Traffic Control System using Zigbee Module
Aadish Agrawal¹, Shreyash Saurabh²
Department of School of Electronics Engineering
VIT University, Vellore, India

Abstract:
Traffic jams in the world today is one of the biggest concerns. Traffics jams might even lead to death of people in case of serious situations. Not only ambulance but the other emergency vehicles like Fire Brigade trucks and Police cars tend to get stuck in jams. These different emergency vehicles which get delayed due to traffic jams might result in loss of many lives [1]. With the help of our system all the red traffic light signals will be turned to green in order to provide a clear way for the emergency vehicles. Apart from providing clearance to the emergency vehicles our system will also help in identifying any stolen vehicle when it crosses the different traffic light signals.

I. INTRODUCTION

Ambulances are the primary source of transport which are used for saving life of human beings. Great deal of problem arises when such emergency vehicles get stuck in jams specially when someone is critically injured and needs urgent treatment.. All ambulances are not equipped with advanced life saving equipment inside them which increases the risk of a patient to lose his or her life. Not only ambulances but the other emergency vehicles like the fire brigade and police cars may stuck in these traffic jams and therefore might not be able to perform their emergency operation on time. It takes a very long time in clearing such traffic jams and since it is a priority to save someone’s life new and efficient traffic control system is a must [2].

II. APPLICATION

In our proposed system emergency vehicles will be provided clearance by turning the red traffic lights to green, hence providing a complete green wave to the desired vehicle. Emergency vehicles should be given the highest priority and therefore this system will be very efficient in giving priority to these emergency vehicles. A comparison of the responses of “ambulance drivers” and “family members of patients in wards” showed that 60% of drivers agreed i.e 15 respondents and 40% disagreed while 100% of the family members i.e 25 respondents agreed that traffic jams led to deaths due to architectural short comings like congested and wrecked roads, unorganized traffic and no visible role of traffic management. This serious turmoil ultimately left negative impacts on the health of common man. In addition to providing clearance to the different emergency vehicles, this system will also help in location a stolen vehicle when it crosses a traffic signal.

III. EXISTING SYSTEM

In the pre-existing system sensors have to fix along the roadside. As sensors need to be fixed along the roadside the cost of implementation becomes very high and thus is not a feasible method. Some of the traffic control system models are fixed in nature. At present Bus priority control system is used which is based on Zigbee and Wireless Sensor Network. In this system the emergency vehicle is equipped with an on board node that sends information regarding the traffic conditions along its entire route. Apart from this sensors are fixed along the roadside and intersection nodes too. Also it should be put into notice that all the nodes should be working all the time [3]. Here, care is taken not to make the public wait for extended periods of time due to interruptions caused by the ambulance interruption passing through the signal. This is accomplished by reverting the signal duration to the previous state from where it was interrupted. The components used in the current system are a CC2500RFmodule, microchip PIC16F877A. The CC2500 RF module, which is a transceiver that provides a way to use RF communication at the industrial, scientific, and medical band of 2.4 GHz. From any standard complementary metal-oxide semiconductor (CMOS) /transistor–transistor logic (TTL) source it can be used to transmit and receive at 9600 baud rates. This module is a direct replacement for serial communications and does not require any extra hardware and coding. It works in half-duplex mode and provides communication in both directions but only one direction at a time. Its operation range is 30 m, and the input voltage needed for operation is 5 V dc. It works with the RS232 interface and the TTL interface.

IV. PROPOSAL

The main idea of this project is to provide better navigation to the emergency vehicles such that they can pass highly congested traffic junctions without facing difficulty and by consuming less time along with the second tier of this project which is to provide theft alert for stolen vehicles. To do this our project is divided in to two parts. The first part describes the ZigBee transmitter that is placed in the ambulance, and the second part details the ZigBee receiver implemented at the traffic pole. In the first part of the proposed model, the ZigBee transmitter is switched on only by the driver, in case of emergencies. There are situations where the ambulance is not carrying patients who are in need of urgent treatment, and the traffic need not be controlled using the ZigBee module. As a result the system is implemented such that only the driver can turn it on. As soon as driver switch on the zigbee module transmitter part will start communication with nearby traffic signal and automatically it will convert to green in order to reduce congestion [4]. Along with this RFID reader will be connected to the traffic pole such that it can find any stolen vehicle if any vehicle is registered as stolen status in the traffic control database and can be detected by RFID tag that will be installed in every vehicle while
V. WORKING

In order to improve the existing system we have developed a new green wave system. In which the traffic signal management for emergency vehicle is included. To make the proposed system work two methods are implemented. First is that as soon as emergency vehicle driver switches on the zigbee module transmitter and as soon as it starts communicating with the zigbee module that will be installed in the other end at the traffic pole, the traffic light will turn green and as soon as the vehicle passes the junction, traffic signal will automatically convert to previous state as well as the timing in the traffic signal will be bring back to previous state in order to take care of people’s convenience [5]. Second method is that every vehicle will be provided RFID tag while registration or manufacturing. In this information for that particular vehicle will be provided like unique vehicle identification as well as a tag which will help RFID reader to identify it as emergency vehicle or a normal vehicle by providing E or N tag where E stands for emergency vehicle and N for normal vehicle [6]. As ‘E’ tag vehicle pass through traffic signal RFID reader that will be installed in traffic signal pole will identify by doing a cross check in traffic control database and that lane will be made green w.r.t to the other lanes so that emergency vehicles can pass easily without wasting more time. In addition to the above theft vehicle detection method is also used. To find a stolen vehicle, the user has to contact the Transport office to update the database of the vehicle with T (for Theft) such that as soon as vehicle passes through any of the traffic signal junction RFID reader will identify the stolen vehicle by sending details to the traffic control centre via zigbee module and cross check the details with the Transport control unit database and on confirmation of the vehicle system control unit send alert to the nearby police station so that police can take immediate action for the same. Thus the single system is used in 2 Tier methods.

