



## Intelligent Traffic Control Unit

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**ABSTRACT:** Traffic congestion is the biggest problem faced by densely populated countries like India, China etc. So, our project focuses on three areas-Ambulance, Priority vehicles (like VIP cars, police jeeps) and Traffic density control. The project is a replica of a four way lane crossing of real time scenario. In the first part, concentrated on problems faced by Ambulances, RFID concept is used to make the Ambulance's lane Green and thus providing a stoppage free way for the Ambulance. In the second part, concentrated on problems faced by Priority vehicles, IR transmitter and receiver are used to make the vehicles' lane Green and thus preventing traffic congestion. In the third part, concentrated on Traffic density control, IR transmitter and receiver are used to provide dynamic traffic control and thus increasing the duration of the Green light of the lane in which traffic density is high and hence, regulating traffic.

**Keywords:** IR (infrared), RF (radio frequency.)

### I. INTRODUCTION

Traffic congestion is a severe problem in many major cities across the world and it has become a nightmare for the commuters in these cities. The Traffic congestion can also be caused by large Red light delays, etc. The delay of respective light is hard coded in the traffic light and it is not dependent on traffic. Therefore for simulating and optimizing traffic control to better accommodate this increasing demand is arises.

One of the major problems faced by heavy traffic is by Ambulances. As we all know that Ambulances are the most important medical means of transport in any country as they carry patients to the nearby hospitals. But due to heavy traffic, one can often see the Ambulances stuck in traffic for long durations thus causing danger to patient's life. So, our project aims to solve this problem of Ambulances. When an Ambulance arrives, its corresponding lane traffic light becomes green and all the others become red, thus paving traffic less way for the Ambulance and thus helping it to reach the hospital swiftly. This is possible by the use of RF transmitters and Receivers.

In the second use of our project, we aim at controlling traffic density using microcontroller. In this the system contains IR transmitter and IR receiver which are mounted on the either sides of roads respectively. The IR system gets activated whenever any vehicle passes on road between IR transmitter and IR receiver. Microcontroller controls the IR system and counts number of

vehicles passing on road. Microcontroller also store vehicles count in its memory. Based on different vehicles count, the microcontroller takes decision and updates the traffic light delays as a result. The traffic light is situated at a certain distance from the IR system. Thus based on vehicle count, microcontroller defines different ranges for traffic light delays and updates those accordingly.

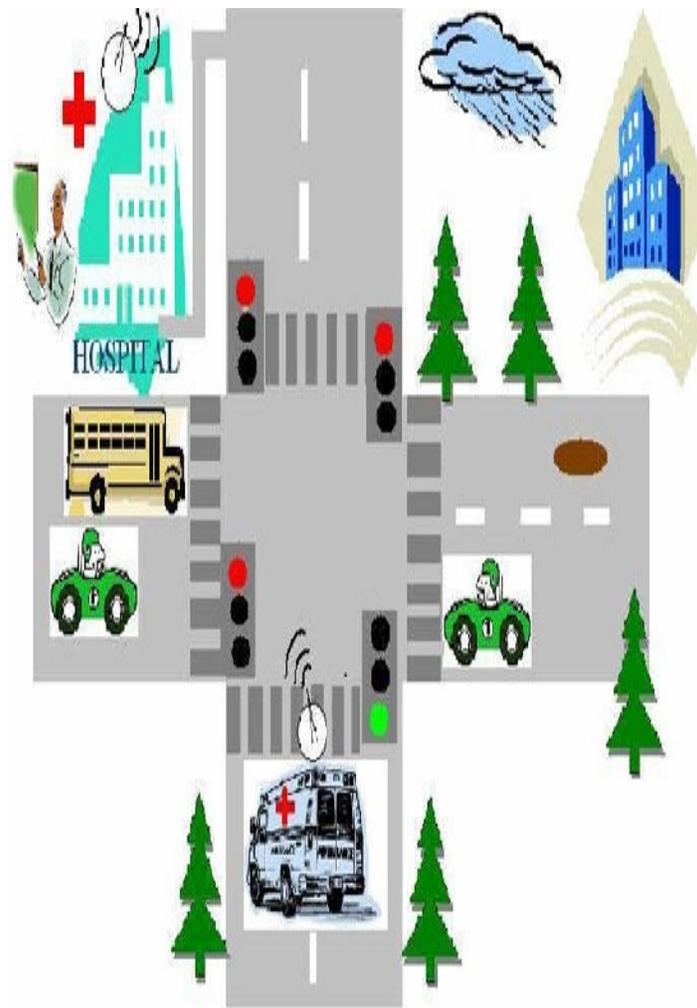
Finally, using the concept of IR we are providing passage to vehicles of extreme priority (VIP and Police cars), here we have installed IR transmitter in one such vehicles, the moment it comes within the line of sight of the corresponding IR receiver installed at a distance from the traffic light, it will send a signal to microcontroller and the respective lane's light goes green.

