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Research and Application of Smart Substation Protection Based on Visual Remote Sensing Image Processing

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Abstract. Under the background of the rapid development of Smart Substation in the new era, the relay protection device plays an important role in the operation of Smart Substation, which has great guarantee for the safety and stability of the power system. However, in the current situation, the relay protection equipment or the failure of the line is very common, which will not only hinder the operation of other systems, but also greatly increase the economic loss caused by system failure. With the continuous development of visual remote sensing image processing, the visualization technology is introduced into the design of remote sensing image processing system and applied in the protection system of Smart Substation. The visualized remote sensing image processing system technology can improve the efficiency of relay protection of Smart Substation. It can be seen that the application of this technology in Smart Substation has obvious superiority. Therefore, the research and improvement of the relay protection scheme for the relay protection of the new generation of Smart Substation is particularly important, which is convenient for the safe operation of the power system.

1. Introduction

The use of remote sensing technology to obtain geospatial information has been widely used in land resources, agriculture, oceanography, meteorology, surveying and mapping, military, urban planning and aerospace. Remote sensing image processing has become one of the important means of information processing. Remote sensing image processing refers to various technical processes such as image enhancement, compression, restoration, segmentation and recognition of remote sensing images and their data by computer. However, with the further popularization and deepening of the application of remote sensing technology, a large amount of remote sensing information accumulated by the departments of land resources, oceanography, geology and meteorology is distributed in various industries, making it difficult to achieve effective sharing and application, and processing capability for large-scale high-performance. And the efficiency of parallel processing is also getting higher and higher. Smart Substation requires high image processing technology [1]. For dynamic image processing problem solving environment, remote sensing image processing needs to have a strong description function expansion. Therefore, it is especially important to develop visual remote sensing image processing technology in Smart Substation.



