PLC based Traffic Density Control using Sensors

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Abstract— The main work of the system will be control the flow of traffic as per the flow and indicate that which lane will be open next by seven segment LED and we can manually open that lane and close other lanes for ambulance with the indication light that indicates next cross road carries heavy traffic. As we know Traffic signals are the most convenient method of controlling traffic in a busy junction. Present traffic signals fail to control the traffic effectively when a lane has got more traffic than the other lanes. In this paper an intelligent traffic control system using PLC is proposed. System measures the traffic density on each road by counting the number of vehicles and then takes the decision. Programming is done using ladder diagram. RSLogix PLC is been used for the system implementation.

Key words: PLC, Sensors, Seven Segments, Traffic Light

I. INTRODUCTION

Here we are going to make the project on the traffic density control system. It is basically use to control the traffic density. In our project, at any particular lane containing more than the expected traffic is present then this lane will be provided more time to be pass.

Similarly if the next cross road contains more traffic then it will be shown in the previous cress road in the LED then when the traffic is heavy at the next cross road then the driver can decide to chance the rout which can save his tine. So it can very much helpful for the traffic and if there is more traffic then it will sense by the sensor on the roads at some distance. At the lane number 1 then sig is red, when the green will get off and the traffic will get off at lane 1.

After that at the lane 2 the green light will get on and the red light gets off. When the green light is near to be off then at that time the yellow light will get on the yellow light will blink at that time. This system will control the density of the traffic and it will get very properly managed by this system.

The main aim of designing AI traffic controllers is that the traffic controllers have the ability to adapt to the real-time data from detectors to perform constant optimizations on the signal timing plan for intersections in a network in order to reduce traffic congestions, which is the main concern in traffic flows control nowadays, at traffic intersections [1]. A traffic light group is defined as a set of traffic lights which are controlled by the same regulator, which acts as a master or coordinator. The regulator operates under a intelligent system that allows for controlling the lights status depending on time, traffic conditions, etc. Urban traffic control strategies are based on lights controllers. An intersection is managed by a controller in charge of several red lights. The management is based on phases, cycles, split vectors and coordination between the controllers of the different intersections on the road network [2].

To implement the applications indicated, a certain level of intelligence is required in both the traffic light and the regulator. Traditional traffic control systems are unidirectional, from regulator to traffic lights, without any response from the status of the traffic lights [3]. One strategy for optimum control and traffic management is the coordination of traffic lights to create green waves. Currently, there exist different strategies to calculate green waves. The main purpose of these techniques is to reduce the number of stops and minimize the travel times in trips [4].

II. CIRCUIT DIAGRAM

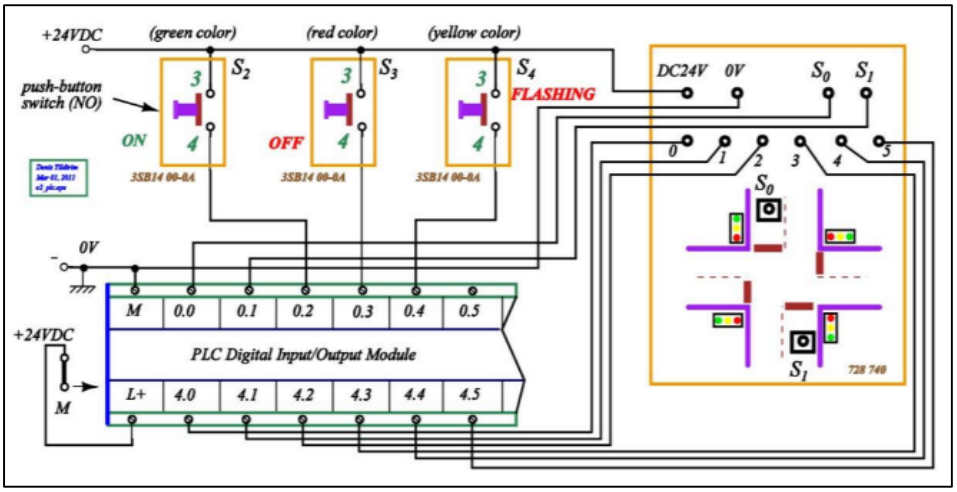

Fig. 1: Circuit Diagram

III. NEW APPROACH

A. Next Crossroad Traffic Indication

It is the solution for the problem like you are on the current cross roads the traffic is going smoothly but if on the next crossroads, you are being to go and there is such a heavy traffic is going on. So, we are putting the one indication light of red colour if there is such a heavy traffic on the next cross road so that light will on and people can know that there is traffic on the next

