AUTOMATIC ESCALATOR CONTROL SYSTEM USING PLC

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ABSTRACT

Today is the world of automation and automation mostly use in industries. When we are talking about automation, we must think about PLC. This project is to design and build an automatic escalator system by using PLC software and also using hardware. This project is about an escalator that will function when there is an object on it. This escalator is a standard design of escalator except it has a sensor. This sensor will detect an object and will start moving when it detected an object. There is a sensor which will switch on and off the escalator. PLC programming has timer tool which will set how long it takes to turn off and turn on the escalator. Moreover, it will count the object that move pass by the sensor by using counter in PLC.

Keyword: *- PLC with software, Escalator design, IR sensor, DC motor.*

1. INTRODUCTION

The basic motto of our project is to conserve energy in escalators so as to reduce energy consumption as well as reduce energy bills. Escalators are use since the beginning of 21st century. However the escalators were made to run even when they are unoccupied. This resulted in wastage of electricity; moreover, it also resulted in increased energy bills.

How electricity is wasted in Escalators?

As the malls theatres and airports run day and night, escalators used in them are also used for the whole day. Now if there is no person using the escalator, still its motor runs idle wasting the precious energy?

Why should we conserve energy in escalators?

Scarcity of electrical energy is increasing day by day. Hence the main objective of the 21st century is to Conserve Energy. Cities are the major energy consumers, as lot of energy is consumed in big cities for luxurious purposes, load shedding is done in small towns and villages on a large scale. Hence to bridge this gap between demand & supply we need to use energy conservation techniques. [4]

Hence we have made a circuit that keeps the escalator operational only when the person intends to use it, however if there is no person using it, then our circuit automatically switches off the motor driving the escalator thus conserves energy.

2. BLOCK DIAGRAM

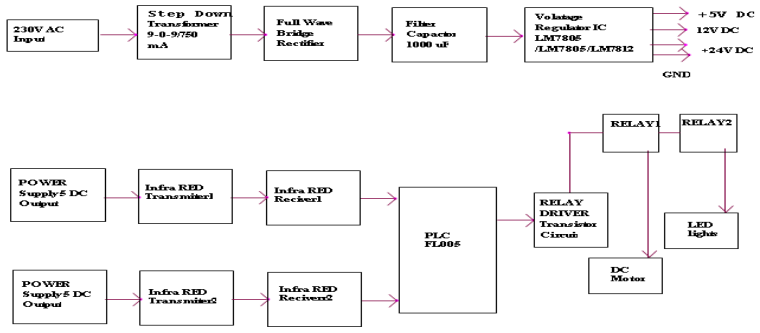

Fig -1: Block Diagram

3. PLC

Day by day new facilities and inventions are introducing in development of the nation which tremendously rises the standard of living of people lives in metro cities. Due to this the construction of buildings are also highly increases for the malls, housing purposes etc. Thus the elevators becomes very important part of such luxurious infrastructure for carrying people and goods. So, control system is essential in the smooth and safe operation of the elevators.

That's why we are using PLC for operation. Programmable logic controller is a digital computer used for automation of industrial processes such as control of machinery on factory assembly lines. Unlike general purpose computers the PLC is also designed for multiple input & output arrangements, extended temperature ranges, immunity to electrical noise, resistance to vibrations and impact. PLC can handle severe conditions like dust, humidity. These are highly reliable fast and flexible. Programs to control machine operation are typically stored in non-volatile memory. A PLC is an example of a real time system since output results must be produced in response to input condition within a given period of time. [2]

In short, this project is to design and construct an automatic escalator using programmable logic controller and IR sensor is used to know the position.

