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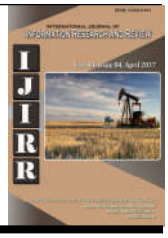

Research Article

AVOIDING COLLISION SCENARIOS IN THE TRAFFIC SIGNAL PREEMPTION ALGORITHM

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ABSTRACT

Traffic is a major issue in metropolitan cities all over the world. The occurrence of traffic congestion is due to the increase in number of vehicles in a certain path than the expected flow. Traffic is a major problem when it comes to the movement of emergency vehicles. Emergency vehicles like ambulances and fire engines are stuck in traffic and often face delay in reaching the destination. Most of the time this happens in Traffic Signals. There are many methods in place to allow emergency vehicles pass by the traffic signal freely. One of the technique used is traffic signal preemption. In this technique, the problem occurs when there are more than one emergency vehicle approaching the same junction at relatively the same time. This paper introduces a method which detects if more than one ambulance would meet at a location simultaneously and reroute one or more emergency vehicles to ensure smooth movement of all the emergency vehicles. If more than one emergency vehicle would reach a signal at relatively the same time, then the algorithm checks rerouting which vehicle is most efficient and reroutes it to the next best route to its destination. This method uses GPS coordinates and google map API's to get the required input values. The method discussed in this paper provides an efficient solution to avoid the confusion of which traffic signal is to be turned green when there are many ambulances approaching the same junction.

INTRODUCTION

There are many issues where many people lost their life due to the delay in emergency vehicle reaching the destination. There are many techniques to overcome this problem. Traffic signal preemption is one of major technique used widely in this concern. Traffic signal preemption is an approach where the traffic signal is manipulated so that the path taken by the emergency vehicle remain or turn green while the other conflicting signals turn red. This technique can be implemented using many methods. Acoustic sensors are one of the methods where the sensor detects the sound wave from the siren of the emergency vehicles and then manipulate the traffic signals. This method is inexpensive but has major disadvantages. Another method is to fix a transmitter in the emergency vehicle and a receiver in the traffic signal, the transmitter and the receiver can communicate through infrared rays as the emergency vehicle approaches to change the traffic signal accordingly. The transmitter and receiver can also communicate with radio signals to manipulate the traffic signal. Global Positioning System (GPS) is another widely emerged method for traffic signal preemption.

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GPS is used to get the location of the emergency vehicles and alter the traffic signal. Although there are many techniques to avoid the delay in emergency vehicles, the problem arises when there are more than one emergency vehicle approaching the same location at the same time. It will lead to major disorder in the smooth movement of the emergency vehicle. This paper discusses the method which will overcome this complication by introducing an algorithm which will assist the emergency vehicle to choose an alternative path in case of collisions and help the emergency vehicle to reach its destination without any collisions and obstacle. The alternative route for the emergency vehicles is decided by finding the difference between the actual route and the next best route to reach the destination along with the priority of the emergency which is decided by the criticality of the patient.

Literature Survey

There are many approaches for the smooth drive of emergency vehicles. Many related papers were researched while coming up with a solution to handle this problem. Hussein R. Al-Zoubi, Sahar Z. Shatnawi, Alaa I. Kalaf, Balqees A. Mohammad (Nikhil Mascarenhas), proposed a paper which uses sender and receiver mobile phones, a headset and dual-

tone multiple frequency (DTMF) chip to send, receive and process signals. The driver calls the cellular phone that is installed in the signal and triggers it to turn the signal green by dialing in the password. The DTMF detects and cross verifies the password and changes the signal accordingly allowing the EV to pass. When two emergency vehicles arrive at the same intersection at the same time from two different directions the green light is granted to the emergency vehicle that dials first, the other one has to wait. Nikhil Mascarenhas, Pradeep G, Manish Agrawal, Subash P, Ajina A (Nikhil Mascarenhas). proposed a paper where a mobile application that uses GPS along with a microcontroller is used to control the signals. GPS hardware, already existing in most smart phones is used to receive and transmit GPS signals. KarthikChaganty, TanmayKaradkar and Dr. RajaniMangala (KarthikChaganty, 2016), proposed a paper where RF 434 MHZ module with a transmitter and receiver pair is used for communication along with a microcontroller and a Zigbee module. When the Emergency vehicle arrives at the traffic signal, the RF transmitter in the Emergency Vehicle will first send data to the RF receiver, which in turn will trigger the Zigbee transmitter through the controller.

