International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 06 Issue: 05 | May - 2022 Impact Factor: 7.185 ISSN: 2582-3930

AB PLC Based Intelligent Traffic-Congestion Control System Using Sensor

[1] Krushna Jadhav, [2] Raj Shirbhate, [3] Ritesh Gade, [4] Rupesh Tayde, [5] Prof. Ajay Lohate

[1] BE Electrical Engineering student, [2] BE Electrical Engineering student,

[3] BE Electrical Engineering student, [4] BEElectrical Engineering student, [5] Assistant Professor (MMCOE)

---***---

Abstract - PLC or Programmable logic controller is used to control a mechatronics system using specific functions. Basic PLC functions such as timing, sequencing, controlling and relaying are to be implemented. The basic programming logic and ladder programming is to be studied and implemented. The intelligent or "Smart Traffic Control" is one which would be able to calculate the vehicle density in a lane at a 4-way crossing and then decide the priority automatically using a program. In practical situations sensors are used to detect presence of vehicles in a lane and calculate the density and sends an interrupt signal to the control unit. In PLC the status of the sensors are checked and certain logical operations are performed to decide which lane is to be serviced first. Under low density condition it would operate sequentially. Ladder diagram is to be developed for the implementation of the same in PLC.

***Key Words*:** Programmable Logic Controller (PLC), NO (Normally Open), NC (Normally Closed), R (Red), Y (Yellow), G (Green),

1. INTRODUCTION

A traffic light is a collection of two or more-colored lights found at some junctions and pedestrian crossings which indicates whether it is safe and/or legal to continue across the path of other road users. Traffic Control Systems are used at a point where there are more than two paths for passage of vehicles or wherever passage is to be given to pedestrians to cross a road. It is also used wherever two paths cross each other thus creating a four-way lane.

In India, traffic lights are widely used both on major roads and in built-up areas.

Their numbers have increased exponentially since they were first invented in 1868.

In our country the traffic control system is mostly based on sequential logic. There are three lights red for stop, yellow for get ready and green for go. Each light operates for a given period one after the other. The programming is so done that two lanes won't have the green light at the same time. The traffic control system at a certain places are even controlled manually by traffic personnel but human error calls for automation to prevent undesirable incidents on road. The traffic signals control the vehicle movements.

Today, traffic congestion is a major issue in many cities throughout the world. In developing countries, the problem is extremely serious. Day by day the utilization of vehicles is increasing in large numbers. So the result of this vehicles is traffic that continue to operate on the way at the same time. Traffic lights are the most practical method of traffic control. In various cases, we notice that these signs fail to effectively restrict traffic when one lane has more traffic than alternate routes. Because of this, that particular path is more crowded than others.

In a traditional traffic control system, the signal light for a particular road is illuminated is always constant. This system becomes more complicated and harder to operate. In our traffic light control system project, we are using traffic density control so that we will be able to monitor the traffic density and control the delay of the traffic signals automatically with the help of PLC.

The number of vehicles in each lane are counted to determine the traffic density. There will be four sensors in four distinct lanes, and as a car goes over the sensor, it will sense the vehicle. It uses a PLC Ladder programming method to compute or monitor the vehicle densities of a 4-way lane and then automatically assigns preference to the particular lane.

The study's major goal was to create and deploy an intelligent traffic control system. The created system is capable of sensing the presence or absence of vehicles within a specified range and adjusting the length of traffic lights properly. The technology can help to solve traffic congestion by using mathematical algorithms to Calculate the proper timing for light to illuminate.

