

# A Novel Technique for Human Safety and Go Green for Priority Vehicles on Road Crossings Using IoT

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## Abstract

*As we all know our country is facing serious impacts on traffic jams, some of which are the span of lane network, vehicle, human population and implementation of road safety rules, heavy traffic raise the time of journey, thus be notable as one of the important issues in urban areas. Emergency vehicles need to reach their destination as much as in time. If Emergency vehicle is spent for longer time in traffic jams, the valuable lives of people may be loose the life. Present traffic management system cannot handle the flexible traffic volume which is changing over time with predefined set of operation's so, heavy traffic lane's are generated at the road crossing.*

*To address the above mentioned issue, this paper proposes an IoT based Adaptive Traffic Management System. It's various edge detection and object calculating process are used as efficient technique's and also focused on the traffic zone. This can be done by two ways: Volume of the traffic will be decided with the avail of IR sensors. And in order to give Green path (Zero traffic) for emergency conveyances RF technology is used. The major concern of proposes system is there are two modes operation i.e. 'automatic' without any human introversion and 'manual' with human introversion.*

**Keywords**— IOT, IR-sensor, Raspberry pi, Congestion, Traffic Control Systems, Traffic Management.

## I. INTRODUCTION

The conveyance systems are an necessary part of human activities. But, conveyance infrastructure in the urban areas is virtually saturated due to the lack of land resources and elevating volume of conveyances on the path. Traffic management on road has become the greatest problem in the current scenario because of faster growth in population, industrialization and urbanization. This paper is in concern of cities with heavy traffic. For example, in Bangalore many roads will be jammed for so much of time. With the increase in traffic there occur so many problems like traffic rule violation, in some areas with heavy traffic, accidents, traffic jams, etc. This increase in traffic

length in turn has an adverse effect on lives of people and also it affects the economy of the country.

Traffic signals play major role in traffic light management system. Usually, the traffic signal lights are programmed for particular time period. There were several attempts made to design the traffic signal, such that it operates based on the density of vehicles at the traffic. But this in turn has the limitation that this principle calculates the density based on counting all the vehicles at the traffic without any priority. If even the emergency vehicles like fire brigade, ambulance and VIP vehicles will be treated as ordinary vehicles. If the RF transmitter is attached to the Emergency vehicle, The Emergency vehicle is continuously transmitted RF signal and RF Receivers placed in traffic control system. When RF Receives is receive the signal the concern authority's alert section is active And will give information via the decision making system(Raspberry pi) to traffic lights converted go RED to GREEN by using the RF Technique'.

A master controller pre-empts original flow sequence of traffic light and executes emergency mode. In emergency mode if original signal is RED then it converted to GREEN for Emergency vehicle. During these operations signals from all other path will be red and the priority will be given to Emergency vehicle only. When Emergency vehicle crosses that path the controller will again continue with the original sequence of traffic signals.

The proposed traffic congestion control system, at first endeavours to quantify the volume of traffic. The density based system using IR Sensor's as a input to control system. The control system understand the condition and decide the provide the more time to that lane. The work of density based system provide the flexibly change the signals and set the Green signals timing according to traffic volume.

## II. RELATED WORK

Lot of related works have been carried out in this field to solve the challenges in vehicle detection and finding the traffic volume.

The utilization of GPS module to track the ambulance and sound sensor to detect the frequency of the siren. With these modules accessed via Node MCU, traffic signals are adjusted and controlled for the ambulance to pass through the traffic [1]. Once vehicles enter into the vicinity of traffic signal area, the vehicles continuously send their positional information to the centrally located fog node on traffic signal and accordingly traffic signal is monitored [2]. The IoT based traffic light signal control for ambulance. It is also used to send location and of the ambulance reach the traffic signal for the prior arrangements to manage the traffic. The proposed system is used to defeat the delay with help of internet of things, raspberry Pi3, Arduino, timer, etc [3]. The main theme of the project is that when the patient is in ambulance in emergency condition the ambulance should reach the hospital extreme expeditious and to send every each and every fundamental information and condition about the patient to for the prior arrangements for the treatment. It sanctions us to preserve the time of major delay aspects in more efficient and economical manner and preserve the life [4]. IoT predicated traffic management solutions for keenly intellectual cities where traffic flow can be dynamically managed by onsite traffic officers through their perspicacious phones or can be centrally monitored or controlled through Internet [5].

