

Deepening research on the construction thought of intelligent substation aerial survey auxiliary system

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Abstract. In the construction and development of modern society, the rational use of intelligent system is the inevitable trend of the development of the world's electric power, and the comprehensive promotion of smart grid is the basic consensus of the world's innovation. Substation intelligentization belongs to a gradual in-depth development process, which will change from traditional substation to integrated automation station, and then to digital substation, and finally become smart substation. Nowadays, Chinese power grid enterprises have already realized the large-scale construction and management of digital substations, and put forward the development goals and basic plans for the construction of smart substations. In 2020, the intelligent development probability of important substations has reached 100%. Therefore, after understanding the construction scheme and development status of smart substation system, this paper mainly discusses the construction ideas and main structure of the new generation of smart substation line measurement auxiliary system, and then defines the future development direction of smart substation auxiliary system, in order to provide effective basis for the construction and operation of power system in the new era.

Keywords: Intelligent substation; Aerial survey; Auxiliary system; drone.

1. Introduction

In the rapid development of social economy and science and technology, our intelligent substation is mainly divided into three levels, the first is the process layer, which contains the isolation switch, circuit breaker, transformer, current and voltage transformer and other primary equipment composed of intelligent components and independent intelligent electronic devices; The second is the isolation layer, which contains the system measurement and control device, relay protection device, monitoring function group and other secondary equipment, can orderly complete the remote input and output, sensor good controller communication; Finally, it refers to the station control layer, which contains the communication system, station domain control, automatic station and monitoring system, etc., and will supervise and control the equipment of the whole station. [1-3]As a basic part of the construction of power transmission and transformation project, substation will be affected by power, hydrology, address, design and other factors during construction and management, which requires close cooperation and comprehensive consideration of all industries. Nowadays, the auxiliary subsystems of conventional substations mostly operate independently, and repeated construction in similar or cross fields is easy to reduce the efficiency of system operation, increase the cost of substation management and operation, resulting in the input and output of smart substations can not reach the expected goals. And the new generation of intelligent substation intelligent auxiliary decision system will integrate the use of information mining, electronic communication, computer, intelligent analysis, identification and other technical means, integrate the study of substation auxiliary information on the power system operation composition, and then after mastering the standard complete substation panoramic information, real-time monitoring substation auxiliary equipment. In this way, the auxiliary decision and intelligent management of substation can be satisfied and the substation can run safely and stably.

With the rapid development of modern science and technology, scientific researchers begin to build and promote the operation mode of unattended computer in substation, which makes the application research of intelligent substation auxiliary system become more and more important. At present, there is still a big gap between the intelligent operation and maintenance management

requirements of the auxiliary system and the new generation of intelligent substation, which cannot meet the fundamental requirements of integrated regulation and operation and maintenance. Therefore, after mastering the existing technical means and engineering practice, scholars from various countries focus on studying the working requirements of the new generation of intelligent substation and the structure of the existing auxiliary control system. And from the background implementation, equipment configuration, expert system three aspects of the construction of a new generation of intelligent substation auxiliary system ideas, to provide effective basis for the substation auxiliary system application management in the new era. For example, taking the site selection of substation as an example, some scholars proposed the use of UAV aerial survey for processing in their research. The detection range is usually determined according to the work experience of designers. Uav technical equipment is used to complete the rapid aerial three-dimensional mapping of the initial selection range, and then three-dimensional site selection is carried out on the computer platform. This can not only directly show multiple stations, but also enrich the comparison results of traditional topographic maps and data, faster and more convenient for staff to determine the substation construction management area. Therefore, after understanding the research experience in the construction of smart substation and auxiliary system, this paper mainly explores the application process and basic principles of UAV aerial survey in substation site selection according to the working requirements and auxiliary control structure system of the new generation of smart substation, so as to clarify the application value of line survey auxiliary system of smart substation.[4-6]