A. BLOCK DIAGRAM

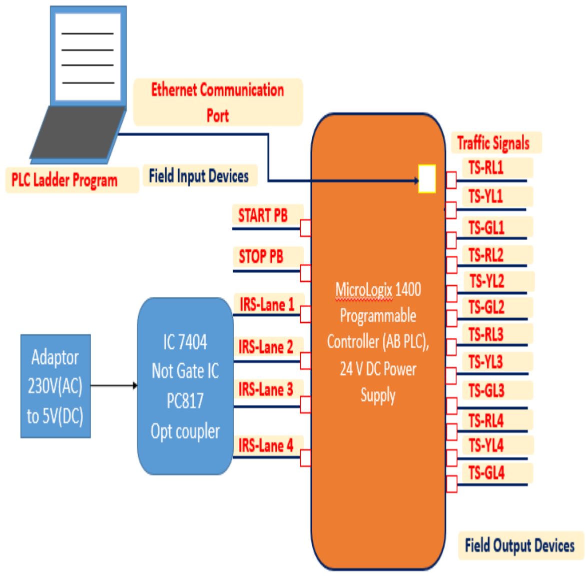


Fig 1: Overall PLC Block Diagram

B. COMPONENTS

1) COUNTERS WITH ADDRESS:

COUNTERS	ADDRESS
Counter (To count vehicles of lane 1)	C5:0
Counter (To count vehicles of lane 2)	C5:1
Counter (To count vehicles of lane 3)	C5:2
Counter (To count vehicles of lane 4)	C5:3

Table No 1: Counters with address

2) SOFTWARES TO BE USED:

SR NO.	NAME	QUANTITY	PURPOSE
1	PLC (Allen Bradley Micro Logix 1400)	1	-
2	Software used 1 – RS Logix 2 – RS Linx		For programming.
3	Communication Cable (RS232/Ethernet)	1	To transmit the data from PC to PLC To transfer/download the Ladder into Plc.

Table No 2: List of Software's used

3) TIMERS WITH ADDRESS

TIMERS	ADDRESS
Timer1 (Red Signal) (T_{on} For lane 1)	T4:0
Timer2 (Yellow Signal) (T_{on} For lane 1)	T4:1
Timer3 (Green Signal) (T_{on} For lane 1)	T4:2
Timer4 (Red Signal) (T_{on} For lane 2)	T4:3
Timer5 (Yellow Signal) (T_{on} For lane 2)	T4:4
Timer6 (Green Signal) (T_{on} For lane 2)	T4:5
Timer7 (Red Signal)	T4:6

(T_{on} For lane 3)	
Timer8 (Yellow Signal) (T_{on} For lane 3)	T4:7
Timer9 (Green Signal) (T_{on} For lane 3)	T4:8
Timer 10(Red Signal) (T_{on} For lane 4)	T4:9
Timer 11(Yellow Signal) (T_{on} For lane 4)	T4:10
Timer 12(Green Signal) (T_{on} For lane 4)	T4:11

Table No 3: Times with Address

4) DIGITAL INPUTS WITH ADDRESS: -

SRNO	NAME OF DIGITAL INPUTS	QUANTITY	ADDRESS	PURPOSE
1	Proximity Sensors (Inductive Type)	4	I:0/2, I:0/3 I:0/4, I:0/5	To detect the vehicle
2	Push Buttons	2	I:0/0 I:0/1	To start and stop the program

Table No 4: Digital inputs with address

5) DIGITAL OUTPUTS WITH ADDRESS: -

SR NO.	NAME OF DIGITAL OUTPUTS	QUANTITY	ADDRESS	PURPOSE
	LEDs	12		
For Lane 1	Red Signal Yellow Signal Green Signal		O:0/0 O:0/1 O:0/2	
For Lane 2	Red Signal Yellow Signal Green Signal		O:0/3 O:0/4 O:0/5	To display the traffic signals
For Lane 3	Red Signal Yellow Signal Green Signal		O:0/6 O:0/7 O:0/8	
For Lane 4	Red Signal Yellow Signal Green Signal		O:0/9 O:0/10 O:0/11	

Table No 5: Digital Outputs with address

International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 06 Issue: 05 | May - 2022 Impact Factor: 7.185 ISSN: 2582-3930