The embedded technology has been used to evade such road traffic jam by controlling road traffic signal which automatically turns the red signal to green whenever the ambulance reaches proximate to traffic light control [6].when an emergency conveyance advent the junction, it will communicate to the traffic controller in the junction to turn ON the green light. It withal designate the network congestion, and hence the green light duration for that path. This process works WI-FI Module uses IR sensor and ARM micro-controller for wireless communications between the emergency conveyance and traffic controller [7]. We have developed an algorithm to find the shortest path to reach the destination. As required the software will identify the present location of the conveyance and ask the utilize for the destination. Then it will show all the available paths, highlighting the shortest one or in several cases the most optimum one [8].

If the traffic condition data is automatically send to the RPi unit managing the lights at an intersection so that the controllers can make and implement expeditious decision. To implement this automation, RFID technique may be used [9].The present theory faces a major disadvantages of transmuting the traffic signal in a clock-sapient mode, it doesn't make store of the traffic denseness. The denseness of the traffic is quantifying and the timer exhibit is shift dynamically [10]. A scheme for the composition of an implement for network monitoring that fortifies IoT contrivances traffic classification and

identification [11]. To develop and implement a working paradigm of a system to facilitate traffic congestion by controlling traffic lights dynamically predicated on the traffic volume, which, in turn, is resolute by utilizing the mundane speed data provided by the conveyances [12].The utilization of IR sensors to provide drivers with an early caveat of the subsisting traffic which will avail the driver to cull another opportune lane to reach his destination [13].

### III. MOTIVATION

In India due to huge increasing in population which in return enhances huge of industrialization that is effected in uncontrollable raising traffic density in urban areas. The loss of human life causes due to heavy traffic, to delay in receiving medical Treatment. The Proposed model provide the free lane to emergency vehicles to reach as much as in time and density based system provide the flexibly change the signals and set the Green signals timing according to traffic volume.

### IV. PROBLEM STATEMENT

Road traffic has become the major challenge in current metropolitan cities. Traffic jams is most continues one. It is not only wasting the precious time but some conditions it pay the valued lives.

- a. The traffic jam curbs the fast moving of vehicles. Which also include emergency vehicles whose delay pays the valued life.
- b. The current traffic system is working fixed time allocation of each lane like Round Robin based. It is not providing the priority based.
- c. Controlling huge traffic can get daunting at a time.

Now a day's traffic increases rapidly therefore Emergency vehicle will get stuck in traffic. Hence, need to solve the problem of traffic to get the medical facility to accident victim within short period of time.

### V. OBJECTIVE

The main objective of this paper includes creating an environment to provide clear lane to the Emergency vehicle whenever it enters into the range. Control the traffic signals by calculating the density of the traffic there by eliminating the unnecessary wasting time and saving the lives. Without altering an existing infrastructure, it is easy to implement with low cost.

Identifying of moving vehicles can give system aims to as following aspects.

- a. **Static Mode:** Traffic signal working as a static mode like fixed allocation of each lane one by one similarly as a Round Robin scheduling basis.
- b. **Dynamic mode:** Traffic signal working as a dynamic mode means it calculating density basis

- If the no traffic on next lane then the system will skip that lane signal and will move to the next one.
  - If the heavy traffic in any one lane. The signal light turns to green signal of that lane. The green signal duration raised according to density basis.
- c. The major role the project aim is to provide clear lane to the Emergency vehicle without any disturbance to public.
  - d. Notification sends to the near hospital to arrange the emergency services.
  - e. The save data can be facilely be alimented into the cloud storage.

**VI. PROPOSED MODEL**

Road traffic has become the major problem but present condition not an efficient solution established. Hence our proposed traffic congestion control system provides the powerful solution this paradigm design. The proposed model blue print of as below.

