

Smart Traffic Signal Control System

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Abstract: Nowadays traffic congestion in the urban areas is becoming very difficult due to enormous increase of automobiles. So in order to rectify this problem we presented a nice way to regulate the vehicles in crowd and a junction area, which eliminates the involvement of humans in its operation. Traditional traffic signal system only gives instructions to stop. However, if someone is breaking the signal then this system is not able to catch them and there are chances of taking bribe. Therefore, to increase the security of traffic signal, to reduce human efforts, and to avoid the bribery we are introducing smart traffic signal system through this project. Smart traffic signal based on the Arduino & infrared sensor, in which infrared sensors are placed at one side of road in such a way so as to cover particular necessary area of road from where the vehicles are waiting in the signal. Then it compares the density of the all the four tracks and it gives green signal to which track have a more density of vehicles. If all the track has same density, then normal flow of signal is maintained. If the signal is red and any vehicle breaks the signal, then the infrared sensor detects it and Arduino microcontroller take immediately action to buzzer alarm to warn the vehicles which cross the signal line mark. In addition, another feature is implemented called "Punishing Signal". It uses special decibel meters connected to traffic signals across the city. When the decibel exceeded a 85dB, the signal timer would reset itself, forcing the people to wait longer at the signal. This is meant to 'punish' them for their impatience with the message that if they honk more; they will have to wait longer. "Honking is a bad habit and an act of traffic indiscipline. Unfortunately, many of them indulge in reckless honking. Honking causes noise pollution, hurts the eardrums, increases heart rate, creates traffic confusion and causes stress, that system have reduce the noise pollution and the avoiding the human error in the signal changing and reduce or control the traffic jumping at the time of red signal is displayed.

Keywords: Traffic signal, smart signal, automatic traffic control, density based traffic control, IR based signal.

I. INTRODUCTION

The traffic signal was first discovered in 1912 by a Detroit policeman named Lester Wire like two-colour, red-and-green light with a buzzer to warn pedestrians ahead of the impending transition. After that, in 1920, this basic design was updated by William Potts to include the tri-coloured red, yellow, and green lights widely used today. This simple, three-color icon has allowed for nearly a century with little change, using modern technologies such as automatic timers, diode lights and motion sensors

Traffic signals are mainly developed to ensure the correct flow of traffic, provide an opportunity for pedestrians or vehicles to cross a junction and helps in reducing the number of collisions between vehicles entering intersections from opposite directions. Traffic signals should be considered when they would alleviate more problems than they create. A warranted signal properly operated may provide for more orderly movement of traffic, and reduce the occurrence of certain types of collisions. Unwarranted signals can result in increased crashes, delays and congestion. And main reason for signal to reduce the traffic accident

Traffic is one of the major modern-day problem in every big city in the world. Recent study of World Bank has shown that average vehicle speed has been reduced from 21 km to 7 km per hour in the last 10 years. The traffic congestion problems are increasing day by day because of the increasing number of vehicles with limited infrastructure. Under this situation, the existing traffic light systems, which are timer based, are not able to control traffic. To solve this problem, a real time traffic control system is needed which will control the traffic signal according to traffic density. For effective traffic management and signal control, it is important to know road traffic density. Based on this density value time delay of signals can be set up dynamically.

The existing traffic signal system is implemented with delays where the signal transition time slots are fixed and do not depend on current traffic flow. The existing traffic system needs to be upgraded to solve the severe traffic congestion problems. So here we propose a simple, low-cost, and real time traffic signal system that aims to overcome many problems and improves the traffic system. The system is based on ARDUINO microcontroller that evaluates the traffic density using IR sensors mounted on either sides of each road and dynamic timing slots with different levels. Our system will be very useful for solving most of the traffic congestion problems occurs today.

Automobile revolution in urban centres has proved to be a big source of noise pollution. Increasing traffic has given rise to traffic jams in congested areas where the repeated hooting of horns by impatient drivers make inconvenience to all road users. It is serious problem in big cities like Delhi and Mumbai. This problem has been solved by introducing the “punishing signal,” which had special decibel (dB) meters connected to it at congested junctions across the city to monitor the level of noise generated. When the decibel level exceeds the dangerous 85dB mark due to incessant honking, the signal timer resets itself and turns red, forcing motorists to wait longer.

