

Application of High-Tech Means in Urban Recreation Landscape Design

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Abstract:

With the aggravation of population aging and the improvement of living standards, urban recreation landscape design, as an important means to improve the quality of life of urban residents, is increasingly receiving widespread attention from society. This paper discusses the basic principles of urban recreation landscape design, and focuses on the application and role of high-tech means in this process. Through the integration of high-tech means, not only can improve the scientific and prospective landscape design, but also effectively promote the sustainable development of the ecological environment and the mutual promotion of residents' healthy life. The article ultimately aims to provide diversified high-tech application paths for urban recreation landscape design, in order to achieve the design concept of harmonious symbiosis of ecology, recreation and technology.

Keywords:

Recreational Landscape Design, High Technology, Intelligent Monitoring, Green Building, Virtual Reality, Ecological Compensation, Artificial Intelligence

1. Introduction

With the rapid development of science and technology, the field of urban recreation landscape design is undergoing a revolution. The application of high-tech tools not only improves the efficiency and accuracy of design, but also provides a more personalised and comfortable environment for the elderly and people with recreational needs. The following section will first outline the basic principles of urban recreation landscape design, and then delve into how high-tech tools are being used in various aspects of this field.

2. Basic Principles of Urban Recreation Landscape Design

2.1. Ecological principle

The principle of ecology plays a central role in urban recreation landscape design. This principle requires designers to prioritise ecological balance and nature conservation when planning and implementing landscape projects as a means of ensuring environmental sustainability and biodiversity. The ecological principle

emphasises harmonious co-existence with nature, and advocates making full use of native vegetation, adopting natural topography and landscape, as well as restoring and protecting natural water bodies in design. These practices not only reduce damage to the environment, but also provide more biological habitats, increase green space in the city and promote the function of ecosystem services. In concrete implementation, the principle of ecology is embodied at several levels: firstly, the protection and utilisation of local species, and the selection of plants adapted to local climatic and soil conditions in order to reduce the consumption of water, soil and other resources. Secondly, urban ecological restoration is carried out through bioengineering techniques, such as the installation of ecological corridors and the construction of ecological wetlands, so as to increase the ecological corridors and green spaces in the city and improve the biodiversity of the city. In addition, landscape design should also take into account factors such as soil water retention, improving air quality, regulating microclimate, etc. Through scientific planning and layout, it can achieve the reasonable collection and use of rainwater and reduce the urban heat island effect [1].

2.2. Recreational principle

The principle of amenity is another cornerstone of urban amenity landscape design, requiring that the design should take full account of the core objective of enhancing people's physical and mental health and promoting the rehabilitation of older persons and other groups. The principle emphasises the creation of an environment that is conducive to physical and mental healing, promotes healthy ageing and improves quality of life. Landscape design guided by the principle of wellness focuses on the combination of functionality and humanistic care, aiming to provide inclusive and accessible public spaces for people of all ages and ability levels. In practice, the principle of wellness advocates a number of considerations: firstly, barrier-free design to ensure that everyone can easily access and use the public space, including gentle ramps, spacious walkways, and clear signage. The second is the provision of facilities corresponding to different recreational needs, such as the installation of fitness equipment, leisure benches, walking paths and healing gardens. These facilities should take into account users of different ages and physical conditions and provide suitable recreational activities. In addition, the principle of wellness places special emphasis on the psychological effect of the environment, creating a peaceful and relaxing atmosphere through the use of natural elements such as soft light effects, the sound of running water and aroma, as a means of stimulating the sensory experience and promoting emotional relaxation and pleasure. At the same time, the design should focus on the interaction between the landscape and the surrounding community, encouraging social interaction and enhancing neighbourly relations, and jointly contributing to the enhancement of the well-being of the occupants [2].

2.3. Integration of high-tech means and traditional design

In modern urban recreation landscape design, the integration of high-tech means and traditional design is an increasingly popular trend, which aims to enhance the functionality, sustainability and interactivity of traditional design through the introduction of advanced technology, while preserving and promoting the cultural values and aesthetic characteristics of traditional design. The application of high-tech tools in landscape design can be seen in intelligent irrigation systems, solar-powered street lights, environmental monitoring sensors, and the use of computer-aided design (CAD) and geographic information systems (GIS) for precise planning. These

technologies not only improve the efficiency of design and ease of management, but also help to conserve resources and monitor environmental quality. At the same time, designers are focusing on combining these high-tech elements with traditional design concepts and elements. For example, on the basis of maintaining traditional garden styles, intelligent sensor technology can be used to adjust landscape lighting and sound systems to enhance visitors' interactive experience. Or while preserving historical sites and traditional buildings, modern materials and technologies can be introduced to reinforce and protect them to make them more durable. In addition, the combination of technology and tradition is also reflected in the modern interpretation of traditional culture. The use of Augmented Reality (AR) and Virtual Reality (VR) technologies allows visitors to gain a deeper understanding of the historical background and cultural stories, providing richer educational information and interactive experiences. This integration not only gives new life to traditional elements, but also makes the recreational landscape design more vivid and contemporary.

