Design Of PLC Controlling System For Three-Storey Double Elevators

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Abstract

As the construction industry developed, the elevator has become more and more important . It's safety and reliable performance has been paid more attention. In this paper, a new technology based on PLC and configuration control two integration of the design of the lift is discussed. Practice shows that this system has strong control ability, high reliability, high efficiency and it further ensures the safety of the lift.

Keywords

PLC; Elevator; Automatic control; Safety.

1. Introduction

As the economy continues to develop, the elevator has become an indispensable tool in our daily lives. The development of national economy promotes the appearance of large numbers of high-rise and intelligent buildings, the elevator has become increasingly important as transportations. Its influences on people's lives become more and more significant. PLC control can improve the performance of the elevator system, ensure high efficiency and energy saving, at the same time can satisfy the passenger comfort. Configuration software can access real-time information from the PLC and make visual simulation.

2. overall structure of two integration system

Two-integration elevators joint response to one call outside the door, working independently on the rest situation. The overall flow chart of the integration elevator system is shown in figure 1. When inside control buttons are pressed to call the request, the two elevators automatically compare which one run to response. The responsed elevator automatically open the door when it arrives the target floor, then automatically closes the door after 5 seconds. Inner calls inside the two elevators do not affect each other. The functions of the two integration elevators are shown below.

(1) Three-Storey Double Elevators automatically answered the calls.

(2) Elevator a and elevator b must immediately start to run after selected by the inside or outside calls.

(3) The elevator began to run after automatically judging running direction.

(4) Integration of two elevator response to call according to efficiency principle of coordination.

(5) Automatic flat layer after arriving the station.

3. PLC control system

3.1 programmable logic controller

Since relay control elevator system has high failure rate ,low reliability and security, bring inconvenience and panic to passengers ,it is more often to choose PLC control in the modern design of elevator. Mitsubishi FX series PLC is the most advanced in the FX series family. It has the largest

range of tolerance standard features, faster program perform ,strong communication function, suitable for power supply in different countries around the world and meet the individual needs of a large number of special function modules, etc. FX2N - 48 has flexible configuration, not only have a large number of special module to meet the special needs, but also have six basic units which can be extended to 256 I/O each. Besides, FX2N series has rich resources of components, it has 3072 auxiliary relay, 256 timer, 235 counter and 8000 data storage, etc.

3.2 The I/O coding

The I/O coding is the basis of program design. According to the elevator operation process and the requirement of control system, firstly summarized all the input signal and output signal in this system, and then address I/O assignment according to the input and output points of PLC, to make each input signal corresponding to the PLC internal input relay, each output signal corresponding to the output of the PLC internal relay. The I/O coding table as shown in table 1. According to design requirements, three-storey double elevators need a total f 24 inputs and 24 outputs.

