Journal of Basic and Applied Engineering Research
p-ISSN: 2350-0077; e-ISSN: 2350-0255; Volume 4, Issue 1; January-March, 2017, pp. 40-43

http://www.krishisanskriti.org/Publication.html

An Interfacing of Elevator with PLC

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Abstract—*Now a days automation is the important field to implement in real world application to reduce the man power from industry to farm field. An elevator is one of the important aspects in automotive application. This paper represent PLC based elevator control system using MITSUBISHI PLC software. The ladder logic has been used to implement the logic for PLC to interfacing with the hardware model. The system is programmed to drive a dc motor for forward and backward motoring mode with proximity switch (sensor-pnp no type) at each floor, emergency STOP switch for maintenance purpose or to prevent any accident inside the lift & door switch for safety purpose. The system is also programmed to conserve energy by automatically switch off lights and fans of cabin when motor is in rest state for a specified duration of time 3sec for door opening and closing.*

Keywords: Elevator, PLC, ladder logic

1. INTRODUCTION

For most people residing in urban cities, elevators have become an integral part of their daily life. Due to the cause of rapid population growth at the cities and multi-stored buildings, the need of elevators is being increased. Elevator control is with a platform which will move up or down through the system as per the instructions or controlling unit for the elevator. Before implementing the elevator using automation there were lot many difficulties were there like high failure rate that were mainly due to numerous contacts, difficulties in wiring to achieve a more complex control function. In this paper The traditionally used relays and IC boards have been replaced by PLC for easy and cheap controlling of machines used in the elevator.

2. PLC AND LADDER LOGIC

A programmable logic controller,PLC or programmable controller is a digital computer used for automation of typically industrial electromechanical processes, such as control of machinery on factory assembly lines, amusement rides, or light fixtures. PLCs are used in many industries and machines. PLCs are designed for multiple analogue and digital inputs and output arrangements, extended temperature ranges, immunity to electrical noise, and resistance to vibration and impact. Programs to control machine operation are typically stored in battery-backed-up or non-volatile memory. A PLC is an example of a "hard" real-time system since output results must be produced in response to input conditions within a limited time, otherwise unintended operation will result. Ladder language (LD) PLC ladder programming language is most commonly used programming languages. It is similar to a relay circuit programming language. Because of electrical control designers more familiar with the relay, therefore, Ladder programming language has been widely welcomed and applications. Ladder logic has evolved into a programming language that represents a program by a graphical diagram based on the circuit diagrams of relay logic hardware. Ladder logic is used to develop software for programmable logic controllers (PLCs) used in industrial control applications. The name is based on the observation that programs in this language resemble ladders, with two vertical rails and a series of horizontal rungs between them.

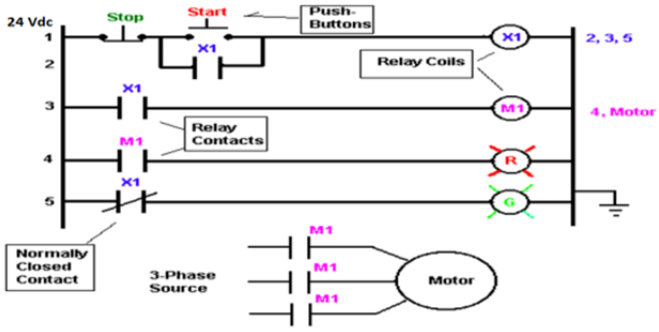

Fig. 1: Example of ladder logic

3. ELEVATOR

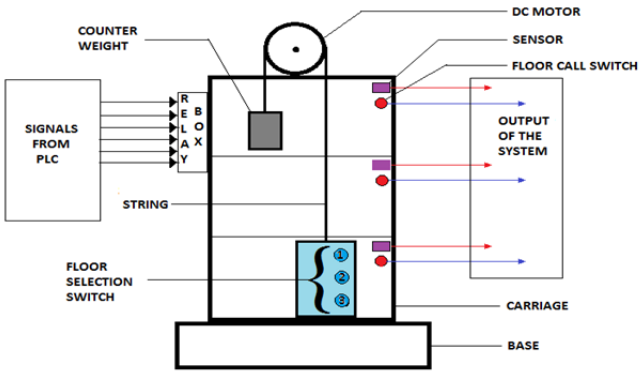

Fig. 2: schematic diagram of elevator

Fig. 3: Model of elevator control(Front side)

