

# An Approach for Prioritizing Emergency Vehicle and Efficient Traffic Flow

Dr. J. Ajayan<sup>1</sup>, R. Keerthikga<sup>2</sup>, R. Kiruthiga<sup>2</sup>, V. J. Mohen<sup>2</sup>, M. Priyadharshini<sup>2</sup>

<sup>1</sup>Assistant Professor, Department of Electronics and Communication Engineering SNS College of Technology, Coimbatore, Tamil Nadu, India

<sup>2</sup>UG Student, Department of Electronics and Communication Engineering SNS College of Technology, Coimbatore, Tamil Nadu, India

## ABSTRACT

The aim of this paper is to prioritize emergency vehicles and to ensure the smooth motion and efficient flow of vehicles by reducing the traffic volume, overall waiting time and travelling time of the people. As population increases, the use of automobiles increases day by day which lead to serious dilemma. A proposed system uses the Raspberry pi-3 that evaluates the traffic density using the piezoelectric material and IR sensor which accomplishes dynamic timing slot according to the traffic density and the RF transmitter receiver is used to prioritize the emergency vehicle which stuck in the overcrowded roads and allow the smooth motion of vehicles. Therefore this system provides the fast, efficient traffic control for our nation development.

**Keywords :** Raspberry pi-3, Piezoelectric, IR Sensor, RF Signal Transmitter Receiver

## I. INTRODUCTION

Traffic congestion is the major problem increases gradually with increase in population. Due to increased transportation which lead to higher emissions and energy consumption[1]. Traffic lights are signalling device which are developed to control traffic flow at road intersection, pedestrian crossing and other locations. Traffic light consists of three universal coloured lights: the green light allows the traffic to proceed in the indicated direction, the yellow light warns vehicles to prepare for short stop and the red light prohibits any traffic from proceeding[3]. There are numerous research work in the automatic congestion detection and the corresponding algorithm used are McMaster[2], sequential timing algorithm, hybrid petri-net optimization[12] and image processing technique[6] [5] [4]. 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.

### 1.1 TRAFFIC SIGNAL CONTROL

Traffic is one of the major issues of transportation system in most of all cities of countries. This is especially true for countries where population is increasing at higher rate. The problems of conventional traffic light are as mentioned.

#### i. Traffic jams are heavy

With increasing number of vehicles on road, heavy traffic jams have increased in cities. This happened usually at the main junctions commonly before and after office hours. The solution for this problem is by developing the program with different time delay for junctions that have high volume of traffic should be set loner than the delay for the junction that has low traffic.



**Figure 1.** represents the traffic congestion

**ii. We need to wait even if there is no traffic**

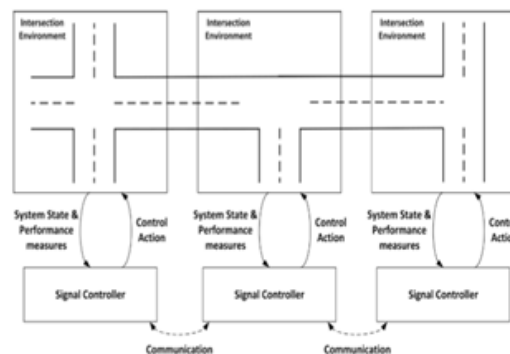
At certain junctions, we have to wait even there is no traffic. The traffic light remains red for the preset time period so that the road users should wait until the light turns green. The solution of this problem can be obtained by developing a system which detects traffic flow on each road and set timings of the signal accordingly

**iii. Emergency vehicles got stuck in traffic**

Usually, during traffic jam the emergency vehicle such as ambulance, fire service etc., will get stuck in the traffic. This is because the road users wait for the traffic light to turn green. This is very critical problem because it can cause emergency case to become complicated.

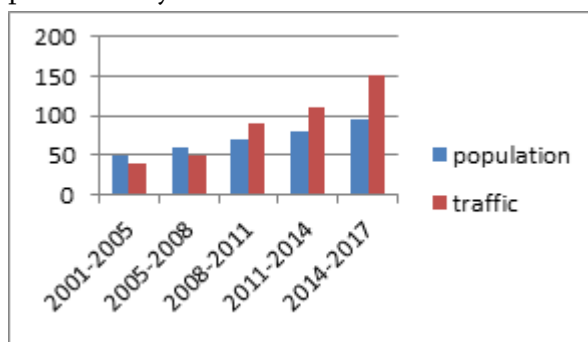
**II. EXISTING SYSTEM**

There are various techniques used to reduce traffic congestion. These techniques are analysed but still it does not able to provide efficient traffic flow. In the existing traffic system the fixed timing of the signals are not able to control traffic. At certain junctions, the traffic light remains red for the preset time period and so the user should wait until the red signal turns into green. This increases the waiting time of the vehicles. During traffic jam, the road users will be waiting for the traffic light to turn green. In case of emergency, the emergency vehicle will get stuck in the traffic which may cause severe complications to the patient.



**Figure 2.** Illustrates the traffic at intersection

The above figure illustrates that a signal controller agent perceives states from intersection environment. The system states rely on observations obtained from deployed detectors. These interactions produce feedback from the traffic environment and further regulate the signal control system. The control actions are dynamically sought by the local elements of the system. The system can adapt quickly to unforeseen changes as elements interact locally. Besides, with the coordination enabled, a signal controller agent is able to communicate with its neighbouring agents. In a multi agent system, each agent has a limited sensing capability and coordination issues can be addressed by changing local control settings between controller agents. The existing traffic signal system is implemented with delays where the signal transition time slots are fixed and do not depend on current traffic flow. The major drawback of the existing system provides less accuracy, no time shifting and no priority based preference system.



