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# Design and Fabrication of PLC Based Elevator

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**ABSTRACT:** Tough practically elevators are not controlled by PLC, still we employed it, because elevator is an appropriate system where we can explore a lot of features of the PLC. As it is a mere model only, while shifting to practical elevator some module of our model need to be replaced, viz. DC motor drive need to be replaced by an induction motor drive, a weight counter-balancing technique should be employed. But as our target of doing this project is mainly PLC oriented, we mainly focused in PLC ladder logic and how to connect an external hardware/system with the PLC to control that hardware.

We summarize the design and implementation of a laboratory model “PLC based Elevator” and its control. We focus on the hardware and software components and on the process of design, actual implementation and application control.

**KEYWORDS:** Elevator control system, PLC, PLC programming

## I. INTRODUCTION

Elevators are an important means of transportation in skyscrapers. Buildings are getting taller with the development of better building techniques. Therefore, elevators become an important medium of vertical transportation. Therefore, it becomes more important to design an elevator control system that is easy to maintain and performs efficient functions. Structural and architectural engineering of skyscrapers today has made remarkable progress. The main requirement for multi-storage halls is elevators. Elevators make working people easier and keep them in a comfortable place. Since elevators are used in multi-warehouse buildings in almost all large cities, it is important to replace conventional elevators with elevators based on PLC technology.

A traditional elevator control system is a relay logic control system. These relay control systems have some limitations: The error rate is high, the circuit is very complicated, and it is difficult to replace the broken parts of the automatic system. Providing fault tolerance using relay logic is difficult. PLCs are an alternative to relay logic control, allowing you to make better use of PLCs when designing elevator control systems.

It is not easy to lift manually using a crank or the like. Traditional elevator control systems initially work with relay logic. Therefore, it became difficult to debug system failures. Also, facilitating alternate connections to fault-tolerant systems with relay logic is a very feasible task and as easily debug gable as a PLC-based system. Debug faults in the system you want to debug because it contains simple logic and easy maintenance.

A programmable logic controller (PLC) is a specialized digital computer used to automate industrial processes. PLCs are used in many industries, such as food processing, robotics manufacturing and control, and conveyor systems. Programs are typically stored in non-volatile memory and control the operation of the machine.

The main purpose of this project is to design a laboratory model and implement an elevator control algorithm using a PLC.

## II. RELATED WORK

Due to rapid population growth in cities and presence of multi-storied buildings, the need of elevators is increasing. With better standard of living, the installation of elevators has become an integral part of the modern world scenario, for the movement of goods and people.[1] Control systems, which provide smooth and safe operation of elevator are in demand. The main components of the elevators are the elevator car: elevator car is the main medium of vertical transportation; it is actually which carries the passengers between the different floors.[2] The improvements are referred to flexibility, safes and low maintenance costs, and the reduction in start-up and operation times (Cox, 1986). The growing up success of this equipment brought a high diversity of PLCs into the shop floor.[6]

## III. METHODOLOGY

The main target of this project is to know the designing and working of multistage PLC based elevator. Using a PLC program. We can Run the multistage elevator by “Programable Logic Controller” also called as PLC. The Elevator can lift Heavy load from one floor to another. Programmable logic controller makes this process very easy. By using DC motors which can be control by PLC elevator runs properly. This Project is a Laboratory Purpose model which consists DC motors, sensors, PLC and many other components. It is helpful to study the design of the elevator and working of PLC program which is made for running the elevator. It can also give some basic knowledge about PLC program making.

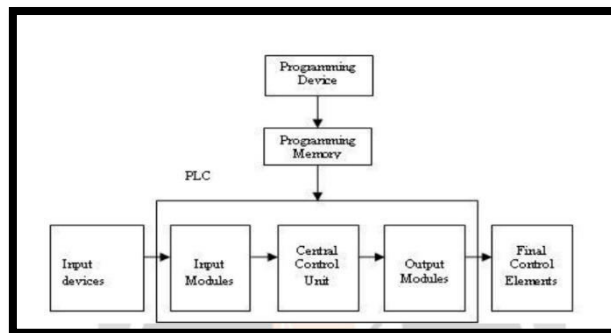


Fig. No. 3.1: Block Diagram of Elevator Control System Using PLC

The design can be divided into several sections such as sensor section, power section, processing section, PLC based Elevator control system Supply is given to PLC as well as to the dc motor. This is connect with the elevator cabin the use of limit switch the position of the cabin will be determined and by using the level sensor limit switch the position of the floor and indication of floor is by using the push button and we are using the emergency start and stop button to stop the operation of lift in the emergency cases figure 1 shows the block diagram of elevator control system by using plc.

## IV. KEY COMPONENTS

### a) Limit Switch:

The limit switch forms part of a power line supplying power to the drive system for controlling movement of the car in a direction towards that end position in an inspection operation. Thus movement of the car is prevented only in that direction when the car is in the selected distance range in an inspection operation. The circuit is opened or closed when a magnetic field is applied to the switch via a magnet or a coil. Because these switches can be used in alternating and direct current circuits, they are ideal for elevator applications. A limit switch can be used for controlling machinery as part of a control system, as a safety interlock, or as a counter enumerating objects passing a point. Limit switches are used in a variety of applications and environments because of their ruggedness, ease of installation, and reliability of operation.



