ISSN: 2664-9640

Research Arrangement of Low Voltage User Identification and Location Based on Big Data Technology

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Abstract

China's electricity consumption shows a continuous growth state, but under the influence of climate factors, the frequency of seasonal overload is getting higher and higher, which makes the power grid operation face enormous pressure and directly leads to the imbalance of power supply. At present, the problem of low voltage in distribution network directly affects residents' quality of life, and the accurate location, identification and law analysis of low voltage problems are the premise for power enterprises to control low voltage. In order to make the power industry develop continuously and maintain a stable situation effectively, it is necessary to find new ways to optimize the whole power grid and even the industry. Strengthening power Demand side management (DSM) can effectively improve power supply efficiency and control resource consumption, and optimize power resource allocation. In this paper, aiming at the reality that the "low voltage" points on the user side are numerous, have great influence and are difficult to identify and locate in advance, a solution of identifying and locating based on big data is proposed. Therefore, it provides technical support and data support for arranging distribution network reconstruction projects and improving residents' power supply quality.

Keywords

Low voltage, Big data, Identification, Positioning.

1. Introduction

In recent years, residents' demand for electricity has increased, and low voltage has become a prominent problem affecting residents' electricity consumption. China's electricity consumption shows a continuous growth state, and under the influence of climate factors, the frequency of seasonal overload electricity consumption is getting higher and higher, which makes the power grid operation face tremendous pressure, and also directly leads to the imbalance of power supply, which has to be alleviated by means of power cut-off, which has a great impact on residents' living electricity consumption [1]. If DSM can directly identify, manage and control low-voltage users, and classify the load of low-voltage equipment in large users, the energy management center of users will switch and realize flexible control according to the level of low-voltage users [2]. This can reduce the influence of load control on important loads such as lighting and security. If, in the DSM of low-voltage users, the power retailer transmits the real-time electricity price to the users, and the users plan to purchase and use electricity and participate in the transactions in the electricity market according to the electricity price, the user electricity market can be realized [3]. When the problem of "low voltage" on the user side appears, it will lead to serious problems if no timely measures are taken [4]. In order to make the power industry develop continuously and maintain a stable situation effectively, it is necessary to find new ways to optimize the whole power grid and even the industry.

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Strengthening power DSM can effectively improve power supply efficiency and control resource consumption, optimize power resource allocation and bring considerable overall benefits [5]. Make full use of the intelligent watt-hour meter, give full play to its measuring function and the function of collecting the information of using points, and effectively process the obtained data information to identify the voltage on the user side, so as to solve the power supply quality problems in the distribution network in time [6]. In the specific work, data and information can also be used as the basis to arrange the distribution network reconstruction project reasonably and improve the power supply quality [7]. The application of information technology to deal with this problem, mainly plays the role of intelligent watt-hour meter, which can not only operate remotely, but also automatically collect information, and analyze and process the information to obtain accurate information of users' electricity consumption [8]. In this paper, aiming at the reality that the "low voltage" points on the user side are numerous, have great influence and are difficult to identify and locate in advance, a solution of identifying and locating based on big data is proposed. Therefore, it provides technical support and data support for arranging distribution network reconstruction projects and improving residents' power supply quality.

2. Power DSM

At present, DSM of power grid is a direction of the development of national grid. Therefore, both power enterprises, power related departments and government departments pay more and more attention to it, and also foresee that it will bring considerable environmental and social benefits. Since the existing information system can not measure the voltage data of the user side, the discovery of "low voltage" is "post event", that is, after the "low voltage" problem occurs and the user complains, measures are taken for on-site verification [9]. In the application of big data technology, the application background analysis of low-voltage identification of distribution network, in order to improve the detection quality, it is necessary to ensure that the data support is good. In order to be able to detect the low voltage of distribution network, it is necessary to ensure that the technical personnel can understand a large amount of data information and provide the basis for the application of big data technology. In order to ensure the smooth implementation of DSM, it is necessary to plan the relevant work clearly, which must be supported by law. DSM enables power enterprises and users to jointly manage the power grid, and the power enterprises and users will jointly participate in the actual management activities.

Electric power enterprises can provide users with various forms of electricity selection, and the power consumption information can be transmitted to users in time by using communication system, so as to build an effective interactive channel. When the three-phase load is unbalanced, it will be found that it is mainly caused by the equipment, and there are many kinds of equipment reasons. Under the guidance of smart grid, distributed generation is becoming more and more popular. This trend is consistent with DSM, which can improve energy efficiency through intelligent dispatching, and provide guarantee for power supply, so that users can get diversified choices. Figure 1 shows the architecture of voltage identification and location model based on polyphase support vector machine.

