Traffic Control System using PLC

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Abstract:

The scope of this paper is to present the initial steps in the implementation of a traffic light control system using PLC & SCADA". The SCADA with PLC logic ladder is used for monitoring the system and helps in improving public transport services that also improve traffic guidance. The system developed by setting the appropriate duration for the traffic signals to react accordingly. The critical timing operation is required to be carried out under the existence of heavy traffic conditions. The system for traffic control system must contain low power consumption, low project cost, increases safety. The PLC checks the status of the sensors. The system resolution is dependent on the output provided by the sensors, then PLC checks the priorities and then provide output signal to the traffic light poles for ON or OFF the red, yellow or green lights and ON time is dependent on the specific priorities. The new timing scheme that was implemented promises an improvement in the current traffic light system and this system is feasible, affordable and ready to be implemented especially during peak hours, off hours and pedestrians. The PLC checks the status of the sensors. The system resolution is depend on the output provided by the sensors , Then PLC checks the priorities and then provide output signal to the traffic lights poles for ON or OFF the Red, yellow or Green lights and ON time is depend on the specific priorities. The roads are opened in that manner that east road, west road, north road and then south road is open.

1. INTRODUCTION

Traffic load is highly dependent on parameters such as time, day, season, weather and unpredictable situations such as accidents, special events or construction activities. If these parameters are not taken into account, the traffic control system will create bottlenecks and delays. A traffic control system that solves these problems by continuously sensing and monitoring traffic conditions and adjusting the timing of traffic lights according to the actual traffic load is called an intelligent traffic control system. Traffic signals have strengths and weaknesses that must be considered when deciding whether to install them. Signalintersections can reduce delay for side road traffic and reduce the occurrence of collisions by turning traffic and cross traffic. But they may also cause delay for traffic on the main road, and often increase rear-end collisions by up to 50%. Since right-angled and turn-against-traffic collisions are more likely to result in injuries, this is often an acceptable trade-off. A variety of different control systems are used to accomplish this, ranging from simple clockwork mechanisms to sophisticated computerized control and coordination systems that self-adjust to minimize delay to people using the road. We need to understand the function of traffic signals so that we can improve driving habits by controlling the speed in order to reduce the number of associated traffic accidents. The more number of driverswho know about the operation of traffic signals, the less frustrated they are going to be while waiting for the lights to change. The main aim in designing and developing of the Intelligent Traffic Signal Simulator is to reduce the waiting time of each lane of the cars and also to maximize the total number of cars that can cross an intersection given the mathematical function to calculate the waiting time. The Intelligent Traffic signal Control System consists of three important parts. The first part is the PLC controller and second part is hardware. These usually comprise of red, yellow, and green lights. The third part

is the sensor. The sensors check the presence of vehicles.

1.1 Overview Of Traffic Light System

Before traffic lights traffic police controlled the flow of traffic. On 9 December 1868, the first, non-electric, gas-lit traffic lights were installed outside the Houses of Parliament in London to control the traffic in Bridge Street and Parliament Street. They were proposed by the railway engineer J. P. Knight of Nottingham,. The main reason for the traffic light was that there was an overflow of horse-drawn traffic over Westminster Bridge which forced thousands of pedestrians to walk next to the Houses of Parliament. The design combined three semaphore arms with red and green gas lamps for night-time use, on a pillar, operated by a police constable. The gas lantern was manually turned by a traffic police officer, with a lever at its base so that the appropriate light faced traffic. The signal was 22 feet high. The light was called the semaphore and had arms that would extend horizontally that commanded drivers to "Stop" and then the arms would lower to a 45 degrees angle to tell drivers to proceed with "Caution". At night a red light would command "Stop" and a green light would mean use "Caution". Although it was said to be successful at controlling traffic, its operational life was brief. It exploded on 2 January 1869, as a result of a leak in one of the gas lines underneath the pavement, injuring or killing the policeman who was operating it.

