JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

SMART TRAFFIC LIGHTING SYSTEM

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ABSTRACT:

Recent studies show that all over the world, there has been a rapid increase in vehicle numbers. The latest statistics show that there are approximately 1 million licensed vehicles in the year 2014. As a result traffic problems has increased in the last few years and the present traffic light controllers have limitations because it uses the predefined hardware that does not have the flexibility of modification on real time basis. Due to the fixed time intervals of green, orange and red signals the waiting time is more. To make this traffic light controlling more efficient we exploit the emergence of new technique called as "Smart Traffic Control System". This makes use of sensors along with embedded technology. The timings of the red and green lights will be smartly decided based on the traffic on adjacent roads. As compared to fixed mode traffic light controller this new system is more efficient and flexible. It also has an intelligent traffic control system to pass the emergency vehicles such as ambulance, fire brigade etc. and also detect and track the stolen vehicles. The design also has scope for further expansion.

Keywords: Smart Traffic Control System.

INTRODUCTION:

Traffic management has become one of the severe problem today because of the growth of industrialization and population there has been a tremendous growth in the traffic.

With the increase in traffic there arise a number of problems such as heavy traffic jams, violation of traffic rules etc. Mismanagement and traffic congestions also results in long waiting times, loss of fuel and money etc. It is therefore necessary to have a fast, economical and efficient traffic control system for national development. One way to improve traffic flow and safety of the current transportation system is to apply automation and intelligent control methods to roadside infrastructure as well as vehicles.

AIM/OBJECTIVE: Our project aims to eliminate the delay on roads by reducing traffic on road automatically using embedded system. It determines traffic on each road by using sensors. Using that traffic information we can manage the signal time and handle the traffic on road. On each road we place IR sensors which detect the vehicle and give current traffic information on each road. The road which has level more than other road then this road assign green signal and for others have red is assign.

In our project we focus on optimization of traffic light controller in a city using IR sensor and developed system using microcontroller AT89c51. We present this paper because to reduce traffic congestion which results in long waiting times to turn signal green, loss of fuel and money. For national development it is necessary to reduce traffic congestion.

The problems of conventional traffic light controller are as mentioned:

1. **Heavy Traffic Jam:** With increasing number of vehicles on road, heavy Traffic jams have increased in cities. This happened usually at the main junctions commonly in the morning, before office hour and in the evening, after office hours. The main effect of this is increased time wasting of the people on the road. The solution for this problem is by developing the program which different time delay settings for red, orange and green signals at different junctions.
2. **No Traffic, but Still Need to Wait:** At certain junctions, sometimes even if there is no traffic, people have to wait. Because the traffic light remains red for the present time period, the road users should wait until the light turns green. The solution of this problem can be obtained by developing a system which detects traffic flow on each road and set timings of the signals accordingly.
3. **Emergency Car stuck in Traffic Jam:** Usually, during traffic jam, the emergency vehicle, such as ambulance, fire brigade etc. get struck in the traffic. This is because the road users wait for the traffic light to turn green. This is very critical problem because it can cause the emergency case to become complicated, involving life.
4. **User's have lack of traffic information:** Present traffic systems unable to provide traffic information on congested roads and also fail to provide information about alternate roads when traffic congested on roads.

LITERATURE SURVEY:

Traffic is a critical issue of transportation system in most of all the cities of Countries. This is especially true for countries where population is increasing at higher rate. There is phenomenal growth in vehicle population in recent years. As a result, many of the arterial roads and intersections are operating

over the capacity and average journey speeds on some of the key roads in the central areas are lower than 10 Km/h at the peak hour. In some of the main challenges are management of more than 36,00,000 vehicles, annual growth of 7–10% in traffic, roads operating at higher capacity ranging from 1 to 4, travel speed less than 10 Km/h at some central areas in peak hours, insufficient or no parking space for vehicles, limited number of policemen. Currently a video traffic surveillance and monitoring system commissioned in Bangalore city. It involves a manual analysis of data by the traffic management team to determine the traffic light duration in each of the junction.

