Automatic Traffic Solution for Emergency Vehicles

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***Abstract*— The Reduction of travelling time of emergency vehicles such as Ambulances, Fire Brigade, etc is very important to reach on time, but as the number of vehicles on the roads are increasing constantly, the current traffic system is failing to serve traffic congestion problems especially on the intersections.**

Lack of efficient traffic control and management has many a times lead to loss of lives due to ambulances and many other emergency vehicles getting stuck in traffic jams.

To overcome this problem the proposed work provides Automatic traffic solution for Emergency vehicles such as Ambulance Fire Brigade, etc to reduce the delay in arrival of ambulance to hospital and Fire Brigade to Fire Accidents with effective traffic signal monitoring by the use of RFID.

***Index Terms*— Ambulance, Fire Brigade, Traffic signal, RFID.**

I. INTRODUCTION

The operation of standard traffic lights which are currently deployed in many junctions, are based on predetermined timing schemes, which are fixed during the installation, and remain until further resetting. The timing is no more than a default setup to control what may be considered as normal traffic. Although every road junction by necessity requires different traffic light timing setup, many existing systems operate with an over simplified sequence. Most of the present day systems use pre-determined timing circuits to operate traffic signals which are not very efficient because they do not operate according to the current volume of traffic at the crossing.

It is often seen in today's automated traffic control systems that emergency vehicles getting caught up by a red traffic signal and wasting valuable time. There are other problems as well like vehicles wait at a road crossing even though there is little or no traffic in the other direction.

fig 1: Emergency Vehicle stuck in Traffic

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The problem of Emergency vehicles getting stuck in a traffic jam can be addressed by ensuring that the lane in which the emergency vehicle is travelling is cleared. That is, the arrival of the emergency vehicle is to be communicated to the nearest traffic signal, so that it can turn the light to green and hence clear the traffic by using Radio Frequency Identification (RFID).

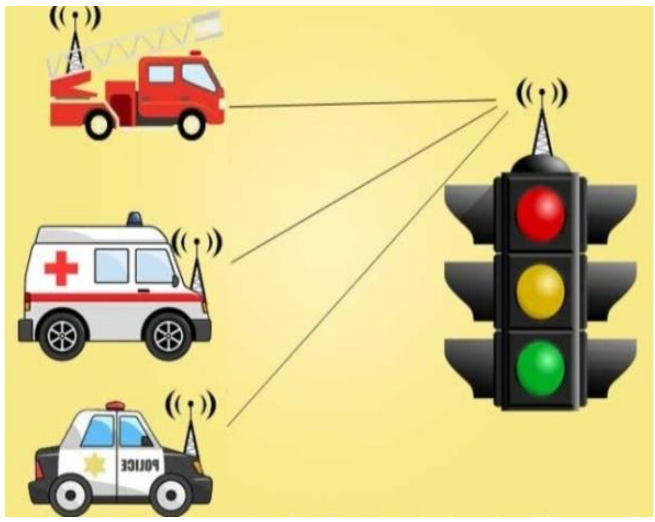

fig 2: Communication of EV to nearest Traffic Signal

II. BACKGROUND

Radio Frequency Identification uses radio frequency waves to transmit data between a reader and a movable item to identify, categorize, track.....RFID is fast ,reliable and does not require physical sight or contact between reader/scanner and the tagged item.

Fig 3: Components of RFID

Architecture of Automatic Traffic Solution

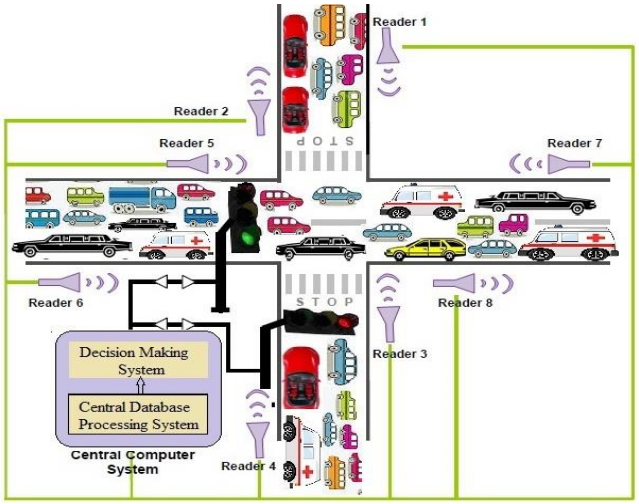

fig 4:Architecture of ATS

Fig 4 describes a typical crossing of a traffic signal junction where there is a huge traffic. The Automatic Traffic Solution (ATS) is comprised of a set of RFID readers, separated by some distance, in each direction of a road crossing and have a Central Computer System (CCS) to control them all. As a vehicle passes by a reader, it tracks the vehicle through the RFID tag attached to the vehicle and retrieves its Electronic Product Code (EPC) data. The EPC primarily consists of Vehicular Identification Number (VIN). each automobile has a unique VIN. Through a table look-up procedure the VIN may be matched against individual vehicle record and all details like type of vehicle, registration can be retrieved. The data obtained is then sent immediately to the Central Computing System by wireless or wired channels, as found convenient at that location. The CCS contains a central database processing system (CDPS) for processing vehicular data and a decision making system (DMS) for controlling the traffic signals.

