Design and application of VRGIS 3D simulation system for power grid soil and water conservation

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Study on improving efficiency of water and soil conservation measures in power grid project based on 3D emulation

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Abstract. Under the development trend of economic globalization, the rapid development of social economy and science and technology provides a new direction for the research of soil and water conservation technology in power grid. As an organic combination of geographic information system and virtual reality technology, VRGIS not only continues the basic functions of traditional spatial data storage and processing, but also has the unreal interface of virtual reality technology, building a new platform for the construction and management of smart grid in the new era. Therefore, after understanding the research status of smart grid construction, this paper mainly studies the design and application measures of 3D simulation system for water and soil conservation of power grid according to the application advantages of VRGIS technology in smart grid management, so as to provide an effective basis for the development of smart grid.

Keywords: smart grid; VRGIS technology; Three-dimensional simulation; Geographic information; Virtual reality.

1. Introduction

In the development of science and technology, China's smart grid industry has entered a stage of rapid development, and VRGIS technology organically combines the advantages of three-dimensional virtual reality technology and geographic information system, which can guide power enterprises to truly realize three-dimensional detection. From the perspective of the long-term development of smart grid industry, the planning and utilization of VRGIS technology is an effective means to realize the modernization of smart grid. Today, smart grid construction management is mainly facing the following trends: First, automation as the main development direction of industry construction management, refers to the overall power supply network to achieve unmanned or a small number of human control, the computer network as the main control, only through human reasonable programming, can complete the full automation control of power supply; Secondly, having a high self-healing ability is the main direction of smart grid construction and development, and the current popular power grid system in the world has obvious characteristics, that is, strong stability and high reliability. Most smart grids have self-healing capabilities, which can normally isolate faulty components in a small amount or without human intervention to ensure the orderly operation of the system and truly minimize the risk of power supply interruption. Finally, the system is more integrated. The biggest difference between smart grid and traditional power grid is that it has strong integration ability, can achieve monitoring, maintenance and control and other goals, can ensure the effective combination of its own functions and other information systems, and finally form an integrated power grid information system, which is convenient to describe and control the data of the power supply network. ［1.2.3］

In the construction and development of smart grid, VRGIS technology can build a digital substation, ensure information sharing among intelligent electrical equipment inside the substation, comprehensively understand the operation of the power supply network, collect and manage the operation of the transmission network in various regions, and provide three-dimensional simulation images for managers, so as to solve the problems existing in traditional substations. At the same time, VRGIS technology can build an energy management system, collect data and information related to the power grid, scientifically forecast and allocate power resources according to local power demand, and realize inspection supervision and control with the help of VRGIS technology. In this process, the organic integration of VRGIS technology and smart grid can scientifically adjust the management and operation of power grid assets, help staff to find problems faster, and the energy assets required in each region, continuously optimize the allocation of power resources, and ensure the comprehensive development of smart grid in the direction of digitalization and advanced; The geographic information system can extract and analyze the operation data of the power grid anywhere at any time, facilitate the market participants to grasp more adequate information, help customers and power grid staff to refine the basic parameters such as power capacity and change rate, and guide the power industry to scientific planning and safe operation. The virtual reality technology can carry out virtual simulation description of the smart grid, extract relevant data parameters from it, and comprehensively monitor the operating status of the power grid to ensure the healthy and stable development of the power market.

With the deepening of intellectualization and marketization and the wide application of digital technology, the interaction between the power network and the market and users is becoming closer and closer, and the social construction and development demand for power energy is increasing. The traditional power operation and management mode can no longer meet the needs of social development. Therefore, under the trend of intelligent development of the power grid industry, Reasonable use of VRGIS technology for monitoring and management, active construction of grid water and soil conservation VRGIS 3D simulation system, and effective application measures for specific business are the main topics of exploration in the electric power industry.「4.5.6」

2. Method

2.1 Feasibility of technology convergence

The two-dimensional GIS system used in the traditional power system will use symbols such as points, lines and surfaces to represent different types of actual ground objects. Its biggest defect is that the geometric figure is relatively simple, and the standard form cannot reflect the topography of power equipment and facilities such as lines, poles and towers, and cannot provide real and operable environmental system for the staff. It can not show the structure of power equipment itself and the topological relationship between each other, and there are limitations in both spatial performance and analytical ability. The application of virtual reality technology (VR) in the graphic management system of smart grid platform has high technical content and strong market demand. Therefore, the development of VRGIS technology is an effective basis for promoting the three-dimensional visualization process of power grid, and it is also the main content of future smart grid system construction research. According to the analysis of the platform function hierarchy planning diagram shown in Figure 1 below, the overall design is mainly divided into three contents:「7.8.9」