SMART TRAFFIC MANAGEMENT SYSTEM GOALS:

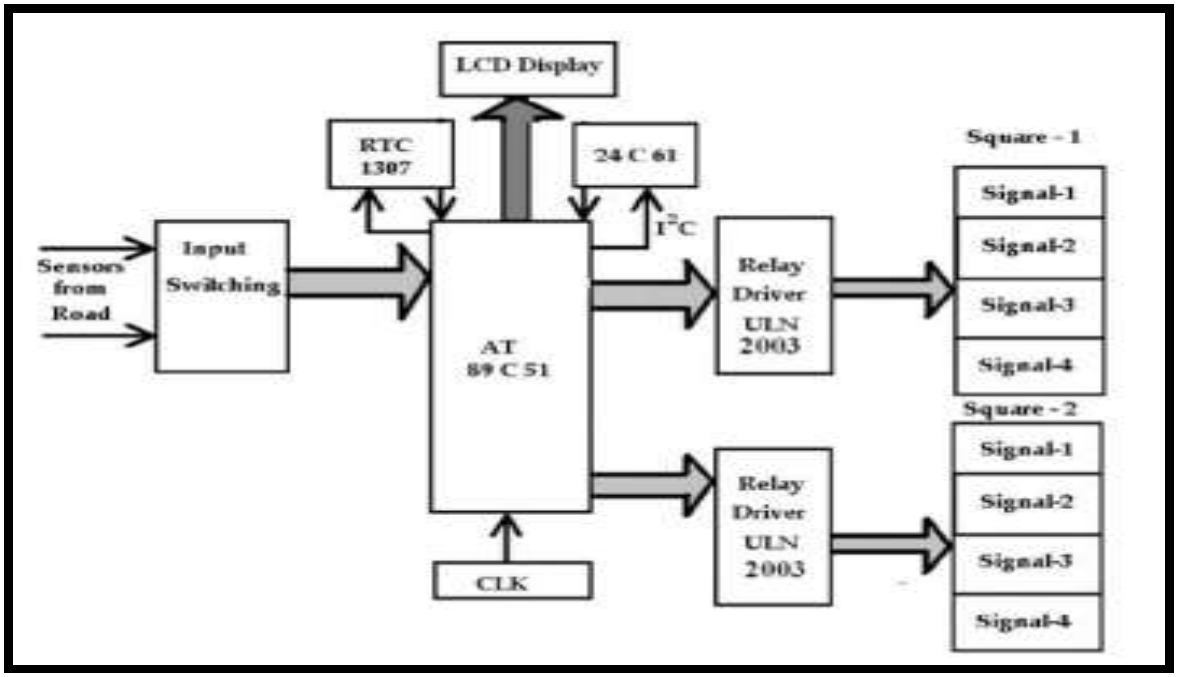
- Prioritize moderate traffic conditions by analyzing real-time traffic situations.
- Providing congestion-free traffic.
- Improvising traditional ticketing with automated E-bill payment system.
- Speed sensors to warn commuters over speed violation.
- Provide a smart lighting system that reserves renewable energy sources.
- Offer safe and punctual public transportation.
- Eradicate pollution.
- Advanced traffic monitoring systems at intersections and narrow road ends to provide the right traffic guidance through GPS and GIS.
- Optimizing road networking systems, through building IoT, enabled quick and better communication systems.

CIRCUIT IMPLEMENTATION:

In our project model the basic operations are implemented using Microcontroller AT89c51

1. **Microcontroller AT89c51:** The heart of the system is microcontroller AT89c51 this microcontroller is fall under 8051 microcontroller. It has chip ROM which is in form of flash memory. After some time flash memory can be erased which provide fast process. We are selecting this microcontroller AT89c51 because it is easy of programming, sufficient number of input output lines, manageable size of RAM and ROM and simple architecture. System program and application program are stored using RAM and ROM. The block diagram of ITLCS consists of the microcontroller, input switching matrix, Real Time Clock 1307, Clock circuit, Relay Driver ULN 2003, LED interfacing circuit.
2. **Relay Driver ULN 200:** These relay drivers are level shifters and current amplifiers. The output of relay driver is applied to Red, Green and Orange LED at each junction.
3. **IR Sensor:** This IR sensor detects vehicle and also detect the emergency vehicle. Thermal radiation is emitted by all the objects in the infrared spectrum. The infrared sensor detects this type of radiation which is not visible to human eye.