2. Method

2.1 Smart Substation

Smart substation is the result of the upgrade and development of digital substation. It integrates the basic needs of digital substation and smart grid. Compared with traditional substation, the design structure is more compact, information resource sharing efficiency and quality are higher, and it has the basic characteristics of energy saving, environmental protection, safety and reliability. Combined with the structural configuration analysis of smart substation shown in Figure 1 below, the overall design can be divided into the following three levels:[7-9]

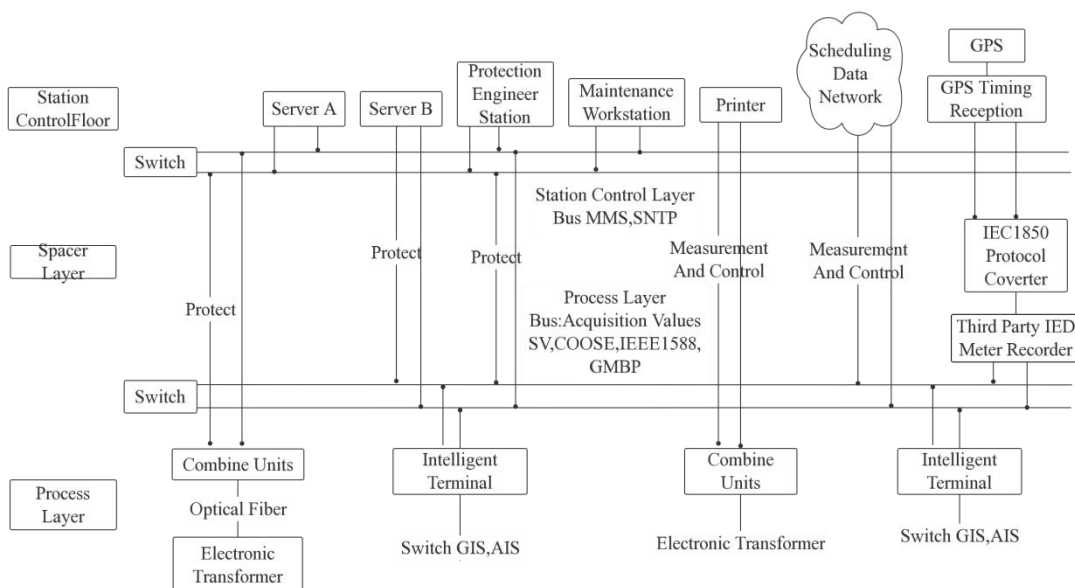


Figure 1 Structure configuration diagram of smart substation

First, the process layer. This level of design includes online monitoring device, intelligent terminal, combined unit, electronic transformer and other equipment; Second, the spacer layer. This level design selects the advanced platform idea, the software and hardware decoupling method and

the modular design idea, on the basis of ensuring the independent upgrade of software and hardware, supports the rapid integration of different functions, so as to ensure that the device can adapt to the basic needs of intelligent substation more quickly. Finally, the station control layer. This level design will build an integrated business platform to provide standard model services for applications, truly meet the application requirements of various intelligent stations, and provide an effective way for data exchange and sharing applications.

2.2 Monitoring System

Based on the analysis of the smart substation automation architecture diagram shown in FIG. 2 below, it can be seen that the integrated monitoring system, as the basis of smart grid dispatching management, should strictly follow the basic principles of unified planning, unified standards and unified construction, and after the basic requirements of digitization of the whole station information, networking of communication platform and standardization of information sharing, through system integration optimization, Truly realize the basic goal of unified access and unified storage.[10-13]