3. The Application of High-Tech Means in Urban Recreation Landscape Design

3.1. Application of intelligent monitoring technology in urban recreation landscape design

The application of intelligent monitoring technology in urban recreation landscape design is an important embodiment of the concept of smart city, which not only improves the management efficiency of the recreation environment, but also enhances the user's interactive experience and sense of security by integrating advanced information technology and Internet of Things (IoT) devices. Firstly, intelligent monitoring technology can be applied to the monitoring of environmental quality. By installing air quality sensors, soil moisture sensors and water quality testing equipment, air pollutant levels, soil moisture and water cleanliness in the recreational landscape are monitored in real time. These data are transmitted to the central database through a wireless network, so that managers can obtain environmental information in a timely manner and adjust maintenance strategies according to the results of data analysis to ensure the comfort and health standards of the recreation environment. Secondly, the use of intelligent monitoring technology in the recreational landscape lighting system is becoming increasingly popular. The use of intelligent lighting control systems to automatically adjust lighting according to time, light intensity and foot traffic not only saves energy and is highly efficient, but also enhances the adaptability and safety of lighting. For example, road lighting can automatically reduce brightness in the evening when the flow of people is low, while increasing brightness once pedestrians are monitored approaching to ensure pedestrian safety. Thirdly, intelligent monitoring technology is also crucial for the maintenance of recreational facilities. Using IoT technology, the use of fitness equipment, seats, pavilions and other facilities can be monitored in real time. By analysing the frequency of use and the degree of wear and tear, timely repair or replacement can be carried out to ensure that the recreational facilities are in good condition and extend their service life.

In addition, intelligent monitoring technology can also enhance the safety management level of recreational landscapes. For example, by installing cameras and motion sensors to monitor the dynamics in the park in real time, the system can

immediately notify the management staff or emergency services to respond swiftly in case of abnormalities, such as fall accidents or potential safety hazards.

3.2. Application of sponge city design in urban recreation landscape design

As a new landscape planning and design concept, sponge city design aims to realize the collection, utilization and discharge of urban rainwater by imitating the function of natural sponge in absorbing and releasing water. This concept has a wide range of application prospects in urban leisure landscape design, which helps to improve the environmental quality of the city, reduce the pressure on the urban drainage system, and at the same time provide citizens with a more comfortable and natural leisure space. For example, in the selection of landscape design materials, permeable paving, ecological fences, permeable bricks and other permeable building materials can be used to increase the infiltration and water storage capacity of rainwater. In the design of green space and water system, low impact development of urban wetlands such as artificial wetland, ecological flood retention area and rain garden can be set up to play the multiple ecosystem service functions of flood retention, water purification and provision of biodiversity. In terms of the layout of urban recreational sites, the edge space on both sides of low-lying areas and artesian drainage ditches shall be reasonably utilized to create water-stagnation zones or wetland parks with both landscaping and water resource utilization effects. And it will be included in the planning consideration of urban green space or water body system, to give full play to its comprehensive benefits in mitigating urban flooding, regulating microclimate and other aspects. In the necessary parts, flood control facilities or regulating water gates are set up to realize the dynamic balance between water storage and utilization and flood control and drainage. In the water feature design, rainwater collection system and recycled water recycling system are utilized to reduce the consumption of conventional tap water. At the same time, open water features such as ditches, fishponds and fountains are used to increase rainwater infiltration and confluence. Irregular water feature contours with extensive shorelines can improve rainwater penetration efficiency while providing people with closer-to-nature leisure spaces to enhance cities' ecological environment, address environmental challenges, and facilitate green urban development.

3.3. Application of virtual reality technology in urban recreation landscape design

The application of virtual reality (VR) technology in urban recreation landscape design is an innovative example of the combination of digital technology and recreation services. VR technology can create an immersive environment that allows users to experience different landscapes and activities without leaving the real world, and thus obtain recreation effects both psychologically and physically. Firstly, VR technology is able to provide a virtual travelling experience for the elderly or people with mobility problems who are unable to go out. By wearing a VR helmet, users can "visit" distant natural landscapes, places of interest, and even places that cannot be reached in person, such as outer space or the deep sea, and this novel experience can effectively alleviate the user's sense of loneliness and anxiety, which is conducive to mental health. Secondly, VR technology has a unique value in the design stage of recreational landscape. Designers can use VR technology to create a 3D simulation of the landscape, allowing decision makers and future users to "walk into" the designed landscape and experience the spatial layout and design elements before construction. This not only helps to gather feedback and optimise the design, but also provides a

sense of anticipation and belonging for potential users. R technology can be used in conjunction with fitness games to create virtual fitness environments that encourage users to engage in physical activity. Especially for those who are limited in their regular physical activities, VR fitness games provide a safe and fun way to exercise, which helps to improve their physical activity and quality of life. Finally, VR technology has also shown potential for assisted therapy in recreational landscapes. For example, for older adults with cognitive impairments such as Alzheimer's disease, VR can provide memory training games or environments that simulate daily tasks to help them maintain cognitive function [3].