Fig.No.4.1 Limit Switch

**Specifications:**

- Type – S3-1370 (NC type)
- Switch Method – Return Roller Connection
- Rated Voltage – AC/220V DC/ 110V
- Rated Current - AC/ 2A DC/ 0.3A
- Actuating Method – DC

**b) DC Geared Motor:**

The 12V DC Motors are very popularly used in robotics applications. The gearbox of the motor helps in providing greater torque that is required to drive robotic vehicles. Based on the gearbox design the RPM and Torque of the motor will vary. Larger DC motors are used in hoists, elevators, and electric vehicles. A 12v DC motor is small and inexpensive, yet powerful enough to be used for many applications.

A geared motor is a component whose mechanism adjusts the speed of the motor, leading them to operate at a certain speed. geared motor have the ability to deliver high torque at low speeds, as the gearhead functions as a torque multiplier and can allow small motors to generate higher speeds.



Fig.No.4.2 DC Motor

**Specifications:**

- Voltage – 12V
- RPM – 150 Rpm
- No Load Speed – 10 Rpm
- Output Torque – 5.9 kg.cm
- Rated Current – 0.6 A



**c) PLC- Programmable Logic Controller:**

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.



Fig.4.3. PLC Trainer kit

**Specifications:**

- Back panel mounted compact PLC with 32-bit RISC
- DC inputs(24v)
- Support for high speed timer and counters
- Upto 16 input/output ports
- One USB device port

**V. CONSTRUCTION AND WORKING**

**Construction:**



Fig.5.1.Construction of Elevator

The construction of the working mode is starts with the frame/body pf the working model. With the help of a steel framework, the elevator is built a steel framework to retain longevity and strength of the elevator. Body holds and contain almost all the other components of the working model so that design of the working model so that it can sustain various stresses and vibration that exerted during the working of the model. After the construction of the body the next part is the working mechanism; Working mechanism should be in height and distance so that it not come in the way of the worker who going to work on this model; The elevator can be constructed with various elevator components or elevator parts that mainly include speed controlling system, electric DC motor, rail, cabin, doors and PLC unit.

### Working:

The working principle of an elevator or lift is similar to the pulley system. A lift pulley system is used to draw the water from the well. This pulley system can be designed with a bucket, a rope with a wheel. A bucket is connected to a rope that passes throughout a wheel. This can make it very easy to draw the water from the well. Similarly, present elevators use the same concept. But the main difference between these two are; pulley systems are operated manually whereas an elevator uses sophisticated mechanisms for handling the elevators load.

Basically, an elevator is a metal box in different shapes which is connected to a very tough metal rope. The tough metal rope passes through a sheave on the elevator in the engine room. Here a sheave is like a wheel in pulley system for clutching the metal rope strongly. This system can be operated by a motor. When the switch is turned ON, the motor can be activated when the elevator goes up and down or stops.

### Objectives:

1. To Design and Fabrication of prototype of Elevator
2. To develop PLC program for Elevator
3. To analyse working of PLC program on Elevator
4. See how elevator is actual work

### VI. ADVANTAGES

1. PLC control system is that it can use the elevator control system of PLC.
2. Maintenance cost is lower.
3. 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.
4. Easy Fabrication
5. Helpful to study working of elevator
6. We can learn the function of OLC.
7. Stresses also can find out using calculation.

### VII. APPLICATIONS

The elevators are widely used for lifting up and down different types of load –

- In apartments of multistore building
- In hotels and stores, etc. for passenger and goods
- For side-walks and garages
- In traction
- In mines for lifting and transporting materials and workers, etc

### VIII. FUTURE SCOPE

In the future, PLCs will continue to evolve while adapting technology improvements in hardware, communications, and software. Part of the evolution will include merging of PLC and programmable automation controller (PAC) functionality, along with advancements to span communications from the plant floor to the top floor. The PLC's hardened embedded processor, running a real-time proprietary operating system, has proven to be a mainstay of the industrial automation world, fighting off all challengers to its supremacy. Microsoft Windows-based open systems have made inroads but lag behind PLCs, a trend expected to continue as the PLC with its purpose-built hardware, specially designed software, and one-supplier support model remains a solid choice for many industrial control applications.

- Nowadays in elevator control model various access control devices are used for safety purposes
- The VFD'S and high-speed motors are used to increase speed and efficiency of elevator



#### IX. CONCLUSION

We conclude that, PLC based elevator for the laboratory development. This model of elevator is designed in order to enhancing the knowledge about Elevator and its programming. The need of this project is completing the laboratory with a PLC based machine and to give the hands-on experience of elevator to the students. It designed in very economical way and help to improving the knowledge of students. This project helps us to know the steps in completing a project work. Thus, completed the project successfully. We Successfully obtained all the objective which we have to achieve and completed this project.

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