N.Yuvaraj, V.B.Prakash, D.Venkatraj (Yuvaraj, 2011), proposed a paper which includes a vehicle equipped with onboard computer system capable of capturing diagnostic information and estimated location of the lifesaving vehicle using the information provided by GPS receiver connected to the onboard computer system and transmitting the information's using a wireless transmitter via a wireless network. The fleet management system connected to a wireless receiver is capable of receiving the information transmitted. A computer is also located at the intersection which uses corrected vehicle position, speed & direction measurements, in conjunction with previously recorded data defining approach routes to the intersection, to determine the optimum time to switch a traffic light controller to preemption mode so that lifesaving vehicles can pass safely. The Emergency Vehicle Preemption (EVP) is a method that has been implemented in many places now to avoid emergency vehicles waiting at signals. This method greatly improves the reliability and efficiency of emergency vehicles. The basic approach of this method is to provide a green signal to an emergency vehicle at a signalized intersection during emergency to ensure safe passage of the emergency vehicle. It has been observed that the above-mentioned method reduces the travel time of an emergency vehicle by saving approximately 45 seconds in each intersection which results in average reductions of 14 to 23 % in total emergency vehicle response time. In all these above-mentioned methods, a problem arises when multiple emergency vehicles arrive at the same signal at a similar time. Hence, we propose a method in which such scenarios are avoided by rerouting one more emergency vehicles.

RESULTS AND DISCUSSION

In the proposedsystem, we are trying to avoid multiple emergency vehicles from intersecting at the same signal simultaneously to avoid the various traffic signal preemption algorithms from failing. The idea here is to alter the route of one of the emergency vehicles to the next possible best path. This can be achieved with the help of GPS coordinates, google maps and the algorithm that we are suggesting.We cannot blindly reroute an emergency vehicle. We must decide on which emergency vehicle needs to be rerouted. For this we need to develop an algorithm that considers many factors and decides which emergency vehicle must be rerouted.

Let us consider (P_1, P_2) and (Q_1, Q_2) as the paths of 2 Emergency Vehicles EV1 and EV2
D_1 and D_2 are the destinations of EV_1 and EV_2 respectively.
While(true) {
If (P_1, P_2) intersects (Q_1, Q_2) then {
Let O be the signal coordinates
Time_A = Time for EV_1 to reach O
Time_B = Time for EV_2 to reach O
If (Time_A approximately equals Time_B) then {
Priority_A = Set by the operator of EV_1
Priority_B = Set by the operator of EV_2
//The priority values are deduced by the type and criticality of issue the emergency vehicle is attending to
O_Time_A = Time of EV_1 to reach D_1 in the best route
O_Time_B = Time of EV_2 to reach D_2 in the best route
Find Alternative Best Route ()
N_Time_A = Time of EV_1 to reach D_1 in the new route calculated
N_Time_B = Time of EV_2 to reach D_2 in the new route calculated
//calculate the difference of time between the old time and new time for both the EV's
Diff_A = absolute (O_Time_A – N_Time_A)
Diff_B = absolute (O_Time_B – N_Time_B)
If ((Diff_A<Diff_B) && (Priority_A<Priority_B)) then {
Reroute EV_1
Else
Reroute EV_2}}}}

Algorithm to tweak the route of an emergency vehicle

The algorithm considers multiple factors like the ETA of the emergency vehicles to their respective destinations, the ETA for the next best route and the priority value of each emergency vehicles which is pre-defined or defined by the personnel on the emergency vehicles during the emergency run. For finding the emergency vehicles that might conflict at a signalized corridor, we must first identify the emergency vehicles that are in a particular radius. This can be done using the closest pair algorithm. After identifying which are the emergency vehicles that can cause conflict, we must check if they are reaching the said traffic signal at the same time. This can be performed using the google maps. Google maps provide ETA's to a destination. Using the same method, we can find the ETA of each emergency vehicle to the signal. If their ETA's are very similar, then we need to alter one of the emergency vehicles route. First, we need to decide which emergency vehicle to reroute.For this we use the below stated algorithm.

