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Design and research of elevator control system based on PLC

Xiaohu Han

PetroChina West Pipeline Company, Urumqi, 830013, China

Abstract: With the gradual popularization of high-rise buildings in China, the elevator control system has also achieved rapid development, and the relevant design is constantly improving and optimizing. For the elevator system, the advantage of PLC control system is that it can use the elevator control system of PLC, and its later maintenance cost is lower. In this paper, the hardware and software design of the elevator control system based on PLC are tested, and the operation of the implementation process is carried out.

1. Introduction

With the development of modernization in our country, the number of high-rise buildings is increasing, more and more high-rise buildings come into our life, and the elevator has become an important part of our life. The design of elevator system is the basic part of high-rise building, and the design of elevator system has become an important part of high-rise building design. In the past design of elevator control system, relay control is mostly used. Generally speaking, the control system mainly includes two parts: logic control system and drag control system. Among them, the logic control system is mainly realized by PLC system software. However, the relay control system has the disadvantages of too many control lines and large volume of components. In addition, it is easy to have faults in the use process and increase the maintenance workload. How to control our elevator system more precisely under the condition of safety is our consideration. Using PLC to design elevator control system has become a popular trend. The application of PLC technology in the design of elevator control system can improve the efficiency of elevator use and reduce the investment of human resources. Therefore, the design and research of PLC elevator control system is of great significance.

2. PLC technology introduction

2.1 Basic structure of PLC elevator control system

PLC is the acronym of PLC, which combines the automation technology, computer technology and micro processing technology to develop a controller. Its main structure consists of power supply, central processing unit, function module, memory and communication module. In operation, it can not only store internal programs, perform logical operations, control sequence information and carry out various user-oriented counting and operation instructions, but also exchange and control the production process of machinery through digital simulation. Elevator system is a complex product produced by the combination of various specialties. From the perspective of the whole macro and micro elevator system, we divide the elevator into the following aspects. The elevator system can be divided into machine room part, hoistway part, floor station part and elevator case part.

The core control system of elevator control system based on PLC is the main phase 1 of PLC. Our signal input is transmitted to the PLC host through the PLC interface. When the signal is transmitted to the PLC host, our own software in the PLC host system performs relative operation processing, and



then outputs through the corresponding output interface, and then judges and processes according to the input signal information, and then displays in the phase In terms of the number of corresponding layers, the corresponding instructions are then executed according to the processing results, and finally the instructions are sent to the control system for operation.

2.2 Advantages of PLC technology in elevator control.

As the research and development of industrial controller, PLC has strong adaptability. The equipment constitutes the elevator logic control system and drag control system. The main function of the elevator logic control system is PLC programming direction layer selection, speed change, determining the position of the elevator, opening and closing the elevator door. In this process, PLC control system is used to monitor the working state. When PLC technology is applied to the elevator system, the elevator system can be controlled automatically, the accuracy is improved, the anti-interference ability is greatly enhanced, and the operation is more stable. The application of PLC technology reduces many layer selectors and relays in the original control system, simplifies the structure of the control system, makes the line arrangement more clear, and the control system also develops towards miniaturization and intelligence. PLC has very strong functions. Even if the control system is very complex, PLC can cope with it. When the system functional requirements change, PLC can change or add its own functions to adapt to the new system.

