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# INTELLIGENT TRAFFIC LIGHT SYSTEM TO PRIORITIZED EMERGENCY PURPOSE VEHICLES BASED ON ZIGBEE

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Abstract: - Traffic management is the critical issue of the road. Traffic lights play an important role in the traffic management. The existing traffic lights follow the predetermined sequence. So these lights are called static traffic lights. These traffic lights are not capable to count the number of vehicles and the priority of the vehicles on intersection point. As a result some vehicles have to wait even there is no traffic on the other side. The vehicles like Ambulance and Fire Brigade are also stuck in traffic and waste their valuable time 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:- Intelligent Traffic light controller, round robin, 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 in the traffic. With growth in traffic, there is occurrence of bundle of problems too; these problems include traffic jams, accidents and traffic rule violation at the heavy traffic signals. This in turn has an adverse effect on the economy of the country as well as the loss of lives[1]. So problem given 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.

ZigBee is a low-cost, low-power, wireless mesh networking proprietary standard. The low cost allows the technology to be widely deployed in wireless control and monitoring applications, the low power-usage allows longer life with smaller batteries, and the mesh networking provides high reliability and larger range.

The ZigBee Alliance, the standards body that defines ZigBee, also publishes application profiles that allow multiple OEM vendors to create interoperable products. The current list of application profiles either published or in the works are:

- Home Automation
- ZigBee Smart Energy
- Commercial Building Automation
- Telecommunication Applications
- Personal, Home, and Hospital Care
- Toys

ZigBee coordinator ZC): The most capable device, the coordinator forms the root of the network tree and might bridge to other networks. There is exactly one ZigBee coordinator in each network since it is the device that started the network originally. It is able to store information about the network, including acting as the Trust Centre & repository for security keys.

ZigBee Router (ZR): As well as running an application function a router can act as an intermediate router, passing data from other devices.

ZigBee End Device (ZED): Contains just enough functionality to talk to the parent node (either the coordinator or a router); it cannot relay data from other devices. This relationship allows the node to be asleep a significant amount of the time thereby giving long battery life. A ZED requires the least amount of memory, and therefore can be less expensive to manufacture than a ZR or ZC.

Protocols

The protocols build on recent algorithmic research (Ad-hoc On-demand Distance Vector, neuRFon) to automatically construct a low-speed ad-hoc network of nodes. In most large network instances, the network will be a cluster of clusters. It can also form a mesh or a single cluster. The current profiles derived from the ZigBee protocols support beacon and non-beacon enabled networks.

In non-beacon-enabled networks (those whose beacon order is 15), an unslotted CSMA/CA channel access mechanism is used. In this type of network, ZigBee Routers typically have their receivers continuously active, requiring a more robust power supply. However, this allows for heterogeneous networks in which some devices receive continuously, while others only transmit when an external stimulus is detected. The typical example of a heterogeneous network is a wireless light switch: the ZigBee node at the lamp may receive constantly, since it is connected to the mains supply, while a battery-powered light switch would remain asleep until the switch is thrown. The switch then wakes up, sends a command to the lamp, receives an acknowledgment, and returns to sleep. In such a network the lamp node will be at least a ZigBee Router, if not the ZigBee Coordinator; the switch node is typically a ZigBee End Device.

In beacon-enabled networks, the special network nodes called ZigBee Routers transmit periodic beacons to confirm their presence to other network nodes. Nodes may sleep between beacons, thus lowering their duty cycle and extending their battery life. Beacon intervals may range from 15.36 milliseconds to 15.36 ms * 214 = 251.65824 seconds at 250 kbit/s, from 24 milliseconds to 24 ms * 214 = 393.216 seconds at 40 kbit/s and from 48 milliseconds to 48 ms * 214 = 786.432 seconds at 20 kbit/s. However, low duty cycle operation with long beacon intervals requires precise timing, which can conflict with the need for low product cost.

In general, the ZigBee protocols minimize the time the radio is on so as to reduce power use. In beaconing networks, nodes only need to be active while a beacon is being transmitted. In non-beacon-enabled networks, power consumption is decidedly asymmetrical: some devices are always active, while others spend most of their time sleeping.

ZigBee devices are required to conform to the IEEE 802.15.4-2003 Low-Rate Wireless Personal Area Network (WPAN) standard. The standard specifies the lower protocol layers—the physical layer (PHY), and the medium access control (MAC) portion of the data link layer (DLL). This standard specifies operation in the unlicensed 2.4 GHz, 915 MHz and 868 MHz ISM bands. In the 2.4 GHz band there are 16 ZigBee channels, with each channel requiring 5 MHz of bandwidth. The center frequency for each channel can be calculated as, FC = (2405 + 5 * (ch - 11)) MHz, where ch = 11, 12, ..., 26.