C. ALGORITHM: -

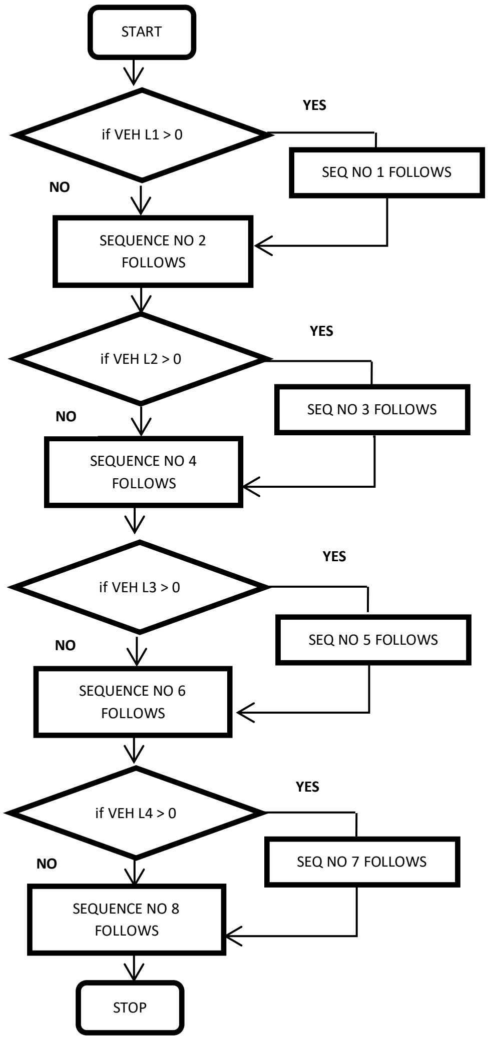


Fig 2: Algorithm

When we start our program, as per our above algorithm
If the number of vehicles in the lane 1 is greater than 0 then the sequence no 1 (G, R, R, R) will follow and then after that the sequence no 2 (Y, Y, R, R) will follow and if the number of vehicles is 0 then directly the sequence no 2 (Y, Y, R, R) will follow.

Similarly, If the number of vehicles in the lane 2 is greater than 0 then the sequence no 3 (R, G, R, R) will follow and then after that the sequence no 4 (R, Y, Y, R) will follow and if the number of vehicles is 0 then directly the sequence no 4 (R, Y, Y, R) will follow.

Similarly, If the number of vehicles in the lane 3 is greater than 0 then the sequence no 5 (R, R, G, R) will follows and then after that the sequence no 6 (R, R, Y, Y) will follow and if the number of vehicles is 0 then directly the sequence no 6 (R, R, Y, Y) will follow

Similarly, If the number of vehicles in the lane 4 is greater than 0 then the sequence no 7 (R, R, R, G) will follows and then after that the sequence no 8 (Y, R, R, Y) will follow and if the number of vehicles is 0 then directly the sequence no 8 (Y, R, R, Y) will follow.

After the sequence 8 of the lane 4 completes, the cycle will again start from the starting i.e., lane 1 and it will again continue to follow its conditions which we have given in our ladder program also which we can see in the algorithm.

II.WORKING

In this project by considering prototype, first consider total 4 different lanes as shown on layout diagram i.e., Lane 1, Lane 2, Lane 3, Lane 4 and each lane has three different lamps i.e., Red(R), Yellow(Y), Green(G), so total 12 lamps are there as shown below

Lane 1- R, Y, G

Lane 2- R, Y, G

Lane 3- R, Y, G

Lane 4- R, Y, G

So, when there are vehicles in each lane at that situation the ideal condition of glowing of lamps of each lane should be as follows.

Sr No.	Lane 1	Lane 2	Lane 3	Lane 4
1	G	R	R	R
2	Y	Y	R	R
3	R	G	R	R
4	R	Y	Y	R
5	R	R	G	R
6	R	R	Y	Y
7	R	R	R	G
8	Y	R	R	Y

Table No 6: - Sequence of operation of traffic signals when vehicles are present

As we are using sensors in our model to detect whether there are vehicles present at that particular lane or not. If there is vehicle at that particular lane then the green lamp of that particular lane will glow otherwise it will directly glow the yellow lamp of that respective lane. And this cycle goes on.