The first Programmable Logic Controller, PLC was developed by a group of engineers at General Motors in 1968. The three main parts of PLC are namely the central processing unit (CPU), the input output selection and the programming device. The block diagram of PLC can be seen as follows. [1]

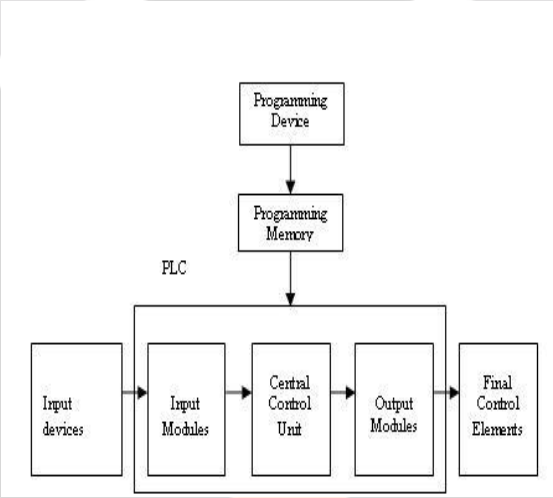

Fig -2: Block diagram representing the different parts of PLC. [1]

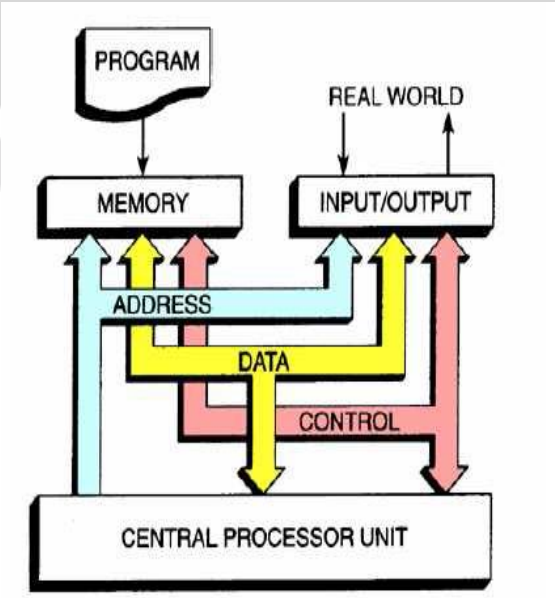

Fig -3: Structure of PLC [5]

3.1 PLC Specifications

Program capacity	33K steps
Total program memory	2.88KB(application+ladder)
Execution Speed	60.0ns/contact 240.01ns/coil 373.35ns/16 bit transfer
Temperature	0 to 60ºc (operating), -20 to 85ºc(storage)
Humidity	10 to 90 % non-condensing
Dimentions (mm)	100mm(H)x26mm(W)x70mm(D)
Weight (approx.)	150 gms.

Table -1: PLC Specifications

4. WORKING

In this project we want to control escalator using PLC. The PLC works on 24V DC power supply. By using step down transformer (230V/24V) we convert 230V AC supply to 24V AC, then full wave Bridge rectifier converts 24V AC into Equivalent DC supply. The filter capacitor of 1000µf converts pulsating DC into pure DC power supply. Voltage regulator IC's 7805 and 7812 gives 5V DC and 12V DC respectively for IR (Infra-red) sensors and Dc motor operations.

When an object is detected by IR sensor it gives necessary signals to PLC. Output of IR sensor is connected to PLC. If person or object is detected by IR sensor, output 1 given to PLC. Similarly if person or object is not present in front of IR sensor the output of PLC is 0. Output of PLC is connected to relay input isolation board. In this PCB opto-coupler circuit is present, this circuit senses input and output is given to the relay board. This isolation board separate input and output ground and provides protection to PLC. Relay circuit controls motor of escalator as per the signals given by PLC.

When an object is detected in front of IR sensor motor starts and escalator moves for specific period of time given in down counter. If one object moving upward and at the same time another object detected by sensor then down counter gets reset and starts counting from initial value.

5. LADDER LOGIC

In this chapter we discuss about the ladder logic network development. Based on our requirements and depending on the need the logic has to be developed and the relevant PLC has been chosen. Here we choose flexisoft for developing and to download ladder logic into the PLC. We developed various logics for different operations of working model of an escalator. [4]