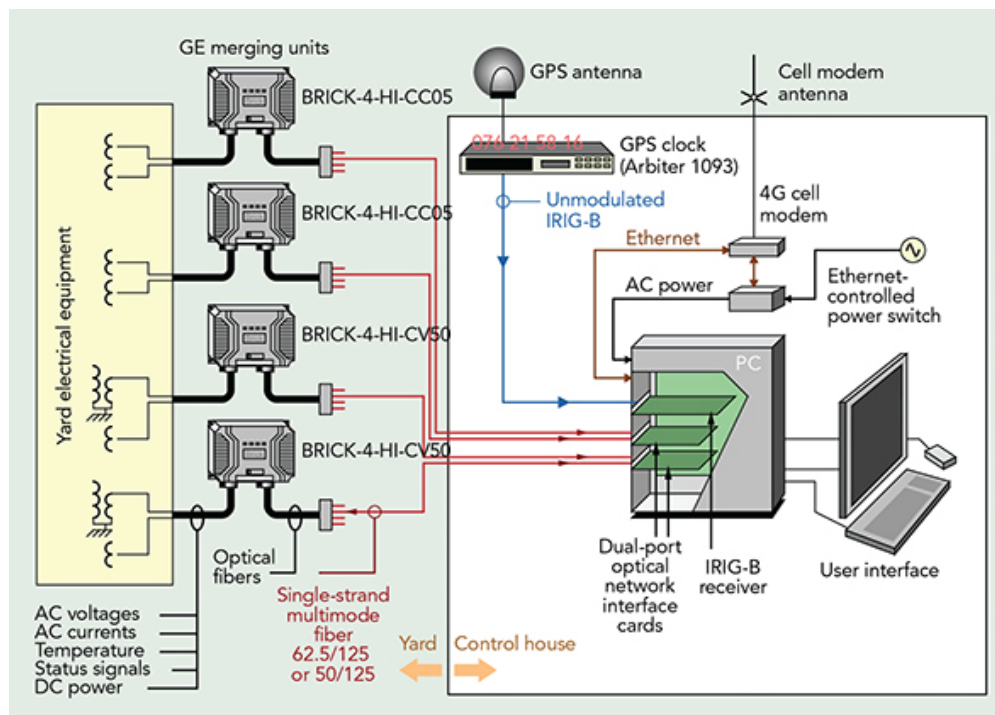


Figure 1. Status of relay protection configuration in Smart Substation

2. Status of relay protection configuration in Smart Substation

In order to improve the efficiency of relay protection, it is necessary to analyze the structure of the Smart Substation and make corresponding treatment according to its structure. The function of the equipment layer of the Smart Substation is mainly to deal with the work related to electric energy, realize the reasonable distribution of electric energy, complete the transportation and conversion of electric energy, and monitor the use of electric energy by means of equipment. The function of the spacer layer of the Smart Substation is mainly to complete the control of the device and transmit the device data by means of the device. There are many systems in the station control layer of Smart Substation. Its function is mainly to monitor the operation of the substation by means of the system and complete the work of collecting and sorting data and information. The implementation of the intelligent system enables the substation to analyze the operation through the system. Once a problem occurs, it can be timely fed back to the staff and control the scope of the fault. The implementation of the intelligent system can minimize the loss of system failure, and can obtain more time for maintenance, which is also important for extending the service life of the equipment. The use of visual remote sensing image processing in Smart Substation needs to solve the following aspects [2].

(1) Remote sensing image resources. Visual hardware integration of remote sensing image systems, including geographically distributed clusters, workstations, high-performance computers, storage-capable databases, mass storage, and various instruments. The unified encapsulation, integration, management and release of these resources are provided to the upper-layer system in the form of services to realize the effective sharing of computing resources in the remote sensing image environment [3].

(2) Basic platform for remote sensing images. It has the ability to shield the distribution and heterogeneous characteristics of remote sensing image resources, and provides a series of basic services for constructing the basic environment of remote sensing images, including communication, information services, coordinated resource allocation, storage access, operation and data management, and information security. The remote sensing image base platform is independent of the specific application field and provides common basic support services for various remote sensing image applications.

(3) Image remote sensing application middleware. Based on the basic platform of remote sensing image, it is applied to image processing applications to build high-level application services in the field of image processing, providing application-level systems and support for complex applications such as remote sensing image processing, medical image diagnosis and digital virtualization. Human reconstruction, etc., mainly includes image processing integrated development environment, programming model, parallel task collaborative processing, application information monitoring and remote image display and other functional modules.

(4) Visual remote sensing image processing system.

The image processing solution environment pre-integrates the deployed image processing system to have component characteristics, and through component reorganization, complete complex and diverse application requirements that cannot be satisfied by a single service component. According to the function and interface of the service component [4], all systems are classified. Systems with similar functions and the same interface are placed in the same class. Each class is encapsulated into a virtual service and provides a unified standard interface [5]. Each service component corresponds to a specific remote sensing image resource and service handle, and is called a physical service. The virtual service shields the underlying implementation details of the service and reduces the difficulty for the user to use the remote sensing image. The physical service uses the information service module to collect all the service component information when the general service request agent makes a service call, and runs through the entire image processing operation process [6].



Figure 2. Visualized remote sensing image processing system

3. Visualization analysis of substation relay protection faults

3.1. Substation relay protection fault information

Visual relay protection fault information intelligent system can analyze the fault of Smart Substation relay protection configuration in the process of running, and can save related information records into relevant files, the system itself will also generate some files in real time to record the details of the fault. Happening [7]. The system itself generates specific files with different storage formats that represent different meanings. The intelligent system transmits the faulty information to the established server in the format specified by the system. The fault condition of the relay protection device will be recorded.

Smart Substation relay protection configuration will have problems, and the intelligent system can accurately analyze the fault, the location of the fault, and then automatically record the relevant detailed fault information in the system file for later review. The storage format of these information

files generated by the system is different, and the meanings of different format descriptions are different. The visualization system delivers the details of the fault to the specific server in the correct format. During the operation of the relay protection device, various fault problem information will be collected and recorded in the file, and the fluctuations in the event of failure will be recorded, and then the information will be presented in the server in a visual form, allowing the staff to Observe and analyze. The fault information and implementation functions recorded by different files are different and should be selected according to the actual situation [8].

