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Retraction

Retracted: Design and Management of Electricity Marketing Information System Based on Multisensor Fusion

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This article has been retracted by Hindawi, as publisher, following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of systematic manipulation of the publication and peer-review process. We cannot, therefore, vouch for the reliability or integrity of this article.

Please note that this notice is intended solely to alert readers that the peer-review process of this article has been compromised.

Wiley and Hindawi regret that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] R. Fu and S. Liu, "Design and Management of Electricity Marketing Information System Based on Multisensor Fusion," *Advances in Multimedia*, vol. 2023, Article ID 5616739, 12 pages, 2023.

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Research Article

Design and Management of Electricity Marketing Information System Based on Multisensor Fusion

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The electricity marketing management information system realizes the whole process of management from accepting customers' electricity application to electricity bill recovery and from business processing to decision support. The electricity marketing management information system is a modern management tool for electric electricity enterprises to go to the market, expand the market, increase supply, expand sales, and provide customers with high-quality services. This paper has completed the following work: (1) described the development of domestic and foreign electricity marketing management information system and provided a theoretical basis for the design scheme proposed later. (2) The construction of the marketing system should focus on eight key points, establish a service-oriented architecture, plan the hardware platform in combination with the principles of advanced and practicality, and at the same time, apply multisensors to the marketing technology support system to improve the efficiency of data interaction. (3) According to the characteristics of the application software of the electricity marketing management information system, the software that runs between the components of the distributed, enterprise-wide C/S application or within the components is adopted. The performance of the software and hardware of the system is tested experimentally, and the results show that the electricity marketing information system has good performance.

1. Introduction

Since the reform and opening up, especially after the implementation of fund-raising and multiple-run electricity, my country's electric electricity industry has undergone tremendous changes. The installed capacity has greatly increased, and the electricity shortage that has plagued economic development and daily life has been basically alleviated. However, while achieving gratifying achievements, we have to face a new practical problem. When electricity production can meet the needs of society, the development of the electricity industry has changed from an increase in quantity to an improvement in quality, and the development strategy has changed from a "seller's market" to a "buyer's market" [1]. How to deliver high-quality electric energy to thousands of households and make electric electricity customers voluntarily and preferentially choose to use electric energy has become an important issue in front of us. With the deepening of the electricity market reform and the establishment and development of the commercial operation of the electricity grid, the electricity industry, like other industries, begins to face the challenges of the market, and all its production and operation activities will revolve around the main line of economic benefits. The establishment of the system of "separation of factory and network and bidding for the Internet" has promoted the pace of electricity grid operation enterprises to enter the market. Electricity demand will remain a buyer's market for a long time to come. How to open up the electricity market and increase the share of electricity consumption in the terminal energy is the primary consideration of the electricity sector [2]. To open up the electricity market and serve customers in an all-round way is inseparable from modern management tools and fast and efficient service methods. In

today's knowledge-based economy and information age, if we do not rely on advanced computer technology and provide customers with high-quality services, our enterprises will eventually lose the market [3]. Electricity will be disadvantaged in the competition with other alternative energy sources. When the electricity goes to market, marketing work is the key. Therefore, the quality of electric electricity marketing is directly related to the economic benefits of electric electricity enterprises. It is also the embodiment of the image of electric electricity enterprises, and the modern management and service of electric electricity marketing have become very urgent [4]. The State Grid Corporation of China has successively issued development plans for marketing modernization such as how to implement these development plans into the process of marketing services, adhere to the combination of advanced nature and practicality, adhere to the combination of service and efficiency, and insist on the combination of management innovation and technological innovation. Being consistent with the overall development goal of "world-class electricity supply enterprise," it promotes the innovation of marketing management and service concepts with technological innovation and promotes the standardization of marketing business processes. In the process of marketing modernization, we will continuously optimize the organizational structure and business processes, improve the quality of personnel, and gradually establish a marketing mechanism and system that adapts to market changes and quickly reflects customer needs [5]. With the full implementation of group operation, intensive operation, and refined management as the main line, the top-down marketing management, customer service automation, informatization of the State Grid Corporation of China headquarters, various network and provincial companies, and grassroots electricity supply companies will be realized. The unified management of electricity purchase and sales are realized and the overall coordination, strategic decision-making, operation management, leadership ability, control ability, and decision-making level of the company headquarters are improved to deal with complex situations. Effectively control and reduce the cost of electricity purchase, enhance profitability, increase market share, and meet the needs of sustainable development of the company [6]. The 12 subordinate electric electricity bureaus have promoted and implemented a unified version of the marketing management system. And, the data warehouse technology is used to collect the summary and statistical data of the province's marketing in the provincial company headquarters, which can meet the needs of marketing professional leaders' query and management. Since the system has been running for more than 5 years, it has accumulated rich experience in marketing management specifications, information system specifications, and technical specifications. At present, a wide-area information network with two ring networks in the east and the west has been built. At the same time, the company's wide area network has a 4 M backup channel and is equipped with two 100 M export channels to connect to the Internet. A high-quality marketing informatization foundation and good wide-area network conditions have prepared for the realization of marketing group operation, intensive operation, refined management, and the construction of a centralized marketing technical support system [7]. Electric consumer goods and their supporting service products have a high one-to-one awareness of producers and consumers. Electric energy, which is based on the four necessities of human beings, is a consumer necessity that cannot be easily stripped. Facing the needs of customers, the service personnel of the enterprise includes not only the medium and low voltage operation and maintenance workers who read meters to the home but also the counter service personnel who handle various businesses such as expansion and installation of the electricity industry in the customer service center. There are also production technicians, electricity failure approval personnel, on-site repair monitoring personnel, and so on as technical support during the troubleshooting period. Only the full cooperation of various personnel can complete the full range of services for electricity customers, so information communication and sharing between them is an important part that restricts the improvement of service efficiency [5]. There are also electricity price reviews and changes for electricity customers with different electricity prices, real-time recording of customer electricity consumption information, and quarterly statistics of customer electricity consumption information to make statistical reports. Anticipate the need for electricity growth and plan the impact of grid load development standards to reduce the impact of load restrictions on customers' continuous electricity consumption. The combination of macro- and microelectricity grid shunting, load reversal and other intelligent deployment, electricity leakage monitoring, electricity stealing behavior monitoring and blocking, clearing the user's electricity consumption level, and reminding self-adjustment and a series of work are not one-time services [8]. In the traditional electricity marketing system, these problems are chronic diseases, which require enterprises to invest a lot of resources to complete them, which increases the operating costs and resource consumption of enterprises. To establish a new generation of electricity marketing management information systems, intelligent screening of useful information is used to share all information. The content including the customer's average electricity consumption, electricity consumption category, and the operation status of the supporting electricity supply network is provided to the service representative who connects with the customer in real time. Improving the timeliness of information sharing can also enhance the sense of intimacy with customers and the responsiveness to deal with electricity emergencies [9]. Simply put, the electricity client uploads consumption data, the electricity supply level data are uploaded to the line end, and the automatic control system calculates and reports the analysis data to the electricity department, giving the line end and the client real-time feedback data requirements. In such interactive information flow transmission, consumption, production, and market demand communicate in real time, and information packets move bidirectionally between networks. Through continuous delivery, the new marketing strategy can easily realize the real-time change function of