Even in our daily life, we come across many problems caused due to traffic rule. Violation by public. Also, when we go through the daily newspaper, we realize that road accidents is one of the major problems now a days in every city. These problems cause disturbance to the government through the public and consumes our precious valuable time. So in an attempt to reduce & improve the traffic control, advanced technological solutions has been proposed. In this project, we sly a system which will automatically warns the vehicle owner for violation of traffic rules. The warning will be done automatically if vehicle is standing on zebra crossing when the signal is red. This Project detects any signal break by the vehicle and generates the warning buzzer through implementation of Programming and hardware mechanism.

II. LITERATURE SURVEY

[1]In recent years, surveillance systems and video monitoring have been widely used for traffic control. Historically, there exist several vehicle detectors such as radar, ultrasonic, and microwave detector. But these sensors are expensive, with less capacity and difficult to maintain, difficult for installation and implementation and extra maintenance charges be there. Metal barriers near road affect radar sensors. In mathematical modelling parameters of a vehicle are designed mathematically using the geometric positions of camera; sunlight and vehicle are compared with values obtained using video.

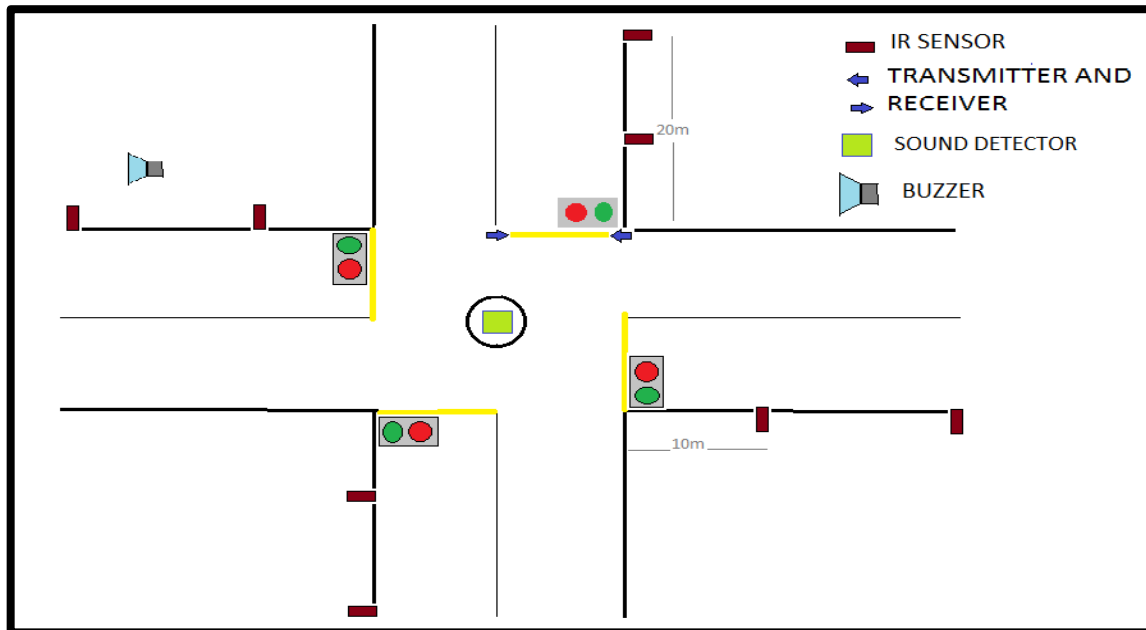
[2]The manual dependencies between intersections lead to a complicated derivation with fault parameters. These parameters are hazardous and most of the problem is because of the variance of these parameters with time. Several techniques are designed for traffic congestion detection that is based on sensing. Another approach is that measure the traffic density based on the number of occupied fraction of road based on RF signals, which was placed on roadside. This method was inefficient because significant manual work was required at different roads.

[3]A lot of innovations have been made for predicting the density of the traffic based on image processing. But these techniques require the good images whose quality is weather dependent, especially with the rain and the fog. Algorithms to model the various states of the traffic such as fuzzy logic were used.

