

TRAFFIC SIGNAL CONTROL FOR EMERGENCY VEHICLES USING RFID AND SENSOR

Submitted in partial fulfilment of the requirements for the award of
Bachelor of Engineering Degree in Electronics and Communication Engineering

By

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(DEEMED TO BE UNIVERSITY)

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BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of **VADDI JAGADEESH** (Reg. no. 39130493) and **THUMKUNTA LOKESHWAR REDDY** (Reg. no. 39130478) who carried out the project entitled "**TRAFFIC SIGNAL CONTROL FOR EMERGENCY VEHICLES USING RFID AND SENSORS**" under my supervision from June 2022 to April 2023.

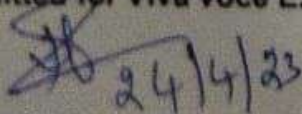
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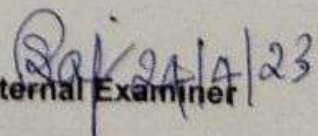
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DECLARATION

We, VADDI JAGADEESH (Reg. No. 39130493) and THUMKUNTA LOKESHWAR REDDY (Reg. No. 39130478) hereby declare that the Project Report entitled "Traffic Signal Control for Emergency Vehicles using RFID and Sensors" done by us under the guidance of Dr. G. Sundari, M.E., Ph.D., Professor, Department of Electronics and Communication Engineering, at SATHYABAMA INSTITUTE OF SCIENCE AND TECHNOLOGY, CHENNAI is submitted in partial fulfilment of the requirements for the award of Bachelor of Engineering degree in ELECTRONICS AND COMMUNICATION.

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ABSTRACT

Traffic lights play such important role in traffic management to control the traffic on the road. Situation at traffic is getting worse especially in the event of emergency cases. During traffic congestion, it is difficult for emergency vehicle to cross the road which involves many junctions. Emergency vehicles, like ambulance have responsibility to reach patient or those who are met with accidents have to quickly transfer them to hospital. Due to traffic signals, they may be delayed for rescue operations. Traffic signal Control for Emergency Vehicle is designed and developed to detect emergency vehicle, how to manipulate the traffic lights and how to provide free way to emergency vehicles. Emergency vehicles include Ambulance, Fire Engine, Police vehicles... etc. This system creates a connection between emergency vehicles and traffic signals. This system uses Radio Frequency Identification (RFID) as its key component to implement the control system. The RFID tag assists in confirming the passage of emergency vehicles from the traffic signal. Based on that movement of emergency vehicle near the traffic signal reflects in changing the signal, this helps the emergency vehicle to clear all the junctions without wasting time at the signals. This is continued until the emergency vehicle reaches its destination. All these processes happened without any human intervention. The quantified output that this system is going to provide with the display of the following parameters that are all the four ultrasonic sensor readings continuously, the timer count and the lane in which the emergency vehicle is detected. Along with the reading the system is going to change the signals accordingly. The timer readings display in milliseconds and the ultrasonic sensor readings that is the distance will be displayed in centimetres.

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LIST OF ABBREVIATIONS

RFID	-----	RADIO FREQUENCY IDENTIFICATION
LCD	-----	LIQUID CRYSTAL DISPLAY

CHAPTER 1

INTRODUCTION

Traffic has different definitions in different forms that is like the vehicles, pedestrians, ships, or planes moving along a route, congestion of vehicles, the movement (as of vehicles or pedestrians) through an area or along a route. Each definition is having their own identity in it.

On average, travellers in Delhi, Mumbai, Bengaluru, Chennai and Kolkata spend 1.5 hours more on their daily commutes than their counterparts in other Asian cities during peak traffic times, according to an April 18 report released by The Boston Consulting Group and commissioned by Uber. In fact, peak-hour congestion, which implies the additional time taken during peak traffic to travel a given distance.

A traffic signal, or stoplight as it is also known, controls vehicle traffic passing through the intersection of two or more roadways by giving a visual indication to drivers when to proceed, when to slow, and when to stop. In some cases, traffic signals also indicate to drivers when they may make a turn. These signals may be operated manually or by a simple timer which allows traffic to flow on one roadway for a fixed period of time, and then on the other road-way for another fixed period of time before repeating the cycle.



Fig.1.1 Emergency vehicles on Road

1.1. NEED FOR TRAFFIC SIGNALS



Fig.1.2 Traffic signal

A traffic signal is used as an instructing device that indicates the road user to act according to the displayed sign. Following the traffic signal ensures road safety and to make things simple to understand, these signals have been using a universal colour code.

Red is generally the sign of danger or warning and on traffic lights, it signals potential hazard ahead and hence, is an indicator for the motorists to stop. Also, it can turn left in a red signal only if there is a sign to do so. Also, when doing so, it needs to give the right of way to pedestrians and vehicles that would be coming from opposite directions.

A yellow traffic light is a warning signal that lets you know that the red signal is about to be displayed. Hence, when you see the yellow light, vehicles should start slowing down to come to a stop in anticipation of red light. Also, in case, for any reason, vehicles can't stop, then you should look out for vehicles that might be entering the intersection around the same time. Just like a red light corresponds to danger and STOP, the green light signals safety and the word GO. However, just to play it really safe, it should first let any vehicle remaining in the intersection pass before you go ahead.

Traffic lights are used to control the movement of vehicles and passengers to ensure smooth and safe traffic. Traffic lights have been around for years and are used to efficiently guide traffic at intersections and crossings. Since, traffic lights apply some rules and regulation on the vehicle drivers and there is a major possibility to meet an accident for those who do not follow these instructions. Hence, Traffic lights help to reduce the rate of accidents on the roads.

Traffic lights also save time by coordinating traffic routes and flows without traffic jams. It also helps to teach discipline to people to everyday life because the people who violate road rules and road safety signals have to pay fines to the authorities. Before traffic lights, traffic police controlled the flow of traffic. Hence, traffic lights cut down the number of hours a traffic police had to spent on the road to instruct the traffic and thus save them from road air pollution.

1.2. HISTORY OF TRAFFIC SIGNAL

A traffic signal with light is placed in London capital of England next to Parliament building in 1868. The purpose of this traffic signal is helping the traffic police especially at night. There was colourful arms and colourful lamps on the device. The lighting is made by gas inside the device. The colour of the light was changed with the help of green and red lenses. The police officer stands next to the pole that the device is connected and could turn the coloured arms and lamps towards the traffic with the help of the arm just below the pole. That was the first time of using red and green lights to control the traffic. Two months later, this modernist lamp which works with gas was exploded and the police officer who used it injured.

In 1920, foundation of modern traffic signal was laid in Detroit which is the eleventh biggest city of USA. It was the first three coloured electrical traffic control device which is made of three separated chambers as rectangle boxes shape. Each chamber illuminated separate lamp and equipped with different signal lenses. Yellow light added to red and green lights informed the drivers that the traffic signal was changing. Especially after 1950, road traffic increased dramatically with the increase in the production and use of motor vehicles. In 1975, the number of automobiles in the world reached to 300 million. The increasing number of vehicles created a need

for traffic lights to be used almost everywhere. Almost every city in the world used traffic lights to manage the traffic flow.

More than 100 years have passed since the first traffic light was used. Red, yellow, and green... Three colour traffic lights have now become a daily part of every person's life. Although the technology, appearance and management of traffic lights have changed, their function has remained basically the same.

1.3 CURRENT STATUS OF TRAFFIC SIGNALS

In the present days of traffic signals, we can find different types of traffic signals used according to the traffic congestion. The below mentioned and discussed are the different types of signals.

- FIXED TIME SIGNAL
- PEDESTRIAN SIGNAL
- MANUAL OPERATED SIGNAL

1.3.1. FIXED TIME SIGNALS

These signals are set to repeat regularly a cycle of red, amber yellow and green lights. Depending upon the traffic intensities, the timings of each phase of the cycle is predetermined. Fixed time signals are the simplest type of automatic traffic signals which are electrically operated.

1.3.2. PEDESTRIAN SIGNALS

When the vehicular traffic remains stopped by red or stop signal on the traffic signals of the road intersection, these signals give the right of way of pedestrians to cross a road during the walk period.

1.3.3. MANUAL CONTROLLED SIGNALS

In these types of signals, the traffic police watch the traffic demand from a suitable point during the peak hours at the intersection and varies the timings of these phases and cycle accordingly.

CHAPTER 2

LITERATURE SURVEY

2.1 INTERFACING FROM LITERATURE SURVEY

Seetharaman.R1, Karthikeyan.S2, Saranraj.M3, Sankar Kumar.P4, Naina Mohamed. M5 et. al. [55] presented a system CALLED Smart traffic system for emergency vehicles and density-based traffic control using RFID in LabView. Here traffic density is calculated by using RFID. The number of vehicles in a lane is calculated using a reader and tags, reader is placed on the road and the tags are attached to the vehicles, when vehicles pass the reader, the reader will count the vehicles based on that traffic signals time will be raised It is done in the LabVIEW stimulation.

Miaomiao Cao1, Qiqi Shuai1, and Victor O.K. Li1, et. al provided a system to called Emergency vehicles – centred traffic signal control in intelligent transport system. It is based on an algorithm, after detecting the arrival of an emergency vehicles at an intersection, the controller keeps measuring the speed, delays, distance from the stop line and stay time of the emergency vehicles

Kaushik S Abhishek Raman Dr. Rajeswara Rao K.V.S provided a system leveraging computer vision for emergency vehicles detection, implementation and analysis Obstacle detection, The two selected computer vision techniques for emergency vehicles recognition are obstacle detection are obstacle detection and instance segmentation, specifically designed CONVOLUTIONAL NEURAL NETWORK (CNN) called Furter RCNN are MAK RCNN for obstacle Detection.

Sai Surya Prakash Moka1, Sai Manikanta Pilla2 and S. Radhika3 et. al. The tag is attached to vehicles has been read by RFID reader with Arduino. The reader counts the number of vehicles passing it for a specific duration, by determining the count the green signal will be turned on for the path with highest vehicles. The emergency vehicles are detected by XBEE and the green light is turned on.

Tejas Naik, Roopalakshmi R, Divya Ravi N, Pawdhan Jain, Sowmya B H and Manichandra et. al. presented the system called RFID-Based smart traffic control frame work for emergency It uses RFID technology, it uses the tags for all calculate the density are according to that the signal will run, this system uses different tag with another range and it is detecting and the lane is cleared for help.

Abhishek Raman, Kaushik S, Dr. Rajeswara Rao and K.V.S Dr Minal Moharir et. al. provided a system called A Hybrid framework for expediting emergency vehicles movement on Indian roads, this paper proposes a model that employs real time IP and obstacle detection using a convolutional neural network (CNN) architecture called SSD is employed to an acoustic signal processing algorithm potential false positive that creep into obstacle detection using Image processing both algorithm work in detection.

Anam Firdous, Indu, and Vandana Niranjane. al. presented a system called Smart density-based traffic light system, smart way by automatically adjusting its timing based on traffic density using Arduino Uno ATmega 328. In this, traffic is sense using digital IR Sensors and IR Sensors detect vehicles further based on the signal reflected from them. Sensors placed adjacent to the road to control the traffic density by changing traffic signal appropriately. All IR Sensors are interfaced with Arduino Uno and it reads data from IR Sensors. Traffic Signal for the system is designed using LEDs and each signal consist two LEDs for each lane. Using this system development at traffic junction we need not to worry about handing the traffic manually and also consumes less time as compared to the conventional traffic system. We harness solar power from solar panel and this is used to build prototype working model of smart traffic signal which automatically adjusts its timing based on traffic direction.

Shajnush Amir, Mirza Sarwar Kamal, Syeda Shabnam Khan, K.M.A Salam. presented a system called PLC based traffic control system with emergency vehicle detection and management, The design of an automated traffic control system with an eye-catching feature of emergency vehicle control is presented in this paper. When an emergency signal interrupts the normal sequence, the system automatically restores the previous state and, as long as the emergency signal is high, illuminates the corresponding road with a green light. The system immediately resumes the retained state of the normal sequence the moment the emergency signal drops below a certain

threshold. RFID is used for emergency signal detection. Ladder logic programming for Programmable Logic Controllers (PLC) is used to design the system. The system was put into practice in a PLC simulation setting. It was later examined in a hardware prototype. According to the test results, it can be used in practice without changing the original code. The traditional traffic control system can be replaced with this PLC-based system. The PLC system can be easily expanded to dynamically manage the traffic system of an entire city by adding extra input and output modules.