Conclusion

The above stated method relies on the effective usage of Global Positioning System. Ideally for the GPS coordinates to be found we require at least three satellites. Normally wherever you are on the earth you'll always be under at least four satellites. These numbers keep changing but it is made sure that every point on earth will be within the limits of at least four satellites. Once the GPS receiver gets the information of how

far at least three satellites are, it can calculate your location using a process called trilateration. As the number of satellites above the horizon increases the GPS receiver can better determine where you are. Though most of the time this system works without trouble, there are many instances where the GPS coordinates might not be very accurate leading to a wrong judgement. Thick obstruction to the view of the sky will make it difficult for the GPS receiver to get exact satellite information leading to incorrect coordinates or inability to find coordinates.This can cause delay in calculating the alternative route for the emergency vehicle, hence we have to implement a method which uses GPS as well as some other methods to eradicate this problem. The best method that is used in maps these days is cellular networks. This system works by finding the MCC - Mobile country code, MNC - Mobile network code, LAC - Local Area Code and the CID - Cell ID. The above stated algorithm would then efficiently avoid the situations where there are multiple emergency vehicles in the same intersection causing trouble to the traffic preemption systems that are installed at signals.

REFERENCES

Bullock, D., and A. Catarella.A Real-Time Simulation Environment for Evaluating Traffic Signal Systems. In Transportation Research Record 1634, TRB, *National Research Council,* Washington, D.C., 1998, pp. 130-135.

Bullock, D., T. Urbanik II, and A. Catarella. Traffic Signal System Progression Recovery from Railroad Preemption. Proc., 5th *International Symposium on Railroad-Highway Grade Crossing Research and Safety*, 1998, pp. 355-365.

Hussein R. Al-Zoubi, Sahar Z. Shatnawi, Alaa I. Kalaf,Balqees A. Mohammad. A Wireless Mobile-Phone Approach to Traffic Signal Preemption for Faster Service of Emergency Vehicles. *International Journal of Computer Applications* (0975 – 8887) Volume 46– No.3, May 2012

KarthikChaganty, TanmayKaradkar and Dr. RajaniMangala. Traffic Signal Preemption for Emergency Vehicles. *International Journal of Electronics and Communication Engineering and Technology (IJECET)* Volume 7, Issue 4, July-August 2016, pp. 48–53, Article ID: IJECET_07_04_006

Koonce, P. J. V., T. Urbanik, II, and D. Bullock. Evaluation of Diamond Interchange Signal Controller Settings Using Hardware-in-the-Loop-Simulation. In Transportation Research Record: *Journal of the Transportation Research Board* No. 1683, TRB, National Research Council, Washington, D.C., 1999, pp. 59-66.

Nikhil Mascarenhas, Pradeep G, Manish Agrawal, Subash P, Ajina A. A Proposed Model for Traffic Signal Preemption Using Global Positioning System (Gps).

PratyushParida, Sudeep Kumar Dhurua, P. SanthiPriya. 2014. An Intelligent Ambulance with some Advance features of Telecommunication. *International Journal of Emerging Technology and Advanced Engineering* Website: www.ijetae.com (ISSN 2250-2459, ISO 9001:2008 Certified Journal, Volume 4, Issue 10, October 2014)

Sachin Grover, Vinay Shankar Saxena, TarunVatwani. Design of Intelligent Traffic Control System Using Image Segmentation. *International Journal of Advances in Engineering & Technology*, Nov. 2014. ©IJAET ISSN: 22311963

Shoup, G. E., and D. Bullock. Dynamic Offset Tuning Procedure Using Travel Time Data. In Transportation Research Record: *Journal of the Transportation Research Board*, No. 1683, TRB, National Research Council, Washington, D.C., 1999, pp. 84-94.

Yuvaraj, N., Prakash, V.B., Venkatraj. D., 2011. Hi-Fi Traffic Clearance Technique for Life Saving Vehicles using Differential GPS System. *International Journal of Computer, Electrical, Automation, Control and Information Engineering* Vol: 5, No:10.

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