Fig. 4: model of elevator control(Back side)

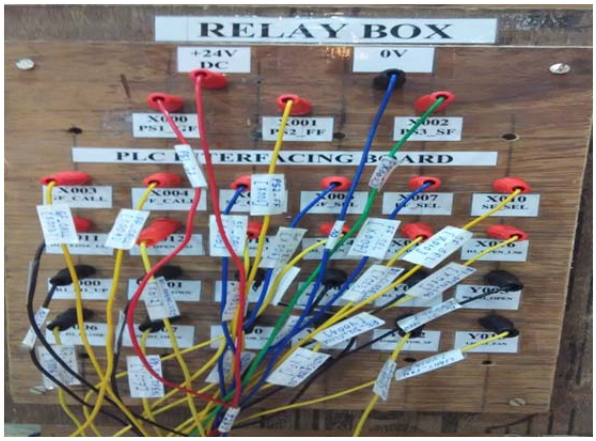

Fig. 5: PLC Interfacing board

4. RESULT ANALYSIS

A person can be in any of the 3 floors.

By default doors of all the 3 floors should remain closed and the platform should be present in the ground floor. For this we have an INITIATOR / EMERGENCY OPERATION switch. Initially if the doors of all the floors are closed then the platform is brought to the ground floor by switching the INITIATOR switch off, and on switching it on if the doors are not closed then it will be closed and the normal operation of the lift is ensured. Hence the sequence should be ON- OFF-ON.

case-1: If the person is in ground floor (outside the lift) and he presses the push button (GF_CALL) for calling the platform to the ground floor.If the platform is in the ground floor i.e. the sensor for ground floor (PS1_GF) is sensing the metal target.The ground floor indicator (INDICATOR-GF) must be glowing till the platform is in ground floor.Main motor should not run.Door-1 (previously closed) should open upon pressing GF_CALL for a specific interval of time and then it will close(D1_OPEN_LS2→open,D1_CLOSE_LS1→close).If the platform is not in the ground floor i.e. the sensor for first (PS2_FF) or second floor (PS3_SF) is sensing the metal target.The platform is brought to the ground floor.Door-1 (previously closed) should open for a while and then it will close.Person presses the selection switches (floor choice).Selection of moving to any floor by pressing **SELECTION SWITCHES** should be effective only after the door is closed.If the person selects ground floor select switch (GF_SEL) motor doesn't run and DOOR-1 will open for a specific interval of time and then it closes.If the person presses the first floor select switch (FF_SEL) the motor starts moving in UPWARD direction until the proximity switch for first floor (PS2_FF) senses the target. Indicator for first floor (INDICATOR_FF) glows and is followed by door opening and closing.Similarly if the person presses the second floor select switch (SF_SEL) the motor starts moving in UPWARD direction until the proximity switch for second floor (PS3_SF) senses the target. Indicator for first floor (INDICATOR_FF) glows and is followed by door opening and closing.

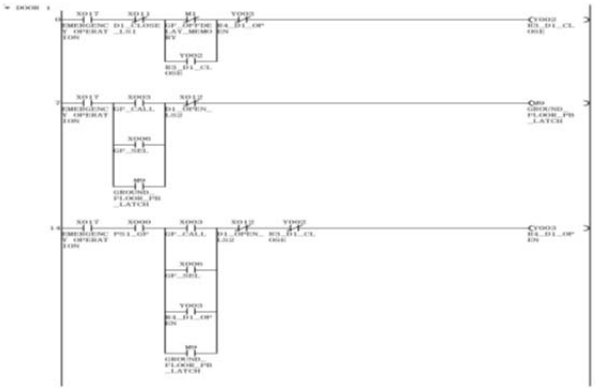

Fig. 6: Ladder logic for Door 1

case-2: If the person is in first floor (outside the lift) and he presses the push button (FF_CALL) for calling the platform to the first floor.