Olasupo Ajayi, Antoine Bagula, Hloniphani Maluleke and Ifeoma Chukwubueze et. al. a system called Priority based traffic pre-emption system for medical emergency vehicles in smart cities queues at traffic intersection can increase travel times of medical EVs by an average of 20%. This in many instances could mean the difference between life and death. Prioritizing EVs could be a potential solution to this challenge. In this paper, an Internet of Things based priority pre-emption model for EVs in smart cities is proposed.

It leverages on sensors to dynamically track the EV's location and speed, and adaptively adjusts the timing sequence of all traffic lights on the EV's path. This ensures that the EV experiences little or no delay to and from its destination. Experimental results show that the proposed model has the potential to reduce travel delays experienced by medical EVs by up to 35%.

Luiz Fernando Pinto de Oliveira, Leandro Tiago Manera and Paulo Denis Garcez da Luz et.al. presented a model called Development of smart traffic control system with real time monitoring system, this paper aims to contribute to traffic signals improvement by developing a centralized traffic light control system, using a unique wireless communication network. In order to prove the system's effectiveness, the most common types of urban intersections were analysed. Direct control routines were implemented for network traffic lights, providing a complete control system for extraordinary events, such as closing roads due to accidents or public events. Finally, safety routines were formulated to report the operating status of the traffic light system lamps to a central management. With the aid of a logic analyser connected to the outputs for each focal group, it was possible to set up an operating stages timing

diagram of each traffic light. Thus, the system validation was achieved based on theoretical and practical timing diagrams similarities

Neetesh Kumar, Syed Shameerur Rahman, and Navin Dhakadet. al. presented model called Fuzzy Inference Enabled Deep Reinforcement Learning-Based Traffic Light Control for Intelligent Transportation System, a Dynamic and Intelligent Traffic Light Control System (DITLCS) is proposed which takes real-time traffic information as the input and dynamically adjusts the traffic light duration. Further, the proposed DITLCS runs in three modes namely Fair Mode (FM), Priority Mode (PM) and Emergency Mode (EM) where all the vehicles are considered with equal priority, vehicles of different categories are given different level of priority and emergency vehicles are given at most priority respectively. Furthermore, a deep reinforcement learning model is also proposed to switch the traffic lights in different phases (Red, Green and Yellow), and fuzzy inference system selects one mode among three modes. We have evaluated DITLCS via realistic simulation on Gwalior city map of India using an open-source simulator i.e., Simulation of Urban Mobility (SUMO). The simulation results prove the efficiency of DITLCS in comparison to other state of the art algorithms on various performance parameters.

2.2 OPEN PROBLEM IN EXISTING SYSTEM

2.2.1. The Product is not for Real time purpose

Traffic Control System for Emergency Vehicles which is in the existing methodology is generated in the software simulation platform called LabView. Which is not more effective for the real time application. Yet it's not as simple as it looks to put this innovative technology into practice. While making a traffic control system, developer must deal with several issues. The price of creating a traffic control system is expensive. The process might take a while and the necessary supplies and equipment are not appropriate in this existing method.

2.2.2. The Microcontrollers and Processors used are High End and Complex

Programming microcontrollers or microprocessors is challenging for a variety of reasons. Secondly, it might be challenging to know how to configure them because they frequently include a lot of peripherals and I/O pins. Second, it might be challenging to decide which one to employ for a given activity because they frequently offer a wide variety of skills and features. Ultimately, they frequently need some programming knowledge in order to reach their full potential. As a result, many non-programmers find it challenging to begin working with microcontrollers or microprocessors. One of the most significant problems with the current approach to using traffic control system is that the sensors have not been used correctly.

2.2.3. Deployment of Sensors

Traffic Control system must include sensors since they are in charge of recognising density launching the required responses. Nevertheless, a lot of the systems that are now in use either have no sensors at all or have sensors that are incorrectly calibrated. Users may find it annoying if this results in false positives or false negatives. Finding or developing sensors that satisfy these needs is then achievable if these requirements are known. A successful traffic control system must have properly deployed sensors in order to function properly and offer a satisfying user experience. All other efforts will be in vain without effective sensor placement.

2.2.4. Unrealistic and Adaptable

The current approach of using a traffic control system has a number of issues that prevent it from being adaptable or workable. The existing method, for starters, necessitates the purchase of pricey gear, including an LCD screen. Second, installing and setting up the software needed to run a traffic control system is challenging. Finally, the existing strategy can only accommodate to limited way signals, making it not very scalable. Lastly, because it does not allow for much modification, the existing technique is not very versatile.

CHAPTER 3

REQUIREMENT ANALYSIS

3.1 FEASIBILITY STUDIES/RISK ANALYSIS OF THE PROJECT

- Some of the main risks to the growth of the traffic control system in market include the expensive cost of the devices. The cost of the traffic control for emergency vehicles, which is quite exorbitant in comparison to regular traffic control system, is the main barrier to the market for these devices.
- Compared to currently available commercial designs, the system should be substantially less expensive. The design of the system should be appealing. The interface should be simple to use.
- The system what we are prosed is to give accurate density and accurately identify the emergency vehicles and it to display the accurate lane that the emergency vehicle is identified.

3.2 HARDWARE AND SOFTWARE REQUIREMENTS AND SPECIFICATION DOCUMENTS

3.2.1. RADIO FREQUENCY IDENTIFICATION

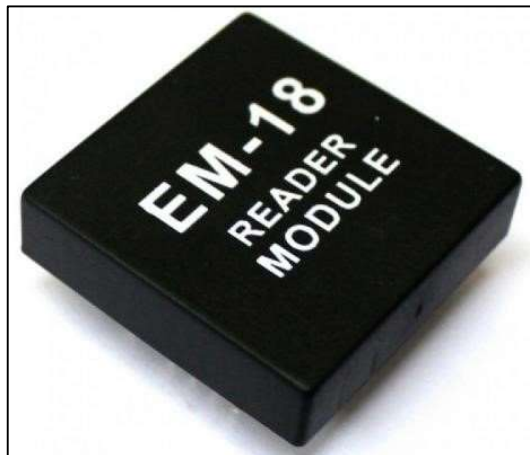


Fig.3.1 EM-18 Reader Module

Radio Frequency Identification (RFID) refers to a wireless system comprised of two components: tags and readers. The reader is a device that has one or more antennas that emit radio waves and receive signals back from the RFID tag. Tags, which use radio waves to communicate their identity and other information to nearby readers, can be passive or active. Passive RFID tags are powered by the reader and do not have a battery. Active RFID tags are powered by batteries.

RFID tags can store a range of information from one serial number to several pages of data. Readers can be mobile so that they can be carried by hand, or they can be mounted on a post or overhead. Reader systems can also be built into the architecture of a cabinet, room, or building.

I. WORKING OF RFID

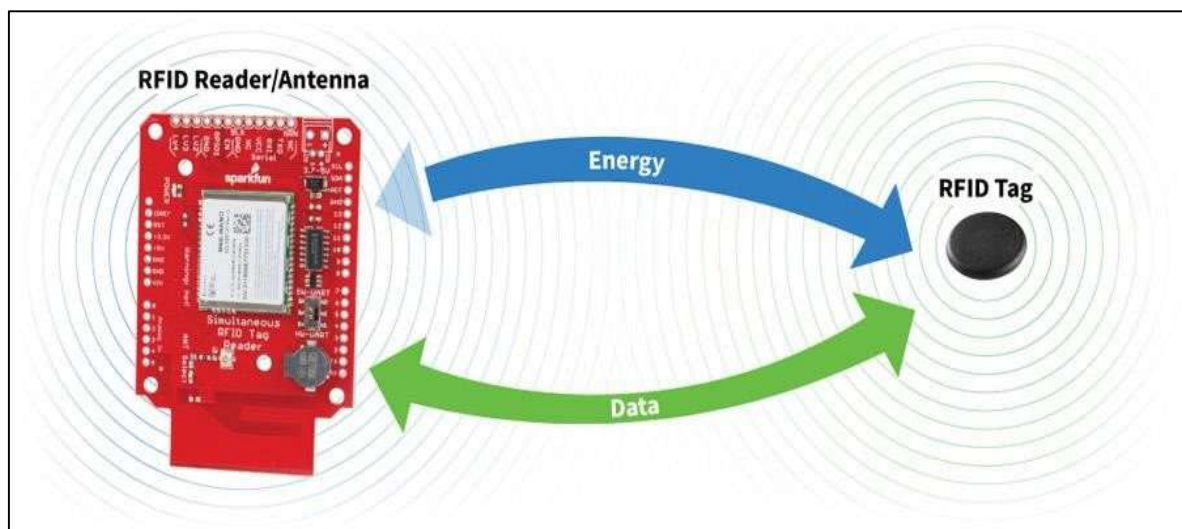


Fig.3.2 RFID Working

Every RFID system consists of three components: a scanning antenna, a transceiver and a transponder. When the scanning antenna and transceiver are combined, they are referred to as an RFID reader or interrogator. There are two types of RFID readers -- fixed readers and mobile readers. The RFID reader is a network connected device that can be portable or permanently attached. It uses radio waves to

transmit signals that activate the tag. Once activated, the tag sends a wave back to the antenna, where it is translated into data.

The transponder is in the RFID tag itself. The read range for RFID tags varies based on factors including the type of tag, type of reader, RFID frequency and interference in the surrounding environment or from other RFID tags and readers. Tags that have a stronger power source also have a longer read range.

There are two main types of RFID tags:

- Active RFID. An active RFID tag has its own power source, often a battery.
- Passive RFID. A passive RFID tag receives its power from the reading antenna, whose electromagnetic wave induces a current in the RFID tag's antenna.

Table 3.1 Comparison between Three RFID'S

	Active RFID	Passive RFID	Battery Assisted Passive (BAP)
Tag Power Source	Internal to tag	Energy transfer from the reader via RF	Tag uses internal power source to power on, and energy transferred from the reader via RF to backscatter
Tag Battery	Yes	No	Yes
Availability of Tag Power	Continuous	Only within the field reader	Only within field of reader
Required Signal Strength from Reader to Tag	Very Low	Very high (must power the tag)	Moderate (does not need to power tag, but must power backscatter)
Available Signal Strength from Tag to Reader	High	Very Low	Moderate
Communication Range	Long Range (100m or more)	Short range (up to 10m)	Moderate Range (upto 100m)
Sensor Capability	Availability continuously monitor and record sensor input	Ability to read and transfer sensor values only when tag is powered by reader	Ability to read and transfer sensor values only when tag receives RF signal from reader

3.2.2. SPI PROTOCOL (SERIAL PERIPHERAL INTERFACE)

It is a digital communication protocol that is used to transfer data serially (one bit at a time) between two or more digital devices like microcontrollers, microprocessors, or other devices. Many analog devices like analog to digital converts, analog sensors, temperature sensors, and data converters also provide interfacing

mode based on SPI communication. The most used devices which communicate with microcontrollers over SPI bus are:

- SD Cards
- RFID Modules
- 2.4GHz wireless transmitter and receiver module

It is a serial and synchronous interface. The synchronous interface means it requires a clock signal to transfer and receive data and the clock signal is synchronized between both master and slave. Unlike UART communication which is asynchronous.

The clock signal controls when data is to be sent to the slave and when it should be ready to read. The only master device can control the clock and provide a clock signal to all slave devices. Data cannot be transferred without a clock signal. Both master and slave can exchange data with each other. No address decoding is done.

I. FUNCTIONALITY

- SCLK or SCK pin: This signal provides a clock to Slaves and only Master can control clock signal. Note that this pin remains in idle state that is inactive or tristate when no operation is carried out.
- SS or CS: This is known as a chip select or Slave select pin. This line selects the slave to which Master want to transfer data.
- MOSI: It is a unidirectional pin. This stands for Master output and Slave input pin.
- As its name suggests, this line used to send data from master to slave.
- MISO: This is known as Master input and a Slave output. This line is used to send data from the slave to the Master.

In short, in this communication protocol, devices exchange data in master/slave mode. The master device is mainly responsible for the initiation of the data frame. The master device also selects the slave device to which data need to be transferred. Chip select line is usually used to identify or select a particular slave device. Whenever a master device read to transmit data to slave or want to receive data from the slave, the master does so by activating the clock signal. Every master device sends data on the MOSI line and receives data through another line that is MISO.

