

Lift Control System Based on PLC

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Abstract— In this paper we are scheming and construct three level elevator control system and increase its steady state & stability by using a (PLC) programmable logic controller (Allen Bradley Micrologix-1400 BXBA) the software used for communication is RSLogix-500/5000 PLC'S [1]. These are useful in industrial automation where numbers of equipments are replaced by contactor and switches. In this paper Elevator is nothing but the vertical carrying device which is used to transfer the goods and peoples. Limit switch is used for the floor suggestion. The limit switch is used for positioning of floor. DC motor is used for movement of elevator filing cabinet. Electromagnetic type relay is used in organize circuit to control elevator in upward and downward track. As the India is developing country and there are wide increase in high rise buildings and malls. Elevator is integral part of infrastructure by implementing such paper we can reduce the human efforts, accident due to breakage of rope, efficiency and speed of elevator is improved. Even the time can be consumed by using such system. This paper mainly concentrates on programmable logic controller to control the circuit and building the elevator model. In this paper Three level efficient elevator control system is designed which can be used for different elevator control system having different number of floors.

Keywords- PLC, Elevator, limit switch, relay, rope, Push buttons.

I. INTRODUCTION

Due to the cause of rapid population growth at the cities and multi-stored buildings, the need of elevators is being increased. Elevator system is more useful by expanding life standards and awareness to human and with the technologic developments, elevator systems are getting better, faster, stronger and better quality elevators are produced.

With the overall speedy capitalization taking place in all fields the living standard of human being particularly in metros vastly increased as such as industries, malls, hotels etc. Thus the excavation of lift in high rise buildings becomes an important part of infrastructure for the transportation of human and material. So the control system is to be vital for stability and steady state of lift. It guides the lift in what order to stop at Floors, when to close and open the door. This paper describes the application of PLC for elevator control system. The PLC used for the paper is Abmicrologix-1400 using ladder diagram.

II. RELATED WORK

To overcome the problems and improve the reduce energy and consume time, various approaches are proposed and can be found in the literature [7], [11], [13-14].

The early elevators were considered as cabs and driven by hands or by animals or by rope. The creation of screw driver based system was the significant step in elevator's designs, which finally led to the design of latest modern elevators [1]. FPGA technology is the best replacement of Relay logic, PLC and Microcontroller due to its flexibility, lower cost, efficiency, security, operational speed and parallel processing ([3], [4]). For the implementation of different hardware architectures, the

option of reconfiguring the FPGAs by software makes it better option ([5], [6]). PLC's are still preferred in industrial and automation applications but it does not cover all the practical applications. For this reason, researchers are still investigating for other alternatives. One of the best choices for control applications is to implement control algorithms on FPGA. System performance is improved due to parallel processing of PLC instructions. As soon as possible technique to share allocated sources is used to implement different arithmetic operations with single atomic units as used by [3].

A state diagram is simply used to explain the state machine automation graphically. State CAD is used to implement state diagram of elevator control system, which is a graphical tool that express ideas of state machines, as state diagrams [7]. After making state diagram State CAD convert the state diagram into Hardware Description Language (HDL) that can be used as source file in Xilinx paper and changed into schematic symbol Xilinx State CAD include State Bench which is used to see results as waveforms simulation.

Traditional elevator control system is based on Relay logic, PLC and Microcontroller etc. but these systems have reduced number of inputs and outputs [2].

III. SYSTEM ARCHITECTURE

A. System Architecture

The PLC is basically computer-based so, their architecture is very parallel to computer architecture. The memory contains operating system stored in fixed memory like ROM. The application program is stored in read-write memory. Central processing unit (CPU) presents in each and every programmable controllers, power supply, memory, input/output (I/O) modules and programming devises. The operating system is the heart of the system. It is essential to differentiate between

the instructions used by operating system to instruct the central processing unit and the instruction used by the programmable controller to handle the specific control problem. The operation system performs: implementation of application program, Memory organization, the communication stuck between programmable controller and the other units, Input/output interfaces handling etc.

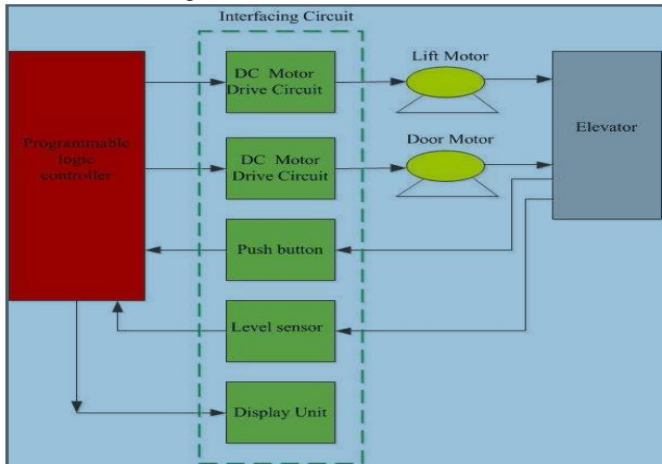


Figure 1. System Architecture.

The central processing unit receiving the instruction from the memory and send a feedback based on the status of the I/O devices. As per directions generates commends to the output by resources of the o/p modules these commands control the o/p elements on a machine or process device such as relay coils, solenoid valves, indicator lamp and motor starters are typical load to be controlled. When program implementation is done than the processor reads all the inputs, takes these morals and according to supervise function curriculum, energizes the outputs, thus solving the ladder system.

B. Block Daigram of Propose System

The main aim of this paper is to develop elevator control system by using PLC to control problem of the stability state. Also reduce energy and time required for certain buildings.