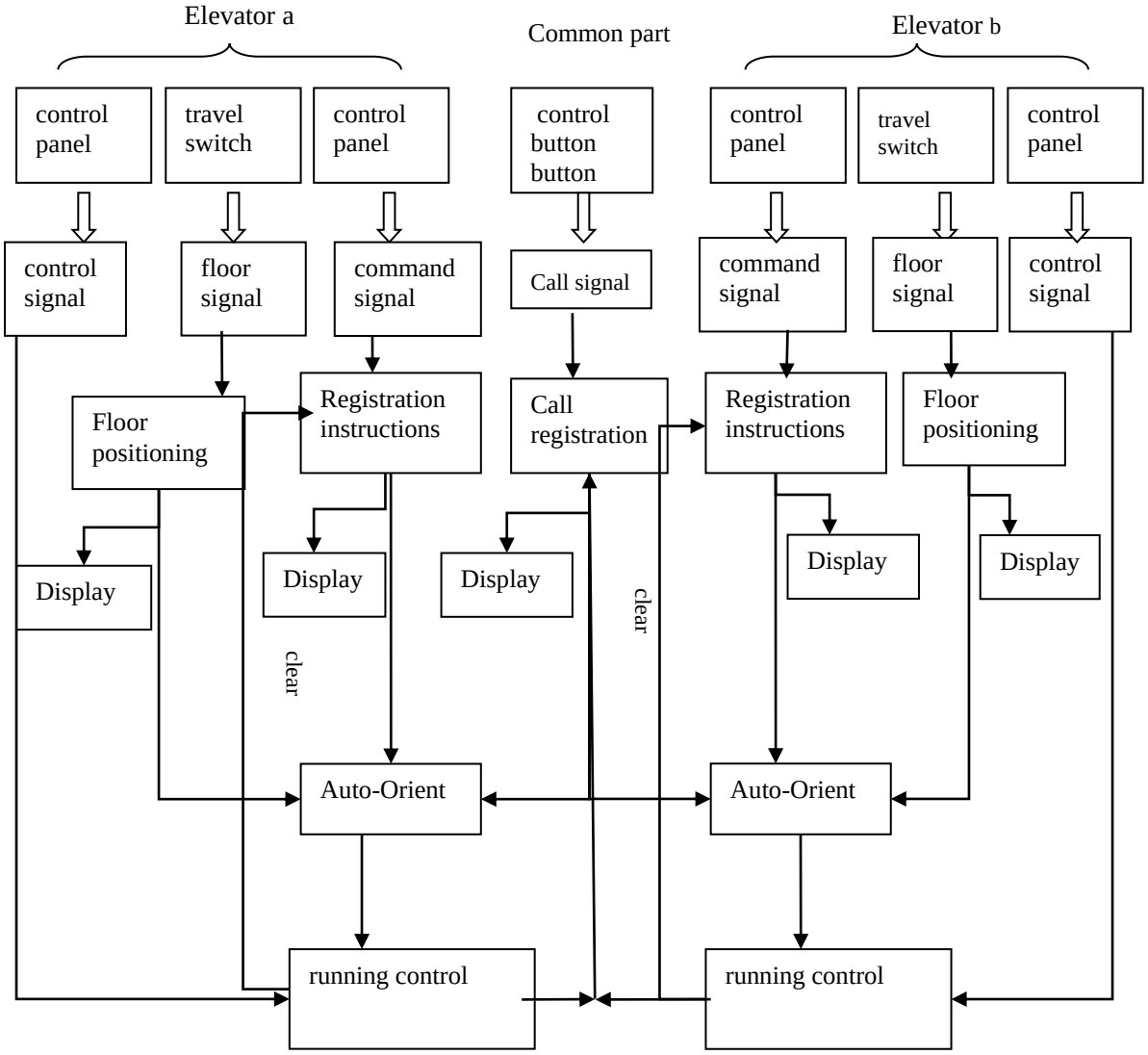

Figure 1. overall flow chart of the integration elevator system

Table 1 I/O coding table

Input	function	Output	function
X0	Elevator an open button	Y000	Elevator a upgoing
X1	Elevator a close button	Y001	Elevator a downgoing
X2	Elevator a 3rd call inside	Y002	Elevator an open lamp
X3	Elevator a 2nd call inside	Y003	Elevator a close lamp
X4	Elevator a 1st call inside	Y004	Elevator a 3rd call inside
X5	Elevator a 3rd travel switch	Y005	Elevator a 2nd call inside
X6	Elevator a 2nd travel switch	Y006	Elevator a1st call inside
X7	Elevator a 1st travel switch	Y007	Elevator a 3rd
X10	Elevator b open button	Y010	Elevator b upgoing
X11	Elevator b close button	Y011	Elevator b downgoing
X12	Elevator b 3rd call inside	Y012	Elevator b open lamp
X13	Elevator b 2nd call inside	Y013	Elevator b close lamp
X14	Elevator b2nd call inside	Y014	Elevator b 3rd call inside
X15	Elevator b 3rd travel switch	Y015	Elevator b 2nd call inside
X16	Elevator b 2nd travel switch	Y016	Elevator b 1st call inside
X17	Elevator b 1st travel switch	Y017	Elevator b 3rd
X20	3rd downward button	Y020	Elevator a 2nd
X21	2nd upward button	Y021	Elevator b 2nd
X22	2nd downward button	Y022	Elevator a 1st
X23	1st upward button	Y023	Elevator b 1st
X24	Elevator an open detect	Y024	3rd downward
X25	Elevator a close detect	Y025	2nd upward
X26	Elevator b open detect	Y026	2nd downward
X27	Elevator b close detect	Y027	1st upward