As shown in above table no.6 when there are vehicles at each lane that means the count of vehicles is greater than 0 then the green signal of each lane should glow, so as vehicles are there at lane 1 so green lamp of the first lane will glow and at the same time the red lamps of other lanes will glow. If in case there are no vehicles in lane 1 then the second condition will execute i.e., the yellow signals of lane 1 and lane 2 will glow while other remains red.

Similarly, as vehicles are there at lane 2 so green lamp of the Second lane will glow and at the same time the red lamps of other lanes will glow. If in case there are no vehicles in lane 2 then the Fourth condition will execute i.e., the yellow signals of lane 2 and lane 3 will glow while other remains red.

Similarly, as vehicles are there at lane 3 so green lamp of the Third lane will glow and at the same time the red lamps of other lanes will glow. If in case there are no vehicles in lane 3 then the Sixth condition will execute i.e., the yellow signals of lane 3 and lane 4 will glow while other remains red.

Similarly, as vehicles are there at lane 4 so green lamp of the Fourth lane will glow and at the same time the red lamps of other lanes will glow. If in case there are no vehicles in lane 4 then the Eighth condition will execute i.e., the yellow signals of lane 1 and lane 4 will glow while other remains red.

Below table shows the glowing of lamps of each lane when there are no vehicles in any lane out of 4 lanes.

Sr. No	Lane 1	Lane 2	Lane 3	Lane 4
1	Y	Y	R	R
2	R	Y	Y	R
3	R	R	Y	Y
4	Y	R	R	Y

Table No 7: - Sequence of operation of traffic signals when there are no vehicles.

As per above table no.7 if there is no vehicle at any lane then it follows the cycle of glowing of lamps.

There are four different IR sensors are connected in four different lanes. The purpose of this sensors is to detect the presence of vehicles only. Also, in programming we used four different up counters one for each lane

I.e.C5:0 for lane 1,

C5:1 for lane 2,

C5:2 for lane 3,

C5:3 for lane 4.

For each counter when the accumulator value is equal to preset value then it's done. So here in this we provided the done bit of that respective lane's counter to the green signal of that particular lane. As we have used two types of conditions for each lane

I.e.,1) when the vehicles are greater than or equal to one

2) When the vehicles are less than 1 i.e.,0

So, the counter is done only at that time when the accumulator value is equal to preset value and we put

Preset value as 1. So as per our first conditions when there is vehicle at that particular lane then the green signal of that particular lane will glow. In programming we have also used different timers. The purpose of these timers is to provide delay to that particular signal.

Now we will consider one example:

1.1) When the vehicles of lane one is greater than or equal to one: as vehicles are there at lane 1 so firstly the IR sensor will detect the vehicle it will go live it's receiver's output signal to the counter i.e. for lane 1:C5:0.As we have already put the preset value in that counter as 1 .So the Done bit of that counter will turns on .As in programming we have provided this done bit to the timer i.e. T4:0.and the TT bit of this timer is given to the green lamp of lane one i.e.O:0/2.

So, the green lamp will be in on state for the time period provided in the timer.

While the same TT bit is used for the red lamps of other all lanes. For the above conditions we used NO contacts for those particular lamps. So that the green lamp of lane 1 and red lamps of other 3 lanes will only remain in on state while all other lamps will be in off state. So as mentioned in table no 6...its first sequence

i.e., G R, R, R will execute. Like this the sequence of operation of traffic signals of each lane will be as per vehicles in that particular lane.

III.CONTROL STRATEGY:

As we all know that in traditional traffic signal system the sequence of operation of traffic lamps of each lane is fixed. And since the delay of each lamp is fixed so the overall time for completion of one cycle of glowing of lamps will be more and it will remain constant for all the conditions i.e. When there are no vehicles then all the other vehicles will stop for more time though there are no vehicles in particular lane.so in this project the most important control strategy is going to implement with the help of IR sensors which are connected in each lane. The purpose of this sensors is to detect the vehicle only.so that we get to know whether there is vehicle or not at that particular lane.

So, sensor will detect the vehicles and give count to PLC. In program we have used counters for each lane to count the signal by IR sensor. So, the most important part of controlling strategy is that, it checks whether there is vehicle present or not and according to that the glowing of lamps and sequence of operation of lamps of each lane will execute. Hence it will reduce the time of waiting of other vehicles for no reason.

