

A Smart Prioritized Ambulance Service Using Mobile Zigbee in a Traffic Control System

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Abstract – Time is of the essence when ambulances are utilized to save people's lives, but when an ambulance needs to pass through a junction, its speed often will be reduced due to traffic. This complicates situations when the patient in the ambulance needs urgent treatment that can be administered only at a hospital. Due to the unavailability of advanced medical procedures in an ambulance, there is a possibility for patients to suffer a loss of life. This project aims at controlling normal traffic as well as clears path in case of ambulance reaching the signal, so that the patient can reach the hospital in the right time. In case of two ambulances reaching the signal at a time, based on the data from the ambulance the traffic signal will decide which ambulance to clear the signal first. ZigBee communication module is used as wireless technology.

Index Terms – PIC Microcontroller, ZigBee, RF Transmitter and RF Receiver, GSM.

1. INTRODUCTION

Time is of the essence when ambulances are utilized to save people's lives, but when an ambulance needs to pass through a junction, its speed often must be reduced due to traffic. This complicates situations when the patient in the ambulance needs urgent treatment that can be administered only at a hospital. Due to the unavailability of advanced medical procedures in an ambulance, there is the possibility for patients to suffer a loss of life. 108 services are used to admit patients to the nearest hospital. Everything gets thrown for a loop whenever an ambulance gets stuck in traffic. It may take hours to clear the traffic and, in the meantime, the patient's situation may become critical. Traffic control is a challenging issue in the urban cities of India, as is the case in much of the rest of the world. Traffic administration on the road has become a biggest severe problem of today's society. Traffic congestion is a major problem in cities of developing. Increase in urban population and the middle-class segment contribute significantly to the increasing number of vehicles in the cities. Congestion on roads eventually results in slow moving traffic, which boost-up the time of travel, thus stands-out as one of the major issues in metropolitan cities like India shortage of efficient traffic control and administration has many a times lead to loss of lives due to ambulances getting stuck in traffic jams. Unlike western countries, Indian cities cannot think of having separate lanes for

emergency purpose due to shortage of road planning and infrastructure. Where the lives of the patients is depending on the speedy arrival of the ambulances to Hospital, a substitute solution to the above problem is the need of the hour. The separate emergency lane system is implemented. One of the disadvantages is that apart from the huge cost, this lane will always remain underutilised. It is a static system, static means not providing services on real time. This lane is not useful every time and it is not an adequate system. Moreover, because of this system the width of road for general use is reduced which cause in traffic congestion and inconvenience.

There are so many examples that ambulance got struck in the traffic load, Ambulance has to wait for some minutes to hours to clear the traffic load. Patient may die because of lack of treatment at proper time. To overcome this hazard and to save many lives, the scenario is done by upgrading technology called Internet of Things. In this the peripherals are connected to the internet and those peripherals can be controlled via internet from being in some other place. This has great importance since the object that represents itself digitally makes itself something greater than the object by itself. Traffic administration on the road has become a severe problem of today's society because of increase in the urbanization, industrialization and population; there has been a tremendous growth in the traffic. With increase in traffic, there is existence of bunch of problems too; these problems include traffic jams, accidents and traffic rule infringement at the heavy traffic signals. This in turn has an adverse effect on the economy of the country as well as the destruction of lives. So problem given above will become worst in the future. Traffic lights play a significant role in traffic administration. Traffic lights are the signalling devices that are placed on the intersection points and are used to control the traffic flow on the road. In 1868, the traffic lights only installed in London and today these have installed in most of the cities around the world. Most of the traffic lights around the world follow a planned timing circuit. Sometime the vehicles on the red light side have to wait for green signal even though there is some or no traffic. It results in the loss of valuable time. Traffic control at intersections is a matter of worry in large cities. Different experiments have

been done to make traffic light's sequence dynamic so that these traffic lights serve according to the current amount of the traffic. Most of them use the sensor to calculate current amount of traffic but this approach has the restriction that these techniques based on counting of the vehicles and treats an emergency vehicles as the ordinary vehicles has no priority to ambulance, fire brigade or V.I.P vehicles. As a result, emergency vehicles get stuck in traffic signal and waste their valuable time. At present, very less system are available which are proving helpful for ambulance to cross the traffic or signals on road.

