Design of Distributed Substation High Voltage Electrical Equipment Online Monitoring System Based on Image Segmentation Technology

Mingzhong Lin¹, Lei Fu², Fanxing Zeng², Guang Yang², Ming Sun²⁺
¹State Grid Enshi Electric Power Supply Company, Hubei, China
²Powerchina Hubei Electricl Engineering Co., Ltd, Hubei, China
*Corresponding author e-mail: sunming@hbedi.com

Abstract. As an important support mechanism for real-time monitoring and display of system frequency, harmonic voltage, harmonic current, three-phase voltage unbalance, voltage fluctuation and flicker, true power factor and other power quality parameters specified in national standard, especially for fast and accurate data processing and improving test frequency and level, the online monitoring of substation is an important support mechanism for real-time monitoring and display of system frequency, harmonic voltage, harmonic current, three-phase voltage unbalance, voltage fluctuation and flicker, true power factor and other power quality parameters specified in national standard. The research of distributed substation high voltage electrical equipment online system based on image segmentation has important practical value. However, the design system of the online monitoring network of some substation electrical equipment can not effectively follow the development needs of society and industry, and there is an urgent need for effective reform. Based on this, this paper first analyzes the problems existing in the design system construction of online monitoring network of distributed substation electrical equipment, and then gives the construction strategy of online monitoring system of high voltage electrical equipment in view of these problems.

Keywords: Distributed Substation, High Voltage Electric, Online Monitoring, Image Segmentation

1. Introduction
With the continuous development of social economy, all industries in China are facing the key tests and challenges of transformation and upgrading as well as the adjustment and optimization of industrial structure. As an important way to promote the professional technology required by the power industry and social development, it is of great practical significance and value to construct a scientific and reasonable real-time monitoring system for electrical equipment in high-voltage substation [1]. And the substation online monitoring as real-time monitoring display system frequency, harmonic voltage, harmonic current, three-phase voltage unbalance, voltage fluctuation and flicker, true power factor and other power quality parameters specified by the national standard, especially the
data processing fast and accurate, improve the test frequency and level of important support mechanism. The design of relevant monitoring system is of great practical significance for the development of domestic electric power industry and the matching of social industrial demand, as well as the promotion of high level and high quality development of electrical monitoring equipment.

Current distributed substation high voltage electrical equipment monitoring indicators data in the system of real-time monitoring system build level there are still many deficiencies and problems, the specific performance in the substation high-voltage electrical equipment quality level and quality of the monitoring data of real-time feedback terminal level with the actual needs of society and industry exists dislocation and disconnectedness. This dislocation and disconnection lead to the distributed substation in the use of substation high-voltage electrical equipment for online monitoring at the same time, the relevant data indicators in the transmission process of the deviation and other problems [2]. Therefore, in the process of online monitoring of various types of substation data, especially in the process of high-voltage electrical equipment based on image segmentation data information monitoring, we should focus on the following aspects as shown in Figure 1, so as to lay a solid foundation for the construction of a perfect online monitoring system.

Figure 1. The focus of real-time monitoring system design for high voltage electrical equipment

In addition, the high voltage electrical equipment on-line monitoring as a local power one of the common entities of the electricity sector, and different places based on the characteristics of its geographical location and the differences of the electric power research institute, adopted by the electric power monitoring device is not the same, but when calculating the single harmonic content in the high voltage formula is the same, such as Single harmonic content calculation formula 1:

\[ \frac{u_{(k)}}{u_{(l)}} \times 100\% \quad (k=2\sim50) \]  

(1)

Yet despite the different type of high voltage electrical equipment used by the electric power research institute, but these equipment online monitoring data of real-time data transmission capacity building aspects not effective feature and to create their own power of brand, causes the power station in graphic division on the basis of research design system gradually show the trend of homogeneity [3]. Lack of its own core competitiveness. In this context, as a complicated system engineering in the domestic power industry, it is of great practical value to carry out the design system of the distributed substation online monitoring system, which needs to establish a long-term, scientific and benign cultivation system.

