Abstract
Managing the traffic and reducing congestion on roads is an important issue in cities. Traffic junction and traffic police play a crucial role in this regard. The current traffic light system has a static module which turns ON and OFF after a specific duration of time. As the traffic lights work on a static module, they are not capable of counting the density of vehicles on road and recognizing the emergency vehicles like ambulance and fire brigade. This will lead to a situation where some vehicles may have to wait even though there is no traffic on other sides. Also emergency vehicles have to wait till the traffic signal in their road turns green. So this work provides a module of dynamic traffic control system based on the density of vehicles on road and recognizing emergency vehicles automatically based on the RFID tags and clears their way by turning respective traffic signal to green. It also communicates with the driver on request by sending the notification about the traffic incidents and traffic density status in the junction using GSM module. This gives the driver the knowledge of the vehicle congestion of any desired traffic junction.

1. INTRODUCTION
Increasing population is increasing the vehicles count at an alarming rate in our cities. But the existing traffic infrastructure has its own limitations to accommodate the exponential growth of vehicles. It is becoming a serious issue to handle the problem of the vehicles on roads majorly on traffic junctions. In traffic junctions vehicles accumulate quickly and traffic jams will occur if the traffic control system is not efficient to manage the vehicles in a faster and smarter way. Traffic lights play an important role in traffic management. Traffic lights are signalling devices that are placed on the intersection points and used to control the flow of traffic on the road. In this proposed work, a model is developed for the traffic density recognition, emergency vehicle recognition and notifying the drivers the
status of traffic in desired roads or junctions. IR Sensors are used to detect the vehicle on the road. The emergency vehicle can be detected by using Radio Frequency Identification (RFID). RFID is a device that consists of three components: RFID Tag, RFID Reader and Database. Each intersection point has its own database. The RFID reader stores the records of all the vehicles that passed through the road. The proposed system provides GSM phone interface to the user, with SMS facility to those who wish to obtain the latest traffic information on congested roads.

2. LITERATURE SURVEY
The world's first, manually operated gas-lit traffic signal was short lived. Installed in London in December 1868, it exploded less than a month later, injuring or killing its policeman operator. The first safe, automatic electric traffic lights were installed in the United States in the late 1890s. The rapid growth in the vehicle ownership is one of the measures for economic growth of country. However indirect effect of vehicle ownership is acute traffic congestion. The exploitation of new trends and technologies requires fast transportation of goods, machinery and manpower for various reasons. The work in [1] proposed a smarter traffic control system to distinguish the vehicles based on the priority of the vehicles. Vehicles are divided into four categories of emergency vehicles, school buses, private vehicles and heavy vehicles based on RFID tags attached to it. In [2] method to detect the vehicle on the road is proposed using infrared sensors which acts as an input to the traffic control unit. The work in [3] uses image processing technique and passive sensors to identify the shape of the vehicle. It classify the vehicle i.e. detect the type of the vehicle using BLOB analysis. The work in [4] proposed an intelligent traffic light controller which uses sensor network along with the embedded technology. In this paper traffic light will be intelligently decided based on the total traffic on all adjacent roads. This will optimize the traffic flow, prevent the traffic congestion.

3. METHODOLOGY
The present traffic light control system provides fixed time interval for red and green light. This causes unnecessary waiting time. As the design of proposed system provides dynamic traffic light intersection that will minimize the waiting time of vehicles and also manage the traffic load at the intersection adaptively. This maximizes average number of vehicles passing through each intersection.

![Figure 3.1: Algorithm of proposed methodology](image)

Sachin Bhat, Namitha Karkera, Shubha, Trupthi Shetty, Varsha::
Emergency Vehicle Detection And Traffic Density Notification System
Fig. 3.1 shows the algorithm of the proposed work and fig. 3.2 shows the flow chart of the methodology used in this paper. Multiple Infrared Sensors are mounted on the roads at different distances away from the traffic junction to detect vehicle density on the road at each signal. Counter will be incremented each time when IR rays are blocked by the vehicle. Traffic level will be detected depending on the counter values of all the sensors used in a particular road and provides this as an input to the control system. Microcontroller used in the control system monitors the time period for each Red, Green and Yellow light for which it remains in glowing state depending on the current traffic present at a signal. The priority has been given to the emergency vehicle like ambulance, fire brigade or V.I.P vehicles etc. by glowing Red lights to all the lanes except from the lane where emergency vehicle is passing. This can be implemented by using Radio Frequency Identification (RFID). RFID is a technique that uses the radio waves to identify the object uniquely. RFID tag is inserted into the emergency vehicles. When an emergency vehicle approaches the signal, the RFID reader detects the RFID tag which results in the change of traffic signal in that particular road to green and the signals of remaining roads to red, so that vehicle can pass without wasting precious time. The proposed system provides GSM mobile phone interface to the user, with SMS facility to those who wish to obtain latest traffic information on congested roads. If vehicle driver sends SMS to the control unit at the junction, the driver will get the message
indicating congestion status of the road. This system will also give information about alternative route to the user by using its database, if present traffic is heavy. The system has been developed using the sensor assembly along with embedded technology. In power supply circuit the DC pulsating is removed by electrolyte capacitor (1000uF). Our hardware requires 5v DC and hence a voltage regulator of 7800 series is used. A crystal oscillator with 20GHz is used which provides the microcontroller with a frequency clock pulse. Electrolytic and ceramic capacitors are used which removes the ripple and cancels the noise. Output of power supply is given to PIC microcontroller.

