ISSN: 2278 – 909X
International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE)
Volume 5, Issue 7, July 2016

Intelligent Traffic Light Control System

Nipun Sharma[1], Palkin Sharma[2]

Abstract*— As in day to day life while travelling one must have faced the problem of traffic congestion.It is severe problem and is increasing rapidly in cities because the count of vehicles is increasing on roads. This project proposed new solution to traffic control. The main design concept of this project is to control the traffic automatically and also incorporating intelligence to that automatic controller. In this project we are going to use IR communication to analyze traffic density. IR signals from IR receiver are given to microcontroller and microcontroller gives appropriate result according to traffic. For better result we are going to use some array of IR transmitters and IR receivers in all directions. When there is a more traffic in one side more no. of IR receivers will not get the signals and gives delay of more green light to that side having heavy traffic. In prototype prepared for controlling of traffic we are using red, green and yellow color LED's.When there is a more traffic microcontroller gives more delay of green light to that side so that more and more vehicles pass from that. So by using this project we can control the traffic automatically.

This project also provides the facility to provide way to emergency vehicle in traffic so that valuable time is not wasted in red light delays.

***Index Terms*— Congestion , Infra Red , Light Emitting Diode.**

I. Introduction

As Traffic congestion is a condition on road networks that occurs as use increases, and is characterized by slower speeds, longer trip times, and increased vehicular queueing. When traffic demand is great enough that the interaction between vehicles slows the speed of the traffic stream, this results in some congestion. As demand approaches the capacity of a road (or of the intersections along the road), extreme traffic congestion sets in. Traffic congestion occurs when a volume of traffic or modal split generates demand for space greater than the available road capacity; this point is commonly termed saturation. There are a number of specific circumstances which cause or aggravate congestion; most of them reduce the capacity of a road at a given point or over a certain length, or increase the number of vehicles required for a given volume of people or goods. The existing methods for traffic management, surveillance and control are not adequately efficient in terms of performance, cost, maintenance [1]. Avoiding traffic jams is both beneficiary for environment and economy.There are several models for traffic stimulation. The existing methods for traffic management, surveillance and control are not adequately efficient in terms of the performance, cost, and the effort needed for maintenance and support. Many techniques have been used including, above ground sensors like video image processing, microwave radar, laser radar, passive infrared, ultrasonic, and passive acous- tic array. However, these systems have a high equipment cost and their accuracy depends on environment conditions . Another widely-used technique in conventional traffic surveillance systems is based on intrusive and non-intrusive sensors with inductive loop detectors, micro-loop probes, and pneumatic road tubes in addition to video cameras for the efficient management of public roads[2].This project work focus on optimization of traffic light controller in city using IR sensor and visual monitoring using microcontroller. In this system IR sensors are used to measure the density of the vehicles which are fixed within a fixed distance. All the sensors are interfaced with the microcontroller which in turn controls the traffic signal system according to the density detected by the sensors.

II. Effects of Traffic Congestion

We know traffic these days on roads is increasing day by day on roads which led to traffic congestion. Many times traffic light can also cause delay which led to delay causing in traffic congestion this is common thing in metro cities . Traffic congestion has very negative effects some are as follows-

- Blocked traffic also may interfere with passage of emergeny
- High chance of collisions due to tight spacing and constant stopping and going.
- Stressed and frustrated motorists.
- Wastage of valuable time of people.
- Wear and tear of vehicles due to slow moving of traffic[3].

III. Proposed Design

Basically we are designing a model which will able to remove traffic due to red light delays.For this we will be using sensors on each side at certain distance. Here we can use 2 or 3 sensors on each road. From sensors we can roughly calculate number of vehicles too.We can also know the distance up to which queue of vehicles is there.Different cases of distance from stopline upto traffic can be taken and different results can be taken.Delay is adjusted according to length of traffic.We are designing a Intelligent Traffic Light control system that will eradicate traffic congestion and also make path for emergency and VIP vehicles at the same time not disturbing the other vehicles on road. For this microcontroller has been used in this project and IR transmitters and receivers. These are the two most important hardware components in this project. Here basically we are designing a small model so LED are used red, green and yellow LED's.

Project is has two parts hardware part and software part. First step is to make circuit on proteus software and check whether our circuit is correct or not. Then we can go for hardware part according to circuit. An embedded system is developed which consists of a microcontroller, IR transmitter and receiver, LED's.

This project is implemented by placing IR transmitters, receivers and LED's at the 4 way junction, the four paths are represented

as R1,R2,R3,R4.The IR transmitters can be increased or decreased according to our wish or desire to know the Traffic Density.The Following is the block diagram for the project.

