A Study on Design and Key Technology of Intelligent Power Grid Dispatching Visualization System

Zhongmiao Kang, Yijie Li, Zanhong Wu, Ying Wang
Power Dispatching Control Center, Guangdong Power Grid, Guangzhou, 510600, China

Abstract. The design principle of smart grid and the operation mechanism of smart grid dispatching system are studied. A visual system design framework of Smart Grid Dispatching Based on interactive operation of visual interface is proposed. The intelligent grid dispatching visualization model was constructed from four aspects: early warning, analysis, control and observation. The key technology research including system intelligent intelligence and rapid simulation modeling was analyzed in detail. It is designed to ensure the safe and stable operation of the system while improving the efficiency of the dispatcher.

1. Introduction
Due to the physiological structure, the human eye recognizes the graphics faster than the sensitivity to the data. Therefore, the system dispatcher can see that the response speed of the data is not higher than that of the graph. For system anomalies, higher efficiency methods should be used to improve system operation quality and efficiency. In terms of visualization technology, we can complete the test of data transformation to graphics through related technologies. This kind of information will change with time and space differences. At this time, the corresponding image information will be fed back to the interface.

This kind of smart grid mode can take the security and stability of the system as the basic center. It is not only responsible for the relevant transmission dispatch, but also for the decision-making of power generation, substation, power consumption and other issues. If the operation of each functional module in the power grid system is not close enough and coordinated, it will have a negative impact on the stable operation of the whole power grid system. In the dispatching system, the dispatcher is the core element, and its work efficiency and judgment accuracy will have a significant impact on the operation of the system. Therefore, the theory of using images instead of data analyzed in this paper can better reduce the work pressure of dispatchers and improve work efficiency and quality.

2. Smart grid design principle
The design principle of this kind of visualization system is to take people's habits as the core and regard people as the main core of the system. This is the key to the formation of human and computer. Through the integration of human intelligence and computer ability, the system intelligent effect is realized. Optimal. At present, the efficiency of human intelligence utilization in system design is not high. To realize the application of dispatcher's intelligence in system, the goal of improving system performance can be achieved. This is the formation of "dispatcher's thinking mode". The emergence of the "man-machine integration" system can break the existing limitations of the power grid system and realize the overall upgrading of the system.

At present, human intelligence includes the following categories: first, intelligence. To measure a person's intelligence ability, we should take education, experience and so on as the main indicators;
second, intelligence. Essence is a person's physiological intelligence, which is closely related to personal cognitive ability. People's perception, thinking and memory of things can achieve the results of concrete analysis of things, and formulate processing methods according to relevant factors. Third, skills. This is the most basic part of the formation of human intelligence. When people have organ perception of the external environment, they can form an interactive state. The smart grid dispatching visualization system is the most important of these aspects, and the three complement each other and are based on each other. Wisdom in the personal qualities of dispatchers is a very important aspect that can play an important role in the formation of the relationship between intelligence and skills. The advantage of this system model is that it uses the computer to make up for the low efficiency of manual calculation and high error rate. The wisdom of human beings can solve the problem of weak computer learning ability and adaptability [1].

The essence of the grid system is to use the visual targets to summarize the data and form tables and various types of graphics. The technology is able to take advantage of the visual advantages, allowing the dispatcher to handle the problem with a significant increase in speed and accuracy. With the improvement of smart grid system technology, the visualization technology also gains better development space, and the human-machine collaborative decision-making method enables the smart grid to achieve better quality optimization.

3. Design of Visualization System for Smart Grid Dispatching
In order to further upgrade the power grid system, it is necessary to form an effective docking between the intelligent system and the power grid. There are many design criteria to be implemented in this design mode. Specifically: First, the integration function. With the high-speed integration of massive data, all functions of the system can be reasonably allocated. Second, the system should be more open, and the relevant information should be exchanged on multiple platforms on a non-platform basis. Third-party or even multi-party data can be directly input and output. Third, the system must contain professional guidance and advice, thus establishing a special information base to provide reference for the dispatcher to use the data; Fourth, the system develops a unified standard for daily management.

In the system environment, the visual interface design, through the multi-functional implementation, can realize the high efficiency improvement through the system optimization, and can be built into a multi-data fusion system mode. The specific composition of the framework is shown in Figure 1.

![Fig.1. Visualization System Framework for Smart Grid Dispatching](image-url)

At present, visualization system display is mainly divided into three lines. Specifically: the first line, the overall operation of the system. For dispatchers, the importance of this line is obvious. If the system works properly, there will be very little data to display. If there are abnormal conditions in the system, the system will enter the early warning state, and the relevant information can be directly presented to the interface graphically. The warning level will be from low to high, and the color will be from light to deep. The second line measures the main safety distance to determine whether the system is in stable operation. At this time, the interface will also display the relevant distance information. At any time, the
dispatcher will observe the parameter information and give a solution to the problem. The interval between each inspection is usually 3 minutes. The third line mainly observes the monitoring parameters. The interface data changes can provide reasonable parameter information for the dispatcher, and can implement effective and accurate analysis of the specific operation mode.

