Research and Development of Energy Supervision System based on Data Mining

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Abstract: As energy informatization plays an important role in building smart cities, an energy supervision platform based on data mining is proposed. Firstly, according to the demand situation of urban energy, the function and system structure of the energy supervision system are determined. Then the structure, logic application and physical structure of the energy supervision system are designed, and the energy supervision model based on data mining is proposed. In the energy-saving analysis; according to the design requirements, developed a set of energy supervision system, the system realizes the collection and supervision of water, electricity, gas, coal and other energy data, data abnormal alarm, equipment fault location, historical data report, according to monitoring data Energy saving analysis and other functions. The developed energy supervision system was tested in a city in Fujian to verify the reliability and effectiveness of the system. The research and development of this system provides a reliable technical guarantee for the effective use of energy and the development of a scientific energy use strategy.

1. Introduction

Data Mining is a step in Knowledge-Discovery in Databases (KDD). It generally refers to searching for models or rules hidden in it from a large amount of data and having potential application value. A complex process of useful knowledge. From the application level, data mining is a decision support process, mainly based on database, artificial intelligence, mathematical statistics technology, highly automated analysis of data, inductive reasoning, mining potential patterns, predicting corporate behavior, Help decision makers reduce risk and make the right decisions.

2. Demand analysis

The energy monitoring platform uploads information to the monitoring center by collecting data from the monitoring points and using data transmission technology. The information that needs energy monitoring mainly includes the use of water resources, gas and natural gas, and the monitoring of electric energy. According to the data collected by these energy sources, the monitoring center collects energy data to realize the monitoring of energy use. Staff provide data support for energy management and decision making. Thereby the energy supply can be operated stably and economically. The human-computer interaction interface of the energy supervision platform is fully functional, the interface is beautiful, and the operation interface is displayed in Chinese. The platform can achieve 7×24h continuous stable operation, the data transmission delay is less than 60s, the operation response is less than 3s, and the supervised data can be saved for a long time. It can collect data and manage the use of coal, oil, gas, electricity, water, heat and other energy sources. Realize the "cloud computing" and "Internet of Things" functions, through the database collected in the past, to achieve optimal energy scheduling, and to develop a reasonable troubleshooting method. The method of transmitting data can realize optical fiber transmission, wireless transmission and network transmission, ensuring data security, integrity and reliability, using firewalls, anti-virus software, etc. to achieve safe operation of the system, providing complete and secure data support for energy dispatch. When the instrument and software fail, there are corresponding countermeasures. When the system logs in, it must have user rights management; the collected data can be saved in the report. The system software has functions such as user login,

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meter data collection, automatic uploading of data, and display.

The energy supervision platform can achieve electricity market access regulation; power, coal, oil and gas, water, heat market order regulation; energy cost supervision; energy price supervision. Realize the statistics and analysis of energy, energy, coal, oil, water, heat and other energy industry data, explore the inherent laws of enterprise and industry development, and provide decision support for energy regulation. Realize the supervision of energy policy and planning implementation, and realize the supervision of the implementation of energy project construction. Implement accident prevention and hidden danger control, formulate scientific and effective energy emergency plans, combine the pipeline network diagrams of various oil and gas enterprises, power transmission and distribution road maps, traffic maps and weather maps to achieve dynamic and real-time monitoring of detailed energy distribution and assist disasters. Emergency Command. Including the combination of off-site supervision and on-site supervision, safe and dangerous investigation and prevention, to prevent the occurrence of major accidents, carry out special rectification of electric power construction projects to ensure the quality and safety of construction. Monitor important energy-using enterprises and supervise the transaction situation and energy consumption between energy-using enterprises and energy-consuming enterprises. Power supply capacity and quality supervision; strengthen the supervision of power supply service behavior and information disclosure of power supply enterprises, collect multi-party information for comparison verification. Collect qualification information including power business license, decoration test permit, and electrician certificate, and perform statistical analysis and corresponding management on qualification data. The functions included in the energy supervision system mainly include energy statistics, energy analysis, energy conservation management, and function expansion. The functions involved are useful electricity monitoring and management, coal monitoring and management, gas monitoring and management, statistical reports, energy saving analysis, and systems. Management, etc.

