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Research on Key Technologies of 3D Rendering Algorithm in Urban Architecture Design

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Abstract:With the rapid development of 3D rendering technology, the country attaches great importance to the strategic significance of the "digital city", and the emergence of high-performance mobile devices has given the mobile terminal 3D city visualization technology a broad development prospect and strong technical support. Based on the Android mobile platform, this paper studies the key technologies of 3D city visualization. Focus on the establishment of 3D city models, 3D data organization, and the use of their respective advantages in 2D and 3D to realize the linkage display of 2D and 3D city scenes, and realize the multi-resolution display of 3D cities through the streamlining of building models and the study of model selection strategies. The final design realizes the mobile terminal 3D city visualization interactive system.

Keywords: Key Technologies, Urban Architecture Design, 3D Rendering, 3D modeling

1. INTRODUCTION

People who have used Google Earth or other 3D virtual digital earth software will definitely have various impacts on their vision, such as their powerful geospatial data storage and display capabilities, realistic terrain and 3D visualization of buildings, and flexible operations. vivid memory. All this seems so real, giving people a feeling of standing somewhere on the earth. These are all derived from the rapid development of computer graphics technology and three-dimensional geographic information technology, coupled with the powerful calculation and rendering capabilities of modern graphics hardware, can give people Bring this kind of value, and the research content of this article is just another innovation in the field of digital earth using these technologies. In the construction of digital city projects based on digital earth, building models have gradually become the most important visual element. With the expansion of the application of digital city projects, the requirements for the accuracy and quantity of building models are getting higher and higher. The three-dimensional visualization of large-scale building models has become a research focus of Digital Earth [1-6].

At present, the research of domestic and foreign scholars is mainly based on the secondary development or bottom development of the above-mentioned visualization platform. ArcGIS has created the latest weapon of the "new generation of Web. GIS platform", ArcGIS. 10.3, which will further integrate resources and functions and provide them in the form of Web, while users will use multiple terminals to access them anytime and anywhere. Skyline is an excellent three-dimensional platform software that can use remote sensing data, digital elevation data, vector data, and 3D data to create interactive visualization effects; it supports the creation, browsing and analysis of real three-dimensional surface landscapes, building landscapes, etc. SuperMap is useful for 3D GIS products specifically aimed at the mobile terminal. The API based on SuperMap on the mobile terminal can obtain 3D data online or offline for real-time display, and the display effect is better. Imagine. Virtual. GIS platform provides users with a three-dimensional operating platform that can roam in real time, with functions such as visualization, visual analysis, and real-time through-flight [7-12].

CityMaker mobile version supports Apple IOS and Android systems, supports network data services and local data files, supports 3D scenes, visualization of terrain, multi-touch interactive roaming, smooth scheduling of city-level massive data, and exquisite scene rendering effects. With the concept of “Smart Earth and Smart City” being proposed, many three-dimensional virtual models above or below the surface of the earth, such as various buildings, roads, pipelines, hydropower systems, etc., need to be more and more intelligently and networked. Efficiently load it into the digital earth and form the Internet of Things to realize the organic integration of human society and physical systems. Therefore-the development needs of digital cities have brought higher efficiency requirements for 3D virtual models, especially building models, in various stages of visualization. Due to the advancement of smart city construction and the continuous advancement of digital methods, many research institutions have conducted research on building model construction methods in recent years. In foreign countries, Stanford University in the United States used a laser rangefinder to digitize close-up buildings and achieved good results; Canada developed the NRC 3D Imaging platform for model restoration of cultural relics and other buildings [13-17].

2. THE PROPOSED METHODOLOGY

2.1 The Urban Architectural Design

With the continuous improvement of environmental protection awareness and the gradual emphasis on physical and mental health, people's requirements for residential areas have also changed. A healthy, comfortable, and green environment is the ideal living environment for people. In today's era, urban architectural design needs more attention. To meet people's needs for greenness and health, integrate ecological concepts into architectural design to realize the harmonious coexistence of nature, architecture and people. The residential area needs to have excellent lighting performance, ventilation performance and sound insulation performance. Since the building is used for long-term residence, the content of chemical pollutants in the indoor air must be strictly controlled to ensure human health. The

architectural design embodies the ecological concept, which means that the building must be integrated with the surrounding environment, and the space must be fully utilized to create a green environment. Various green plants such as shrubs and trees can be planted around the building.