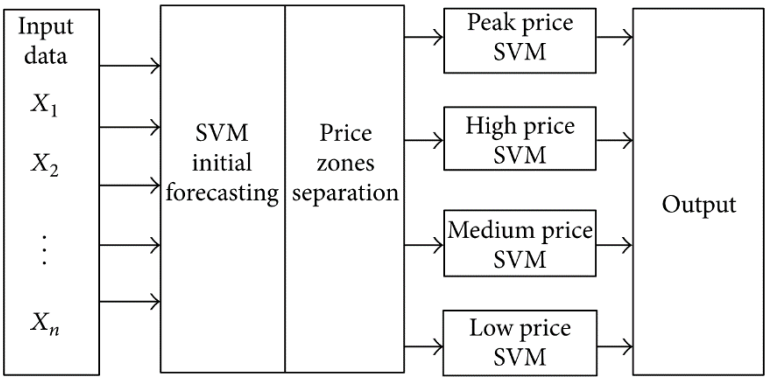

Figure 1 Multi-phase support vector machine voltage recognition and positioning model

In the operation of distribution network, current, resistance, transformer capacity and other factors will affect the voltage. In addition, power factors, short-circuit current, even wire length and equipment type will directly affect the power supply voltage. With the current information system, the voltage on the user side cannot be measured effectively, and accurate and reliable data information cannot be obtained. Therefore, when the problem of "low voltage" is discovered, it is often discovered after the user complains, and it needs the staff to go to the site for verification before it can be solved in a targeted manner. Because the data of distribution network is constantly changing, the data generated is characterized by a large amount. In order to display the data dynamically, it is necessary to have better data analysis and processing ability. Combined with the low-voltage identification data of distribution network, the corresponding database summary information is obtained. By analyzing and mining the summary data deeply with the help of big data technology, the trend graph of average outage time of users and the distribution of outage duration can be obtained. At the same time, it can also get the reason of power failure of users according to the actual situation, and use big data to compare and analyze the main responsibility reasons.

3. Low voltage DSM network module

3.1. Technology roadmap

To realize the automation of DSM of low-voltage users, it is necessary to introduce a set of reliable measurement system to accurately evaluate the related equipment of the power grid, so as to provide a safe operating environment for the power grid, so as to ensure the accurate measurement of users' electricity consumption. The application framework layer is located at the upper part of the middle layer, which mainly provides reusable general basic services for low voltage identification of power industry and distribution network, and provides scientific and perfect software and hardware support for realizing system functions [10]. The whole information measurement system can transmit information bidirectionally, ensure that information integration and information feedback can be carried out effectively, and provide a good network bearing for the automation of DSM of low-voltage users. From the current identification situation, the data acquisition and monitoring control system is widely used, which can identify the bus voltage of substation in real time and realize dynamic identification. The low-voltage customer demand-side management automation network is composed of several sub-modules, each of which has different functions, and the automation management can be realized by working together. User's "low voltage" identification is based on existing information systems, without building new information systems, only expanding and integrating the functions of existing information systems, and using "big data" tools for mining and analysis.

ISSN: 2664-9640

3.2. Key technology analysis

In the process of data acquisition, the distribution network low voltage identification system generally interfaces with multiple systems, resulting in a huge amount of data on the whole system platform. In order to better deal with the problem of large amount of data, parallel computing cardinality and distributed storage technology are introduced to realize data analysis and storage. The construction of user-side communication network is still in the development stage, and the whole system is not mature. Although many enterprises are committed to the construction of these networks, due to the differences in technology and related interfaces, a unified standard has not yet been formed, which restricts the further popularization of automation networks [11]. In order to ensure the in-depth analysis of low voltage data in distribution network, big data mining technology and index prediction technology are also introduced, which meet the actual needs of smart grid construction. Low-voltage side automation network is becoming more and more popular and its coverage is expanding, which will inevitably bring a lot of data information and user information. If this information is stolen or exploited or the network is attacked, it will not only affect users, but even affect the whole network system, and the loss is immeasurable.

Distributed storage makes full use of the storage capacity among various storage devices in the network, makes virtual connection, forms a large-capacity storage pool, and disperses large-capacity data in different nodes. At the same time, the scientific storage strategy is selected to organically link the stored data to form the whole storage. Figure 2 shows the framework of fault diagnosis system.

