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# Research on the application of virtual reality technology in improving the snow and ice landscape tourism experience in Harbin city

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**ABSTRACT**

This study aims to explore the application and effect of virtual reality (VR) technology in improving the tourism experience of snow and ice landscape in Harbin. Through an online questionnaire survey, this study collected the cognition, acceptance and experience feedback of VR technology in the assessment of tourism environment. The results showed that young, highly educated groups have a high understanding and acceptance of VR technology, and most respondents have experienced VR through home devices and mobile applications, highlighting the convenience and accessibility of technology popularization. Respondents generally believed that VR technology has a significant role in enhancing virtual tourism experience, evaluating tourism resources and environment, as well as tourism planning and management, revealing the potential application of VR technology in the tourism field. Although not all respondents were familiar with the snow and ice landscape in Harbin, media and social media were the main access to relevant information, highlighting the key role of these platforms in tourism promotion. According to the research, VR technology has a wide application prospect in the improvement of ice and snow landscape tourism experience in Harbin, which can provide immersive experience, improve the efficiency of resource evaluation and management, and has the potential to become an important tool in the tourism industry. Future research should focus on how to optimize the VR experience and integrate it more deeply into tourism planning and management practices.

**Index Terms—**Virtual reality technology; Harbin tourism; ice and snow landscape; tourism experience; environmental evaluation;

## INTRODUCTION

As a cutting-edge technology, virtual reality technology (VR) has shown its unique application value in many industries. Especially in tourism, the immersive experience VR is changing the way people explore the world. In Harbin, famous for its ice and snow landscape in winter, the application of VR technology not only improves the tourism experience, but also has a positive impact on the evaluation and management of tourism resources. With the continuous progress of globalization and information technology, tourism has become an important part of people's lives. However, traditional ways of tourism are often limited by time, money and geographical location. The advent of VR technology breaks down these limitations, allowing users to explore cultures and landscapes across the globe without physical constraints. This technology not only enhances the travel experience, but also provides new tools and methods for tourism planning and management. Harbin, the pearl of northeast China, attracts the annual winter ice and snow festival of tourists to enjoy the ice sculptures and snow scenery. With the development of VR technology, Harbin city has begun to use this technology to provide a new immersive experience for tourists, and play an important role in the evaluation of the tourism environment. VR technology enables assessors to build a 3 D simulation environment to analyze the tourism environment in detail from multiple

perspectives. This includes assessing the carrying capacity of the tourist attractions, the distribution of tourist traffic, the environmental impact, and the adaptability of the tourism infrastructure. In Harbin, the application of VR technology has gone beyond the simple virtual tourism experience, and it is also used in tourism planning and management, thus improving the overall experience of ice and snow tourism.

In addition, the application of VR technology in tourism planning and management also shows great potential. Through the virtual reality environment, tourism planners can evaluate the tourism resources and environment more intuitively, and develop more effective tourism strategies. At the same time, VR technology also helps managers to monitor the use of tourism resources and ensure the sustainability of tourism activities. Although VR technology has broad application prospects in the field of tourism, the current research focuses on technology development and application, and there are relatively few studies on the role of VR technology in the evaluation of tourism environment in specific areas such as Harbin. Therefore, this study aims to fill this gap and explore the application status and potential value of VR technology in the evaluation of tourism environment in Harbin by investigating participants of different ages and educational backgrounds.

## SIGNIFICANCE OF THE STUDY

**Improve the travel experience:**

Through virtual reality technology, visitors can experience the immersive ice and snow landscape, which is not limited by the actual weather and seasons, enhancing the interest and participation of tourism. The application of this technology not only allows visitors to enjoy the charm of the ice and snow world at any time and place, but also breaks through the time and space limitations of traditional tourism. VR technology can also provide tourists with an immersive scenic spot experience, enabling them to have a deeper understanding of the characteristics and historical and cultural background of the scenic spot, and improve the interest and interactivity of the tour. The application of VR technology in tourism also includes cloud tourism, cloud and other live broadcasting. Virtual reality technology, with its unique immersive features, is revolutionizing the tourism industry, enabling visitors to enjoy a colorful travel experience at any time and anywhere.