maintaining monitoring and dynamic balance control. In this context, this paper designs a multisensor fusion electricity marketing information system.

2. Related Work

Electricity marketing management information system is a typical application of management information system in electricity system operation and management. It is a management system integrating modern computer technology and communication technology. It mainly uses modern computer technology and communication technology to carry out process management of electricity marketing business and manages it in various forms such as text, graphics, data, and sound. Work efficiency and management level are improved. At the same time, it provides auxiliary decision-making to enterprises to obtain the best benefits [10]. The development of management information automation began in the 1950s and generally went through four stages. The first stage, the single-item data processing stage, is the primary stage in which computers are used for management. At this time, the computer is still a stand-alone system, and its application is mainly in the hands of computer personnel, and only a few functional managers use it. The second stage, the comprehensive data processing stage, is the development stage of computer application in management. At this time, computer technology has begun to combine with communication technology to form a central network. A large computer connects multiple remote terminals through communication lines to serve multiple users [11, 12]. The third stage, the management system stage, is the advanced stage of computer application in management. At this stage, computer and communication technology are closely integrated, multiple computers are connected into a network, and data transmission and file transfer are carried out between computers. Guided by modern mathematical methods such as operations research and systems engineering theory, software development is carried out, and a public database, model library, and method library are established. It constitutes a unified large system, which provides complete information and the best decision-making scheme to management departments at all levels. This system is still only a "human-machine" system, which is only an auxiliary management, rather than completely replacing human management. The fourth stage is the automatic management stage. In terms of production management, the production automatic control system is connected with the management information system, and the production data are sent to the management information system in real time. The latter is the background machine of the former, and the former works under the guidance of the latter, forming an automated production management system. This can greatly improve the level of production and operation and try to be scientific and rational [13, 14]. In the past ten years, the rapid development of computer technology and network technology has promoted the research and wide application of management information system. With the popularization and deepening of computer applications and the maturity of network technology, management information systems have developed from a single application to a comprehensive application, from simple processing to complex processing. The information processing mode has developed from centralized and decentralized to distributed, and application tasks are being transferred from mainframe systems to distributed networks supported by client/server (C/S) and browser/server (B/S) [15]. The electric electricity industry is an industry with a high level of modern technology, and the production of electric electricity is highly concentrated and unified. The generation, supply, and consumption of electricity are carried out at the same time, and the production, supply, and sales are closely linked and are managed by the electricity company in a unified manner. The management organization and management methods of electric electricity enterprises are relatively strict, and the application of automation technology and the computer has a certain foundation. It can be said that the production and operation management conditions of the electric electricity industry have favorable conditions for the realization of management information automation. However, the current information management methods and means in the electricity system, especially the management means of electricity marketing, are not suitable for the needs of the electricity industry and the development of information technology. With the continuous development of computer technology and information processing technology, the function and scale of electricity marketing management information system are also developing rapidly [16, 17]. The electricity marketing management information system is a huge system of engineering with high technical content and wide coverage. The method of system integration can greatly shorten the development cycle of the management information system. The integration strategy is divided into two levels. The first level is the integration of different modules within a single subsystem. With the improvement of the application level, the single-machine and single-item management software of each unit can no longer meet the needs. Only by integrating and organically combining them into a complete subsystem can it be called a "system" and provide effective management software for enterprises. Due to the great difference in the application level and the selected database of each unit, it is difficult to integrate the scattered systems uniformly. A province-based electricity marketing management information system construction policy is established, which can truly realize the province's monitoring, information processing, and shared query of electricity marketing business. It can make various information processing links connect with each other and make use of each other, which greatly improves the level of information processing automation [18]. The second level is the integration of various subsystems. Although many management information systems that have been

