10.70711/aitr.v3i3.8033

Exploration of the Application of Intelligent Technology in Electrical Engineering and Automation

Enpu Zhang

Durham University, Durham, DH1 3LE, England

Abstract: In the process of modern technological development, intelligent technology has been widely applied in the field of electrical engineering and automation, and has become an important means to improve system efficiency and optimize operation. Therefore, in modern electrical engineering construction, it is necessary to attach importance to the application of intelligent technology to promote efficient and high-quality management of electrical engineering. Based on this, this article mainly elaborates on the specific application of intelligent technology in electrical engineering and its automation technology.

Keywords: Intelligent technology; Electrical engineering and automation; Practical application

Preface

The requirements for energy efficiency, system safety, and automation level in modern society are constantly increasing, and the limitations of traditional electrical engineering models in terms of complexity and efficiency are gradually becoming apparent. In response to these changes, the introduction of intelligent technology provides new solutions for the technological upgrading of electrical engineering. Intelligent technology integrates cutting-edge technologies such as artificial intelligence, big data analysis, and the Internet of Things, endowing electrical engineering automation with more efficient operation and more accurate decision-making capabilities.

1. The significance of electrical engineering and its automation applications

Electrical engineering and its automation, as a highly comprehensive discipline, includes the combination of strong and weak electricity, electromechanical integration, and software and hardware integration. Moreover, in the process of scientific and technological development in China, automation technology is constantly being updated. And intelligent technology mainly refers to the technology that meets people's various needs with the support of information technology. It simulates the functions of the human brain and improves the overall system operation efficiency. Its application in electrical engineering and automation has significant practical significance. Firstly, in the actual operation of electrical engineering, massive amounts of data are generated, so the efficiency of data processing directly affects the quality of engineering operation. By utilizing big data technology to efficiently process data, it can promote the improvement of data processing standardization, thereby enhancing data processing accuracy. Secondly, enhance the overall control capability of the electrical engineering system. Applying intelligent technology to electrical engineering and automation can help workers monitor different engineering data and equipment operation conditions in a visual way, ensuring that the system is always in good working condition. At the same time, the application of intelligent technology can further strengthen the control of system operation status, improve the level of safety warning, and achieve remote monitoring of the system. Finally, in traditional electrical engineering and its automation systems, due to the lack of effective processing methods, operation and maintenance management work requires staff to rely on professional operation and maintenance experience. However, this approach is not only inefficient, but also prone to various risks. After the application of intelligent technology, the dependence on manual labor can be reduced through intelligent management, achieving intelligent operation and maintenance, and reducing labor costs. And after the practical application of intelligent technology, it can also achieve intelligent inspection and fault diagnosis of the system, thereby avoiding power outages and accidents caused by faults.

2. The specific application of intelligent technology in electrical engineering and automation

2.1 Optimization design of electrical system

The electrical system is a complex system that not only covers a wide range of content, but also has a very complex overall structure. So how to optimize the electrical system in a reasonable and scientific way has always been a research focus. At present, people can use intelligent software to improve optimization efficiency in system design. With the help of intelligent technology, staff can comprehensively

analyze the system, quickly identify the defects in electrical system design, and achieve targeted optimization design based on the optimization suggestions provided by intelligent analysis software. For example, for the braking circuit, by integrating intelligent technology, it is possible to quickly detect delay issues during system operation, thereby improving system efficiency. Therefore, the application of intelligent braking control circuit equipment has become very widespread. In addition, currently, with the help of fuzzy control algorithms and expert systems, the intelligence level of electrical systems can be further improved. Staff can shift from the original two-dimensional system design to a three-dimensional and modeled system design, which can be combined with models to carry out targeted detection and improve the efficiency of system optimization design. Finally, in the application of intelligent technology, power enterprises can use CAD technology and information technology to optimize the design of electrical equipment. With the support of these two technologies, drawings can be optimized through modeling, and virtual design of electrical equipment can be completed with the help of professional simulation analysis software.

2.2 Fault diagnosis

During the operation of electrical engineering, it is often subjected to harsh external environments, which can lead to malfunctions due to various factors. The application of intelligent technology in the field of fault diagnosis is also very extensive. With the help of intelligent technology, staff can immediately identify the fault location of the system after a fault occurs, and partition and control the system to avoid serious damage to the system caused by the fault, while also achieving monitoring of other parts of the system. For example, in electrical engineering, transformers are important components, and their operational reliability directly affects the quality of system operation. In transformer fault diagnosis, if the cause of the fault cannot be clearly identified, it will cause the transformer to stop running, thereby affecting the safety of the electrical system operation. The application of intelligent technology can help workers quickly analyze the leakage situation of transformers. After using sensor devices to analyze the gas situation around the transformer, workers can quickly complete the detection of the transformer in a short period of time, analyze the causes of the fault problems, and finally carry out targeted operation and maintenance work.

2.3 PCL system

In the process of integrating electrical engineering and intelligent technology, PLC technology has gradually replaced traditional electromechanical controllers and become an important component of electrical systems. During the operation of the electrical system, the control system, as the main station layer of the centralized control room, can be directly connected through the human-machine interface. After the application of intelligent technology, the PLC system can remotely control electrical equipment through remote control stations and on-site sensors. The system can analyze the data in the sensors and intelligently control the equipment based on the analysis results, achieving automatic switching of the power supply system and avoiding time delays caused by human operation, thereby improving the efficiency of system operation.

2.4 Control technology

The application of intelligent technology has further enhanced the comprehensiveness and flexibility of control technology. Firstly, intelligent technology provides technical support for unmanned control of electrical automation. In the process of upgrading the electrical system, by collecting and processing on-site sensor data, the system can automatically control electrical equipment through analysis of equipment status and electricity demand, without the need for human intervention throughout the process. This can further improve system control efficiency and reduce labor costs. Secondly, intelligent control technology has significant advantages in handling some hazardous work. In traditional electrical engineering control, some operations must be manually controlled, and this part of the control work has high risks. Therefore, the safety of operators is usually not guaranteed. For example, in high-voltage control, there are certain uncertain factors in the operation of high-voltage equipment. If manual control is used, the work risk will be greatly increased. After the application of intelligent technology, the control of high-voltage equipment can be completed through remote control. Finally, in the process of electrical engineering construction, multiple fields are involved, and in order to improve the quality of the project, workers can use fuzzy controllers to complete control work. The fuzzy controller contains complete control rules, which can predict the operation logic and related behaviors of the equipment, and issue correct instructions through the control center, thereby improving control efficiency.

3. Conclusion

In summary, the widespread application of intelligent technology has completely changed the operation mode of traditional electrical engineering and its automation systems, injecting new impetus into the development of the industry. Intelligent technology, through the deep integration of artificial intelligence, big data, and the Internet of Things, significantly improves the operational efficiency and resource utilization of the system, and enhances the level of intelligent device management.

References

[1] Ma Shiyin, Wang Xiao, Ma Longshan, etc Intelligent Technology Analysis of Electrical Engineering and Its Automation [J]. China Metal Bulletin, 2024 (1): 132-134.

[2] Li Yimeng Discussion on the Intelligent Application of Electrical Engineering and Its Automation [J]. China Equipment Engineering, 2024 (17): 45-47.

[3] Xu Jilin, Li Dong, Liu Fengfeng Application of Electrical Engineering and Automation Technology in Intelligent Buildings [J]. Information Industry Report, 2024 (6): 0053-0055.

About the author: Enpu Zhang, (2006.03-), Male, Han ethnicity, native place: Luoyang City, Henan Province, China, education: Bachelor's degree, research direction: Intelligent Automation.