2. Problems existing in the design system construction of on-line monitoring network for distributed substation electrical equipment

2.1. The practical dilemma of the design system construction of the on-line monitoring network of distributed substation electrical equipment

First of all, most electric power research institutes lack the supply of applied talents, which is mainly reflected in the general quality of student contribution in most domestic universities, and it is difficult to cultivate more innovative talents with applied literacy. In addition, the lack of educational resources in colleges and universities of this kind of major further aggravates the predicament of application-oriented brain drain [4]. Second, now most of the local high voltage research institute adopts on-line monitoring device of high voltage electrical facing researchers and electrical equipment, the structural
faults of main performance related graduate employment rate of decline in local colleges, and not only at a disadvantage compared with the national key universities, and gradually transcended by higher vocational colleges, and because of the lack of the support of scientific research funds, all kinds of monitoring equipment ageing without new monitoring data of equipment investment, lead to the researchers and the present situation of electrical equipment fault structural main reason lies in the electric power research institute environment support system and the social demand mismatch problem is more outstanding, high voltage transmission information talent cultivation orientation and not adapt to the demand of society.

2.2. Practical problems existing in the design system construction of on-line monitoring network for distributed substation electrical equipment
The practical problems in the design system construction of online monitoring network of distributed substation electrical equipment are mainly shown in the following aspects. First, with the continuous expansion of the scale of users, the design direction of online monitoring data system of high voltage electrical equipment is gradually popularized and developed. Secondly, most of the high-voltage electrical equipment has prominent problems in the transmission and feedback planning of the high-voltage data information, such as unclear positioning and unclear goals, which leads to the lack of data collection features in the online monitoring network system of the distributed substation [5]. And further make its research substation data collection in the information breakthrough link set without market competitive advantage and position. In addition, there is a structural imbalance in the technical talent of the existing distributed substation, and most of the newly introduced graduates lack the ability to practice and jump into the role quickly. This is mainly because the current professional courses offered by colleges and universities are too theoretical and too many theoretical courses, resulting in a lack of training of students' practical ability, which is not conducive to the development of students' career after graduation.

2.3. Thinking on the design system of on-line monitoring network for distributed substation electrical equipment
At present, the establishment of high-voltage output device in distributed substation pays too much attention to the benefits and benefits brought by the expansion of output scale, but ignores the establishment and guarantee of the corresponding supporting projects after the increase of the number of monitoring devices. For example, with the increase of the number of distributed substations, the input of test equipment for monitoring terminal information processing ability and information feedback ability has not been matched correspondingly, leading to problems such as incomplete transmission information of various monitoring equipment, which is not conducive to the further development and breakthrough of monitoring substation data [6]. Secondly, the current monitoring link of distributed substation based on image segmentation ignores the personalized needs and characteristics of equipment and technical personnel, resulting in the lack of personalized characteristics of monitoring equipment and technical staff and more like the uniform tool people. In addition, the corresponding high voltage research institute of professional teaching target is lack of the unity of the training objective of students and the correct understanding, many schools blindly pursuing big, and ignore the foundation ability construction, lead to the cultivation of the students work high inadequate, low not, further restrictions on the substation electrical equipment in real-time monitoring network for a long time, the development of effective.