• Traffic lights are signaling devices positioned at road intersections, pedestrian crossings   are today used in almost every city of the world

• On December 10, 1868, the first traffic lights were installed outside the British houses of parliament in London, by the railway engineer J.P. Knight.

• The modern electric traffic light is an American invention; policeman Lester Wire invented the first red-green electric traffic lights.

1.2. What is PLC?

A PROGRAMMABLE LOGIC CONTROLLER (PLC) is industrial computer control systems that continuously monitors the state of input devices and make decisions based upon a custom program to control the state of output devices. It is designed for multiple inputs and output arrangements, extended temperature ranges, immunity to electrical noise, and resistance to vibration and impact. Almost any production process can greatly enhance using this type of control system, the biggest benefit in using a PLC is the ability to change and replicate the operation or process while collecting and communicating vital information. Another advantage of a PLC is that it is modular i.e. you can mix and match the types of input and output devices to best suit your application. A programmable logic controller (PLC), or programmable controller is an industrial digital computer which has been ruggedized and adapted for the control of manufacturing processes, such as assembly lines, or robotic devices, or any activity that requires high reliability control and ease of programming and process fault diagnosis.
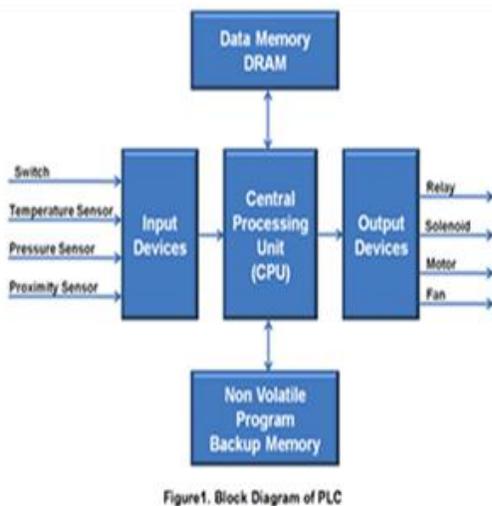

Figure1. Block Diagram of PLC

1.3 Software Used:

Introduction to LogixPro Lab
This is a self-paced lab that will introduce the student to the LogixPro PLC Simulator software. In this lab the student will

 a) Install LogixPro Create a new project
 b) Select a simulator panel
 c) Enter several rungs of ladder logic including branches
 d) Simulate going online with the PLC and running a program
 e) Learn how the simulator I/O interacts with the program code
 f) discover some of the quarks to avoid when using LogixPro

PREREQUISITIES
• Hands-on experience with Windows 2000, Windows XP or Windows Vista
• Successfully completed the Introduction to RSLogix 500 lab
Completing this lab teaches the student how to:
1. Start the LogixPro software
2. Change simulations

3. Change the switch type in the I/O simulator panel
4. Enter rungs of ladder logic
5. Download a project file to the simulated PLC
6. Run the PLC program
7. Adjust scan time
8. Understand I/O interaction, XIC/XIO contacts, OTE coils.

TERMINOLOGY

SENSOR:
A sensor is a device that converts a physical condition into an electrical signal for use by the PLC. Sensors are connected to the input of a PLC. A pushbutton is one example of a sensor that is connected to the PLC input. An electrical signal is sent from the pushbutton to the PLC indicating the condition (open/ closed) of the pushbutton contacts
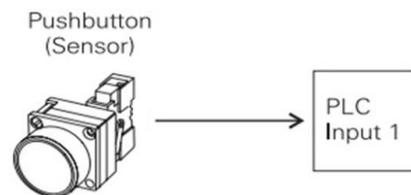

Figure.2.pushbutton contacts

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.
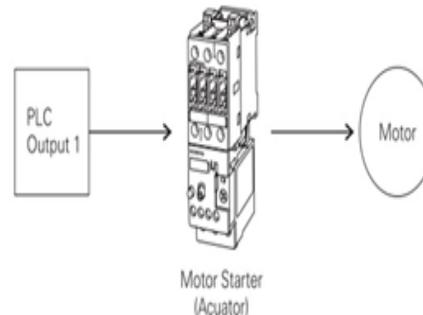