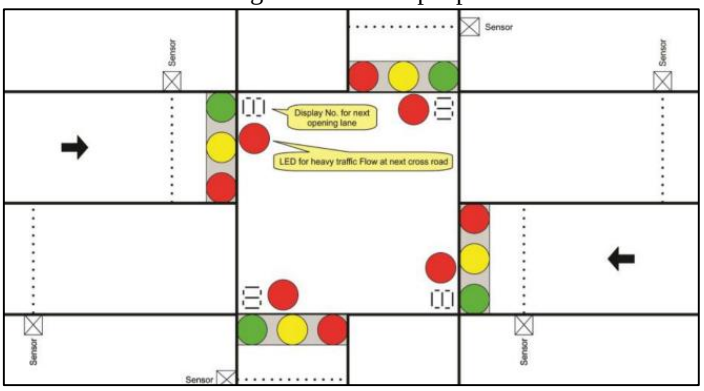

Fig. 2: Cross Road

Cross road so if they want they can change their lane or way.

B. Emergency Switch

If ambulance or firefighting van is coming, then we are putting one push button for emergency case only. This process will be manually operated. In this the person who is in the control room will observe that if ambulance is coming or not with the help of cameras. If that person seems the ambulance or firefighting van is coming so that person will inform the police officer available on the cross roads so that police officer will use the emergency switch so automatically the lane will open from which ambulance or firefighting van is coming.

IV. SYSTEM DESIGN

A. Hardware

1) PLC

Fig. 3: AB SLC 500

A programmable logic controller (PLC), also referred to a programmable controller, is the name given to a type of computer commonly used in commercial and industrial control applications. PLCs differ from office computers in the types of tasks that they perform and the hardware and software they require to perform these tasks. While the specific applications very widely, all PLCs monitor inputs and other variable values, make decisions based on a stored program and control outputs to automate a process or machine.

The basic elements of a PLC include input modules or points, a central processing unit (CPU), output modules or points, and a programming device. The type of input modules or points used by a PLC depends upon the types of input devices used. Some input modules or points respond to digital inputs, also called discrete inputs, which are either on or off. Other modules or inputs respond to analog signals. These analog signals represent machine or process conditions as a range of voltage or current values. The primary function of a PLC's input circuitry is to convert the signals provided by these various switches and sensors into logic signals that can be used by the CPU. The CPU evaluates the status of inputs, outputs, and other variables as it executes a stored program. The CPU then sends signals to update the status of outputs. Output modules convert control signals from the CPU into digital or analog values that can be used to control various output devices.

PLC Definition by NEMA- The NEMA defines a PLC as a "Digitally operating electronic apparatus which uses a programmable memory for the internal storage of instructions by implementing specific functions, such as logic, sequencing, timing, counting, & arithmetic for control machines and processes by NEMA.

2) Sensors

Fig. 4: PNP Sensor

A photoelectric sensor, or photo eye, is an equipment used to discover the distance, absence, or presence of an object by using a light transmitter, often infrared and a photoelectric receiver. They are largely used in industrial manufacturing. There are three different useful types: opposed (through beam), retro-reflective, and proximity-sensing (diffused).

A proximity-sensing (diffused) arrangement is one in which the transmitted radiation must reflect off the object in order to reach the receiver. In this mode, an object is detected when the receiver sees the transmitted source rather than when it fails to see it. As in retro-reflective sensors, diffuse sensor emitters and receivers are located in the same housing. But the target acts as the reflector, so that detection of light is reflected off the disturbance object. The emitter sends out a beam of light (most often a pulsed infrared, visible red, or laser) that diffuses in all directions, filling a detection area. The target then enters the area and deflects part of the beam back to the receiver. Detection occurs and output is turned on or off when sufficient light falls on the receiver.

The detecting range of a photoelectric sensor is its "field of view", or the maximum distance from which the sensor can retrieve information, minus the minimum distance. A minimum detectable object is the smallest object the sensor can detect. More accurate sensors can often have minimum detectable objects of minuscule size. emitter and receiver are housed together and requires a reflector. An object is detected when it interrupts the light beam between the sensor and reflector. These photocells allow longer sensing distances, as the rays emitted are almost totally reflected towards the receiver.

3) Software

Fig. 3: Software

RSLogix 500 is a software we are using for the programing. In this program there is various instruction we have used like input switch NO, input switch NC, timer TON, output.