In addition to the buildings in the residential area, the buildings in the city also include the buildings in the industrial area. The buildings in the industrial area are also an important part of the urban architectural design. The general direction of the architectural design of the industrial zone to embody the ecological concept is to adopt reasonable design, scientific planning and the combination of architecture and greening. Industrial zones mainly carry out industrial production. Compared with the damage caused to the environment by residential areas, industrial zones put greater pressure on the environment. Industrial production will inevitably produce a lot of pollution, such as air pollution, dust pollution, and noise pollution. According to this characteristic of the industrial zone, its architectural design should minimize pollution and avoid pollution to human health.

The design of the interior of the building is very complicated. To reflect the ecological concept inside the building, a multi-faceted design is required. The interior design of the building should strengthen the efficient use of energy. The building is required to improve the energy system in the design process to maximize the effect of energy. In general, designers should take measures in three aspects during the architectural design process. (1) The level of architectural design should be improved, and (2) designers should combine the actual situation of the indoor environment to formulate scientific energy energy improvement plans. (3) On the premise of focusing on efficient use of energy, ensure the functionality and aesthetics of the building.

2.2 The 3D Rendering Technology

Level of detail (or level of detail, multi-level of detail, English: Level of Detail, abbreviated as LOD) technology refers to determining the resource allocation of object rendering according to the position and importance of the node of the object model in the display environment, reducing non- the area and detail of important objects, so as to obtain efficient rendering operations. Level of detail algorithm is a very important research content in computer graphics. Due to the huge differences in the structure and organization of data, spatial distribution, and programs that need to be simplified for different rendering data, LOD is also a research difficulty in the field of graphics. In the digital city, as mentioned above, three types of data need to be implemented with the level of detail mechanism. Now the author will introduce the common mechanisms for realizing LOD in combination with several digital earth products at home and abroad. To use a camera to model a close-range actual building, firstly, it is necessary to obtain the necessary control point information from the control measurement of the house. Follow the implementation steps of first control and then photography, and obtain close-up images of the house in accordance with the pre-designed plan.

For buildings with special structures, every detail must be photographed; but for ordinary buildings, first analyze and consider the symmetry and reproducibility of the building structure, and only the basic parts that are not repeated can be photographed. Usually, only the vertical facade of the building is photographed, and two or more strips are formed through such upright photography to form a free net, which is used as the basis for calculating the three-dimensional object point. According to photography standards, the overlap between every two adjacent images on the same strip must be higher than 65%. After analyzing the experimental area, this article adopts the one-on-one shooting forward method. The whole building was photographed, and the roof images that could not be obtained were supplemented with the help of high-resolution satellite images. In the next analysis and processing, since the subject is a building, its biggest feature is the rich and specific features of points and lines, such as its own structural lines, window lines, and crossing lines and points caused by tiles. In order to obtain the initial values of the internal and external orientation elements of the image in its model coordinate system.

2.3 The Three-Dimensional Rendering Technology in Urban Architectural Design

To use building information modeling technology to achieve the integration of engineering design and construction, it is necessary to solve existing problems, overcome numerous difficulties, and integrate building construction with building information processing. The integration process of architectural engineering design and construction is the unification and integration of architectural information and architectural production. It is to integrate the collected building information, design a building model based on the data, and plan and arrange the overall construction of the building. The building construction is carried out on the basis of the architectural design. And they have a unified operating platform, which is carried out under a unified plan. The traditional architectural design and construction are separated. The functions of the intelligent management platform mainly include the provision of a deep design database, the modular management of the progress of the component production stage, warehousing, and logistics, the integrated management of personnel, machinery, materials, construction methods, and the environment in the on-site construction stage, and the control of the construction progress and correction, and the handover of the database during the operation and maintenance stage.

When designing a building, designers should use building information modeling technology, build building information models based on specific data and information, and make a budget for construction costs, and then visually simulate later construction on this basis. Of course, the ultimate goal of the design is to allow the construction personnel to carry out construction according to the design drawings. In order to achieve the integration of construction and design, the construction personnel are required to participate in the design of the construction drawings in the design.

3. CONCLUSIONS

With the rapid development of 3D rendering technology, the country attaches great importance to the strategic significance of the "digital city", and the emergence of high-performance mobile devices has given the mobile terminal 3D city visualization technology a broad development prospect and strong technical support. Based on the Android mobile platform, this paper studies how to build a 3D city model based on 2D and 3D rendering technology data and realize real-time rendering of 3D scenes through reasonable data organization. First, it introduces the traditional 2D modeling in urban architecture and the most recent 3D. Modeling foundation, and then analyzed the new method of urban architectural design based on 3D rendering technology.

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