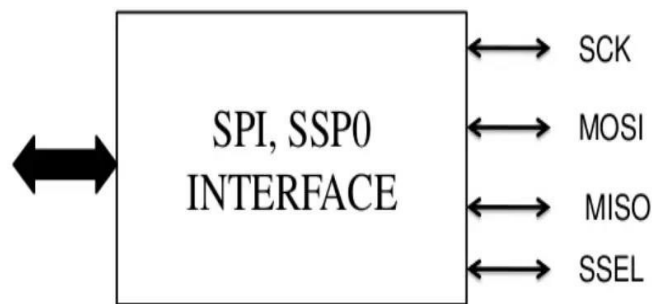


Fig.3.3 SPI Protocol

3.2.3. ULTRASONIC SENSORS

Ultrasonic sensors are electronic devices that calculate the targets distance by emission of ultrasonic sound waves and those waves into electrical signals. The speed of emitted ultrasonic waves traveling speed is faster than the audible sound. There are mainly two essential elements which are the transmitter and receiver. Using the piezoelectric crystals, the transmitter generates sound, and from there it travels to the target and gets back to the receiver component. To know the distance between the target and the sensor, the sensor calculates the amount of time required for sound emission to travel from transmitter to receiver. The calculation is done as follows:

$$D = 1/2 T * C$$

Where 'T' corresponds to time measured in seconds

'C' corresponds to sound speed = 343 measured in mts/sec

I. WORKING PRINCIPLE

Ultrasonic sensor working principle is either similar to sonar or radar which evaluates the target/object attributes by understanding the received echoes from sound/radio waves correspondingly. These sensors produce high-frequency sound waves and analyse the echo which is received from the sensor. The sensors measure the time interval between transmitted and received echoes so that the distance to the target is known.

II. SPECIFICATIONS

Knowing the specifications of an ultrasonic sensor helps in understanding the reliable approximations of distance measurements.

- The sensing range lies between 40 cm to 300 cm.
- The response time is between 50 milliseconds to 200 milliseconds.
- The Beam angle is around 5°.
- It operates within the voltage range of 20 VDC to 30 VDC
- Preciseness is $\pm 5\%$
- The frequency of the ultrasound wave is 120 kHz
- Resolution is 1mm
- The voltage of sensor output is between 0 VDC – 10 VDC
- The ultrasonic sensor weight nearly 150 grams
- Ambient temperature is -25°C to +70°C
- The target dimensions to measure maximum distance is 5 cm × 5 cm

III. PIN DIAGRAM:



Fig.3.4 Ultrasonic sensor pin diagram

Vcc – This pin has to be connected to a power supply +5V.

TRIG – This pin is used to receive controlling signals from the Arduino board. This is the triggering input pin of the sensor

ECHO – This pin is used for sending signals to the Arduino board where the Arduino calculates the pulse duration to know the distance. This pin is the ECHO output of the sensor.

GND – This pin must be connected to the ground.

3.2.4. ARDUINO MEGA

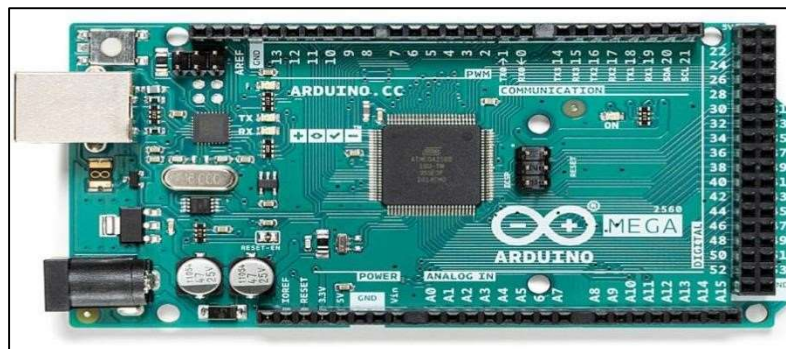


Fig.3.5 Arduino Mega Board

Arduino MEGA 2560 board is just like a brother of Arduino UNO board. It is way more powerful than Arduino UNO and also twice as long from it. This board is the successor of Arduino MEGA. It can be named as ATmega2560. It can have more memory space as compared to other boards of Arduino. Arduino MEGA 2560 is different from all other boards of Arduino that came before as they don't use the FTDI USB-to-serial driver chip. Instead, it uses ATmega16U2 programmed as a USB-to-serial converter. It is programmed in Arduino IDE software like all other boards in terms of coding. We don't need to attach extra components or devices to make this board in running condition to use. As per our requirements we can just plug and play with this board as everything is built in that makes it readily available.

Arduino Mega 2560 is an amazing microcontroller board for the projects that need large amount of input output pins or if high processing power is required. It is designed for more complex projects because as for simple projects large amount of input output pins are useless and a board with less memory fails to achieve our requirements. It can be used as a stand-alone project or in combination with other boards. Mostly it is used for creating a stand-alone project

I. SPECIFICATIONS

Table 3.2 Specifications of Arduino Mega

Microcontroller	ATmega2560
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limit)	6-20V
Digital I/O Pins	54 (of which 15 provide PWM output)
Analog Input Pins	16
DC Current per I/O Pin	20 mA

DC Current for 3.3V Pin	50 mA
Flash Memory	256 KB of which 8 KB used by bootloader
SRAM	8 KB
EEPROM	4 KB
Clock Speed	16 MHz
LED_BUILTIN	13
Length	101.52 mm
Width	53.3 mm
Weight	37 g

II. PINS

- In digital side 54 pins for I/O (input output pins)
- 15 pins out of this are useful for PWM (pulse width modulation)
- In analog side 16 input pins
- Ground pins: 5
- One pin for 3.3 volts
- One reset button
- USART pins: 4 (These are hardware serial ports which produces maximum speed to set up communication)
- ISP programming pins: 6
- Crystal oscillator is added on the board having frequency of 16 MHz
- USB cable port (It is used to transfer and connect code from computer the board)
 - ICSP header (Used to program the board and to upload code from computer. Indeed, a remarkable addition in Arduino MEGA 2560)
- Power Jack
- Resettable Polyfused: (to provide extra layer of protection. It prevents USB port of the computer from overheating in case of high current flowing through microcontroller board)

III. POWER SUPPLY

- Arduino Mega 2560 can have power supply of two voltages i.e., 3.3 V and 5 V
- 3 voltage supply can be generated with the help of on-board regulator and the maximum current is 50 mA that can pass through it.
- 5-volt supply can also be generated and regulated on board. DC supply can be given via power jack or by using USB cable port
- Vin is an input power that can be used within the external power in range.
- GND is a ground terminal which can be connected to the ground of connection from which power is going to be supplied.

IV. SOFTWARE

- Just like other Arduino boards, Arduino MEGA 2560 also uses Arduino IDE. This IDE supports C programming so we must write program in C language. We can type our program in it and then burn that code in our microcontroller and we can also change our code according to requirements. The code that we make on software is known as sketch and it is burned in software and then transferred to our microcontroller using USB cable.
- To reset the board and to erase all previous data from microcontroller we can use the reset button on board
- Arduino Mega 2560 comes with built-in boot loader and it rules out the usage of external burner for burning code into the microcontroller. This boot loader uses STK500 protocol for communication purposes.
- After compiling and burning program / sketch on board, we can unplug USB cable and it eventually removes power from board. If we have to incorporate this board in our project then we can power it by using power jack or Vin pin of our board
- Another feature that is included in Arduino mega 2560 is multitasking. Although

- IDE doesn't support this feature but different operating system can be used to make C program for this purpose and doing so also provides flexibility to use our own build program using ISP connector of board.



Fig.3.6 Arduino IDE

V. APPLICATIONS

- 8-bit computer
- 3D printer
- To control and handle more than one motor
- Robot with many sensors
- CNC router

- DC Power Jack 5V 7-12VDC Input
2.1mm x 5.5mm Male Center Positive
- USB-B Port to Computer
-
- No Connection
I/O Reference Voltage for shields
Reset Input
3.3V Output @ 50mA
5V Output or Input
Ground
Ground
7-12V Output or Input
- Analog Pin 0 / Digital Pin 54 (A0)
Analog Pin 1 / Digital Pin 55 (A1)
Analog Pin 2 / Digital Pin 56 (A2)
Analog Pin 3 / Digital Pin 57 (A3)
Analog Pin 4 / Digital Pin 58 (A4)
Analog Pin 5 / Digital Pin 59 (A5)
Analog Pin 6 / Digital Pin 60 (A6)
Analog Pin 7 / Digital Pin 61 (A7)
- Analog Pin 8 / Digital Pin 62 (A8)
Analog Pin 9 / Digital Pin 63 (A9)
Analog Pin 10 / Digital Pin 64 (A10)
Analog Pin 11 / Digital Pin 65 (A11)
Analog Pin 12 / Digital Pin 66 (A12)
Analog Pin 13 / Digital Pin 67 (A13)
Analog Pin 14 / Digital Pin 68 (A14)
Analog Pin 15 / Digital Pin 69 (A15)
-
- Red numbers in parenthesis are the name to use when referencing that pin.
Analog pins are referenced as A0 thru A15 even when using as digital I/O
- (I2C) SCL - Serial Clock
(I2C) SDA - Serial Data
Analog Reference Voltage
Ground
(13) Digital Pin 13 / PWM / Connected to on-board LED
(12) Digital Pin 12 / PWM
(11) Digital Pin 11 / PWM
(10) Digital Pin 10 / PWM
(9) Digital Pin 9 / PWM
(8) Digital Pin 8 / PWM
(7) Digital Pin 7 / PWM
(6) Digital Pin 6 / PWM
(5) Digital Pin 5 / PWM
(4) Digital Pin 4 / PWM
(3) Digital Pin 3 / PWM / Ext Int 5
(2) Digital Pin 2 / PWM / Ext Int 4
(1) Digital Pin 1 / Serial Port 0 TXD (Main Serial Port)
(0) Digital Pin 0 / Serial Port 0 RXD (Main Serial Port)
(14) Digital Pin 14 / Serial Port 3 TXD
(15) Digital Pin 15 / Serial Port 3 RXD
(16) Digital Pin 16 / Serial Port 2 TXD
(17) Digital Pin 17 / Serial Port 2 RXD
(18) Digital Pin 18 / Serial Port 1 TXD / Ext Int 3
(19) Digital Pin 19 / Serial Port 1 RXD / Ext Int 2
(20) Digital Pin 20 / (I2C) SDA / Ext Int 1
(21) Digital Pin 21 / (I2C) SCL / Ext Int 0
- SV
Digital Pin 22 (22)
Digital Pin 24 (24)
Digital Pin 26 (26)
Digital Pin 28 (28)
Digital Pin 30 (30)
Digital Pin 32 (32)
Digital Pin 34 (34)
Digital Pin 36 (36)
Digital Pin 38 (38)
Digital Pin 40 (40)
Digital Pin 42 (42)
Digital Pin 44 (44)
Digital Pin 46 (46)
Digital Pin 48 (48)
Digital Pin 50 (50)
Digital Pin 52 (52)
GND
SV
Digital Pin 23 (23)
Digital Pin 25 (25)
Digital Pin 27 (27)
Digital Pin 29 (29)
Digital Pin 31 (31)
Digital Pin 33 (33)
Digital Pin 35 (35)
Digital Pin 37 (37)
Digital Pin 39 (39)
Digital Pin 41 (41)
Digital Pin 43 (43)
Digital Pin 45 (45)
Digital Pin 47 (47)
Digital Pin 49 (49)
Digital Pin 51 (51) (S/P) MOSI
Digital Pin 53 (53) (S/P) SS
GND

3.2.5. LIQUID CRYSTAL DISPLAY

21

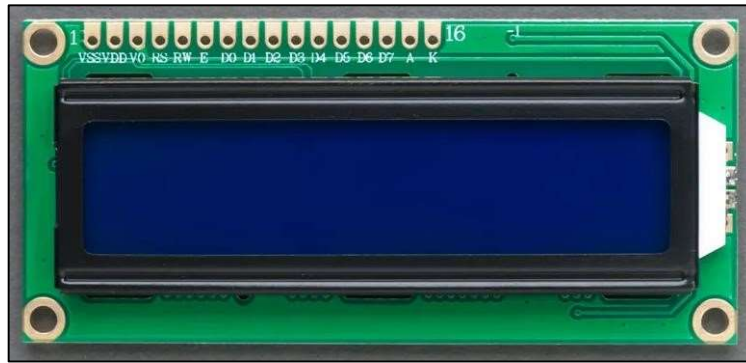


Fig.3.8 Liquid Crystal Display

This LCD has two registers, namely, Command and Data. Command register stores various commands given to the display. Data register stores data to be displayed. The process of controlling the display involves putting the data that form the image of what you want to display into the data registers, then putting instructions in the instruction register. In your Arduino project Liquid Crystal Library simplifies this for you so you don't need to know the low-level instructions. Contrast of the display can be adjusted by adjusting the potentiometer to be connected across VEE pin.

