Middle-East Journal of Scientific Research 24 (11): 3439-3443, 2016
ISSN 1990-9233
© IDOSI Publications, 2016
DOI: 10.5829/idosi.mejsr.2016.3439.3443

A Sophisticated Ambulance Service System by Traffic Signal Preemption

[1]O. Pandithurai, [2]R. Akshaya, [2]A. Saranya and [2]S. Varsha

[1]Asst. Prof, Department of Computer Science and Engineering, Rajalakshmi Institute of Technology, India
[2]UG Students, Department of Computer Science and Engineering, Rajalakshmi Institute of Technology, India

Abstract: Embedded system is one of the most emerging fields in the modern era. All most all the microprocessors being manufactured are used in embedded system, with this dedicated function we have proposed a smart ambulance rescue system by preempting the traffic lights. The sudden appearance of an emergency vehicle en route to an emergency can be a great barrier to nearby vehicles as individual drivers maneuver to get out of the way. Some drivers become confused and create conflicts that causes an emergency vehicle crashes or block lanes increasing response times. Using A Sophisticated Ambulance Service System By Traffic Signal Preemption to provide emergency vehicles a green light at intersections will drastically cut down driver obscuring, reduce conflicts and improve emergency response times. The main idea behind this scheme is ambulance can reach smoothly to hospital in time, by controlling the traffic lights, mechanically in path. In our proposed system we have identified the issues associated with emergency vehicle operations and emergency vehicle pre-emption more generally an ambulance. The implementation of our work is quite systematic and it can be applied to any transportation or communication problems that involves finding the most economical routes through a network.

Key words: Preemption · IR light · Zigbee · Car counting system · Microchip · Traffic congestion

INTRODUCTION

An embedded system is a computer system with a dedicated function within a larger mechanical or electrical system, often with real time computing constraints [Fig 1]. It is embedded as part of a complete device often including hardware and mechanical parts. Embedded systems control many devices in common use today 98% of all microprocessors being manufactured are used in embedded systems.

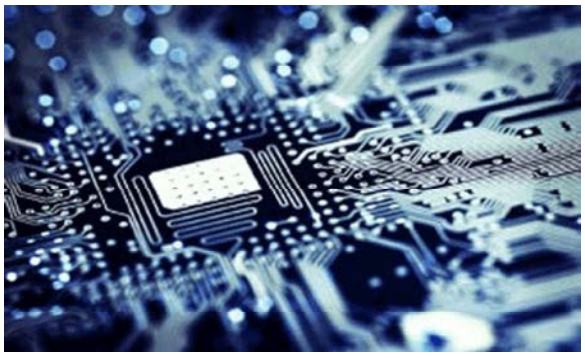

Fig. 1: Embedded System

Human life is put into a high risk due to delay in the arrival of ambulance. The ambulance is not able to reach the hospital in the golden hour. It gets stuck in the traffic signals. It would be of great use to the patient if the traffic signals in the path of the ambulance are ON. There must be a system by which the ambulance would reach the accident spot and then hospital as soon as possible to carry out health services. The existing system operates on a timing mechanism that changes the lights after a given interval. An intelligent traffic light system senses the presence or absence of vehicles and reacts accordingly.

The idea behind intelligent traffic systems is that drivers will not spend unnecessary time waiting for the traffic lights to change. An intelligent traffic system detects traffic in many different ways. The older system uses weight as a trigger mechanism. Current traffic systems react to motion to trigger the light changes. Once the infrared object detector (a photo-diode) picks up the presence of a car, a switch causes the lights to change. In order to accomplish this, algorithms are used to govern the actions of the traffic system. It has lack of intelligence.

Corresponding Author: O. Pandithurai, Asst. Prof, Department of Computer Science and Engineering, Rajalakshmi Institute of Technology, India.

The actual field performance may be less effective. Limitations in the algorithms and sensors may cause difficulty in real world applications. Moreover, it may use more complex algorithms to determine collision risk.

There will be different effectiveness for different algorithms. For the driver's state, there was only limited information available prior to the collision. The traffic signals on the path of the ambulance are controlled. When the ambulance reaches the traffic junction, the IR focus light is focused towards the signal which is placed along with a photo receiver circuit that converts the serial data into parallel data when it passes from the transmitter to the receiver. If the signal is red, it comes to green automatically. The photo receiver circuit in the receiver section converts the parallel data into serial data when it is sent back. This helps the ambulance to cross the traffic junction as soon as possible. The prioritized traffic switching is done priority wise, that is, if two emergency vehicles generally a ambulance are coming at the same time, that is simultaneously the ambulance that arrives first to the traffic junction will be given the priority at first to cross the traffic junction before the next ambulance arrives. In this way, using an advanced wireless technology for the transmission of data from the ambulance to the signal controller and vice versa called Zigbee is used. The information is transferred and the traffic signals are controlled so that the ambulance would be able to reach the hospital on time.

