Research on Design and Implementation of Power Dispatching Automation System Based on Big Data Analysis

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Abstract: Electric power industry is the pillar industry of our national economy. Its development is related to the development of national basic industries and people's livelihood. At present, Chinese power dispatching system lags behind the advanced technology of other countries and has a relatively low level of development. With the continuous increase of national electricity consumption and the continuous increase of electricity users, the power system is facing great challenges. Firstly, according to the method of software engineering, this paper makes a detailed analysis of the power equipment operation monitoring system from the aspects of demand analysis, overall design and functional modules. After studying the related technologies, combined with the big data technology, this paper designs an automatic analysis scheme of power dispatching based on big data. The design and implementation of the power grid dispatching automation system is carried out. Combining the application of the automation system design with the development of the grid power dispatching work can make the wind power supply level of Chinese power companies better.

1. Introduction

With the advent of the big data era, the application of grid big data plays a key guiding role in the planning and development of power grids, power enterprises and power supply areas [1]. The power dispatching automation system has many functions, which not only can effectively collect and sort out the information needed for the operation of the entire power grid, but also can indirectly provide corresponding data and methods for decision analysis of production and operation personnel of power dispatching agencies at all levels [2]. As an important part of power communication network, power dispatching automation system has become the core of the whole power grid automation dispatching system. In the process of rapid development and active promotion of smart grids, there are more types of data to be monitored, and the amount of data increases. These data not only have basic equipment information, but also include operational data, defect data, inspection data, and real-time. Live data and offline data information [3]. The intelligent power dispatching system carries functions such as power flow, information flow and business flow, so that Chinese power industry has the best advantage of deep development in the era of big data [4]. Power system dispatching automation is a complex system engineering, which requires close coordination and mutual restraint between various parts to ensure the safety, high quality, economy and sTable power supply of the power system, which is an important basis for improving power automation.

2. Requirement Analysis of the System

The purpose of big data platform technology is to integrate data, so it is very important to collect different data. Data can be collected through database. In order to realize the requirement of heterogeneous data storage, it is necessary to construct relational or non-relational databases and distributed systems. The big data analysis mining process is as follows: Figure 1, including: data collection; preprocessing; statistical analysis of data; four processes of big data mining.

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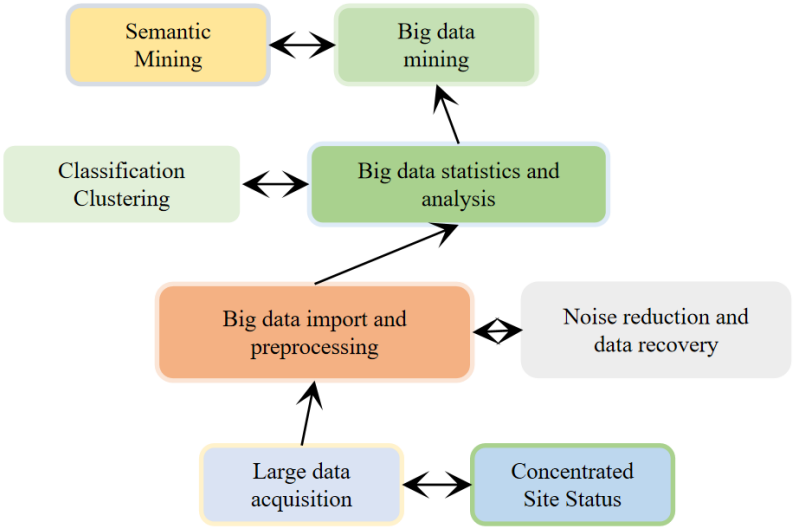

Fig.1. Big data analysis flow chart

2.1. System function requirement analysis

The information exchange between the power dispatching automation system and other systems is very frequent. It is not only necessary to estimate the load value of the power grid in real time, but also to timely process the scheduling information of each region. Physical resources are the basis of the entire solution, but due to the characteristics of the platform, the power system directly follows the classic server group structure, and the requirements for physical equipment are lower [5]. Power equipment generally works in a relatively poor environment, so there are many omissions in its data collection. Therefore, in actual work, in order to ensure the effectiveness of data analysis, the collected data should be preprocessed. The protocol processing module interprets and preprocesses various communication protocols, while the data service module issues data collection information and provides data communication services for background applications [6]. The power flow distribution of the power grid can be calculated by inputting the parameters of main components of the power grid such as main transformers, lines, engines, etc., building a power grid model consistent with reality, and collecting the collected current and voltage data. The main structure of the main station is the deployment coordination system and the operation deployment system. The main structure of substation is active power control structure and reactive power control structure. In order to ensure the reliability of information transmission, error check codes are used for data acquisition. All measured values collected shall be filtered and validated.