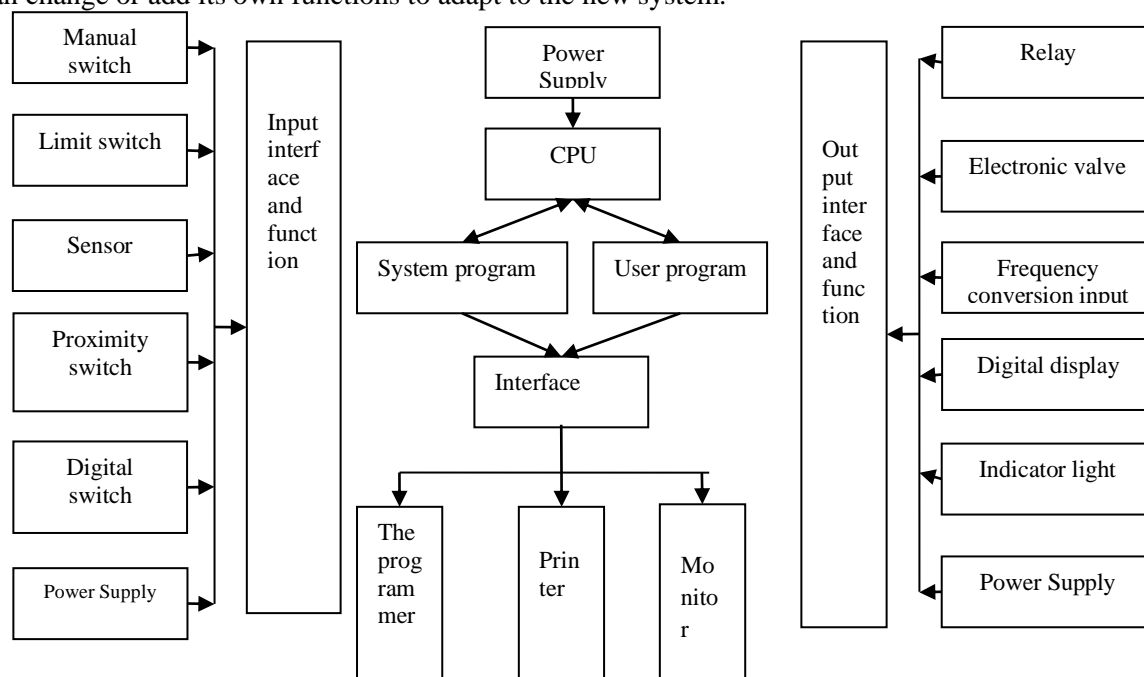


Figure 1. PLC hardware structure system

PLC system also has the function of automatic detection, which can monitor in real time and give alarm prompt. Once there is a fault, it will give alarm prompt in the first time, which greatly improves the safety of elevator control system. In addition, PLC system installation is more convenient, operation and maintenance are more convenient, even if you change the control scheme, you do not need to change the hardware wiring. In the group control deployment and management work, PLC technology can also play a full role in improving the operation efficiency of the elevator. The elevator control system using PLC technology is more reassuring in the operation process, and the comfort is also improved.

2.3 Basic mode of PLC technology in elevator application

The function requirements of PLC technology in elevator control system are shown in several aspects. The motor part can complete the lift function of the elevator, and the elevator can make response

action at a certain speed. In the process of elevator operation, the control system will play a role to ensure that the elevator can normally open the elevator door in case of delay. After the elevator starts to run, there will be many different operation instructions in the same time. PLC control system can judge the instructions, and make a reasonable response quickly, so that each instruction is effective, and ensure the normal operation of the elevator.

The basic algorithm flow is as follows. First, when the elevator is running, if there is signal input outside the elevator, and the elevator must pass through the secondary floor, and the direction of input is the same, the elevator will stop running through this floor. The elevator moves according to the original route. First, it displays whether there are people or objects in the elevator according to the weight. If not, it moves according to the corresponding number of floors, so as to reach the maximum or minimum state all the time. Then it runs according to the opposite direction of the device. Finally, judge whether there is anyone in the elevator. If there is no one to operate the elevator, it will automatically run to the lowest floor. When the elevator is abnormal, we immediately change the running state of the elevator to braking, and ignore any customer's request, and notify the corresponding maintenance personnel to make timely rectification.

3. Design of elevator system based on PLC

In this paper, a simple three-layer elevator control as the research object, elevator function requirements are mainly as follows. Call buttons and position switches are installed on each floor of the building. If the elevator stops at the lower floor and the user at the upper floor presses the elevator call button, the elevator will rise to the user's floor. If a user has pressed the call button of the elevator, the call indicator of the elevator will not light up until the elevator rises or falls to the call floor. In the process of elevator ascending or descending, if two users press the elevator call button, i.e. the elevator receives two call signals, the elevator first completes a call action, and finally ascends or descends to the final target floor, and stops standby.

3.1 Hardware design

The hardware system of elevator PLC control system mainly includes CPL, memory (RAM, Rom), input and output equipment, as well as power supply equipment. CPL is the core processor of PLC system. PLC host is the core of elevator control system. PLC and frequency converter constitute the control system. It can be seen from the figure that there are many components in the system, among which the frequency converter is mainly used to control the control speed of the elevator. When detecting the motor speed, the photoelectric encoder is applied to set it as a relatively closed loop control system.

