Traffic Light Priority Control For Emergency Vehicle Using RFID

Suresh Sharma
Assistant Professor
Department Of Electronics And Instrumentation
Galgotias College Of Engineering And Technology
Greater Noida , INDIA

Alok Pithora,Gaurav Gupta,Mohit Goel,Mohit Sinha
Department of Electronics And Instrumentation
Galgotias College Of Engineering And Technology
Greater Noida , INDIA

Abstract- The proposed RFID traffic control avoids problems that usually arise with standard traffic control systems, especially those related to image processing and beam interruption techniques. This RFID technique deals with a multi-vehicle, multilane, multi road junction area. It provides an efficient time management scheme, in which a dynamic time schedule is worked out in real time for the passage of each traffic column. The real time operation of the system emulates the judgment of a traffic policeman on duty. The number of vehicles in each column and the routing are proprieties, upon which the calculations and the judgments are based.

Keywords-EV (Emergency vehicle),PIC (Priority Intersection Control),RFID TAGS, VTL (Virtual traffic light)

I. INTRODUCTION

With the growing number of vehicles, traffic congestion and transportation delay on urban arterials are increasing worldwide. Therefore it is practically important to develop, verify and validate simple yet powerful models that help in designing and improving the safety and efficiency of transportation. It is a significant issue to control traffic lights in road–vehicle systems. The main reason is that traffic signals are used to manage conflicting requirements for the use of road space – often at road junctions – by allocating the right side of a way to different sets of mutually compatible traffic movements during distinct time intervals. The traffic light control systems regulate, warn and guide transportation for the purpose of improving the safety and efficiency of pedestrians and vehicles. There are many literatures to develop various strategies [1] and they are classified into two categories [2]: (1) fixed-time strategies and (2) traffic-response strategies. Nowadays, most of the industrialized countries are using fixed-time strategies for urban traffic control. In addition, the topic of traffic signal control can be separated into two categories [3]: (1) determining which signal-indication sequence optimizes the system performance and (2) ascertaining how to implement the signal control logic. This paper centralizes on the second category with a traffic signal timing plan that is predetermined.

II. RADIO FREQUENCY IDENTIFICATION (RFID) SENSORS

The problem of traffic light control can be solved by RFID based system. With this system, we can consider the priority of different type of vehicles and also consider the density of traffic on the roads by installing RF reader on the road intersections. Radio frequency identification is a technique that uses the radio waves to identify the object uniquely. RFID is a technique that is widely used in the various application areas like medical science, commerce, security, Electronic toll collection system, access control etc. There are three main components of RFID: RFID tag, RF Reader and Database. Various types of tags are available but we can mainly divide them into two categories: passive tags and active tags. The passive tags don't contain any internal power source. There are three parts of the tag: antenna, semiconductor chip and some form of encapsulation. The life of the passive tag is very long. The reader sends electromagnetic waves that produce current in the tag's antenna. In response antenna reflects the information stored in it. The active tags contain a battery as an internal power source used to operate microchip's circuitry and to broadcast the information to the reader. The range and cost of these tags is more as compare to passive tags **[4] [5].** We have three kinds of tags which work on the three different frequency ranges: low – frequency, high-frequency and ultra high frequency. The Low frequency tags works on frequency lies between 30 ~ 300 KHZ and High Frequency and Ultra High Frequency Tag works on the frequency range lie 3 ~ 30 MHZ and 300 ~ 3 GHZ respectively **[5]** For ranges larger than a critical distance, these two waves cancel each other out, and the received signal strength decreases sharply. An approximation to the useful range of a RF transmitting system is given by:

$$dt = 2\text{Pi}\, hT\, hR / \lambda$$

where λ is the wavelength of the RF signal, and hT and hR are respectively the heights of the emitter and the receiver.

***** Graphical Approach Of Problem :

two lights are called linked lights that are placed on opposite sides of the road that join two intersections. the rfid reader stores the records of all the vehicles that passed through the road. the traffic light controller follows the same round robin sequence of the lights. but if an emergency vehicle is detected at any traffic light then controller leave the round robin schedule and generate the green signal for the ambulance. the other task of the controller is to calculate the time of green signal that is based on the number of vehicle. to solve the problem of starvation a time limit Is defined.

III. DYNAMIC TRAFFIC SEQUENCE ALGORITHM

An algorithm for the control of the traffic sequence that can change dynamically the priority and easy to implement is written to facilitate the efficient traffic control at certain junction. This also can be extended to multiple junction control. It is based on an automatic intelligent selection of traffic sequence in a multilane traffic flow

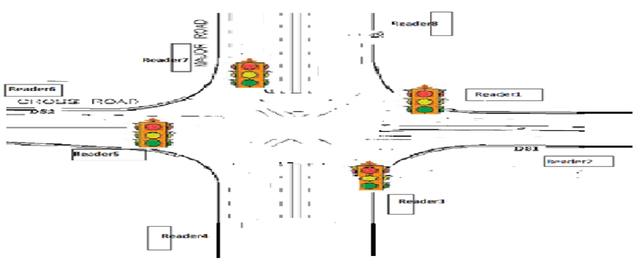

Figure 1 shows an example of how the algorithm

Assuming A, B, C and D are traffic column in which A from south can go forward, east or west, with timing slot that is dynamically determine according to the number of vehicle for each route. The same sequence is then shifted to B, C then D. The decision process for the intelligent traffic control depends on the real time information as provided by the RFID system. The data is also recorded and saved in the centralized management database. A number of readers are deployed to detect and count the vehicle at each junction. The reader captures the time-in for each vehicle passing within its range.