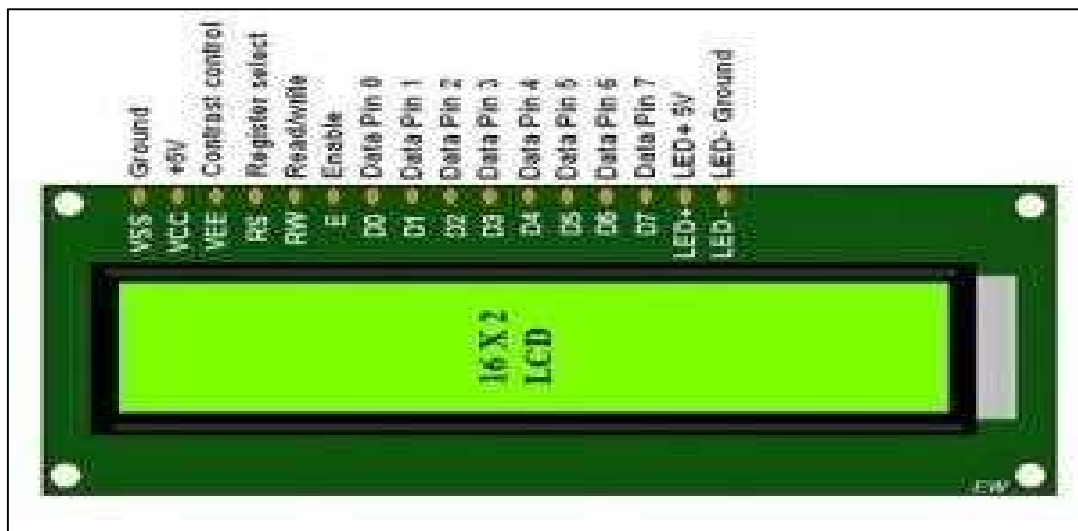


Fig.3.9 Pin Diagram for LCD

- Pin1 (Ground/Source Pin): This is a GND pin of display, used to connect the GND terminal of the microcontroller unit or power source.
- Pin2 (VCC/Source Pin): This is the voltage supply pin of the display, used to connect the supply pin of the power source.

- Pin3 (V0/VEE/Control Pin): This pin regulates the difference of the display, used to connect a changeable POT that can supply 0 to 5V.
- Pin4 (Register Select/Control Pin): This pin toggles among command or data register, used to connect a microcontroller unit pin and obtains either 0 or 1 (0 = data mode, and 1 = command mode).
- Pin5 (Read/Write/Control Pin): This pin toggles the display among the read or writes operation, and it is connected to a microcontroller unit pin to get either 0 or 1 (0 = Write Operation, and 1 = Read Operation).
- Pin 6 (Enable/Control Pin): This pin should be held high to execute Read/Write process, and it is connected to the microcontroller unit & constantly held high.
- Pins 7-14 (Data Pins): These pins are used to send data to the display. These pins are connected in two-wire modes like 4-wire mode and 8-wire mode. In 4-wire mode, only four pins are connected to the microcontroller unit like 0 to 3, whereas in 8-wire mode, 8-pins are connected to microcontroller unit like 0 to 7.
- Pin15 (+ve pin of the LED): This pin is connected to +5V
- Pin 16 (-ve pin of the LED): This pin is connected to GND.

1. APPLICATIONS

- The liquid crystal displays (LCDs) are used in aircraft cockpit displays.
- It is used as a display screen in calculators.
- For displaying images used in digital cameras.
- The television is main applications of LCD.
- Mostly the computer monitor is made up of LCDs.
- It is used in instruments panel where all the lab instruments use LCD screens for display.
- The LCDs are commonly used in all the digital wrist watches for displaying time

CHAPTER 4

DISCRIPTION OF THE PROPOSED SYSTEM

4.1. AIM

The current approach aims to develop a system that utilizes an Ultrasonic sensor and RFID to determine density and identify the Emergency vehicles respectively, with the signals changing by density and Emergency Vehicles. Which will help to clear the traffic effectively and also helps emergency vehicles not to wait due to traffic at the signals and to give inexpensive system.

4.2 EXISTING PROCESS AND METHODOLOGY

In the Existing methodology they are using RFID reader module which generates 125KHz radio frequency wave continuously. When RFID tag comes in that range of radio frequency wave, the coil strip in that particular tag will get excited and it will power the tag's transponder, unique data of the particular tag would send the information to the reader by transponder, at the same time RFID reader will receives the transmitted data. This data will be transferred to the processor. The processor considers each unique data as individual vehicle. The number of data received will be equal to the number of vehicles in the road. According to the number of vehicles the traffic signal timing will be adjusted. Thus, in each road, number of vehicles were detected, the process checks the road in anticlockwise continuously, based upon the number of vehicles in each road, the signal timing will be optimized. The emergency vehicles have unique tag id. When this unique id crosses RFID it opens the signal of that lane and closes the signals of other lanes. As a result, the traffic is regulated accordingly.

4.3. BLOCK DIAGRAM OF EXISTING METHODOLOGY

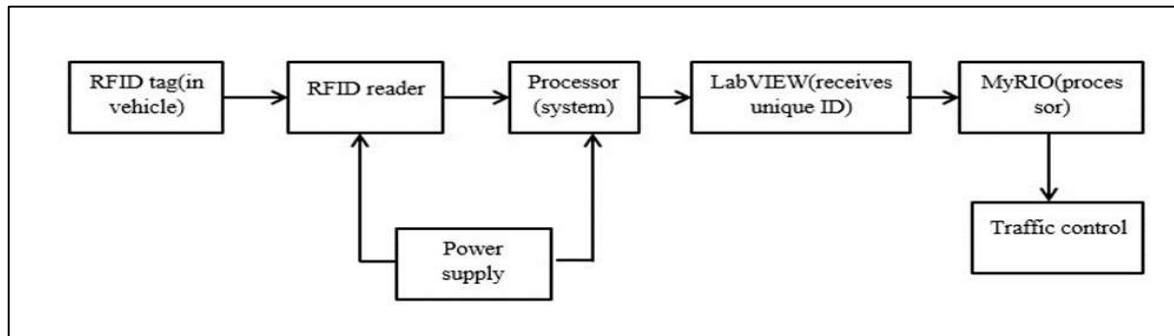


Fig. 4.1: Workflow model of the existing system

RFID reader module will emit the radio frequency wave and the RFID tag is fixed in the vehicle. When the tag detects frequency in the particular range of reader, it will transmit the unique Id to the reader. The reader receives the tag id and send it to the processor, then the processor will consider Id as a vehicle. Similarly, each Id is counted as an individual vehicle and then the number of vehicles is measured as a traffic density. Thereby, traffic signal timing is adjusted according to the vehicle count. The timing to hold the signal open is depend upon the vehicle present in the particular road. Correspondingly, other three roads work in the same way in anticlockwise direction.

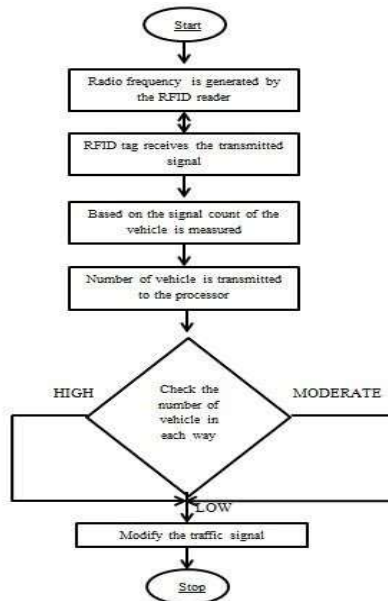


Fig.4.2 Flow diagram of the project

4.3.1. RESULT AND SIMULATION

Once the unique Id is received by the processor, it will count each Id as one vehicle and it counted as vehicle count. If the count of the vehicle is in between the range of 0-5, 15, the traffic signal will be opened for 30 seconds, similarly if the range is 15 and above, the traffic signal will be opened for 60 seconds. All these traffic signals are indicated as Boolean indicator. And the signal from the RFID is received into the LabVIEW using VISA port in LabVIEW toolkit. The number of vehicles in each way is indicated by the numeric indicator. The traffic signal is regulated by implementing the counter in the program. The above-mentioned process is repeated in the anticlockwise direction. And the whole process is reinitialized for every iteration. When a unique id of emergency vehicle crosses, programme goes to exceptional case. Where the code is programmed as signal opens for emergency vehicles and closes the signal of other lanes, at that time it doesn't check traffic density.

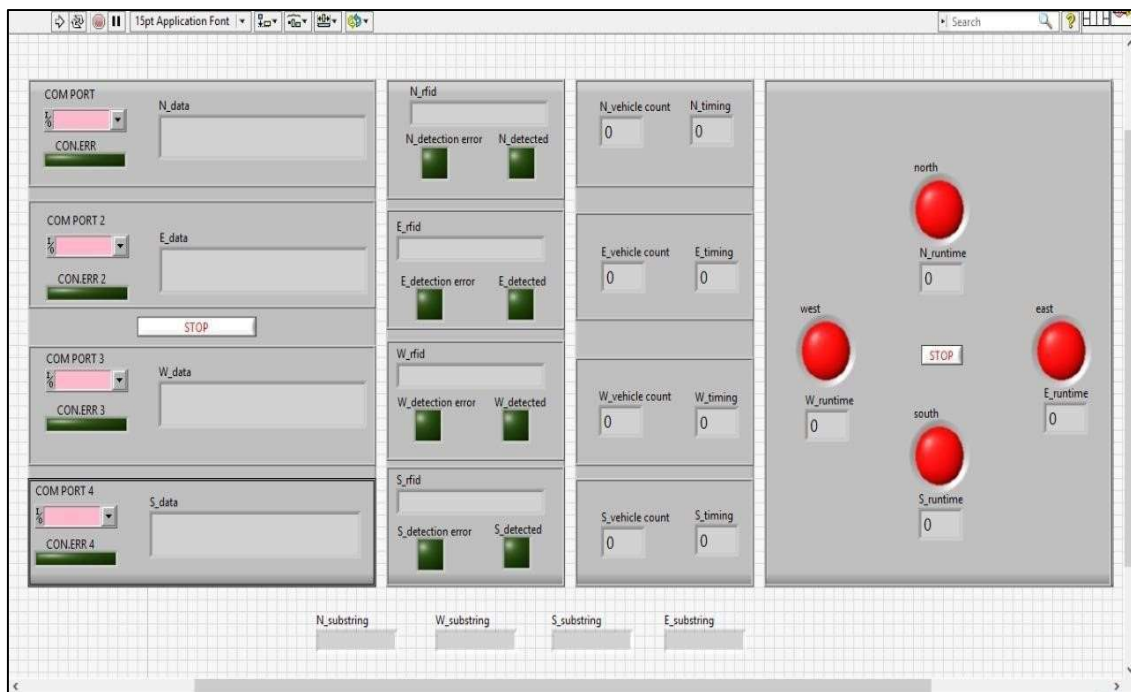


Fig.4.3 The output image

The system which exists already works efficiently to manage the traffic but it is time consuming. The proposed system works uninterruptedly with accuracy in managing the traffic at every junction. By implementing this system, public can save their valuable time by avoiding waiting at the traffic. Also, it helps to reduce the overcrowding in high traffic areas which in turn it reduces the accidents by means of saving the public life. This system saves human life by allowing emergency vehicle at proper time by avoiding traffic density.

In addition, it also helps to reduce the human interruption in traffic signals.

4.4. IMPROVEMENTS TO BE MADE



Fig.4.4 Emergency Vehicle stuck in Traffic

These are the several improvements that can be made in the existing system. They are: Accuracy: The accuracy of the present system can be improved, Model loss: the loss of the system can be reduced, Differentiation: The differentiation between detecting the density and detecting Emergency vehicles that can be made.