BLOCK DIAGRAM OF ITLCS:



SYSTEM ARCHITECTURE:

Methodology:

1. Sensor Send the current traffic information to microcontroller.
2. Microcontroller analyze the sensor &it's way.
3. Microcontroller decides the traffic level of each road.
4. Then Microcontroller take decision of glowing signals.
5. Then system store the traffic information.

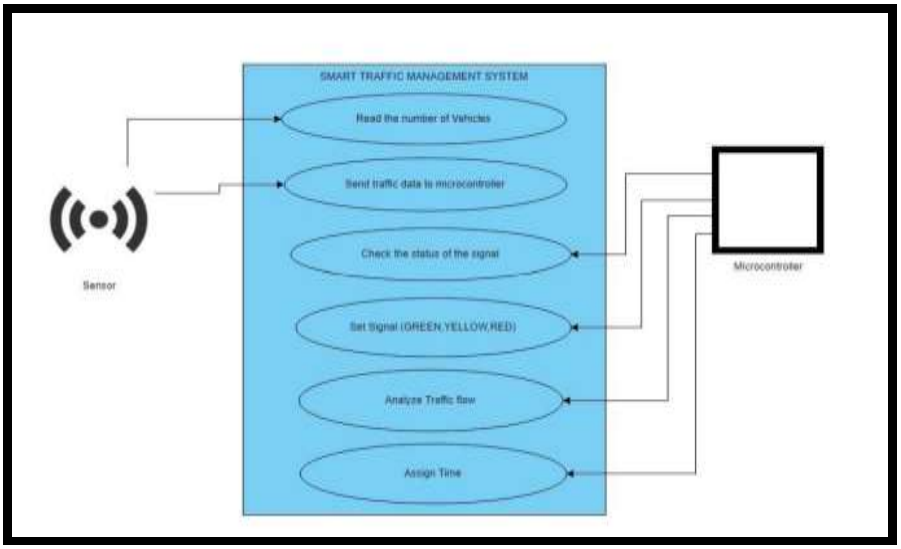
In this, it shows system architecture of ITLCS in which sensor send traffic information to PCB in the binary form. PCB will store this information in the form of hexadecimal and send this traffic information to the system. System stores this information in the decimal form so that user can easily read this information and control the traffic congestion.

The basic idea is to make use of IR LEDs to send the infrared waves to the object. Another IR diode of the same type is to be used to detect the reflected wave from the object. For example, when emergency vehicle come like ambulance, police etc is come which have already set sensor that time sensor detects this emergency vehicle and sender, receiver sensor send signals to each other. When IR receiver is used to infrared light, a voltage difference is produced. At less voltage which is produced can be hardly detected and therefore operational amplifiers (Op-amps) are used to detect low voltages accurately. The signals generate from sensor will be applied to input switching circuit. These input signals which generate from sensors will be in the form of digital signals that indicate to presence or absence of a vehicle. These digital signals from each road will be given to the input port of microcontroller, where the microcontroller will determine the length of vehicle at each road and counts the length of each road and decide to on which road

which signal is glow. This information is the input to microcontroller to determine the various timing signals where the ON and OFF time of the four junctions will be calculated by microcontroller, in order to keep the waiting time minimum and these signals will be applied to two relay drivers which consist of ULN 2003.