IV.CONDITIONS:

In this project

There are two conditions on which we have worked.

1) When the vehicles count at particular lane >= 1.

2) When the vehicles count at particular lane < 1 (i.e.,0).

For these above conditions we have used two different compare type instructions from the RS-LOGIX software i.e.

1) GREATER THAN OR EQUAL TO instruction

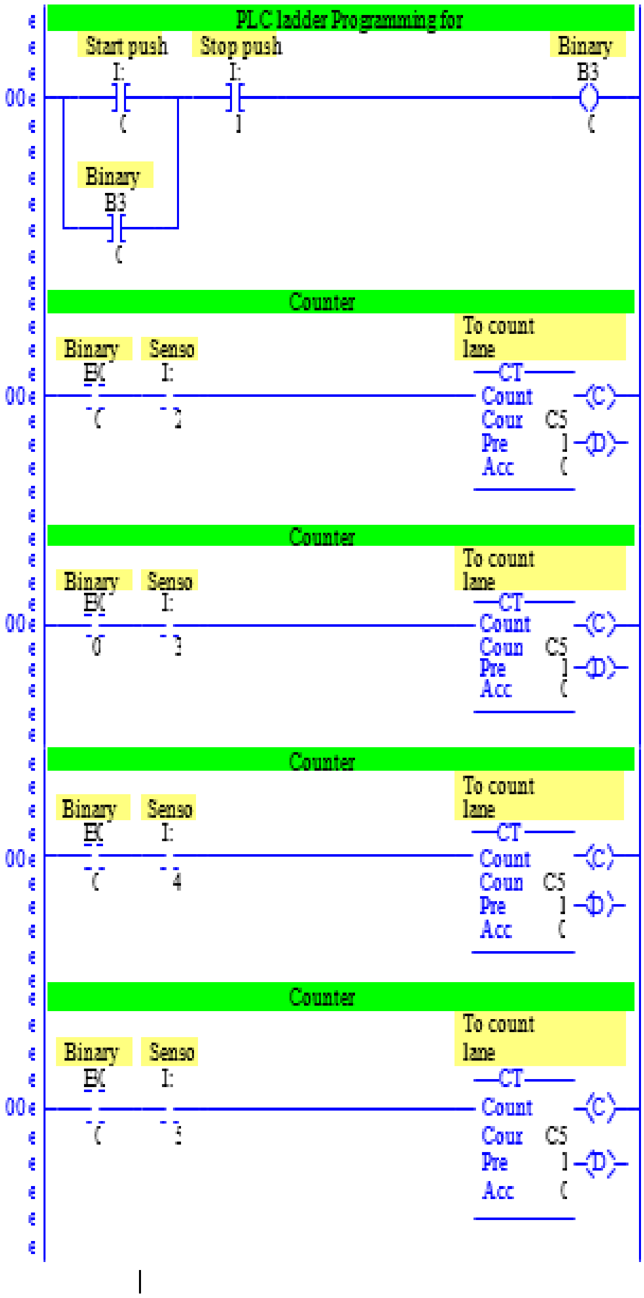
2) LESS THAN instruction

With the help of first instruction i.e., Greater than or equal to instruction we are taking the reference value as 1 so the instruction is whether the count of vehicles of that particular lane is greater than or equal to one. If count of the counter of that lane is greater than or equal to one then and then only this instruction will execute. And the glowing of lamps will be according to sequence mentioned in table no 6.

