

Automation In Conventional Lifts By using PLC

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Abstract

This paper explains control of two floor elevator using PLC. With the increasing life standards and attention to human and with fastly development in engineering for building, the installation of elevators becomes an integral part of the infrastructure for the movement. IN this case one can make the better use of PLC for controlling of lifts which is efficient due to its flexibility, operational speed, reliability, easy to programming, security, and it is easy in implementing changes and minimizing errors. So, the control system is necessary for safe and smooth operation of the elevator. Hence for more efficient performance, more importance is given to the design of an elevator control system. Since output results must be produced in response to input condition within a given time, it is an example of a real time system. Ladder diagram programming is selected as it is easy to program the PLC

Keywords: Elevator, sensors, PLC, floors, motor, switches.

1. Introduction

The main requirement of the multi storage buildings are elevators for movement of goods and people. Elevators ease the work of human being and keep them in comfort zone. Elevator control system is needed to control all the functions of the lifts. In addition, electrical contacts were easy to burn out, which could result in poor contact. One can make the better use of PLC in the designing of the elevator control system. This control is based on the input that is received from the operator as well as from the sensors at every floor. Because of use of PLC, elevator systems are performing better, faster, stronger and best quality elevators are designed. Hence more importance is given to the design of an control system. It is the one which guides the elevator car, which actually carries the passengers between the different floors; it also controls the opening and closing of doors at different floor, and the various safety switches are also controlled by the elevator control system. Preliminarily, old elevator control systems work on the relay logic. Some of the drawbacks of the traditional system are the control system have high failure rate that were mainly due to numerous contacts, complexity of wiring circuit.

2. Literature survey

An elevator is a simple device which is used to save human efforts. Elevator is the good example of law of energy conservation. When peoples are coming down there is small amount of loss in cable and brakes. Lift installation consist of cover design, supply delivery installation, testing and commissioning of passenger lift. It also consists of rope pulley arrangement. The machine shall be placed directly above the hoist way upon the machines room slab. Speed regulating system in elevator is called as governor. The lift is balanced by a heavy counterweight that weighs nearly the same amount as the car when it is loaded half-full. When the elevator goes up, the counterweight goes down and vice-versa. The counterweight reduces the amount of energy that motor needs to use. Safety brake prevents the elevator car from crashing the floor. The car shall be mounted on the frame so that vibrations and noise get minimized so that, passenger feel comfort in travelling. Controlling of an elevator can be done automatically or manually. When there is overload in the car then buzzer shall operate during this period and the door will be open till the overload is removed. The car enclosure shall include LED bulbs and fan at ceiling. The lift have sensors that the fan is operating only when there is at least one person inside the lift, the car has plain finish for peoples. Lift doors protect

passengers from falling into the shaft. Emergency stop button is on the interior button panel of each cabin. A passenger can press this button to stop the lift no matter where it is in a shaft. The main components of the elevators are the elevator car: elevator car is the main medium of upward/downward transportation; it is actually which carries the passengers between the different floors. Hoist way is the second important part of the elevator control system which supports the elevator car to travel between the different floors. Lift control system is one of the most important part of the elevator, elevator control system is needed to control all the functions of the elevator. It is the one which guides the elevator car to travel between the different floors; it also controls the opening and closing of doors at different floor, and the safety switches are also controlled by the elevator control system. Electric power driving system is another important system which is used in the proposed system, this system includes elevator car, the traction motor, door motor, brake mechanism and relevant switch circuits. Here plenty of intermediate contacts can be substituted by the PLC's contacts. The circuit of traction motor are reserved, thus the original control cabinets disadvantages like high noise and big volume are sufficiently reduced.