3.4. Application of ecological compensation technology in urban recreation landscape design

The application of ecological compensation techniques in urban recreation landscape design is to find a balance between urban development and natural environmental protection. Through these techniques, designers can compensate or make up for the impacts of urban construction on natural ecosystems while creating beautiful, livable recreational environments. This approach helps restore and protect biodiversity, maintain ecosystem services, and provide ecological benefits such as clean air and water. Ecological compensation techniques include ecological restoration and reconstruction. In recreational landscaping, this may mean restoration of damaged natural areas, such as replanting trees, restoring wetlands, and re-establishing vegetation strips along the edges of rivers, etc. These measures help provide recreational space while restoring ecological functions. Ecological compensation also includes the use of native planting strategies to support local ecosystems. The use of native plants not only reduces maintenance costs as they are adapted to local climatic conditions, but also provides food and habitat for local wildlife and promotes biodiversity. In addition, green infrastructures such as eco-roofs and green walls are part of eco-compensatory techniques. These facilities not only beautify the urban environment, but also provide essential ecological services to the city, such as cooling and slowing down runoff. Ecological compensation techniques can also be realised through the creation of ecological corridors that connect natural areas separated by urban construction, allowing plant and animal populations to exchange and migrate, and enhancing the stability and resistance of the entire ecological network. Ecological compensation in urban recreation landscape design can also be achieved through the provision of environmental education, combining landscape design with education to inform citizens about the ecological values of their environment and how their behaviour affects these values. This education can be provided through interpretive signage, interactive exhibits, or guided tour programs [4].

3.5. Application of artificial intelligence technology in urban recreation landscape design

The application of Artificial Intelligence (AI) technology in urban recreation landscape design is increasingly becoming a hot area that not only improves the efficiency and effectiveness of design, but also plays an important role in the use and maintenance of landscapes. AI technology can facilitate the creation of more personalised and dynamic recreation environments through data analytics, machine learning and automation. AI can help designers to understand users' needs at the design stage by analysing large amounts of data to understand the needs

of users. Through in-depth analysis of historical weather data, foot traffic monitoring data, residents' health conditions and other information, AI can help determine the most appropriate vegetation types, path layouts and locations of recreational facilities to meet the needs of specific populations. Through machine learning algorithms, AI can optimise the configuration of design elements in the recreational landscape. For example, by analysing user behaviour patterns, AI can guide which areas to install additional seating, which paths need improved lighting, and even predict and plan for future expansion needs. AI can also enable intelligent monitoring and maintenance of the recreational landscape. For example, by implanting sensors, AI systems can monitor soil moisture and vegetation growth in real time and automatically adjust the irrigation system to not only save resources but also keep the landscape in optimal condition. Similarly, AI-powered drones or robots can be used for inspections to identify and report maintenance needs. AI can also provide a personalised experience in the interactive amenities of a recreational landscape. Through facial recognition and behavioural pattern recognition technologies, AI can adjust environmental factors such as music, lighting and temperature to suit the moods and preferences of different users, creating a comfortable recreational environment. In addition, AI technology can provide guidance and companionship to the elderly through virtual assistants. For example, in a recreation park, AI assistants can provide users with navigation, health advice, and even quick response in emergencies through mobile devices or interactive screens in the park. With the continuous progress of algorithms and the accumulation of data, the application of AI in urban recreation landscape design will become more and more accurate, more and more able to meet people's growing demand for recreation, and provide a healthier, smarter and more sustainable living environment for urban residents.

4. Conclusions

In summary, the integration of high-tech means can not only enhance the sense of science and technology and the sense of the future of urban recreation landscape design, but also greatly enhance the practicality and ecological nature of the design. Through the application of high-tech means such as intelligent monitoring, green architecture, virtual reality, ecological compensation and artificial intelligence, urban recreation landscape design will be more humanised and intelligent, creating a healthier and more comfortable living environment for urban residents, especially the elderly population. In the future, with the continuous progress and innovation of technology, urban recreation landscape design will continue to develop and become an important part of sustainable urban development.

Conflicts of Interest

The author declares that there is no conflict of interest regarding the publication of this article.

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