incorporating more interactive elements into current urban tourism to enhance the experience and promote tourism development. While maintaining the visual appeal of urban attractions, MR interactive technology is overlaid to enable visitors to interact with established 3D models. Combined with artificial intelligence, it provides guidance for itineraries and allows for customized themed itineraries to facilitate check-in experiences at each attraction. This study demonstrates that XR and AI technologies can transform tourism beyond superficial appreciation or the fear of information fog, thereby further promoting the development of the urban tourism market.

Keywords: Mixed Reality, Urban tourism, Interactive design, Artificial intelligence

1. Introduction

With the rapid development of computer graphics technologies such as Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR), human-computer interaction technologies, and artificial intelligence, the concept of integrating Expanded Reality (XR) technology with artificial intelligence has begun to serve different industries such as medical care, education, and tourism, becoming an effective tool for service innovation [1]. Artificial intelligence is defined as a series of technologies that can identify, analyze, act, learn, and demonstrate advanced features of human intelligence in the process of problem-solving. XR extended reality technology refers to the technology that combines reality and virtuality through computers to create a virtual environment for human-computer interaction. It is also a general term for AR augmented reality technology, MR mixed reality technology, and VR virtual reality technology. With the digital transformation of the tourism industry, the initial impact of artificial intelligence has penetrated into all aspects of the industry. Not only that, XR technology has also become an important tool for enriching the tourism experience [2]. Currently, the tourism industry is one of the most important activities in the world

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that can drive economic growth. In recent years, the tourism market has continued to develop steadily. From an innovative perspective, the tourism industry is not only a resource-based industry, but also an innovative industry. The shift from resource-driven to innovation-driven is an inherent requirement for the high-quality development of the tourism industry [3]. The traditional tourism system may focus on infrastructure construction and scenic spot development, while the current development trend focuses on digital transformation, personalized services and sustainable development. At present, people's tourism consumption is no longer limited to traditional transportation and accommodation, but spending on shopping, entertainment, experience, etc. is increasing. This not only promotes the diversified growth of tourism income, but also gives the tourism industry a better trend of innovation and development. In addition, the tourism market is constantly influx of young people aged 18 to 35. This group has strong consumption power and willingness to consume, and maintains a high degree of enthusiasm and stronger acceptance for new and interesting things, which can promote the continuous development of the tourism industry in terms of innovation. With the continuous maturity of XR technology and the continuous improvement of artificial intelligence systems, they are changing the way tourists experience real and virtual environments and reshaping the tourism industry [4]. The achievements of MR technology make it possible to interactively visualize the combination of virtual and real worlds. The published research and applications have also profoundly changed the way humans interact with virtual and real scenes. "Interaction" is a key term in augmented reality and mixed reality systems; in mixed reality environments and applications, interaction occupies the common space between any combination of humans, physical environments, and computers [5]. However, among XR technologies, AR currently accounts for the largest share in the tourism industry, followed by VR, and MR accounts for very little. Therefore, the use of XR technology in tourist attractions is currently limited to viewing and lacks interactivity, and a common pain point for tourists in tourism is the existence of information fog. Therefore, this paper chooses to use MR interactive technology combined with artificial intelligence to optimize the design of urban tourism systems. Adding interactive technology to urban tourism and combining it with the information screening capabilities of artificial intelligence may elevate the economic development of the tourism market to a new level.

2. Development and challenges of the tourism system

Tourism is one of the world's major economic industries and an important mechanism for promoting economic development. With the rapid rise of "digital transformation" including virtual commerce, online education, and social networks, the tourism system has also begun to undergo a transformation with "smart tourism" as its core. The tourism sector has begun to adjust and continuously innovate through the application of modern information technology to improve the quality of tourism in order to support the tourism industry in the new era and new changes [6].The development of information technology enables tourist destinations to provide new opportunities and activities and gain an advantage in competition [7].In this transformation, extended reality (XR) technology, including virtual reality (VR), augmented reality (AR), mixed reality (MR) and artificial intelligence (AI), plays a subversive role, reshaping the face of the tourism industry from multiple dimensions such as experience and management. The combination of XR technology and artificial intelligence has become a powerful tool for interpreting cultural connotations, effectively promoting the dissemination and inheritance of culture by making deep culture perceptible and interactive. All these technological advances and integrations serve to deepen the integration of culture and tourism, allowing "smart tourism" to develop more deeply. At present, the tourism industry has a large influx

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of young people aged 18 to 35, who account for the largest proportion of tourists. This group pursues individuality and unique experiences, enjoys broadening their horizons and enriching their lives through travel, and possesses high spending power and willingness. They also prioritize visiting scenic spots and sharing their travel experiences on social media. These traits can further drive new developments and changes in the tourism industry and support the deeper integration of emerging technologies into the sector. However, tourists still face unresolved pain points during travel. One is the information fog: the sheer volume of travel guides online is both complex and difficult to sift through, and the information is often outdated and missing. The second is the expectation gap: discrepancies between images and text, discrepancies between the online and real-life scenarios, and filtered photos are common online. These are issues we need to address and address.