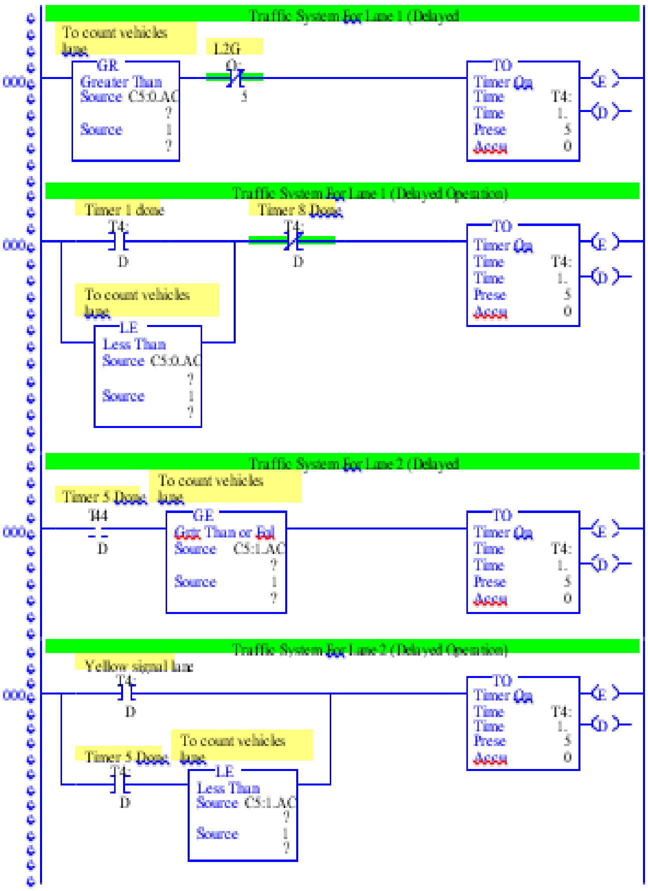
With the help of second instruction i.e., less than instruction, we are taking the reference value as 1 so the instruction is whether the count of that particular lane is less than one. If count of the counter of that lane is less than one i.e., 0 then and then only this instruction will execute. And the glowing of lamps will be according to sequence mentioned in table no 7.

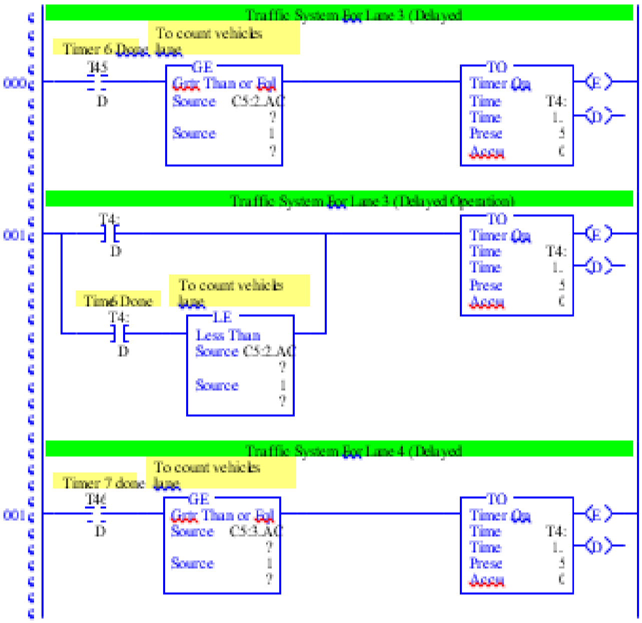
Since we have provided these two instructions for each lane. And according to the counters count of each lane the sequence of operation of lamps of that respective lanes will be as per table no 6 or 7

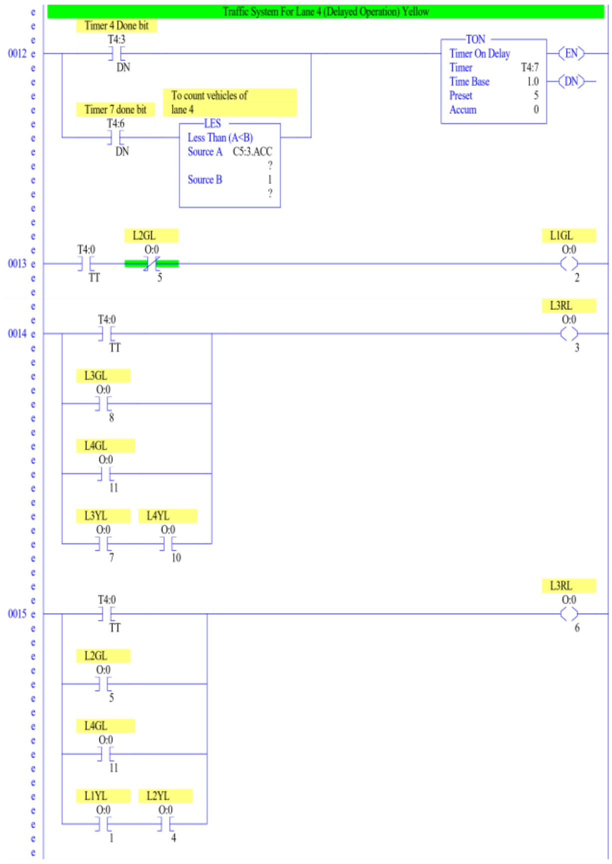
V.PROGRAMMING:

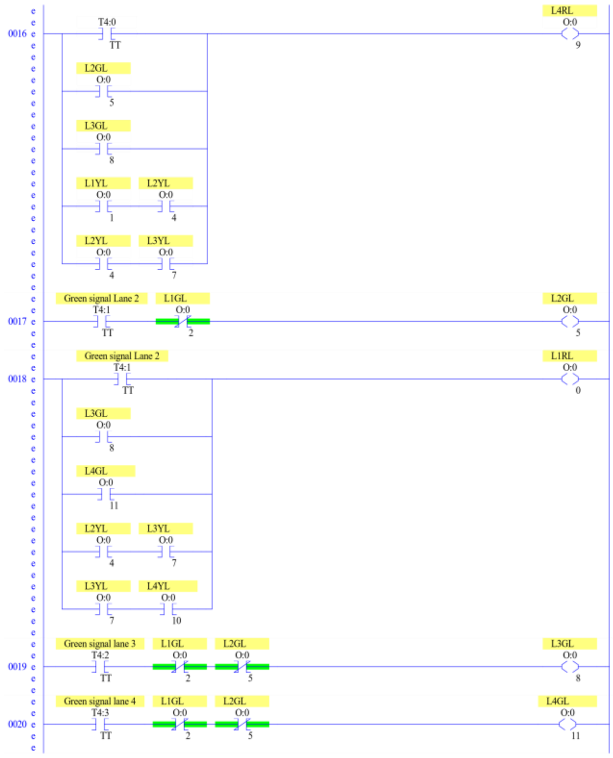


International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 06 Issue: 05 | May - 2022 Impact Factor: 7.185 ISSN: 2582-3930









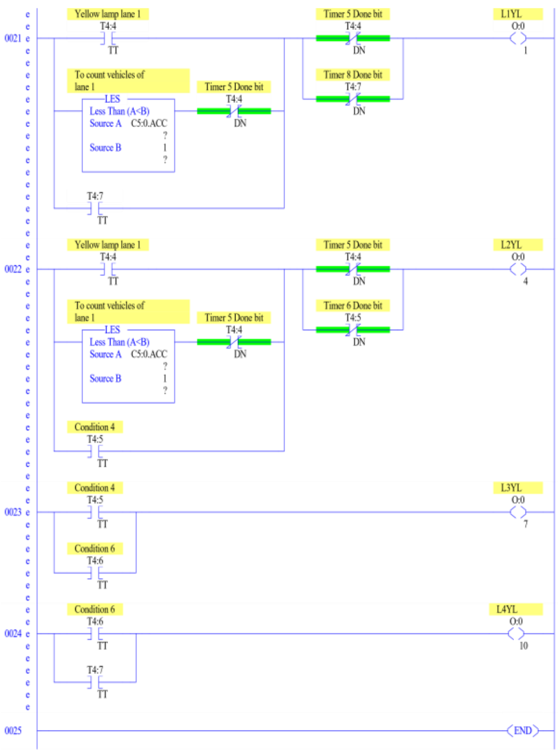


Fig 3: Ladder Program

VI.CONCLUSION:

With the increasing development of transportation, the increase in vehicles traffic is suffering from unprecedented challenges. The system can improve the efficiency of traffic control, and also is a kind of intelligent traffic control system, so, it can automatically adjust the time length of the traffic lights based on the road and seasonal changes, to reduce the crossroads vehicles stagnation, relieve traffic congestion and improve traffic control system optimal control. In a
Word, the future will trend towards the development of intelligent control direction.
Countries all over the world are also actively taken measures to enhance a high-speed and improve energy-efficient the prevailing environment, making a contribution to energy conservation and emission reduction.

