

A Smart Distributed Wireless Traffic Management System for Emergency Vehicles Using Zig Bee

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Abstract— These days, the quantity of vehicles has expanded exponentially, yet the bedrock limits of roads and transportation frameworks have not created in an identical approach to proficiently adapt to the quantity of vehicles going on them. There has been huge exploration on Traffic Management Systems utilizing sensor networks to evade congestion, guarantee urgency for emergency vehicles and lower the Average Waiting Time of automobiles at junctions. In order to solve the problem we have developed a distributed embedded electronic system that can considerably solve the problem of ambulances and other emergency vehicles getting jammed at traffic signal lights. The fundamental idea driving this plan is to give a smooth stream to the emergency vehicles like ambulances to achieve the healing facilities in time and along these lines minimizing the delay owing to traffic congestion.

Keywords- smart; traffic; ambulance; zig bee; micro controller; congestion; delay; emergency;

I. INTRODUCTION

Traffic jamming is one of the significant issues in developing countries. Jamming is the underlying cause of different issues including roads turned parking lots, traffic rule infringement and mishaps. This affects adversely human lives. Traffic lights assume an essential part in managing the traffic. Traffic lights are the gesturing gadgets that are put on the road crossing points and utilized control the stream of traffic on roads. Crisis happens at any area, any time, and in different ways will make one at danger. These circumstances require a rapid reaction. So it is extremely urgent and critical to set up immediate, quick and proficient system immediately. With the expanding number of populace in the metropolitan zones effectively, existing issue of poor traffic management has developed to a disturbing occasion. This issue must be legitimately investigated and the fitting measures must be taken. In rural areas there is no traffic congestion. The best possible consideration is to be given to the urban ranges for the most part concentrating on to the metropolitan urban cities. Regardless of the fact that every single vehicle going through the traffic has its own particular need, the earlier significance is given to the Ambulance and other emergency vehicles.

The Traffic density is expanding at a disturbing rate in developing nations like India which require the need of Advance smart Traffic signals to supplant the Conventional manual and time based Traffic signal framework. The Conceptual System which depends on interaction of vehicles and can't be essentially actualized in nations like India which have more than 10 crore vehicles on Road [1]. Traffic lights can be made to be astute to perceive vehicles in emergencies and give them urgency and let them pass the signals as right on time as could be expected under these circumstances. The

framework can be introduced in vehicles of any legislature higher authorities, ambulances or any others for whom time is critical. At the point when any vehicle with emergency enters a road hindered with vehicles, and once the vehicle communicates with traffic lights, the signal lights in that path are given green signal. They are kept up green till it reaches the required lane.

The sensors have pulled in wide enthusiasm from scholarly and industrial analysts because of their lower upkeep, low cost, and utilization in a colossal application regions, for example, wellbeing, the military, business and the home [15]. The selective attributes of sensor networks incorporate the versatility of sensor hubs, the capacity to withstand unforgiving environmental conditions, node failures, low power and adaptability [16]. The traffic signal framework in all urban communities in India depends on the time that outcomes in time wastage, more fuel utilization and more clog on roads. Numerous techniques and frameworks were at that point proposed for the traffic management utilizing the density of the vehicles on roads. In this paper we have developed a wireless network of emergency vehicles and traffic signals in which vehicles communicate with the traffic signals when they reach close to them. After receiving the signal from the emergency vehicles using Zig bee, traffic signal will provide green signal and thereby allow emergency vehicles like ambulances to move forward.

II. RELATED WORK

Many researchers have proposed many techniques for reducing the waiting time of emergency vehicles in traffic. Zhao sheng Yang [1] proposed a technique based on the navigation system. In his paper author clearly mentioned that

the purpose of paper is to reduce the waiting time of priority vehicles in traffic. GPS technology is used to track the vehicle. According to Athavan [9], Tandrima [8] the general idea is to track the emergency vehicle, use some sought of communication between the emergency vehicle and traffic signals in order to operate traffic lights.

According to Athavan [9], controllers are connected to GSM modems and are placed at the traffic junctions in such a way that only one controller is placed at one traffic junction. All the modems with controllers are controlled by a centralized server. When the ambulance comes near the traffic junction, controller of that junction informs to centralized server which turns the signal to green.