4.5. PROPOSED METHODOLOGY

The suggested approach uses RFID EM 18 to identify emergency vehicles and Ultrasonic sensors to determine density. We will make use of both an RFID reader and an RFID tag while utilizing RFID technology. This approach involves placing an RFID reader at the signal and attaching RFID tags to the emergency vehicles. The RFID reader activates the tag using radio waves when the rescue vehicle is nearby. When a tag is activated, a wave is emitted, which returns to the antenna and is transformed into data the reader can read. The emergency vehicle will cause the signals to change from red to green in the lane where it is detected.

The traffic management system in place is already effective, but it takes a lot of time. The proposed system accurately and continuously manages traffic at every intersection. By putting this system into place, the public can save valuable time by avoiding traffic jams. Additionally, it helps to lessen congestion in areas with high traffic, which lessens accidents by preserving public life. This system prevents traffic density and allows emergency vehicles to arrive at the appropriate time, saving human lives. Additionally, it aids in minimizing human interference with traffic signals.

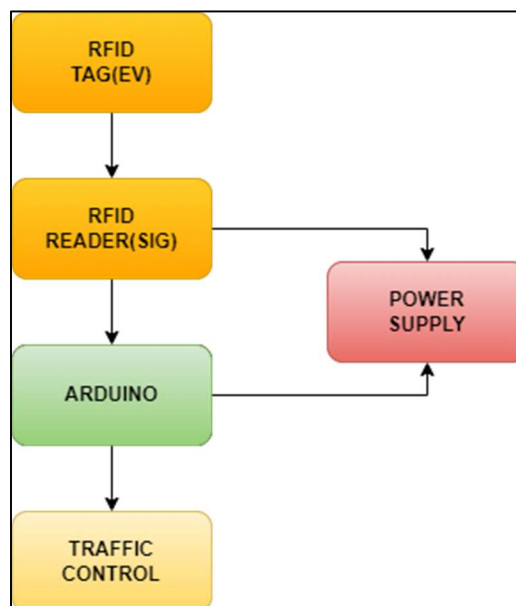


Fig.4.5 Initial Design for Proposed System



Fig.4.6 Giving way for Emergency Vehicles

Now that we have reached the final stage, we have proposed a model that combines RFID and Ultrasonic sensors, with the Ultrasonic sensor being installed alongside the RFID reader at the signal. The traffic density will be determined by an ultrasonic sensor, and the lane with the highest density will receive a green signal while the others will display a red one.

The delay of the yellow signal will be five seconds, and the traffic signals will change every 45 seconds. Twenty meters from each line's signal, the RFID readers will be placed in the path. This model uses an ultra-high-frequency RFID module with a frequency of 433 MHz, and the RFID reader has a range of 100 meters. The RFID reader will recognize any nearby emergency vehicles, and the process will then proceed. In addition to this, ultrasonic sensors will also be placed along the sides of RFID readers. The most popular range for ultrasonic sensing is 40 to 70 kHz, which can detect objects at a distance of about 11 meters. It will manipulate the traffic control system to increase the time of the green signal for the lane that is having more density and it will stay in the red until it turns comes means usually the change in the signals will be taken at a particular time and it will be shifting from one lane to other. Emergency vehicles will be detected using RFID module and the traffic signals will change immediately, given clearance for that lane.

4.5.1. MAJOR DIFFERENCES BETWEEN THE EXISTING AND PROPOSED METHODOLOGY

Table 4.1 Differences between Existing and Proposed System

FEATURES	EXISTING METHODOLOGY	PROPOSED METHODOLOGY
Microcontroller used	My RIO	Arduino Mega
Social Networking	Few existing methods have implemented in it	More effectivity
Inputs	RFID	RFID and Ultrasonic sensor
Methodology	Calculating Density	Calculating Density and detecting emergency vehicle
Complexity	complicated	User friendly
Simulated	LABVIEW	Not implemented
Cost	Expensive	Is to reduce the cost

4.5.2. ADVANTAGES OF PROPOSED METHODOLOGY

- The proposed methodology is easy to implement with almost all the Features available in the existing methodologies.
- The microcontrollers used are relatively inexpensive unlike the other microcontrollers used in most of the methodologies.
- Here the methodology includes both detection of emergency vehicles and density.
- The complexity of the project is less compared to others.
- User friendly and can be implemented across all the locations.
- Cost effective

4.6. ARCHITECTURE / OVERALL DESIGN OF THE PROPOSED METHODOLOGY

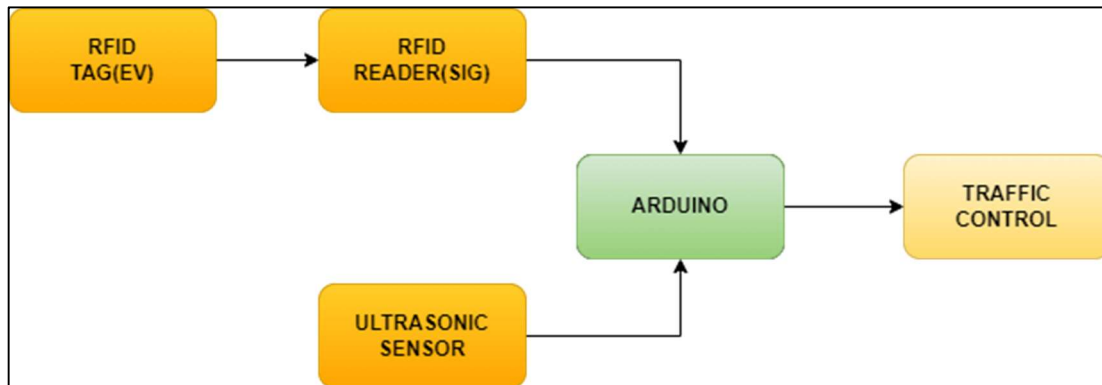


Fig.4.7 Final Design for Proposed System

The architecture of the proposed model contains two main components and a Arduino microcontroller that enables the code to interface with the sensors. The components that play a major role are RFID reader and ultrasonic sensor that work based on the movement of emergency vehicles. The RFID reader have a specific set of RFID tags that read the data and sends signals to the microcontroller later the microcontroller enables the traffic signals based on the requirement and clears the route based on the tag that is enabled. As there is another component connected that is Ultrasonic sensor, there are totally four Ultrasonic sensors connected each pointing to various directions when an heavy traffic movement is detected on one of the sensor the timer set for the change of signals is increased by half cycle.

4.7. DESCRIPTION OF SOFTWARE FOR IMPLEMENTATION AND TESTING PLAN OF THE PROPOSED MODEL/SYSTEM

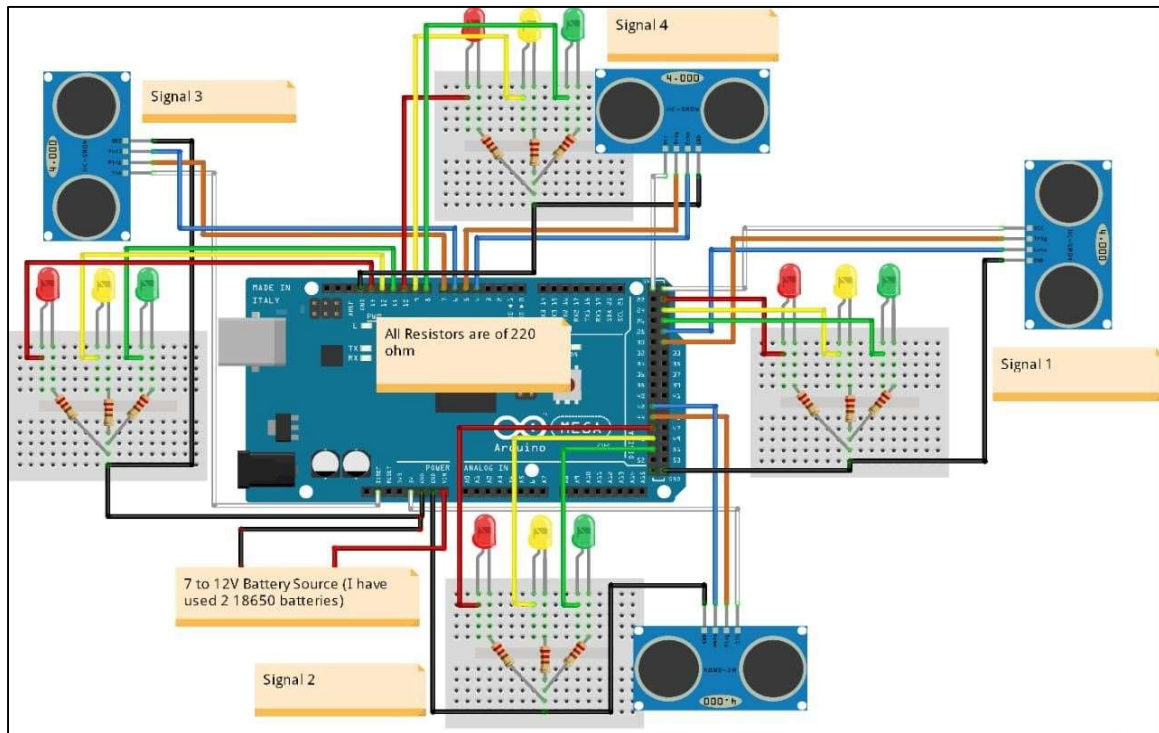


Fig 4.8 Circuit Diagram for proposed method

Four ultrasonic sensors are interfaced with the Arduino. Arduino will read from these sensors and will calculate the distance. This sensor can measure from 2 to 400 cm. In order to generate a wave, we will have to set the trigger at high for 10 us which will send an 8 cycle sonic burst at 40 KHz which will hit the object and after hitting the object, the wave will be received by the echo. The echo will then tell us the time that the wave have traveled in us (micro seconds). We will then convert this time into distance travelled by using $S = v \cdot t$. LED's are connected to the Arduino through the 220 ohm resistors. It is necessary to use the resistor with the LED. The resistor limits the current flowing through the LED. If you won't use

it then the LED will burn out soon. You can use the resistor of value from 100 ohm to 10k ohm with the LED. Larger the value of LED, lesser the current will pass.

First, we tested our practice and implementation by using TINKERCAD software which led up to focus on our mistakes and to move forward with the other procedures here this traffic control system which we practiced only with the ultrasonic sensors for all the four-way signals and the signals are acting and increasing time according to the density.

Later on, we discussed with the RFID module and we tried with RFID MFRC522 reader and it haven't shown us the results then we gone for the train and error method and we found RFID EM18 reader is an effective one which help us to get effective results.

4.8. PROJECT MANAGEMENT AND PLAN

- The first step was to investigate the available microcontroller possibilities. We looked at the Raspberry Pi, Arduino UNO, Arduino Mega and Node MCU, as different options. We ultimately decided on Arduino Mega after weighing our demands and requirements.
- After that, we looked into other uses for the RFID and made decisions on the sensors to utilise and the information that would need to be shown.
- The RFID reader was then given a thorough examination, and we ultimately decided to use an RFID EM 18 reader.
- Once all of the components and other decisions had been made, we simulated the circuit separately using the sensors i.e., Ultrasonic sensor as needed in the Tinker CAD programmes. And we went through with the direct implementation for the RFID module as we haven't found any essential source to stimulate it.
- When everything was connected and tested, we arrived at the end as anticipated.

4.9. TRASITION / SOFTWARE OPERATION PLAN

- we first used IR sensors in the place of Ultrasonic sensor, and we felt like whatever the accuracy we are seeking is not up to the mark so we changed it to ultrasonic sensor.
- We attempted to display the data on the serial monitor as well during the implementation phases, but we now intended to do it on the LCD screens.
- Moreover, we considered employing four RFID readers, but changed our minds due to the microcontroller that we selected and went with a one RFID reader with four RFID tags.
- Also, we used the mfr522 reader programme to create the simulated circuit; however, when it came time to physically execute the circuit, we decided that the mfr522 reader would not be very useful and switched to using RFID EM 18 reader.