The above chart represents as the population increases traffic increases.

### III. PROPOSED SYSTEM

The proposed system mainly deals with the time which is the main factor causes traffic. These system improves efficiency and expand the benefits in economic as well as environmental sectors. Piezoelectric material will be mounted on the road and IR sensor will be fixed on either side of road. These sensors will be used to measure the density of vehicles. Vehicle count will be taken when both the sensors produce the equal output. In some cases a threshold value will be fixed and if the output of both the sensors are higher than or equal to 1.5 then vehicle count will be taken into account. Depending on the densities, the lower density lane is allowed first then the timing of lower density lane is shifted to the lane with higher density. If two lanes have same densities, one of them will be released at first as per traffic.

Emergency vehicles such as ambulance, fire service etc., are provided priority using RF transmitter receiver module. The RF transmitter will be fixed in the ambulance and the receiver will be in the signal pole. The RF transceiver module transmitter is connected to the Raspberry-pi unit which receives the signal from the receiver in the ambulance. As soon as the signal is received, the lane with the emergency vehicle is cleared immediately even the lane has the higher density by turning the signal to green while all three signals will become red. So that the emergency vehicle can have easy passage and the life of the patient can be saved.

### A. BLOCK DIAGRAM

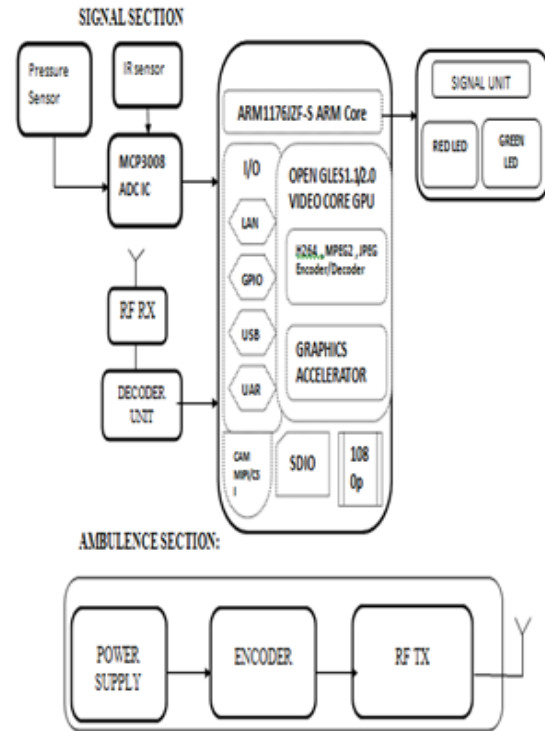


Figure 3. Entire module of the system

In figure 3, both signal and ambulance section is controlled by Raspberry-pi controller. The above system minimizes the time required for the waiting vehicles to reach their destination, gives priority to the emergency vehicles and also reduces congestion.

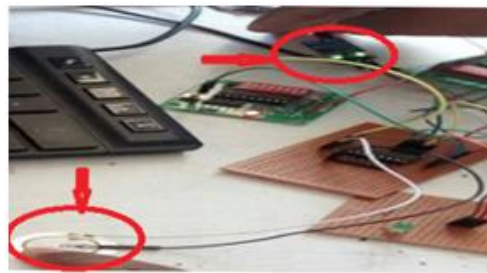


Figure 4

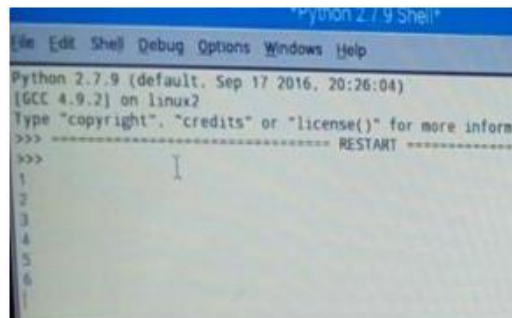
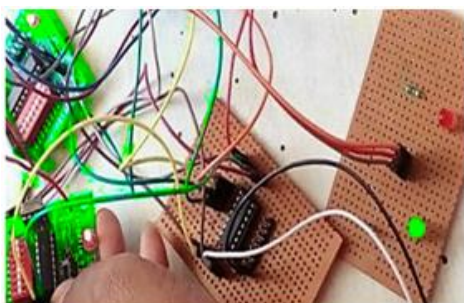


Figure 5

In the above Figure 4,5 Figure 4 represents the input to the system which is taken from both piezoelectric and IR sensor. Figure 5 represents the corresponding output of the sensors. If the output voltages of both matches controller takes into count and the count value is incremented. By comparing amount of vehicles in each lane, signal light is turned on and the traffic is cleared.



**Figure 6**

Figure 6 indicates the ambulance section. When the ambulance is approaching in the particular lane the information is perceived through the RF signal transmitter and receiver. Then that particular lane is cleared first indicating the green light.

#### **IV. CONCLUSION**

Nowadays, traffic congestion is a main problem in major cities since the traffic signal lights are programmed for particular time intervals. However, sometimes the demand for longer green light comes in at the one side of the junction due to huge traffic density. Thus, the traffic signal light system is enhanced to generate signal based on the traffic on roads at that particular instant.

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