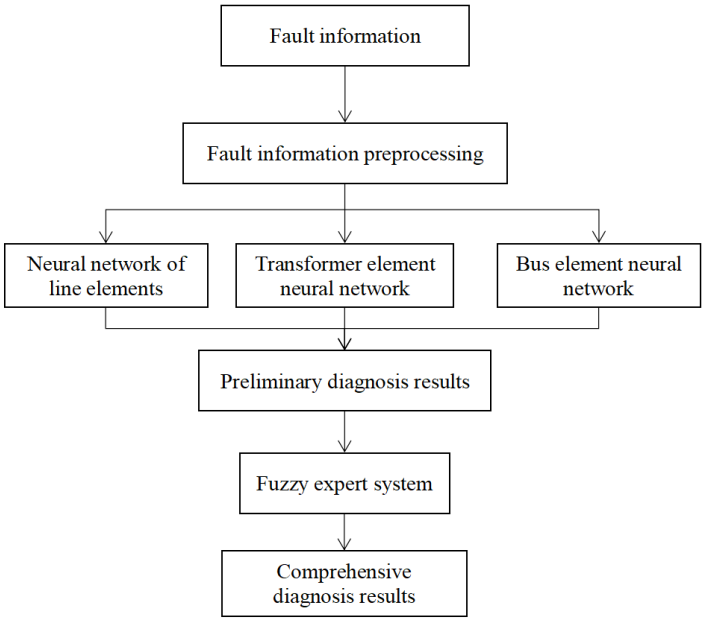

Figure 2 Fault diagnosis system framework

In the normal state, set the load learning cluster $\{(c_n, u_n)\}$, introduce the cluster data in the high-dimensional space according to the nonlinear function $\gamma_{(c)}$, and obtain the linear expression of the regression function:

$$g(c) = E^Y \gamma(c) + m \tag{1}$$

In the formula, E is the priority coefficient quantity, and m is the introduced variation setting quantity. Using DBZ calculation to optimize the regression target coefficient group is:

$$\min \|E\|^2 + \frac{1}{2} V \sum_{n=1}^{i} h_n^2$$
$$\begin{cases} u_n - E^Y \gamma_{(c)} + m = r_n \\ n = 1,2,\ldots,i \end{cases} \tag{2}$$

In the formula, V is the reverse misjudgment coefficient; rn is the deficit entity quantity. Do two-factor directional optimization conversion, you can get:

$$A(e,n,h,\int) = \min \|e\|^2 + \frac{1}{2} V \sum_{n=1}^{i} h_n^2 + \sum_{n=1}^{i} \int_n \left(e^T \gamma_{(c)} - n + r_n - u_n\right) \tag{3}$$

In the specific work, the user electricity information collection system is mainly used. For remote data collection, it is necessary to use big data technology to mine, and it is necessary to play the role of smart watt-hour meter, which can collect voltage and current in real time and process data information [12]. In the process of low voltage identification of distribution network, we should not only analyze and process the data through traditional online analysis, but also dig deeply with the help of big data technology, analyze various indicators and potential laws, and provide scientific and powerful support for the operation and development of distribution network. There is no need to update the currently applied information system, and its functions can be expanded according to the actual needs, and various tasks can be integrated, and the role of "big data" technology can be brought into play to mine data information and extract valuable information for analysis.

4. Conclusion

With the acceleration of smart grid construction and the prominent voltage load problem, it has become a hot spot for people to take scientific and effective measures to maintain the stability of electricity consumption. The coverage of "low voltage" points on the user side is very wide, which will have serious consequences, and there is also a problem that it cannot be detected in advance and cannot be located accurately. DSM of low-voltage users realizes the control and management of low-voltage electrical equipment in power departments, and improves the level of power load management. User's "low voltage" identification is based on existing information systems, without building new information systems, only expanding and integrating the functions of existing information systems, and using "big data" tools for mining and analysis. To improve the quality and level of low voltage identification in distribution network, it is of great significance to introduce big data technology. There is no need to update the currently applied information system, and its functions can be expanded according to the actual needs, and various tasks can be integrated, and the role of "big data" technology can be brought into play to mine data information and extract valuable information for analysis. In order to improve the efficiency of accident treatment, a hierarchical early warning method can be established, so that technicians can quickly select treatment methods and achieve the effect of ensuring voltage stability.

Acknowledgments

This work is supported by Mass Innovation Project of State Grid Zhejiang Power Supply Co., Ltd., No.5211NB20000A.

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