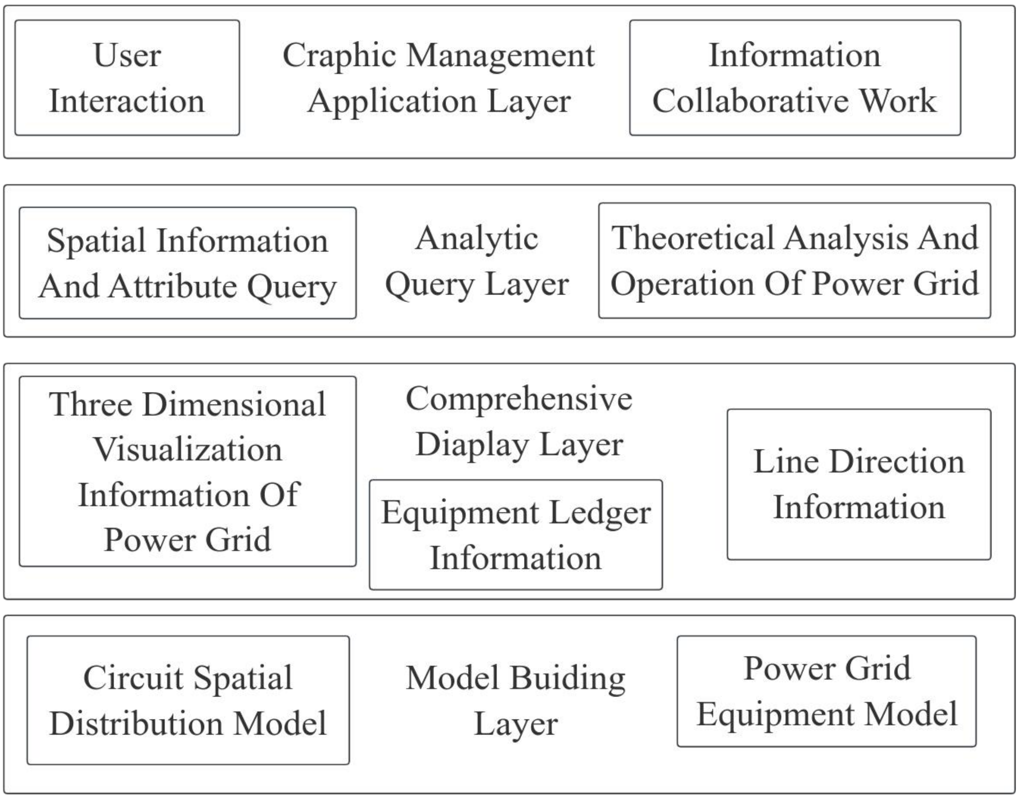

Figure 1. Planning diagram of platform function level

First, the model builds the graph. When constructing the 3D model of smart grid, it is necessary to use 3D substation, 3D line and other power equipment to accurately present the relevant information of the overall spatial distribution. Secondly, the comprehensive display layer. The application system comprehensively displays the smart grid, which can better query the visualization state of the three-dimensional power grid, the operation of the power line and the surrounding environment. Finally, the graphics management application layer. As the navigation basis of the power industry, this part can provide users with basic functions such as line inspection, power grid early warning, and state maintenance, and can orderly complete the work of scheme optimization, scene design, landscape roaming, and on-site evaluation.