![Block diagram of Emergency Vehicle Detection and Traffic Density Notification.](image)

### 3.1 Microcontroller PIC16F877

PIC16F887 as shown in fig. 3.4 is one of the most advanced microcontrollers which are widely used for experimental and modern applications because of its low price, wide range of applications, high quality and ease of availability. It has special features like RISC CPU, up to 368*8 bits of RAM, 256*8 of EEPROM, 8K*4 of flash memory. PIC16f877 has 5 basic input/output ports. PORTA is 6 bits wide, PORTB, C and D with a width of 8 bits. And PORTE has only 3 bits wide.

![PIC16F877](image)
3.2 RFID (Radio Frequency Identification)

Fig. 3.5 shows the RFID technology that incorporates the use of electromagnetic or electrostatic coupling in the radio frequency (RF) portion of the electromagnetic spectrum to uniquely identify an object, animal or person. RFID is coming into increasing use in industry as alternative to bar code. RFID consists of 3 components, which are antenna, Transmitter and receiver. Figure 3.5: RFID reader and tag

Low frequency RFID systems have frequency range of 30 KHz to 500 KHz, High frequency RFID system have frequency range of 800MHz to 950MHz and 2.4GHz to 2.5GHz.

3.3 GSM

Fig. 3.6 shows the GSM module which is a digital mobile telephony system that is widely used throughout the world. GSM uses a variation of time division multiple access (TDMA). It digitizes and compresses data, then sends it down a channel with two other streams of user data, each in its time slot. It operates at either the 900MHZ or 1800MHZ frequency band.

GSM is considered a second generation (2G) mobile phone system. There are mainly two type of service offered through GSM: Telephone and data. Telephone service is mainly voice service that provide subscriber with the complete capability to communicate with other subscriber. Data service provides the capacity necessary to transmit appropriate data signal between two access points creating an interface to the network.

3.4 IR Sensor

The Infrared sensors shown in fig. 3.7 are one of the most basic and popular sensor modules in an electric device. These sensors are parallel to the human’s visionary senses, which can be used to detect obstacles. IR Sensors are used to measure the speed of object moving at a very high speed. Principles used in ALL Infra-Red proximity sensors are same.
3.5 Power Supply

Fig. 3.8 shows the circuit diagram of power supply. It consists of a transformer with primary and secondary windings which are linked together through inductively coupled electrical conductor. From the main, 230V AC voltage applied to step down transformer to convert to 12V AC voltage. It also consists of a bridge rectifier which converts both the positive & the negative half cycle into DC i.e. 12V AC voltage from the transformer into 12V DC voltage. Output of rectifier is provided to a voltage regulator to convert varying input voltage into a constant regulated output voltage. The voltage regulator used here is IC7805. It supports an input voltage of 10 volts to 35 volts and output voltage of 5 volts. This 5V is given as input to the PIC microcontroller.

![Diagram of power supply](image_url)

**Figure 3.8: Block diagram of fixed regulated power supply**

4. RESULTS

Multiple IR sensors mounted on road detects the traffic level. This is given as the input to the microcontroller. Microcontroller turns the green light ON in the respective road where highest traffic density in measured by the sensors. Traffic lights in the remaining roads will be automatically turned OFF for specific duration of time. Fig. 9 shows the setup of smart traffic light system. Here the threshold value of vehicles is given as 10. If more than 10 vehicles are detected by the sensors in a particular road, yellow light will be turned ON. It will turn ON the red light signals in rest of the roads and turns ON green light where the traffic density is measured.

Fig.3.10 shows the RFID reader mounted 150m away from the junction. Whenever emergency vehicle containing RFID tag nears the reader, a signal will be sent to microcontroller circuit which will turn ON the green light in the respective road.

![Diagram of RFID reader](image_url)

**Figure 3.9: Hardware Setup of traffic junction with IR sensors**

This setup also uses the GSM module attached to the controller circuit. Driver can send the message to know the status of traffic density in a particular junction to this GSM module. A message will be sent back to the mobile of driver notifying the current density of all the roads in a junction which is measured by the IR sensors. Message sent notifying the number of vehicles in a junction is shown in fig. 3.11.

![Diagram of RFID reader](image_url)

**Figure 3.10: RFID reader**
5. CONCLUSION

The proposed system has been developed using the IR sensors along with embedded technology. The proposed work considers the priority of the vehicles on road and traffic density of vehicles and controls the traffic light sequence effectively and accurately. Emergency vehicles are detected using RFID tags which automatically sends signal to the respective traffic signal to turn the Green light ON. The accuracy of the RFID is more than camera’s. It also sends notifications through messages regarding the traffic density status of a required junction and possible alternative roads to the drivers using its database and GSM module. It will help the commuters to know about the congestion in the road they are travelling and options to take the alternative routes. In this project smartness of traffic signal controller is introduced with powerful functions and hardware interface. Proposed system works efficiently over the present traffic controlling system with respect to less waiting time, efficient operation during emergency mode and suggesting alternate route.

6. REFERENCES


7 AUTHOR’S BIOGRAPHIES

Sachin Bhat received his BE degree in the field of Electronics and Communication from AITM, Bhatkal and M.Tech degree in Digital Electronics and Communication from NMAMIT, NITTE, Karnataka. He has more than 5 years of industrial and research experience and currently working as Asst. Professor in the Dept. of ECE in SMVITM, Udupi. His research interests include Digital Image Processing, Pattern Recognition, Paleography, Neural network and C++ design.