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Electrical Control Method of Intelligent Building

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Abstract. Under the current background of China, aging and high energy consumption have become the main obstacles to the acceleration of urbanization. Most of the old residential areas have problems such as low efficiency of parking space management and disorderly internal road planning. At present, most of the office rooms and buildings in China generally have the problems of high energy consumption and low efficiency. In order to better meet the needs of the market and the "double carbon" goal, a variety of intelligent control technologies are applied to traditional buildings. For example, the introduction of high-tech equipment to old residential areas can make more accurate and efficient design of roads and parking spaces, and improve the comfort and safety of residents. At the same time, sensors are installed in high-rise commercial buildings to detect energy consumption data and indoor parameters in real time, improve the application efficiency of energy, achieve the effect of energy conservation and emission reduction, and comprehensively upgrade and transform it in the direction of "intelligence" and "digitization".

Keywords: Intelligent; energy-saving; efficient; sustainable development; precise management.

1. Introduction

With the acceleration of urbanization and the iteration of information technology, the construction industry is upgrading from traditional function orientation to "smart" in order to better meet the current needs. For buildings, electrical control is mainly to realize the refined management of energy consumption by optimizing the power distribution system, adjusting the operation status of equipment, monitoring electrical parameters, and other means [1]. Through the combination of intelligent sensors, Internet of Things, and other technologies, real-time monitoring and analysis of energy consumption data can be achieved, providing accurate data support and a scientific basis for energy consumption management.

The essence of smart city construction is people-oriented, which means that the relationship between man and nature should be fully considered and the natural ecological laws should be respected. Under the guidance of the principle of smart city construction, intelligent buildings have built a modern building intelligent design system through the functional modules, equipment models, and equipment management entities of the automation system, which has changed the traditional design methods and concepts, and improved the applicability and energy conservation of buildings [2].

Through the background analysis, it is not difficult to find that China currently has a large number of old buildings and communities, which also means that a large number of citizens live in a residential environment lacking advanced technology. At the same time, under the background of "double carbon", the year 2030 of the first stage "carbon peak" is getting closer and closer. Therefore, the energy conservation and emission reduction of high-rise modern buildings and the comprehensive transformation of old residential areas have become the two most important goals of the current construction industry. It can be seen that intelligent building control technology has broad application fields and prospects. To further discuss the practical value of this technology integration, this paper will first describe the market prospect and application fields of this technology, and clarify the development background and application direction by analyzing the actual situation of China's current buildings, such as the existing problems and impacts of old residential areas, and the root causes of high energy consumption and high waste in modern buildings. Secondly, the integration of information technology in building electrical design is studied, including system evaluation,

coordinated selection of hardware and software, design principles and standards, and subsequent maintenance. Finally, combined with a specific case analysis: through the analysis of the design structure and operation effect of the electrical control system of Guangzhou Baiyun science and technology building and the old community, the electrical control methods of intelligent building are deeply studied, such as using new energy generation to replace the traditional power generation mode, reducing energy consumption by reducing the glass radiation effect and other practical applications. At the same time, it also defines the application and development direction of future technology. It can be seen that intelligent building technology is of great significance to promote the implementation of energy conservation and consumption reduction in the construction industry and improve the quality of human settlements, and also provides technical support and practical direction for the development of intelligent buildings in the future.

2. Development Background of Intelligent and Information Technology in Building Electrical Design

Intelligent and information technology have broad prospects in building electrical design, and are profoundly reshaping the pattern of the construction industry. The following describes the development prospects of intelligent and information technology innovation in the construction industry from two aspects.

There are a large number of old residential areas in China, most of which were built before 2000. At that time, due to the low construction standards, relatively backward planning concepts and years of wind and rain erosion, the old residential areas were generally faced with many problems, such as aging infrastructure, incomplete functional supporting facilities, deterioration of living environment and so on, which seriously affected the quality of life of residents and the overall image of the city [3]. The reconstruction of old residential areas has become an important topic in the field of urban construction and social development. It is of great practical value to explore its connotation, significance, current situation and future development direction. At the same time, with the acceleration of urbanization and the in-depth promotion of the "double carbon" goal, the problem of energy consumption in the construction field has become increasingly prominent. How to realize the efficient coordination and energy saving optimization of electromechanical systems with the help of intelligent technology has become a key issue for the sustainable development of the construction industry. In recent years, intelligent building technology has provided new ideas for improving building energy efficiency by means of big data and automatic control [4]. However, the existing research and practice still face many challenges, such as the problem that the intelligent transformation of a single subsystem is difficult to achieve global optimization, and decentralized control leads to data islands and low collaborative efficiency. To sum up, the introduction of intelligent and information technology has multidimensional significance in improving the environment of old residential areas and promoting building energy conservation.

