Design of Real-Time Power Quality Monitoring System for Active Distribution Network Based on Computer Monitoring

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Abstract. The power system is continuously optimized and advanced, and then various equipment auxiliary systems are produced. This paper studies the real-time power quality monitoring system of active distribution network based on computer monitoring. The system can monitor the real-time parameters of electric energy and the running status of equipment, and design the memory function and fault processing function. When some equipment or parts of the power grid failure, the system can produce alarm signals in a timely manner, notify the system monitor, the staff can immediately deal with the problems caused by the signal, reduce the loss caused by failure in time. The memory function of the system is to carry on the memory to the fault signal, then can quickly find, is advantageous to the fault study and the prevention.

Keywords: Computer, Active Distribution Network, Power Quality, Real Time Monitoring

1. Active distribution network

1.1. Definition of active distribution network
In a general sense, the active distribution network is a distribution network with distributed or distributed energy sources and control and operation capability. Active distribution network usually has four characteristics, the first is to have a certain distributed controllable resources, the second is to have a more perfect controllable observable level, and the third is to have a control and management center that can realize coordinated and optimized management, the fourth is a network topology with considerable flexibility [1]. In 2008, the active distribution network received enough attention that, unlike other smart grids, the active distribution network is a fairly well defined technical term, not just a common verbal one. With the rapid development of communication technology and information, the management mode and control of distribution network is different from the traditional control mode, which makes it possible to install a device for measuring information accurately. Just as in modern life, with Weibo, with live audio and video, individuals and management departments have a lot of...
available live information. As shown in figure 1:

![China's global power grid investment surge](image)

Figure 1. Active distribution network

1.2. Active Distribution Network function

Active distribution network. Based on the development of intelligent measurement technology and the development of information and communication technology, the active distribution network can delay investment, improve response speed, network visibility and network flexibility, higher power quality and reliability of power supply, higher level of automation, easier access, potential reduction of network losses, better utilization of assets, improved load power factor, higher distribution network efficiency, higher power quality and availability to sensitive customers[2].

Of course, the development of active distribution network will still face some problems and obstacles, such as maintenance issues, communication complexity involving a large number of stakeholders, increased investment costs (equipment, education, software), lack of experience, and lack of uniform international standards for the setting of active distribution network characteristics, the lack of risk-taking incentives, the difficulty of changing day-to-day operations, and the capacity of existing protocols and communications infrastructure[1]. New regulations are needed, the scale continues to grow and is connected to the power grid, the security of the information and communications infrastructure, and the incompatibility of the active network with the existing passive network. In Layman’s terms, the active distribution network has a larger observable range and can hold more information. At present, the monitoring scope of the power grid can only reach the distribution network, and there is no way to know more information about the actual power consumption of users, such as whether air conditioning is used or not, whether photovoltaic installations are installed, what are the important equipment, and it is even less possible to know the power consumption habits of users, when to wash clothes, air conditioning... active distribution network can know this information, and then active service users to meet user needs. Through the automatic collection of signals, data analysis to master the relevant information, to provide the best program for users[4]. The power supply enterprise may prepare the network and the load beforehand, reminds the user in the suitable time choice uses the electricity and so on[2]. Users can query the real-time electricity price at any time, to adjust the behavior of electricity consumption, to save electricity costs, but also can query the surrounding distributed power supply, self-selection, to achieve the optimal allocation of power resources within a certain region. The active distribution network is also reflected in the anticipation of possible dangers and the formulation of certain coping strategies to be effectively implemented through the control center, rather than the traditional distribution network can only be in the event of a failure to take passive measures.

1.3. Development of active distribution networks

In recent years, the rapid development of new energy sources and electric vehicles in the capital has put forward new requirements for distribution network planning, construction and operation
management. The establishment of the project provides an opportunity to solve the above problems. The significance of the subject is more than that -- it will lead the development direction of intelligent distribution network in our country, and has great economic and social benefits. For users, flexible access to the active distribution network means higher reliability and quality of power supply. Distributed Power Supply and grid power supply can be used as standby power supply to reduce power outage time, reduce the area of power outage, and improve the efficiency of terminal energy utilization. For Consumers, active participation in demand response and Power Grid operation can not only greatly enhance the autonomy of electricity consumption, but also directly save electricity expenditure [3]. For example, customers can sell electricity generated by their own distributed power sources to the grid when the grid load is high, and use the large grid when the grid load is low, minimizing tariff points.