CHAPTER 5

IMPLEMENTATION DETAILS

5.1 DEVELOPMENT AND DEPLOYMENT

- We have made use of two microcontroller boards.
- One Arduino Mega board is attached to the RFID EM18 reader, and it only turns on when RFID tag approaches the reader and with the help of ultrasonic sensor it will calculate the density. Also, Arduino Mega board is attached to the LCD screen.
- We use an adapter that is connected to the 230 volts ac supply from the plug board and it converts these 230 volts supply into 12 volts dc supply.
- The density and identification of emergency vehicles are the result of connecting the ultrasonic sensor, RFID module, to Arduino, which is then linked to the LCD screen.

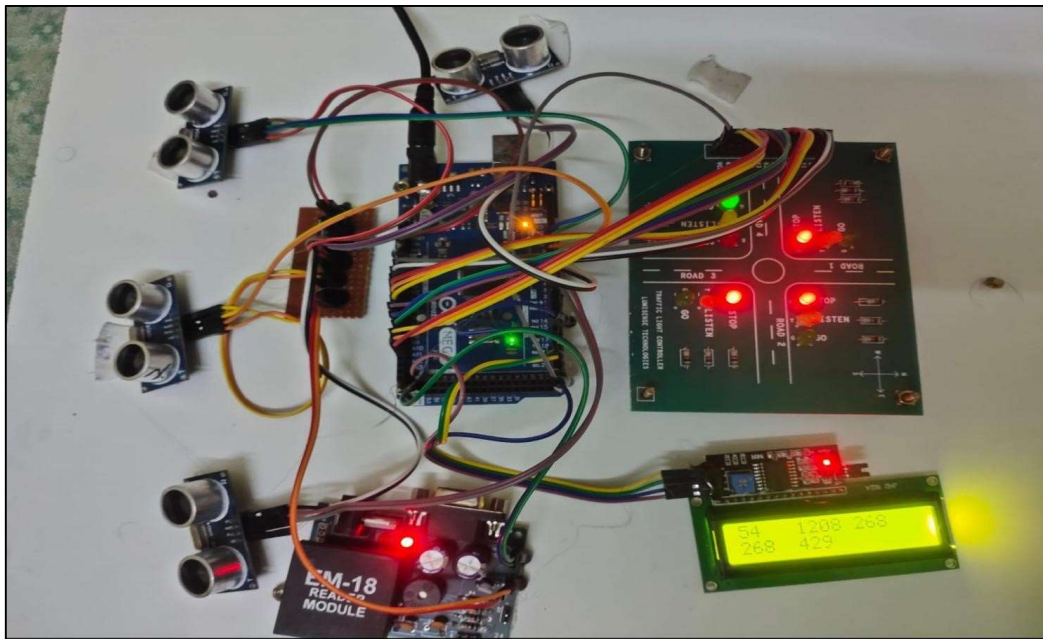


Fig 5.1 Connections of the circuit

The PCB board has been designed according to the circuit that which develops the four-way signal with three led each lane and resistors connected to it respectively. And these connections have been directed to the GPIUO's of Arduino mega.

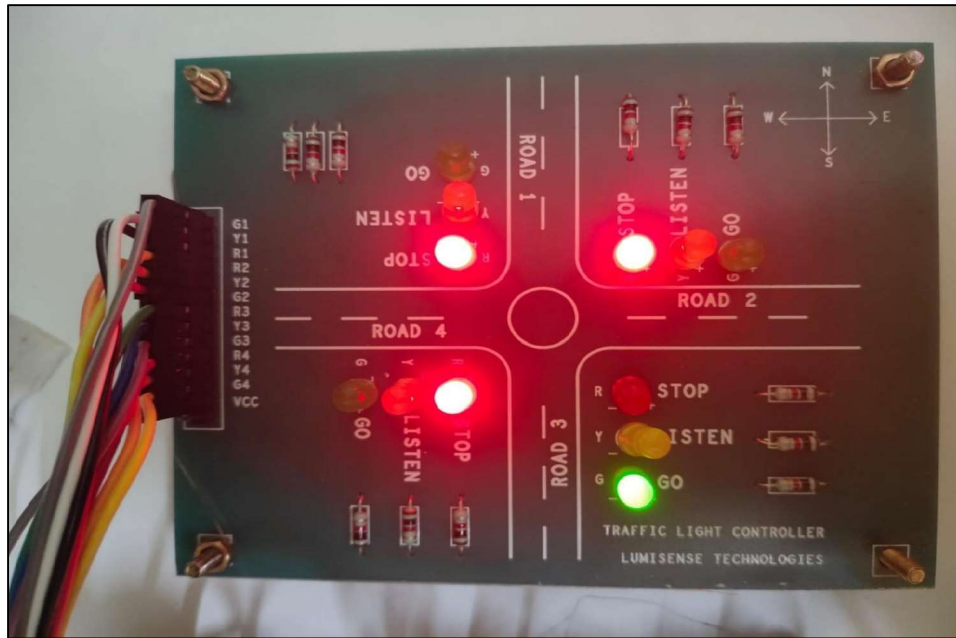
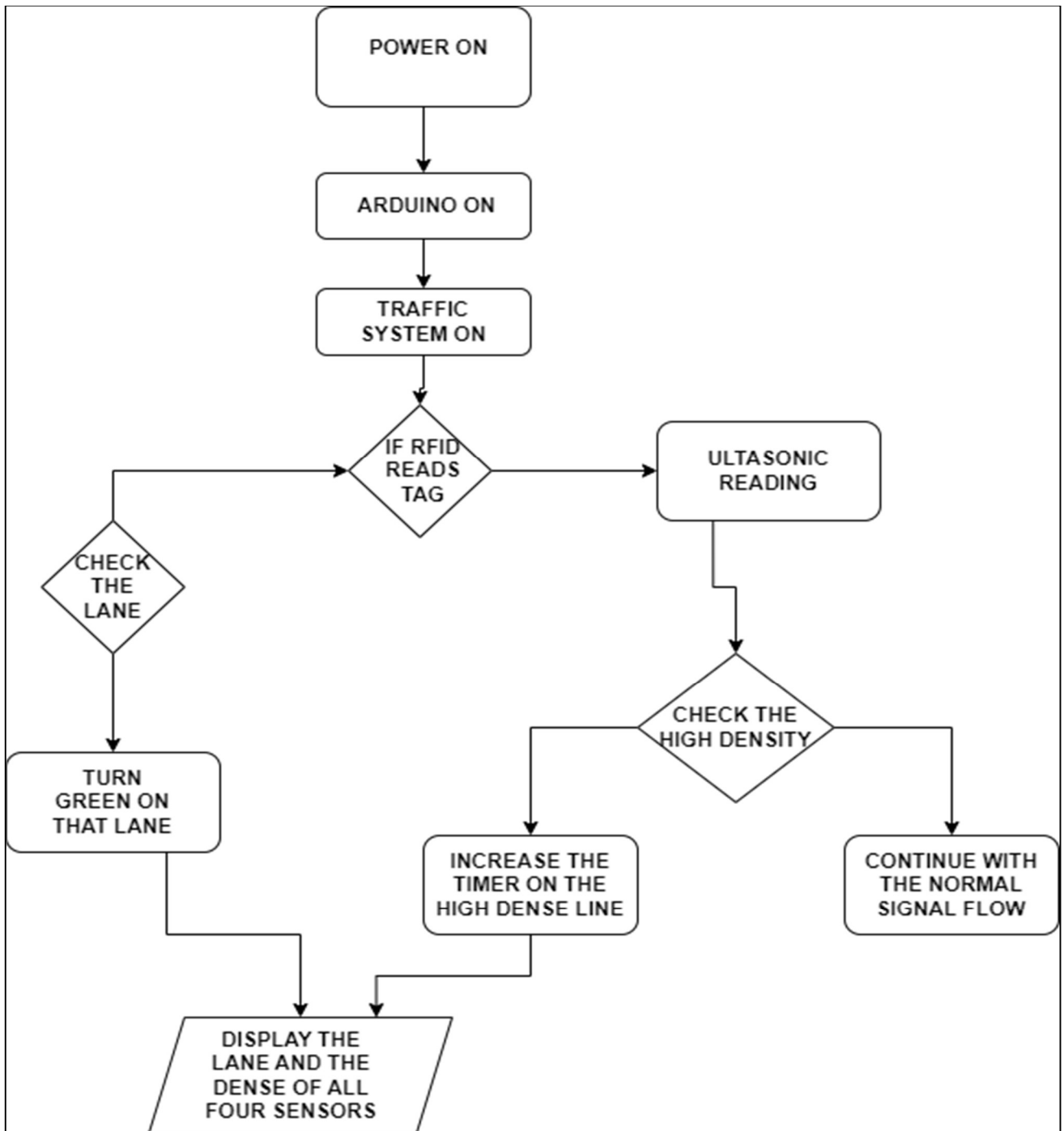


Fig 5.2. PCB Design of the Four-way signal

5.2. ALGORITHMS AND FLOWCHART



Explanation of algorithm,

Step 1: - When power on through an adaptor, Arduino Mega and other sensors connected to that will be turned on

Step 2: - After a delay of 2 seconds the traffic control system will turn on and follows the pattern i.e., for every 100ms the signal green will be changing from one lane to another

Step 3: - Here the conditional statement will come into place and checks for the detection of

RFID tag through the RFID reader

Step 4: - If the system identifies the detection of RFID tag from RFID reader, it will be checking for the which lane tag is detected

Step 5: - the system will shift the signal from the present to the signal in which the tag is detected

Step 6: - If the reader fails to detect the tag, then from step 3 the condition statement will be checking into Ultrasonic sensor reading

Step 7: - By using all those readers the comparison will takes place and look into the lowest reading from all the four reading (lowest reading is considered as the high

density) Step 8: - Based on that comparison the delay time for changing the signal will be increased

Step 9: - the output will be printed in the LCD display with six parameters

Step10: - if no condition is satisfied the traffic signal will follow the regular flow that is changing the signal for every 100ms

CHAPTER 6

RESULTS AND DISCUSSIONS

This project mainly concentrates on the clearance of traffic for the emergency vehicles and also for high density traffic so that the clearance for the required path or way is created in a suitable manner, As the sequence of the traffic signal cycle is 100ms. If the ultrasonic sensor detects the density below the fixed threshold level the cycle of that direction is increased by 50ms. If the RFID tag detects any one of the emergency vehicles in any lane then the signal changes to green immediately.

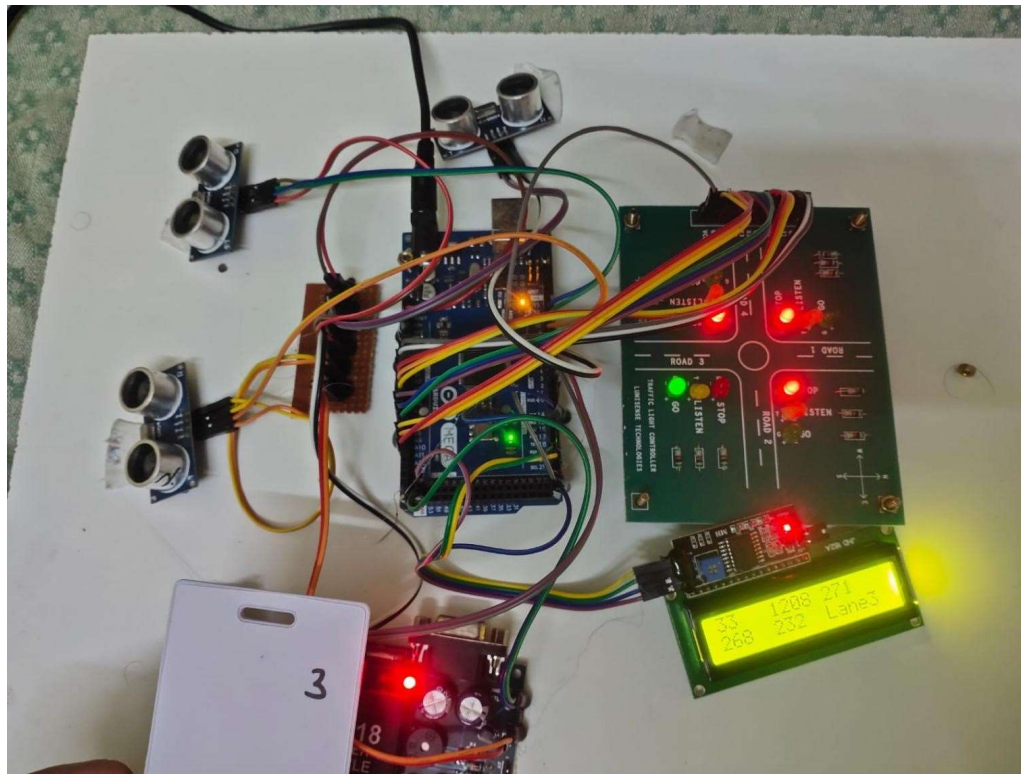


Fig.6.1 The final Output

This is the final circuit that has been connected according to the circuit diagram and the main components that has been connected in this are RFID EM 18 reader, Ultrasonic sensors, PCB where are the four-way signal is designed and LCD

The LCD is used to display the ultrasonic sensor reading, timer and the line in which emergency vehicles is detected. The five parameters that the first four parameters will give the readings of ultrasonic sensor, fifth parameter will be the timer and final parameter will be intimating us on which lane the emergency vehicle is detected.