2.2. System non-functional requirements

In design, it must have the ability to adapt to system changes, such as the increase in the number of system users and business volume, changes in rules or codes, and the reorganization of approval processes. Localization of impacts caused by changes should be ensured as much as possible. If the front desk sends a knife disconnect signal, the background remote signal processing flow receives the signal and analyzes the knife gate state and the disconnection time. Based on this platform, you can continue to create multiple virtual servers, install the underlying operating system for each server, install an integrated management server, and configure parameters for additional devices such as network and storage. This mechanism allows the power dispatching automation system to handle some errors internally, ensure that the core processes of the system can be properly accessed, and avoid the failure of a critical point to the greatest extent and cause the entire system to collapse [7]. The data structure design of the front-end real-time library should be oriented to data acquisition and communication, optimize the data preprocessing process, and meet the requirements of the front-end communication subsystem for function and performance to the greatest extent. The voltage data in the power grid is collected by the voltage transformer connected to each bus or the outgoing line side of the substation, which is also used for the blocking of relay protection devices

and monitoring and metering. The power dispatching automation system needs to back up the database of the whole system to different media for storage when the system business is not busy every day to prevent the loss of system data.

3. The Overall Design of the System

3.1. System design principles

The use of modern information technology can effectively allocate power dispatching reasonably, thus promoting the rapid development of the power industry. The ultimate goal of implementing online monitoring technology for grid operation is to master the real operating conditions of the equipment in time to improve the stability and reliability of the power supply. Only when the power dispatching automation system is properly allocated can the safety and stability of people's electricity use be guaranteed [8]. The purpose of digitalization is to use the framework of power grid operation information data integration, communication and information integration to improve the power grid dispatching system, and finally achieve unified and standardized management and intelligent dispatching of power informatization.

Stability. At present, when installing network firewalls, power dispatching automation systems in various power enterprises need to intercept some malicious software to ensure the safety of the system. The system should have the capability of continuous, reliable and sTable operation, and timely provide the dispatching department of the power department with on-line monitoring of each monitoring point of the power system network, while meeting the needs of production management. Based on all kinds of state monitoring data and existing equipment performance evaluation rules, the comprehensive performance level of equipment is reasoned and evaluated [9]. The dispatching automation system carries out relevant application services at this level, and the required service resources are allocated to this level after requesting from the superior control center. In addition, on-line monitoring equipment manufacturers also need to fully grasp and understand the actual operation of the equipment, in order to establish a fast response, high-level maintenance and management mechanism, and constantly improve and improve the performance of on-line monitoring devices.

Openness. In the actual operation environment, data information is processed from different angles through an information system, and then the data is analyzed and reviewed, so that the operation state of the equipment can be predicted more accurately [10]. The system has the ability to exchange data with other power dispatching related systems, including: data acquisition and monitoring system, information processing system, etc. The system platform layer is a real-time information system platform, which realizes the basic dispatching function and management of power grid. More importantly, it provides the data, equipment and basic service resources needed for various applications at the upper level. Under the large-scale operation mode, the data information in the power dispatching automation system is unified, and the information types of substations are guaranteed to correspond with the data.

Extensibility. For structured databases in large data environments, two operations need to be quickly supported: one is to quickly retrieve the desired results from massive data. Second, it can support a large number of online transaction processing. Aiming at the characteristics of power dispatching automation system, the extended method is used to deal with it, and the structure of CPU and GPU is analyzed and calculated to ensure the safety of power dispatching automation system. During the design use period, due to the increase of stations and the increase of lines, the dispatching automation system must meet the requirements of the power dispatching department to the system scalability. Through the intelligent management of the dispatching automation support system, the coordination and flexible organization of the distributed control systems at all levels is realized.