developed at present have been gradually improved in the course of use, the use efficiency and benefits have been improved. The integration technology of electricity marketing management information system includes the integration of computer hardware platform, network system, system software, tool software, application software, and middleware, as well as the corresponding consultation, service, and technical support around these systems. The development of network technology provides technical support and guarantee for the hardware integration of management information systems. The hardware integration can adopt C/S and B/S system structure, and the main advantage of this structure is that clients can share various resources and devices in the network. It is convenient to realize the interconnection, interoperability, and integration of multiple computer systems and improve the reliability and practicability of the entire system [19]. Software integration includes system software integration, application integration, and data integration. Generally, application software can be divided into three parts: the first part is interface presentation processing, which is the application code that interacts with devices such as user terminals or workstations, completes screen formatting, screen information reading and writing, window management, keyboard and mouse management, and other tasks. The second part is transaction processing; the application code that uses the input data to complete the task. The third part is data and database management. Ensuring system reliability, high performance, high flexibility, and low cost is the key to management information systems [20]. Through application integration, the management information system can be coordinated in structure, function, and I/O format; it is not intended to overthrow the original or developing application. Instead, it acts as a "red line" that runs through the entire system, so that the original application program can directly play its original or greater role in the new system. Data integration is the core of marketing management information system integration. The purpose of data integration is to maintain the original local data consistently in the new system and improve its accuracy [21]. More importantly, in the new integrated system, these local data will become more comprehensive and complete information that users are more interested in. Then, users are provided with statistical analysis and decision support information, so that the information has greater practical value for users in the management information system. The system integration method provides an effective way to develop the electricity marketing management information system. It makes the marketing management information system get rid of the limitations of scale, technology, and scope of adaptation and realizes both distributed processing and unified control and management. From the perspective of the openness of the system, it can enable enterprises to quickly absorb and utilize advanced international technologies, and at the same time make full use of the original various information and data resources. This not only ensures the advanced nature and practicability of the system but also utilizes the existing investment, which greatly shortens the system development, promotion, and application cycle [22].

3. Methods

3.1. The Overall Scheme of the System

3.1.1. System Construction Focus

(1) Unified core module. Unified design and development of marketing management, energy collection, 95598, customer payment, marketing and service quality analysis and supervision, sharing data and applications, and achieving vertical integration and horizontal integration of core modules.

(2) 95598 provincial concentration. Realize the provincial centralized construction of 95598 customer service platform, local access, and agent distribution. Open up the desktop technical support function in the 95598 system and establish a technical support service hotline.

(3) Provincial or regional centralized construction of marketing management modules. It realizes the provincial concentration of the software and hardware platform, data, and application of the marketing management module and can meet the requirements of the regional concentration.

(4) The electricity purchase and settlement of the bank-electricity network are centralized at the provincial level. Electricity purchase and settlement of provincial-level payments, withholding, transfer, etc., are realized for the centralized banks at the provincial level.

(5) Electric energy collection realizes prefecture-level concentration. Realize electricity collection at the electricity purchase side, electricity collection at the electricity supply side, and electricity collection and monitoring at the sale side.

(6) Provincial cross-regional customer payment function. Realize cross-regional payment functions including bank outlets and electricity supply enterprise windows, carry out bank withholding, payment, and transfer for small and medium-sized enterprises.

(7) Disaster recovery. Implement system disaster recovery from different levels, including hardware platform level, data level, and application system level disaster recovery.

(8) Data separation. Separate operational data, analytical data, and decision-making data and ensure automatic archiving and online query of historical data.

3.1.2. Overall Scheme Design. The electricity marketing technical support system is constructed in a fully centralized way, with functions covering marketing management, 95598 customer service, customer payment, and electric energy