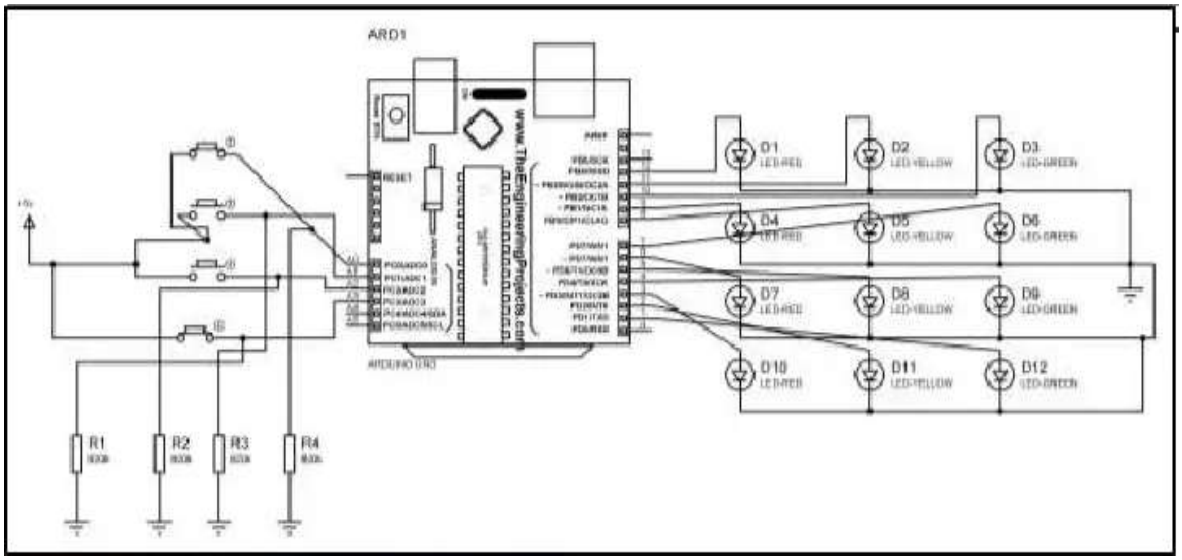
4. **IC 24C6:** IC 24C61 is one type of IC used for I2C interface. There is one LCD display is provided to each signal. LCD Display will indicate the time left for the signal to become green i.e. it indicates the time for a vehicle has to wait at a particular junction. We can use a good contact LED displays which will be visible from a longer distance.

CASE DIAGRAM:

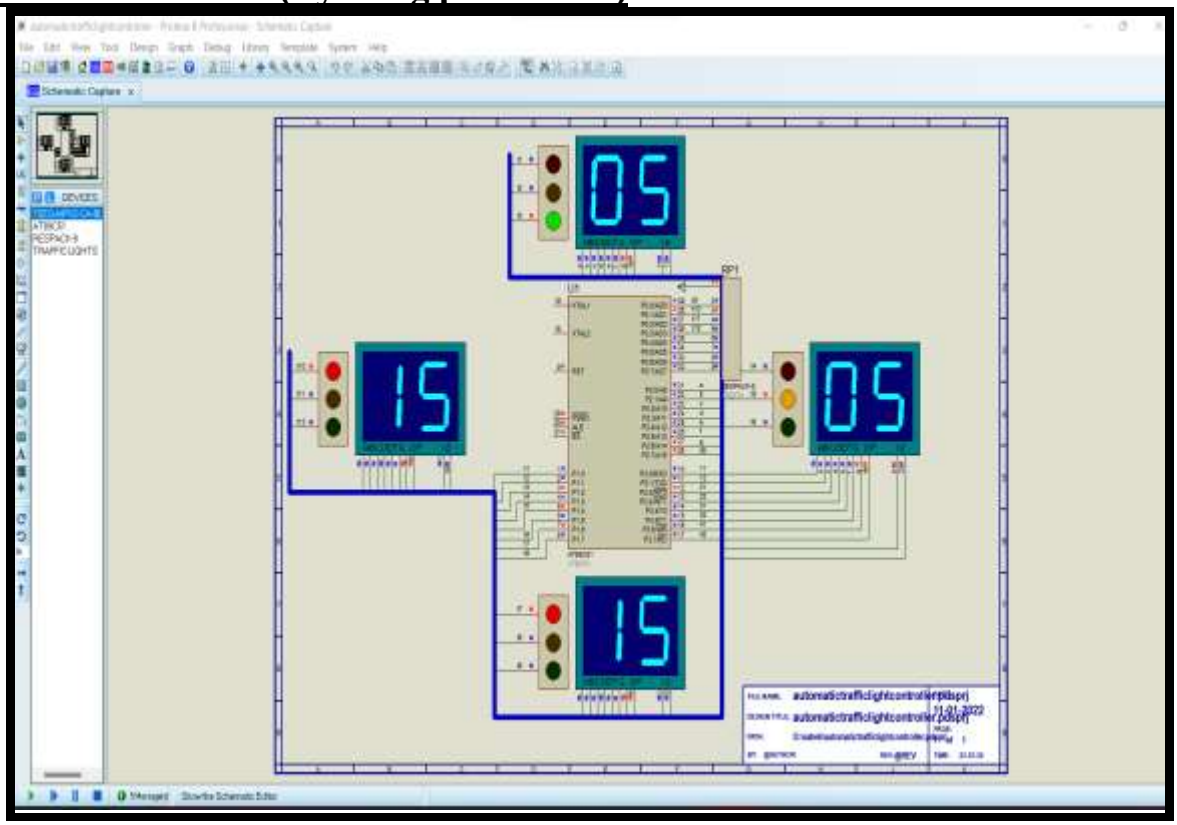


TRAFFIC LIGHT CONFIGURATIONS DURING THE TWO MODES OF OPERATION:

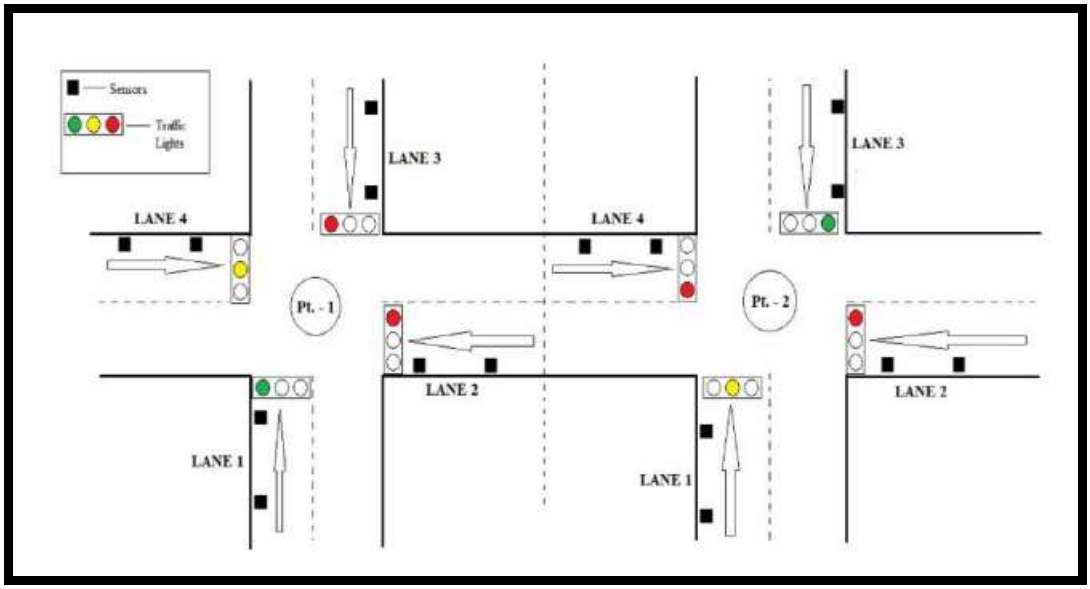
Circuit Diagram for Smart Traffic Light



CIRCUIT DIAGRAM: (By using proteus 8.0)