The radios use direct-sequence spread spectrum coding, which is managed by the digital stream into the modulator. BPSK is used in the 868 and 915 MHz bands, and orthogonal QPSK that transmits two bits per symbol is used in the 2.4 GHz band. The raw, over-the-air data rate is 250 kbit/s per channel in the 2.4 GHz band, 40 kbit/s per channel in the 915 MHz band, and 20 kbit/s in the 868 MHz band. Transmission range is between 10 and 75(up to 1500meteres for zigbee pro.)meters (33 and 246 feet), although it is heavily dependent on the particular environment. The maximum output power of the radios is generally 0 dBm (1 mW).

The basic channel access mode is "carrier sense, multiple access/collision avoidance" (CSMA/CA). That is, the nodes talk in the same way that people converse; they briefly check to see that no one is talking before they start. There are three notable exceptions to the use of CSMA. Beacons are sent on a fixed timing schedule, and do not use CSMA. Message acknowledgments also do not use CSMA. Finally, devices in Beacon Oriented networks that have low latency real-time requirements may also use Guaranteed Time Slots (GTS), which by definition do not use CSMA.

# II. EXISTING APPROACHES

**D-WAN:** This method states that vehicles have some active communication system through which a driver can communicate to the traffic intersection point regarding the lane in which he should drive to reach its destination. On other hand intersection point guides the vehicle driver to take appropriate turn in order to reach his destination. The whole idea proposed in this paper was to make vehicle intelligent so that they can communicate with the traffic system in advance before reaching to that intersection and get information about the path to reach destination. But this method does not take care for the load of traffic on a particular intersection and adaptation of traffic light as per the traffic load. Vehicles keep on waiting even if no vehicle has to pass from other's intersection side.[9]

**WSITMN:** WSITMN is a traffic monitoring system that uses Radio Frequency Identification (RFID) tags and Wireless Sensor Network (WSN).[7] Here every vehicle is given a RFID tag and when a vehicle with a RFID tag enters the monitoring zone, the RFID reader reads the information on the RFID tag and gathers information about the traffic flow. All the data gathered are then processed and sent to the base station. The base station then compiles the data, and

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transmits it to the monitoring center, where all the data gathered are analyzed and a decision is taken. Here the drawback is that the main monitoring center is a centralized system and if it fails then the whole system becomes useless. This process is also a bit time taking and it is also not possible to set RFID tags on all the passing vehicles.[3]

## III. PROPOSED APPROACHES

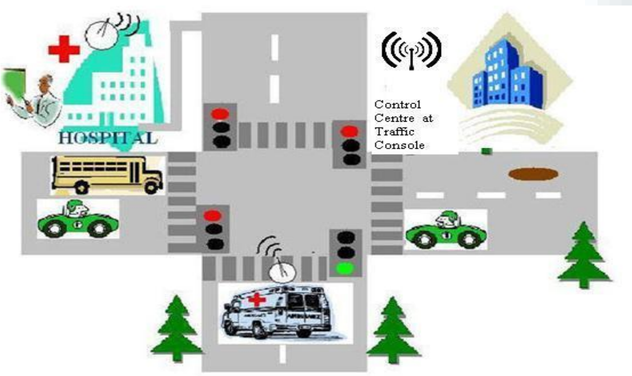


**Fig. 1: Schematic Representation of the Proposed System**

The proposed system wills use Zig-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.

### 3.1 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 console is shown in Fig.2.

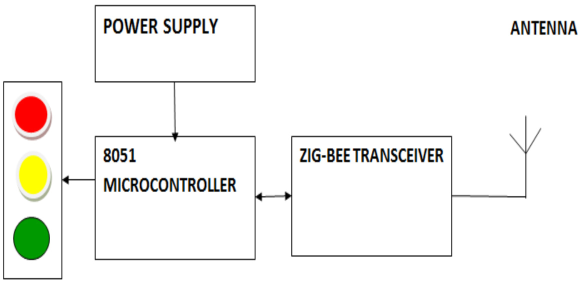


**Fig.2: Block Diagram of Sub system in the Traffic console**

### 3.2 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. 3.

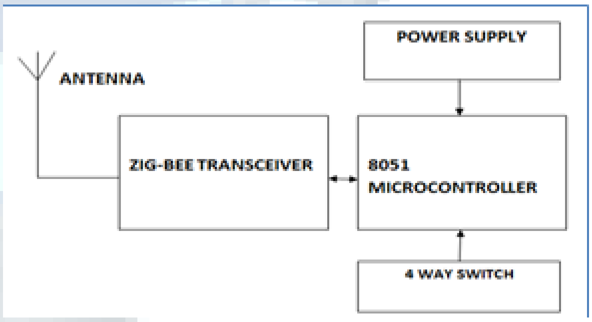


**Fig. 3: Block Diagram of the Subsystem in the Ambulance**

## IV. 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.4 and Fig. 5 has been simulated and all the necessary conditions were verified. The snapshot of the Proteus simulation result is shown in Fig. 6.Snapshot of the implemented Traffic console subsystem and Ambulance subsystem is shown in Fig. 7 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.