For Power Grid Enterprises, the active distribution network investment will greatly reduce the operating costs. The active distribution network with high efficiency can improve the efficiency of power transmission and bring energy-saving benefits, while the multi-source coordination can effectively solve the problems such as the shortage of power transmission and distribution capacity and ensure the stable and reliable operation of the power network. The active distribution network can also solve the problem of renewable energy consumption. Its commissioning will increase the share of clean and renewable energy in the region, achieve full absorption of renewable energy and improve the environment [4]. It will also promote the construction and development of a series of smart grid-related technologies such as smart buildings [5].

2. Power Quality

In fact, power quality refers to the quality of the power system. Just as seeds can be of good or bad quality, there is also a quality problem with the electric energy we usually use. High-quality electric energy can not only reduce the loss of electrical appliances, but also improve the efficiency of electric energy use, more importantly, high-quality power can guarantee the stable and healthy operation of the power system. Hospitals, data centers and other industries that pay special attention to power supply security have high requirements on power quality [5]. Electricity is also a special energy commodity, which is provided for the normal use of electrical equipment, it can be considered that the deviation of voltage, current or frequency which causes the fault or abnormal operation of the electric equipment belongs to the category, and this definition may not be academic enough, but the general situation is not unreasonable.

3. Real-time monitoring system

3.1. Introduction of real-time monitoring system

There are four methods for a real-time monitoring system. In order to understand the monitoring object, performance benchmark index, alarm threshold definition, fault handling process. There are four cores of the real-time monitoring system. Here are a few examples. For example, there are number of nodes, something is always work to be done, total active load, proportional adjustment factor and so on. As shown in Table 1:

| Number of nodes | There is always work to be done | Total active load | Proportional adjustment factor |
|-----------------|-------------------------------|------------------|-------------------------------|
| 14              | 272.84                        | 259.00           | 0.504269                      |
| 30              | 288.77                        | 283.40           | 0.560054                      |
| 2.273           | 43188.63                      | 42684.60         | 0.568635                      |
Respectively for the discovery problem, when the system failure alarm, will receive the failure alarm information. Location problems, fault mail generally write a host fault, specific fault content, need to analyze the alarm content, such as a server is not connected; Need to consider whether it is a network problem, or load is too high for a long time cannot be connected, or the development of a fire rate firewall prohibited related policies, we need to analyze the specific reasons for failure [6]. To solve a problem, once you understand the cause of the problem, you need to solve the problem through the priority of troubleshooting. Summary of the problem, when the solution to the major failure, the need to summarize the reasons for the failure as well as the prevention, to avoid repeated in the future.

3.2. Function of real-time monitoring system
Real-time monitoring system is generally speaking can be any system real-time monitoring without interruption. Its advantage is that it can feedback the current state of the system in real time without interruption. It can be used to monitor a device, a piece of hardware, or an important system. These systems can see the current status of some important systems at any time, anywhere, is Normal, faulty, overhauled, or abnormal. Real-time monitoring system can not only improve the service security accuracy and reliability. There is no doubt that to ensure the normal operation of the system, service and business is the ultimate goal of the real-time monitoring system. In order to ensure that some important business operations continue to run steadily, if the monitoring system is done accurately and perfectly, then even if there is a failure in normal operation, people can also ensure to receive the alarm signal of the fault in the first time, and the fault is solved in the first time, so as to ensure the stable operation of business continuity [6].

4. Conclusion
Depending on the function of the computer, the power quality of the active distribution network is monitored in real time. This monitoring system is of great practical significance, which has greatly promoted the development and progress of production technology and reduced the waste of human resources, the work quality is improved and the superiority of the power quality of the active distribution network is ensured.

References
[1] Liang Kun, Xiao Hongwei, Du Yingying, et Al. . A real-time monitoring system for fruit and vegetable cold chain logistics based on Internet of things technology [J] . Jiangsu Agricultural Science, 2018(11) : 519-521.
[2] Ding Yang. Research on quality monitoring system of Xi'an fruit and vegetable cold chain logistics based on Internet of things, 2017(14) : 12-13.
[3] Wang Shaobo. Design of monitoring system for agricultural products cold chain logistics based on Internet of things technology [ J ] . China logistics and procurement, 2017(16) : 60-61.
[4] Chen Hua, Weng Huilian, [ C ] Xiamen: Proceedings of the National Academic Year Meeting of the Chinese Medical Association, 2015. [5] lucify, 2015.
[5] Lucify, ning Pengfei. Design of cold chain logistics monitoring system based on Internet of things. Logistics Engineering and management, 2019(5) : 80-83.
[6] Zhao Jiatao. Electric locomotive and electric appliance [ m ] . BEIJING: China Railway Press, 2003.