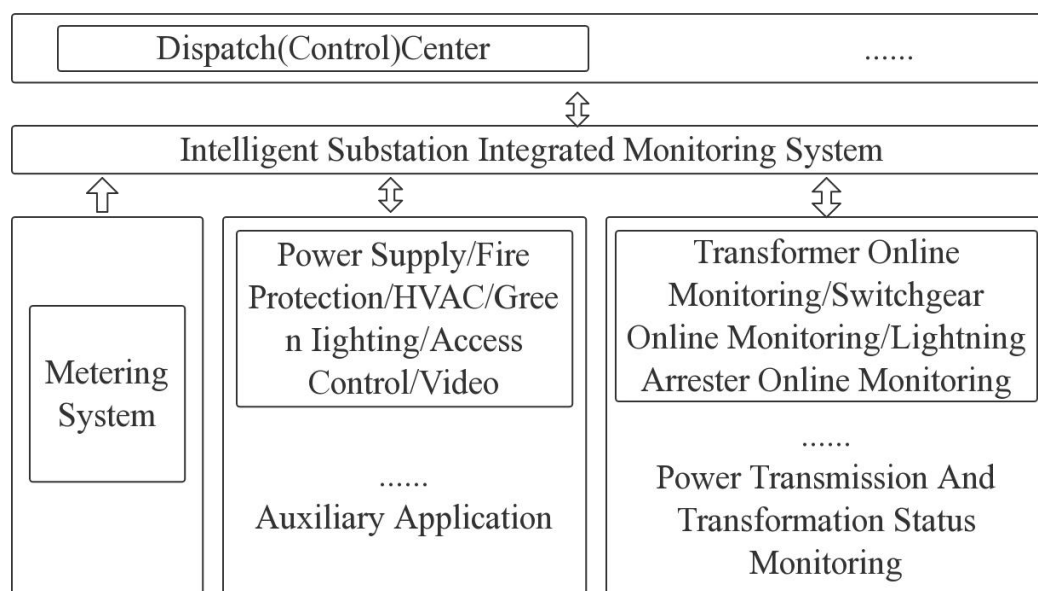


Figure 2 Architecture diagram of intelligent substation automation

Based on the above analysis, it can be seen that the integrated monitoring system is mainly reflected in two aspects: on the one hand, it refers to the supervision of auxiliary applications such as power supply, fire protection, security, environment, HVAC, green lighting, and access control. On the other hand, it refers to the supervision of transformer, switching equipment, arrester and other transmission and transformation state. At the same time, the measurement system can provide effective basis for the system operation, and finally realize the basic requirements of intelligent monitoring, intelligent analysis, intelligent diagnosis and intelligent decision-making of the substation.

2.3 Auxiliary System

The new generation of intelligent substation auxiliary system should comprehensively improve the level of system operation and management to ensure the safe and stable operation of all equipment after the biochemical fusion of substation information data. Combined with the analysis of the construction and operation of the smart substation system in the new era, it can be seen that the construction of the auxiliary system is mainly reflected in the following points:

First, the background implementation. In order to ensure intelligent linkage and data sharing between subsystems within the system and horizontal collaboration between devices at the station

end, a unified monitoring platform for auxiliary systems must be created, as shown in Figure 2 above. After comprehensive consideration of the implementation forms of the background of the condition monitoring system and the background of the auxiliary control system in the station, it can be found that both belong to the technical mode with independent sub-projects and the background host as the core. Therefore, the network and integrated monitoring system of the two can be integrated into the server to construct the architecture diagram of the auxiliary system of the smart substation as shown in Figure 3 below:[14-15]