In the organic combination of 3D technology and smart grid module, the final platform can comprehensively present 3D visualization effects to users, as shown in Figure 2 below: ［10.11.12］

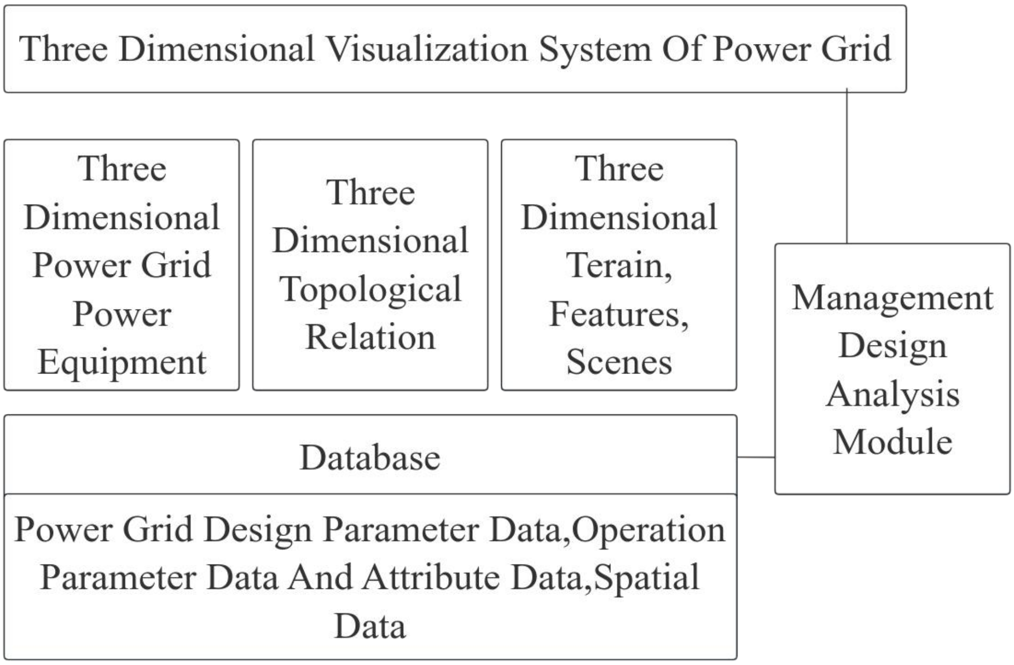

Figure 2. 3D visualization structure of power grid

The overall design should be realized by C++ dialog engineering design. After the design of three wizard pages, the wizard design and C++ single document dialog box class are combined to obtain a three-dimensional smart grid visualization system.

2.2 Three-dimensional modeling of digital power grid

To build a 3D simulation environment for power grid soil and water conservation, the overall process is different from the traditional model, and basic technologies such as model segmentation, texture and mapping will be used to form a comprehensive modeling platform as shown in Figure 3 below: ［13.14.15］

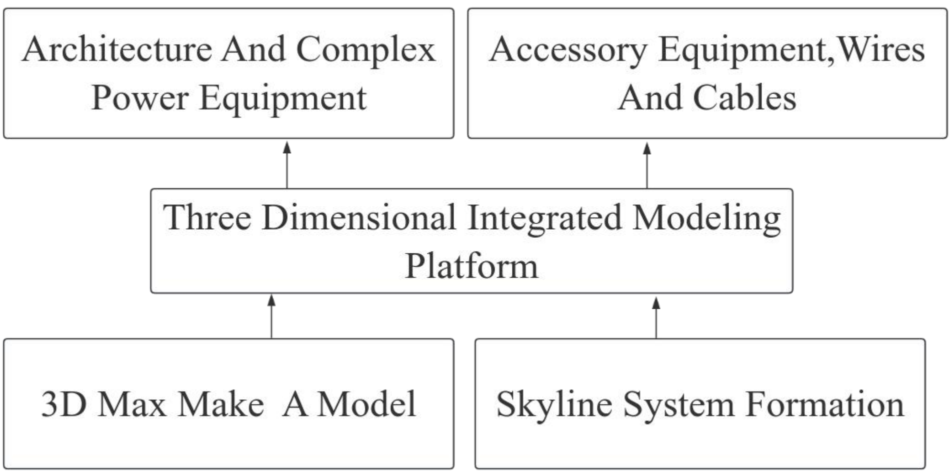

Figure 3. Structure diagram of the integrated modeling platform

Based on the analysis of the above figure, it can be seen that 3DMax software modeling includes modifier, surface, subdivision, grid, etc. When constructing the 3D model of electric power equipment, 3D coordinate of digital city should be used first, and basic spatial geographic information of power grid should be quickly mastered under the guidance of data acquisition, aerial data and vehicle scanning technology, and then 3D modeling software should be used to build the electric power equipment model. After completing the modeling, convert the 3DS file to. X format file, and then import into the Skyline system, master the size and position of the model, you can achieve line, cable and other equipment modeling. If there are many duplicate models in the system, then it can also be copied in the system, and only need to adjust the parameters of the design model characteristics, you can get the desired real model. From the perspective of practical application, the modeling method of Skyline system is simple and intuitive, and meets the modeling requirements of large-scale urban scenes.