Figure. 1. Vehicle Unit

Figure. 2. Traffic Signal Unit

Figure. 3. Control Unit

Figure. 4. Flowchart of working of theft detection

Figure. 5. Flowchart of working of traffic control
VI. TECHNICAL DETAILS

A. Hardware Description:

1. PIC Microcontroller
PIC microcontroller is programmed according to the following need of the project:

- One PIC will be connected in the emergency vehicle which is used to control zigbee module for transmitting signal when driver press emergency button.
- Other PIC will be connected on traffic signal which will do few task as RFID reader will be connected to the traffic signal so it will help to send data to traffic control unit using zigbee module as well as it will also control traffic signal according to the need in emergency situation.
- One will be present in the control section which will be used to crosscheck data in database as well as for transmitting and receiving data.

2. RFID READER AND TAG
RFID reader will be installed in the traffic signal in order to identify whether vehicle is emergency type or not which can be done by reading unique vehicle identifier tag that will be present in the vehicle as well as it will also be used for identifying theft vehicle by reading vehicle tag [7].

Properties of RFID:

- An RFID reader is a device that is used to read an RFID tag. An antenna will be attached to the RFID reader which emits radio wave and in respond RFID tag send back data.
- An antenna will be attached to the RFID tag in a compact package and this packaging allows the RFID tag to be attached to an object to be tracked. In the response of signal sent by RFID reader, RFID tag sends signal along with the some additional data (Unique identification number or other information) [8].
- When radio waves sent by reader reach passive RFID tag, the coiled antenna within the tag form magnetic field and tag uses this magnetic field to energies the circuit and in return tag sends the information in the encoded form.
- The receiver and transmitter pins of RFID reader will be connected to transmitter and receiver pins of PIC Microcontroller respectively. Then the reader receives data from tag via Rx pin and these data will be further transfer to PIC using serial port.

3. MAX 232
It will be used in order to present interface for serial communication devices like zigbee module, GSM module as well as for RFID reader. MAX 232 act as a dual driver/receiver which is used to supply RS 232 voltage levels from TTL power supply using capacitive voltage generator. Each receiver converts RS-232 to TTL levels and each driver converts TTL level to EIA-232 level.

<table>
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<th>Logic diagram (positive logic)</th>
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<tr>
<td>T1IN</td>
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<td>T2IN</td>
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<tr>
<td>R1OUT</td>
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<tr>
<td>R2OUT</td>
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Figure. 6. Max 232 logic diagram

4. ZIGBEE MODULE
Zigbee module is used for wireless communication which is playing a major role for this project it will be connected in all the three parts vehicle, traffic signal and control unit. Zigbee is a wireless technology used as an open global standard and has very unique characteristics like low cost, low power, Wireless Sensor Networks. Zigbee technology follows IEEE 802.15.4 physical radio specification and its operating range is in unlicensed bands worldwide at the following frequencies-2.400–2.484 GHz, 902–928 MHz and 868.0–868.6 MHz. The zigbee module required 3.3 v of power supply that can done by voltage drop from 5v to 3.3v. It also act as a transreceiver which can transmit as well as receive data. The Rx pins of Zigbee module is connected to Tx of PIC microcontroller and Tx of zigbee to Rx of PIC. So data first transfer from microcontroller to zigbee module via UART port and its further transmitted wirelessly via Dout pin of zigbee module and it will receive in the other end by zigbee receiver via Din pin.

5. GSM MODEM
It will be connected in the control section for the purpose of sending alert messages to the user who have made stolen vehicle complaint in the registered phone number as soon as stolen vehicle get identified.

Properties of GSM module:

- A GSM modem is a wireless modem which behaves like a dial-up modem and works with a GSM wireless network. The working of GSM modem is totally depends upon command which always start with AT which stands for Attention and ends with character. Ex- ATD3314629080;
- The AT commands are given to the GSM modem via PC or microcontroller. GSM modem is serially connected to the microcontroller with the help of MAX 232 for interfacing as it provide proper voltage conversion from TTL level to RS-232 levels. For serial interface GSM modem requires the signal based on RS 232 levels. Therefore, T1_OUT pin of MAX232 will be connected to TX pin of GSM modem and R1_IN pin to Rx pin of GSM.

B. SOFTWARE DESCRIPTION

1. EMBEDDED C
Here embedded C is used for programming PIC microcontroller for configuring it for working of particular set of task. It is a C programming language with the few extensions added by the C Standards committee that can be used for different embedded systems. Due to high acceptance of C language it is most widely used in many microcontrollers and microprocessors that is further used to program many embedded system.

2. Proteus software
This is used for doing hardware simulation to check proper output from different components of project before implementing it for real. This will help to make more efficient hardware with less consumption of time. The following figure shows circuit design of this project:
VII. FUTURE PROSPECTS

This technology is very vital and it has major impact on real time scenario like number of deaths due to delay of treatment can be reduced with very high margin [10]. Few more features can be added to this technology to make it more effective and error prone free:

- As soon as emergency vehicle sends signal to the nearby traffic signal it will also send few more data like destination address according to that we can make smart traffic system in which traffic signals will communicate with each other for the best possible path such that according to vehicle location traffic signal changes its state and help emergency vehicles to reach the destination as early as possible.

- One more feature which can be added is that when a stolen vehicle get identified it will send alert to traffic police, along with that possible path of the vehicle can also be provided to the police which make easier to catch stolen vehicle.

VIII. REFERENCES


[4]. A Ranganath, T Sree Valli “Intelligent Management System For Density Based Control, Stolen Vehicle And Auto Clearance.