3. Integration of Intelligent and Information Technology in Building Electrical Design

3.1. Integration Method of Intelligent and Information Technology

3.1.1. Requirement analysis and system evaluation.

The current demand is mainly reflected in the urgency of intelligent transformation of old residential areas nationwide, and the urgency of reducing the pressure of energy-saving technology applied to high energy consumption buildings under the goal of "double carbon". However, there are some problems in the existing system transformation. For example, although a building network management platform has included 120000 houses' information, it has not reached interoperability with the data of natural resources and fire department, which is inefficient in the investigation of potential safety hazards. The main reason is that the system transformation is often limited to the independent upgrading of a single subsystem, without connecting the various systems in series, which

is easy to form a "data island", resulting in low overall coordination efficiency and difficult to achieve global energy optimization.

Therefore, the core focus of the system evaluation is to build a comprehensive management platform, realize the transformation from decentralized control to centralized optimization decision-making, and finally achieve the ultimate goal of improving human living comfort and significantly reducing building energy consumption.

3.1.2. Coordinated selection of hardware and software.

The premise of achieving reasonable electrical control of an intelligent building is to accurately collect and analyze the electrical demand and consumption status of the building. The collection of building electrical energy consumption data is realized within the framework of building equipment control. Through the integration of equipment ring network technology, the comprehensive monitoring of building energy consumption can be realized. According to its functional characteristics and communication mode, the whole acquisition process is divided into two levels: the field equipment layer and the information control layer, which work together to support the operation of the system. In order to achieve accurate acquisition and effective analysis of these data, it is necessary to reasonably select hardware and software.

The main components of the system include Internet of Things, router, data server, monitoring computer, man-machine interface, network ring switch, sensor, local control equipment, frequency converter, remote i/o and network ring adapter. The operation process is roughly as follows: firstly, the sensors at the bottom of the architecture are used to collect various data (such as environment, equipment operation and other information), and then the control equipment is responsible for the local control of relevant equipment. The frequency converter is used to adjust the operating frequency and other parameters of the equipment, while the remote i/o is used to realize the remote input and output function. These devices are connected to the network ring switch through the network ring adapter to form an Ethernet ring structure to ensure the stability and reliability of data transmission. The network ring switches are connected with each other to build a network loop for data transmission, which gathers and transmits the data of the underlying equipment. Finally, the data is transferred to the Internet of Things level through the router, and then interacts with the data server, monitoring computer, human-computer interface and other upper devices. The data server is used to store and process data, and the monitoring computer monitors the running state of the system. The man-machine interface is convenient for personnel to operate and view the relevant information of the system, so as to realize the intelligent monitoring and management of the whole system [5].

3.2. Generic Cabling Design

The structured cabling system (SCS) is a unified cabling system built for all kinds of communication equipment and network services inside the building. Its core is to integrate the functional requirements of data transmission, voice calls, video signals and other types of information transmission into the same system through standardized architecture design, so as to ensure the efficiency and stability of various information flows in the transmission process.

3.2.1. Design principles and standards.

When designing the generic cabling system, the following principles and standards should be followed: first, it should meet the design requirements of international standards; The standards formulated by the International Electrotechnical Commission (IEC) and the American Electronics Industry Association (EIA) shall be followed to ensure the quality and compatibility of wiring. Second, the consideration of flexibility and expansibility; Future technological development and demand changes shall be considered in the design to ensure that the system can be easily expanded and upgraded. Third, security and reliability guarantee; The generic cabling system must be capable of fire prevention, anti-interference and data security to ensure the safety and stability of information transmission [6].

3.2.2. Implementation and maintenance plan.

Cabling planning is the core link of the implementation of a generic cabling system. It is necessary to scientifically design the route direction and layout path in combination with the structural characteristics of the building, the actual use functions and the layout of various equipment, to fully meet the actual use requirements while ensuring the aesthetics of wiring. After entering the construction stage, the operation must be carried out in strict accordance with the standardized operation process, focusing on the accuracy of line connection, and ensuring the overall quality of wiring construction through the whole process quality control.