3. Proposed system

For controlling elevator we are using PLC. We give the sensor as an input to the PLC. As per our requirement we choose sensors like IR sensors, oxygen sensor, load cell etc. IR sensors are used for detecting object. It prevents the door closing when a person or object is present in between. It is also used to detect floor. The limit switches are used for holding a car in correct position at each floor. Load cell is used to measure weight present in car. Oxygen sensor is the additional feature used in elevator. Whenever there is any failure in supply system and lift is blocked, then oxygen level in car will go on decreasing and it may harm people which are locked inside and hence oxygen sensor is used which senses oxygen level and when it detects minimum set level it will give an signal to PLC so that car will be moved to nearest floor and will open the door. It is connected to analog input module of PLC. One of the classes represents all the automata. This contains seven automata. Two threads are used in the given implementation. The development of nine storage elevators control system for a residential building is given. The control system adopts PLC as controller, and uses a parallel connection dispatching rule based on minimum waiting time to run two elevators in parallel mode. The authors developed the elevator control program for the sake of simplicity three storage building is considered. The organization of this paper is as follows Section 2 presents the elevator system structure, The block diagram of the proposed system is presented below.

- **BLOCK DIAGRAM OF ELEVATOR CAR**

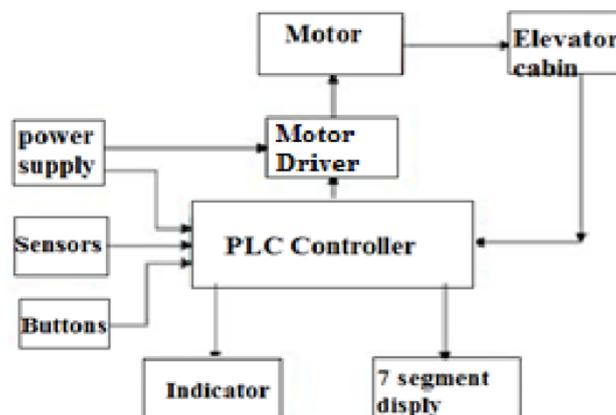


Fig. 1: Block Diagram of an Elevator

3.1. PLC Controller

PLC controller is main element in this system which controls elevator functions. A PLC is

user friendly microprocessor based specialized computer that carries out control function of many types and levels of complexity. PLC receives input signal from operator or various sensors used at different floor for performing many functions. PLC controller produces control signals via output module which controls the motor operation and feedback is given to PLC controller.

3.2. Elevator Cabin

Elevator cabin is nothing but elevator car which carries peoples as well as goods in upward and downward direction. Lighting and cooling arrangement is also provided in elevator cabin.

No. of switches and sensors are connected in an elevator car. According to conditions present in car respective sensors are operate automatically.

3.3. Power Supply

Power supply is given to PLC controller as well as motor drive circuit. The power available in most plants is 230 volts AC at 50 HZ. Most PLC operates on +5volts and -5volts DC. Therefore the PLC CPU must contain circuitry to convert 230 volts AC input to the required 5 volts DC value.

3.4. Motor

A motor is an electrical machine which converts an electrical energy in mechanical energy. The elevator engine is connected to a pulley with ropes are looped around. The elevator system uses a roped mechanism. The controller interacts with the elevator engine by sending it a signal that specifies at which speed and in what direction the engine should be going in.

3.5. Driver Motor

Driver Motor driver is used to control the motor in forward and reverse direction. There are four switching elements are used. The name H Bridge is derived from actual shape of switching circuit which controls the motion of motor.

3.6. Sensors

A sensor is a device which converts a physical quantity into a signal used by an instrument. A sensor's sensitivity indicates how much the sensor's output changes, when the measured quantity changes. Many sensors are mounted on different floors for performing various applications.

3.7. IR Sensor

IR sensor is used as Obstacle detector. This sensor detects the obstacles. When the IR transmitter emits radiation, it reaches the object and some of the radiation reflects back to the IR receiver. Based on the intensity of the reception by the IR receiver, the output of the sensor is defined. As the output of infrared detector is very small, we need amplifier for signal processing.