2.4. The root analysis of the mismatch between environmental support system and social demand of Electric Power Research Institute
First of all, most of the current electric power research institutes lack the embodiment and representation of innovation connotation, which leads to the neglect of their development monitoring concept of the profound observation and feeling of social and industrial needs. Not only that, the lack of innovation connotation of the research institute makes the homogenization of the professional
construction of the online monitoring network of most substation high-voltage electrical equipment prominent. Most of them pursue the large and complete network construction while ignoring the construction of their own characteristics, the individualized thinking of substation development data and the promotion of the subject status [7-8]. Second, the electric power research institute of environmental atmosphere to cultivate the lack of innovation, the innovation is not only reflected in the lack of technical personnel of the institute of development methods, development goals and the dimension of research model, but also in the body of the research team practices and ability enhancement, as well as the technical personnel independent thinking, pioneering consciousness and practice ability, etc. In addition, the monitoring network on the basis of image segmentation ignored the innovation in the process of socialization of talent training and the personalized needs of researchers balance, researchers, the balance of the principal position of passive acceptance and play, high voltage electrical equipment monitoring network in the talents training goal of the development of market economy and the balance between the long-term target some objective problems and phenomena. The above aspects together constitute the root of the problem that the environmental support system of ELECTRIC Power Research Institute does not match the social demand.

3. Construction strategy of on-line monitoring system for high voltage electrical equipment

3.1. To improve the application characteristics of real-time monitoring network for high voltage electrical equipment in distributed substation
First of all, at the positioning level of real-time monitoring network design for high-voltage electrical equipment in distributed substation, each electric power research institution should accurately locate the construction goal and direction of monitoring network based on its own conditions and related development needs of society and industry. Secondly, in the aspect of monitoring network and high voltage electrical equipment application system innovation, on the one hand, it is necessary to actively promote the theoretical knowledge literacy of technical staff and enhance their professional knowledge reserve level; On the other hand, it is necessary to strengthen the application and practice ability of high-pressure monitoring equipment and improve its comprehensive ability in several aspects as shown in Figure 2 below. In addition, the construction of the practical characteristics of the real-time monitoring network of electrical equipment needs to cultivate the engineering practice concept and thinking of the power station personnel [9]. By improving the proportion of practical courses and practical operation reward mechanism, we can help them establish a scientific engineering application concept and improve the further improvement of the monitoring network.

![Figure 2. Architecture of the monitoring network information system](image-url)
3.2. **Build a perfect application system of power personnel training**

First of all, the talents training goal of power and position level, should be to enhance the power of graduates engineering applicability as the goal, to build up the scientific and reasonable top talent training plan, and active in the academic and professional Settings into the distributed substation equipment and the latest concept of monitoring network industry, cutting-edge technology development trend and the development trend of the future, So that students will not be divorced from the development needs of the automation industry after graduation in the future [10]. Secondly, at the level of building the practical teaching system of electric-power related disciplines, it is necessary to strengthen the evaluation and assessment of students' engineering practice courses, establish the cooperation platform of enterprises and research institutions and the directional training mechanism of practice, so as to help students have more opportunities to contact the specific application of engineering practice in distributed substation setting. In addition, we should strengthen the guarantee of applied electrical personnel training and the improvement of supporting measures, set up organic innovation mechanism in every link of production, learning and research, promote the integration of students' theoretical thinking and practical ability, and ensure the ultimate realization of the goal of electric power personnel training and application.

4. **Conclusion**

In short, in view of the current distributed substation high-voltage electrical equipment real-time monitoring network system construction level there are still many deficiencies and problems, embodied in the manifestation in substation high-voltage electrical equipment quality level and quality of the monitoring data of real-time feedback terminal level and the actual demand of social and industry such as dislocation and disjointed phenomenon, In this paper, through the analysis of the problems existing in the construction of the real-time monitoring network system of the distributed substation high-voltage electrical equipment, the practical difficulties and the root of the problems of the real-time monitoring network system of the distributed substation high-voltage electrical equipment are studied. Then, in view of the prominent problems and deficiencies in the online monitoring network of high voltage electrical equipment, this paper gives the construction strategy of the online monitoring system of high voltage electrical equipment, that is, to improve the application-oriented characteristics of the real-time monitoring network of high voltage electrical equipment in distributed substation and build a perfect application system of power talent training. Thus the multi-dimensional and multi-level guarantee of the distributed substation online monitoring network system to achieve the goal of construction.

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