IV PROPOSED ALGORITHM FOR ENABLING PRIORITY INTERSECTION CONTROL

The proposed scheme is an important new application that builds upon of the VTL system described in [**6**], [**7**] by incorporating new local rules (i.e., mechanisms): by detecting the presence of an EV, the proposed scheme, namely Virtual Traffic Lights with Priority Intersection Control (VTL-PIC), assigns priority (i.e., gives the right of way) to the road (or approach) on which the EV travels. To enable the priority scheme, two additional mechanisms (i.e., local rules) are designed and added to the original VTL scheme. In the following, we briefly describe these two additional mechanisms.

4.1. Detection of an EV when it approaches and leaves an intersection

Upon approaching an intersection, the EV periodically broadcasts a PIC request message to announce its presence and to demand priority until it receives a PIC grant message from a vehicle that is leading the intersection (i.e., the intersection leader). Note that in addition to the PIC request message, the intersection leader can detect the presence of the EV when it receives a hello message generated by the EV. Besides PIC request messages, when the EV crosses the conflict point (intersection), it periodically broadcasts a PIC clear message for a certain period of time so that the intersection can now resume its normal operation for normal traffic management. In the case when PIC clear messages are lost, the intersection leader can also detect the departure of the EV when it does not receive hello messages from the EV (or does not receive PIC clear message after PIC request) for a certain period of time.

4.2. Priority assignment scheme

Once the presence of an EV is detected, phase layout
configuration of the traffic signals of the intersection needs to be re-computed and broadcasted to vehicles involved in the conflict at the intersection. While there are a number of algorithms that could be used for priority assignment, a simple scheme (i.e., the road on which the EV is traveling always gets the green signal) is used in our protocol to illustrate how priority intersection control could be used in conjunction with the VTL system. Since the VTL scheme is used as the underlying mechanism of the proposed VTL-PIC protocol, the VTL-PIC will also share the same benefits as the VTL scheme. To put things into perspective, benefits of the VTL-PIC protocol on the travel time of EVs can be described as follows:

• **Given the same amount of traffic, an EV in VTL-PIC scheme encounters less severe traffic congestion as compared to the congestion found in typical scenarios with physical traffic lights.**

It has been shown in [**8**] that because of a more efficient use of intersections as a *resource* and the fact that the VTL renders traffic control ubiquitous (i.e., traffic control at every intersection), during rush hours traffic congestion takes place at a much later stage (i.e., more vehicles need to be in the network before traffic congestion kicks in) as compared to the typical scenarios with physical traffic lights and identical traffic generation rate. As a result, vehicles and especially the EV reach their destination locations within a much shorter time duration when VTL scheme is employed. Furthermore, when traffic congestion is inevitable (i.e., generated traffic exceeds the capacity of the road network), the VTL scheme could resolve the congestion situation more quickly; hence, travel time of the EV is substantially reduced.

• **"Green-wave" allows EVs to travel at higher speeds such that they do not need to slow down when approaching intersections.**

Since VTL-PIC always assigns green signals to the road on which the EVs are traveling, the EVs will encounter greenwave phenomena as they pass through intersections (i.e., series of traffic lights are coordinated and present progressive green displays to the EVs). This results in a higher traveling speed of the EVs as compared to the conventional operation where the EVs have to slow down significantly as they see red signals when approaching intersections (i.e., as reported in [**9**], at least 26% in average EV travel time could have been saved). In addition, by assigning higher priority to the roads EVs travelon, VTL-PIC protocol could clear up the EV's route by also giving higher priority to vehicles that travel in front of the EVs to cross the intersections.

• **The proposed scheme can prevent potential EV-crash accidents that take place at intersections.**

By presenting green signal to the EV's direction, other vehicles that approach from different directions are presented with red signals, and hence, are prepared to stop and give the right of way to the EV. Note that because of ubiquitous traffic control enabled by the VTL-PIC scheme, it is expected that the proposed protocol could prevent a significant number of EV crashes (i.e., more than 25% of EV-crashes [**10**].thus making *both signalized* and *non-signalized* intersections safer for both emergency and normal vehicles.

The following given pseudo code helps to generate an efficient algorithm to control the sequence of the traffic light according the parameters discussed above.

While (true)
1. Store all lights in Queue
2. Sense the vehicles on different lights continuously
3. If a high priority vehicle is detected then

a. Send an emergency signal to center Traffic light controller
b. Find the road corresponding to the reader that detect a high priority vehicle
c. Set the corresponding traffic light Green

4. Else
5. For i=1 to 4
a. At decision point dp Pick the traffic light Queue[i]
a. At traffic i Count the number of vehicles & check type of vehicle
b. If Emergency vehicle found then

1. Go to step 3
c. Else follow steps d to f
d. Find the priority of the different vehicle at traffic light i
e. Calculate the total sum according to Number of vehicle
f. On the basis of sum calculate the time for green signal
g. If any light doesn't get it term within the threshold time then
1. Give the turn to that light
6. End Loop
7. End

V. CONCLUSION

We have proposed a self-organized traffic control scheme that helps facilitate emergency response operations (i.e., facilitate and expedite the movement of emergency vehicles through traffic in urban areas). In the proposed VTL-PIC scheme vehicles can resolve the ensuing conflicts at intersections by themselves and implement a priority scheme that can prioritize emergency vehicles at intersections. Our approach is based on a RFID tagging of traffic signals to convey their information to the car The proposed on-board architecture is portable and easily adaptable to any commercial car with minimal modifications .The system shows promising results, since active RFID technology permits to detect the presence and identity of the traffic signals reliably and sufficiently in advance**.**

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