2. RELATED WORK

1. Xiaoguang Yang et al. (2000) deals with the analysis of the shortcomings of traditional technologies, including location technology, communication technology, the advantages of Wireless Sensor Network (WSN) and ZigBee are given first. Then the data requirements of Bus Priority Control System (BPCS) are presented. In the BPCS, the WSN nodes are classified into three ' types, i.e. intersection node, roadside node and vehicle node. Also the system architecture and operation process are expounded briefly. Finally, through the simulation and application of the test platform, the practicability is proved and some useful conclusions are drawn.

2. In this paper Vahedha and Dr.Naga Jyothi.B (2016)proposed on how smart the traffic controlling is being done. In India as the population is being increasing day by day the traffic is also increasing with proportionality. So the traffic signals need good coordination for the smooth flow of traffic during the busy hours as the traffic is at peaks. In order to avoid traffic jams when the emergency vehicles are passing towards the junction this paper is being implemented. Each vehicle is equipped with the RFID tag which can't be removed or destroyed. When the emergency vehicle reaches the junction reads the signals and shows a green wave so that it can move smoothly without any jam. Automatically when it crosses the signal point the signal gets changed. This is done by considering the multi road junction point.

3. Swati S Sarowar and Seema M Shende (2015)now a day's traffic rules are frequently violated by the drivers and over speeding occur due to bad driving behavior. Objective of the study is to design and develop a new system that can effectively detect speed violations on the road and supports the driver to obey traffic rules while driving by maintaining the speed according to the speed limit prescribed by particular zone. The proposed system has an alerting, recording and reporting system for over speeding vehicles. It will use ZigBee technology. The main advantage of this system is that if over speeding vehicles don't get controlled manually, and then system gets ON and will get controlled automatically.

4. This paper by Rajeshwari Sundar et al. (2015) presents an intelligent traffic control system to pass emergency

vehicles smoothly. Each individual vehicle is equipped with special radio frequency identification (RFID) tag (placed at a strategic location), which makes it impossible to remove or destroy. RFID reader, NSK EDK-125-TTL, and PIC16F877A system-on-chip are used to read the RFID tags attached to the vehicle. It counts number of vehicles that passes on a particular path during specified duration. It also determines the network congestion, and hence the green light duration for that path. If the RFID-tag-read belongs to the stolen vehicle, then a message is sent using GSM. This module uses ZigBee modules on CC2500 and PIC16F877A system-on-chip for wireless communications between the ambulance and traffic controller. The prototype was tested under different combinations of inputs in our wireless communication laboratory and experimental results were found as expected.

5. Fang-yieleu et al. (2012) deals with a traffic control scheme, called the Ambulance Traffic Control System (ATCS for short) is proposed, in which before an ambulance (AMU for short) passes through a street/road intersection, the ATCS turns the traffic lights of the intersection to green so that the injured people can be transported to a nearby hospital as soon as possible. When roadside Transportation Authority (RTA for short) and AMU communicate with each other, the delivered messages are encrypted by random numbers and the RSA algorithm. According to the analyses, the ATCS can safely protect the messages.

6. Amit Bhat et al. (2015) says that the worst enemy of people living an urban lifestyle is commute. The exponential increase in the number of vehicles and public transport options has led to an inevitable increase in congestion of pathways, which has, necessitated the need for an efficient traffic congestion control method. In this paper, an intelligent dynamic traffic control system is proposed. The system is aimed at achieving traffic control in developing countries such as India, where additional parameters need to be considered such as road quality. It operates on the principle that "At any instant of time, no vehicle must be allowed to wait for more time than the average vehicle waiting time, at that instant". Also, it accomplishes prioritizing of vehicles such as ambulances and detection of unprecedented events such as road accidents. The objective of the system is to reduce the average waiting time that each vehicle has to wait, before it is allowed to pass, while also ensuring uniformity in the waiting times.