4. Construction of Visual Model for Smart Grid Dispatching

The establishment of such a system model requires the following four levels:

(1) Early warning

Early warning function is very important for the construction of smart grid visualization system. It is an important way to inform the operation of the platform, and it is also the basic voucher for dispatcher to carry out parameter analysis. It can be seen that the early warning function has the function of showing the monitoring problem, so as to avoid serious damage to the equipment and cause the system to collapse.

(2) Analysis

The dispatcher can intuitively interpret the grid operation status through the system interface, and judge the specific system status through rigorous and effective information judgment. On the system interface, you can see the sorting method of voltage values. Most of them are based on different sequence modes of lifting and lowering. The dispatcher can analyze the abnormal conditions of the equipment according to the specific parameter information. If overloading and curing occur, the efficiency of problem processing can be improved by sensitivity sequencing. However, the system can not process too much information at the same time. If there are too many goals, the computing speed will be reduced. The system can not make a reasonable allocation during maintenance, which leads to the difficulty of dispatcher judgment.

(3) Control

Use the system intuitive mode to adjust the interface content at any time, which is to complete the control and display of the results in a visual way. In this way, the dispatcher can more accurately determine the system situation, and the work pressure can be better reduced, and the work efficiency is significantly improved. From this perspective, the dispatcher can judge the system health through the results given by the system, thereby improving the control efficiency.

(4) Observation

According to the general regional sensitivity, the system is divided into several parts through different regions, which can judge the system overload and overload, and give the heavy load ratio. Measure whether the voltage value meets the safety interval, and should be independently studied for the safety value. In addition, the system capacity-load ratio is also the focus of the analysis. Power grid balance analysis, security monitoring and other important research core, thus completing specific and comprehensive information control.

5. Research on Key Technologies of Smart Grid Dispatching Visualization System

5.1. Intelligent Early Warning

Through the analysis of the current technological level, we think that although there seem to be many kinds, the basic forms are not very different, and the homogenization of each type of technology is more obvious. This kind of early warning can basically complete data acquisition, and has a certain judgment and analysis function for the operation status of power grid, which involves: continuous power flow stability calculation, sensitivity calculation, fault screening and sorting, etc. Then, the system stability calculation results are analyzed by using the system measurement method. When there are different data from the system indicators, the interface will appear early warning signals. Most of these single alarms are set in advance. If these parameters are exceeded, the system will start the automatic alarm module immediately. However, the application space of this early warning method is not large. Different types of early warning signals required by modern society should be satisfied by system upgrade and technology optimization. When judging the type of fault, it is necessary to consider the specific warning state and give different warning signals. The degree of correlation between the faults is different, which
will also cause the warning signal to change. For the functional design of the early warning module, the most important thing is to achieve the enhancement of the stability of the monitoring component, which is an important way to achieve the stability of the system stability. For these problems that have not been completely solved, this paper can comprehensively analyze the early warning monitoring objects and coordinate the dynamic and static operation conditions to achieve effective division within the monitoring scope and achieve the ultimate goal of regional overall monitoring [3].

During the actual operation of the power grid, when a system failure occurs, a large amount of data information can be captured and monitored and delivered to the data scheduling core. Because the dispatcher is too large, it is difficult to find the core problem quickly in a short period of time, and the time for giving a precise strategy is not likely to be very fast. These issues are the main research contents of this paper. The application of intelligent early warning technology can effectively classify fault types, including primary, secondary, static and dynamic. Through the application of screening mechanism, dispatchers can directly judge the type and level of early warning signals. Figure 2 shows the specific screening process.

![Fig.2. Intelligent Early Warning Information Screening Process](image)

### 5.2. Fast simulation and model construction

The operation of power grid must adopt more effective theory as the basis to construct the technological model needed by modern society. The original theoretical calculation is too complex. For modern power grid, the application value is gradually declining. By means of simulation modeling, it is applied to various fields to improve dispatcher's work efficiency with the advantages of high accuracy, fast calculation speed and good result quality [5]. This technology is measured by a variety of high-precision instrument measurement results, the system topology is obtained, and the online processing of simulation modeling is completed by real-time monitoring. The key technologies are shown in Figure 3 and Figure 4.
5

6. Conclusion
In this paper, the basic technology is visualization type. Through the construction of smart grid dispatching system, the combination mode of dispatcher and computer technology is analyzed, and the effective combination of manual and computer technology is realized. By improving the effectiveness of intelligent early warning, the dispatcher's work efficiency can be better improved to meet the requirements of safe and stable operation of the system.
References

[1] Wang Ping, Li Lei, Hu Cong, et al. Short-term load forecasting method for smart grid in cloud computing environment [J]. Science and technology and engineering. 2018 (07): 153-158.

[2] Li Bo, Gao Zhiyuan. Application analysis and Prospect of artificial intelligence technology in smart grid [J]. China Electric Power. 2017 (12): 136-140.

[3] Zhang Yong. Interpretation of real-time monitoring and warning function specification of smart grid dispatching control system [J]. China Electric Power. 2017 (11): 48-53.

[4] Zhang Rui, Chen Shuyong, Liu Daowei, et al. Research and application of Web visualization of power network based on ECharts [J]. Electrical measurement and instrumentation. 2017 (19): 59-66.

[5] Cheng Yiqiang, Wu Xiaona, Li Huiqun, et al. Wide-area maintenance and browsing technology for graphics of smart grid dispatching control system [J]. Power system automation. 2017 (14): 171-175.