Maintainability. In the future, the work mode of power dispatching automation system will be collecting, transmitting and processing massive information under complex and highly automated power grid, and at the same time, the system reliability and business continuity under high

requirements. Large data analysis tools include unstructured and structured data analysis engines, and cloud computing engine technology is used to speed up data processing. The power dispatching automation system must have reliable and complete functions for diagnosis and maintenance of the entire system, provide accurate and reliable system operation records, and the power dispatching automation system maintenance personnel can easily and quickly discover and dispose of system faults. At the same time, remotely realize through information professional means. Maintenance diagnostics. You can also use the form of semi-supervised semi-learning to ensure the accuracy of data project use, and also combine these data information structures to visually analyze data information.

Security. The security system in the power dispatching automation system in the era of big data is an integral and comprehensive system structure, which can be designed according to the power dispatching automation system during the construction process. Including the safety of each safety area and software and hardware of the ceremony dispatching automation system. At the same time, it meets the requirements of the state for the secondary security protection of the power industry. In general data analysis systems, histogram, pie chart, trend chart, etc. are usually used to display the processing results of structured data, and classification chart, rule list, etc. are used to display the analysis results of unstructured documents. Man-machine interaction of dispatching automation will give full play to the combination of system and human, and achieve efficient information transmission. The module requires that user information should not be stored directly in the database, but be encrypted and stored in the database. When the user information is checked, then the information stored in the database is decrypted and compared, which improves the security of user login.

3.2. Overall design of the system

In the design of the entire power equipment operation data analysis system, how to effectively collect and synchronize the data in multiple black boxes is the research focus and difficulty of the whole subject. The system can not only process multi-source data transmitted through the protocol interpreter of the system, but also provide an open quasi-real-time data (that is, real-time data of multiplication and transformation ratio) transmission protocol, and data transponders of other manufacturers on the data network. It can also be used as a source to send data directly to the server of the system according to the protocol. It comprehensively utilizes multi-angle, multi-scale, wide-area and large-scale power grid information and various data existing in currently separated systems, which is greatly beneficial to power grid dispatching informatization and management modernization. The B/S-based architecture uses black boxes to collect data from the system and transmits the data based on the Internet, which is different from the general data collection and processing based on single chip microcomputer. The platform real-time database management system based on file mapping can better support background applications. Subsystem weakens the concept of main and standby front-end processors. Instead, path acquisition is used, and channel switching for front-end acquisition realizes single-channel switching instead of switching the entire front-end processor. So as to ensure the safe use of the power dispatching automation system.

Because the geographic background image has a large amount of data and a long loading time, in order to save system resources and speed up the program startup, the background layer is dynamically loaded, that is, the corresponding background layer is loaded according to the map browsing range. The overall design flow chart design of the power dispatching automation system is shown in Figure 2 below.