Traffic research has the goal to optimize traffic flow of people and goods. As the number of road users constantly increases, and resources provided by current infrastructures are limited, intelligent control of traffic will become a very important issue in the future. However, some limitations to the usage of intelligent traffic control exist. Avoiding traffic jams for example is thought to be beneficial to both environment and economy, but improved traffic-flow may also lead to an increase in demand. There are several models for traffic simulation. In our project we focus on optimization of traffic light controller in a city using IR sensor and developed visual monitoring using microcontroller. Traffic light optimization is a complex problem.

Even for single junctions there might be no obvious optimal solution. With multiple junctions, the problem becomes even more complex, as the state of one light influences the flow of traffic towards many other lights. Another complication is the fact that flow of traffic constantly changes, depending on the time of day, the day of the week, and the time of year. Roadwork and accidents further influence complexity and performance. In this paper, we propose three approaches, the firstly - to give authority to ambulances to pass the respective lane without delay, secondly - allow smooth passage of vehicles with maximum priority (VIP cars, POLICE cars), and thirdly - control traffic density of cross-roads by increasing the green light time.

## II. MODELLING CIRCUITS

In this section we focus on circuitry required to achieve smooth flow of traffic. The proposed system uses a microcontroller AT89C52 interfaced with sensors, changes the junction timing automatically to accommodate movement of vehicles smoothly avoiding unnecessary waiting time at the junction. The sensors used in this project are IR and photodiodes are in line of sight configuration across the loads to detect the density at the traffic signal. The density of the vehicles is measured in three zones i.e., low, medium, high based on which timings are allotted accordingly. Also we have used the IR sensors for VIP vehicles.



**Fig.1.** Conceptual View of the Project.



For ambulances we have introduced the RF transmitter and RF receivers, with the transmitter installed in ambulance, the driver is provided with the switch and receiver installed near the traffic light. This shows the complete circuit diagram of our project with all the connections made from traffic lights (16 LED's), IR circuitry, and RF circuitry, LCD, Power Supply and Crystal Oscillator to the MICROCONTROLLER AT89C52.

### III. CONCEPTS USED

#### A. Radio Frequency Identification

Radio-frequency identification (RFID) is the use of a wireless non-contact system that uses radio-frequency electromagnetic fields to transfer data from a RF transmitter attached to a vehicle (ambulance), for the purposes of automatic identification and tracking. These devices use a power source (9V) and emit radio waves (electromagnetic radiation at radio frequencies). The transmitter sends signal to the receiver which can receive from several meters (yards) away.

Unlike IR devices, the RF transmitter does not need to be within line of sight of the receiver.

#### Advantages of RFID System

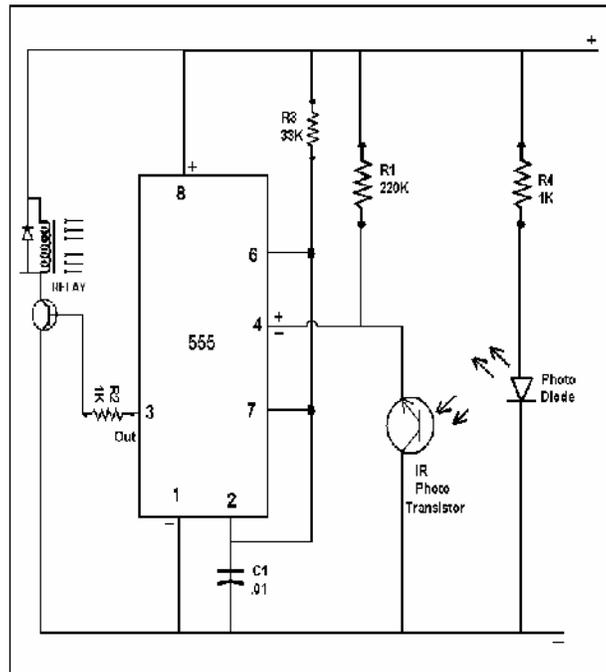
- No line-of-sight of contact is necessary.
- The speed of RFID system is less than 100 milliseconds.
- It provides bidirectional communication.
- It has a bulk detection capacity.

#### Disadvantage of RFID System

- RFID systems are expensive in comparison to normal bar code systems.
- RFID technology is difficult to understand.

#### B. Infrared Devices

In this we have an IR detector and transmitter circuit, the IC 555 timer is working under monostable mode. The pin 4 i.e. reset pin is when grounded via IR receiver the pin 3 output is low. As soon as the IR light beam transmitted is obstructed, a momentary pulse actuates the relay output (or LED). The IR transmitter is simple series connected resistor network from battery. The timing capacitor connected to pin 2 and ground can varied as per requirement.



#### Advantages of Infrared waves

- Due to high frequency of transmission, large amount of data can be transmitted and received.
- Infrared waves are not susceptible to adverse weather conditions.

- Infrared circuitry has low cost and low power requirements.

#### Disadvantage of Infrared waves

- As infrared waves have Line-of-sight transmission, thus the transmission cannot take place through walls, doors etc.

- Line-of-sight transmission is blocked by common materials such as people, animals etc.
- The data rate transmission is lower than normal wired communication.

