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Research on Realization of Automatic Control in Intelligent Buildings

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Abstract: The intelligent building has become a key direction in architecture field in China. It is the application-efficiency of automatic control technology that improves the value of intelligent building applications. This article firstly introduces the definition and characteristics of automatic control technology, then explains the function of intelligent building automatic control, and finally expounds the realization mode of intelligent building automatic control.

Keywords: Intelligent Buildings; Automatic Control; Implementation Approach

1. Introduction

It is widely known that, with the emergence of intelligent buildings, the application value has been enhanced greatly in the development of China's architecture field and promoted the application and promotion of intelligent buildings as well. Ideal automatic control, the vital feature of intelligent buildings, makes occupants' life and work, to a certain extent, more convenient, qualified and comfortable in its application process.

2. Automatic control technology and characteristics

2.1 Definition of automatic control technology

Automatic control technology is to promote corresponding parts to have a higher automated level when it works. Therefore, it can highly liberate human resources, avoid and reduce humanpower as much as possible, and improve its control level and effect. The effective application of automatic control technology has very ideal value and function as to original manual control mode, especially for rapidity and convenience which can't be met by manual control. However, it does have some problems in terms of control intelligence and accuracy, which still need to be improved and perfected it will be more prone to failure in the way of manual control. In general, with continuous improvement and development, automatic control technology still has strong advantages and prominent value in the future[1].

2.2 Characteristics of automatic control technology

As far as the detailed application process of automatic control technology in intelligent buildings is concerned, its characteristics have the following three aspects. First, as the biggest feature of the application of automatic control technology, the automatic control has very high application value which is reflected by the advantages introduced before in this article, which enhances the development of automatic control. Then, automatic control technology involving wider and higher technologies brings about high application level overall, and inevitably brings about a relatively high complexity

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of the corresponding automatic control technology. Especially at the early design stage, professional designers need pragmatically high design level to ensure a high automatic control technology to play a relatively better application effect. Finally, as its own high technical level, automatic control greatly depend on high technology and perfect technical system in application. Once technical problem happens in a certain link, it is likely to lead to the failure of the whole automatic control technology and affect the final effect. Therefore, the technical dependence has become the biggest feature of this technology[2].

3. The role of automatic control in intelligent buildings

The electromechanical facilities of intelligent buildings are monitored centrally through an automated control system in the whole building, such as lighting, drainage, air conditioning and elevators, which further improve the building management level, effectively lower facility failure rate and decrease the cost of operation and maintenance. In the process of use automatic control system in intelligent buildings, the goal is to manage and detect the whole internal environment and equipment of the building. It is required the designer to provide a more comfortable and safer environment for the users, and to optimize and adjust facilities to enhance low-cost and benefit-efficiency. The automation control system of intelligent buildings basically covers most systems and equipment in buildings, such as water supply and drainage, electricity, ventilation, lighting and air conditioning. It is the most extensive system involved in the whole building intelligence, and its design level can directly affect the realization of every function of intelligent buildings. Therefore, it is necessary to pay attention to the design of automatic control system[3].

4. Implementation of automatic control in intelligent buildings

4.1 System structure

The reliability of the automatic control system is very important for intelligent buildings. If the system breaks down, the whole intelligent building will be impacted greatly. Based on the mentioned above, three-layer distributed control architecture is adopted in the design the automatic control system to integrate communication, computer and control technology and central management of intelligent buildings. The system architecture realizes the monitoring and control of each running electromechanical facility by means of control layer, field control layer and management layer. First, for the monitoring layer, it is mainly to monitor each unit of the system, including the following contents of making record report, system operation status and operation parameters, monitoring and prompting abnormal conditions. Operating station provide brief surface for users and ensure all requests could be sent to monitoring station which would execute the order according to network service; industrial computer should be used in monitoring station to improve its reliability. Then, for the field control layer, field control whose core is the field controller can be directly and reliably connected with facilities installed in different positions, such as sensors and actuators, in order to control each single machine. The field control layer possesses the following functions: facility detection, data acquisition, system diagnosis and digital control. Finally, the management layer is mainly to manage and coordinate with each subsystem. This layer can make each system used as a node in the management system, and bring the field management and monitoring into the unit network together to integrate with the management information, thus making the information system optimized and facilitates the improvement of economic[4].

