Application of Power System in Electrical Engineering and Automation

Yahan Li¹ *

¹China Three Gorges University, YiChang, HuBei, 443002, China

*Corresponding author e-mail: 13872585752@139.com

Abstract. Nowadays, with the continuous development of China's economy, it promotes the continuous progress of electric power enterprises. However, in electric power enterprises, electrical engineering and automation play a very important role. Through the rational application of this technology, it can promote the rapid and stable progress of China's electric power enterprises. Therefore, in this paper, This paper mainly analyzes the development of power system automation under the electrical engineering and automation technology, and then puts forward the following contents, hoping to provide the corresponding reference value to the staff of the same industry. In this paper, based on the investigation and analysis of the current situation of intelligent power system based on electrical engineering technology, the introduction and application of electrical engineering technology is completed based on the demand of intelligent power system. On this basis, the intelligent power system based on electrical engineering technology is successfully established. Based on a large group of perceptible terminal equipment, the system can complete all kinds of data collection, and send to the upper application by using different network communication modes for intelligent management and analysis. The experimental results show that it can promote the level of intelligence in the power system by about 20%.

Keywords: Electrical Engineering, Power System, Automation Technology, Power Enterprise

1. Introduction
For electrical automation technology, it is mainly a comprehensive technology composed of electronic computer technology and network information technology. This technology can not only help the sustainable development of China's electrical enterprises, but also provide the corresponding power for the further scientific and technological development of enterprises. According to the current development situation, automation technology is widely used in electrical engineering. Because it can effectively carry out remote control, it can play a good role in the actual development of power system.

Power system automation technology refers to the use of computer technology, network information technology, communication technology, monitoring technology, power electronics technology and other advanced technologies to control and manage the power system [1-2]. Monitor the
real-time action of power network through online monitoring technology, monitoring platform and information technology. When the power system is abnormal, the person in charge of power system monitoring knows the abnormal information of the power network for the first time, and can find the power after analyzing the abnormal information. The power distribution center that sends the system abnormal reason and abnormal information to the power distribution center, the power technical personnel will entrust the fault site for repair according to the fault location and fault scope, and entrust the repair. The power system automation technology is helpful for the power company to effectively control and manage all aspects of the power system by organically connecting all departments of the power company.

In this paper, based on the investigation and analysis of the current situation of intelligent power system based on electrical engineering technology, the introduction and application of electrical engineering technology is completed based on the demand of intelligent power system. On this basis, the intelligent power system based on electrical engineering technology is successfully established. Based on a large group of perceptible terminal devices, the system can complete all kinds of data collection, and send to the upper application using different network communication modes for intelligent management and analysis.

2. Method

2.1. Electrical Engineering and Automation Technology
In electrical engineering, in order to ensure that the automation technology can be reasonably applied, we must ensure that it has a good science, but also need to combine its new technology with each other, so that it can give full play to its own effect, but it involves relatively more content, and different content can achieve different effects. According to the actual situation of our country, the reasonable application of this technology makes its market economy have relatively great changes, and our country also takes it as the key content of the construction period, at the same time, it is deepening constantly. According to the analysis of the current actual situation, at present, the enterprises in our country are constantly carrying out optimization work when they are operating, and making corresponding innovation when they are managing.

2.2. Automatic Technology of Power System
(1) Intelligent control in the power system, its intelligent development to ensure that it can play a greater effect, we must take advanced technology to ensure that it can get a larger rise space. In addition, intelligent technology also plays an important role in power system automation. At present, with the continuous development of science and technology in China, it also plays a corresponding role in the continuous development of automation technology, and in the process of intelligent system development, it has the following functions: first, it can effectively promote the effect of automation system in actual operation. Second, it can effectively improve the actual effect of power system management. According to the analysis of the actual situation of the power system at all levels in China, it can be concluded that the intelligent technology is also the corresponding foundation for the actual development of the power system in China, which can not only reduce the probability of problems, but also improve the safety factor to a certain extent.

(2) The dynamic safety supervision and control system can guarantee the safe and stable operation of the power system, and its automation plays an important role in the power enterprises of our country. However, the system includes SCADA system and monitoring and control system. The core technology is to automatically detect the fault, and also to reasonably apply electromagnetic transient application, and to make corresponding analysis of the fault recording. In terms of detection, the effect is relatively good, and the effectiveness is relatively high. In addition, this technology is also a reasonable application of GPS technology, timely data transmission, to ensure that the maintenance efficiency is improved. Because the traditional wave recorder has the problem of data redundancy, but
the reasonable application of this technology can solve the problem of data redundancy in time, and ensure the accuracy and availability of data.

The basic mathematical expression of the power system in this paper can be expressed as follows:

\[ f(t) = A_k + \sum_{i=1}^{\infty} A_i \cos(\omega_i t + \varphi_i) \]  

(1)

The parameter \( \omega_k \) in the formula is the information of the angular frequency of each power system harmonic, and its formula meets the following requirements: \( \omega_k = 2\pi f_k \). \( A_k \) is the amplitude information of each harmonic of the power system, while \( \varphi_k \) is the phase information of each harmonic.

3. Experiment

3.1. End Node Design of Intelligent Power System

The system involves many monitoring end nodes. The specific composition of sensor nodes in the end node mainly includes the data acquisition unit in the early stage, the unit to transmit the collected data, the data processing unit and power supply of the terminal. The function of the acquisition unit is to widely collect the relevant data needed by itself. In fact, the processing unit acts as the data storage station. The transmission unit uses the wireless transmission mode to transmit the relevant data among multiple nodes, and the power supply is responsible for the power supply of the whole system.