Figure.3.the motor

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)
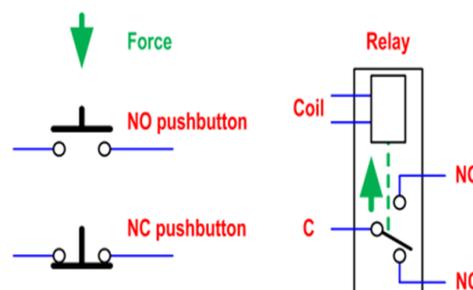

Figure.4. Switches:

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 extended timer

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-Down counter

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.
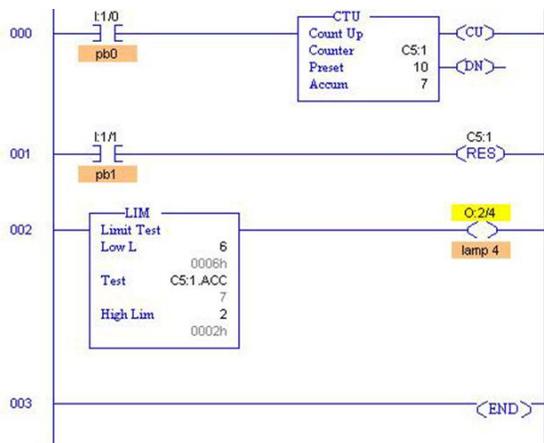
II. RESULT AND ANALYSIS:

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.
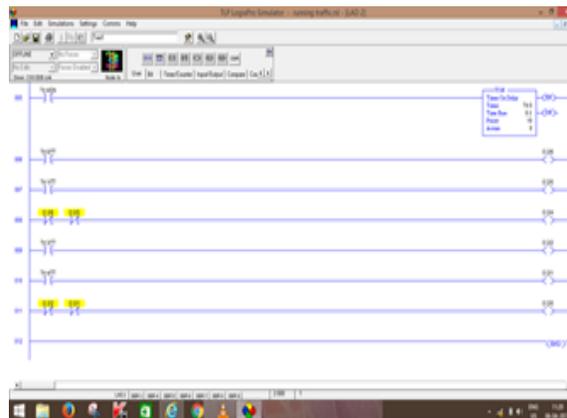

Figure.6. ladder diagram.

PLC operates by continually scanning the program and acting up on the instructions, one at a time, to switch on or off the various outputs. In order to does this PLC first scans all, the inputs and stores their states in memory. Then it carries out program scan and decides which outputs should be high according to the program logic. Ladder Logic is a graphical programming language, initially programmed with simple contacts that simulates 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)

PROCEDURE

- Make a Ladder Logic of working of Traffic Light.
- Save the program on Logic Pro Software.
- Simulate the program and check for errors.
- Run the program using run option. Program is complete.

Advantages

Traffic signals help control the flow of vehicles, pedestrians and bicycles by giving "right-of-way" to the various movements in an orderly manner. Signals that are properly located, designed and maintained can:

- Provides orderly movement of traffic.
- Increases capacity of the intersection.
- Reduce frequency and severity of certain types of crashes, especially right-angle collisions.
- Provide for continuous movement of traffic at a definite speed along a given route
- Interrupt heavy traffic at intervals to permit other vehicles or pedestrians to cross.

Disadvantages:

Traffic signals are sometimes considered problems at intersections. In fact, traffic signals that are poorly located can

adversely affect the safety and efficiency of vehicle, bicycle and pedestrian traffic. Improper or unjustified signals can result in one or more of the following:

- Significant increase in the frequency of some types of collisions
- Increased congestion, air pollution, and fuel consumption.
- Excessive delay.
- Excessive disobedience of the signal indications.
- Increased use of less adequate streets as motorists attempt to avoid the traffic signals.
- Frustration especially in hot weather.

III.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

IV. ACKNOWLEDGMENTS

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