3.2. Smart Substation analysis of accidents

The information structure of the substation relay protection device is very important. The logical relationship can be used to study the specific situation of the fault, and then the details of the accident are recorded into important analysis tools. After that, the staff can find the required information according to the time of the fault record, and then comprehensively process the information to realize the visualization, and then the staff can correctly adjust the relay protection component according to the visual information. If the information is presented graphically, the staff should mark it accordingly for easy understanding. The information of these marks must be processed according to the standard, and the mark must be accurately specified. Each message and attribute has its own special symbol and markup form. Different markup methods have different meanings.

3.3. Smart Substation alarm system information source maintenance

The visualization system not only collects information on the operation of the power equipment, but also comprehensively and accurately analyzes the data, can grasp the running status of the equipment, can find the location of the fault in time, and has an intelligent alarm function, which can issue alarms in time. It has a great effect on the handling of faults and can also avoid accidents. The new generation of Smart Substation can collect the information generated by itself in a timely and accurate manner during operation, and build a complete integrated management mode to facilitate the transmission of information. A new generation of Smart Substation relay protection fault visualization system can analyze this information as a whole, and then display it in a graphical form, such as charts, data, etc., and can also be formulated into a certain model, which lays a foundation for the staff to analyze the fault. A solid foundation.

3.4. Smart Substation Visual Load Control

When the power system is in normal operation, overload conditions often occur, and the relay protection device can monitor the load of the power grid at any time, and can realize intelligent control of the load. The visualization system can formulate a fault treatment plan based on the correct operation information, and then intelligently adjust the equipment to restore the stable operation of the power system; if the substation has a load problem, the power equipment cannot be faulty during the system processing, only the power equipment Stable operation can ensure the effective processing of the problem; after the load problem is processed, the system will automatically generate information and then back up, which is convenient for the staff to query in the future and provide information support for the system management.

3.5. Smart Substation Operation Method Drawing Visualization

The main tool used is the relay protection substation monitoring host, which should strictly follow the relevant drawing rules language, so that the graphics are easy to understand and display comprehensive information. The survey results show that visualized remote sensing image processing is often used to express the overall meaning, and there are advantages in terms of scalability. The elements of the graphic can be defined by visualizing remote sensing image processing. Interoperability is more common between substations, which can quickly locate faults and improve the efficiency of maintenance personnel. The visualized remote sensing image processing should be consistent with the actual situation of the structure, and the specific conditions of the abnormal

operating equipment should be clarified. If different languages are used in each other, an appropriate visual fault system can be provided to improve the efficiency of accident maintenance. Using visualization software, various languages can be used together to improve the interoperability of devices.

3.6. Visualization of Smart Substation operation equipment

When the visual system monitors the actual operation of the power equipment, it generally collects data through the system. When the information is collected, it will automatically detect whether the equipment is faulty. The database is used to store related information of the device, which can visually present the information, so that the staff can intuitively feel the problem of the device, and can improve the efficiency of the staff in analyzing and handling the device failure. When drawing graphics with the new generation of Smart Substation relay protection, it is necessary to follow the relevant standards, and the drawn graphics should be easily understood by the industry, and the information should be comprehensive and clear. The visualization system mainly uses images to express, and uses some of its functional structures to uniformly process the collected information. Different substations can use the visualization system to achieve interoperability, and then adjust according to the manufacturer's layout and system conditions. No need to install other software in the system, only need to set relevant parameters, pay attention to the system fault record file name, and do the analysis and processing work.