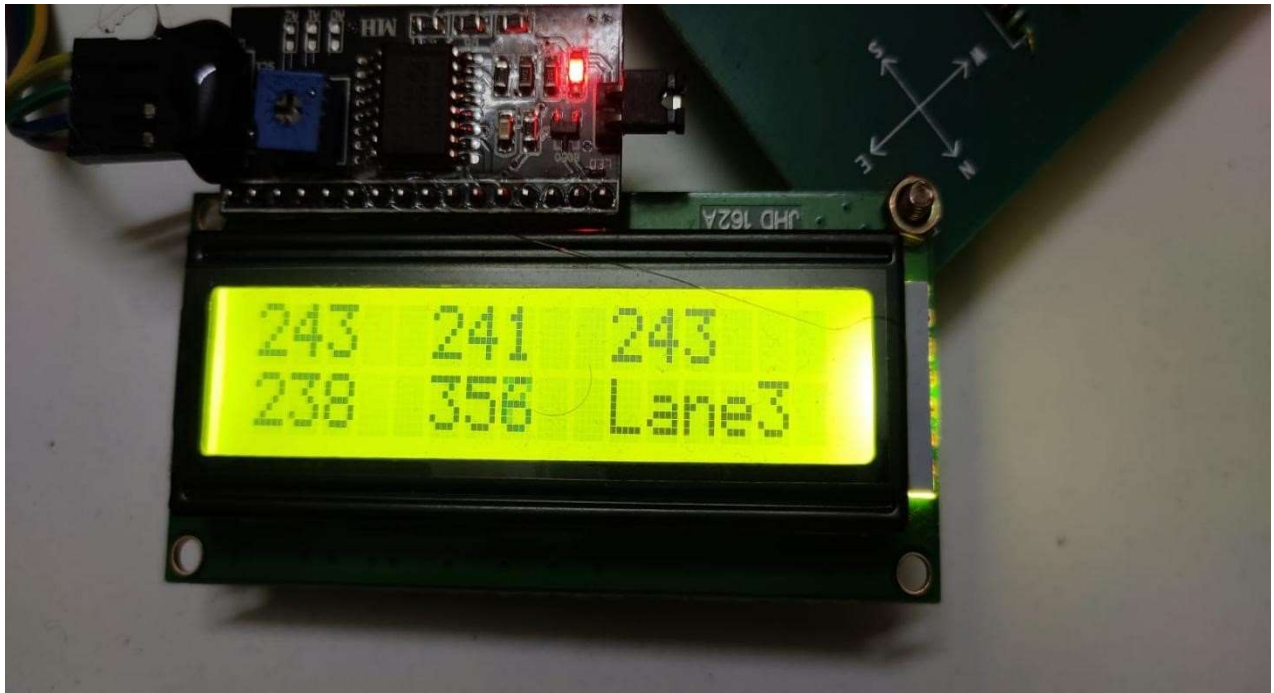
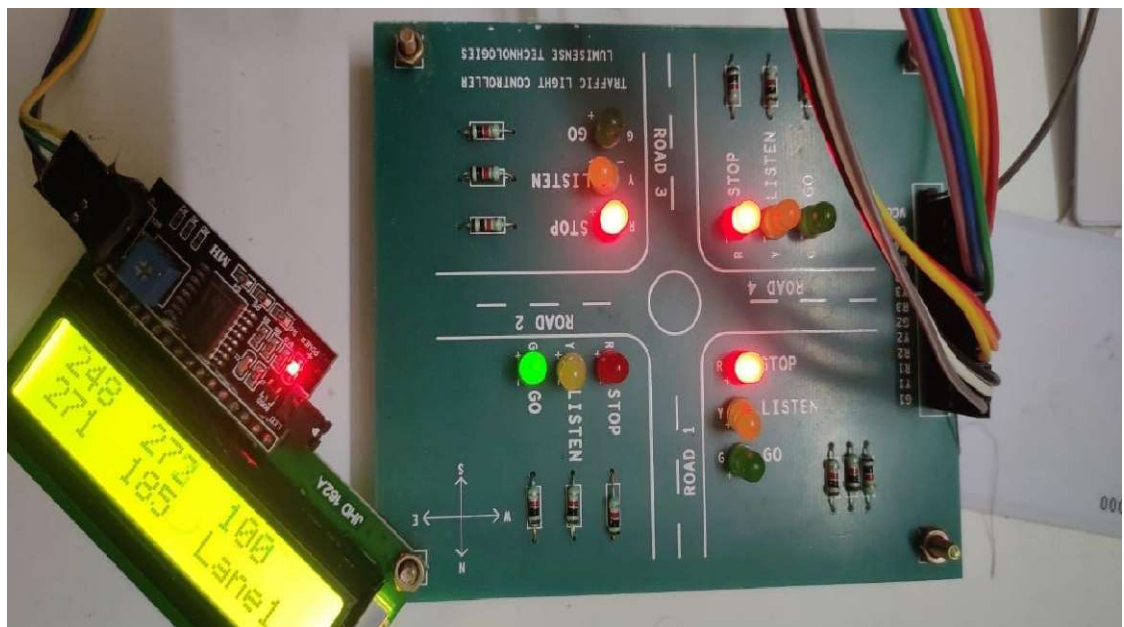
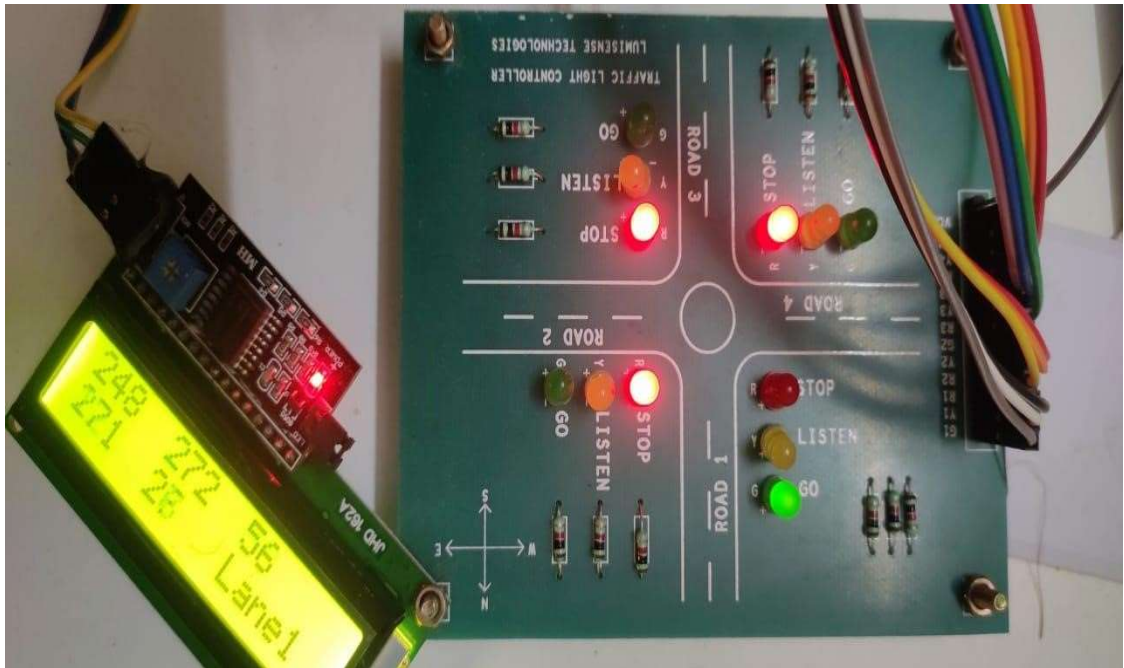


Fig.6.2 Displaying the Parameters

The four-way signal is designed in the pcb in which the the signals will be changing from one signal to another for every 100ms, based upon the density that is the less ultrasonic reading the signal in which it has high dense the timer will increase for that signal upto 150ms and if RFID reader identifies the tag it will change to that particular signal and LCD display will show which lane it is.



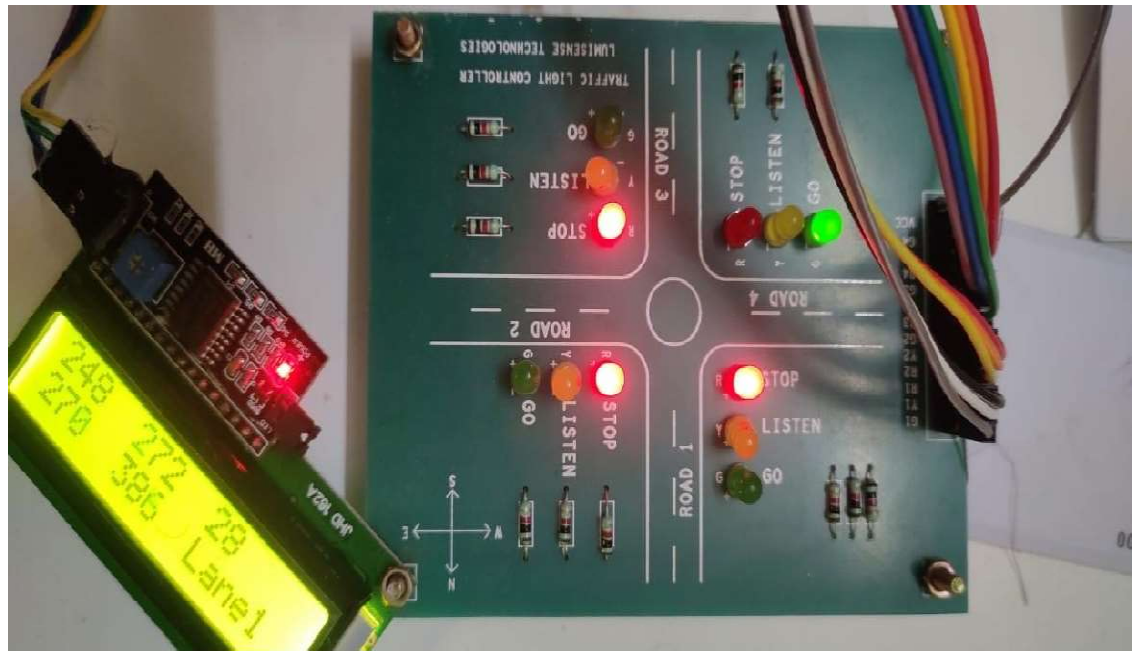
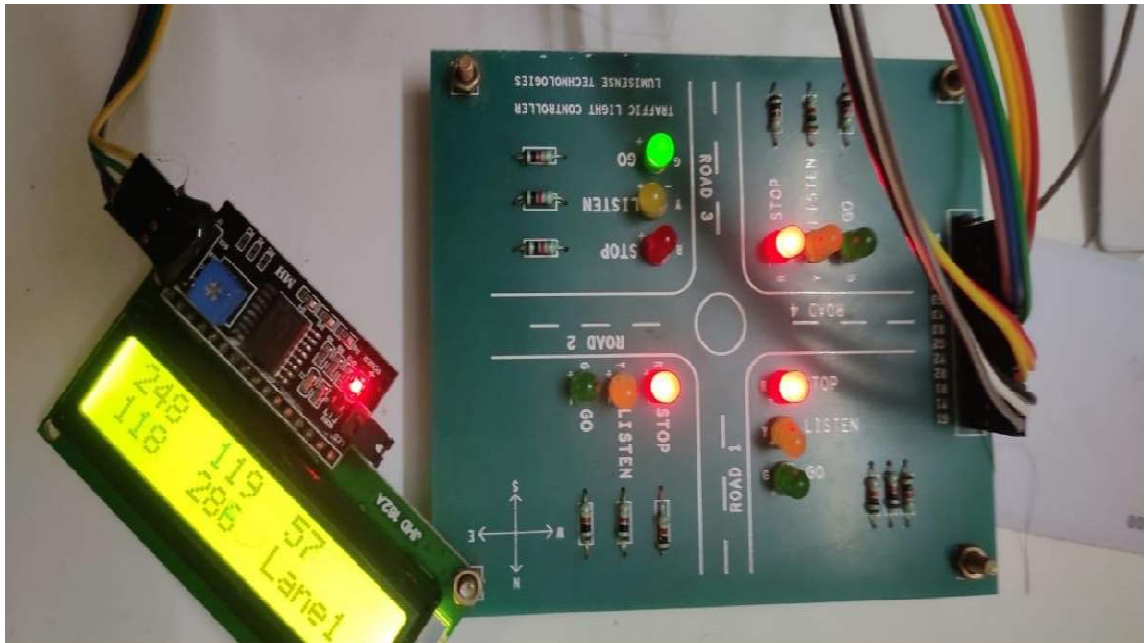


