Research on the Application of Interactive Projection Technology in Park Landscape Design

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Abstract: With the rapid progress of science and technology, interactive projection technology has become an indispensable part of modern design and display. In park design, the use of interactive projection technology not only improves the technological sense of the park landscape, but also enhances the artistic atmosphere and gives visitors a more colorful experience. Through the method of case study, this paper takes Chanba Park in Xi'an City, Shaanxi Province, as an example, where interactive projection technology has been successfully integrated to give the park a new vigor and charm. Unlike traditional landscape design, the use of this technology in Chanba Park will allow visitors to fully experience the perfect combination of technology and nature. This increased traffic will not only improve visitor satisfaction, but will also indirectly drive the economic development of the park's neighborhood, bringing more business opportunities to local merchants. The success of the interactive projection space on the left bank of the Ba River clearly demonstrates the importance of integrating technology into the landscape design of parks and its potentially far-reaching effects. This trend has not only been proven in Ba River Left Bank Park, but also provides a new direction for future park design.

Keywords: Interactive Projection Technology; Digital Projection; Park Landscape Design; Night Tour Economy

1. Introduction

With the increasing popularity of the Internet, various digital technologies have gradually become the norm in people's daily lives. In park landscape design, the integration of digital art is gradually seen as a key development direction, giving rise to an innovative interactive projection landscape. This kind of landscape represents the current new trend in park park construction, research and utilization. The use of digital technology for park landscape design not only broadens our understanding of the aesthetics of park landscapes, but also provides a new method of digital art creation, which has a far-reaching impact on the progress of park landscape design in the twenty-first century. outlined below when submitting your final draft to the STEMM Press. These guidelines include complete descriptions of the fonts, spacing, and related information for producing your proceedings manuscripts.

2. Interactive Projection Technology Development Process

Against the background of global digitalization and technological revolution, China has also made remarkable progress in the field of interactive projection technology. Since the end of the last century, with the rapid growth of China's economy and the strong investment in the field of technology, interactive projection technology began to gain attention and development in China. In the early 2000s, China's multimedia industry came into its own. Shopping malls, exhibition centers and enterprises in many cities began to use rudimentary interactive projection systems to provide more vivid and engaging displays for customers and audiences. This rudimentary interaction was mainly realized through simple touch screen technology [1]. Subsequently, with the advancement of technology, domestic R&D teams began to explore more advanced methods of interactive projection. For example, the use of infrared sensors, cameras and professional image processing software can capture the user's movements and gestures to achieve more complex interactive effects [2]. This technology was first applied in large-scale commercial exhibitions, art performances and

public spaces. In recent years, with China's breakthroughs in artificial intelligence, deep learning and machine vision, interactive projection technology has been further enhanced. Many domestic tech companies and startup teams, such as Baidu, Alibaba and Tencent, have been doing a lot of R&D and practicing in this field. The products and solutions they have launched have not only gained wide recognition in the domestic market, but also received high attention internationally. At present, interactive projection technology has been widely used in China, from education, medical care, entertainment to commercial display, everywhere. Especially in some large-scale public events and cultural festivals, interactive projection has become an important highlight, bringing a brand new experience to the audience. Overall, the development process of interactive projection technology in China is a process of continuous innovation and breakthrough. In the future, with the further development of technology and the continuous expansion of the market, the application and influence of interactive projection technology in China will continue to strengthen.

3. The Significance of Interactive Projection Technology in Park Landscape Design

In recent years, parks have evolved from simple leisure space to a public place integrating high-tech interactive experience, in which interactive projection technology plays a crucial role. Interactive projection technology enriches the visual effect of the park. Through projection, trees, ground or lakes in the park can show fantastic patterns and animations, especially at night, this visual feast not only attracts more visitors, but also creates a unique romantic atmosphere. The park is no longer just a place to play during the day, but also a hotspot for people to gather at night. Interactive projection enhances the interactivity of the park. With the help of sensors and cameras, the projected content can interact with visitors in real time [3]. For example, when visitors walk around, the patterns on the ground change; or when they interact with an animated character, the character reacts. Such experiences not only bring fun to visitors, but also bring them closer to the park, making every trip to the park full of novelty. This technology also provides new

educational avenues for the park. Through projection, the park's history, ecology and other knowledge can be displayed so that visitors can learn while having fun and better understand the park's culture and values [4].

4. The Main Application Types of Interactive Projection Technology in Park Landscape Design

4.1 Dynamic Ground Projection Technology

Dynamic ground projection is a modern digital technology that projects various dynamic patterns or images onto the ground in real time through high-tech sensors and projection equipment. This technology transforms the calm ground surface into an active and interactive platform, greatly enriching people's experience in public space. Dynamic ground projection relies on high-resolution projectors and highly sensitive sensors. The sensors capture the movements of people or objects, and then the projector responds quickly to generate the corresponding images according to a preset program or real-time computation, which are displayed on the ground [5]. Dynamic ground projection provides a highly interactive and immersive experience for participants. For example, when people walk in the projection area, the fish on the ground may "swim away", or the "water" under the feet will appear ripples.

4.2 Dynamic Game Interactive Area

Interactive game area, as a new form of entertainment in modern public space and commercial places, is more and more popular among people. Combined with dynamic ground projection technology, these game zones provide participants with an innovative and fun experience. Dynamic ground projection technology detects players' movements in real time, and based on their movements, jumps or other actions, projects the corresponding image feedback, such as ripples under the feet, popping effects or following points of light. The technology also supports multi-player interaction. With high-precision sensors, multiple players can participate at the same time, increasing the competitive and cooperative nature of the game. The immersion experience is stronger in interactive game scenarios. Dynamic ground projection creates a virtual, but nearly real,

game environment for players, which greatly enhances the immersion of the game [6]. At the same time, players can not only interact with the projection, but also work with other players to complete the game task, which promotes human interaction.