7. In this paper, Yi-Li Huang et al. (2014) deals with a novel traffic control scheme, called the secure traffic control system (STCS for short) is proposed, which can guide an ambulance to safely navigate so as to shorten the attendant time, and safely and fastly deliver patients to hospitals. In addition, we add an exception handling mechanism to the STCS. With this mechanism when an ambulance encounters unforeseen situations, it can accordingly resolve them quickly and safely. Also, a two-dimensional stream function is

employed to make the STCS provide users with a more secure environment and better performance.

8. The paper by Chandan Tiwari et al. (2016) presents the Traffic management is the severe problem of today's society because of growth of the urbanization. This cause the traffic jam at the traffic junctions which in turn causes delay to ambulance and it causes loss of life. In order to overcome this problem, this paper presents a simple ambulance controlled traffic system. The main objective of this system is that to control the traffic, allowing an ambulance to arrive at a particular location without it having to stop anywhere until the destination is reached. This system includes RFID technology. This device will be interfaced with the signal approached by the ambulance in its desired destination. The signals will be turned green, a particular time before the ambulance reaches the signal, thus making the route clear for the ambulance. By using this system, we can save lot of time of the ambulance which is usually wasted due to heavy traffic on signals in metropolitan cities.

9. This paper by Bhargavi Yadav N and Mohan Kumar Naik.B (2016) presents an intelligent traffic control system to ensure smooth flow of traffic. Vehicle is equipped with special Radio Frequency Identification (RFID) tag, placed such that it is impossible to remove or destroy. RFID reads when a vehicle comes in the range, and counts the number of the vehicles on a particular path for a specified duration and determines the congestion and hence the green light duration. If the RFID-tag-read belongs to the stolen vehicle, immediately a message is sent along with the latitude and longitude details to the police control room using GSM SIM300 module and GPS. Also, the traffic signal is turned to red making the vehicle to stop at the traffic junction. In addition, when an ambulance with an emergency case approaches the junction, it communicates wirelessly with the traffic controller using ZigBee modules to turn ON the green light.

10. Joshua et al. (2014) deals that in today's world, traffic jams during rush hours is one of the major concerns. During rush hours, emergency vehicles like Ambulances, Police cars and Fire Brigade trucks get stuck in jams. Due to this, these emergency vehicles are not able to reach their destination in time, resulting into a loss of human lives. A system which is used to provide clearance to any emergency vehicle by turning all the red lights to green on the path of the emergency vehicle is proposed, hence providing a complete green wave to the desired vehicle. A green wave is the synchronization of the green phase of traffic signals. With a green wave setup, a vehicle passing through a green signal will continue to receive green signals as it travels down the road. Around the world, green waves are used to great effect. Often criminal or terrorist vehicles have to be identified. In addition to the green wave path, the system will track a stolen vehicle when it passes through a traffic light. In contrast to any traditional vehicle

tracking system, in which the Global Positioning System (GPS) module requires battery power, our tracking system, installed inside the vehicle, does not require any power. The information regarding the vehicle has to be updated in the system database. So, it is an autonomous 2-tier system which will help in the identification of emergency vehicles or any other desired vehicle. It is a novel system which can be used to implement the concept of the green wave.

11. This paper by Pratyush Parida et al.(2014) is based on an Automatic traffic light control system in an emergency case i.e. when an Ambulance is approaching towards Traffic light, which drives to reset the traffic light to green light at ambulance side and red light at other three sides. Ambulances have a transmitter which transmits the Infrared signal (IR). IR-LED (Light Emitting Diode) is connected in series for better range and wider directivity. This module can transmit IR rays up to few meters without use of any external lens. Traffic light has a receiver. The receiver uses infrared module (photodiode). The output of the photodiode is connected to microcontroller. Microcontroller is wired here in time delay and switching mode. Along with this concept, the concept of GSM (Global System for Mobile Communication) is also being used, by which Doctor of particular specialization, as needed by the patient, is messaged to report to the Hospital before the arrival of ambulance. SIM 900 is used for Serial communication and the message is displayed to doctor in a 16x2 LCD (Liquid Crystal Display). GSM here, not only used for just sending message to the doctor but also used for video display of the patient in the ambulance using 3G connection, by which Doctor can analyze the condition of the patient and recommend some immediate possible therapy in ambulance before reaching hospital.