2.3 System Design

The design of VRGIS 3D simulation system for power grid soil and water conservation studied in this paper is the same as the common GIS system design, which is mainly composed of four elements: hardware, software, data and users. Among them, the host selects desktop virtual reality professional workstation graphics workstation, which can process 3D graphics, 2D graphics and video images and other data information in real time, organically combined with supercomputing and visualization technology, to provide users with higher application performance and running speed, all-round data recording information, convenient follow-up monitoring and management; IMAGIS three-dimensional visualization geographic information system is mainly divided into two parts, on the one hand refers to the three-dimensional geographic information system, on the other hand refers to the plane graphics marginal system, can provide users with high-quality interactive tools, can really build a variety of complex shapes in the three-dimensional dynamic environment, for the power grid water and soil conservation construction management to provide effective decision-making. From the perspective of practical operation, this software includes data management, 2D image editing, virtual 3D modeling, database query, 3D visualization, 3D space analysis and other basic functions; The application development of VRGIS system contains a large workload at each stage, so it is necessary to determine the organizational structure of the data as soon as possible. The polarized organizational method can not only master the organizational structure of the data, but also put forward a clear development goal. Specific data sources include surface DEM data, remote sensing image data, vector data such as river roads, CAD data such as houses and Bridges, texture image data, etc. The data flow of the actual system establishment is shown in Figure 4 below:

