Research on Smart Grid Planning and Construction Based on GIS Resource Allocation Technology

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Abstract. Smart grid planning and construction is a very complex engineering project that requires intelligent technology to protect systems such as grid lines and substations to control grid stability and power quality. The smart grid GIS resource allocation technology has designed a new system architecture for the needs of building smart grids. The article expounds the key technologies and typical applications of smart grid GIS resource allocation technology, and describes its broad application prospects in smart grid. As a public service platform for graphical display applications, GIS platform constructs a spatial geographic information data center, which is intelligent. Applications such as grid integration, data mining, and intensive resource utilization provide a massive data storage, management, and analysis environment. The grid GIS platform provides geospatial information sharing and business application integration for smart grid power generation, transmission, substation, power distribution, power consumption, dispatching, etc., providing planning methods and visual analysis services for the construction of smart grid systems.

1. Introduction
Smart grid is one of the important indicators for China's modernization development. After the grid is configured, it can become more flexible and show strong coordination. At the same time, the smart grid will become more stable and safe in the context of the world's vigorous development of new energy sources. In addition, the smart grid is in line with the concept of human environmental development, and can achieve zero pollution to the environment. In order to meet people's growing power needs, the development of smart grids is crucial. Therefore, relevant researchers should conduct further research to achieve sustainable socio-economic development [1].

The use of GIS resource allocation technology in smart grid is the combination of GIS technology and power system. It realizes the spatial positioning and spatial analysis of power facilities. For the planning, design, construction, operation, maintenance and repair of power facilities such as lines and equipment, The monitoring and settlement of the whole process of smart grid construction, user registration, inquiry, and charging need to use geographic information system for spatial positioning, graphic output, spatial analysis and decision making[2]. At present, power companies mainly apply GIS in power grid planning, design, production, emergency repair and other aspects. Especially in the application of production and emergency repair, GIS has become an important part of a strong smart grid.
2. **Planning and construction content of smart city power grid**

Smart urban power grids include power transmission grids, high-voltage distribution networks, medium-voltage distribution networks, low-voltage distribution networks, and substations and power plants. They are the general term for voltage grids that supply electricity to cities in urban administrative areas. Smart city power grid has become one of the important infrastructures for urban modernization and is also an important part of smart grid because of its safety and reliability, high power quality requirements, large load and density, and intelligence and speed. The smart city power grid planning is carried out on the basis of urban planning. It studies the various construction electricity consumption indicators in the city, predicts the load growth, load density and power consumption level, rationally arranges the power supply, determines the reasonable structural form of the power grid and constructs the phased construction. Steps to clarify the reliability requirements of the power supply and the levels that may be achieved. By estimating the demand for construction equipment and materials and construction investment, determine the location, area, construction form, corridor width and orientation of voltage lines at all levels in the planned construction area, and other power construction facilities [3]. Calculate various technical data of system operation in each planning and statistical year, and propose construction principle requirements for dispatching communication and automation. Predict the economic benefits that will be obtained at the end of each planning period and the social and economic benefits obtained after the grid power supply capacity is enhanced, and draw a map of the geographic location of the urban network planning at the end of each planning period, and use GIS technology to make reasonable planning so that The urban power grid can be built into a modernized grid that is reliable, economical, abundant, coordinated and reasonable. The use of GIS resource allocation technology in smart grid can effectively allocate various resources, transform urban power grids and strengthen existing urban power grid structure, gradually solve weak links, enhance power supply capacity, standardize power infrastructure, and improve power quality and safety.

![Figure 1. Planning and construction framework for smart urban power grids](image)

3. **Application prospects of GIS resource allocation technology in smart grid**

3.1. **GIS resource allocation in the smart grid application of professional fields.**

Apply the grid GIS platform to various business areas such as power generation, transmission, substation, power distribution, electricity, communication, and agricultural power, deepen the application of various professional fields, and ensure the standardization and unification of space.
resources information of various professions, for each application of smart grid. The system provides a reliable source of data and an analytical platform.