The ambulance unit which contains power supply RF transmitter and ZigBee. RF transmitter which carries the information and passes the data to the RF receiver which is placed in the roadside. ZigBee has stored all the data and helps the ambulance to travel in a signal and finds the direction of the path.

3. PROPOSED MODELLING

The traffic control system is cleared by using ZigBee sensor and RF transmitter and receiver is used to find the arrival of the two ambulances in a particular path. In existing method, there is an Automatic traffic Signal for ambulance clearance but Patient monitoring system inside ambulance is not considered and ambulance location identification to hospital is not available. But ZigBee Module is used for traffic control in case of ambulances arriving the signal with the patient in critical condition. All these drawbacks are rectified in this project. The data was send to the PIC controller by using ZigBee sensor through ambulance driver. The PIC microcontroller has in-built analog-to-digital converter which converts the analog current

and voltage values in digital form. These data are transferred to server unit by using ZigBee.

The ambulance unit is shown in figure 3.2. It consists of temperature and heart beat sensors to monitor the patient's condition. The respective values are displayed with the help of LCD display. RF Transmitter is used to transmit the signals. The signals are transferred using the GSM and ZigBee Module. The receiver unit consist of microcontroller, ZigBee module, RF receiver. The RF receiver receives the signals from the RF transmitter and immediately controls the traffic signals with the help of microcontroller and ZigBee modules. The path in which the ambulance arrives is cleared and the remaining signals are turned OFF(red). Thus the life of patients can be saved.

FIGURE 3.1 TRAFFIC CONTROL UNIT

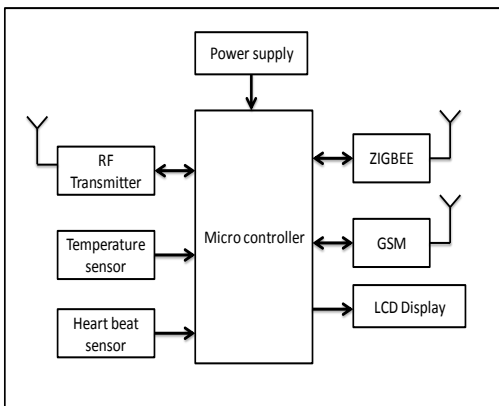
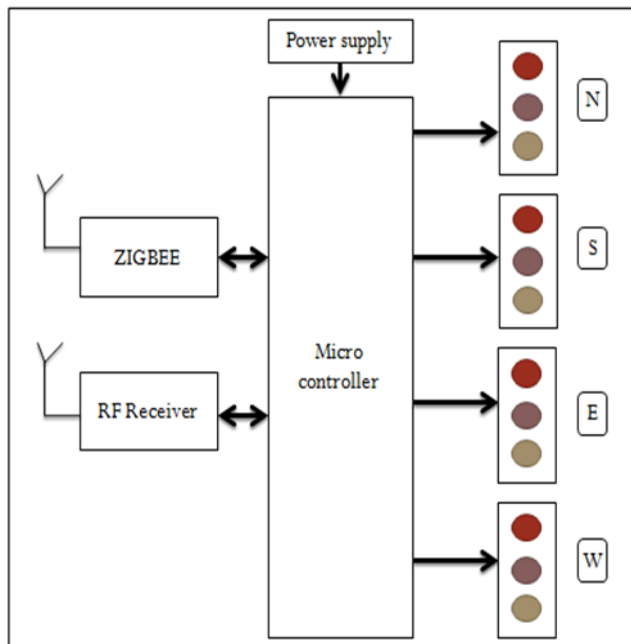


FIGURE 3.2 AMBULANCE UNIT

4. RESULTS AND DISCUSSIONS

The figure 5.1 shows the hardware module of the transmitter unit of the traffic control system.