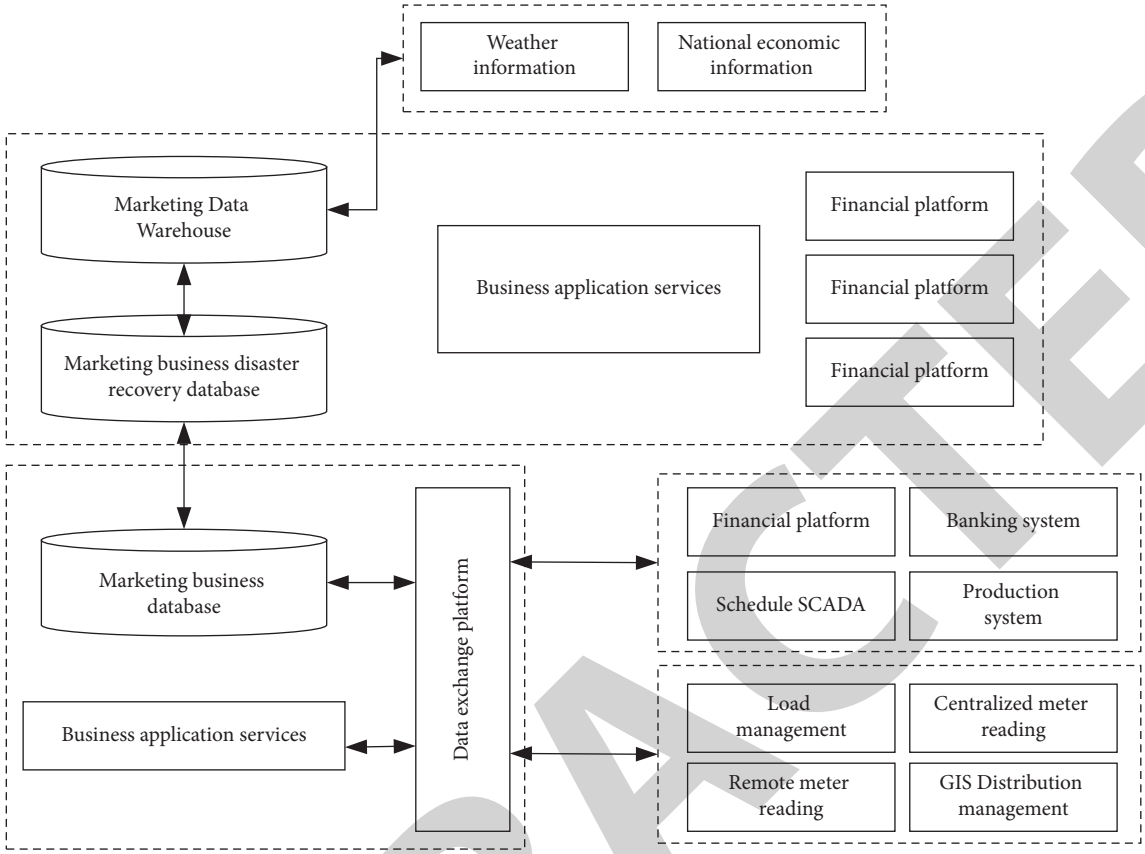

Figure 1: The logical diagram of the electricity company's marketing technology system.

collection and supervision modules. As well as the supervision and analysis functions to meet the daily business management requirements of marketing, the provincial company has unified the construction of a marketing data center and a marketing disaster recovery center. The marketing data center satisfies all the functions of daily marketing real-time business processing, and the marketing disaster recovery center of the same scale provides application-level disaster recovery support for large centralized systems. At the same time, the system resources of the disaster recovery center are fully utilized, and real-time services such as statistical reports, marketing supervision, and historical queries that consume system resources are deployed based on the disaster recovery database of the marketing business. In this way, a marketing data warehouse is formed, various OLAP applications are deployed, and marketing analysis functions are realized. The application deployment of the disaster recovery center not only ensures the performance of real-time business processing in the marketing data center but also makes full use of the resources of the disaster recovery center. The basic data resources of marketing distributed in various regions and cities, and the basic data resources provided by other businesses of provincial companies are all collected through the data exchange platform, and the interaction between the marketing system and other businesses is also carried out through a unified data exchange platform. The marketing data warehouse also obtains some analysis source data from other external applications through ETL. The logical deployment of the marketing technology support system is shown in Figure 1.

The system is planned and constructed according to the service-oriented architecture. The basic model includes four layers: access layer, application layer, service layer, and resource layer. The division of the basic model to four levels basically reflects the realization logic framework of the integrated business platform of electricity marketing. The logical layers are connected through corresponding protocols, adapters, data definition standards, and interfaces.

Resource layer: share the public information integration facilities of the entire enterprise and deploy the marketing data center facilities at the same time. All resources use a unified system-level monitoring and management software to achieve unified management of enterprise information resources.

Service layer: J2EE services and data warehouse services are provided by general commercial middleware, providing general service component objects such as application permission control, data exchange, workflow, etc., supporting the electricity marketing business application layer.

Application layer: the business components of electricity marketing are all encapsulated in this layer. The management of various general standardized

marketing business components and related normative standards and constraints appears in the form of prefabricated application resources. These prefabricated business components can ensure the stability of the core business of the system and the stability of the system's quality. When promoting applications at the implementation site, use various customizable platforms of the service layer according to the management responsibilities of the implementation site. Personalized deployment of prefabricated applications, composed of business logic used, and unified management by the system according to components and parts, the entire application layer can also be expanded and upgraded according to business development.

Access layer: if the enterprise has a public enterprise portal platform, the marketing application fully supports single sign-on. To meet various requirements such as interface integration and public information release, before the establishment of the enterprise public portal platform, the system also has its own unified front-end interface display and access layer.

3.2. Software Technology System Design

3.2.1. Software Architecture Description. The basic composition of the electricity marketing technical support system is as follows:

(1) Presentation layer. The presentation layer is the user interface part of the application and is the window for the interaction between the user and the system. It includes the user graphical interface and the logic components that communicate with the application layer. The main function is to check the data input by the user and display the data output by the system. The presentation layer takes the end user as the core to present and receive data according to the workflow set by the user, so as to realize the transition from the department-centered application environment to the process-centered application environment. If the presentation layer needs to be modified, it is only necessary to rewrite the display control and data verification procedures without affecting the other two layers. The content of the inspection is limited to the data format and value range and does not include the processing logic of the business itself.

