IEEE 802.15.4 BASED ROAD TRAFFIC MANAGEMENT FOR MEDICAL EMERGENCY

Arun P[1], Alphy Jose[2], Anju Jose[3], Arathi[4], Jitty P Tom[5]

[1]Asst. Professor, [2,3,4,5] UG Scholar, Dept. of ECE,

St.Joseph's College of Engineering and Technology, Palai, (India)

ABSTRACT

A Zig-Bee based traffic management system which offers highest priority to ambulances is proposed in this paper. In medical emergencies patient death happens half way before reaching hospital. Often this is caused by the inadvertent delay in transporting the patient and critical time lost in traffic. The Road Traffic Management System has two subsystems namely, Traffic Console Subsystem and Ambulance Subsystem. The ambulance subsystem continuously connects with the traffic console through Zig-Bee protocol. When ambulance is in a predefined proximity to the traffic console, highest priority is offered to the track of the ambulance and other green lights are inhibited till the ambulance crosses the traffic console. Initial model was simulated in Proteus and a real-time prototype of the proposed system was tested successfully. The proposed system would certainly reduce the risk associated with medical emergency transportation.

Keywords: Ambulance Subsystem, Microcontroller, Proteus, Traffic Console, Zig-Bee.

I.INTRODUCTION

Traffic management on the road has become severe problem of today's society because of growth of the urbanization, industrialization and population; there has been a tremendous growth inthe traffic. With growth in traffic, there isoccurrence of bundle of problems too; theseproblems include traffic jams, accidents and traffic rule violation at the heavy traffic signals. This inturn has an adverse effect on the economy of thecountry as well as the loss of lives[1]. So problemgiven above will become worst in the future.Traffic congestion and tidal flow management were recognized as major problems in modern urban areas, which have caused much thwarting for the ambulance. Moreover road accidents in the city have been incessant and to bar the loss of life due to the accidents is even more crucial [2]. To implement this we introduce a system called an Intelligent Traffic Management System especially for medical emergency. The main theme behind this scheme is to provide a smooth flow for the ambulances to reach the hospital in time and thus reduce the risk associated with medical emergency transportation. The idea is to implement a system which would control automatically the traffic light in the path of the ambulance.

In 1868, the traffic lights only installed in London and today these have installed in most cities around the world. Most of the traffic lights around the world follow a predetermined timing circuit. Sometime the vehicles on the red light side have to wait for green signal even though there is little or no traffic. It results in the loss of valuable time [2]. Traffic control at intersections is a matter of concern in large cities. Several attempts have

been made to make traffic light's sequence dynamic so that these traffic lights operate according to the current volume of the traffic. Most of them use the sensor to calculate current volume of traffic but this approach has the limitation that these techniques based on counting of the vehicles and treats the emergency vehicles as the ordinary vehicles means no priority to ambulance, fire brigade or V.I.P vehicles. As a result, emergency vehicles stuck in traffic signal and waste their valuable time [3]. The problem of traffic light control can be solved by RFID based system. But this system is also having some drawbacks as follows [4].

- RFID systems are often more expensive than barcode systems
- RFID technology is harder to understand
- Tags are application specific. No one tag fits all
- More than one tag can respond at the same time
- The error rate is quite high.
- Maintenance is very tedious.
- Traffic cannot be managed locally.

A steady increase in metro-city population, the number of automobiles and cars increases rapidly and metro traffic is growing crowded which leads to the traffic jam problem. This proposed system will have effective role to avoid the traffic jam. Under ordinary conditions, traffic signals control mainly has two defects:

1. When the traffic lane waits until the green light, time setting is almost same and fixed. A-road was always crowded with vehicles and go-ahead time is short. So, vehicles can't pass through in the time allowed. But sub lane has few vehicles and go-ahead time is relatively long.
2. Emergency cars are not considered. (For example, fire engines and ambulances have priority over other traffic. The two lanes should both wait them to pass through.) Because the traffic light control system is lack of emergency measures, the crossroads always meets a traffic jam and leads to unnecessary economic losses [5].The author Zhang Yuye et.al. [6] System use AT89C51 and CAN BUS controller which leads to complicated design and cost of the system more because of CAN BUS controller.

