Journal of Electronic Research and Application, 2024, Volume 8, Issue 3
http://ojs.bbwpublisher.com/index.php/JERA
ISSN Online: 2208-3510
ISSN Print: 2208-3502

# Application of Intelligent Technology in Building Electrical Lighting Project

**Yingling Dai*, Qinghua Zhao**

China Merchants Chongqing Communications Technology Research & Design Institute Co., LTD., Chongqing 400067, China

***Corresponding author:*** Yingling Dai, daishushu@163.com



**Abstract:** The rapid development of intelligent technology has led to its introduction into the field of electrical lighting in buildings. It provides more technical support for system design, use, and management, and creates a comfortable and safe living environment. The adoption of intelligent technology enables the creation of an intelligent management system, where controllers and sensors are used to adjust the light source within the building, monitor and manage the lighting system in real time, monitor the energy consumption and safety of the system, and achieve the goal of energy saving and emission reduction. This paper briefly discusses the application and significance of intelligent technology in electrical lighting and puts forward design ideas to optimize electrical lighting and measures for lighting system management.

**Keywords:** Intelligent technology; Buildings; Electric lighting

**Online publication:** June 14, 2024

## 1. Introduction

Under the support of intelligent technology, relying on information processing, intelligent communication, and field bus, combined with the application of various types of sensor technology, the building's indoor and outdoor light environment information is collected, and the information is fed back to the controller to take real-time adjustment of the building light source. When the light inside the building is sufficient, the intelligent system can automatically reduce the brightness of the light source to prevent energy waste. The light source will also be adjusted automatically depending on the weather and the time of the day. In the lighting project, Internet technology can be used with cloud computing to support data collection, analysis, and management to provide support for the energy-saving operation of the system. Therefore, it is clear that the adoption of intelligent technology in electrical lighting can create an energy-saving and comfortable living environment, so this topic should be further explored.

## 2. Types of intelligent technology

(1) Intelligent communication

Intelligent communication is a crucial technology in the development of intelligent lighting systems.

It enables the integration of control systems and lighting equipment through wired or wireless connections, facilitating communication and data transmission. This technology allows for advanced features like fault diagnosis, remote monitoring, and data collection, enhancing the overall intelligence of lighting systems.

With intelligent communication, users can monitor and control indoor lighting in real time over a wireless network. This includes adjusting light color, temperature, and brightness, which adds convenience to daily life. In commercial settings, it supports energy management by enabling remote control, thereby optimizing the energy efficiency of building lighting systems. Intelligent communication also offers robust data monitoring capabilities. It can collect and analyze real-time operational data from lighting equipment, predict potential issues, and notify users to take appropriate maintenance actions. This proactive approach can extend the lifespan of lighting equipment and reduce operational and maintenance costs. For instance, if a lighting system detects abnormal brightness, it can automatically alert the user to replace the faulty equipment, preventing disruptions in lighting performance [1].

(2) Information processing

Information processing is also one of the most commonly used intelligent technologies in the electrical lighting systems of buildings. This technology ensures accurate control and management of lighting equipment based on the lighting data. This stage involves handling significant amounts of data, where intelligent technology excels in extracting valuable information, which aids managers in decision-making. Information processing can also improve the level of intelligence of electrical equipment, assist in safety management, analyze monitoring data, and identify inspection and monitoring targets.

(3) Fieldbus

Fieldbus technology, commonly used in industrial automatic control, establishes digital communication with field equipment. When applied to electrical lighting, it integrates control systems and lighting design to facilitate collaborative interaction and transformation of lighting equipment. Fieldbus enhances the operability of lighting systems, enabling easy information transfer between lighting equipment and the control system through digital communication, thereby supporting remote control and monitoring. A central control room in an intelligent lighting system can monitor equipment in real time, aiding in operation, fault diagnosis, and management, which improves the stability and safety of lighting operations. Fieldbus also allows for the control of energy consumption through centralized management, enabling real-time monitoring and regulation of equipment status to address energy consumption issues and achieve energy-saving and emission-reduction goals. Furthermore, it enhances the safety of building electrical lighting by allowing remote monitoring, which helps managers quickly identify and address operational abnormalities, preventing potential safety incidents [2].

## 3. Significance of intelligent technology in building electrical lighting

(1) Ensuring the quality of light

By applying intelligent sensors, we can create an electrical lighting system that automatically adjusts brightness based on ambient conditions such as natural light, human presence, and overall brightness levels. On sunny days with ample natural light, the system reduces the brightness of artificial lighting, conserving energy and extending the lifespan of the lamps. Intelligent technology also allows for flexible lighting modes through control methods like timed switches and scene modes, adapting seamlessly to environmental changes. For instance, when indoor light is sufficient during the day, the system deactivates artificial lighting and relies on natural light; conversely, when indoor light is dim at night, the system activates artificial lighting to ensure optimal illumination.