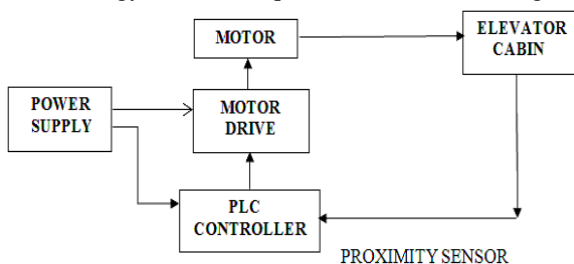


Figure 2. Block Daigram

Elevator control system divided into several sections like: power station, processing station, sensor station etc. The system consists of power supply connected to PLC as well as DC motor. This system is connected to elevator cabin; the use of limit switch is to control the position of cabin and by use of the level sensor limit switch is to control position of the floor and indication of floor by using push button. Also we are using emergency start and shop operation of lift in the case of emergency [4].

IV. HARDWARE & SOFTWARE

- DC Motor
- Cabinet of Lift
- Rope
- Push button Switches
- 24V DC Power supply
- AB-MICROLOGIX 1400
- SENSORS (LEVEL SENSOR , LOAD SENSOR)
- RX Logix-500

A. Design of Caninet

Elevator control system consists of main part as a elevator car in which it is use for vertical transportation purpose. It works to carry passengers between different floors. The second important part is lift, which supports the elevator car to travel between the different floors. System is able to control all possible function as well opening and closing of doors at different floor. The general calculation for elevator [1]:

- No of person accommodate in the elevator is = 8
- Approximate weight of each person =60 kg
- Maximum weight that the cabin can handle = 480 kg

B. Calculation of Rope Strength

- The force which acts on the rope can be given below [1]
- $F=mg$
- $F= (480+100+100)*9.8$
- =6664 N
- The dynamism acting on the string is 6.6kN. So a string with the strength to 7kN conveys at least to be chosen.

C. Limit Switch

The limit switch is used to for motion of elevator. The motion of the elevator is in both directions during operation. . When the elevator starts moving from one floor to another it will operate the limit switch. This gives output signal to PLC. PLC check the status of limit switches and gives exact position

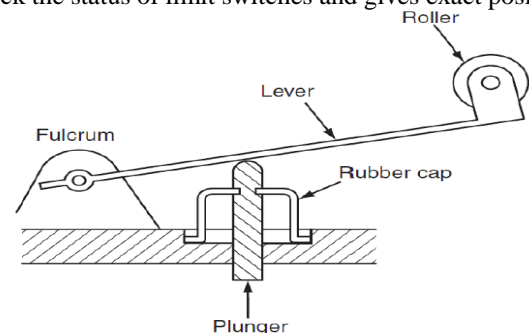


Figure 3. Limit Switch

D. Ladder Logic

In PLC Ladder logic is one of the programming language is used. In ladder logic editor displays program in graphical representation same as that of electrical wiring diagram. Ladder logic programs allow the program to follow the flow of electrical current from a power source throughout a series of logical input conditions that in turn enable logical output condition. A Ladder logic program includes a left power railing that is energized. Contacts that are open block that energy flow.

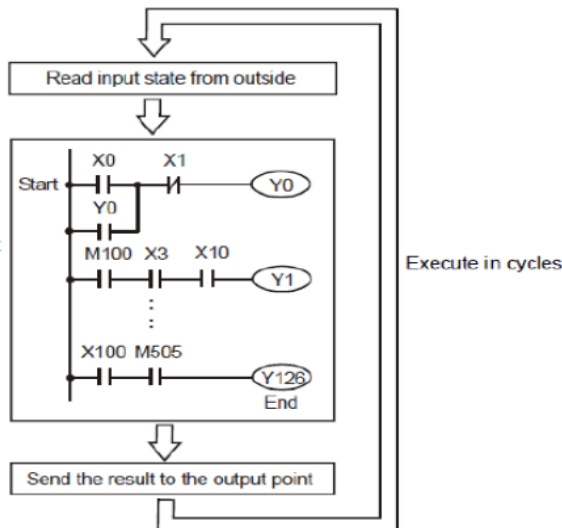


Figure 4. Ladder Logic

V. RESULT

To elevate way is the second most important part of the elevator control system and which supports the elevator car to pass through between the different floors. The Elevator control system is most important parts of the elevator; this system is needed to control all the functions of the elevator. It also controls the opening and closing of doors at different floor, it is the one which guides the elevator car to travel between the different floors; also safety switches are also restricted by the elevator control arrangement. Another most important system which is used in the proposed system is Electric power driving system; this system includes elevator car, the traction motor, door motor, brake mechanism and relevant switch circuits. At this point a load of in the middle of contacts can be substituted by the PLC's associates. The circuit of traction motor are reserved, thus the original control cabinets.

When the purpose to the elevator is agreed by the PLC, it will construct the suitable limit switch ON i.e. it will only sense the limit switch on that floor only. In this way the elevator is move on to the destination correctly. The logic of up- collecting and down collecting is also incorporated in the programming of the PLC. This will enable the PLC to take input signals in between current operation. Electrical engineering a limit exchange is a switch operated by the proposition of a mechanism part or attendance of an article



Figure 5. Elevator System

VI. CONCLUSION

In this paper entire circuit diagram and ladder logic was explained. By using RS-LOGIX 500 we have to developed ladder logic for elevator control. In this paper different sensors are configured at different floors to execute many functions. For whole system we required inputs and outputs for elevators are: forward and reverse motoring, door opening and closing and the indication of floor end of both the door opening and door closing have been included Also the safety of the system can be improved by adopting more safety techniques.

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