#### IV. DESIGN AND DEVELOPMENT OF THE SYSTEM

Development of the complete intelligent control unit includes lots of study and implementation work. The implementation work of the complete data logger is divided into points discussed below.

- As shown in the circuit a microcontroller is programmed to automatically “ON” and “OFF” the LEDs (traffic light).



#### Liquid crystal displays (LCD):

The voltage needed is preferable 2-20 V A.C. The voltage threshold for watch type LCD display is 1 to 2V. It is a 16 pin device with 16\*2 displays. LCD is used here to display the modes of 4 traffic lanes. It consists of two modes N(normal traffic) and C(high density).

LCD has one main function during density control. All the time it displays NNNN for the four lanes, depicting a NO traffic density. The moment there is traffic density it displays CNNN, meaning that Lane 1 has traffic density and requires to be cleared.

*Crystal oscillator:* Crystal oscillators are oscillators where the primary frequency determining element is a quartz crystal. Because of the inherent characteristics of the quartz crystal the crystal oscillator may be held to extreme accuracy of frequency stability. These provide necessary timing for the microcontroller.

#### AT89C52 Microcontroller: Features-

- Compatible with MCS-51™ Products
- 8K Bytes of In-System Reprogrammable Flash Memory
- Endurance: 1,000 Write/Erase Cycles
- Fully Static Operation: 0 Hz to 24 MHz

- The crystal oscillator provides the necessary clocking for the microcontroller to work properly.
- The four traffic lights, shown as 4 groups of 4 LEDs (Red, Green, Yellow), is installed at each of the four roads.
- The whole circuit will be implemented on a zero PCB. The programming of the Microcontroller is done in Assembly, using a programmer.

*Power Supply:* As per the power requirement of the hardware of the intelligent control unit, supply of +5V is as shown

- Three-level Program Memory Lock
  - 256 x 8-bit Internal RAM
  - 32 Programmable I/O Lines
  - Three 16-bit Timer/Counters
  - Eight Interrupt Sources
  - Programmable Serial Channel
  - Low-power Idle and Power-down Modes
- Microcontroller is the main controlling unit. Every device is connected to this main unit. It controls all the devices connected to its pins. Henceforth, microcontroller is the heart of our project.

#### Functions-

- Turning ON-OFF of Traffic Lights in sequence.
- Control for Ambulance- Receiving the signal from RF receiver and making the respective lane's traffic light green.
- Control for VIP vehicles- Receiving the signal from IR receiver and making the respective lane's traffic light green.
- Density Control- receiving signal from IR Receivers and changing the delay of traffic light green signal from 6sec to 12 sec.
- Sending message to LCD pins so that it displays the right information on screen.

*Pin Configuration-*

MICROCONTROLLER	PIN NAME/OTHER DEVICES
9	Reset pin(active high)/ RF receivers IR
1-17	I/O PINS/Traffic lights
18,19	Crystal oscillator
20	GND
21,22(4,6 of lcd) 32-35(11 to 16 of lcd)	LCD (rest all r connected across a 1k resistor)
23-28	I/O PINS/IR receivers
31,40	VPP + VCC
29	PSEN
30	ALE

**Fig. 4.** Pin allotment to various devices.*Infrared led's:*

Gallium arsenide is a direct-gap semiconductor with an energy gap of 1.4eV at room temperature.

These take electrical input and give infrared light as output.

**Advantages of Smart Ambulance System**

- ✓ Ambulance service will no longer be affected by traffic jams.
- ✓ Use of radio frequency signal (not blocked by objects, fast).
- ✓ Over a wide range applicability.
- ✓ One time investment cost.
- ✓ Life of people can be saved.

**Advantages of Traffic Density Control System**

- ✓ A modernised way of controlling traffic.
- ✓ Number of road accidents can be reduced to a large extent.
- ✓ Easy traffic regulation in busy cities such as Delhi, Mumbai etc..
- ✓ Help the traffic police in easy control of traffic.

**V. FUTURE SCOPE**

- This project can be enhanced in such way as to control automatically the signals depending on the traffic density on the roads using sensors like IR detector/receiver module extended with automatic turn off when no vehicles are running on any side of the road which helps in power consumption saving.
- No. of passing vehicle in the fixed time slot on the road decide the density range

of traffics and on the basis of vehicle count microcontroller decide the traffic light delays for next recording interval. The recorded data can be downloaded to the computer through communication between microcontroller and the computer. The Administrator sitting on computer can command system (microcontroller) to download recorded data, update light delays, erase memory, etc. Thus administrator on a central station computer can access traffic conditions on any approachable traffic lights and nearby roads to reduce traffic congestions to an extent. In future this system can be used to inform people about different places traffic condition. This can be done through RADIO. Data transfer between the microcontroller and computer can also be done through telephone network, data call activated SIM This technique allows the operator to gather the recorded data from a far end to his home computer without going there.

- Traffic lights can be increased to N number and traffic light control can be done for whole city by sitting on a single place.
- In ambulance system, the data of the patient in the ambulance can be sent to the Hospitals via GSM technology. Thus, it can provide early and fast treatment of the patient.

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