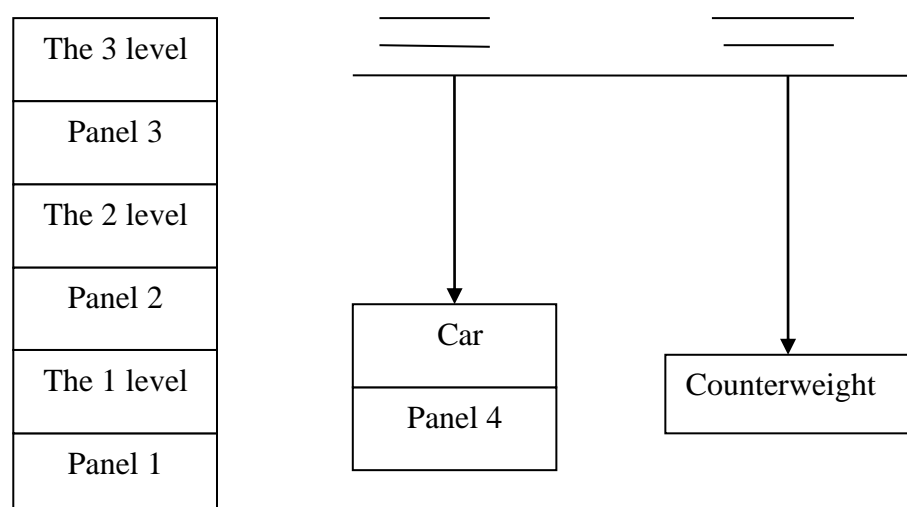


Figure. 2 Structure of elevator control system

3.2 Software design

Software design is an important part of PLC elevator control system design. When designing software, we should fully consider all kinds of situations in elevator operation, to ensure the elevator function is perfect and safety after being put into use. In the process of elevator operation, it is often a mechanical repetitive work. Its cycle is to receive the call signal, the elevator goes up and down, the user selects the floor signal reception, the elevator operation status judgment, the elevator starts, reaches the target floor, opens and closes the door. Before the operation of the elevator, PLC will carry out self inspection on the overall operation condition of the elevator, and the elevator will start to run if any fault is found.

When the elevator is in a static state, the elevator will receive two kinds of signals. If the call signal from other floors is received, PLC will control the lift based on the signal response program. When the elevator is in operation, if the elevator is going down at this time, the elevator will only feedback the received down call signal, otherwise, it will only respond to the up call signal.

The program design of elevator control system mainly includes the registration of signal, the determination of action direction, the function design of signal queuing and forward loading, the drive and stop of elevator car. If there is a call signal in the process of elevator operation, no matter the elevator is going up or down at this time, the elevator control system will make a comparison between the current position and the end point, and then determine the running direction of the elevator. When the elevator reaches the end point, the running direction of the elevator will not disappear, and the running end point and direction of the next cycle will be determined according to the new call signal.