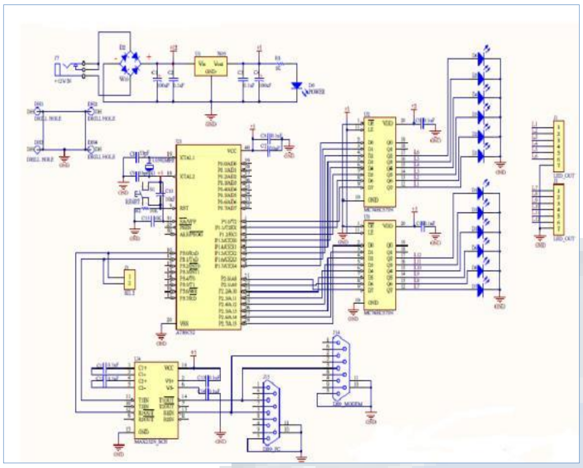

**Fig.4: Circuit diagram of Traffic Console subsystem**

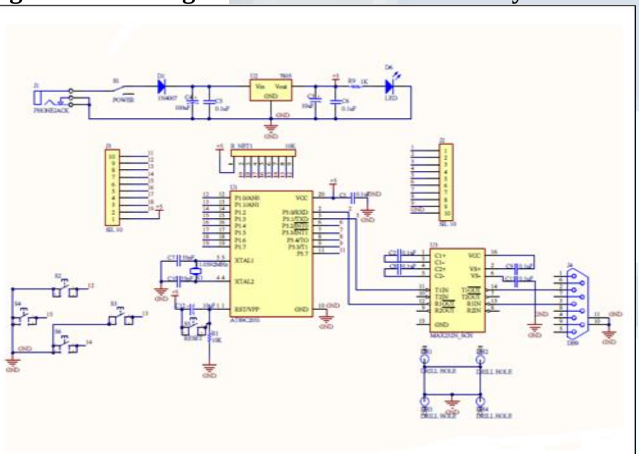

**Fig. 5: Circuit diagram of ambulance subsystem**

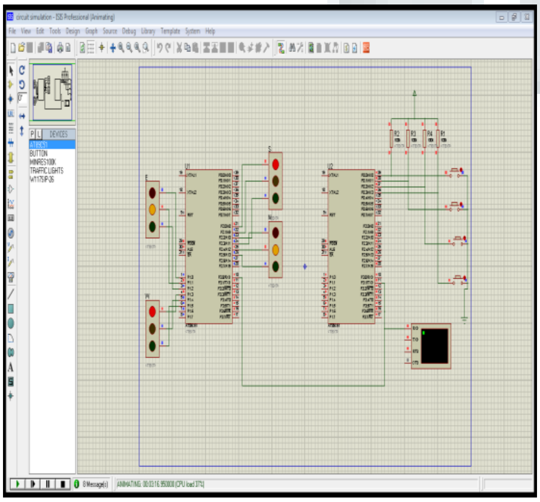

**Fig.6:Snapshot of the proteus simulation**

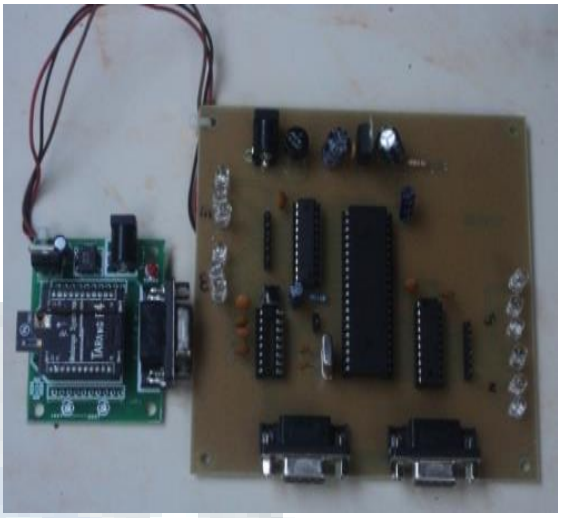

**Fig.7: Hardware implementation of Traffic Console subsystem**

# VI.CONCLUSION

In this project, Intelligent traffic control offering priority to ambulances has 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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