VII.REFERANCES:

1. Mr. Ajay Lohate Payal Paygude, Sumit Ghodke, Pavan Kshirsagar, Atul Mali, "Active Solar Tracking System Using PLC and SCADA," International Journal of Engineering Research in Electrical and Electronic Engineering (IJEREEE) Vol 7, ISSN (Online) 2395-2717, DOI: 01.1617/vol8/iss8/pid01572, Issue 8, August 2021.

2. Ajay Lohate, Rupesh Tayde, Krushna Jadhav, Raj Shirbhate, Ritesh Gade "A Review Paper on Micrologix Controller Based Intelligent Traffic-Congestion Control System", International Research Journal of Modernization in Engineering Technology and Science (irjmets), Issue:01/January-2022, Volume-4, 2022/1/23.

3. Azrulnor Bin Ahmad" Development of a Traffic light Control System using Programmable Logic Controller"

4. Mohit Dev Srivastava "SMART TRAFFIC CONTROL SYSTEM USING PLC and SCADA" International Journal of Innovative Research in Science, Engineering and Technology Vol. 1, Issue 2, December 2012

5. RupakDatta and Rohan Das" STUDY OF PLC AND ITS APPLICATION IN A SMART TRAFFIC CONTROL SYSTEM", National Institute of Technology, Roorkela

6. Azeez Olarewaju Lawal,"PLC BASED TRAFFIC CONTROL SYSTEM", University of Sunderland, UK

7. John W Webb, Ronald A Reis,"PROGRAMMABLE LOGIC CONTROLLER and ITS APPLICATIONS"PHI Learning, New Delhi, 5th Edition

8. John R Hackworth, Fredrick D Hackworth,"PROGRAMMABLE LOGIC CONTROLLERS PROGRAMMING METHODS AND APPLICATIONS", PHI Publishers

9. Muhammad Arshad Khattak "PLC Based Intelligent Traffic Control System", International Journal of Electrical & Computer Sciences IJECS-IJENS Vol: 11 No: 06

10. Rajeshwari Sundar, Santhoshs Hebbar, and Varaprasad Golla "Implementing Intelligent Traffic Control System".

11. Ghazal, Bilal & Khatib, Khalamp & Chahine, Khalamp & Kherfan, Mohamad. (2016). Smart traffic light control system. 140-145. 10.1109/EECEA.2016.7470780.z

12. Barz Cristian & Todea Ciprian & Latinovic Tihomir & Preradovic, Dragana & Deaconu, Sorin & Berdie, A dela. (2015). Intelligent traffic control system using PLC. IOP Conference Series Materials Science and Engineering. 294. 012003. 10.1088/1757-899X/144/1/012017.

13. Joshi, Jaswandi G., and D. D. Ahire. "A Brief Survey on Programmable Logic Controller and Its Versatile Applications Using Scada System."

14. Ganapathi, Padmavathi & Shanmugapriya, D. & Kalaivani, M. (2010). A Study on Vehicle Detection and Tracking Using Wireless Sensor Networks. Wireless Sensor Network. 2. 173-185. 10.4236/wsn.2010.22023.

15. Ajay Lohate; Mandar Chaudhari "Thyristor Binary Compensator Strategy for Reactive Power Compensation and PF Improvement using Static VAR Compensator",2018 International Conference on Recent Innovations in Electronics & Communication Engg. (ICRIEECE) (DOI: 10.1109/ICRIEECE44171.2018.9008980) Date of Conference: 27-28 July 2018, Date Added to IEEE Xplore: 27 February 2020, Publisher: IEEE Bhubaneswar, Uddisa, India.