**Tourism Planning and Management:**

The application of virtual reality technology (VR) in tourism planning and management has brought revolutionary changes to tourism. VR technology can help tourism planners and managers to evaluate tourism resources more intuitively, providing a new perspective and method. Through the 720 panoramic technology, you can capture and display the horizontal 360-degree and vertical 360-degree panoramic images, so that users can feel as if they are in the scene, so as to have a more comprehensive understanding of the details and features of the scenic spots. In terms of tourism management, the application of VR technology has also greatly optimized the management strategy. VR technology has also promoted the development of smart tourism. Through the combination with geographic information system (GIS) and other technologies, a virtual tourism platform can be built to serve the planning management and decision-making departments of villages and towns, and realize the three-dimensional display and efficient management of tourism resources. This digital transformation not only improves the service level of tourism, but also promotes the upgrading and development of the industry.

**technological development:**

Through virtual reality (VR) technology, visitors can visit the scenic spots in the virtual environment, and experience the local scenery, culture and local customs. This realistic display method can not only arouse tourists' interest in tourist attractions, but also remain attractive in the long-term promotion and marketing. Using VR technology, scenic spots can develop interactive immersive digital experience products, such as intelligent tour and virtual display. With the help of new VR technology, the cultural and tourism industry has accelerated the research and development of a variety of cloud tourism products, and innovated the form of tourism presentation through live broadcasting, games and other interactive ways, so as to increase people's tourism fun. Promote the application of virtual reality technology in the whole process of tourists and in multiple environments, and broaden the application scope and application scenarios. Combining digital twin and XR technology, create 360-degree panoramic video to provide an efficient and convenient immersive experience. Support the application of virtual reality technology in the field of tourism, and promote the development of interactive immersive digital experience products in scenic spots, resorts and blocks.

Environmental impact assessment: By building a three-dimensional virtual environment, VR technology can simulate real scenarios to provide decision support for sustainable tourism. VR technology can reduce the impact of actual tourism activities on the natural environment. Through technologies such as 3 D visual modeling and

digital photogrammetry, the environment formation can be reproduced realistically and its future development process can be rehearsed. This allows managers to conduct a detailed environmental impact assessment before the project implementation, so as to develop more scientific and reasonable environmental protection measures. Using game engines to create green infrastructure content in VR can effectively assess its potential health impact. This approach not only helps to improve the efficiency of environmental management, but also provides strong data support for decision makers. Virtual reality technology has a significant role in assessing the potential impact of tourism activities on the ice and snow landscape environment. It can not only reduce the direct damage to the natural environment, but also provide an important decision support tool for the development of sustainable tourism.

**SCOPE AND DELIMITATION**

The purpose of this study is to explore the application and effect of virtual reality (VR) technology in improving the experience of snow and ice landscape tourism experience in Harbin. Through an online questionnaire survey, this study collected the cognition, acceptance and experience feedback of VR technology in the assessment of tourism environment. The results showed that young, highly educated groups have a high understanding and acceptance of VR technology, and most of the respondents have experienced VR through home devices and mobile applications, highlighting the convenience and accessibility of technology popularization. Respondents generally believed that VR technology has a significant role in enhancing virtual tourism experience, evaluating tourism resources and environment, as well as tourism planning and management, revealing the potential application of VR technology in the tourism field. Although not all respondents were familiar with Harbin's ice and snow landscape, media and social media were the main access to relevant information, highlighting the key role of these platforms in tourism promotion. VR technology has a wide application prospect in the improvement of ice and snow landscape tourism experience in Harbin. It can provide immersive experience, improve the efficiency of resource evaluation and management, and has the potential to become an important tool in the tourism industry. Future research should focus on how to optimize the VR experience and integrate it more deeply into tourism planning and management practices.