Related Work: The traditional subsystem the traffic in urban areas is mainly regularized by traffic lights, which may contribute to the unnecessary long waiting times for vehicles if not efficiently configured. This inefficient configuration is unfortunately still the case in a lot of urban areas, where most of the traffic lights are based on a 'fixed cycle' protocol [1].

A generalized framework for integrating a wireless network simulator and a vehicle traffic simulator for rapid prototyping and evaluation of Dedicated Short Range Communication (DSRC) based vehicular communication protocols and their applications in the context of Intelligent Transportation System (ITS). A novel method of inter-simulator time synchronization has been designed to simulate the interactions between vehicles and wireless networks at resolutions of up to few tens of milliseconds [2].

Adaptive signal control systems that are able to optimize and adjust the signal settings are able to improve the vehicular throughput and minimize delay through appropriate response to changes in the measured demand patterns. With the introduction of two un-coupled feed-back loops, whether agent technology is used or not, a pro-active theory of traffic control can be met [9].

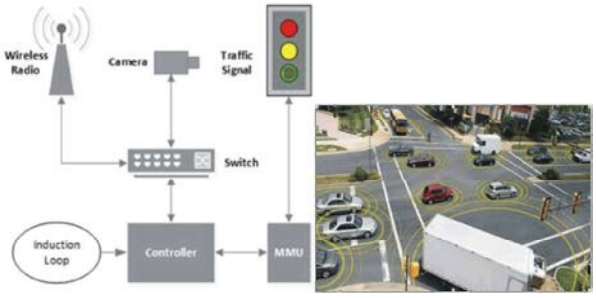

Fig. 2: A schematic representation

Existing Model: Vehicles growth leads to critical issues over the globe especially crowded cities, an intelligent traffic control system is designed to introduce many parameters such as the crowded roads, the emergency vehicles and the intersection of roads. Intelligent cameras are connected for capturing real-time traffic flow images of each direction. The control system can automatically adjust the traffic light control parameters according to the changes of the traffic flow in different directions, thereby increasing the traffic efficiency of intersection of roads and achieving a best control for traffic. This work needs a study of traffic flow over the city to implement.

Millions of vehicles pass via roads and cities every day. Various economic, social and cultural factors affect growth of traffic congestion. The amount of traffic congestion has major impacts on accidents, loss of time, cost of money, delay of emergency, etc. Due to traffic congestions there is a loss in productivity from workers, people lose time, trade opportunities are lost, delivery gets delay and thereby the costs goes on increasing. To solve these congestion problems it is better to build new facilities and infrastructure but at the same time make it smart. Many traffic light systems operate on a timing mechanism that changes the lights after a given interval. An intelligent traffic light system senses the presence or absence of vehicles and reacts accordingly. The idea behind intelligent traffic systems is that drivers will not spend unnecessary time waiting for the traffic lights to change. An intelligent traffic system detects traffic in many different ways. In the traditional traffic light control system of the intersection roads the vehicles entering the intersection are denoted by red color, but the vehicles which are leaving the intersection are denoted by blue color.

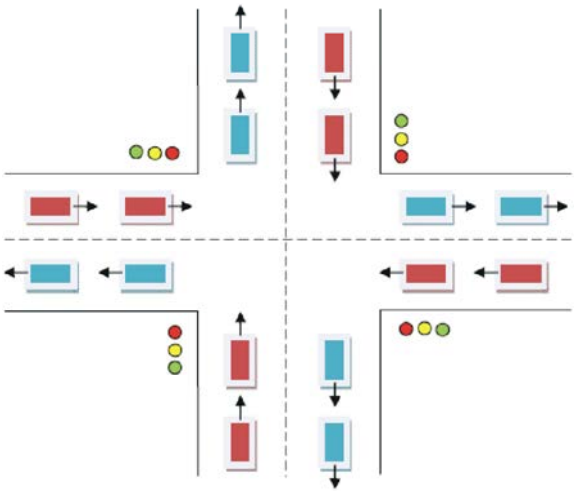

Fig. 3: The subsystems of the intelligent traffic control system

Any vehicle has the priority to enter the intersection; it has the priority to cross any road via the intersection. Each red vehicle entering the intersection can take place any blue vehicle leaving the intersection. In crowded cities, it is difficult to implement a normal traffic control system, because of the variation of flow of roads vehicles during different period of time. Many parameters must be considered to develop a certain traffic control system. These parameters are concentrated on flow of vehicles, the emergency vehicles, the rush hours, the accidents, the important persons and the closing of any incoming road. The proposed system consists of many subsystems working together under certain roles in order to increase the overall system efficiency.