In the design of this paper, wireless temperature sensor node is at the bottom of the whole sensor network system. Its main function is to collect important data information and send it out in time. It is composed of temperature sensor and sink node. The temperature sensor can fully play an important role in collecting real-time temperature data, while the sink node can control the operation of temperature sensor and transmit and receive data from related nodes. Temperature sensor, MCU and wireless transceiver are the basic components of the end node.

In this paper, the most complex video monitoring end node system design is described in detail. The hardware structure of the video monitoring end node includes camera, front-end image processing module, wireless transceiver communication module and power module. The end node selects important monitoring points in the monitoring area, deploys the end node in these positions, and plays its function of collecting, identifying, transmitting data and information.

3.2. Software Design of Intelligent Power System

The hardware of intelligent power system consists of wireless sensor node, base station and monitoring platform. The corresponding software design also includes wireless sensor node programming, base station programming and monitoring platform programming. The wireless sensor node program can collect the data reflected by multiple temperature sensors set in the system in time; the base station program is responsible for receiving and uploading the data in time; the monitoring platform carries out detailed analysis and processing of the data received by itself and builds the corresponding database.

3.3. Intelligent Power System Structure

According to the internal technical framework, the electrical engineering technology can be divided into three different levels: perception layer, network layer and application layer. The sensing layer collects relevant data through a series of terminal equipment, base station and other infrastructure. The sensing layer is at the lowest level of the electrical engineering system in the overall structure, which is an essential part to help the electrical engineering to carry out comprehensive perception; The network layer is based on the Internet and related LAN and other network systems to transmit the collected relevant data in real time and accurately. Its existence greatly improves the reliability of electrical engineering on the original basis. The application layer is to process the relevant data in a
scientific and intelligent way, and then design the corresponding personalized service according to the actual needs of customers. The main components of the sensing layer are intelligent sensors to obtain real-time temperature, electrical engineering system, smoke sensors and other collection facilities built on the base station. The network layer makes full use of the powerful function of industrial Ethernet to transmit the collected important data to the upper layer in time and apply it. The application layer arranges and classifies the data transmitted from the lower layer into the database, and at the same time, analyzes it intelligently. In addition, the application layer can also query the early original data and repair the related vulnerabilities.

Intelligent power system is based on the advanced science and widely used electrical engineering technology. At the same time, after full consideration, it chooses the security monitoring and intelligent maintenance module as the breakthrough point to carry out in-depth and detailed research. Because many acquisition devices on the sensing layer have little difference in access mode, the real-time hot spot temperature monitoring of the device is put in the important position of research.

4. Discuss

4.1. Signal Analysis of Electrical Engineering and Its Automation Power System

Firstly, Gaussian white noise is added to the harmonic signal of the original power system. The parameters are selected as follows: (1) input SNR: 5dB (SNR = 5dB); (2) wavelet function: DBN series wavelet function, including DB wavelet, sym wavelet function and coiflets wavelet function; (3) wavelet decomposition layers J: J = 4; (4) threshold rule: adaptive sure threshold rule; (5) threshold function: soft threshold function. The results and data after the simulation test are shown in Figure 1 and table 1.

| Wavelet basis function | Sym2 | Sym3 | Sym4 | Sym5 | Sym6 | Sym7 | Sym8 |
|------------------------|------|------|------|------|------|------|------|
| SNR_out                | 14.999 | 15.214 | 15.466 | 15.726 | 15.433 | 15.009 | 15.535 |
| MSE                    | 0.140 | 0.136 | 0.132 | 0.128 | 0.132 | 0.139 | 0.131 |

With the increase of the order, the output signal to noise ratio (SNR) and the root mean square error (MSE) of the same wavelet function gradually increase. Although from the results, these three wavelet...
functions can significantly improve the signal-to-noise ratio (SNR) of power system signal output, as far as the denoising effect is concerned, coiflets are obviously better than Daubechies and Symlet, and have better stability.

4.2. Application of Electrical Engineering and Its Automation in Power System

(1) Application of power distribution automation

In the power grid of our country, the reasonable application of electrical automation technology can promote the stability of power supply and lay the corresponding foundation for people's daily life. Therefore, it plays an important role in the security and stability of the whole power grid by strengthening the stability operation of electrical automation. In our actual life, the safety of the power grid is a very important content, but the staff may have some accidents in their daily work. The existence of these accidents will threaten the staff's own life safety. Therefore, the reasonable application of electrical automation technology can find the cause of the fault in time and help the staff to eliminate the potential safety hazards.

(2) Information system application of Ethernet

There are great advantages in the application of Ethernet, because this technology has a strong real-time information, because the data transmission speed of electrical system is relatively fast, it can promote the data transmission function of its distribution station to meet the actual needs. In addition, it can also carry out curve calculation and data statistical analysis of graphics. Fieldbus can make corresponding combination for its monitoring software according to serial cable and other ways. PLC system can also carry out corresponding links to ensure the automation of its on-site execution and detection, and improve the safety and stability of the system operation.

At the same time of the continuous economic development, the investment of power system is also growing gradually, which has achieved better results. However, from the national perspective, the research time of this technology in China is relatively late, but it has also made some achievements. With the deepening of the research of this technology, its actual function is also constantly improving. The automatic technology of power system has become an important content in the development of our country. Reasonable application of this technology can lay a foundation for its development and reduce the investment in human capital. The automation equipment of power system can also promote its further development and provide good help for practical application and users.

5. Conclusion

Through the analysis and research of the above content, it is concluded that the management of electrical automation is a very important technical content, which contains relatively more content. Through the comprehensive way, the overall management effect of the power system can be improved comprehensively, and the unified management method can improve its actual effect. In addition, the reasonable application of this technology can not only save a lot of human resources, but also reduce the error probability caused by manual operation, further ensure the overall effect of the power control system, lay the corresponding foundation for good operation, and to a certain extent ensure the more stable operation of the system.

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