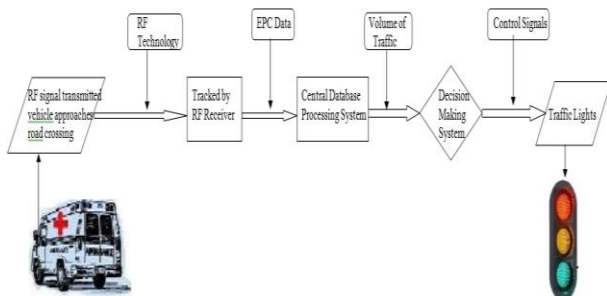


Figure 1: Proposed system of Emergency vehicle

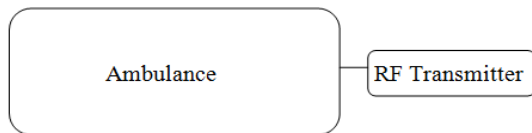


Figure 2: Ambulance with RF Transmitter

The proposed designs specifically focus on below reasons:

- a. Wasting of unnecessary time in actual lane, when present the few vehicles.
- b. If any lane has emergency vehicle it also has to wait for its turn to change the signal.
- c. The proposed system will recognize Priority vehicle or density based change the traffic signals accordingly.

The proposed methodology can be tray to get the solution to congestion, To provide free lane to Emergency vehicles used by RF Technology it is the highest priority and next priority is density based. The density based system is used the IR sensor's basis otherwise it worked as normal mode by using time slice like Round Robin. The major concern in the proposed system is operated in two mode's automatic mode and manual mode.

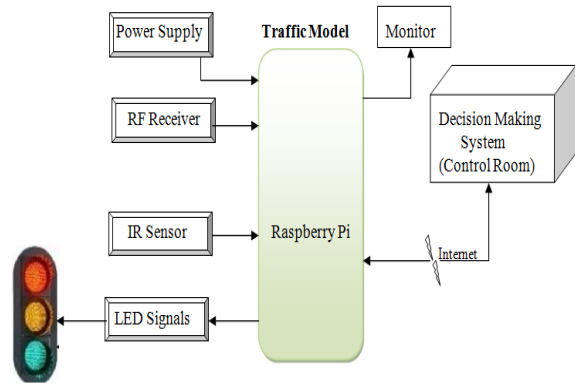


Figure 3: IoT Based Traffic Signaling System

In manual mode with human introversion authorized person to control the traffic which is done in control room.

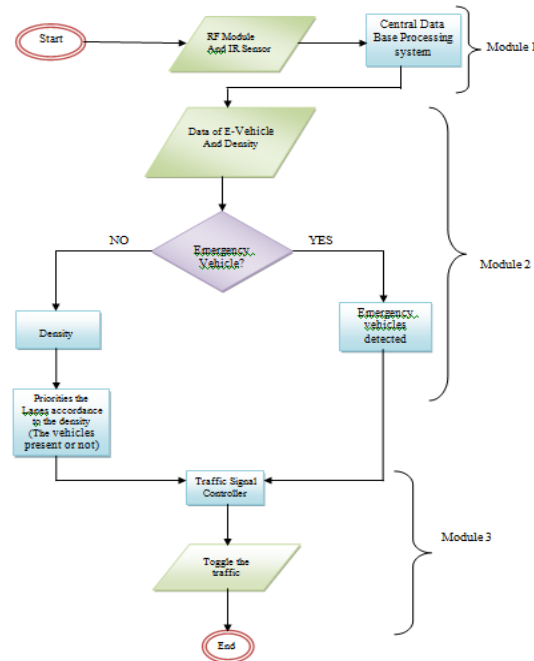


Figure 4: Flow Chart of purposed system

- a. The first will be recording vehicles, the frames will be taken from that records and the same is fed to the Central data base processing system.
- b. If Emergency vehicle detected then signal controller transfers the signals to the traffic controller room then the signal is toggled accordingly it is high priority.
- c. If the vehicle detected is not a Emergency vehicle then traffic density is estimated and signal is prioritized accordingly by the signal controller.

**VII. DESIGN AND IMPLEMENTATION**

Emergency conveyances will be fine-tuned with RF signal and its ID number will be preserved in control room system. RF signal will be keep at certain distance near sensor 2. When emergency conveyance arrives, RF signal will get the data. The ID number

received from RF will be collating with number present in control room system. If match the ID then automatically green light will be turned ON.