Fig. 4: Heavy Traffic Congestion

Proposed Model: In our project we are providing a very sophisticated method for an ambulance to reach the hospital on time without getting stuck in traffic congestion. The idea behind intelligent traffic systems is that the ambulance drivers will not spend excess time waiting for the traffic lights to change. An intelligent traffic system detects traffic in many different ways. Here we make use of a IR333-A 5mm Infrared Emitting Diode. IR333-A is a high intensity diode, molded in a blue transparent plastic package. This device is matched spectrally with a photo-transistor photodiode and infrared receiver module. This infrared emitting diode is connected to a microcontroller PIC16F877A. The microcontroller PIC16F877A is one of the latest microchip product, it features all the components which modern microcontrollers normally have. The 16F877A is a efficient microcontroller that can multitask because it has a large enough programming memory (large in terms of sensor and control projects) supporting a 8k words and 368 Bytes of RAM

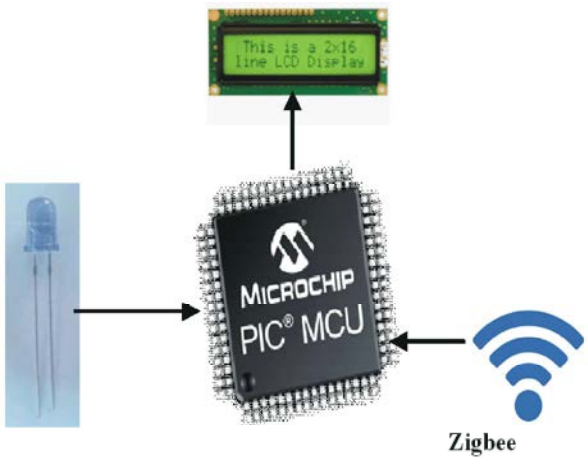

Fig. 5: The subsystem of the ambulance.

When the ambulance is travelling towards the path of the signal the IR light focus it's light waves towards the traffic signal, the photo receiver circuit generally termed as a photo diode, A photodiode is a semiconductor device that converts light into current. The current is being generated where the photons are absorbed in the photodiode. A scanty amount of current is produced as well, when no light is present. Photodiodes may contain optical filters, built-in lenses and may have large or small surface areas. This is connected to a similar microcontroller receives the light waves and causes the traffic light to switch to GREEN from any signal, eventually making it RED for other pathways. Thereby the ambulance need not wait in the traffic congestion. A car counting system is banded on to the Traffic signal which determines the intensity of the traffic if there are less than 50 vehicles it marks it as a less traffic zone, this information is transmitted to the ambulance driver through a Zigbee.

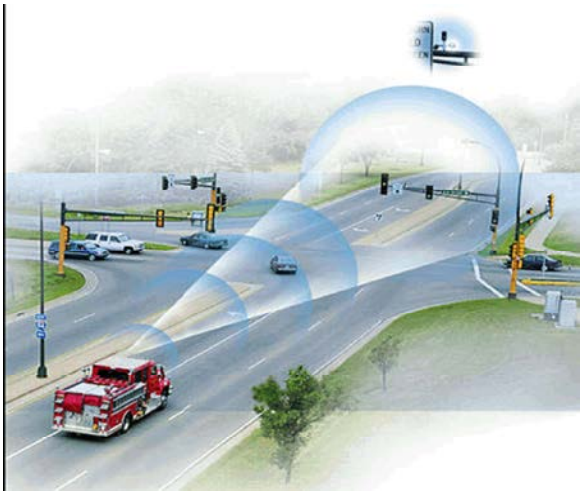

Fig. 6: IR light being focused on signal lights.

Zigbee is an IEEE 802.15 4-based specification for a suite of high-level communication protocols used to create personal area networks with small, low-power digital radios. The technology defined by the Zigbee specification is intended to be simpler and less expensive than other wireless personal area network (WPANs), such as Bluetooth or Wi-Fi. A zigbee which is also coupled with the ambulance, receives this traffic intensity information and displays it using a 16*2 LCD. Accordingly the driver may choose a different path to reach the nearest hospital. The application the LCD includes, palmtop computers, word processors, photocopiers, point of sale terminals, medical instruments, cellular phones, etc. The 16 x 2 intelligent alphanumeric dot matrix display is capable of displaying 224 different characters and symbols.