[4]Traffic signals operating on fixed signal timing delays cannot be used properly to control the traffic congestions. When the traffic density increases more than a limit on a particular road, it needs larger green light duration to reduce the traffic flow. The major problem of the existing traffic light system is that the transition timing slots are fixed in software and unnecessary waiting time when no vehicles are present on opposite route. Since the vehicle to stand in a proper, line due to which many of the traffic occurs. Our system uses Arduino microcontroller that is interfaced with IR sensors. Three IR transmitters and the IR receiver are placed on each road. When an automobile pass between the IR sensors, the photodiode is activated and the object is detected counter is incremented. The collected information about the traffic density of each road of a “+ “junction is analysed in order to change dynamically the delays of green light. Traffic density is measured as low, medium and highl. Based on this density varies the traffic signal duration for a particular way.

[5]Some of the available technologies are Inductive loop detection, Passive infrared sensors, Wireless sensor network and Radio Frequency Identification. In this related work it is gathered that RFID has demand and importance in these days, application of this technology in various fields like security, medicals, military, smart cards, mechanism and identifying attack ranges. And the aim of this work is that RFID reader is accountable to power and interact with the RFID tag. The reader has the generating a high frequency electromagnetic energy and a query signal. This energy used in tag antenna and transmits (releases) the tag’s unique ID to the reader. Basic idea is to develop the controlling and analysing signal jumping using r-fid and Hadoop that can check for signal jumping by any vehicle. The RFID Reader reads and checks the information like vehicles biodata and automatically sends a report to the hive database and it sends to the owner.

III. BLOCK DIAGRAM



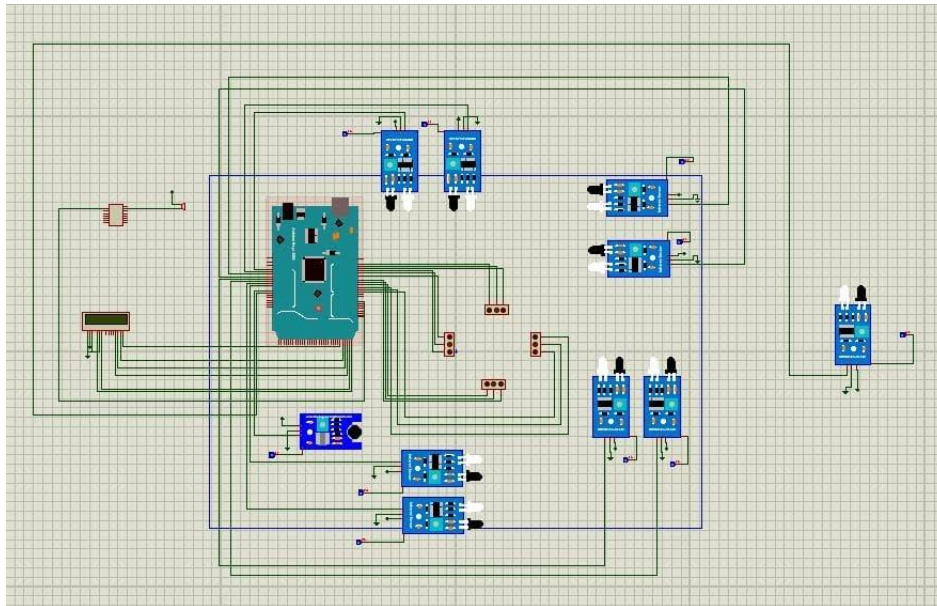
IR sensor read the density of all the road in the signal, if the density of all the road is same then the normal flow is followed by the controller. Otherwise the density is varied in each road then the signal will be change by according to density of the signal. If all the road have same density the normal flow is followed. And other hand, if anybody cross the line mark even in red signal is displayed then the IR sensor detect it and warned by buzzer to the rider. It is used to reduce the accident in the signal zone. Also the noise pollution in the signal zone is increasing rapidly, it is controlled by the sound detector system. It will measure the sound level in the signal zone and if the sound level will increase above 85DB, then all the traffic light will glow in red colour.