After the design of program, we can download and run, it will show the working of the entire program.

After that we can download that program on the plc setup and then we can run it on our hardware.

4) Indicating Lights

Fig. 4: Amber LED

This amber LED used for indication in the different colour showing the different purpose of a colour of the LED. These LED has a 24V of operating voltage basically used for the PLC technology. The LED is a light source which uses semiconductors and electroluminescence to create light. Large LED array designed for use as a street lamp. A massive aluminum heat sink is needed with the high wattage LEDs. Most types can be operated with battery power supplies. LED driver is required to convert the alternating current from the power supply to the regulated voltage direct current used by the LEDs.

V. SOFTWARE SIMULATION

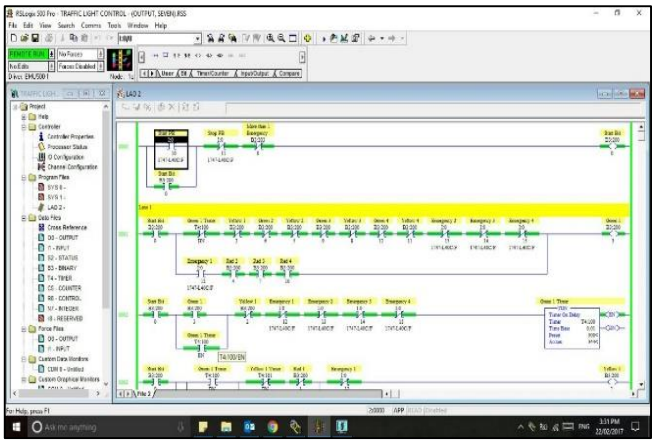

Fig. 5 Green light is on

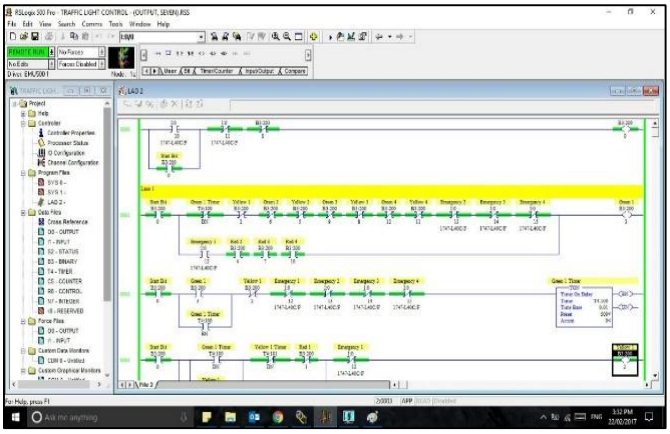

Fig. 6 Yellow light is on

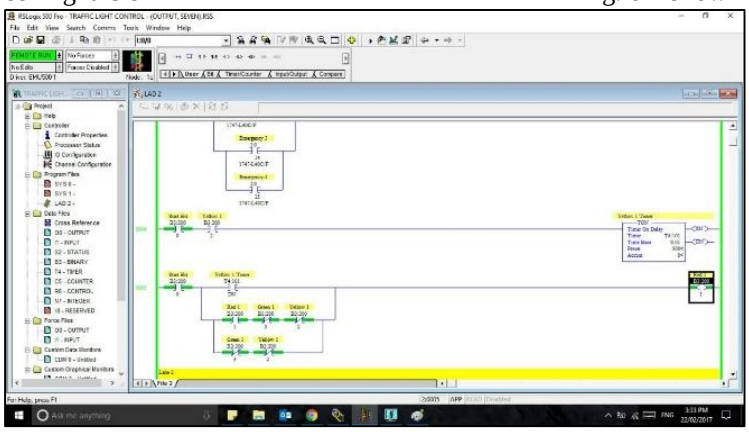

Fig. 7: Red light is on

As per the results in initial condition which is been seen in fig. 5 green signal is glow as per given time and in the second condition after 10 sec. of the green gets off yellow is on which is been shown in fig. 6, and at the last red signal is been on when yellow is off, there will an indication of seven segment display for next lane indication.

VI. CONCLUSION

An intelligent traffic light system had successfully been designed and developed. The sensors were interfaced with SLC 500 PLC module. This interface is synchronized with the whole system of the traffic system. This project can easily be implemented in real life situation. Increasing the no. of sensors to detect the presence of vehicles can further enhance the design of the traffic light system. Another room of implement is to have the photoelectric 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.

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