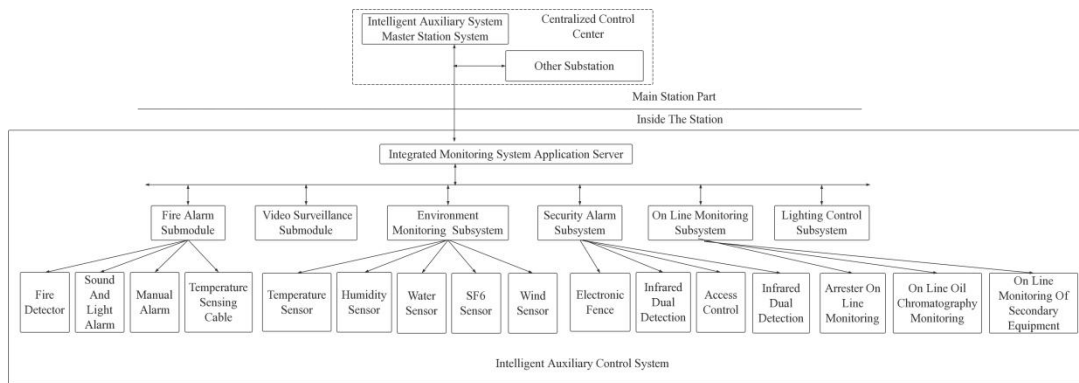


Figure 3 Architecture diagram of auxiliary system of smart substation

Second, device configuration. Since the auxiliary system is mainly to meet the requirements of automatic control, although various manufacturers currently choose more control methods, but also faced with many problems, so some scholars proposed to learn from the online monitoring subsystem to configure the unified protocol of IED device, through IED access to the integrated application server, truly realize information sharing and effective interaction. Therefore, the terminal design of the new generation of intelligent substation auxiliary system is shown in Figure 4 below:

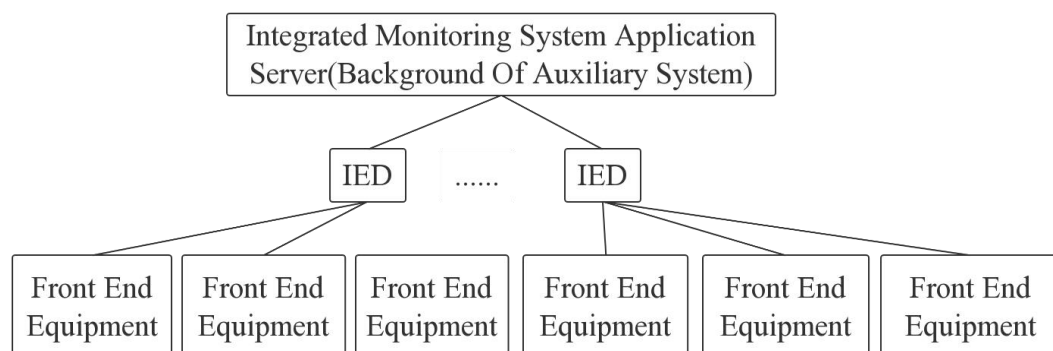


Figure 4 Hierarchical structure diagram of auxiliary system equipment in smart substation

It mainly includes the following contents: First, front-end auxiliary equipment. This part mainly collects status polishing automatically, such as camera, light controller, status sensor, etc. Second, smart electronic devices. This part will be used as the data interaction and control node of the auxiliary system device and the integrated application server, which can really realize the function of on-site caching and forwarding. Finally, the integrated application server. Manage and control all supervision devices, collect and store relevant information, establish a database for operation and maintenance management, pay attention to providing power equipment status, information and fault warning information to operators, and truly realize intelligent data classification storage and intelligent linkage functions.

Finally, experts analyze the system. At present, the online monitoring is mainly based on the independent detection of equipment, and there is no multi-system linkage with event as the core. The information collected by the unattended substation will be directly transmitted to the centralized control center. If the number of substations monitored by the centralized control center

is too large, it is easy to store a large amount of information in a short time, leading to the omission of important warning signals by the personnel on duty, which will bury the mark of hidden danger for the future system operation. Therefore, the new generation of intelligent substation auxiliary system will design intelligent warning expert analysis system, the overall system will extract fault alarm information, timely analysis of the causes and areas of failure, and then formulate effective solutions.