(2) Application layer. The application layer includes the functional processing logic of the application system, and the interface for sending messages between the presentation layer and the data layer. The application layer also manages the workflow between application layer logic components and multiple data layer logic components. All business processing programs in the application are in the application layer; that is, except for the input/output functions in the presentation layer and the database in the data layer, all statistics, summarization, analysis, printing, and update functions are stored in the application layer.

(3) Data layer. A DBMS must be able to perform updates and retrievals of large amounts of data quickly. The current mainstream is the relational database management system. Therefore, the database retrieval statements generally transmitted from the application layer to the data layer mostly use SQL statements.

The distribution of the three-tier structure is very flexible, and there can be one or more servers in the application layer and the data layer. In this way, the database and application components in a large-scale information system can be distributed and run on different servers. These servers can be local or remote, making the system more reasonable, more flexible, and more scalable. In the three-tier structure, the presentation part, the application logic part, and the data part each occupy one layer. The presentation layer manages the interaction with the user and completes the request made by the client by invoking the middle layer. The application logic layer runs business logic and accesses databases and other resources. A client can call multiple server-based parts to fulfill a request. The three-tier structure enables the application logic to run on the server in the middle tier independently of the presentation tier interface and the execution of the database. If there is no request, each part runs on a different machine.

There are many benefits to having application logic independent of the presentation and data layers. Developers can use electricity full development tools to develop portable applications without having to use more limited stored procedure languages. A hypervisor can replicate application components to run on multiple machines simultaneously. This distributes the client load across multiple machines for high operational performance. Application component replication is not possible in two-tier and two-tier-half architectures because stored procedures must run in a single database. Application components can share database connections, and in two-tier and two-tier and half-structure systems, the database must establish a connection for each user. Access to business databases and other databases is through local protocols and application interfaces, not through data gateways. This improves runtime performance and allows applications to control access to their data.

The three-tier architecture is divided into B/S/S mode and C/S/S mode. In recent years, Internet/Intranet technology has been widely used all over the world. Internet-based C/S three-tier structure, that is, B/S/S structure enterprise solutions emerge as the times require. The C/S three-tier structure of the Internet mode takes the web server as the presentation layer and puts a large number of business processing programs on the application server as the application layer. The database is placed on the database server as the data layer, that is, the web server + application server. Compared with the traditional C/S structure, the three-layer structure of Internet mode has greater advantages. Because the Internet supports the low-level TCP/IP protocol, the Internet network can be seamlessly connected with almost

all local area networks currently used, thus completely solving the connection problem between heterogeneous systems. Because the Internet method adopts "thin client," the system is completely open, and the system does not limit the number of users who will be accessed. Since the system is relatively centralized and on several servers, it is easier to maintain and expand the system. For example, if the database storage space is not enough, you can add another database server. To add functions to the system, the original program can be modified, or a new server can be added to run new functions without doing anything on the client side. The interface is unified and the operation is relatively simple. It is highly portable, and as long as it is an application server that supports J2EE/Java, the application can be directly published and used without any modification. According to the above analysis combined with the characteristics of the users of the electricity company, the system application distribution architecture is as follows:

(1) The system consists of five large host groups, CTI server, queuing, and related network and storage, including business database group, application server group, WEB server group, statistical analysis server group, and unified interface server group.

(2) The main functions of the business database group are to run the business database to store data, run the accounting module, run the workflow and task management background module, and run the data audit background module.

(3) The main function of the application server group is to run the intermediate business logic of marketing management, business acceptance, payment, statistical query, authority management, and resource management.

(4) The main function of the web server group is to run webserver and provide web access management and web interface.

(5) The main function of the query statistical analysis server is to run the statistical background process, which is responsible for extracting the statistical base table from the business database and storing the statistical analysis data and data mart.

(6) The main function of the unified interface server is to provide protocol conversion of external real-time interfaces and data message format conversion. And, it is responsible for calling the services of the middle layer or directly extracting some data from the background database.

3.2.2. System Division. Design ideas according to the overall architecture of the application system, we divide all modules of the electricity marketing technical support system into customer service system, business processing system, electricity billing system, personnel and task management system, measurement management system, external interface system, report management system, monitoring operation, and maintenance system. All systems are based on the unified model data model, and each system has its complete function.

(1) Customer service system. All levels of dealing with customers belong to the customer service system. It includes access management, agent management, business expansion functions, payment acceptance, query management, complaints, suggestions, consultation, and query. The business expansion function refers to the function of the front desk to accept business. After the business expansion is accepted, a work ticket will be passed to the business processing system. After the payment is accepted, the payment work order will be transmitted to the electricity bill accounting.

(2) Business processing system. This system is mainly used by staff who handle background business expansion. The system obtains work tickets from the customer service system, and after processing them one by one, finally establishes, changes, and confirms customer data. In terms of software design, componentization of business processing links, process automation and flexibility, and unified management of work tasks are the core of the system.

(3) Electricity billing system. Including meter reading, accounting, payment processing, accounting processing, accounting management, arrears management, and many other contents. The most important thing in electricity billing is to establish a set of configurable customer electricity billing algorithms.

(4) Authority management system. Including employee management, authority management, organization management, and task management. The core content of the system is to establish a configurable and flexible authority organization management.

(5) Measurement management system. Establish a management system for the life cycle of measuring equipment.

(6) External interface system. Build an interface platform with configurable protocols, configurable data formats, and configurable calling services.