If the platform is in the first floor i.e. the sensor for second floor (PS2_FF) is sensing the metal target. The first floor indicator (INDICATOR-FF) must be glowing till the platform is in first floor. Main motor should not run.Door-2 (previously closed) should open upon pressing FF_CALL for a specific interval of time and then it will close (D2_OPEN_LS4→open,D2_CLOSE_LS3→close).If the platform is not in the first floor i.e. the sensor for ground (PS1_GF) or second floor (PS3_SF) is sensing the metal target. The platform is brought to the second floor.Door-2 (previously closed) should open for a while and then it will close. Person presses the selection switches (floor choice).Selection of moving to any floor by pressing **SELECTION SWITCHES** should be effective only after the door is closed. If the person selects first floor select switch (FF_SEL) motor doesn't run and DOOR-2 will open for a specific interval of time and then it closes. If the person presses the ground floor select switch (GF_SEL) the motor starts moving in DOWNWARD direction until the proximity switch for ground floor (PS1_GF) senses the target. Indicator for ground floor (INDICATOR_GF) glows and is followed by door opening and closing. Similarly if the person presses the second floor select switch (SF_SEL) the motor starts moving in UPWARD direction until the proximity switch for second floor (PS3_SF) senses the target. Indicator for second floor (INDICATOR_SF) glows and is followed by door opening and closing.

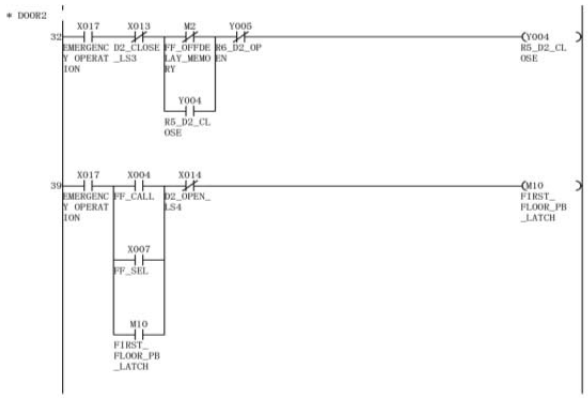

Fig. 7: Ladder logic for Door 2

case-3: If the person is in second floor (outside the lift) and he presses the push button (SF_CALL) for calling the platform to the second floor.If the platform is in the second floor i.e. the sensor for second floor (PS3_SF) is sensing the metal target.The second floor indicator (INDICATOR-SF) must be glowing till the platform is in second floor.Main motor should not run.Door-3 (previously closed) should open upon pressing SF_CALL for a specific interval of time and then it will close(D3_OPEN_LS6→open,D3_CLOSE_LS5→close).If the platform is not in the second floor i.e. the sensor for ground (PS1_GF) or first floor (PS2_FF) is sensing the metal target.The platform is brought to the second floor.Door-3 (previously closed) should open for a while and then it will close. Person presses the selection switches (floor choice).Selection of moving to any floor by pressing **SELECTION SWITCHES** should be effective only after the door is closed. If the person selects second floor select switch (SF_SEL) motor doesn't run and DOOR-3 will open for a specific interval of time and then it closes. If the person presses the first floor select switch (FF_SEL) the motor starts moving in DOWNWARD direction until the proximity switch for first floor (PS2_FF) senses the target. Indicator for first floor (INDICATOR_FF) glows and is followed by door opening and closing .Similarly if the person presses the ground floor select switch (GF_SEL) the motor starts moving in DOWNWARD direction until the proximity switch for second floor (PS1_GF) senses the target. Indicator for first floor (INDICATOR_GF) glows and is followed by door opening and closing.

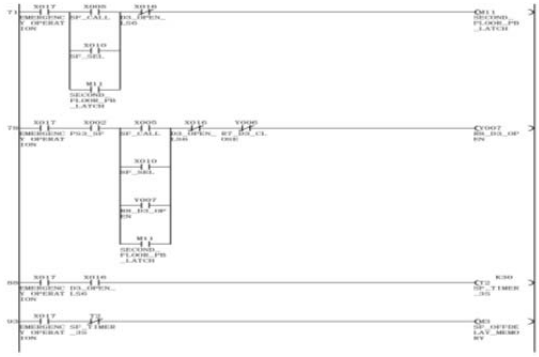

Fig. 8:ladder logic for Door 3

5. CONCLUSION

The elevator is a critical component of the building system. It allows for the efficient vertical transportation of people throughout the building. In the high-rise market; the efficiency of the elevator system is one critical aspect of the property's marketability. For the passenger with disabilities, the accessibility and usability of the elevator systems are even more critical. In developing their new destination-based control system. The practice results that are obtained in real implementation of all experiments in the laboratory and the simulation results by LD program, it can be seen that the implementation of PLC controller with classical control systems is necessary. This implementation has high performance, high accuracy and more speed response compared to the classical controller.

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