(2) Saving energy consumption

In the field of electrical lighting, the application of intelligent technology enables the use of smart devices to sense environmental factors such as temperature, humidity, and light, and automatically adjust the brightness of lights and control equipment switches to use electric energy efficiently. This technology also allows for group management based on different time periods and lighting requirements, providing intelligent dimming to enhance light source utilization. Preventing issues like excessive or insufficient lighting ensures optimal lighting conditions and visual comfort while reducing energy consumption costs.

(3) Easy operation and management

With the application of intelligent technology, electrical lighting systems can preset lighting programs and automatically control light source brightness and equipment switches based on factors such as lighting time, ambient light, and the number of people present. This makes lighting management more refined and intelligent, reducing the manpower costs required for management. Through network connectivity, lighting managers can monitor the system's status in real time, collect data on light brightness, equipment failures, and power usage, aiding in problem identification and improving management efficiency. Additionally, the system can automatically adjust the color temperature and brightness according to user needs and preferences, creating a comfortable living environment and enhancing the convenience of system operation [3].

## 3. Examples of intelligent technology applications in electrical lighting systems

(1) Lighting design

With the rapid development of intelligent technology, its application in building electrical lighting systems has steadily increased. During the system design process, intelligent technology enables intelligent management and automatic control, ensuring high-quality system design and enhancing the energy-saving efficiency of the lighting system.

First of all, during the system design process, intelligent technology is applied to monitor internal and external light levels in real time, automatically adjusting indoor light brightness based on ambient conditions. Supported by intelligent technology, the lighting system gains self-adaptive functions, allowing it to flexibly adjust lamp brightness according to changes in the environment, time, and other factors. This not only prevents resource wastage and achieves energy-saving and emission-reduction goals but also enhances the comfort of building occupants [4].

Secondly, in the lighting system design stage, the integration of intelligent technology enables remote control capabilities for managers. Leveraging Internet technology and mobile devices, lighting system operations can be monitored anytime, anywhere. For instance, managers can utilize mobile applications to remotely adjust light brightness, control lamp switches, and schedule timed management tasks, enhancing convenience for both work and daily life. With the support of intelligent technology, monitoring and managing the lighting system becomes more efficient, enabling timely resolution of system failures to ensure reliability and stability of operation.

Furthermore, in the domain of lighting engineering design, the integration of intelligent technology with smart home systems enhances people's life experiences. For example, the lighting system design can be seamlessly linked with intelligent air conditioning, smart audio, and other devices, allowing for centralized control. This integration enables multi-scene switching and voice control, thereby creating an intelligent and convenient environmental space for users.

(2) Energy management

In the ongoing process of scientific and technological advancement, intelligent technology finds extensive

applications across various fields, including architectural lighting systems where its usage is increasingly prevalent. Leveraging intelligent technology enables real-time control, optimizing energy management within the system, thereby reducing energy consumption costs and enhancing energy utilization rates. Intelligent technology facilitates the monitoring of lighting system data, allowing for comprehensive analysis of energy consumption patterns. This involves the incorporation of data acquisition and sensor devices during system design to collect energy consumption information. Subsequently, analysis software is utilized to conduct in-depth analysis of the gathered data, effectively demonstrating the advantages of intelligent technology in computation and analysis [5]. Moreover, the application of intelligent technology facilitates the prediction of lighting system power consumption and the development of usage plans. Managers harness artificial intelligence, big data, and cloud computing technologies to analyze historical data on system power consumption and forecast future energy demands for system usage. This enables the development of management programs to optimize lighting system operations, achieving resource savings and efficient resource management objectives. Additionally, intelligent technology enables automatic vehicle control management of lighting engineering. Utilizing functionalities such as fieldbus, intelligent controllers, and automation systems, adjustments to the color temperature and brightness of the lighting system are made based on the needs of building occupants and environmental characteristics. Furthermore, integration with other home systems enables comprehensive energy management strategies [6].

(3) Lighting management

Under the application of intelligent technology, lighting system management relies on technical means to conduct intelligent and even automated monitoring, providing convenience for building users. Intelligent management of lighting primarily involves utilizing intelligent technology to automate brightness adjustments, aiming to achieve energy savings, protect users' vision, and reduce visual fatigue. The intelligent lighting system can create a suitable lighting environment based on user preferences and adjust lighting according to the specific scene requirements. Moreover, intelligent lighting management allows for personalized settings and control of lighting scenes, enabling users to establish preset scenes such as parties, reading, movie watching, and dining, enhancing user experience. Users can easily switch between lighting scenes as needed to ensure optimal lighting quality [7]. Additionally, users can personalize settings based on their preferences for light color, adding a unique style to interior spaces. Furthermore, intelligent light management functions find application in commercial settings, such as hotel lobbies where intelligent light management systems automatically adjust brightness to create a welcoming atmosphere based on guests' activities. Similarly, in office areas, intelligent light management systems ensure staff comfort by adjusting lighting brightness according to office requirements.

