Research on Monitoring Model and Key Technologies of Substation Automation System

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Abstract: In the operation process of power dispatching, the automatic monitoring system of its substation plays an important role, and it is also an important foundation to ensure the safe and reliable operation of the power grid. In the process of power grid operation, due to long-term use, the stability of automation equipment will fluctuate, and then the difficulty of operation and maintenance will increase. Therefore, this paper mainly analyzes and studies the monitoring model of substation automation system and the key technologies used.

1. Introduction

Automation system is widely used in the current power system. Therefore, in order to ensure the efficiency and stability of power grid operation, it is necessary to analyze the key technologies applied in the system, so as to improve the efficient operation of substations and provide users with a good power supply environment.

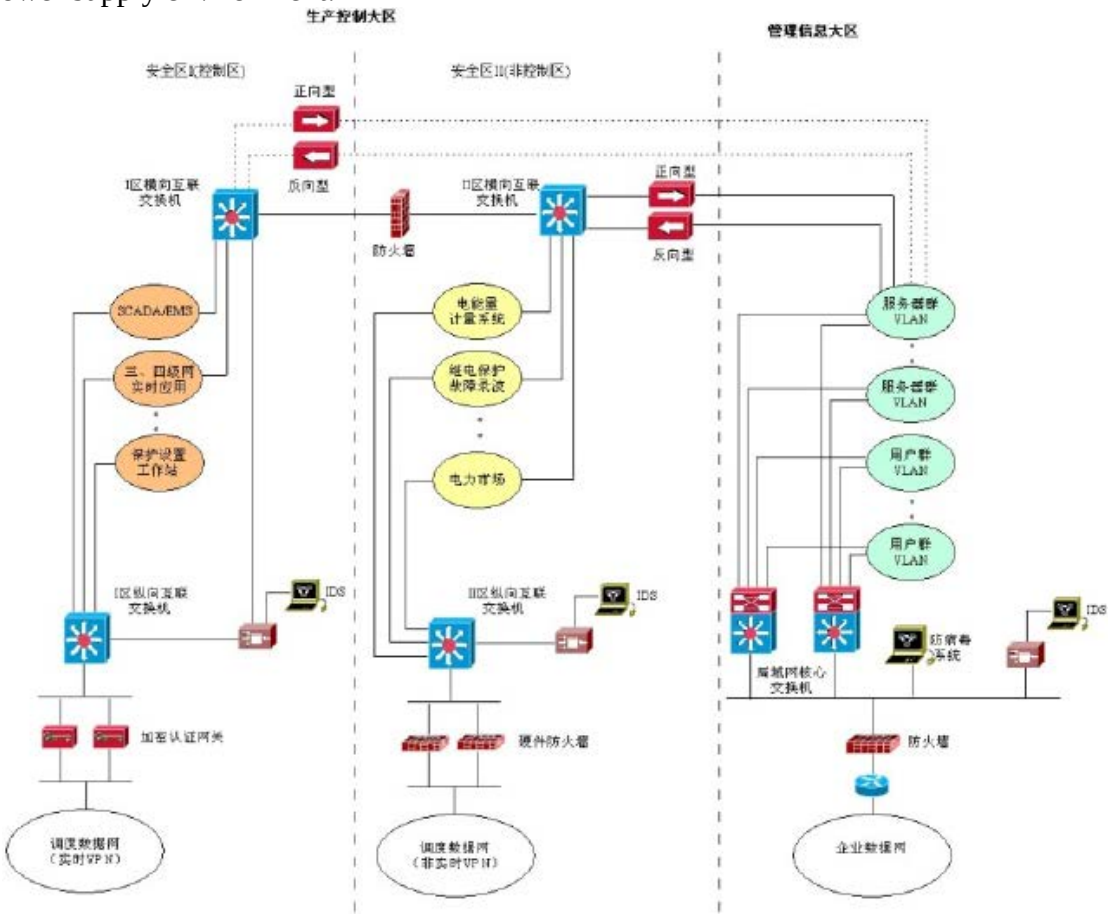

Figure 1 Construction scheme of main station of power dispatching automation system

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2. Analysis of Substation Automation Monitoring System

In the operation process of power system, the most important thing is to ensure the high security and economy of power system. In the process of stable operation of power system, the automation construction of power dispatching can play an active role, effectively guarantee the safety of economic operation, and then realize the monitoring of the power grid and various power plants. At the same time, it can also remotely monitor the primary and secondary equipment of the power station, and after obtaining the information data, analyze the corresponding causes of the accidents, and even realize the automatic recovery of the accidents. In the automation system, online power flow analysis can also be realized, and corresponding safety early warning can be set up for automatic power generation control, and a comprehensive control mode of automatic voltage and reactive power can be formed. In this mode, the systematic monitoring and management of power system has been formed, which is an active and important content in the development of power system at present and the key to realize the development of power construction. Figure 1 shows the construction scheme of the main station of power dispatching automation system.