The proposed system wills use IEEE 802.15.4Zig-Bee Technology for communication. The author CaiBai-gen et.al. [7] Designed a vehicle detection system based on magneto-resistive sensor is composed by wireless traffic information collection nodes which are set on two sides of road to detect vehicle signal. The magneto-resistive sensor is costly and maintenance cost of the system will be more if the system fails. This system is lack of emergence measures and proposed system will able to solve this problem effectively.

As per the proposed system, when the traffic console identifies the presence of an ambulance in its proximity, the traffic console automatically turns the traffic light in to 'RED'. So that the ambulance can take any deviation conveniently. Immediately when the ambulance crosses the console the Turned ON RED light will be brought back to 'GREEN'.Thus we propose a new design for automatically controlling the traffic signals and achieving the above mentioned task .So that the ambulance would be able to cross all the traffic junctions without waiting. Every traffic junction will have a control station controlling the traffic flow. The proposed system consists of a 'self-acting'8051 microcontroller and Zig-Bee[8] based data communication system which works to avoid time lag to the ambulances.

Often the length of the vehicles in queue at the traffic may be at least l00 meters. The siren of the ambulance at the back of the queue may not be audible to the traffic police. If the proposed strategy could be incorporated with the present day automatic traffic control systems, the wastage of critical time during patient transportation can be eliminated and even patient mortality rate could be brought down.

The system has been designed and simulated using Proteus software. The rest of the paper is organized as follows; Section 2 deals with the overview of the proposed System, dealing the block level representation and detailed explanations for various subsystems, section 3 deals with the Simulation results and discussions followed by conclusion and future scope. The ambulance is controlled by the central unit which furnishes the most scant route to the ambulance and also controls the traffic light according to the ambulance location.

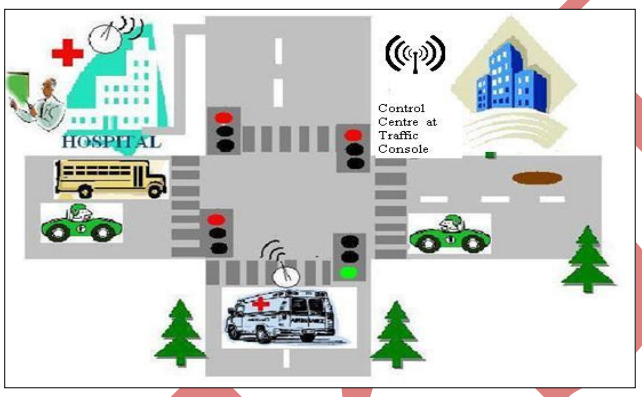


Fig. 1: Schematic Representation of the Proposed System

II.OVERVIEW OF THE PROPOSED SYSTEM

Fig. 1 shows schematic of the proposed system. It consists of an intelligent microcontroller89C51 [9] and two ways Zig-Bee based data communication system. The purpose of this system is to implement an automated system for clearing the traffic for conveyance of ambulances. The Intelligent Traffic Management System for Medical Emergency showed in Fig. 2 has two subsystems; namely, Traffic Console Subsystem and Ambulance Subsystem. The system developed is able to sense the presence of an ambulance within a predefined area of coverage. All subsystems have been designed and simulated using Proteus electronic simulation package.When the traffic console identifies the presence of an ambulance in its proximity, the traffic console automatically turns the traffic light in to 'RED'. So that ambulance can take any deviation conveniently. Immediately when the ambulance crosses the console the Turned ON'RED' light will be brought back to 'GREEN'.Ordinary traffic light performs the traffic light switching operation on a time sharing basis. But the proposed system uses wireless communication Zig-Bee technology based on 802.15.4 standard in cooperated with the designed hardware platform.

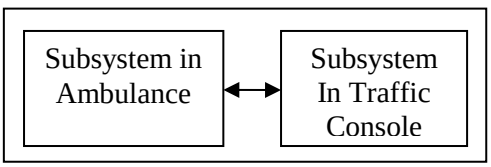


Fig. 2: Block Representation

2.1 Subsystem in the Traffic Console

The subsystem to be placed in the traffic console has a Zig-Bee module, a microcontroller unit and power supply units. The role of the subsystem in the traffic console is to change the traffic light according to the signal received from the ambulance subsystem. The Block Diagram of the subsystem in the traffic consoleis shown in Fig.3.