**DEFINITION OF TERMS**

**Virtual reality technology:It is a kind of computer-generated three-dimensional environment to simulate human's visual, auditory and tactile senses, so that users feel as if they really exist in a virtual world. This technology, often implemented with a head-mounted display device, allows the user to interact with objects in a virtual environment in a natural way. A key feature of VR technology is its ability to provide an immersive experience, which means that they feel really in a virtual environment. VR technology can respond to the user's actions and inputs in real time, ensuring the continuity and fluency of the experience. By tracking the position and movement of the user's head, hands or other body parts, the VR system is able to accurately map the user's real-world movements into a virtual environment.**

**Harbin Tourism:** Harbin is famous for its unique history, rich culture, magnificent natural scenery and the snow and ice landscape in winter. The city is known as the "Ice City", especially for its winter ice world and for activities such as ice lantern garden parties. The natural landscapes around Harbin, such as the Songhua River and the Sun Island, provide an ideal place for tourists who enjoy outdoor activities and leisure holidays. Harbin has different seasons, with flowers blooming in spring, cool and comfortable in summer, colorful in autumn, and winter is covered with snow silver-white. The city's tourism activities cover city sightseeing, cultural experience, natural exploration and winter ice and snow sports, attracting visitors from all over the world.

**Snow and snow landscape:** refers to the landscape formed by natural or artificial means, with ice and snow as the main elements. These landscapes usually occur in cold climates, especially in winter, with natural ice and snow landscapes: natural snow-covered mountains, forests, grasslands, and more. Large ice bodies formed by snow compaction that can flow in the valleys. The landscape, formed by frozen waterfalls, is usually seen in the mountains. Snow and ice landscape not only has a high ornamental value, but also is closely related to the local culture and lifestyle, and is an important part of winter tourism. In some areas, the ice and snow landscape is also of great scientific value and is an important object in the study of climate change and glaciology.

**Tourism experience:** Tourism experience is a multi-dimensional concept, involving the process of cognition and perception. It includes not only the tourists' perception and cognition of the tourist attractions, but also includes the interaction with the local people, other tourists, the local culture and so on during the travel process. This experience process is a sequential process realized through the form of appreciation, communication, imitation

and consumption, and it is a continuous system, which is composed of situations with characteristics and specialized significance. Tourism experience is a complex and comprehensive experience, covering cognitive, emotional, social, cultural and entertainment aspects, and is a dynamic and continuous process, aiming to improve the overall satisfaction and happiness of tourists through various activities and interactions.

**Environmental evaluation:** it is a method and system to analyze, predict and evaluate the possible environmental impact caused after the implementation of planning and construction projects. The main purpose of environmental evaluation is to identify and evaluate the possible environmental consequences of human activities through scientific and systematic methods, so as to propose countermeasures and measures to prevent or mitigate adverse environmental impacts. This process includes not only the consideration of the natural environment, but also the comprehensive analysis of social and economic factors to ensure that the implementation of the project can promote the coordinated development of the economy, society and the environment. Environmental evaluation is an important tool designed to protect the environment and promote sustainable development, through scientific analysis and prediction, helping decision makers to make more informed choices in planning and construction activities to reduce the negative impact on the environment.

## CONCLUSION

The purpose of this study is to explore the application and effect of virtual reality (VR) technology in improving the snow and ice landscape tourism experience in Harbin. Through an online questionnaire survey, this study collected the cognition, acceptance and experience feedback of VR technology in the assessment of tourism environment. The results showed that young, highly educated groups have a high understanding and acceptance of VR technology, and most respondents have experienced VR through home devices and mobile applications, highlighting the convenience and accessibility of technology popularization.

Respondents generally believed that VR technology has a significant role in enhancing virtual tourism experience, evaluating tourism resources and environment, as well as tourism planning and management, revealing the potential application of VR technology in the tourism field. Although not all respondents were familiar with the snow and ice landscape in Harbin, media and social media were the main access to relevant information, highlighting the key role of these platforms in tourism promotion.

According to the research, VR technology has a wide application prospect in the improvement of ice and snow landscape tourism experience in Harbin, which can provide immersive experience, improve the efficiency of resource evaluation and management, and has the potential to become an important tool in the tourism industry. Future research should focus on how to optimize the VR experience and integrate it more deeply into tourism planning and management practices.

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