(4) Application examples of intelligent technology

In the development of an electrical lighting project for a multifunctional building that encompasses commercial, office, leisure, and various other functions, the adoption of intelligent technology is essential to guarantee both the construction quality and energy-saving effectiveness of the lighting system. The technical application primarily encompasses the following aspects:

The first aspect is intelligent control. The building implements an intelligent lighting monitoring system, enabling intelligent management and automated monitoring of lighting equipment throughout the application process. Specific measures involve installing controllers, sensors, and other devices within the system to monitor indoor lighting [8]. Additionally, establishing a linkage between the intelligent system and other systems such as intelligent office and smart home systems enriches user experiences across different building spaces. With intelligent technology in place, the brightness parameters of lighting equipment can be automatically adjusted.

The second aspect is energy management. To enhance the building's energy efficiency and reduce electricity consumption costs, during the transformation of the intelligent lighting system, an energy management module is established. This module monitors the energy consumption of the lighting system in real-time and manages electrical equipment in different areas of the building. Users can utilize remote control technology to manage lights and other home appliances within the building. Additionally, the system features a reminder function. In case of abnormal power consumption, users are promptly alerted to turn off devices, ensuring efficient energy management [9].

After undergoing intelligent transformation, the user experience of the building's electrical lighting system improves significantly, with superior energy-saving effects. Supported by intelligent technology, the lighting system achieves higher quality, providing people with a more comfortable experience and enhancing the environment for commercial activities and office work within the building. Through the application of intelligent technology, operating costs are reduced, and the integration with home systems offers users a convenient living space. Compared to previous setups, the energy consumption of lighting projects is reduced by approximately 30%. This demonstrates that under the application of intelligent technology, the building's lighting system transforms, allowing for automatic adjustments based on environmental needs, thus reducing artificial management costs, operating costs, and conserving energy. Moreover, the integration of intelligent technology promotes synergy between the building's electrical system and smart home systems, facilitating user usage and management. The economic and social benefits of intelligent technology applications are clearly evident in these improvements [10].

## 4. Conclusion

Intelligent technology encompasses a diverse array of types, and its application in the realm of electrical lighting serves to aid in the design of lighting systems, the creation of intelligent lighting setups, and the efficient management of lighting energy. Its utilization offers advantages in terms of both economic and social benefits. As intelligent technology continues to develop, its application scope is poised to expand significantly, particularly within the field of electrical lighting, where it will delve deeper. This trajectory aims to establish increasingly intelligent and comfortable lighting systems for people, thereby fully harnessing the value of intelligent technology applications.

## Disclosure statement

The authors declare no conflict of interest.

## References


[1] Yu Y, 2023, Application of Intelligent Technology in Building Electrical Engineering. Chinese Science and Technology Journal Database (Full Text Edition) Engineering Technology, 2023(4): 189–192.

[2] Dong H, 2023, Application of Intelligent Technology in Building Electrical Design. Light Source and Lighting, 2023(5): 174–176.

[3] Han W, 2023, Application of Intelligent Technology in Building Electrical Design. Integrated Circuit Application, 40(4): 342–343.

[4] Tan J, 2023, Research on the Application of Intelligent System Linkage Control Technology in Building Electrical Engineering. Modern Engineering Science and Technology, 2(6): 53–56.

[5] Wu J, 2023, Application of Intelligentization Technology in Building Electrical Engineering. Integrated Circuit Application, 40(3): 266–267.

[6] Guo Z, Yang Y, 2023, Analysis of Building Electrical Energy-Saving Design and Green Building Electrical Technology. Building Materials Development Guide, 21(6): 195–198.

[7] Zhao K, 2023, Application of Electrical Engineering and Automation Technology in Intelligent Buildings. Information Systems Engineering, 2023(3): 71–73.

[8] Zhang J, 2023, Application and Development of Electrical Automation Technology in Lighting Engineering. Light Source and Lighting, 2023(5): 109–111.

[9] Chai F, 2023, Application of Electrical Automation Technology in Intelligent Buildings. China Kitchen & Bath, 22(9): 253–255.

[10] Zhang Y, 2023, Application Strategy of Intelligentization Technology in Building Electrical Design Project. China Building Metal Structure, 22(6): 130–132.