Tandrima.c [8] used GPS technology to track emergency vehicles. But there are many disadvantages and problems with GPS. Rajeshwar sundar [2] used Zig bee modules on CC2500 for communication between vehicle and traffic controller. Emergency vehicle sends the signal to the traffic controller to turn the green light on by using above modules. Kali [3] used RF transmitter and RF receiver for the communication between vehicle and traffic lights. The former is used in the ambulance and the latter on traffic junction lights. Bharadwaj.R [4] proposed a System which successfully reduced the waiting time of emergency vehicles. In the above system, special priority is given to emergency vehicles. G.sathya [5] used a different technology to control the traffic signals. In this, the author used controller on the traffic junction and used 3G GPRS technology to track the vehicle. Out of two, one GPRS 3G modem has been put in the vehicle and the other on traffic junction light for communication.

Ligi.k [6] used GPS technology and zig bee 802.15.4 protocol. Four cases of algorithms are used. The proposed model is based on concentration of automobiles which can be found by using Zig bee and General position system. Gerhard [7] used Wireless Sensor Networks (WSN) to give priority for emergency vehicles. In this, the author, based on a survey proposed a model by using WSN which avoids congestion and gives priority to emergency vehicles.

III. PROPOSED METHODOLOGY

GPS innovation is the most widely recognized approach to track vehicles. However, at times, the mistake delivered in the tracking can make issues. Therefore, we chose to make a framework taking into account ZigBee [9]. Another thought was the detection of path from where the emergency vehicle is drawing nearer and where it wishes to go. Given the way that ZigBee does not make directional shafts, we actualized a self-created algorithm to distinguish the right lane. Choice of the microcontroller was a matter of accessibility. For the model, we chose to utilize the Arduino UNO 3 [14]. Given below is the flow chart of the whole operation.

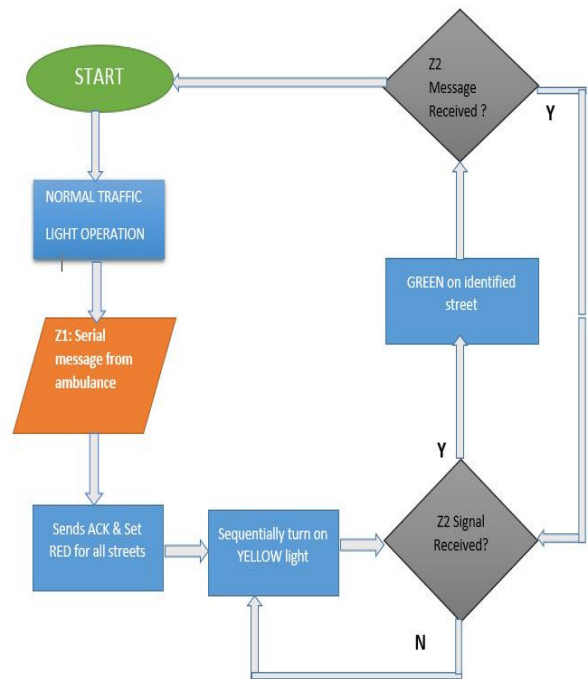


Figure 1: Flow Chart

The gadget in typical operating mode works the ordinary traffic sequence in the path by the utilization of the GPIO ports. The Lane traffic sequences are controlled by a clock and the predefined order execute in constant loops. On accepting a serial signal from a ZigBee gadget in the same network the gadget reacts by getting the UART input, the microcontroller reacts to the approaching message. On distinguishing the trigger message from an emergency vehicle, the controller starts a red signal to every one of the lanes and consecutively create red-yellow mixes to each of the paths each one in turn. At the point when the emergency vehicle reacts with the second confirmation message the path under consideration at that time is set to green signal. The signal is kept green until the emergency vehicle leaves the scope and the framework resumes ordinary method of operation.

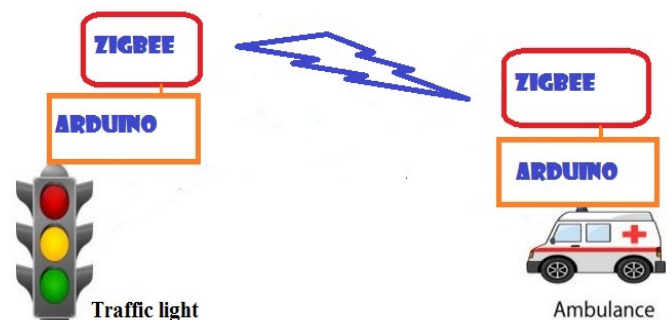


Figure 2: Schematic of a Traffic management system

Essentially the framework contains of two fundamental modules: one controller situated in the emergency vehicle and other situated on the traffic light framework. The emergency vehicle module comprises of an Arduino microcontroller interfaced with a ZigBee module and a couple of switches. The driver pledges the signal to the traffic light controller. The rescue vehicle to traffic light communication is done with the utilization of the ZigBee modules interfaced to the Arduino microcontroller. The driver starts signal utilizing the switches and microcontroller transmits the message through ZigBee module. The Traffic light controller module comprises of a microcontroller interfaced with the traffic light system and a ZigBee module. At the point when the module gets a message from its Arduino it starts the UART transmission to the controller of the traffic light and the traffic light controller reacts to the message by delivering the appropriate response sequence. The below figure shows how the system works