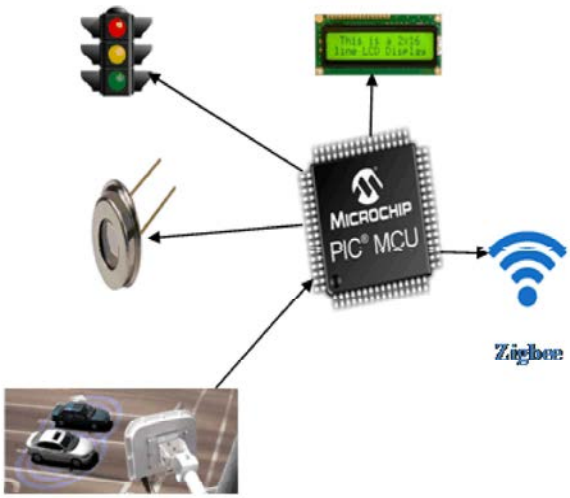

Fig. 7: The subsystem of the traffic signal

Experimental Analysis: Based on the existing Intelligent traffic light control system using image intensity measurement, a type of extended system for the ambulance to arrive at the spot to carry out health services, thereby providing a more productive way is established. This sophisticated method overcomes the limitation of the existing system such as, the downtime.

The sophisticated ambulance service system consist of PIC16F877A-32 microcontroller with inbuilt 8-channel ADC to receive IR-input from IR-transmitter which is embedded in the emergence vehicle. The 8-IR sensors are used to detect the emergence vehicle and open the divider gate to pass emergence car and then immediately closed the gate. This system used the genetic algorithm to find the traffic flow information at signalized intersection using previous data. Genetic algorithm calculates the green light time for signal depending on the three factor's demands, densities and flow.

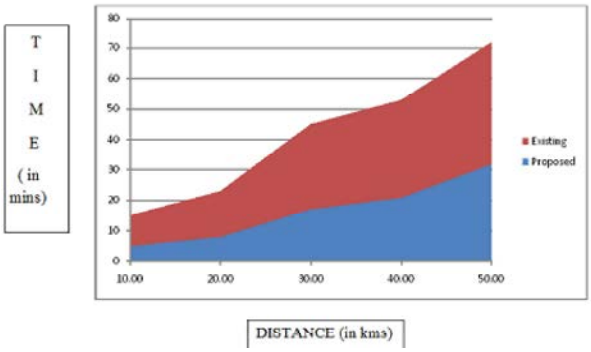

Fig. 8: Comparative analysis Distance Vs Time

CONCLUSION

The existing scheme addresses the problem of creating a chaos when an emergency vehicle such as an ambulance is stuck in heavy traffic congestion, leading to risk the life of the patient. To overcome the issues an economical and productive scheme is proposed. The proposed scheme addresses a solution that not only removes the issues of the downtime and also it enhances the overall schema by effectively transporting the patients to the health care center on time which eventually reduces the emergency response time.

Future Enhancement: The solutions described above provide security in different ways but none of the solutions cover all the vulnerability. To enhance the more a sophisticated traffic light controllers can be developed and also many other parameters such as minimizing pollution can be brought into practice.

REFERENCES

1. Emad I Abdul Kareem, School of Computer science, University Sains Malaysia (USM), mmimad72@yahoo.com Aman Jantan School of Computer science, University Sains Malaysia (USM), aman@cs.usm.my doi: 10.4156/ijipm.vol2. issue2.4
2. Mahmoud Taghizadeh *et al*., 2010. A Generalized Framework for Integrated Vehicle Traffic and Wireless Network Simulation, AD-HOC Now 2010, LNCS 6288, pp: 205-219.
3. Ayad M. Turky *et al*., 2009. Genetic Algorithm Applications for Traffic Light Control, UNISCON 2009, LNBIP 20, pp: 115-120.
4. Khalid A.S. Al-Khateeb *et al*., 2008. Dynamic Traffic Light Sequence Algorithm Using RFID, Journal of Computer Science, 7(4): 517-524.
5. Shwe Yi Aye, 2008. Design and Construction of LAN Based Car Traffic Control System, Word Academy of Science, Engineering and Technology, vol.46.
6. Visit Hirankitti *et al*., 2007. A Multi agent Approach for Intelligent Traffic Light Control, Proceeding of the Word Congress on Engineering 2007 vol. I, WCE 2007, July 2-4 2007, London, U.K.
7. Ta-Hsiang, *et al*., 2007. Design of a Supervisor for Traffic Light Systems, KES 2007/WIRN 2007, part II, LNAI 4693, pp: 704-711.
8. Lawrence Y. Deng *et al*., 2006. Self Awareness and Adaptive Traffic Signal Control System for Small Word", ATC 2006, LNCS 4158, pp: 163-172.
9. Danko A. Roozemond *et al*., 2000. Agent Controlled Traffic lights, ESIT 2000, 14-15 September, Aachen, Germany.
10. Martin Molina *et al*., A propose and Revise System for Real Time Traffic Management", ESIT 2000, 14-15 September, Aachen, Germany.