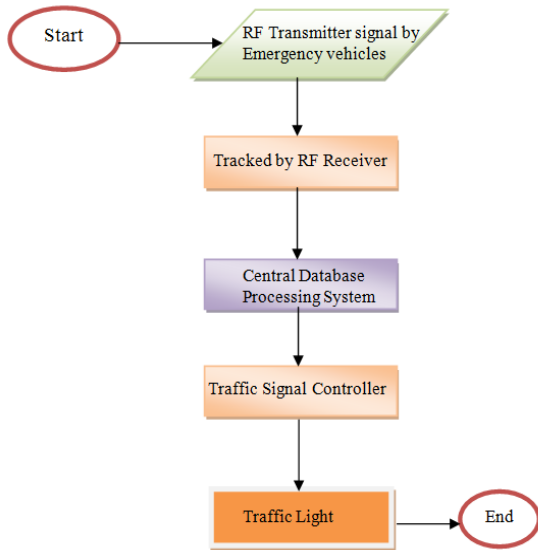


Figure 5: Flow Chart for Emergency vehicle

- If any Emergency vehicle arrival in lane Without considering the density the traffic signal to go RED to GREEN by the RF Technology.
- Its provide clearance way of lane to Emergency vehicles automatically without any disturbance of public.
- A database which stores the records of Emergency vehicles that have passed the crossing.

Traffic management system will place IR sensor at certain distance. Starting from signal light of that road first sensor is kept at ‘Y’ metre distance. 2nd sensor at (Y+5) meter distance.

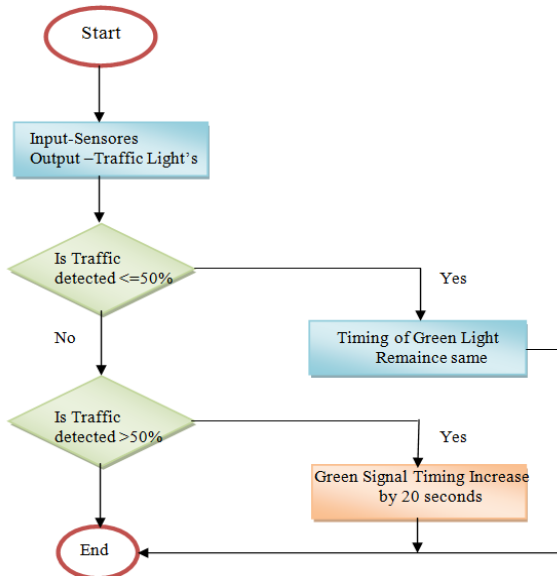


Figure 6: Flow Chart for Density based Traffic

When traffic too high all these sensors will give high output which denotes ‘traffic is heavy’, then for 45 second green light will be ON. If 2nd sensors

are high it verbally expresses that ‘traffic is normal’, then for 30 second green light will turn ON. If only 1st sensor output is high the ‘traffic is low’ so only for 20 second green light is turn ON.

- Flow chart show when the traffic volume is  $\leq 50\%$  ( here first sensor). Response of Traffic signal is same as normal not need to vary the time duration.
- If 2nd sensor detects traffic means traffic is  $> 50\%$  and Green signals timing raised by 15-20 seconds as per requirement.
- The time will be set as flexible.

**Algorithm**

The Algorithm can be developed by analysis of traffic volume as follows:

- If any Emergency vehicle arrival in lane and transmit the RF signal Without considering the density the traffic signal to go RED to GREEN. This is the highest priority.
- Traffic congestion information received from IR sensors placed 50 meters distance on sides of road.
- If 2<sup>nd</sup> sensor detects traffic then send the signal to Raspberry pi which is understand the condition and decide giving the more time to that lane. This is the next highest priority.
- If 1<sup>st</sup> sensor detects the traffic it sends the signal to Raspberry pi which is decides to provide the less time for normal traffic.
- If the sensors not detect the any vehicle in next lane then the system will skip that lane signal and will move to the next one.

The analyzed data with time and date as updated on cloud storage for future analysis.

**VIII. FUNCTIONAL UNIT DESCRIPTION**

The purposed design consists of hardware and software. Hardware components are Raspberry pi (Rpi), Sensors, RF Technology, and Software like Python, Raspbian OS which are described briefly as below.