3.1.1. Access to distributed energy in smart grids. As an important part of the national energy strategy, new energy has developed by leaps and bounds. The grid GIS platform is also a tool for the analysis and control of new energy sources, such as wind power assisted site selection[4], wind power equipment management, operation monitoring; photovoltaic power station monitoring, biomass power generation equipment, network management; electric vehicle charging equipment management, operation monitoring and analysis. From the access and detection of power generation, to the production management, safety assessment and supervision of power transmission and transformation, power distribution automation, power detection, power collection, and marketing, which support is needed. The grid GIS platform is the best display platform for the power Internet of Things [5].

3.1.2. For smart grid users. Multi-dimensional GIS technology can enhance interaction with users, provide various types of information query and analysis for power users, and play an advantage in smart power, smart community and smart home. From the massive GIS data, mine some objective laws and statistical laws in time and space [6]. From any angle, it can mine its value in time and space through GIS platform, and provide auxiliary decision-making basis for smart grid, such as equipment performance tracking and user electricity consumption behavior habit analysis [7].

4. Overview of the construction of smart city power grid platform based on GIS resource allocation technology

![Figure 2. General Situation of Intelligent Urban Power Grid Platform Construction Based on GIS Resource Allocation Technology](image)

With the continuous development and deepening of intelligent urban power grid information construction, the application of relevant business applications to grid space information is becoming more and more urgent. At the same time, the construction of smart city power grid puts higher application to geographic information system (GIS). Requirements, the construction of the grid GIS spatial information platform has been fully developed. In the past, the power GIS system was divided
into majors and units, and there were problems such as data crossover, multi-head maintenance and data model not being standardized. It is necessary to build a set of integrated grid space information service platform for the transmission, transmission, transformation, distribution and use of data and applications to meet the standardization, standardization and refined management, and improve the production management level of the grid. The core content of the smart city grid GIS spatial information service platform is the space grid model.

4.1. Smart City Grid GIS Platform Architecture and Key Technologies.

4.1.1. Overall architecture of the grid GIS platform. The overall architecture of the smart grid GIS resource allocation technology. The smart grid GIS resource allocation technology realizes horizontal integration with various business application systems and vertical penetration of headquarters and network provinces through an integrated data center, data exchange, and application integration platform. Through the application integration platform, the grid GIS platform publishes various types of grid space information services, providing service support for production, marketing, scheduling, communication, planning and design, emergency and real-time systems, and horizontal integration of platforms and business application systems; The center and the data exchange platform complete the sharing and exchange of grid space data, realize the vertical penetration of the headquarters and the network province; at the same time, release various spatial graphic information for the enterprise portal through the integrated platform.

4.1.2. SOA-based GIS architecture. SOA is a component model that links different functional units of an application (called services) by defining good interfaces and contracts between services. Interfaces are defined in a neutral manner, and should be independent of the hardware platform, operating system, and programming language that implements the service. Services built into the system can interact in a uniform and versatile manner.

4.2. GIS resource allocation technology intelligent urban power grid platform construction.

Figure 3. GIS resource allocation technology intelligent urban power grid platform construction
4.2.1. Basic resource allocation GIS platform selection. After the GIS positioning is clarified, according to the GIS application situation in the province, the GIS system adopts the resource allocation as the basic platform, and distinguishes the ways of accessing the power grid by multiple energy sources, so that the power grid has stable performance and functions. Powerful and other good features for advanced application development and system integration.