Fig.6.3 Four-way signal

CHAPTER 7

CONCLUSION

7.1 CONCLUSION

The system which exists already works efficiently to manage the traffic but it is time consuming. The proposed system works uninterruptedly with accuracy in managing the traffic at every junction. By implementing this model, it helps to reduce the overcrowding in high traffic areas which in turn it reduces the accidents by means of saving the public life. This system saves human life by allowing emergency vehicle at proper time by avoiding traffic density. In addition, it also helps to reduce the human interruption in traffic signals. The proposed methodology is easy to implement with almost all the features available in the existing methodologies. Here the methodology includes both detection of emergency vehicles and density. The complexity of the project is less compared to others. User friendly and can be implemented across all the locations and cost effective. The proposed model that the model includes RFID and Ultrasonic sensors where the Ultrasonic sensor is placed at the signal along with the RFID reader. Ultrasonic sensor will calculate the density of the traffic, the lane with larger density than others will be given green signal and remaining will be shown red. When the emergency vehicles enter the traffic signals the RFID reader will detect the vehicle and that lane will be given priority than the dense lane, the lane with the emergency vehicle will be given green and the remaining will be given red.

It is possible to reduce traffic in congested areas by using this model, which lowers accidents by sparing the lives of bystanders. This system aids in lifesaving by reducing traffic congestion and allowing emergency vehicles to arrive when they are most needed. Another advantage is lessening human interference with traffic signals. The recommended approach is straightforward to use and has almost all of the same traits as those currently in use. Here, the methodology considers both density and the ability to detect emergency vehicles. This project is less complicated than others in

comparison. It can be used in any circumstance, is reasonably priced, and is easy to use. The RFID reader will recognize an emergency vehicle as it gets close to the traffic light, giving it priority over the backed-up lane and turning that lane green while the other lanes turn red. Similarly, density is the basis for how ultrasonic sensors operate.

The quantified output that this system is provided is displayed in the LCD display with the following parameters that are all the four ultrasonic sensor readings continuously, the timer count and the lane in which the emergency vehicle is detected. Along with the reading the system is going to change the signals accordingly. The timer readings display in milliseconds and the ultrasonic sensor readings that is the distance will be displayed in centimetres. As the density of a line is detected the timer will be increased for 50 milliseconds more so that the traffic can clear in that particular lane. The EM 18 RFID reader is working with the 125khz speed, as soon as the emergency vehicles detected the signal will change with a delay of two seconds. The regular flow of the signal will change from one to another lane for every 100 milliseconds.

7.2 FUTURE DEVELOPMENTS

A traffic control system for emergency vehicles using RFID and ultrasonic sensors can help improve the response time and safety of emergency vehicles on the road. Here's a possible overview of how such a system could work:

- RFID tags are installed in emergency vehicles, such as ambulances and fire trucks. These tags contain unique identification numbers that can be read by RFID readers installed in the road infrastructure at key intersections.
- Ultrasonic sensors are also installed at these intersections to detect the presence of emergency vehicles approaching. When an emergency vehicle is detected, the sensor sends a signal to the traffic control system.
- The traffic control system uses the information from the RFID tag and ultrasonic sensor to identify the specific emergency vehicle and its location. Based on this

information, the system can give priority to the emergency vehicle by changing the traffic lights to green in its direction of travel.

- The system can also alert other drivers in the area of the approaching emergency vehicle using digital signs or other warning devices. This can help reduce the risk of accidents and allow emergency vehicles to reach their destination more quickly and safely.
- The system can also provide real-time data on the location and status of emergency vehicles to the central command centre. This can help emergency responders better coordinate their efforts and respond to emergencies more effectively.

7.3 RESEARCH ISSUES

- ultrasonic sensors. implementation of a traffic control system for emergency vehicles using RFID and Some of the key research issues are: There are several research issues that need to be addressed for the successful
- Technical feasibility: One of the main research issues is the technical feasibility of the system. Researchers need to investigate whether the RFID and ultrasonic sensors can accurately detect emergency vehicles and provide real-time data to the traffic control system. They also need to ensure that the system is compatible with existing traffic control infrastructure.
- System reliability: Another important research issue is the reliability of the system. Researchers need to develop methods to ensure that the system is robust and can operate under various environmental conditions, such as heavy rain or snow.
- Privacy and security: The use of RFID tags and sensors raises concerns about privacy and security. Researchers need to develop methods to protect the privacy of the emergency vehicles and prevent unauthorized access to the system.
- Cost-effectiveness: The cost of implementing a traffic control system for emergency vehicles using RFID and ultrasonic sensors can be significant. Researchers need

to investigate the cost-effectiveness of the system and identify ways to reduce the cost of installation and maintenance.

- Public acceptance: The success of the system depends on the acceptance and cooperation of the public. Researchers need to investigate public attitudes towards the system and develop strategies to increase public awareness and education about the benefits of the system.

7.4 IMPLEMENTATION ISSUES

There are several implementation issues that need to be addressed for the successful deployment of a traffic control system for emergency vehicles using RFID and ultrasonic sensors. Some of the key implementation issues are:

- Infrastructure deployment: The deployment of the system requires installation of RFID readers, ultrasonic sensors and other infrastructure at key intersections. This can be a costly and time-consuming process, and may require coordination with other agencies or departments.
- Integration with existing systems: The traffic control system for emergency vehicles using RFID and ultrasonic sensors needs to be integrated with existing traffic control systems to ensure a seamless operation. This can require modifications to existing software and hardware, and may require training for operators and maintenance staff.
- Maintenance and repair: The system requires regular maintenance and repair to ensure reliable operation. This can be challenging, especially if the system is deployed across a large geographic area.
- Public acceptance: The successful deployment of the system depends on public acceptance and support. It is important to involve the public in the planning and deployment process and to provide clear information about the benefits of the system.

REFERENCES

- [1] Seetharaman.R1, Karthikeyan.S2, Saranraj.M3, Sankar Kumar.P4, Naina Mohamed.M5” Smart traffic signal control system for emergency vehicles and density-based traffic control using RFID in LabVIEW” International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, Vol. 9, Issue 3, March 2020.

- [2] Abhishek Raman, Kaushik S, Dr. Rajeswara Rao K.V.S, Dr Minal Moharir, “Hybrid frame work for expediting emergency vehicles movement on Indian roads”. Proceedings of the Second International Conference on Innovative Mechanisms for Industry Applications (ICIMIA 2020) IEEE Xplore Part Number: CFP20K58-ART; ISBN: 978-1-7281-4167-1.

- [3] Anam Firdous, Indu, Vandana Niranja, “Smart density-based traffic light system”. 2020 8th International Conference on Reliability, Infocom Technologies and Optimization (Trends and Future Directions) (ICRITO) Amity University, Noida, India. June 4-5, 2020.

- [4] Olasupo Ajayi, Antoine Bagula, Ifeoma Chukwubueze, “: Priority based traffic preemption system for medical emergency vehicle in smart cities”. Authorized licensed use limited to: Carleton University. Downloaded on November 03,2020 at 22:08:52 UTC from IEEE Xplore. 978-1-7281-8086-1/20/\$31.00 ©2020 IEEE

- [5] Luiz Fernando Pinto de Oliveira , Member, IEEE, Leandro Tiago Manera and Paulo Denis Garcez da Luz , Member, IEE. “Development of a Smart Traffic Light Control System with Real-Time Monitoring”. JOURNAL OF LATEX CLASS FILES, VOL. 14, NO. 8, AUGUST 2015

- [6] Neetesh Kumar, Member, IEEE, Syed Shameerur Rahman, and Navin Dhakad." Fuzzy Inference Enabled Deep Reinforcement Learning-Based Traffic Light Control for Intelligent Transportation System". 1524-9050 © 2020 IEEE.
- [7] P. Devi, S. Anila. "Intelligent Ambulance with Automatic Traffic Control". 2020 International Conference on Computing and Information Technology, University of Tabuk, Kingdom of Saudi Arabia. Volume: 01, Issue: ICCIT- 1441, Page No.: 374 - 377, 9th & 10th Sep. 2020.
- [8] Miaomiao Cao¹, Qiqi Shuai¹, and Victor O.K. Li¹, Fellow, IEEE. "Emergency Vehicle-Centered Traffic Signal Control in Intelligent Transportation Systems". 2019 IEEE Intelligent Transportation Systems Conference (ITSC) Auckland, NZ, October 27-30, 2019.
- [9] Kaushik S Abhishek Raman Dr. Rajeswara Rao K.V.S. "LEVERAGING COMPUTER VISION FOR EMERGENCY VEHICLE DETECTIONIMPLEMENTATION AND ANALYSIS".11th ICCCNT 2020 July 1-3, 2020 - IIT – Kharagpur. IEEE – 49239.
- [10] Sai Surya Prakash Moka¹, Sai Manikanta Pilla², S. Radhika³. "Real Time DensityBased Traffic Surveillance System Integrated with Acoustic Based Emergency Vehicle Detection". 2020 4th International Conference on Computer, Communication and Signal Processing (ICCCSP). 978-1-7281-6509-7/20\$31.00 @2020 IEEE.
- [11] Tejas Naik, Roopa Lakshmi R, Divya Ravi N, Pawdhan Jain, Sowmya B H and Manichandra. "RFID-Based Smart Traffic Control Framework for Emergency Vehicles". Proceedings of the 2nd International Conference on Inventive

- [12] Nik Nur Shaaadah Nik Dzulkefli et al 2020 J. Phys.: Conf. Ser. 1529 022061. "Density Based Traffic System via IR Sensor". JICETS 2019 Journal of Physics: Conference Series 1529 (2020) 022061 IOP Publishing doi:10.1088/1742-6596/1529/2/022061.
- [13] G. Lakshminarasimhan¹, V. Parthipan², Mohammed Irfan Ahmed³ Sri Harsha K Nvm⁴, Dr.D.Dhanasekaran. "TRAFFIC DENSITY DETECTION AND SIGNAL AUTOMATION USING IOT". International Journal of Pure and Applied Mathematics Volume 116 No. 21 2017, 389-394
- [14] Tenepalli Kalyan Sai Manikanta Chari¹, SaiTeja Tutika². "Density Based Traffic Control Signaling Using IR sensors" International Journal of Engineering and Information Systems (IJEAIS) ISSN: 2000-000X Vol. 3 Issue 3, March – 2019, Pages: 51-56.
- [15] Ashwini Basavaraju¹, Senhalata Doddigarla², Navitha Naidu³, Shruti Malgatti. "VEHICLE DENSITY SENSOR SYSTEM TO MANAGE TRAFFIC". IJRET: International Journal of Research in Engineering and Technology eISSN: 2319-1163 | pISSN: 2321-7308.
- [16] Mohammed Fayaz, Pooja K, Pranitha P Reddy, Swathi T. "Density based Traffic Control System with Ambulance Detection". International Journal of Engineering Research & Technology (IJERT) ISSN: 2278-0181 Published by, www.ijert.org RTESIT - 2019 Conference Proceedings.

[17] ShivaPrasad K S, Shruthi S, Chandana R Nayaka, Arun Y K. "Advanced Traffic Control System for Emergency Vehicle". International Journal of Engineering Research & Technology (IJERT) ISSN: 2278-0181 Published by, www.ijert.org NCESC - 2018 Conference Proceedings.