(7) Report management system. Establish marketing-related data warehouses, build OLAP models for reports, provide basic reports, and generate related data marts.

(8) Supervise the operation and maintenance system. Provide comprehensive operation status management and maintenance management of the application system. Provide running status and maintenance management of network, host, database, and middleware. Provide the display of key KPI indicators of system operation and indicators of the quality of marketing work.

The customer service system mainly includes the following contents: the construction target of the customer service system. One of the key points of system construction is to provide services to customers. Its

purpose is the system integration construction for customer service. That is, the original 95598 system, online business hall system, and marketing system use shared information models and information data. At the same time, the application service layer is shared, and the access layer is managed uniformly. Functional integration for customer service. That is to clean up the original system functions, integrate processes, organize functions around customer service, and simplify the interface and functions of front-end operations. Such as the integration of high-voltage new installations, low-voltage new installations, and new residential installations into new business installations. Integrate high-pressure capacity increase, high-pressure capacity reduction, low-pressure capacity increase, and low-pressure capacity reduction into capacity changes, etc., in line with the requirements of the electricity company to establish a customer service center. From the application software, it satisfies the organization management, authority management, business process management, monitoring, and assessment management of the customer service center.

3.3. Hardware Technology System and Network Platform

3.3.1. Marketing System Network Wide Area Network Design. The reliability of the wide area network channel is one of the most worrying problems in the construction of the provincial centralized mode marketing management information system. To build a centralized marketing management information system in the whole province, to ensure its normal operation, the requirements for network bandwidth are very high. The existing marketing management information system running in the C/S mode is running on the local area network of the local municipal bureau with a bandwidth of 100M, and the response is no problem. If the B/S mode is used, the network overhead brought by the construction is greater than that of the original C/S mode system. Under B/S, there are mainly two types of ping-pong data exchange and bulk data transmission, and the calculation methods of the occupied bandwidth are different. The formula for estimating the bandwidth occupied by a ping-pong data exchange is as follows:

$$W = 8 \times N \times K \times M + (K \times P + T), \tag{1}$$

where N is the number of users exchanging data, T is the user think time, K is the number of packets exchanged per direction in either direction, M is the number of bytes per packet in either direction, and P is the one-way network delay time.

The key parameters in bulk data transfer are the number of bytes transferred and the maximum transfer time that the end user can tolerate. Without information about the end user's tolerance for transmission time, the bandwidth used for transmission cannot be accurately estimated. This is because high-volume data transfers tend to consume as much bandwidth as possible. A simple formula for bandwidth estimation in bulk data transfer mode is as follows:

$$W_b = F \times O \times 8 \div R, \tag{2}$$

where F is the size of the bulk data to be transmitted, O is the protocol overhead factor, and R is the required end-user transmission time. The overhead factor indicates the necessary TCP/IP and link-layer overhead for each TCP segment.

WAN lines are nothing more than leased telecommunications lines or owned lines. Whether it is a leased line or its own line, the bandwidth can reach more than 100 M. Restricted by the telecommunications network, more leased lines may use 155 M or even higher. If you use your own line, you can set the network interface bandwidth to 155 M or GE, which fully meets the wide area network bandwidth requirements of the marketing management application system. Considering the reliability of the network, it is recommended to apply for a 2–8 M telecom line outside the marketing proprietary wide area network as a backup line for the wide area network of the marketing system. The headquarters network of the provincial company is the core of the electricity marketing network. The core of its local area network can be composed of two high-performance multilayer switches, and the two multilayer switches are interconnected by two or more gigabit ethernet links. It is recommended to configure two WAN routers to realize the WAN connection between the marketing private network and the backup network, respectively. Configure the corresponding router interface card according to the application situation of the WAN link. The WAN router of the marketing dedicated network is required to support 18 155 M or GE interfaces. The standby network WAN router requires 18 2 M or 18 × 4 2 M interfaces, and 4 2 M link bundling capabilities. The WAN router also provides at least 3 gigabit ethernet ports for connecting to the local area network. The municipal company WAN router of the secondary node can use one to complete the connection of the electricity marketing private network and the backup network. Of course, it can also be similar to the WAN router in the headquarters of the provincial company, using two to complete the connection of the private network and the backup network, respectively. The municipal company LAN system is connected to the entire provincial electricity marketing system network through the ethernet interface of the municipal company WAN router of the secondary node. The municipal company WAN router is configured with at least one router, providing one 155 M or GE port, one to four 2 M dedicated line interfaces, and at least one gigabit ethernet port. The specific network product model and configuration are selected and determined according to the actual situation of the user's WAN link.