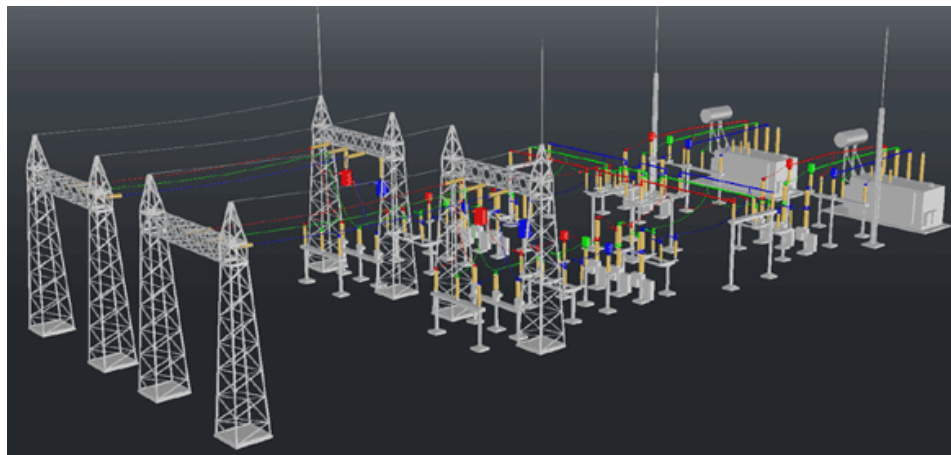


Figure 3. Smart Substation operation equipment visual protection system

4. Measures to improve remote sensing image processing of Smart Substation relay protection system

4.1. Strengthen the application of digital image technology

In view of the inevitable human error, some errors will be caused. In combination with the rapid development of information technology and digital technology in China, we can fully reduce the current high-developed digital image by avoiding the failure rate of the Smart Substation relay protection system. Technical applications in which to reduce the failure caused by human error. Through the application of digital technology, improving the transmission performance of the transformer and reducing the failure rate can realize a series of transformer faults such as secondary circuit short circuit, current transformer protection and secondary circuit grounding in the Smart Substation relay protection. At the same time, the accurate and real-time transmission of power quality information brought by digital image technology also contributes to the significant improvement of the performance of the Smart Substation relay protection system.

4.2. *Lifting the level of visualized remote sensing image processing technology*

Smart Substation relay protection system problems need to take measures to improve the accuracy of operation operators and reduce the incidence of operation failures. With the help of visual remote sensing image processing technology, for the professional Smart Substation relay protection system operators, in the context of continuous innovation of technical theory in the relevant knowledge field, strengthen the study of professional knowledge and strengthen their own practical operations. Ability. Strengthen the study of the protection principle and ensure that it has qualified operational theory knowledge and practical ability. Improve your professionalism, in the specific operation can strictly operate according to technical standards, to ensure their own high degree of rigor and precision in operation, to avoid failure caused by negligence. It is also necessary to strengthen the inspection of the Smart Substation relay protection system. The duty personnel must strictly follow the relevant inspection regulations, conduct personnel operation inspections and equipment operation inspections, and continuously improve their operational accuracy and proficiency through learning to ensure Smart Substation relay. The protection system operates at its best to make the visualization of remote sensing image processing applications even better. Through some processing software, some data can be securely protected. Based on the information obtained, a suitable treatment plan can be developed, which not only improves the processing efficiency of the fault, but also helps to improve the accuracy of the processing. When the relay protection is started, different fault information will be recorded, and then the fault signal will be fed back to other management systems for visual analysis, which can improve the visibility of the fault of the staff, and formulate according to the characteristics of the fault. A suitable treatment plan. This method has many advantages, which can effectively reduce the fault loss during the operation of the substation and improve the efficiency of the enterprise.

5. Conclusion

The realization of relay protection of Smart Substation requires timely treatment of the failure of the relay protection device to minimize the loss of the Smart Substation. Through the system analysis of the fault visualization, combined with the information to analyze the logic pattern of the protection device, master the fault situation, and select an effective strategy for processing, to achieve continuous enhancement of the performance of the protection device. Based on the Smart Substation in the power system as the center of power grid construction, the visualized remote sensing image processing should be further explored in the Smart Substation relay protection organization mode, new principle and architecture system to improve the technical level of Smart Substation and maintain the safe operation of the smart grid. In order to ensure the sustainable and scientific development of relay protection technology, the application of remote sensing image technology in the field of remote sensing image processing has a very bright future, and there will be more and more applications.

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