The maintenance and management of a generic cabling system need to establish a normalization mechanism, and conduct comprehensive inspection and maintenance of lines regularly, so as to ensure that the system is always in an efficient operational state. It is suggested to formulate a detailed maintenance plan and introduce professional management software to achieve accurate management and real-time monitoring of system assets, so as to improve the efficiency of system management and fault response speed. In addition, targeted training activities should be organized to help managers deepen their understanding of the cabling system, improve their maintenance and operation ability, and provide a guarantee for the long-term stable operation of the system.

4. Case Study on the Application of Intelligent and Information Technology

4.1. Electrical Design of Science and Technology Building

Zhujiang city building is located in the core area of Zhujiang New Town, Tianhe District, Guangzhou. It is a high-rise building integrating office, business, hotel and other functions [7]. Various energy-saving and environmental protection technologies are widely used in urban buildings in the Pearl River, such as efficient exterior wall insulation system, low radiation glass curtain wall, Light-Emitting Diode (LED) lighting system, rainwater collection and recovery system, etc. The designers installed four vertical axis wind turbines on both sides of the central part of the building, using high-altitude wind power to replace traditional power generation. In addition, photovoltaic panels are integrated in the exterior wall and top, and solar energy is used for power generation. After the application of these energy-saving technologies in Zhujiang city building, compared with the traditional building, the consumption is reduced by about 50%, and the overall energy-saving rate can reach 63.2%. It is estimated that the building saves more than 580000 kilowatt hours of electricity every year, of which the 12 wind turbines on the top of the building can generate about 140000 kilowatt hours of electricity every year, and the photovoltaic glass on the building facade can generate about 220000 kilowatt hours of electricity every year. It can be seen that the comprehensive application of these technologies has effectively improved the energy efficiency of buildings, reduced operating costs, reduced carbon emissions, and laid the foundation for the sustainable development of buildings.

4.2. Intelligent Electrical System of Residential District

The Meiqi community in Yangzhou is a typical old community. The construction time is too long, the average age of residents tends to be aging, and the community has been unable to meet all aspects of the needs of elderly residents, so it is necessary to carry out a comprehensive aging adaptation transformation of the community environment. First, use intelligent equipment to transform the internal traffic flow line. The main roads in the residential area are planned for diversion, in which the main roads are dedicated to motor vehicles, and the secondary roads are divided for people and vehicles, and the speed is limited. Secondly, under the premise of using intelligent equipment to transform the parking lot without occupying the original activity site, the above-ground multi-storey three-dimensional parking lot will be built. Set up an intelligent parking management system to master the real-time vacancy situation through the parking space detection sensor, and guide the driver to park correctly by using voice prompts or display screens, so as to improve the utilization efficiency of parking spaces. Finally, some motor vehicle parking lots will be restored to elderly

activity venues by using intelligent equipment to transform the activity venues. The venues will be divided according to different activity needs, such as setting up a fitness equipment area, chess and card area, square dance area, etc [8].

In this case, it is not difficult to find that even in old residential areas dominated by elderly residents, intelligent technology has many application scenarios to improve the living environment and happiness index of residents.

5. Conclusion

This paper mainly analyzes the necessity and feasibility of the application of building intelligence and information technology in the field of building electrical in China. In the face of the problems of old community facilities, high energy consumption and serious waste of commercial buildings, promoting the upgrading of intelligent technology has become the core way to improve the quality of human living and implement the goal of "double carbon". The research shows that the key point of this application is to build a highly integrated management platform, integrate lighting, Heating, Ventilation and Air Conditioning (HVAC) and other subsystems based on the Internet of Things sensing equipment and data analysis technology, and eliminate the phenomenon of "data island", to achieve energy-saving management and control and equipment regulation from local optimization to global coordination. Among them, through the examples of Guangzhou Pearl River City Building and Yangzhou Meiqi community, this paper respectively confirms the remarkable effect of this technology in energy conservation and emission reduction and improving the efficiency of community operation.

In the future development process of the construction industry, it should further strengthen the construction of industry standards, promote the compatibility and adaptation between systems, and implement the differentiated transformation strategy. At the same time, it is deeply combined with artificial intelligence to create a "smart brain" that upgrades from automation to autonomous decision-making. Secondly, it is interconnected with the intelligent city system and participates in the energy scheduling at a more macro level. Finally, it is to break through the limitation of a single dimension of energy conservation and focus more on creating a healthy, comfortable and humanistic building environment. Finally, the intelligent building industry will enter a new stage of harmonious coexistence between human buildings and nature.

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