3.3.2. Provincial Company Headquarters LAN Design. The core of the provincial local area network will be composed of two intelligent multilayer switches. The ethernet link binding technology is used between the two core switches to realize link redundancy backup and expand the LAN backbone bandwidth. The two core switches provide Layer 3 routing functions at the same time and use routing

redundancy backup protocols such as VRRP or HSRP to implement routing redundancy backup between different VLANs. When one switch fails, another switch can take over all the services on the faulty device without affecting the normal operation of the entire service system. Between the WAN router and the LAN core switch, a firewall is used for network security isolation to enhance network security. The two core switches form the backbone of the local area network of the provincial company headquarters, connecting the marketing management system application servers, including WebServer, ApplicationServer, DataServer, and other application system servers. At the same time, it is connected to the access switch to connect the application system client terminals distributed on different floors of the office building to the marketing network system. The marketing management system WebServer, ApplicationServer, and DataServer will contain multiple servers, providing high-reliability technologies such as server clusters to ensure the normal operation of the application system. For the core resource database server of the marketing management system, it is recommended to use a network firewall to strengthen network access control before accessing the local area network. SAN mainly provides storage space for database servers and provides backup. The local area network of the provincial company headquarters also provides the interface between the marketing network and other application systems, including the SMS platform system, the online business hall, and the banking and telecommunications networking system concentrated in the provincial company headquarters. Including control systems, dispatching systems, emergency repair systems, financial systems, GIS systems, call centers, etc., which are applied in provincial company headquarters and municipal companies. Some other business application systems will require connection with other networks. It is recommended to use firewalls for network security isolation when connecting the local area network with other networks to improve the security of the entire system. For example, the online business hall system and the banking system need to be connected to other untrusted networks. It is recommended to strengthen security access control through network firewalls. In the application system deployment of the provincial company headquarters, 4 web servers need to be configured. To enable the four web servers to provide a unified access interface, it is recommended to deploy the web server behind an application load-balancing device. The load balancing is judged by checking the 4–7 layers of information of the data packet, and the load balancing of the four web servers is realized by applying the load balancing device. The two configured application load balancing devices back up each other to provide high reliability and ensure high system reliability.

4. Experiment and Analysis

4.1. Test Data Samples and Indicators. The experimental data samples in this paper are all composed of data generated when the collection system is running. According to the experimental test indicators, the formula used in this paper is as follows. The samples are divided into positive samples and negative samples. The positive samples are predicted as positive samples as true positive (TP), the positive samples are predicted as negative samples as false negative (FN), and the negative samples are predicted as positive samples as false positive (FP); negative samples predicted as negative samples are true negative (TN). So there is $P = \mathrm{TP} + \mathrm{FN}$, $N = \mathrm{FP} + \mathrm{TN}$.

$$\begin{aligned} \text{Precision} &= \frac{\mathrm{TP}}{\mathrm{TP} + \mathrm{FP}}, \\ \text{Recall} &= \frac{\mathrm{TP}}{\mathrm{TP} + \mathrm{FN}}, \\ \text{flasealarm} &= \frac{\mathrm{FP}}{\mathrm{FP} + \mathrm{TN}}. \end{aligned} \tag{3}$$

Table 1: Transmission mode bandwidth system estimates compared with actual values.

Number	1	2	3	4	5	6	7	8
System value	6.0	4.8	8.6	10.1	7.5	8.2	9.3	7.8
Actual value	6.0	4.8	8.5	10.1	7.6	8.2	9.3	7.8

4.2. Bandwidth Estimation Test for Bulk Data Transfer Mode. The peak of a large amount of data generally occurs in the information query without any restrictions, and we use the mean value to consider. Comparing the value output by the system with the century value, the results obtained are shown in Table 1.

From Table 1, we can see that the difference between the estimated value of the system and the actual value is very small. It can be shown that the system has a high accuracy rate in this regard.

4.3. System Function Test. Each test is more than 1000 times, and the average value is taken after the test, and a total of 8 test results are obtained.

(1) System delay: this indicator is also a very important indicator in the system. The final result of the experiment is shown in Figure 2. It can be seen that the delay of the system is very small, which proves the efficiency of the system to transmit data.

(2) System downtime rate: this indicator is one of the most important indicators of the electricity marketing information system, which is related to whether the system can complete the basic functions efficiently and accurately. The same 8 experiments were performed on the system to verify its downtime times, and the results obtained are shown in Figure 3. As can be seen from the figure, the downtime rate of the system is very low, which can prove that the system is very stable.

(3) System precision rate: the system accuracy rate is one of the important indicators to ensure the accurate transmission of system data. If the precision rate is

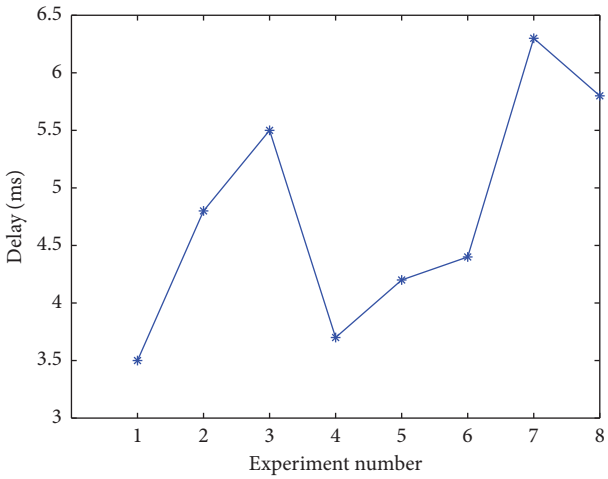

Figure 2: System delay test.