**A. Raspberry pi**

The purposed model requires perspicacious Hardware platform the SBC quality with network futures would be a felicitous cull. The purposed hardware is Raspberry pi because of following reasons.

- Rpi hardware is lowest cost.
- The OS on Rpi allow convenient software updates.
- Rpi running directly from Raspbian OS.

Rpi on board general purpose input output (GPIO) line allows interfacing with external circuitry. The Rpi constancies 40GPIO pines in that 8-ground pins, 2-5v pin, 3-3.5v pins, 2-special pins and 26 GPIO pins these all pins are physical interface between the Rpi and the out said device. The CPU speed is 700 MHz to1.2 GHz. HDMI port used for monitor connection, 4USB slots. It includes camera

interface and also video, Audio jacks, Ethernet port, SD card slot for OS and storage purpose.

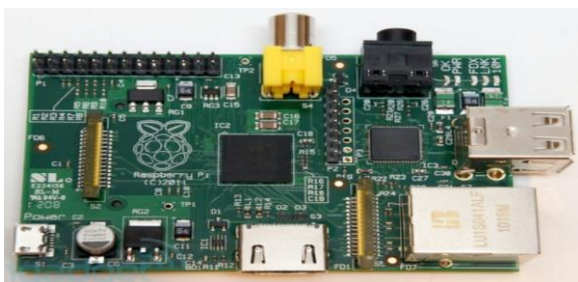


Figure 7: Raspberry Pi

**B. RF Module (Transmitter and Receiver)**

The RF Transmitter (Txr) works 433/34 MHZ Radio waves. It includes 4 pins 1 for VCC+5, 1 for Ground, 1for Data transmitter and 1 for Antenna. It used 4\*1 HT12E Encoder with 8 bit address mode means 8C8 address combination for especially for ID of the roads. It allow extra future is adding the switch.

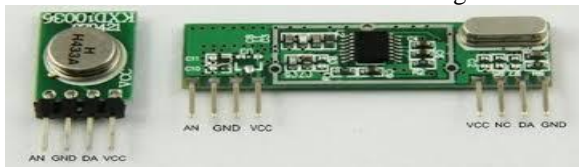


Figure 8: RF Module (Transmitter & Receiver)

The RF Receiver (Rrx) works 433/34 MHZ Radio waves. It includes 8 pins. It used 4\*1 HT12D Decoder with include crystal isolator. It used 8 bit addressing mode 8C8 combination. RF Receiver(Rrx) working like input which change the traffic light from Red to Green and make the way for the Emergency vehicles.

**C. Infrared Sensors or IR Sensors**

An Infrared sensors' used for sensing devices. It contains 3 pin's 1for VCC, 1 for Ground and 1for IO pin. The IO pin act as a Input of the project. The IR sensors contain LM358 IC to transmit the sensing single to Rpi like 0 and 1's. 0-Means low it is not sensing any device. 1-Means high it senses the device. The wave length is 0.75 μm near infrared and 6 μm for infrared.

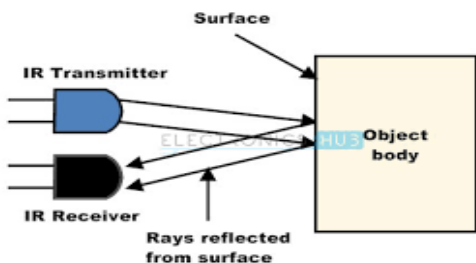


Figure 9: IR Sensors

**D. LED(Light Emitting Diode)**

LED's are acts as a out put's devices. Three different colure LED's are used like Red, Yellow, Green. There are 12 LED's required 4 of each to

mimic the traffic light. The 5mm sizes LED are used. The power supply is 16 μA for LED including registers are used.

**E. Python**

Python was developed in the early 1990 by Guido van Rossum. All python version released open source. Python IDLE is interface built in python in first installer. The python IDLE first launcher in single window called python shell. Python shell used interpreter window for mathematical expressions evaluated immediately. IDLE window allow new multi windows. It used scripiter with standard temple. IDLE python integrated development and learning environment. IDLELIB Files lists files alphabetically by category with short description of each. IDLE MENU show the menu tree annotated with the module object that implements the corresponding functions.