and ZigBee [11]. ZigBee has been chosen for the usage as a result of its features. ZigBee can give a decent range to communication when contrasted with different advances when the information should be transmit at rate of few Kb/s. ZigBee is having these features.

IV. HARDWARE AND SOFTWARE DETAILS

A. HARDWARE

ARDUINO

The Arduino microcontroller is a simple to utilize yet capable single board computer that has increased impressive footing in the hobby and expert business sector [12]. The Arduino is open-source, which implies equipment is sensibly priced and development software is free.

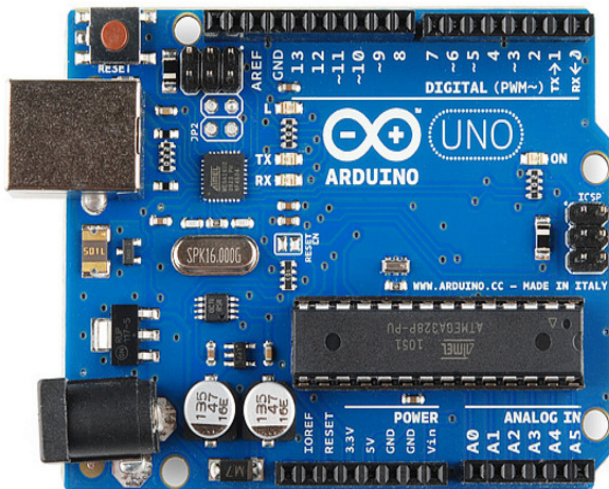


Figure 3: Arduino

ZIG BEE

Presently for the home automation systems scientists are giving more consideration towards it. The most widely recognized technologies which are utilized to execute these frameworks are Z-wave, Insteon, Wavenis, Bluetooth, Wi-Fi

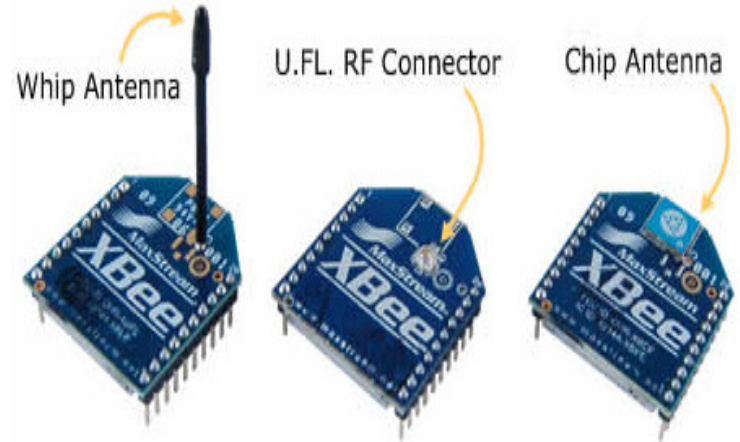


Figure 4: XBee

Parameter	Value
Range	10 - 100 Meters
Extensions	Automatic
Power Supply	Years
Complicity	20 kbps 40 kbps 250 kbps
Frequency Range	868 MHz, 916 MHz, 2.4 GHz
Network Nodes	65535
Linking time	30 ms
Cost of terminal unit	Low
Security	128 bit AES
Integration levels and reliability	High
Prime Cost	Low

Table 1 Features of Zig bee

B. SOFTWARE

XCTU

It is a multi-platform application that empowers designers to communicate with Digi radio frequency (RF) modules through an easy to-use graphical interface [13]. The application incorporates installed devices that make it simple to set up, configure and test Digi RF modules.

CONCLUSION

With smart and intelligent distributed wireless traffic management system the manual exertion of the traffic police is saved and also precious lives can be saved by allowing emergency vehicles like ambulances and fire and emergency vehicles by reducing the waiting time at traffic signals. When the ambulance will reach close to traffic light and if the red signal is displayed on traffic light the driver will send message to traffic management system and then the ambulance will be given green signal thereby decreasing the average waiting time of the vehicle. In the future the system may be secured by using encryption and also only authorized users will be allowed to activate the system.

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