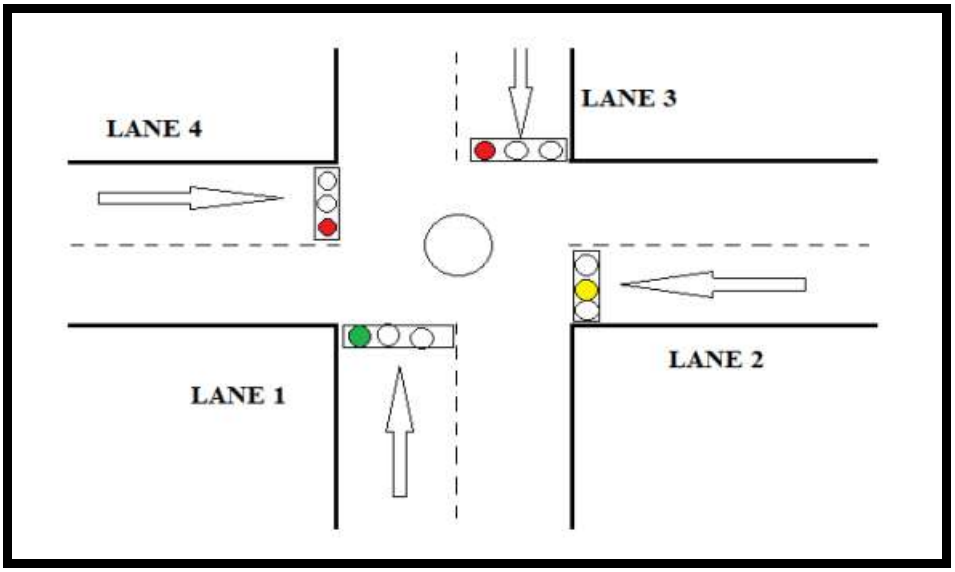


A View of Signals at Different Lanes:



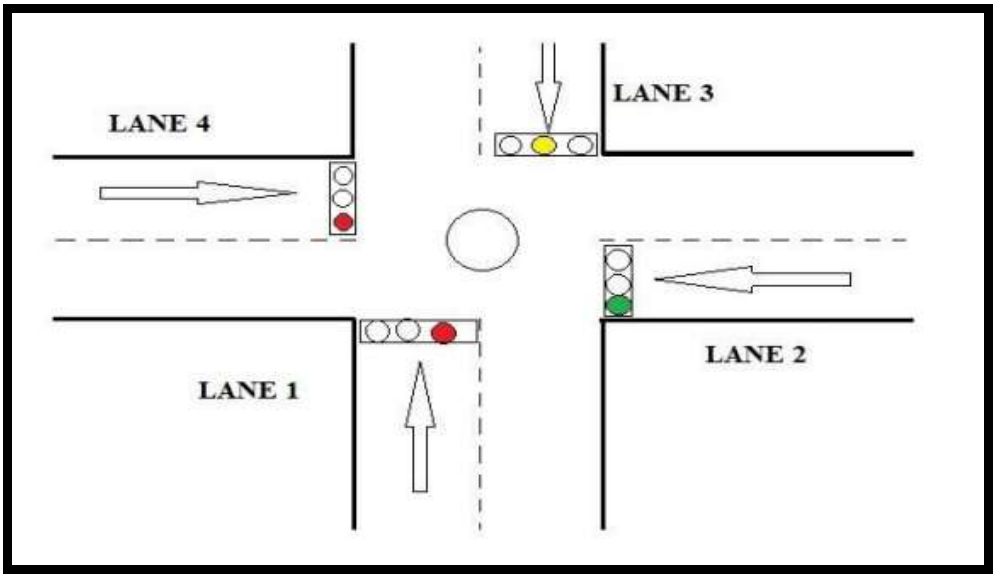
Control of previous Intersection

In the above figure, in Pt. - 1, LANE 1 is currently open with green signal and LANE 4 is ready with an yellow signal but LANE 2 and LANE 3 are blocked. In LANE 3, vehicle count is already greater than the threshold value, therefore the road coming to LANE 2 of Pt. - 1 is blocked in the Pt. - 2 itself. Thus re-routing them through another lanes. (Assuming that Pt. - 1 is the current intersection and Pt. - 2 is the previous intersection).