3. Composition of Substation Automation Monitoring System

As far as the automation monitoring system of substation is concerned, it mainly consists of telecontrol terminal, power transmitter, power collector, dispatching data network and so on.

In the automatic monitoring system of substation, the core equipment is the construction of telecontrol terminal. The construction of this telecontrol terminal is mainly responsible for the realization of functions such as remote communication, telemetry, remote control, remote tuning and remote pulse. Among them, remote communication is the collection of status information in the station section, such as the acquisition of information data on the actual position of circuit breaker and power station. Telemetry is to detect the parameter data of various devices in the motherboard, bus and circuit. In the process of application, electrical parameters need to be converted into standard current and voltage signals by power transmitter, and then sent to RTU telemetry board, thus realizing information collection. As far as remote control operation is concerned, it is necessary to drive the intermediate relay to a certain extent. In use, it is necessary to connect the intermediate relay into the control loop at the station end, and then it is necessary to use the remote control board on RTU for remote control. At the present stage, with the rapid development of substation technology, the used pulse shaking function and the electronic transformation are carried out, and multi-functional electric energy meters are mostly adopted, so that the remote terminal of the substation does not need to realize this skill. Therefore, at this stage, the function of "four remotes" has been realized in terms of sports terminals.

At present, in substations, dispatching data network equipment and main station of control center are mostly used to connect wide area network communication. However, at the station end, it is necessary to combine the use of automation equipment with its remote network communication, and to build it under the corresponding regulations of power system network security protection. At the station end, it is necessary to ensure that the automation terminal passes through the longitudinal IP encryption gateway, so that it can access the network of the power company. At present, in most power grids, optical fiber is used for network connection, so that large-capacity communication can be realized.

4. Optimal Design of Mobile Terminal

In the research process of this paper, KX-96 RTU is selected as the telecontrol terminal. In the process of studying it, the main purpose is to further improve the operation efficiency and service life of the equipment. In this way, it can ensure the normal operation of the automation system before the whole transformation.

In the research process of this paper, the selected RTU has been used for more than 10 years, and the electrolyte in the pump capacitor in the power subsystem of the system has almost evaporated,

which causes unstable output of the power supply, makes the output waveform burr more, and even appears damage in the process of use, without current output, which seriously affects the normal operation of the RTU.

According to the actual situation on site, it is necessary to analyze the power supply system in detail, so as to make clear the health level of the system.The analysis shows that the RTU is a decentralized structure, which consists of three parts: main control unit, intelligent I/O unit and terminal board. On the other hand, the main control unit has relatively independent power supply, while the intelligent I/O unit uses centralized power supply mode. In this device, there is a special power board. After defining the corresponding power supply, the telemetry unit in its RTU can no longer be used, which leads to a significant decrease in the power supply capacity of the intelligent I/O unit during its operation. Therefore, its power supply module needs to be replaced.

After analysis and demonstration, the module selection of power supply is made clear. Therefore, in order to further reduce the difficulty and cost of transformation, it is necessary to design the model with the original power board size in the selection of power supply.

5. Network Interface Expansion of Telecontrol Terminal

In the early days, the KX-96 RTU used asynchronous serial port and frequency shift keying to communicate with the master station, so that in the process of information transmission, it has real-time performance and can effectively receive the corresponding remote control shake command issued by the master station.

In the research process of this project, in order to ensure that the equipment can run in a specific transition period, and to reduce the design difficulty and cost investment in the design optimization project of RTU, the software running on the original device does not need to be designed, and the asynchronous serial port is still used for communication connection and use. At the same time, in order to further improve the realization of network access, in the construction process of using asynchronous serial port network terminals, it is also necessary to access them into the dispatching data network, so as to improve its stability and quality in the process of network communication access.

6. Integrated Design of Biplane Scheduling Data Network

At present, there are many types of substation dispatching data network information in terms of its equipment configuration, dispatching data network equipment and various communication equipment used, so as to realize the automatic information collection and processing of the system, and at the same time be able to forward the information. In the way of data transmission, it is necessary to transform the digital information number into electrical signal through the router, and at the same time, use coaxial cable to use its communication digital distribution frame. At present, with the rapid development of science and technology, the grid structure in the power grid becomes more and more complex, which will lead to a large increase in the number of access data. Therefore, the traditional single-plane method can no longer meet the transmission of power grid data, and it cannot have high security and stability in the process of data transmission.

7. Design of Telemetry System Using Electricity Collector

In the traditional substation, the telecontrol terminal established by it needs to use the power transmitter to output DC sampling, so as to realize the information collection of corresponding electrical parameters.

