

Application and research of fault location system for distribution network based on big data platform

Meifang Cai

Nanchang Institute of Science & Technology, 330108

Keywords: Big data platform; Distribution network; Fault location system; Hardware design; Software design

Abstract: For improving the shortcomings of traditional fault location system for distribution network, like inaccurate positioning, slow data transmission, troubleshooting and low efficiency of the process defect. Basing on the development and design of big data platform towards this system, this paper describes the design idea of and analyzes the principle of fault location and puts forward concrete countermeasures to cope with hardware design and software design. After the completion of system design and debugging, it is used in specific work. The practical application show that the fault location system of distribution network based on big data platform can not only locate faults accurately, but also improve the data transmission speed, facilitate fault search, and improve the efficiency of fault treatment.

1. Introduction

With the development of economy and society and the continuous improvement of people's living standards, the whole society has higher and higher requirements on the quantity and quality of electricity. It is necessary to design an effective fault location system for distribution network in order to better meet people's demand for electricity, eliminate the faults of distribution network in time and improve the quality of power supply. Due to tower, transformer, distribution line, reactive power compensation capacitor and other equipment are in operation in the same time, once a certain equipment failure, the power supply may be interrupted. Nevertheless, if there is a large area of power failure phenomenon, the negative impact is greater. In order to better deal with these challenges, improve the quality and efficiency of power supply, and improve the shortcomings of the fault location system of traditional distribution network, this paper combined with the background of big data, developed and designed a fault location system of distribution network based on big data platform, and used it for fault location and detection of distribution network. The practical application shows that the system has a good effect, which is conducive to accurate and timely fault location of the system as well as quick and rapid detection of the power grid. What's more, it is also convenient to carry out fault maintenance activities, which is of great significance to ensure stable and reliable power supply and improve the quality of power supply in the distribution network.

2. The shortcomings of traditional fault location system for distribution network

10kV distribution network is widely used in practical work, and it has its own remarkable characteristics. Therefore, targeted measures should be taken in fault location and treatment. However, the 10kV distribution network has many branches, which generate branches. As the number of branches increases, so does the scope and coverage. Then, the signal will decline gradually, which increases the difficulty of fault detection and brings adverse effects on fault maintenance and treatment. In addition, the tower of 10kV distribution network is mostly lime rod. Affected by its performance, if a fault occurs in line operation, the resistance value will increase rapidly, which may reach thousands or even tens of thousands of ohms. Thereby, the signal becomes weak, which increases the difficulty of detection or even stops testing. In order to meet these challenges and improve the level of fault detection, location and maintenance, the traditional fault

location system for distribution network plays a great role and can provide effective guidance for detection and maintenance personnel, however, the current detection system still has shortcomings.

2.1 Inaccurate positioning

The common problem of the previous detection system is inaccurate positioning. In the fault detection of distribution network, it is difficult to locate the fault accurately. Therefore, it will affect the effective development of detection and maintenance activities, and reduce the efficiency of detection and maintenance, and make it difficult to repair and deal with faults quickly and accurately.

2.2 Slow data transmission

Due to the imperfect system design, ineffective application of big data and Internet cannot support its operation, which affects the improvement of data transmission efficiency. In the past, the data transmission speed of the fault location and detection system was slow, which made it difficult for the detection and maintenance personnel to timely, quickly and accurately obtain the fault information of the system, which was not conducive to taking immediate fault maintenance measures, finally, it was difficult to ensure the fault treatment effect.

2.3 Low efficiency in troubleshooting and handling

Due to inaccurate positioning and slow data transmission speed of the previous system, it is difficult to provide fast and convenient detection and maintenance data information for relevant workers, which affects the improvement of fault detection and processing efficiency. Once the fault occurs, the detection and maintenance personnel often need to spend a lot of time carrying out the detection and maintenance, which restricts the improvement of work efficiency and reduces the level of system fault detection and treatment.

3. Design of fault location system of distribution network based on big data platform

Generally speaking, big data can be regarded as a collection of massive data, with mass, high speed, diversity, low value density and authenticity as its significant characteristics. With the arrival of the era of "Internet Plus" and the popularity of computers and smart phones, it is more and more convenient for people to obtain data, and the role of big data in people's daily life and study is more and more prominent. In order to make up for the shortcomings of the fault location system of the distribution network, realize accurate fault location, and facilitate maintenance personnel to repair and deal with faults quickly and timely, this paper uses the big data platform to design and develop the fault location system of the distribution network. The following will introduce the system software and hardware design.

3.1 Design ideas

With the support of big data, through development and design, the fault location system of the distribution network can be used for fault detection and positioning, so as to quickly and accurately locate line faults and create convenience for detection and maintenance personnel to carry out detection and maintenance activities. At the same time, it can reduce the difficulty of testing and maintenance, and facilitate the staff to take maintenance measures. In order to achieve this goal, we need to give full play to the role of big data, and build a distribution network fault location system with reasonable structure, excellent performance, convenient data transmission and convenient management. In the specific application, the center main station system, fault information acquisition system and fault indicator are mainly used to locate faults quickly and accurately. In the distribution network, fault current path can be indicated by using fault indicator. At the same time, once the fault occurs, the system can immediately alarm and show the location of the fault, which is convenient for people to carry out various testing and maintenance activities. The central main station system and fault information acquisition system can monitor system faults in real time and locate fault areas accurately, so as to facilitate fault search, save staff time for fault search and

facilitate timely and rapid treatment of faults.

