Traffic Light Control System using Programmable Logic Controller (PLC)

Mihir sunil salunke, Siddharth pralhad Pardeshi, Vedant shivaji panchal, Aniket Daniyal Valvi
Students, Sandip foundation
P.G.Mahajan
Project guide, Sandip foundation

Abstract

Traffic congestion is a major problem in modern urban areas due to the rapid increase in vehicle population. Conventional traffic signal systems operate on fixed timing sequences, which are inefficient under varying traffic conditions. This paper presents the design and implementation of a Traffic Light Control System using a Programmable Logic Controller (PLC). The system uses ladder logic programming to control traffic lights in a sequential and automated manner. The proposed system improves traffic flow, reduces waiting time, and enhances safety. The PLC-based system is reliable, flexible, and can be easily modified for future expansion.

Keywords:PLC, Traffic Light Control, Automation, Ladder Logic, Smart Traffic System

I. Introduction

Traffic management is one of the major challenges faced in urban areas. With increasing population and vehicle usage, efficient traffic control systems are essential. Traditional traffic lights operate on fixed timers and do not adapt to real-time traffic conditions, leading to congestion and delays.

Programmable Logic Controllers (PLC) are widely used in industrial automation due to their reliability and flexibility. This paper proposes a PLC-based traffic light control system that automates signal operations using ladder logic programming. The system ensures smooth traffic flow and minimizes human intervention.

II. Literature Review

Several researchers have proposed traffic control systems using PLC and microcontrollers. PLC-based systems are preferred due to their robustness, ease of programming, and real-time operation. Previous studies highlight that PLC systems reduce traffic congestion and improve signal efficiency. Advanced systems integrate sensors and SCADA for intelligent traffic management.

III. System Architecture

The system consists of three main components:

1. Input Section: Switches or sensors to detect vehicle presence

2. Processing Unit: PLC executes ladder logic program

3. Output Section: Traffic lights (Red, Yellow, Green)

The PLC processes input signals and controls outputs based on predefined logic and timing.

IV. Methodology

The system operates based on sequential timing control using PLC timers. The steps involved are:

1. Initialize system

2. Activate Green signal for Lane 1

3. After preset time, switch to Yellow

4. Turn Red signal ON

5. Activate Green signal for next lane

6. Repeat the cycle continuously

7.Timers in PLC control the duration of each signal.

V. Working Principle

The PLC receives input signals and executes ladder logic to control outputs. Each traffic signal operates in a sequence:
Green signal allows traffic movement
Yellow signal indicates transition
Red signal stops traffic
The sequence ensures that only one lane is active at a time, preventing collisions.

VI. Ladder Logic and diagrams

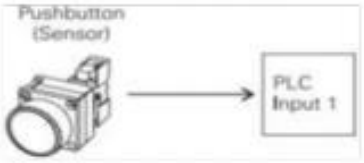


Figure.2. push button contacts

ACTUATOR:

Actuators convert an electrical signal from the PLC into a physical condition. Actuators are connected to the PLC output. A motor starter is one example of an actuator that is connected to the PLC output. Depending on the output PLC signal the motor starter will either start or stop the motor.

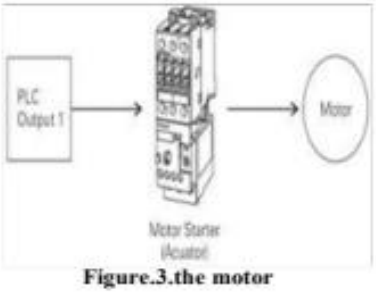


Figure.3.the motor

SWITCHES :

NO=Normally open (open = open circuit=not creating a path for the current)
NC = Normally closed (closed = short circuit = creating a path
for the current)

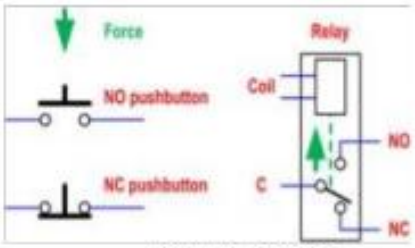


Figure.4. Switches:

TIMER:

Timers are an electronics devices used to to provide time delay at different conditions and situations. Range of timer in logix pro varies from 0-255. In accordance with PLC there are three types of timers-

- ON delay timer
- OFF delay timer Pulse timer
- Pulse extendedtimer

Figure.5. Timer COUNTER:

Counter are electronics devices used for counting positive as well as negative transition 0 to 1 and 1 to 0. There are three types of counter-

- Up counter
- Down counter
- Up-Downcounter

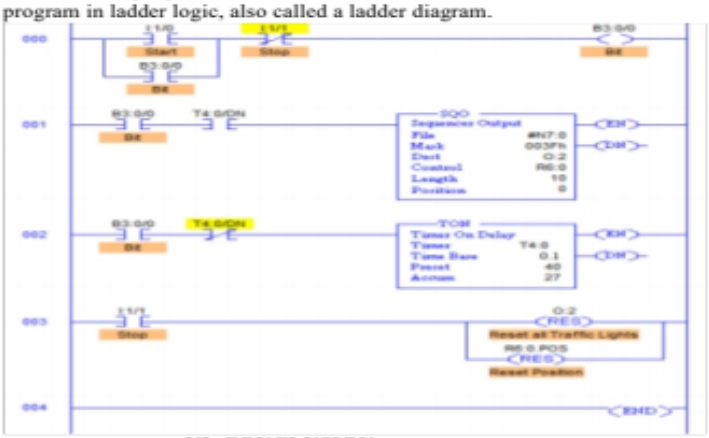
Up counter- It is an electronics device which is used to count only positive transition. To make it excited we will provide interrupted supply to its input terminal. After achieving preset value it will become excited. To make it normal we provide continuous supply to its reset supply.

Down counter - it is an electronics device used to count only negative transition. To make it excited we will provide intrupted power supply to its input terminal. After achieving reset value it gets excited.

V. RESULT AND ANALYS IS:

Ladder Diagram:

It is a graphical programming language, initially programmed with simple contacts that simulate the opening and closing of relays. Ladder Logic programming has been expanded to include functions such as Counters, Timers, shift registers and math operations. Ladder logic is a method of drawing electrical logic schematics. It is now a graphical language very popular for programming Programmable Logic Controllers (PLCs). 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. A program in ladder logic, also called a ladder diagram.



VI. CONCLUSION:

This method will help reduce congestion on roads and would help in coping with accidents as the heavy vehicles and light vehicles will be in different lanes. Resultantly, a solution to a much critical problem of traffic congestion and fatal accidents is possible using this system. Thus the proposed system would make our roads a safer place to travel. An intelligent traffic light system had successfully been designed and developed. The sensors were interfaced with Lab PLC Module. This interface is synchronized with the whole process of the traffic system. This prototype can easily be implemented in real life situations. Increasing the number of sensors to detect the presence of vehicles can further enhance the design of the traffic light system. Another room of improvement is to have the infrared sensors replaced with an imaging system/camera system so that it has a wide range of detection capabilities, which can be enhanced and ventured into a perfect traffic system

REFERENCES:

[1]. Azura CheSoh/Lai Guan Rhung "MATLAB Simulation of Fuzzy Traffic Controller for Multilane Isolated Intersection"

[2]. www.enggjournals.com/ijcse/doc/IJCSE10-02-04-11.pdf

[3]. Monica Vo inescu, AndreeaUdrea, SimonaCaramihal " On Urban Traffic Modelling and CONTROLhttp:// www. ceai. [4]. C. M. Mwangi, S. M. Ka