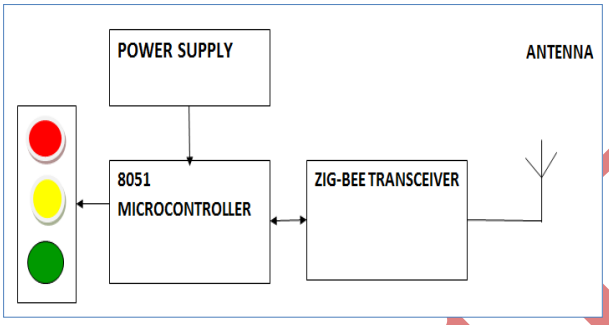


Fig.3: Block Diagram of Sub system in the Traffic console

2.2 Subsystem in the Ambulance

The subsystem to be placed in the ambulance consist a Zig-Bee modem, a microcontroller unit, four switches and a power supply unit. The role of this subsystem in the ambulance is to transmit the progressing direction of the ambulance. The Zig-Bee modem transmits the desired direction. The Block Diagram of the subsystem in the ambulance is shown in Fig. 4.

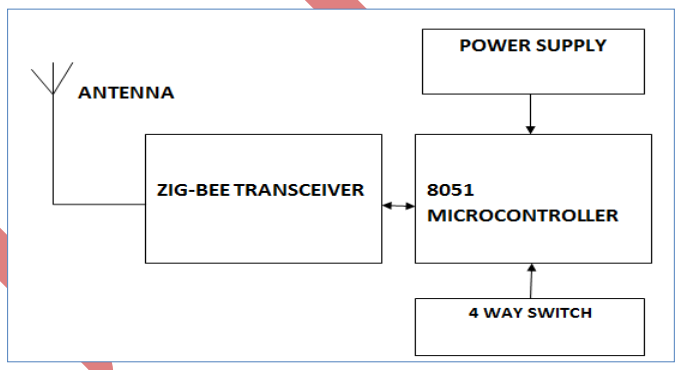


Fig. 4: Block Diagram of the Subsystem in the Ambulance

III.SIMULATION RESULTS AND DISCUSSION

Simulation of the proposed scheme has been carried-out in Proteus Simulation Package. The circuits for the various sub systems Fig. 5 and Fig. 6 has been simulated and all the necessary conditions were verified. The snapshot of the Proteus simulation result is shown in Fig. 7.Snapshot of the implemented Traffic console subsystem and Ambulance subsystem is shown in Fig. 8 and Fig. 9 respectively.

A condition which had to be taken care was, if two ambulances approach the unit simultaneously, conditional processing on first come first served approach has been implemented in this work. A manual processing switch in the ambulances for drives of to request for emergency cases have also been implemented.