IV. WORKING DESCRIPTION

The smart traffic signal control system have eight infrared sensor and it placed in two pairs at each road, the first IR sensor placed 10 meter distance from the signal and second IR sensor placed 20 meters distance. The each sensor continuously measuring the density of the each road and then automatically the signal was change according to the output from the sensors. if all the track have same density then normal flow is maintained or if no traffic in each track then also normal flow was maintained

NORMAL SIGNAL FLOW	1	2	3	4
ROAD	B	D	A	C

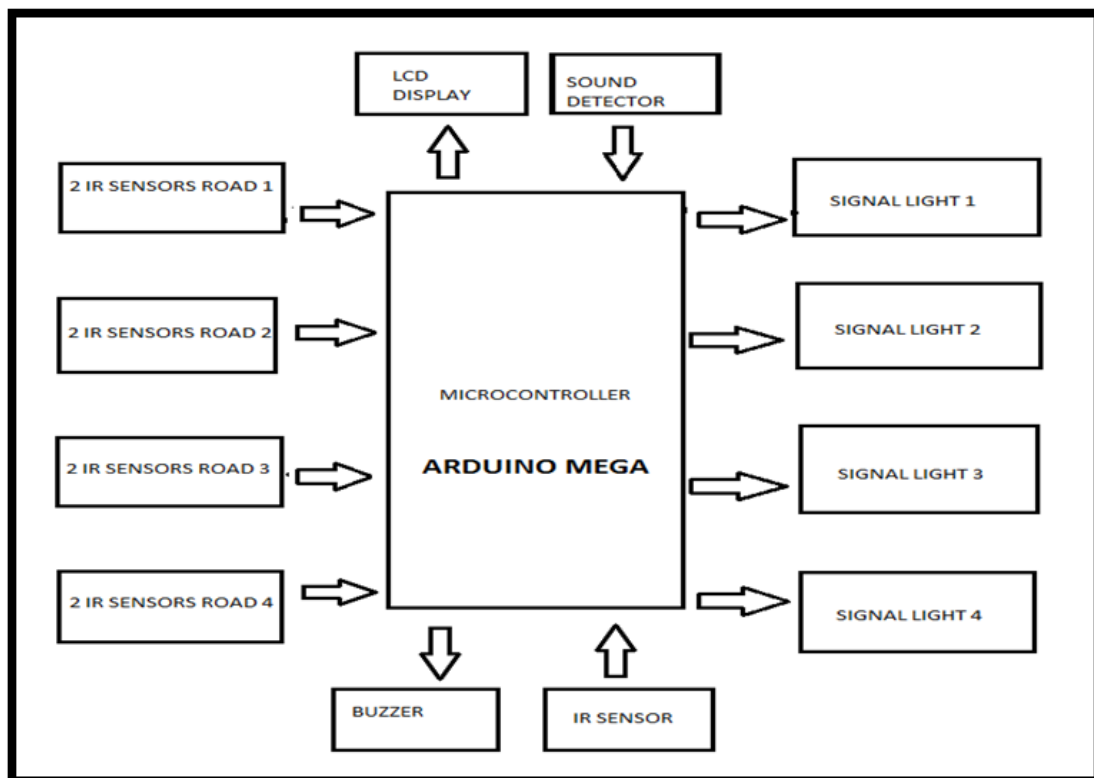
ROAD TO BE OPEN	SIGNAL A	SIGNAL B	SIGNAL C	SIGNAL D
ROAD B	R	G	R	R
	-	Y	-	Y
ROAD D	R	R	R	G
	Y	-	-	Y
ROAD A	G	R	R	R
	Y	-	Y	-
ROAD C	R	R	G	R



On the other hand if red signal is displayed in any particular track, if any vehicles cross the line mark then it is detected by IR sensor and immediately warned by buzzer to eliminate traffic hijacking.

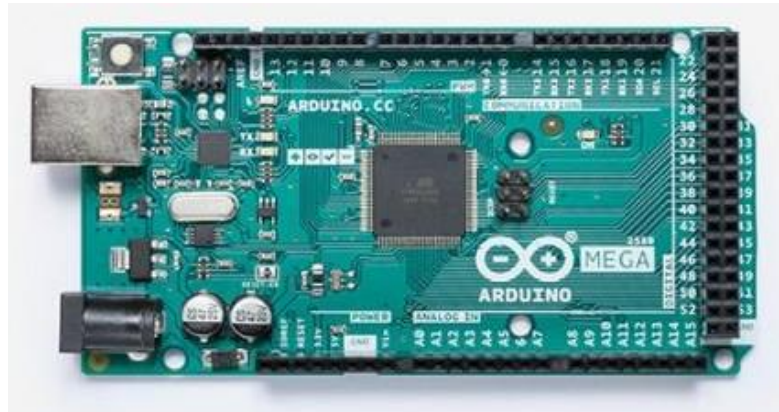
And another main problem is noise pollution due to traffic congestion, the vehicles produces the loud noises ,to control the noise we uses sound detector to measure the decibel continuously.