3. Data mining and platform design

The energy supervision integration platform is a sub-platform of the national energy regulatory information system. It provides data access channels and integrated interfaces for national energy information platforms, and is an integral part of the national energy regulation information platform. The energy supervision integration platform enables data collection and business collaboration of energy companies, industry associations and government departments, and supports the specific operations of users of the National Energy Administration, users of the regulatory bureau, users of regulatory offices, energy companies or individual users. The group provides targeted energy regulation information services. The logic application of the energy supervision integration platform is divided into three levels: network transmission layer, data acquisition layer and platform application layer. The network transport layer provides security management and access authentication services, and is responsible for the complete transmission of the collected data to the system platform. Communication methods include power communication networks, the Internet, and 2G/3G/4G mobile network transmission. The data collection layer supports three main collection methods: enterprise data collection, terminal collection and reporting, and system integration. It provides services such as data filtering, data caching, protocol analysis, and interface adaptation. On the one hand, the platform application layer implements business applications such as market supervision, industry supervision, security supervision, qualification management, and audit supervision, and on the other hand provides operational support for the entire system. Security protection and operational monitoring run through these three logical levels.

Business application modules are mainly composed of market supervision, industry supervision, safety supervision, qualification management, audit supervision and comprehensive management. Application support mainly includes mobile applications, large-screen display applications, GIS applications and main station applications, and is the medium for data presentation. The basic components are the key modules supporting the business application, including unified permissions, workflow engine, load balancing management, message queue management, data interaction and

other modules. The unified permission module is used to handle the resource allocation in the entire system management. The workflow engine module is used to process the related business processes in the platform. The load balancing module ensures platform traffic balance and ensures the reliability of the platform operation. The message queue module is used to process communication between various business modules, and the data interaction module is used to handle data interaction between different business systems. The data support module mainly includes the management of structured data, unstructured data, geospatial (GIS) data, and supports various business applications.

4. System Implementation

Based on the above analysis, the data mining-based energy supervision system is developed to realize real-time monitoring and management of water, electricity, heat, gas, coal and other energy sources. The login interface of the system is shown in Figure 7. Through the SCADA system installed in the water supply company, the water consumption data is collected in real time and uploaded to the upper computer system for supervision. The data collected to the host computer can be saved and displayed in the form of a curve. By installing sensors on the output pipelines of natural gas, gas, oil and gas, etc., the collected gas consumption is uploaded to the upper computer system to realize real-time supervision of gas energy, monitoring the operating state of the equipment, and setting upper and lower thresholds to provide an alarm function. The gas supply system supervision platform is shown in Figure 9. The supervision platform for the heat exchange station network and the data monitoring system are shown in Figure 10. The power monitoring system is shown in Figure 11. The monitoring system for device usage is shown in Figure 12. Figure 13 shows the historical database query results for energy consumption. The data mining method is adopted in the energy supervision system, and the data information valuable for analyzing the energy consumption is obtained from the massive data, and the energy consumption supervision model is constructed. Through the experimental test of the various functions of the system in actual operation, the article can be known. In the monitoring system of water, electricity, coal and gas, the data detection function is accurate and normal, the fault alarm and the energy consumption exceeding the standard alarm function are normal, the equipment information monitoring and feedback information is real-time and accurate, and the historical data report The system can query according to parameters such as time, place and equipment. The energy analysis system can realize the analysis of energy consumption distribution, and can perform data query display and corresponding data analysis according to time. This system has complete functions and provides theoretical and technical support for energy regulation, energy saving and consumption reduction. In the process of testing the functions of the energy supervision system, through the detection and correction of the item-by-item function, the system realizes the basic power consumption, water, gas, coal and other energy supervision functions, and the data alarm function is normal. The collected data can be saved normally and generate historical data reports. It can be accurately located in the event of a fault, and the response time is within 5s. It can cope with various faults in time, and can find in the historical database according to the current real-time running situation. Similar cases and provide energy saving advice. From the test operation results, it can be concluded that the energy supervision system developed in this paper directly receives the data of the field equipment operation, obtains the energy consumption parameters, and realizes the effective monitoring of the energy use area, thereby realizing the optimal utilization of energy, saving energy and improving The management level laid the foundation. The system provides theoretical and technical support for energy statistics, analysis, and management. The energy data is supervised in various company equipments, and the equipment with old safety hazards has the function of troubleshooting, and the life cycle management of the equipment can be realized.

5. Conclusion

Energy informatization plays an important role in building smart cities. Therefore, this paper

proposes an energy supervision platform based on data mining. Based on the demand for urban energy use, the design of the energy supervision system was carried out, and an energy supervision system was developed according to the design requirements. The system implements the functions of water, electricity, gas, coal and other energy data collection and supervision, data anomaly alarm, equipment fault location, historical data report, energy saving analysis based on monitoring data. Experimental tests were conducted in a city in Fujian to verify the reliability and effectiveness of the system. In order to build a smart city, realize the effective use of energy, reduce the incidence of failures in energy use, and develop a scientific energy use system provides a solid hardware foundation.

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