3.3 plc program design

In this system, ladder diagram instruction is written in mitsubishi Gx Developer Version 8.6 environment, using the modular structure design, realized the integration of two elevator of various functional modules respectively design into small independent subroutine, facilitate sharing installation, debugging and reading. Modularized program is divided into: open and close program, inside and outside called response program, the layer of prompt program, flat layer program and stop program. Since the two elevators coordinated operation is the key point of the lift program design, elevator a and b should response to their inside calls, and coordinated response to outdoors calls, these all according to the program designed by software. The running state was divided into ascending and descending, TDD and clearing program should have a response signal, etc. Take elevator a ascending for example, ascending ladder diagram is shown in figure 2, part of the intermediate relay defined in figure 3.

Figure 2 elevator a uplink program diagram

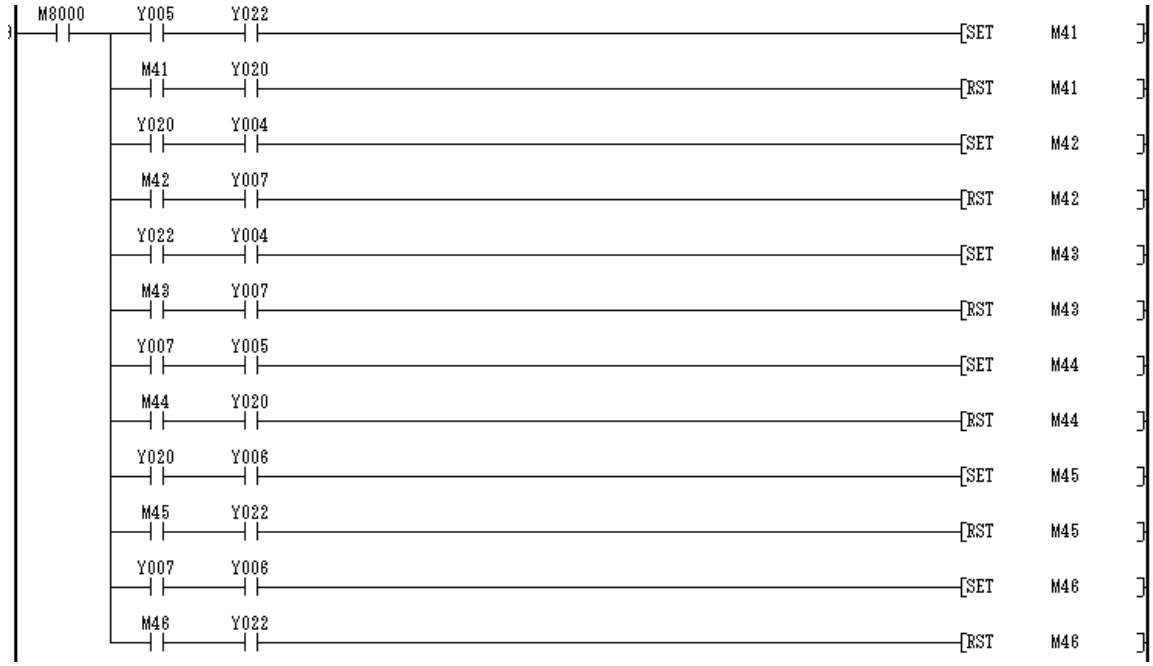

Figure 3 intermediate relay part of elevator running program

If elevator a is on the second floor and b is on the first floor, when there is a downgoing call on the third floor, Y20 electric Y23 electric closed, Y24 electric closed, intermediate relay M67setting, then Y0 electricity closed, elevator a going upward. When detect the elevator a arrive the third floor, elevator a stop.

4. design of the simulation system

Write the PLC program to mitsubishi PLC and then connect PLC and configuration software together. MCGS (Monitor and Control Generated System) is used for rapidly construct and generate the PC configuration software system of the monitoring System, mainly complete field data acquisition and monitoring .It has perfect visibility and maintainability, users can construct their own application systems such as outstanding characteristics only through a simple modular configuration. Since it is very suitable for monitoring and controlling requirements. The monitor model interface established in this paper is shown in figure 4.