The electricity collector is also used as the remote terminal eRTU of electric energy, so the design of the equipment is mainly based on the automatic meter reading system, which can realize the internal data collection of the electronic multifunctional meter, and at the same time, the equipment has a certain function of storing information. In the process of structural design of the equipment, it is necessary to realize the supporting role of the hardware platform as much as possible, so as to ensure

that it meets the use requirements of related fields. Figure 2 below shows the specific composition of eRTU hardware platform.

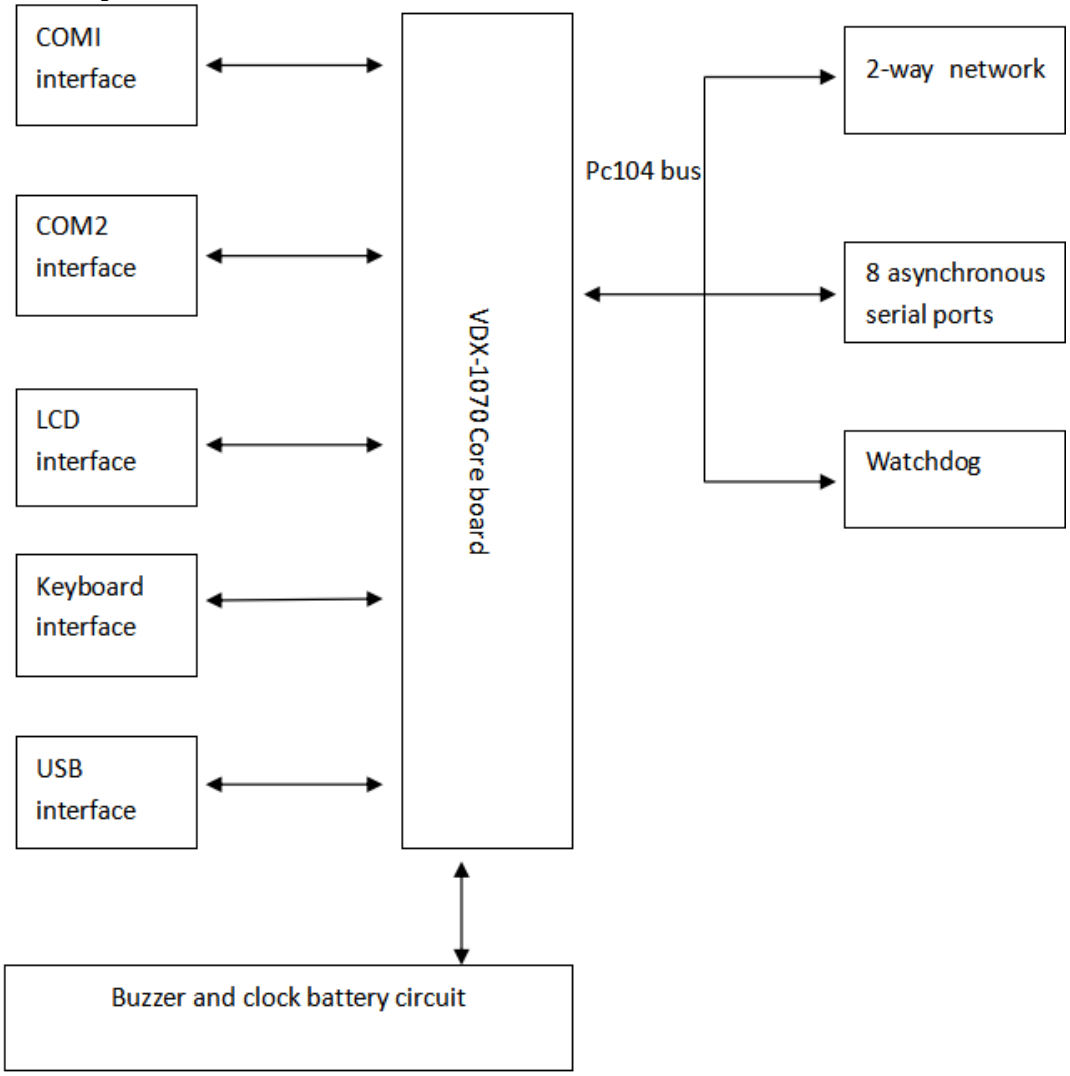

Figure 2 Specific composition of ERTU hardware platform

ERTU is essentially a kind of PC under industrial control mode, so in the early use process, the operation and development principle of its software is the same as that of PC. However, in the design process in the future, the corresponding optimization design will gradually form, which can bring the application value into play for the stability and security of power system and enhance the rationality of the monitoring model in power system.

To sum up, during the research and analysis of the monitoring model and key technologies of substation automation system, its system is the key to the stable operation of the power grid. Therefore, it is necessary for relevant technicians to fully master the key technologies and specific models used, so as to improve the operational stability of the power grid and further promote the development and construction of China's power industry.

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