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Application of GIS, GPS, Remote Sensing Technologies and Virtual Reality in Environmental Planning

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Abstract: Environmental planning is a systematic work with large-scale issues and big difficulties. This article briefly discusses GIS, GPS, remote sensing technologies (3S technologies) and virtual reality (VR), and verifies that these technologies can provide assistance for environmental planning. On this basis, this article focuses on the application of 3S technologies and VR in environmental planning, such as point processing, line processing and surface processing, constructing geometric virtual environment and image virtual environment. In order to maximize roles of these technologies, advantages, scientificity and rationality of environmental planning should be enhanced to create ideal space for social and economic development.

Keywords: Virtual Reality (VR); Environmental Planning; Image-based Rendering Virtual Environment; GIS, GPS, and Remote Sensing Technologies; Virtual Environment for Geometric Planning

1. Introduction

With the rapid development of China's social economy in recent years, more and more attention has been paid to environmental planning in order to build a city with nice ecological environment. However, the previous planning methods are backward, which makes it difficult to collect and analyze information efficiently and to provide guarantee for the scientific bases of environmental planning. Therefore, it is of great significance to actively explore the application of 3S technologies and VR under the new situation.

2. Overview of 3S technologies and VR

3S is the general name of three high technologies, which are GIS, GPS, and remote sensing technologies, being as a whole. GPS and remote sensing can provide high-quality spatial data for GIS. Meanwhile, GIS is an ideal platform for comprehensive data processing, which can enhance the ability of remote sensing and GPS to acquire information[1]. The combination of these three can promote them to give full play to their own performance, form a joint force and produce greater utility.

VR refers to virtual reality and has the characteristics of autonomy and interactivity, which can create a virtual environment that makes people feel by touching, listening and seeing. Although the created virtual environment is not real, valuable information can be acquired.

3. Application of 3S technologies and VR in environmental planning

3.1 Application method of 3S in environmental planning

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With the supports of GPS and information acquisition paths such as RS and field detection, geographic information database of the planned area can be established in actual practice, covering various contents, like rivers, administrative divisions, traffic, mountains, etc., and can provide reference for the practical environmental planning[2]. GIS can provide diversified functions, specifically in the following fields. First of all, relevant environmental information is allowed to be included in the database system to edit and maintain data. Secondly, relevant information can be quickly found through the function of quick query. Thirdly, environmental data can be presented in different forms, such as statistical maps. Fourthly, spatial relationship among environmental goals can be obtained with some other derived information. Fifthly, multimedia demonstration can be carried out.

When using 3S technologies in environmental planning, attention need to be paid to the establishment of geographic information database. Moreover, related researches should be carried out, like the distribution of pollutant treatment points, land use status, etc. According to the analysis, proper use of GIS to carry out environmental planning activities is helpful to improve the planning level.

3.1.1 Point processing

With the help of 3S technologies, point processing is a key link in environmental planning. It is necessary to extract human landscape points, sewage outlets, geographical features, etc. The attributes of points also need to be different after the acquisition. In order to play the spatial analysis function of point source, it is necessary to use GIS software correctly. In this process, the points whose attributes can satisfy the conditions should be selected. On this basis, the point sources for spatial analysis can be obtained effectively. It is also necessary to formulate the scope of buffer analysis in order to obtain the influence area of this kind of point source. Moreover, in the process of point processing, it is necessary to pay attention to the transformation of point source information, which should be transformed into non-point source information to provide an intuitive picture for planners. It is also necessary to understand the distribution of existing point sources, which can be used as a basis to explore the most suitable spatial location for governance and help lay a good foundation for the subsequent environmental planning[3].

3.1.2 Line processing

After point processing is completed, line processing is needed for the main reason that a lot of information is expressed in the form of lines, such as sewage pipes and rivers. Regarding to 3S technologies, the function of lines is relatively powerful. Lines with different thicknesses represent different objects, and they can also represent the spatial position of relevant information, such as pollution degree, being undoubtedly beneficial to planning. To get the relevant information of linear pollution sources, GIS is needed and in which buffer zone is set. In this case, not only the area of pollution sources can be known, but also their distribution status can be obtained.

3.1.3 Surface treatment

Great influence will take place when dealing with critical links in the application of 3S technologies in environmental planning. It is mainly due to the fact that most of the information is presented in the form of surface. For example, soil type map, division of environmental functional areas, etc. By processing surface's data scientifically, the relevant geographical background information can be obtained effectively. The comprehensive analysis of environmental planning can be realized, and the scientific and rational planning can be improved.

3.1.4 Production of drawings

With the support of GIS, basic graphics can be made, such as transportation, scenic spots and historical sites, topography, water system, soil quality and meteorology. Beyond that, special civil works can be carried out, such as optimal design drawings of urban layout, pollution source distribution maps and regional pollution assessment maps, providing an important reference for environmental planning[4].

3.2 Construction methods of virtual environment

The biggest advantage of VR is to construct a virtual environment. Therefore, VR can be applied to simulate the environment, and to find out, deal with the unscientific aspects in time in environmental planning process.

3.2.1 Virtual environment for geometric planning

Virtual environment for geometric planning is one of the main forms in environment planning, and a 3D

model will be built in the form of polyhedron stacking various objects. The establishment of this model can enhance user's understanding of the virtual environment from a comprehensive perspective. It is more intuitive and interactive, and even allows users to walk freely in the corresponding scenes to obtain a more stereoscopic perspective.

Generally speaking, it is difficult to make relevant 3D models on computers. The requirements for computer technology and equipment are extremely high, which increases the obstacles in making 3D models. Especially for complex and huge scenes, it will be limited by many factors, which will easily lead to the problem of unrealistic scenes. Based on this, the system uses the simplified method to carry out the entity layout work, which is easier in operating and data structuring. It helps to enhance the visual effect of graphics, reduce the difficulty of constructing fictional scenes, and is able to display ideal planning results in a short time (as shown in **Figure 1** which shows the urban planning and construction map with VR).

Figure 1. Urban planning and construction map presented by VR.

3.2.2 Image-based rendering virtual environment

Image-based rendering virtual environment is one of the important means when applying VR to environmental planning. A 360-degree ring scene image is mainly created through the use of cameras, and other imaging equipment. The scene is of a strong sense of fidelity and is not limited by the network bandwidth. However, it also has certain defects. Its interactivity is poor and cannot provide stereo vision with depth of field[5]. Therefore, there are certain conditions for the application of image-based rendering virtual environment in the actual practice. It is generally used when existing scenery is displayed. Users need to go to the scene to take pictures. There are certain requirements for the shooting environment—small crowd, good weather, and up-to-standard visibility. It is necessary to select a representative place for shooting. Moreover, a tripod is needed and a digital camera with wide-angle lens is preferred to keep the picture stable. After the shooting, photos should be input into the computer, processed by Photoshop software, and spliced by PixMaker software in order to obtain 360 circular angle images.

4. Conclusion

In summary, environmental planning is influenced by many factors such as time, environmental construction and spatial distribution. In order to effectively obtain and manage relevant information, 3S technologies and VR should be given fully to. The powerful functions of information collation and display can be highlighted and the efficiency and quality of environmental planning will be enhanced.

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