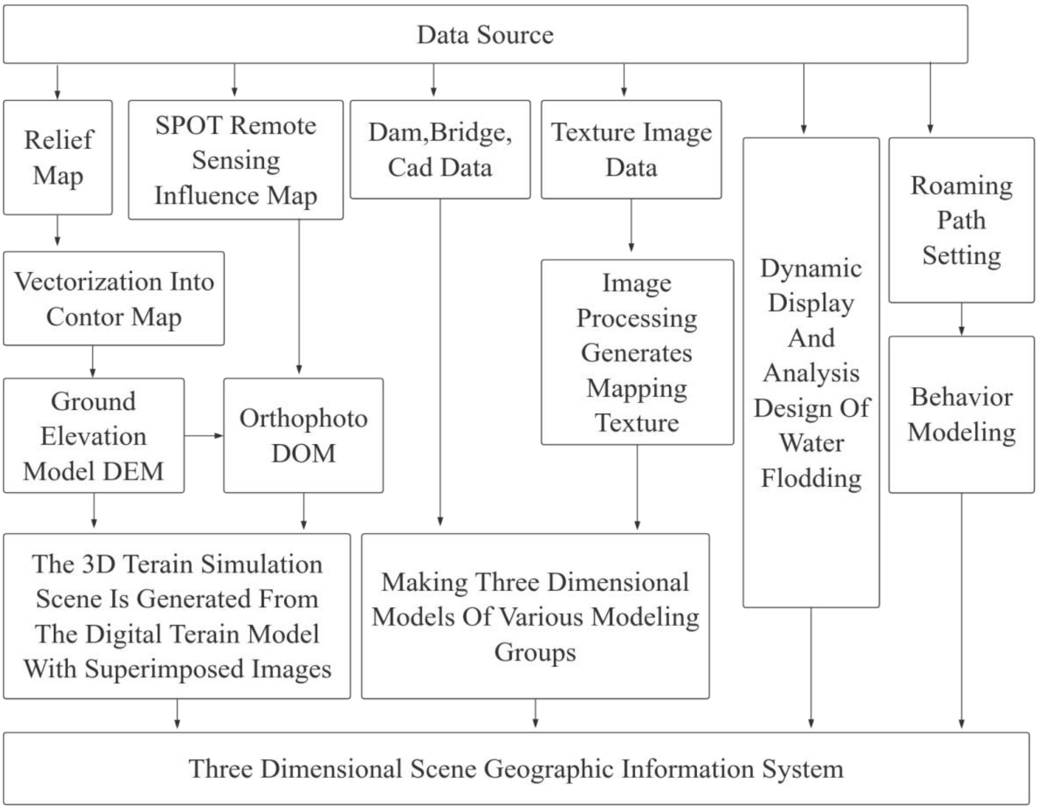

Figure 4 Technical route structure diagram

System functions are designed according to system function modules, as shown in Figure 5 below. There are many common functional modules in the system, and practical applications should be analyzed one by one according to specific needs. For example, the virtual ground scene roaming management of large reservoir basins can provide users with three roaming types, walking mode, flying mode and observation mode. Different roaming modes are suitable for different landforms, which can help users grasp relevant data as soon as possible and provide reference for the following decision analysis. The flood analysis code design will simulate the dynamic situation of water flow, and can analyze the direction of water flow and the area of water source using the height of each pixel in the superimposed DEM ground object model.

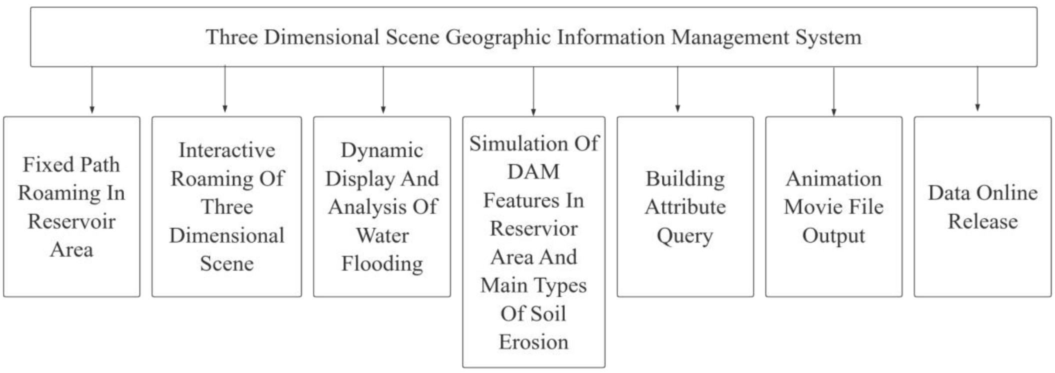

Figure 5. Structure diagram of functional modules of the system

3. Result analysis

Through systematic understanding of the construction process of smart grid GIS platform, organic combination of virtual reality technology, research on the design content of grid soil and water conservation VRGIS 3D simulation system, summary and analysis, problems faced in practical work and management experience, according to modern project management thinking analysis, in the system design and application to do the following work: First of all, the application of virtual reality technology in smart power grid is becoming more and more widespread. The design of 3D simulation system for water and soil conservation in power grid should be based on the technical characteristics of virtual reality to clarify the feasibility and necessity of the integration of the two. Secondly, on the basis of collecting three-dimensional spatial visualization information of the urban power grid, a comprehensive power grid information model should be built according to the urban landform and architectural characteristics and geographical coordinates, and these models should be combined by the platform to help users understand the basic situation of the urban power grid more quickly and deeply analyze the macro and micro states of future development. Finally, power enterprise users should strengthen the research and development of virtual reality technology software while intuitively feeling the overall power grid system, and truly realize the complexity of the project construction site. At the same time, we should pay attention to the standardized management of the project, improve the efficiency of technology research and development, ensure the quality of software application, improve the efficiency of practical work and project quality, and provide an effective basis for urban construction and resource planning.

Conclusion

In summary, as the pace of smart grid construction is getting faster and faster, smart electricity consumption plays an important role in the social development of the new era, and VRGIS technology will inevitably cover the entire city in the near future, providing technical support for the construction of intelligent urban environment. In the design and application of grid soil and water conservation 3D simulation system, VRGIS technology can not only provide more expansion functions, but also change the traditional power grid construction management mode, accelerate the pace of technological innovation in the power field, and guide China's power industry to move steadily towards the direction of intelligence and digitalization. Therefore, while attaching importance to the research of VRGIS technology and the design of 3D simulation system, Chinese scholars should cultivate outstanding talents in different fields from multiple perspectives, so as to lay the foundation for the construction and management of smart grid.

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