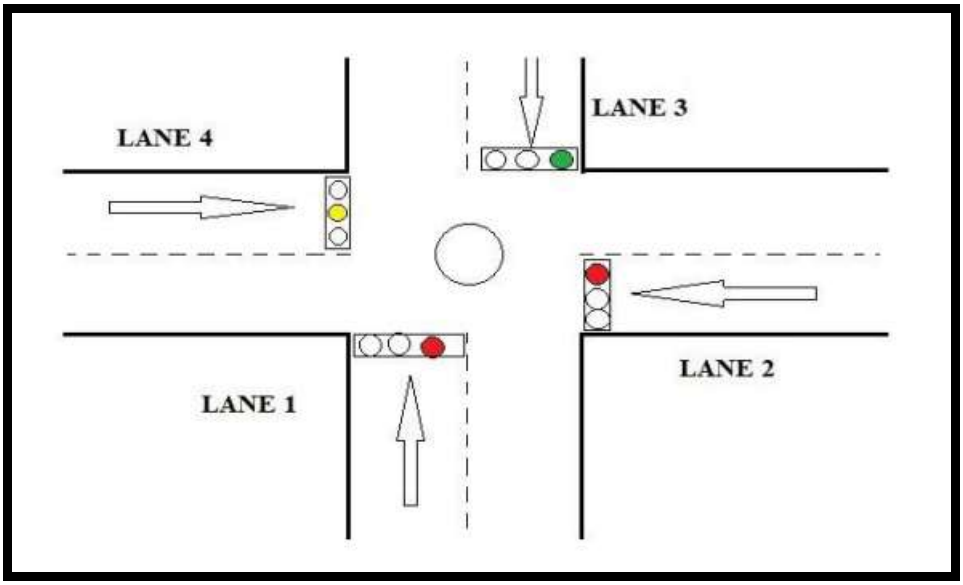
Signal at Lane 1

In the above figure, Lane 1 is open with green signal and other lanes are closed with red signal.



Signal at Lane 2

In the above figure, Lane 2 is open with green signal and other lanes are closed with red signal.



Signal at Lane 3

In the above figure, Lane 3 is open with green signal and other lanes are closed with red signal and after that Lane 4 will get the green signal automatically.

In this proposed system, the traffic lights are LEDs and the car counting sensor is an ultrasonic sensor. Both blocks are connected to a Microcontroller using physical wires. The Microcontroller is the traffic light controller which receives the collected sensor data and manages the traffic lights by switching between green, yellow and red. The Microcontroller computes the number of cars in the street of the inter section it is monitoring based on the distances measured by the ultrasonic sensor and the timing between those measurements. The Microcontroller then sends the number of cars every minute to the local server. This communication is done using the Microcontroller serial port. The local server exchanges the data received with the cloud server in order to better predict the changes in timings of the traffic light. This communication is done using Wi-Fi. More specifically, the cloud server uses an equation that takes the data received (number of cars) as input then determines the time interval of LEDs needed for a smooth traffic flow. This calculated time is then compared to the current actual time of the LEDs (this data is saved in a

database on the cloud server). The server then comes up with a decision. If the current actual green time is less than the calculated time, the decision is to increase the green time, else to decrease the green time.

PROPOSED METHODOLOGY AND RESULT

Conventional traffic light systems provides predefined green light time to each road at junction, hence it results in heavy traffic jams and congestion on the road. Hence, we developed an algorithm, which work like round robin algorithm. According to our algorithm, Arduino UNO will check each road of junction in circular fashion and if it detects any traffic on the road then it allow it to cross the junction by signaling green light to it. However, if there is no traffic on the road then it will signal the road as red light and check for traffic in next road. To implement our algorithm we need some micro controller, which can sense with the help of sensors and respond accordingly.

ADVANTAGES:

- Simplicity, user friendly, Easily programmable
- This system reduces the overheads on the database server, by deleting the data after every 4 hours automatically.
- This system is highly responsive that means it gives a quick response to change in traffic.
- This system reduces the waiting time as traffic signal's light will change according to current traffic density. So it also reduces traffic jams.
- Minimizes number of accidents.
- Easy implementation and maintenance.
- Remotely controllable.

DISADVANTAGES:

- Implementation cost is high.
- In case of defect or repair, troubleshooting of the system is complex.
- System is prone to damage by environmental conditions.

APPLICATIONS:

The applications are:

- Smart Street lights could be equipped with Radar Sensors which could detect if any object comes near the pole and the light gets brighter.
- It could act as a hub for smart applications.
- It could also be equipped with charging station for electric vehicles.
- It is also used for digital signage.