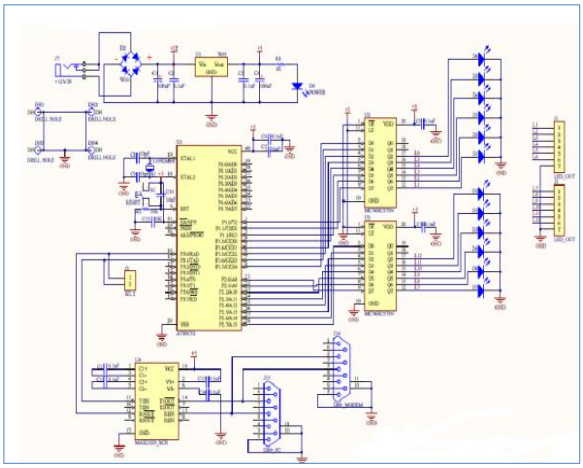


Fig. 5: Circuit diagram of Traffic Console subsystem

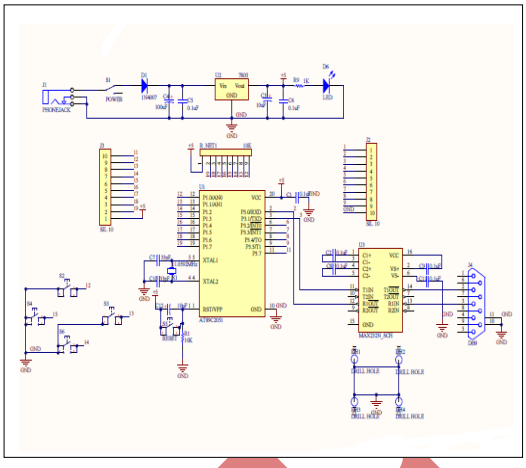
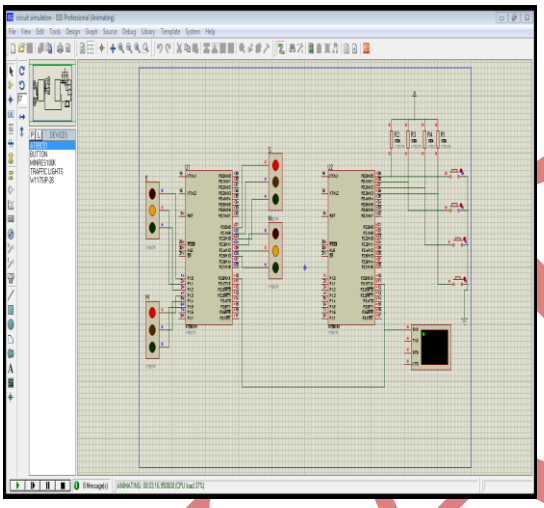


Fig. 6: Circuit diagram of ambulance subsystem



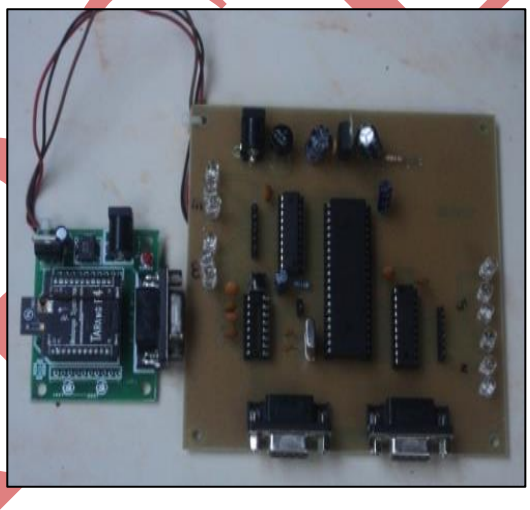


Fig.7:Snapshot of the proteus simulation Fig.8: Hardware implementation of Traffic Console subsystem

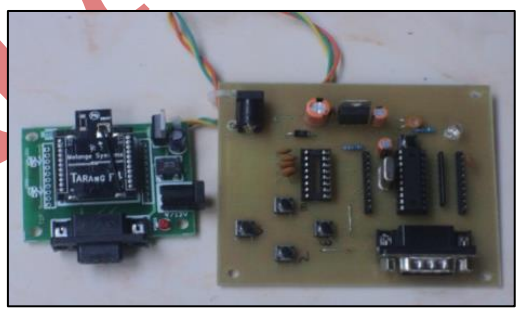


Fig.9: Hardware implementation of Ambulance subsystem

IV.CONCLUSION AND FUTURE SCOPE

In this project, Intelliegent traffic control offering priority to ambulances has been designed,simulated and tested.The simulation has been done using proteus.The tested System allows easy and safe transport of patients under medical emergency.

As a future expansion it is proposed that licensing procedures of two ways LEO satellite communications [10] may be initiated so as to implement a system upgrade whereby real time data of moving ambulances like speed, current location, Condition of patient may be tracked and monitored at the hospital/Traffic Control center. The ambulance subsystem can be optimised by adding 'Two Way LEO Satellite Modem' instead of Zig-Bee. All vital parameters including the video files can be transmitted to the clinician. GPS communication is unidirectional and GSM has demerits of null points. But the two ways LEO has no such deficiencies.

As a future proposal, the system can be efficiently integrated in to the existing traffic system so that an efficient traffic system with an intelligent central monitoring and control station can be developed.

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