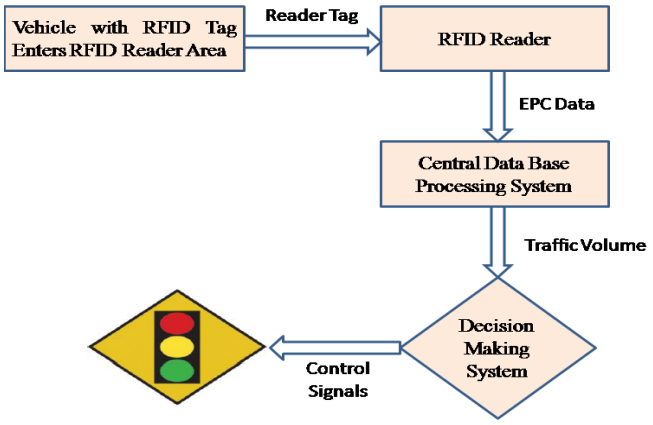

Fig 5: Data Flow of ATS

CDPS

Central data Base processing System consists of :

- A dynamic database where the records of vehicles currently passing the RFID Reader Area are temporarily stored.
- A permanent database which stores the records of all vehicles that have passed the junction

The dynamic database arranges the EPC data of vehicles according to their path and direction of travel. Whenever a vehicle moves towards or away from the junction, the readers detects the type of vehicle, priority assigned to the vehicle, priority assigned to the path of the vehicle, time etc then it sends the obtained data to the CCS. The readers determines the direction of travel of the vehicle (whether it is moving towards or away from the junction). The vehicle data is then sent to any one part of the database corresponding to its path and direction of travel.

The CDPS checks the data in various parts of the dynamic database at each instant, and computes the traffic for all the roads at junction. It then sends the computed information to the DMS of the CCS which operates the traffic signals according to the current volume of traffic (showing the green light in the direction of maximum traffic towards the direction that emergency vehicles are passing). Once a vehicle has passed the junction, that is it has gone out of the range of the readers, its data is moved from the dynamic database to the permanent database where it is stored along with its direction of travel, both arrival and departure directions, and time.

Decision Making System (DMS)

The DMS consists of Decision Making Algorithm which determines how traffic signal lights are operated.

This work takes the following parameters for calculating the priority value of a RS.

- ✓ Number of EV(Reqnum): Number of requests from the RS. Each RS can have zero or more number of ambulances.
- ✓ Emergency Vehicle value(EVval): Each vehicle is assigned a value based on the sensitivity of condition. Values range from 1 to 5 as higher value indicates more seriousness.
- ✓ Minimum distance(Mindist): It is defined as the distance of closest EV from a traffic light intersection.
- ✓ Waiting Time(Maxwait): It is defined as maximum value of the waiting time of EV present in a RS. All these parameters are crucial in deciding the priority value of a RS.

fig 6: Data flow of DMS

Priority value is calculated as:

$$P_{valRS}=Reqnum_{EV}*W_{Reqnum}+ (Min\ dist_{EV})^{-1} *W_{mindist} +Maxwait_{EV}*W_{Maxwait} + EVval * W_{EV\ val}$$

where Pval*RS* is priority of a RS at a traffic Junction ,Req num is number of EV requests from a RS, Min dist is distance of closest EV on a RS from a traffic light at an intersection, Max wait is maximum of the waiting times of the EV on a RS of an intersection, W*Reqnum*, W*Mindist*, W*Maxwait*, W_{EVval} are the multiplying factor of Reqnum*EV*, Mindist*EV*, Max wait*EV*, EVval respectively.

Case 1: When there is no Emergency Vehicle in a RS then, Reqnum*EV* = Min dist*EV*= Maxwait*EV*= EV val = 0.
This implies that Pval*RS* = 0.

Case 2 : When there are Emergency Vehicle in a RS then Pval*RS* is nonzero.
When Pval = 0 for all RS at an Junction then traffic lights run in a default manner else the traffic light turns green for RS having highest Pval.

III. IMPLEMENTATION

pvalRS-Priority value
TV-Traffic Volume
t1- time for Signal when TV is less.
t2-time for signal when TV is more.
t3-time for signal when Emergency Vehicle is in junction.
v-number of vehicles

```
Decision_Making(PvalRS,TV)
{
    if(PvalRS)
    {
      green(t3);
    }
    else
   {
     Normal_Traffic(TV);
    }
}

Normal_Traffic(TV)
{
  max(waiting time);
  if(min(v))
  {
    green(t1);
  }
 else
  {
   green(t2);
  }
 for(i=1;i<10;i++)
  {
   green(people);
  }
}
```

IV. CONCLUSION

In this paper the architecture for Automatic Traffic Solution for Emergency Vehicles such as Ambulance Fire Brigade, etc to reduce the delay in arrival of ambulance to hospital and Fire Brigade to Fire Accidents with effective traffic signal monitoring by the use of RFID.
The System operates in real-time, improves traffic flow and safety, and fully automated saving costly constant human involvement. The model provides constant assistance to the Emergency Vehicles at each traffic intersections by turning the light green for the Emergency Vehicle on its request.

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