3.2 Principle of fault location

After the fault occurs in the distribution network, the fault indicator will automatically detect the line fault. Based on the detailed understanding of the line fault, the fault information node action signal will be given in time, and the fault information will be analyzed and compiled by the fault information monitoring terminal. Then the information will be transmitted to the background, for correction. After that, topology analysis and calculation are used to find fault paths and locate faults accurately. Then, the fault location is displayed in the system to locate the geographical location accurately, so as to facilitate the detection and maintenance personnel to carry out the detection and maintenance activities.

3.3 Hardware design of fault location system

The fault location system of distribution network is established on the basis of wireless service and fault indicator, and divided into power supply control module, CPU core module, communication module, fault detection module, radio frequency module and input-output module by using the distributed modular design idea. These modules interact with each other and promote the best performance of system functions. CPU is the core and key module, as well as the core and key of system operation. Its important task is data processing and forwarding, which facilitates detection and maintenance personnel to obtain various data information. It can also collect the fault alarm information sent by the radio frequency module, and meet the operation needs of the communication system, as well as transmit the fault information to the main station in time. The 16-bit chip is used in the system with low energy consumption, stable and reliable operation, which meets the needs of system operation and facilitates timely and rapid uploading of fault information, and ensures its uploading to the main station.

3.4 Software design of fault location system

The software design needs to deal with the whole system structure, design principle and signal flow direction. This system software program mainly includes multifunctional module initialization, sampling procedure, radio frequency transmit and receive procedure, remote communication procedure, fault determination procedure and so on. With the support of these software systems, it can not only meet the needs of fault location, but also lay a foundation for better fault diagnosis and treatment. In the programming of software design, the specific functions of each module should be taken as the basis, and the corresponding compilation and debugging should be carried out to facilitate data transmission and application, so as to ensure the system to play a more effective role.

4. Application of fault location system of distribution network based on big data platform

After the completion and debugging of the system design, it will be used for fault location and treatment of practical activities on the premise of ensuring all the indicators qualified.

4.1 Specific application

In order to verify the application effect of the distribution network fault location system based on big data platform, we apply it to the test practice of 10kV distribution network fault location system after its completion and debugging. Nevertheless, the operation of the system fault indicator light, the main station fault topology and display, query and fault location system will be verified, and then the application effect of the system will be analyzed.

4.2 Application effect

The application of this system shows that with the support of the fault location system of distribution network based on big data platform, the fault information can be detected quickly and transmitted to the main station in time. In this way, it is convenient for maintenance and testing personnel to quickly obtain rich information, so that they can know the location of the fault in a

relatively short time, and then deal with the fault quickly. Compared with previous systems, the time to query and isolate faults can be reduced by 1.5 hours. In short, the application of this platform can not only locate the faults of distribution network accurately, but also greatly shorten the time of fault treatment. Thus, the efficiency of fault location is improved greatly and the area of power failure is reduced. This shows that the distribution network fault location system based on big data has good performance and good operation effect, which is worth promoting and applying in fault location and detection.

5. Conclusion

In the development and design of fault location system of distribution network, the application of big data platform can not only improve the shortcomings of traditional fault location system, but also speed up the data transmission, facilitate the staff to obtain detailed data information, and locate and determine the fault accurately. At the same time, it also facilitates the workers to take immediate treatment and fault repair measures, which is conducive to ensuring the system is in good performance and running state, therefore, it is worthy of promotion and application. With the development of technical innovation and fault treatment, it is necessary for staff to maintain and upgrade the system. Thus, the comprehensive performance and operating efficiency of the system will be improved to make it play a more effective role, and finally the fault location level and fault treatment efficiency of the distribution network will be improved continuously.

References

- [1] Gang Yao, Wenrong Jiang, Minghai Huang. Online fault monitoring and location analysis of 10kV distribution network [J]. Science and technology innovation guide, 2018(10):51-52.
- [2] Youyu Chen. Research and application of fault location system for 10kV distribution network [J]. China new technology and new products, 2015(11), part :74.
- [3] Shuhao Huang. GIS based fault location system for distribution network [J]. Guangdong electric power, 2017(11):48-51.
- [4] Yujian Jia, Shumin Sun. Fault monitoring method of distribution network based on big data analysis [J]. Shandong electric power technology, 2017(10):1-5.
- [5] Qianyi Chai, Wenbin Zheng. Research on state monitoring and fault treatment method of intelligent distribution network based on big data analysis [J]. Modern electronic technology, 2018(4):105-108.
- [6] Chunliu Peng, Yuehui Chen. Development and application of low voltage monitoring and early warning system based on big data platform of distribution network [J]. Hunan electric power, 2018(2):5-8.