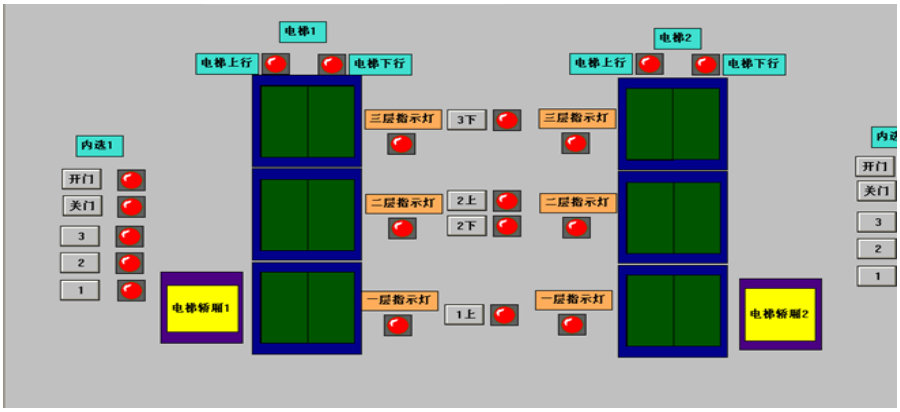

Figure 4 monitoring interface of three-storey double elevators

When connecting to the configuration software, PLC should be put at the STOP state ,after the ladder diagram of software program written to the PLC, then open the PLC to the RUN state, implement configuration software monitoring and simulation of the integration of two elevators.

5. the safety system

There are three dangerous space related to the passengers: floors, shaft and capsules. Inside the floor space is absolutely safe, capsules space is managed to ensure safety, so the space of shaft is the most dangerous. Integration elevator should ensure that the passengers stay in the capsules or outside the floors. When part of the body is on the floor and the other part in the elevator capsules, elevator should not continue at this time, in order to prevent that the elevator suddenly downward lead to passengers crashed into shaft or the elevator suddenly upward lead to passengers' life-threatening and other accidents. Also, suddenly abnormal problems such as acceleration, deceleration, drops will cause psychological and even physical harm to the passengers, in order to reduce the elevator safety troubles, acceleration and deceleration passengers carried should be kept in a safe range. So integration elevators should have electrical and mechanical security, since safety protection system should be perfect and careful, a lot of mechanical safety protection devices, such as slow switch, limit switch, trip switch, etc should be set up. Also electric interlock and self-locking should be applied to ensure safety and reliability of the operation system. In this article the following safety protection devices are set up on the elevators.

(1)The electromagnetic brake

Electromagnetic brake is installed on the axis of the traction machine, it electric brake power when the elevator start, and it brake power after the elevator layer.

(2) Deceleration switch

Deceleration switch is on the top and bottom of the lift shaft, when the elevator arrive the top or the bottom without slowing down, then the car will hit the deceleration switch, forcing the lift to slow down.

(3) limit switch

If the elevator arrive the top, bottom and flat layer zone without stop, limit switch works to force the elevator to stop.

(4) Hall door switch

Each hall door installed lock switch. the elevator is allowed to start only when the hall door switch is closed; When the hall door switch open, the elevator stop immediately.

(5) Limit protection switch

When the limit switch doesn't work, the elevator continued to run over the flat area, limit protection switch work to cut off the power and stop the elevator quickly.

(6) Overweight switch

Set up the overweight switch, the elevator will not run if it is overweight.

6. Conclusions

This article put forward PLC to control the elevator, the elevator PLC control two integration elevator system has strong control ability, high reliability, high efficiency and further ensure the safety of the lift. Designed the integration of two elevator system and determined the process diagram, set the elevator safety protection devices, reasonable arranged travel switch, speed switch, etc. Chose mitsubishi FX2N - 48 MR PLC, reasonable arranged the I/O points and wrote the PLC modularized program in Gx Developer Version 8.6 environment. Configuration simulation shows that the designed system has high efficiency, safety and reliability. Due to experiment limitation. However overweight tips and fire button should be taken into consideration in practical application.

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