4.2.2. Design Resource Allocation Architecture The grid GIS platform consists of the business architecture. Application architecture, data architecture, technical architecture, and physical architecture. Each component independently supports a certain part of the grid GIS platform, and cooperates with each other to form a grid GIS platform architecture. It is based on the application requirements of GIS for various business applications of the grid, and analyzes the business application function system that can meet the application requirements of the grid GIS platform at different levels of headquarters, network, and city, and form a business model based on business development needs. Provide the basis for the design of the application architecture, technical architecture and data architecture of the grid GIS platform. Through the understanding of the business model, the system analysis method is used to analyze and abstract the business application process and objectives of the grid GIS platform, and form the functional modules and corresponding functional domains of the grid GIS platform. The application architecture consists of five major parts: grid resource management, spatial information service, typical application framework, GIS advanced application, and platform support application. Grid resource graphics management is used to maintain the spatial information, attribute information and topological relationship of grid graphics resources, which is the data support foundation of the platform; provides service support for business applications; the typical application framework provides comprehensive data display for business applications by calling GIS background services. Graphic analysis application; GIS advanced application provides advanced application functions such as line loss analysis and power flow calculation through grid GIS platform and business application integration, providing auxiliary decision-making for economical and efficient operation of smart grid; platform support application is grid resource graph management, spatial information Services, typical application frameworks, and GIS advanced applications provide management applications for configuration, management, and other related support.

4.2.3. Data Architecture Data architecture. The goal is to provide data services for the grid GIS platform in the grid GIS platform, to achieve data collection and access for the data sources required by the grid GIS platform, and to realize the basic data synchronization maintenance of each business application system and grid GIS platform through the data center and data exchange platform. Basic data consistency. Following the technical system of desktop application and web application, adopting the componentized, dynamic and service design ideas, based on the unified grid GIS platform data model, the multi-layer structure system design is carried out according to the data layer, business logic layer and presentation layer. It also realizes horizontal integration with various business applications through integrated platform application integration, and provides grid space graphics and analysis services for various business applications. At the same time, through the data center and data exchange of the integrated platform, the vertical and through technical design of the headquarters and the network province is realized. The physical architecture physical architecture is a platform that provides software and hardware support for upper-layer applications. The design content mainly includes software and hardware facilities such as software platform, server, network, and storage.

4.3. Resource allocation production management system in GIS intelligent platform
The key to the integration of production management system is to integrate the static parameter information of the equipment, the dynamic operation system with the spatial relationship and the location information, and adopt a unified workflow engine to achieve consistency maintenance of the grid resource account and topology relationship, and reduce the repeated maintenance of the business
personnel. Improve work efficiency. According to the requirements of the relevant national departments, the business application service integration adopts the GIS application framework combined with the service integration method, that is, the grid GIS platform not only provides services, but also provides a graphic application integration framework, which encapsulates most GIS integrated application functions, and the PMS calls The GIS application framework can complete most of the application integration functions; for the functional requirements that the framework cannot meet, the application integration is realized by directly calling the grid GIS platform service. Considering that the PMS system exchanges data with the grid GIS platform more frequently, in order to ensure more stable and reliable data interaction, the integration of the PMS system and the basic data maintenance of the grid GIS platform is realized by means of data center and application integration. This method is based on the data center shared area model. The data center is the sharing and exchange medium of the equipment account, grid graphics, and equipment change information. After the PMS system or the grid GIS platform completes the creation, update, and deletion of the corresponding device information. Synchronizing the changed data to the data center, and the data center sends a data change message to the receiver through the service bus, and the receiver obtains the corresponding data from the data center after receiving the message; the integrated mode is mainly used for the PMS system to the grid. The GIS platform synchronizes related device attributes, or the grid GIS platform synchronizes the grid pattern to the PMS system and other scenarios, so that the entire process can be controlled.

Figure 4. Relationship between resource allocation GIS intelligent platform and production management system
5. Conclusion
In summary, the planning and design of smart grid planning and construction is very complicated, involving many construction projects. Relevant enterprises need to rely on various modern technical means to ensure that the smart grid does not have unexpected situations in the planning and design process. After the resource allocation function of the GIS system, the planning of the smart grid has been greatly improved. During the construction process, the overall operation of the power grid needs to be carefully understood. From the GIS system, the surrounding environment and topographic information can be understood. Increase the monitoring and management intensity of the power grid, and promote the healthy development of smart grid planning and construction while ensuring the feasibility of the construction plan.

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