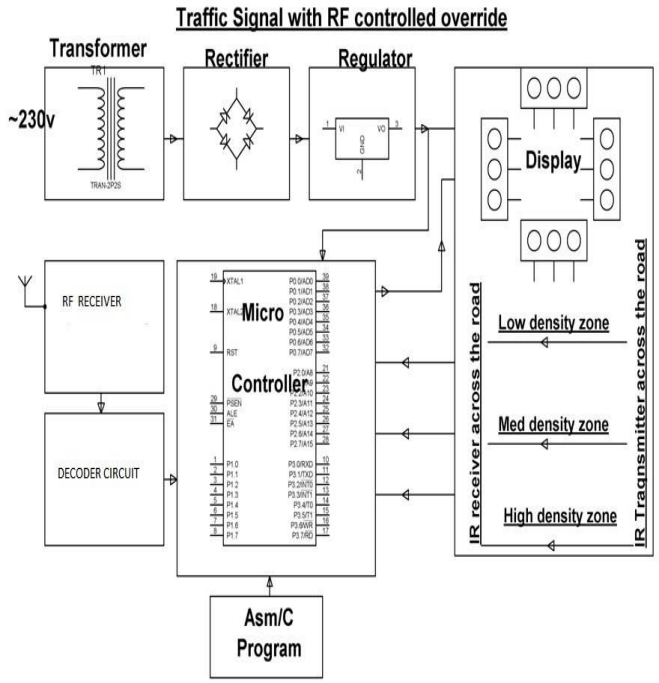

Fig 1 Shows interfacing of hardware components

The Figure consist of power supply ,microcontroller, IR transmitter signals, RF transmitter signals, LEDs connected to microcontroller from all four sides.The microcontroller used is AT89S52.All the control operations are performed by microcontroller.Power is supplied by power supply circuit(5v dc) .When supply is given traffic lights operate normally with green light delay of 5 sec. Density is sensed by IR sensors connected on all four sides. Normally output of sensors is high , when obstacle comes in its path output gets low.We are using IR transmitter and receiver for this purpose on each sides of road.When IR sensors detect the obstacle they send signal microcontroller.Microcontroller then automatically increases the delay of green light so that traffic passes.Proposed plan also solves problem of emergency vehicle. RF receiver is connected to microcontroller .Supppose there is traffic on one side and ambulance vehicle is behind the driver using RF transmitter sends signal to RF receiver making that side green and others red for few seconds.

IV. RESULTS AND SIMULATION

The successful completion of project includes the implementation and testing of both software and hardware. Mainly the implementation of project covers two aspects,hardware implementation and application oriented software/programming implementation.In Hardware all the hardware components like IR Sensors,LCD, Power Supply, RF receiver are interfaced as shown in figure above

For simulation we are using proteus 8. In proteus we have to interface all the components so that we can get the required results. We are designing the time interval of green light, yellow light and Red light based on some formulas as used for designing standard traffic light control system. First we tested our design on Proteus 8 and then started making hardware according to that. Although there were some changes in actual hardware and Proteus design but most of circuit is same. Different cases of all sides of roads are discussed, like first is that when there is no density of traffic at any other side, then we have taken case when density on A side is high.We have programmed our microcontroller like that when both sensors are blocked then only it will change the timing of green signal otherwise not. In normal timing delay given is 3 sec to green and when high density detected it gives delay of 25 sec which is verified using proteus software. Also case of emergency vehicle is discussed Here but it is dicussed only for One side i.e Road A.In that case green light blinks as switched is pressed. The snapshots are as follows.In last we have done calculations for calculating for Effective Green Time,Saturation flow rate which are quite useful in proper designing of Traffic Light System.Figure shows complete simulation on proteus 8.

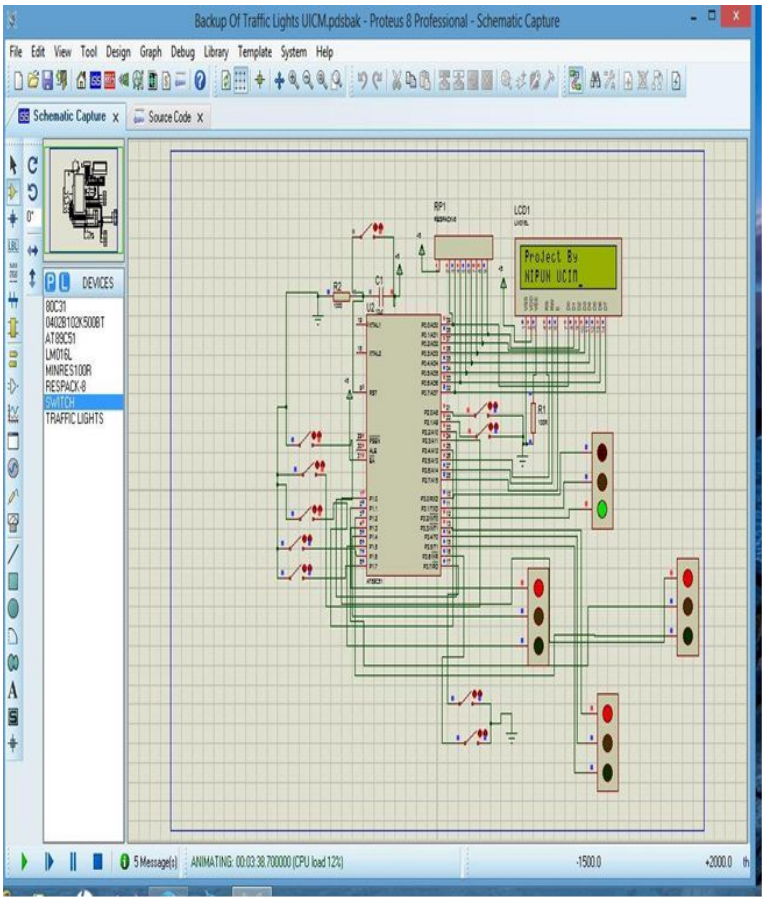

Fig 2 Shows complete schematic view of proposed work.