**F. Raspbian**

A Broadcom + University of Cambridge and co-foundation launch Raspberry pi and Raspbian operating system(OS). Raspbian is a Debian-based free OS. Raspbian is a simple use as a desktop operating system. It is a basic version of desktop on Rpi running directly from Raspbian OS. Raspbian build with four Rpi as Linux distribution the works links and fast. Raspbian desktop can work as regular computer. Raspbian cast allow to Net-flex it is in chrome web store and it is still in development. A Raspbian OS required minimum 2 GB SD card but 4 GB SD card or above is suggested.

**G. Adafruit IO**

The Adafruit IO is a simple to use internet service easily enable IoT to get post data. The system is not just limited to storing data IoT devices. The possibly used GUI interface given data controlling devices.

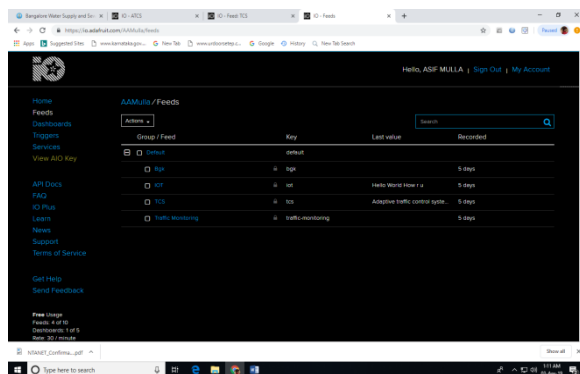


Figure 10: Adafruit IO Dashboard

First task signup service is two options one is limited version and subscription service. Different features in Adafruit IO mainly following thinks need to find out.

- User name is use to identify your account and privet key used as your password.
- Dashboard allow many different types of input output interface to gauge and allow you to visualize data and control Adafruit IO

connected projects from any modern web browser.

- Feed's Adafruit IO is use to store's data from IoT device. IoT device controls data from feed's. This means we need to setup a feed otherwise devices nothing to say.
- Trigger is a valuable to which can use to create lots in sudden situation. It allow E-mailing, publisher a message to feed's.

Adafruit is to create IoT dashboard only provide a simple math of sending data, saving data and displaying the data.

**IX. IMPLEMENTATION RESULTS AN ANALYSIS**

The perfect paradigm of IoT based traffic control system has been developed using to Raspberry pi is a controlling and processing unit. In addition IR sensor's are placed on edges of the road and connected to Raspberry pi for managing the traffic signal based on traffic volume information receives. If any Emergency vehicle arrival in lane and transmit the RF signal Without considering the density the traffic signal to go RED to GREEN. Also all information can be updated in cloud storage like Adafruit IO dashboard by using internet for future analysis.



Figure 11: Adaptive Traffic control Model



Figure 12: Traffic signal changing from RED to GREEN.

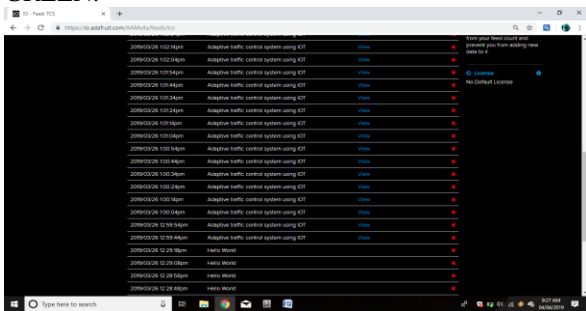


Figure 13: Adafruit IO Dashboard shows the Traffic analysis information.

**X. CONCLUSION AND ENHANCEMENTS**

The observing the purposed system results are provides the time management in traffic signal is possible which is reducing the traffic. The purposed model can be tray to giving the solution of Density based and clear way of Emergency vehicles. The work of density based system provide the flexibly change the signals. It provides the clearance way of lane to Emergency vehicles hence many precious lives would be saved. The purposed system has worked in automatically without any disturbance of public. This can be elongated to more number of junctions. An 'app' can be designed which uses traffic status at different location from the control station database to exhibit so that it avails mundane people.

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