4.2 Hardware design

In the process of designing an automatic control system, the selection of hardware facilities is the most critical link, which directly affects the reliability of the system operation, so it is necessary to pay sufficient attention to this link. At present, due to the complexity of intelligent control products, it is necessary to carry out specific screening and analysis in the relevant design process. A well-known brand industrial computer from China is selected as the host, and IFIX5.0 is selected as the configuration software with the SQL Server database. Data transmission between DDC and the monitoring platform is realized by means of Ethernet, and the monitoring platform uses the topology of star network. In

addition, RS-485 Modbus is used in the communication protocol of the bottom layer. The connection work is carried out with information acquisition components and related communication modules. The collected field data will be converted before transmitted to DDC XL100 connected with the monitoring platform through Ethernet. This platform monitors the running state of the field controller in real time, stores and processes relevant data automatically, and provides detailed operation steps for relevant operators and information of sorted data. In case of abnormal problems, the system will automatically send out alarm signals[5].

4.2.1 Field controller

Field controller is a key component of the system hardware, connected with the controlled facilities to control and collect data. Although there is certain differences between the name of field control units and distributed control systems, they are all composed of standardized control modules installed inside cabinets in structure, which is configured into field control units of different scales according to the relevant requirements. Field controller can independently control the operation of equipment and correspond algorithms according respective parameters. In this design, DDC is selected as the field controller, and the control logic all comes from the micro signal processor. The software program can automatically process these signals after the signals sent by instrument and sensors are received by the controller and output the processed signals to external equipment for execution to open or close dampers, valves and facilities, and to complete complicated actions according to relevant program instructions. As the core of the whole control system, DDC collects data timely through AI or DI and collects analog signals before converting it into digital signals. As a result, the computer can directly process these signals, perform operations according to specific control rules, and issue control instructions to convert the signals into analog signals before transmitting them to the controller, thus effectively controlling the field equipment[6].

4.2.2 Serial device server

Serial device server with feature of low-cost and wide-control is manufactured based on embedded technology, which can complete the protocol conversion of serial communication to make a full use of Ethernet resources, management and data transmission. ADAM-4570, a well-known brand of two-port facility in China, is selected as the serial equipment server, with functions of access control and automatic detection. It can be used to fully connect serial equipment and network. After being driven, the communication between IFIX and serial equipment is connected.

4.2.3 Selection of other equipment

First, in order to facilitate the subsequent modeling and adjustment of the air conditioning system, the selected sensor is integrated temperature and humidity. The chip is a patched one with main features of good expansibility, high reliability, flexible scattered layout and configuration, etc. Second, industrial computers need a 24-hour-continuous-running to keep supplying stable and reliable power, while UPS is to mainly provide uninterrupted power and ensure the safe and reliable operation of the load.

4.3 Implementation of system software

4.3.1 Software configuration

Operating system of central control room is Windows XP, database software is SQL Server2008, and configuration software of monitoring system is IFIX5.0. SCU is the configuration file of configuration software IFIX. The local node name can be set to FIX1 after the program is started while the present file is a configuration. The way of obtaining data by IFIX can be determined by setting SCADA. Data can be obtained in real time by starting SCADS in the configuration window and select OPC by the I/O driver.

4.3.2 Implementation of communication between IFIX and DDC

In order to realize the communication between IFIX and DDC, the premise and foundation is to set up the relevant modules of DDC. The communication will be complete by connecting DDC with the upper PC by Ethernet and configure the system, creating a DB data block and inserting a data block named DB1, creating an array in it as a communication data source after opening it.

5. Conclusion

To sum up, the automatic control system designed in this article has been used in some intelligent buildings, and the system runs reliably and stably without serious faults. Electromechanical facilities in

intelligent buildings have been effectively controlled since the system is used. It can be seen that this system is worthy of application and promotion.

References

1. Duan X, Wang J, Hu G. Research and exploration on the construction of teaching platform for building electrical and intelligent professional practice. Laboratory Science 2016; 19(5): 227-232. doi: 10.3969/j.issn.1672-4305.2016.05.066.
2. Yu G. Application analysis of intelligent technology in electrical automatic control engineering (in Chinese). Science and Technology Innovation Herald 2016; 13(17): 1-2. doi: 10.16660/j.cnki.1674-098X.2016.17.001.
3. Zhang J, Yang W. Automatic control analysis of building intelligence (in Chinese). Jiangxi Building Materials 2016; (5): 99-100. doi: 10.3969/j.issn.1006-2890.2016.05.083.
4. Zhang Z, Zhang X. Application of building automation system in intelligent building. Intelligent Building & City Information 2014; (10): 60-61. doi: 10.3969/j.issn.1671-9506.2014.10.012.
5. Yang W. Research on optimization of automatic fire control system in intelligent building design (in Chinese). Technology Innovation and Application 2014; (7): 190. doi: 10.3969/j.issn.2095-2104.2014.28.372.
6. Xie H. Application of LonWorks bus technology in intelligent building automation control system (in Chinese). Technology Outlook 2016; 26(28): 148. doi: 10.3969/j.issn.1672-8289.2016.28.131.