Table 1. Showing readings

Traffic density from Stop line Upto	Sensor 1	Sensor 2	Green light delay	Approx vehicles 2cm each	Output of Sensor 1 fed to microcontroller	Output of Sensor 2 fed to microcontroller
2 cm	No density	No density	2.5 secs	1	3.4 volts	3.4 volts
4 cm	No density	No density	2.5 secs	2	3.45 volts	3.4 volts
6 cm	density	No density	25 secs	3	0.3 volts	3.4 volts
10 cm	density	density	25 secs	5	0.3 volts	0.2 volts
X	No density	density	2.5 sec	Cant b calculated	3.4 volts	0.2 volts

The table shows the readings which we had taken on our prototype model.Model depicts the successful implementation of our project.

Calculations

Following are the calculations about delay and other parameters related to Traffic Signal Design.

Different Observation from our model of traffic light.

Green light delay – 2.5 sec (normal)

Yellow light delay- 1 sec. Complete Cycle- 12 secs.

- **Saturation Flow rate**

  S = 3600/h

Where S is Saturation Flow rate (vehicles per hour of green time per lane) Where h is Saturation Headway in seconds.[4]

Assume h= 2 sec

Then S = 1800 vph (1.1)

- The green time required to clear N vehicles can be found out as, T = L1 + h.N

Where L1 is Start Up Lost time(L1 =0.5 Secs)

h is the Saturation headway

N is number of vehicles

From results maximum vehicles in queue were 5

T = 0.5+ 2*5

T = 10.5 Secs (1.2)

- **Effective Green Time**

  gi = Gi + Yi –Tl [4]

  where gi = Effective green time

  Gi = Actual green time delay

  Yi = Yellow time Delay

  Tl = L1 +L2

  L1 = start up Lost delay

  L2 = Clearance Lost delay

  gi = 2.5 +1- 0.5

  .gi = 3 secs (1.3)

- **Capacity Of lane**

  We Know the ratio of effective green time to the cycle length (gi / C)is defined as green ratio.

  Capacity of Lane = S*.gi /C Where S is saturation flow.

  .gi is the effective green time.

  C is the cycle length in seconds.

  Ci = 1800*3 /12 = 450 vph (using 1.1 and 1.3)

- **Yellow light delay calculation**

  y = t + v85 / 2a + 19.6g

  where y is the length of yellow interval in seconds, t is the reaction time of the driver,v85 is the 85th percentile speed of approaching vehicles in m/s, a is the deceleration rate of vehicles in m/s2,g is the grade of approach expressed as a decimal.From these factors we can derive other formulas for Critical volume lane, queue, density on a road.These are helpful in proper design of traffic light signal taking all the parameters like headways, saturation flow so that a proper design is implemented.[4]

V. CONCLUSION

This project Intelligent Traffic Light Control System Using Microcontroller has been quite successful in determining the density of vehicles and giving delays according to that working as a Intelligent Traffic Light Control System. The physical hardware and software was successfully developed. It was simulated on Proteus 8 and physical hardware results based on distance from stopline were almost matching. We have calculated the delays for green , red , yellow, cycle length which are useful in designing proper Traffic light control system by calculating

certain parameters related to signal design. From the calculations we can adjust the sensors and delay according to density.The proposed model is really helpful in eradicating Traffic congestion at traffic lights and passing emergency vehicle in traffic without waiting for green light.

References

[1] K. M. Yousef, J. N. Al-Karaki and A. M. Shatnawi, "Intelligent Traffic Light Flow Control System Using Wireless Sensors Network", Journal Of Information Science and Engineering 26, 753-768 (2010).

[2] Minnesota Department of Transportation, "Portable non-intrusive traffic detection system,"

http://www3.dot.state.mn.us/guidestar/pdf/pnitds/techmemo-axlebased.pdf.

[3] Urban Traffic Operations/Traffic Lights, available at en.wikibooks.org/wiki/Urban_Traffic_Operations/Traffic_lights.

[4] T. V. Mathew and K.V .Krishna Rao ,"Introduction to Transportation Engineering" http://www.cdeep.iitb.ac.in/nptel/Civil%20Engineering/Transportation%20Engg%201/41- Ltexhtml/nptel_ceTEI_L41.pdf

Author

Nipun Sharma has done M.tech from **Panjab University, Chandigarh**.His areas of interest are Electronic Devices and Circuits, Sophisticated Analytical Instruments.Currently he is Assistant Professor **in Shaheed Bhagat Singh State Technical Campus, Ferozepur**,Punjab.

Palkin Sharma has done M.tech from **Punjabi University, Patiala.**Her areas of Interest are Wireless Communication,Wireless Sensor Networks.