4.3 Nighttime Light Scene Display

Nighttime light shows have gradually occupied an important position in the cultural context of modern cities, providing the public with a unique and unforgettable audiovisual feast. In the busy city life, this kind of performance brings people a moment of tranquility and relaxation, making them forget the daily pressure and busyness for a while. LED lighting technology is one of the main technologies in the night light show. Due to the high brightness, long life and low energy consumption characteristics of LED lighting, it creates a colorful and brilliant visual effect for the show. This lighting technology is not only for illumination, but also for artistic and emotional expression. It can simulate natural phenomena such as sunrise and sunset, flowing water, flame, etc. It can also create a variety of fantastical scenes and effects, so that people can feel the visual shock. The addition of 3D mapping technology brings more possibilities for light shows. By projecting 3D images onto the surface of buildings or other objects, static objects can be made to "come alive", creating the illusion that they are alive. This technology adds depth and three-dimensionality to the performance, making it seem as if people are in a dreamlike world. The perfect combination of music and light is also a highlight of the night light show. When the lights flicker to the rhythm of the music, it brings a strong sense of immersion to the audience. Harmonious music light show can touch people's hearts and make them feel deep emotions while enjoying the show [7].

5. Analysis of the Application of Interactive Projection Technology in Ba River Left Bank Park as an Example

The transformation of Ba River Left Bank Park highlights the trend of integrating modern technology with the natural environment, especially the introduction of interactive projection technology, which brings innovation and vitality to the traditional park.

5.1 Digital Innovation of the Environment

In the past, the Ba River Left Bank Park relied mainly on natural scenery to attract visitors and provide a natural environment for daily leisure activities. Compared to modern facilities, the park lacked attraction at night and the visitor experience was relatively homogenous. Now, with the integration of interactive projection technology, the park's appearance and functions have been greatly enriched. The left bank of the Ba River at night will be transformed into a magical interactive space with the help of light and shadow technology, and the introduction of this technology not only beautifies the park's night view, but also makes the park an all-weather leisure place [8].

5.2 Comprehensive Enhancement of Overall Experience

The use of interactive projection technology has greatly enhanced the market competitiveness of Ba River Left Bank Park. The unique attraction of the art of light and shadow has become a new visitor magnet, especially in the evening, when the park, which was originally sparsely populated, will become lively in the transformation of interactive projection, and the goal will be to attract a large number of tourists who seek fresh experiences. Through the spread of social media, the interactive projection technology in Ba River Left Bank Park has the potential to become an emerging hotspot, further increasing visitor traffic and creating more business value.

5.3 Significantly Increase Visitor Traffic

The use of interactive projection technology is expected to greatly enhance the market competitiveness of Ba River Left Bank Park. The unique attraction of light and shadow art has become a new visitor magnet. As mentioned above, in the evening, the park, which was sparsely populated, will become lively and will be expected to attract a large number of visitors seeking fresh experiences. At the same time, through the spread of social media, the Ba River Left Bank Park's interactive projection technology has become an emerging hotspot, further increasing visitor traffic and creating more business value.

6. Future Development Trends of Interactive Projection Technology in Park Landscape Design

6.1 The Development Trend of Virtual and Reality Integration in Park Landscape Design

In the future, parks will become a platform for displaying the perfect combination of science and technology and nature, and the application of AR technology and interactive projection will give park landscapes a new dimension. Visitors will not only enjoy the natural scenery, but also be able to superimpose virtual historical or ecological content on the actual scenery through smart devices. For example, visitors may be able to follow the tracks of virtual animals or experience the re-enactment of historical events first-hand. Children can also have fun and learn in such an environment [9]. Combined with AR technology, the park is no longer just a place for leisure and relaxation, but also a vivid, educational and interactive experience space, presenting the public with the beauty of the harmonious integration of technology and nature.

6.2 Development Trend of Combining Ecology and Technology in Park Landscape Design

Modern interactive projection technology has injected more vivid elements into this ecological world. Through high-tech means, we can simulate the living scenes of rare plants and animals, show the charm of seasonal changes, or present rare wonders in nature, so that the public can receive ecological education and environmental protection revelations in a relaxed environment. Imagine a corner of the park where children can follow the fluttering of simulated butterflies and learn about their life cycle, or stand in a simulated rainforest and listen to the sound of waterfalls and observe the ecological balance. This approach to ecological education not only makes the transfer of knowledge more intuitive, but also makes the concept of environmental protection deeply rooted in people's hearts. While enjoying the natural beauty of the park, people can better understand the importance and urgency of environmental protection. Interactive projection technology for the park adds a bright landscape, so that man and nature, science and technology and ecology are perfectly combined to create a harmonious future [10].

7. Conclusion

At a time of rapid technological progress, digitalization has deeply penetrated into park landscape design, giving modern vitality to traditional parks. Through digital means, designers are able to simulate the natural environment and predict vegetation growth and light changes, thus realizing precise design and eliminating traditional errors. This technology also introduces rich artistic elements that transcend the limitations of traditional design. What's more, the digital tool improves design efficiency and makes it more precise. It also provides visitors with an immersive experience, such as the application of virtual and augmented reality technology. In conclusion, digital tools have revolutionized landscape design, which proves the harmonious combination of technology and art and shows us a new chapter of park design full of possibilities.

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