3. Conceptual overview of XR technology

Extended Reality (XR) technology is a general term for augmented reality, virtual reality, and mixed reality, which aims to achieve interaction between the virtual world and the real world. Virtual reality (VR) technology creates a completely virtual space that allows individuals to interact with the simulated environment through sensory perception. Users need to wear devices such as headsets or glasses to interact with the environment. Augmented reality (AR) technology is a technology that overlays digital information, such as images or text, onto the user's real-world view, thereby providing a rich and interactive experience of the surrounding environment. Mixed reality (MR) technology is a combination of virtual reality and augmented reality. This combination can create a new space where real and virtual objects or people can interact [8].In summary, AR technology is a simple overlay, VR technology is a complete isolation, and MR technology is a fusion of virtual and real.

4. Application of XR technology in the tourism industry

AR augmented reality technology can improve the tourist experience, help tourists obtain relevant information, and thus enhance their understanding of tourist destinations [7]. Currently, the application of AR in the tourism industry is mainly divided into four categories: first, AR smart navigation, which uses AR technology to display 3D navigation information in real time on the tourist's mobile phone interface or AR glasses; second, AR virtual explanation, through AR technology, scenic spots can create virtual tour guides or display corresponding knowledge on the tourist's mobile phone or AR glasses; third, AR map, which combines traditional maps with AR technology to make the marks or attractions on the map move on the mobile phone screen; fourth, AR architectural special effects, which uses AR technology to add virtual 3D elements or animations to real buildings to create visual effects. Compared with VR technology and MR technology, AR technology has the highest proportion of use in the tourism industry, and most of them are implemented on mobile phones, and the use rate of AR glasses is extremely small. Currently, AR technology experience is more common in museums, theme parks or research laboratories [9]. VR technology can cover a larger target audience while reducing carbon footprint or overcrowding, thereby promoting the ecological protection of scenic spots. It can also restore the original appearance of historical destinations and help protect cultural heritage. VR technology also provides new opportunities for the development of tourism activities and meets new needs [10]. The application of VR technology in the tourism industry is divided into two categories. One is to build VR scenes on the web or mobile phone, so that tourists can check the scenic scene or hotel

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environment in advance; the other is to experience a fully immersive VR virtual scene in the scenic area, so that tourists can experience a wonderful journey in an immersive way. The application areas of VR technology include theme parks, museums, natural attractions, world-famous attractions, etc [10]. At present, the proportion of MR technology used in tourist attractions is the smallest, and its application is not widespread but is on the rise. Mixed reality is a constantly developing field, and new interactive methods can be described with novel methods and innovative applications [5]. Compared with AR and VR, MR emphasizes the interactivity between virtual and real, creating an environment that retains a mixture of real space and virtual elements. Tourists can directly interact with virtual content through gestures, voice, etc., bringing a higher level of immersive experience. The core features of MR technology are: first, the fusion of virtual and real, allowing virtual content to physically interact with the real world; and second, high interactivity: users can interact with virtual objects directly through handheld devices, gestures, voice, and other means. Currently, MR technology is primarily used in scenic spots to create immersive scenes that blend virtual and real, using MR mixed reality technology. Through careful design and virtual elements to guide visitors, the tour is interactive and engaging. This gamified experience of combining virtual and real experiences has significantly increased visitor engagement and enhanced the attraction's appeal.

5. Research questions and optimization solutions

This paper addresses two key research questions: First, the current integration of XR and the tourism industry focuses on enriching the experience but lacks interactivity; second, how to mitigate the information fog and expectation gap experienced by tourists during city tours. This paper's optimization solution targets young people, explorers, and achievers. These individuals tend to explore without a purpose or seek something with a purpose, and are open to trying new things. Secondly, it proposes connecting tourist attractions together. Tourists can select attractions based on their interests and connect them into itineraries through AI. This can mitigate the information fog to a certain extent and enhance interactivity by incorporating different game interactions and scenarios along different itineraries (Figure 1). Third, it proposes the use of intelligent AI capable of voice chat, enabling interaction based on tourist preferences, behavior, and feedback, such as intelligent guidance, intelligent planning, and intelligent screening. This can mitigate the expectation gap issue to a certain extent and allow scenic spots to better receive tourist feedback (Figure 2). Fourth, interactive check-ins based on specific scenarios along the itinerary. For gaming scenarios, this article prefers serious fun, such as script-based killing games, adventure games, and brain-teasing games. Visitors can interact with virtual characters to complete tasks, earning points that can be redeemed for prizes at the destination (Figure 2). Finally, for the point-based prize redemption activity at the destination, this article proposes creating unique city IP figurines or souvenir blind boxes. This perfectly aligns with the recent trend of young people checking in and collecting tourist attractions, and also taps into the popularity of blind boxes.

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Figure 1. Attraction selection and AI intelligent recommendation



Figure 2. Interact with virtual characters through MR interaction technology

6. Conclusion

Tourism is vital to every country and region. With the advancement of science and technology, tourism, as an innovative industry, has entered a stage of "smart development." The current application of XR technology and AI in scenic spots has significantly increased their appeal to tourists and enhanced their experience. This paper focuses on optimizing the design of urban tours by integrating MR interactive technology and AI. However, due to the high cost of MR technology, its application in scenic spots is currently limited, and most are still in the exploratory stage. MR, as a technology that can create interactive scenes that blend the real and the virtual, is even more attractive to tourists. Currently, investment from companies and applications in scenic spots are on the rise. This paper argues that compared to the lack of interactivity in AR or the fully immersive VR, MR's integration of the real and the virtual and interactive technologies will bring greater development and benefits to urban tours, bringing the innovative development of the tourism industry to a higher level.

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