3.8. Oxygen Sensor

An oxygen sensor is an electronic device that measures the proportion of oxygen (O₂) in the gas or liquid being measured. It is used in elevator application for protecting people during emergency situation. Whenever there is any failure in supply system and lift is blocked, then oxygen level in car will go on decreasing and it may harm people who are locked inside and hence oxygen sensor is used which senses oxygen level and when it detects minimum set level, it will give an signal to PLC so that car will be moved to nearest floor and will open the door.

• SOFTWARE IMPLEMENTATION

Ladder diagram has commonly used programming languages for the PLC. As it is the simplest method with the basic knowledge of computers and logic circuits one can program the PLC by the use of this method [5].

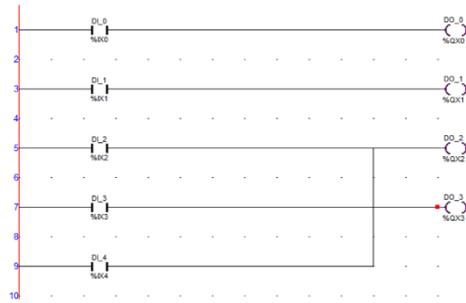


Fig.2. Ladder diagram

Sensors are connected to input module of PLC, while motor driver as well as lighting and fan load is connected to output module of PLC.

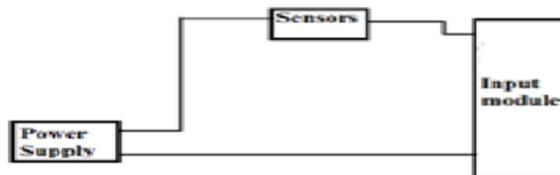


Fig. 4. Interfacing of Sensors with PLC

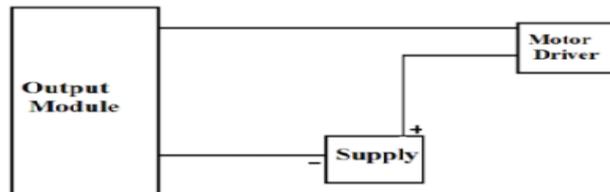


Fig. 5. Interfacing Of Motor Driver with PLC

4. Program control using PLC

There are three different states in this program. All these states are loaded in the Register#0.

1. No Movement / Stop the lift car. This state is indicated as 0 in Regtstor#0.
2. Floor request. This state is indicated as ‘1’ in Register#0.
3. Lift car Movement (Either up or down). This state is indicated as ‘2’ in Register#0. The Lift Car position feedback is stored in Register#2 and the position of the lift is indicated by annunciators 0 to 2 respectively. Floor request is stored in Register#1. Keys 0, 1 arid 2 are used as request keys at Floor Level and Keys 4, 5 and 6 are used as request keys in the lift car for Ground Floor to Second Floor. Stepper motor movement is simulated in both registers.

5. Advantages and Disadvantages

5.1. Advantages

- Automatic door opening and closing helps to increase comfort.
- Load cell which also functioning as sensor can result in reduced energy usage.
- Oxygen level sensing adds extra safety feature in case whenever there is any failure in supply system.
- Emergency alarm can reduce accidents and risk.

- More flexible.

5.2. Disadvantages

- More costly as compared to microcontroller based control as PLC is used.

References

- [1] Darshil, Sagar, Rajiv, Satyajit A. Pangaokar, and V.K. Sharma, “Development Of A Plc Based Elevator System With Colour Sensing Capabilities for Material Handling In Industrial Plant” IEEE 2008.
- [2] Manjunatha “Postal Automation System for Mail Sorting”, IRJET 2015
- [3] Albert T. Jones, Chales R. Maclean, ”A proposed hierarchical control module for automated manufacturing system”, National Bureau.
- [4] Programmable Logic Controller by Gaerry Dunning
- [5] Contour-based Object Detection in Automatic Sorting System for a Parcel Boxes(ICAMIMIA 2015

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