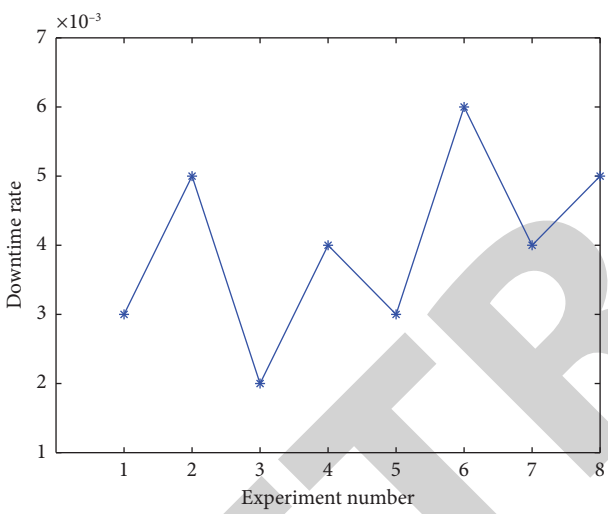

Figure 3: Data interaction accuracy test.

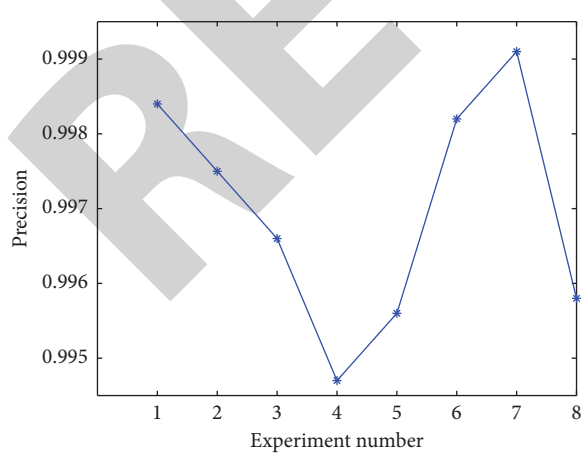

Figure 4: System precision test.

too low, it will affect the user experience and reduce trust. The same method of taking the average of 8 experiments is adopted, and the results obtained are shown in Figure 4. It can be seen that the precision of the system is very high and can meet the needs of users.

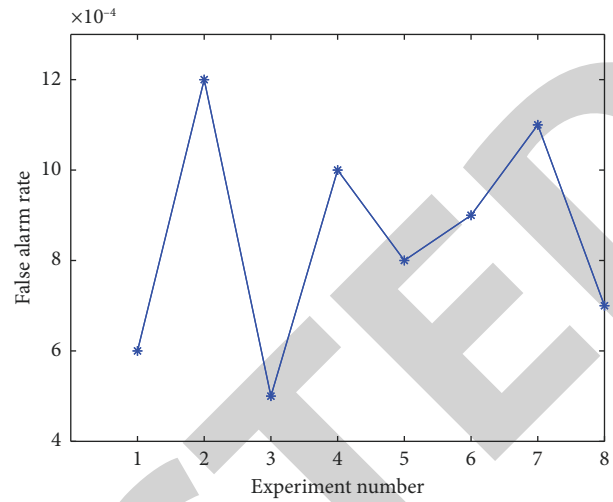

Figure 5: False alarm rate test.

(4) False alarm rate: the false alarm rate of the electricity marketing information system is a very important indicator. If the false alarm rate is too high, it will affect the accuracy and efficiency of the system and is not conducive to the normal management of electricity marketing information. The method of taking the average value of 8 experiments is also adopted, and the results obtained are shown in Figure 5. It can be seen that the false positive rate is within an acceptable error range.

5. Conclusion

The digitalization of the market economy is a feature of the information age. With the continuous deepening of the market-oriented reform of electricity supply and demand in my country in recent years, electricity supply companies are faced with the intervention of market competitors and the intervention of new energy-distributed electricity sources advocated by the state in the electricity grid structure of the distribution network, the electricity supply and demand standards of different customers, and intelligent grid operation monitoring standard. All of them indicate the fierce competition of the new electricity market economy under the reform of the electricity system and face new industry development trends such as the relationship between electricity supply and demand. This requires the State Grid Corporation of China, which has the right to operate, to summarize and practice the management and control methods and standards corresponding to market development as soon as possible, so as to achieve the ability to quickly deal with various electricity problems. The new generation of electricity marketing management information systems based on network technology is the only way to improve the market competition of electricity marketing and

improve the efficiency of service feedback in the information age. Starting from all aspects of the electricity marketing business, a digital model is established, and through the digital collection, aggregation, storage, and real-time extraction of information, it can effectively deal with the electricity disputes that are difficult to solve in the daily electricity customer service work. This will further improve the customer service satisfaction of electricity consumption and establish a benign supply-demand relationship and a stable customer base, which is conducive to the expansion and deepening of the electricity market. This paper has completed the following work: (1) described the development of domestic and foreign electricity marketing management information systems and provided a theoretical basis for the design scheme proposed later. (2) With the provincial company as the network core and the city-level company and county-level company as the tree nodes, the local area networks of companies at all levels are connected to the entire network system. The construction of the marketing system should focus on eight key points, establish a service-oriented system architecture, plan the hardware platform in combination with the principles of advanced and practical, and at the same time, integrate the defects and deficiencies found and existing in the application of the current marketing technology support system. (3) According to the characteristics of the application software of the electricity marketing management information system, the software that runs between the components of the distributed, enterprise-wide C/S application or within the components is adopted. The performance of the software and hardware of the system is tested experimentally, and the results show that the electricity marketing information system has good performance.

Data Availability

The datasets used during the current study are available from the corresponding author upon reasonable request.

Conflicts of Interest

The authors declare that there are no conflicts of interest.

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