Application of Electronic Information Technology in Electric Power Automation System

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Abstract. Forty years of reform and opening up, China's economic development has achieved world-renowned achievements. At the same time, the power system has also developed rapidly and the degree of automation has continued to increase. The development of power system and power grid infrastructure, computer software and hardware, and communication technology are also inseparable. This article describes the current situation of power development in China, combining three aspects of power system dispatching automation, substation automation, and distribution network automation, and looks forward to its development direction.

Keywords: information technology, power automation, application analysis

1. Introduction
With the continuous improvement of people's living standards in our country, the safety and ornamental design of power supply systems have also drawn more and more attention from the people. Intelligent power systems are also produced with the requirements of the times. By using modern information systems and various important parameters in power systems and effectively combining them [1-2], various remote control commands can be perfectly implemented through the control system. Therefore, the remote monitoring system can analyze the operating conditions and various problems in the power system in detail, accurately and timely judge the causes of various faults and provide relevant solutions [3-4]. Therefore, intelligent power system can not only improve the system operation efficiency, but also reduce the probability of safety accidents caused by human operations [5]. The key factor that plays a decisive role in the intelligence of the power system is electronic information technology. Therefore, maintaining the rational operation of the information system of the power system plays a vital role in the sustainable development of the power system.

2. Overview of Power System Automation Technology
The power system is to step up and down the voltage through the engine power generation transformer and then transport it to various users' homes through various transmission line equipment, including power generation, transmission, transformation, distribution and power consumption. As to ensure the
normal and stable operation of the power system and the safety of power supply, improve the economic benefits brought by the whole society, it is necessary to carry out relevant real-time monitoring, dispatch control and necessary protection on the lines. The secondary equipment contains various intelligent contents of the power system, , Protection devices, communication devices, power systems, power stations, monitoring systems and other components. Figure 1 shows the application analysis in the power automation system.

![Power automation system diagram](image)

**Figure 1.** Power automation system diagram

3. **Electronic equipment and electronic technology in electric power automation system**

3.1 **Electronic information hardware equipment**

Power system equipment is an automated intelligent device that integrates information collection, scheduling and control of various equipment. It uses internal information collection hardware to query in real time and various equipment parameters and data sharing, and then returns to the post-processing system after analysis and processing to adjust related requirements as required. The parameters are intelligent. The information collection device can collect various information such as relay protection operation information, switch status, etc., transmit effective data to the monitoring management system and issue adjustment and accusation instructions, and dispatch the command equipment to change various parameters in the system according to relevant requirements. Eventually realize automatic adjustment. It can be directly applied to various remote terminal equipment, remote channels, dispatching command center communication interface devices and other aspects in power intelligent systems.

3.2 **Electronic information system**

According to the management requirements and related content, the software system required for operation in the power automation system is composed of an energy management system, a monitoring system, and various information collection systems, and is supported by supporting management systems and related control software to achieve automation. The main function of the energy management system is to regulate and manage the electrical energy in the power system, and perform related registration and calculation while operating. The monitoring and information acquisition system is to adjust various parameters of the information acquisition equipment, analyze and optimize various abnormal conditions, so as to avoid similar problems from recurring, and record various software for the operating status of the power grid. Table 1 shows the composition and application of electronic information systems.

**Table 1.** Construction of electronic information system
In calculation, we need to coordinate the properties of all the issues involved and analyze the types and integrity of its multi-attribute utility. To this end, we establish a function to objectively reflect the correlation between the various attributes.

\[ v_i(\bar{x}) = \sum_{j=1}^{n} w_j \left( u_j + \sum_{k=1}^{n} \epsilon_{j,k} u_k \right) \]  

(1)