CHALLENGES:

- **Limited Budget:** As graduate students our ability to test different technologies for accurate results are very limited.

- **Service to emergency vehicles:** No method implemented for providing passage to emergency vehicles such as ambulances.
- **Lack of Time:** Due to lack of time only one method using sensors have been implemented.

IMPACT OF COVID-19 ON TRAFFIC SIGNAL CONTROLLER MARKET:

COVID-19 first began in Wuhan (China) during December 2019 and since then it has spread at a fast pace across the globe. The US, India, Brazil, Russia, France, the UK, Turkey, Italy, and Spain are some of the worst affected countries in terms confirmed cases and reported deaths. The COVID-19 has been affecting economies and industries in various countries due to lockdowns, travel bans, and business shutdowns.
Shutdown of various plants and factories has affected the global supply chains and negatively impacted the manufacturing, delivery schedules, and sales of products in global market. In addition to this, the global travel bans imposed by countries in Europe, Asia-Pacific, and North America are affecting the business collaborations and partnerships opportunities.

CONCLUSION

- In this project we introduced sensor based technology for traffic control. We conclude that it provides powerful solution to improve existing system with the new intelligent traffic light controller.
- This project has two major phases –
  (1) Blinking of traffic signal light according to the traffic level present on the road.
  (2) This system manage traffic when any emergency vehicle come. For example ambulance, fire bridged etc.
- Proposed system will have wider future scope that user can get traffic information on mobile phone.

Smart traffic light systems is better Conventional traffic light systems because it is capable of handling variable flow of traffic through the junction and reduces waiting time at junction. It also helps in preventing traffic jams on the roads. It also helps to prevent road accidents by not allowing vehicles to break traffic signals.

The designed system is implemented, realized electronically, and tested to ensure complete validation of its operations and functions. The current design can be promoted by monitoring and controlling an intersection with double roads. Future improvements can be added such as pedestrian crossing button, delay timing displays, as well as car accident and failure modes. The integration of different traffic controllers at several junctions will be investigated in the future in order to accomplish a complete synchronization. To study the system performance, traffic data can be recorded and downloaded to computer platform where statistical data analysis studies could be applied to better understand the traffic flows between the intersections. Finally, traffic light controller could be powered by solar power panels to reduce grid electricity consumption and realize green energy operations.

The purpose of making this paper is to discuss the solution of problem that we face with conventional traffic light system. In conventional traffic light system, we need to wait for at least 90 seconds even if there is no traffic in other sides of junction. To solve this problem we propose the idea of smart traffic light. Smart traffic Light has many applications in real day-to-day life. It can used to reduce traffic accident by controlling the traffic across the signal. Smart traffic light is smart enough to reduce waiting time at the signal by allowing green signal only when there is traffic in the road. It can also reduce accident rates because in order to get green signal, Driver need to register themselves to traffic light by stopping their vehicle just above the FSR sensor, which is placed before the zebra crossing. It can also prevent traffic jams by using round robin algorithm designed by us.

REFERENCES:

- http://iraj.in/journal/journal_file/journal_pdf/4-54-140014802684-87.pdf
- https://www.researchgate.net/publication/305674408_Smart_traffic_light_control_system
- https://www.cmu.edu/epp/people/faculty/course-reports/SURTRAC%20Final%20Report.pdf
- https://www.internationaljournalssrg.org/IJECE/2016/Volume3-Issue3/IJECE-V3I3P106.pdf
- file:///C:/Users/user/Downloads/sensors-20-00508%20(1).pdf
- file:///C:/Users/user/Downloads/sensors-20-00508%20(2).pdf
- http://centrallibrary.cit.ac.in/dir/Project%20Report/2019/BTech/CSE/Smart%20Traffic%20Management%20System%20using%20Internet%20of%20Things%20%28IoT%29-btech-cse-04-07-48-1562605128AhQYTHe2.pdf
- https://www.academia.edu/33669779/Intelligent_Traffic_Control_System
- file:///C:/Users/user/Downloads/824-Article%20Text-1473-1-10-20210404.pdf
- https://www.watelectronics.com/how-traffic-light-control-system-works/