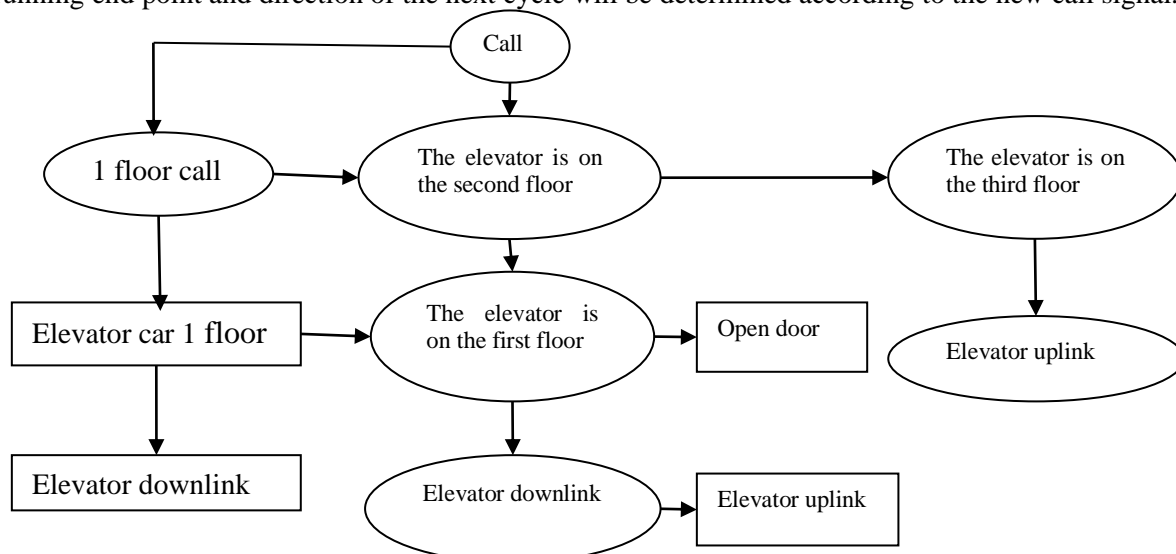


Figure 3. Elevator response call signal

We use PLC to control the elevator system. On the premise of safe operation, we put forward excellent control program and adjust the basic operation direction of the elevator in the control process. In the process of debugging and monitoring the elevator monitoring system, we found some problems. The solutions to these problems are as follows. When the working conditions are fixed, the elevator door cannot be opened, so that the elevator cannot perform the car function of driving in this direction. After analysis, after debugging and processing, "floor detection signal self-locking" is placed behind "instruction signal and call signal registration in the car", then the elevator can work normally. Therefore, the elevator control system based on PLC technology has very strong expansibility, and the maintenance is simple and easy.

4. System implementation

The specific implementation process of elevator control system based on PLC is as follows. First register the environment variable, then create a menu, set the registered environment variable to $U < D$,

and the variable value is e. Create dialog boxes and file dialog boxes to store folders. Create a folder for files in the e directory. After editing, select Save to generate the required process in the menu bar. First, input the process parameters of the equipment, and then select the equipment according to these parameters. The structure flow chart is as follows:

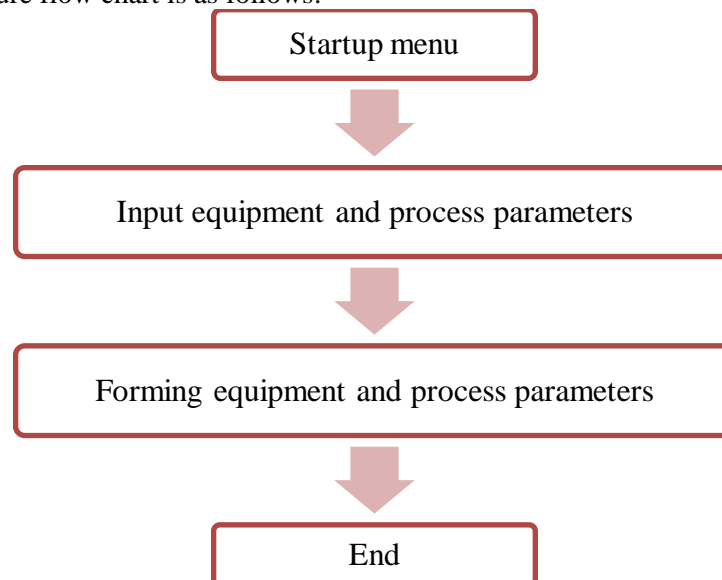


Figure 4. Design process of equipment and process parameters

Secondly, realize the function of equipment selection module. In the equipment selection function module, it is stored in the database according to the model classification. The modeling is completed by generating dialog box in the software. First, the database file is established and stored, and the corresponding model parameters are input in the table, then the data source registration is completed. Finally, the production line drawings are generated. The design of the production line needs to select the appropriate proportion and size according to the layout of the production line equipment. After initializing the program, input the information of the human equipment, draw the table of the parts list, input the number, name and number of the human equipment in the parts list, and the overall 3D entity diagram of the production line equipment will be generated in the software.

5. Conclusion

With the rapid development of social economy, elevator has become a necessary product for building. The main characteristic of elevator system is huge and complex, so in the research process of elevator control system, it is difficult to fully and deeply understand the elevator system from the outside. The elevator control system based on PLC is easy to learn and operate, the language level control is flexible and convenient, and the operation is reliable and stable. Therefore, not only the elevator system, but also many large-scale equipment use PLC control system. The operation of the elevator is controlled by PLC, which greatly simplifies the hardware structure of the control system and improves the flexibility and reliability of the system to a large extent. Although in the early stage of PLC operation, the cost is a little higher than the traditional relay, but in the later stage, the cost can be reduced by saving the input point and other methods. Although the application of PLC technology has been very extensive, but there are still some problems, still need to continue to study and explore, further improve the application of PLC technology in elevator control system.

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