3. Result analysis

Take the site selection of smart substation as an example. During the work, it is necessary to determine the general range according to the rich experience of the designers, and then ask the surveyors to carry out measurement analysis, and use the UAV line survey to complete the rapid three-dimensional aerial mapping of a large range of primary election, requiring the designers to achieve three-dimensional site selection in the computer. Combined with the analysis of the operation process shown in Figure 5 below, compared with the traditional substation location selection idea, the UAV aerial survey location has the following characteristics:

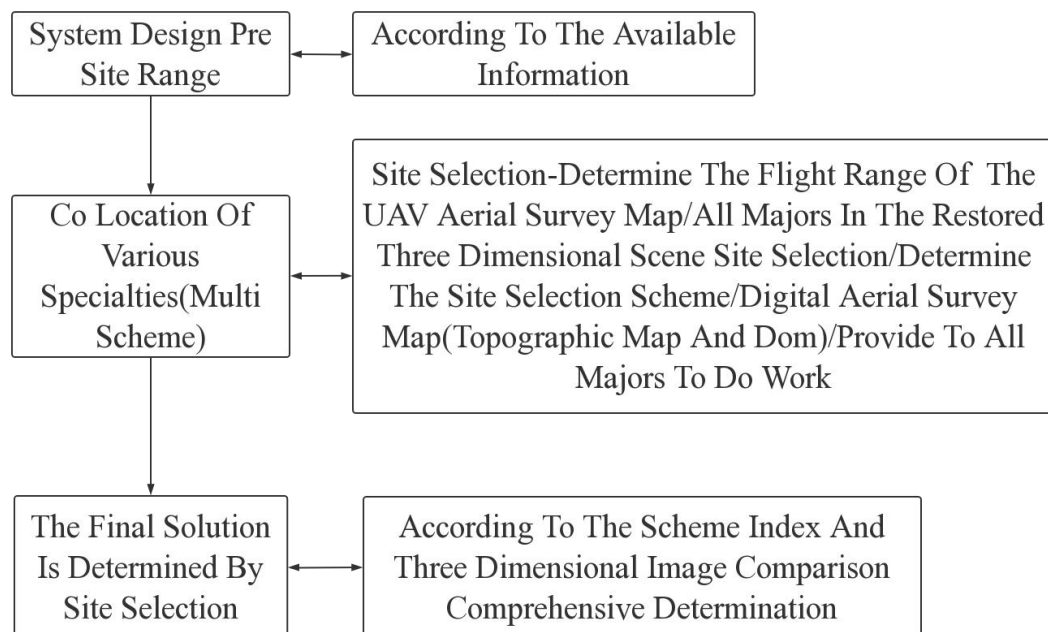


Figure 5 Flow chart of location selection for UAV aerial survey

First, location model. Most of the work of site selection will be changed from on-site work to internal work. The original working mode of site selection and scope determination is simplified into general site selection. For some areas with certain scope limitations, some professions can even determine the selection scope without going to the site, which effectively reduces the labor cost and time cost. Second, the measurement model. In the traditional site selection mode, many majors need to conduct topographic map survey and analysis after multiple site selection. This mode is easily affected by factors such as staff and site environment, and the overall work efficiency is extremely low, and the final measurement results cannot be guaranteed. The UAV aerial survey site selection will do digital measurement and analysis in advance after the preliminary determination of indoor work scope, and finally improve digital products such as digital elevation model and digital ortho image. Finally, the site was determined. The traditional site selection mainly focuses on the investigation and research of various specialties and program indicators, and the overall presentation content is not intuitive. The UAV aerial survey mode can present the final results of all schemes into three-dimensional graphics, so that the staff can accurately judge the effectiveness and rationality of the substation construction scheme according to the paper data and three-dimensional

data. Thus, the construction and promotion of intelligent substation aerial survey auxiliary system is very important.

4. Conclusion

To sum up, the construction and application of the new generation of intelligent substation auxiliary system conforms to the technological innovation and development needs of The Times, can truly meet the basic objectives of intelligent management and operation, and comprehensively improve the operation efficiency and work quality of intelligent substation. Therefore, in the future, researchers should continue to explore the standardization of information model, intelligent decision of fault diagnosis, electronic map system, etc., in order to master more data information and provide effective basis for the construction and management of smart substation.

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