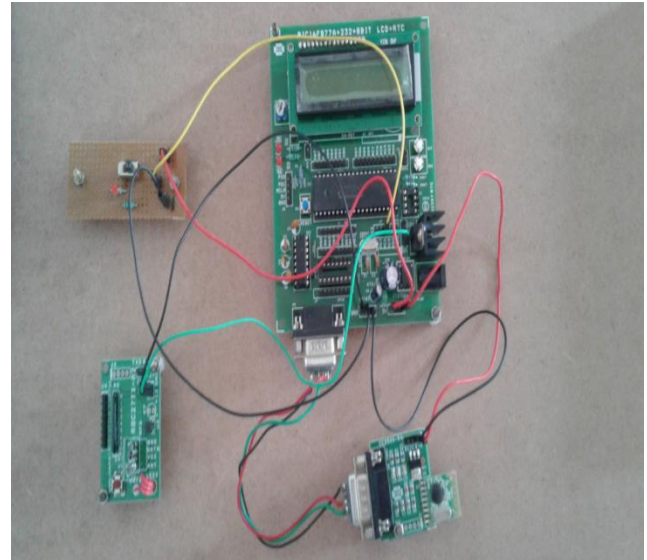


Figure 5.1 Transmitter unit of the traffic control system

The Transmitter unit consist of microcontroller, ZigBee module, RF Transmitter, LCD display and a switch. LCD display is used to display the condition of the patient if the switch is activated. The ZigBee module holds all the necessary information required to control the traffic signal path clearance. The arrival of the ambulance in a particular path is sensed by the RF transmitter and the control signals are sent to the receiver unit of the traffic control system.

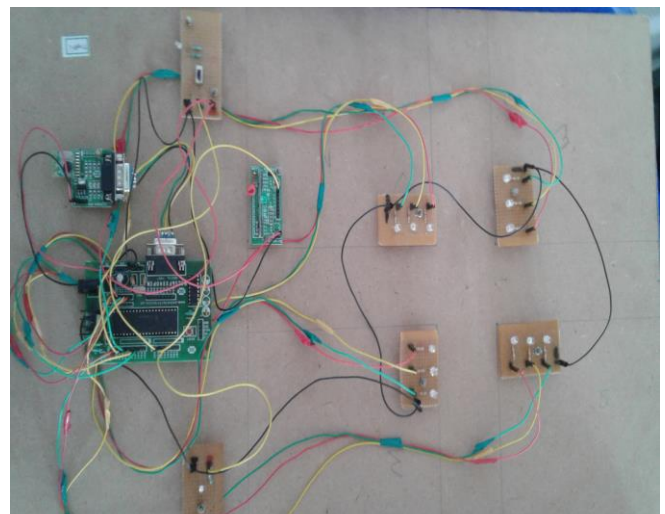


Figure 5.2 Receiver unit of the traffic control system

The receiver unit shown in Figure 5.2 consist of microcontroller, ZigBee module, RF receiver. The RF receiver

receives the signals from the RF transmitter and immediately controls the traffic signals with the help of microcontroller and ZigBee modules. The path in which the ambulance arrives is cleared and the remaining signals are turned OFF (red). Thus the life of patients can be saved. Ions should be numbered as shown above.

5. CONCLUSION

The traffic clearance in case of two ambulances arriving at the same junction is designed. The condition of the patient is monitored continuously using various sensors and the information is sent periodically to the traffic control unit. The ambulance which holds the patient in more critical stage has given high priority and the particular path was cleared. In addition to this the condition of the patient also sent simultaneously to the nearest hospital using GSM and ZigBee module so that necessary treatment can be provided at the right time.

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