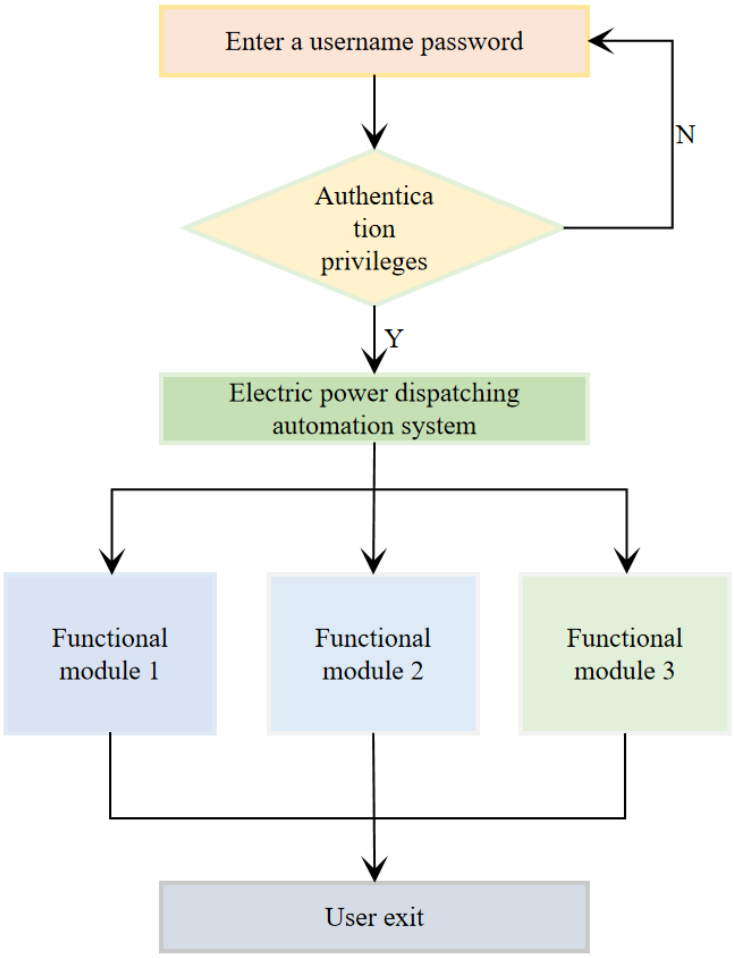

Fig.2. System overall flow chart

The terminals that the system accesses are divided into multiple groups to form multiple sets of front-end machines, each of which is responsible for the processing of the terminals under its jurisdiction. The clustering of the front-end machine is realized. This technology effectively reduces the collection load of the system; perfects the security defense system of the power dispatching automation system, ensures the safe use of the system, and solves the deficiencies, defects, and confusion in the operating system. The structure ensures that the power dispatch automation system has a good integrity. The design method of data acquisition based on B/S architecture should ensure the independence and scalability of data, which is more complicated and difficult to implement. When the system is initialized, the database supported by the platform real-time database management system is generated by downloading the database server or mapping the disk files, and then the pre-shared memory real-time library is created according to the content of the platform real-time library. In the network transmission layer, the communication overhead under smart grid is more huge, the processing speed is faster, and higher requirements are put forward for the communication network bandwidth. The communication bandwidth of Chinese dispatching automation platform has been improving. According to the types of collection points, it is beneficial to the maintenance of the system. It provides a possible optimal scheme for the expansion of the acquisition points.

Physical layer security in power dispatching automation system mainly includes communication security and equipment security. Through the use of communication equipment, the security and reliability of connection routes in power dispatching automation system can be understood. By setting a certain node to the research state, users can extract a certain state, the operation of the power grid system in a certain peak period and various data on a certain node according to their own work requirements and some special requirements, and carry out anti-accident exercises. By using the function of correlation analysis, the equipment with the same interval, function location,

batch, manufacturer and problem can be reasoned and correlated, so as to enhance the ability of equipment hidden trouble detection. Then the main and standby channels and different system protocols are added to the real-time operation system, so that when new equipment is added to the system operation debugging, both the real system operation environment and the operation of the power dispatch production command of the entire power network can not be affected.

4. Implementation of the System

After completing the design of the system, users can implement the system. After entering the preset user name and password, they can successfully log in to the system. All operating platforms are reserved in the cloud, and then appear in each terminal by virtue of virtual desktop. In fact, all the settings made by managers are carried out by means of instructions uploaded to the cloud by virtue of the virtual operating platform of the terminal. After the user opens the interface of the power dispatching automation system and enters the username and password, the system will verify the user's input. Only after the validation, can the system successfully log in. When the task is executed, the task name is composed of three times of taking the task, the type of the task, and the user name. This can effectively ensure the uniqueness of the data. If the task is submitted successfully, the task will be inserted into the database. The process directly accesses the data object through the read and write pointers, and moves the read/write pointer according to the result of the access, and uses the semaphore technology to synchronize the concurrent operations of the read and write pointers of multiple processes. The power flow diagram of each power station system shows the direction of the power point through the power flow arrow, and the user can intuitively see the operation of the entire system.

5. Conclusion

With the introduction of the power market, more market participants require the use of dispatch automation systems for information reporting and query operations, which puts higher demands on the information security protection capabilities of intelligent dispatch systems. Based on the current problems in data analysis, this paper proposes a design of grid power dispatching automation system based on big data. Using the analysis method of big data, make a systematic analysis of massive data, combine various technical supports, make a perfect information processing system, and realize the analysis of massive technologies. The subsystem is designed in detail and the system is tested strictly after the design is completed. However, there are still some deficiencies. I hope our professional technicians will strengthen the research on the safety and realization of power dispatching automation under the big data construction.

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