In the equation: \( v_i \) stands for the utility value calculated by the buyer or seller for the multi-attribute issue in the i-th round of negotiations, \( u_j \) stands for the value normalized by the buyer or seller for the j-th attribute in the n-th dimension attribute, \( w_j \) stands for the weight evaluation of the buyer or seller on the j-th attribute, \( \epsilon_{j,k} \) stands for the degree of association between the j-th attribute and the k-th attribute, and \( u_k \) stands for the normalized value of the k-th attribute. Normalization of \( u_j \) and \( u_k \) is carried out and the following can be obtained

\[
\begin{aligned}
  u_i &= \frac{A_{i_{\text{max}}} - a_i}{A_{i_{\text{max}}} - A_{i_{\text{min}}}} \quad A_i \text{ is a positive attribute} \\
  u_i &= \frac{a_i - A_{i_{\text{min}}}}{A_{i_{\text{max}}} - A_{i_{\text{min}}}} \quad A_i \text{ is a negative attribute}
\end{aligned}
\]  

(2)

Even for the variables of the same attribute, because the property type of the buyer and seller is completely opposite, even the understanding of the evaluation system is quite different, the difference of position and perspective makes the two sides have different acceptance of the value of the variable. Ultimately, the recognition of utility values is different. The difference between the buyer and seller's convenience directly leads to the very different utility value data, so we adopt the method of optimization algorithm to make multiple different attributes compromise each other to achieve compatibility, thus establishing the data model.

4. The specific application of electronic information technology in power automation

4.1. Power plant automation

At present, the most widely used automation system in China's power plants is the decentralized control system (DCS). Its role is to install protection and monitoring devices on-site to connect various
data lines and communicate them to the general control center to achieve comprehensive distributed control of the system. Most control systems use multiple computers to jointly control each loop of information, which is then transmitted to the various control stations by the transmission system and the relevant parameters are optimized, and finally transmitted to the CRT of the operation station. The introduction of DCS has greatly promoted the power system revolution. In particular, various software and hardware equipment of the computer can form a technical advantage in configuration technology and communication technology, ensure that the early-stage power station control system is relatively independent, and form digital subsystem management technology with tightly connected subsystem information, centralized monitoring parameters, and control. Intelligent system with decentralized functions.

4.2. Automation of power grid dispatching

The power grid dispatching automation system is a computer network system consisting of various links such as servers, displays, printing devices, workstations, power grid dispatching control centers, power plants, and transformer terminal equipment. Its effective guarantee cannot only ensure the safe and stable operation of the system, but also reasonably solve many problems in power distribution. In this new era of new demands on market operations, power companies are moving toward more efficient power transmission while ensuring the safe and smooth operation of the grid. It is also important to improve the utilization of resources and socio-economic benefits because of the reduction of various losses in the transport process. It is necessary to ensure that the power grid dispatching intelligent system collects and monitors various parameters in real time during the production process, and automatically generates power in the power grid at the provincial level or above, and performs relevant feasibility analysis and environmental impact safety books, and finally realizes the healthy and sustainable development of the power grid.

China's current automatic grid dispatching includes five different levels of grid dispatching at the national, regional, provincial, regional and county levels. National and regional power grid dispatching control centers are the largest dispatching systems with the largest scale, large network equipment, and advanced software, while county-level power grid dispatching is the smallest dispatching system, and the equipment is relatively backward. For example, servers are usually commercial PCs.

4.3. Substation automation

With the continuous increase of the degree of social automation, in order to realize the efficient and efficient operation of substations, and to strengthen various monitoring functions of substations, the introduction of information technology in substations has made it possible to use computer intelligent equipment (IED) in substations. Through direct measurement, a lot of relevant data that could not be obtained in the field can be obtained. At the same time, various digital intelligence can be effectively realized, and relevant data collection can be completed through various computer interfaces.

The substation automation system is to use computer technology, automatic adjustment management system and communication system to optimize and upgrade secondary equipment of the substation (such as relay protection, regulation, measurement, signal, fault handling, automatic device and remote equipment, etc.). Finally, the system realizes information sharing, data processing, real-time monitoring, measurement, management, and coordination of various equipment operations within the system, thereby replacing the backward management of ordinary secondary equipment and reducing the difficulty of secondary wiring in the substation. It is essential for the automation development of power grid systems.

5. Conclusion

As an effective carrier to promote contemporary intelligence, its development is inseparable from the introduction of new technologies and new achievements. As an important field of modern electronic information technology, its development directly determines the progress of power system automation.
Therefore, we must attach great importance to the development of the power system, rationally optimize the management structure of the power grid system, and achieve a qualitative leap in the power grid system.

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