It measures the sound level and it is displayed by the LCD display. If sound level is goes to high or 85 decibel then all the signal goes to red and LCD shows “punishing signal”.

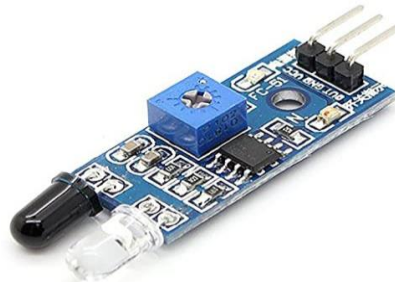


V. COMPONENTS

1. Arduino Mega.
2. Infrared Sensor.
3. Sound Detector.
4. Traffic LEDs.
5. Buzzer.
6. Jumper wires.
7. LCD.

A) ARDUINO MEGA

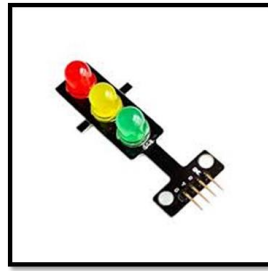
The Arduino Mega 2560 is a microcontroller board based on the ATmega2560. It has 54 digital input/output pins (of which 15 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button.

B) INFRARED SENSOR

IR LED emits light, in the range of Infrared frequency. IR light is invisible to us as its wavelength (700nm – 1mm) is much higher than the visible light range. The Infrared light is emitted back to the receiver when an obstacle interrupts.

C) SOUND DETECTOR

A Sound Sensor is a simple device that detects sound. It has a Microphone with some processing circuit. Using a Sound Sensor, you can measure the intensity of sound from different sources like knocks, claps, loud voices, etc.

D) TRAFFIC LEDS

A light-emitting diode (LED) is a semiconductor device that emits visible light when current passes through it. An LED consists of two junctions called P and N junction. The process of recombination of electrons and holes takes place. By this process, we can obtain light which is converted by an electric current.

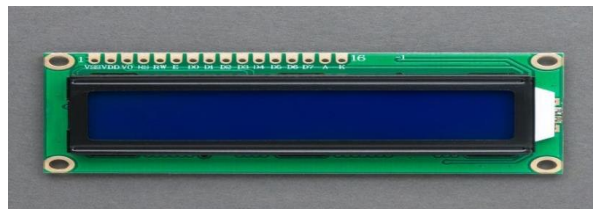
E) BUZZER

Buzzer is an electronic component which makes a beep sound . It is very small, compact 2-pin structure and can be easily used on breadboard, Perf Board, and even on PCBs. There are two types are buzzers that are commonly available.

- 1.Active Buzzer
- 2.Passive Buzzer.

An **Active Buzzer** needs a dc supply to generate a tone using an internal oscillator.

The **Passive Buzzer** needs an ac supply to make a sound. It is operated by changing an input signal which produces a sound rather than a tone.

F) LCD

A LCD(Liquid Crystal Display) is a combination of two states of matter, the solid and the liquid .It uses a liquid crystal to produce a visible image. Liquid crystal display screen works on the principle of blocking light rather than emitting light. Here, 16x2 LCD display is used. It is a very basic module which translates a display 16 characters per line in 2 such lines.

G) JUMPER WIRES

Jumper wires are simply wires that have connector pins at each end, allowing them to be used to connect two points to each other without soldering.

VI. CONCLUSION

Nowadays, timer based traffic signal control system is exist. Since traffic signal lights are programmed for particular time intervals. It leads to the higher consumption of time. so we proposed a smart traffic signal control system. With the help of infrared sensors placed at pathway of each lane, we can achieve the smart traffic signal control system. It reduces, traffic congestion and it tends to smooth traffic flow. The number of passing vehicles on the road decides the density range of traffic and on the basis of vehicle count the microcontroller decides the traffic light delays.

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