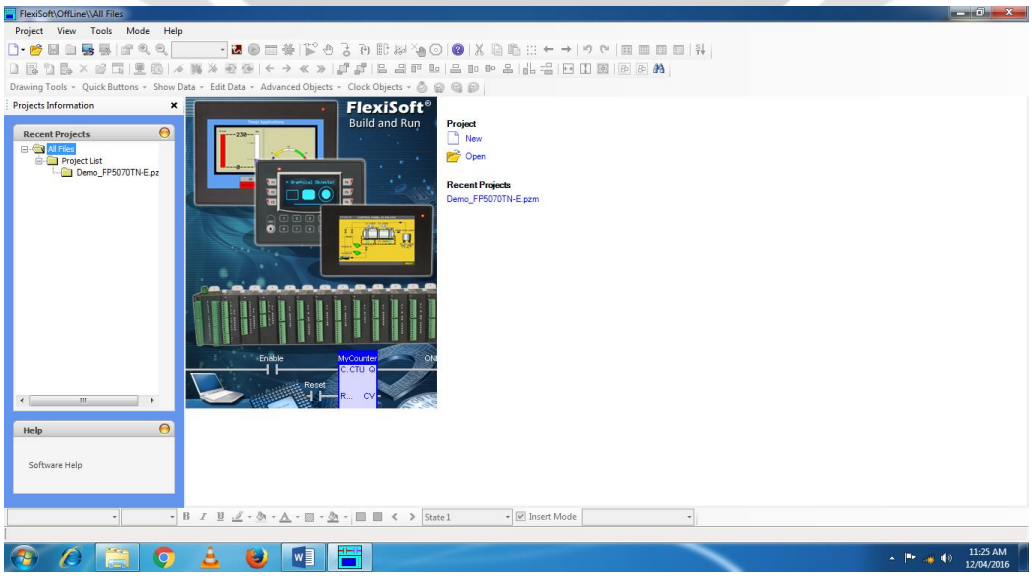

Image -1: Flexisoft Software

6. ADVANTAGES, DISADVANTAGES & APPLICATION

6.1 Advantages

- Due to the use of PLC manual error does not occur in system.
- PLC with monitor continues input supply and taking automatic decision.
- The Escalator can work in automated mode as we programmed as well as in continuous mode.
- Escalator can be made "ON" only when required, thereby saving electrical energy by avoiding unnecessary running of escalator as a conventional one.
- Escalator can be worked on scheduled mode.
- Reduces losses in equipment. If the losses are less then the system efficiency increases.
- The reliability of the system is more.

6.2 Disadvantages

- It is compatible for special purposes application and costly for the general purposes

6.3 Applications

- Department stores/shopping:- As noted above, a few escalator types were installed in stores. Escalators proved instrumental in the layout and design of shopping venues. In Stores and Malls they are actually used to carry Shoppers & Customers from one floor to the next floor.
- Public Transportation: - It help passenger to reach platform on a given time. It also help passengers on airport to undergo fast check-inn and check-outs.
- Industrial Production Environments: - Escalators help to carry its workers between floors four times a day. By using the escalator the efficiency of operator increases because escalator reduces stair climbing efforts.
- Military use: - Escalator also plays an important role in military for the transportation of aircraft and pilots.

7. CONCLUSION

For fulfilling the increasing energy demand it is very essential to use energy efficiently. From this paper the author can conclude that by using PLC and IR sensor more energy can be conserve as compare to traditional technique. This system can easily implemented on modern as well as traditional escalators.

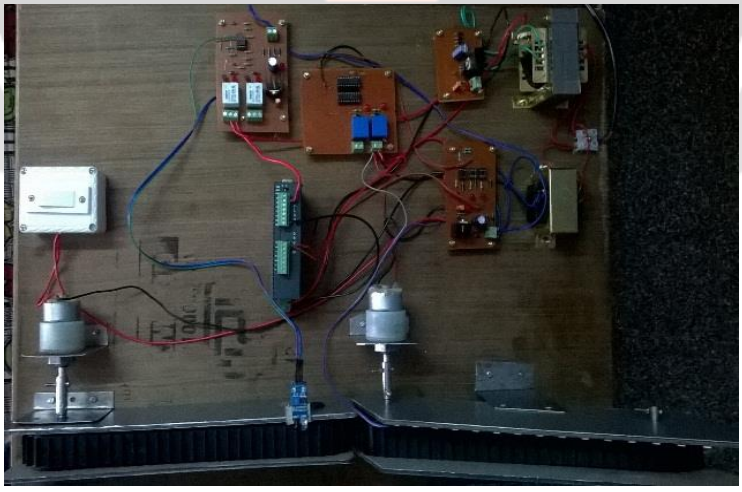

Image -2: Hardware Model

8. ACKNOWLEDGMENT

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