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IMPLEMENTING INTELLIGENT TRAFFIC CONTROL SYSTEM FOR AMBULANCE CLEARANCE USING RFID

T.K.P. Rajagopal, Dr.M.S.Sathish Babu, S.Dhivya Bharathi

Assistant Professor[1],Associate Professor[2]Assistant Professor[3],

tkprgrg@gmail.comsatish_babu5@yahoo.com,dhivya04bharathi@gmail.com

Department of CSE, Kathir College of Engineering, Coimbatore, Tamil Nadu, India.

Abstract

The proposed system presents an intelligent traffic control system to pass emergency vehicles without hassle. Vehicles are equipped with special radio frequency identification (RFID) tag, which cannot be removed or destroyed. We use RFID reader, Arduino and PIC16F877A system-on-chip to read the RFID tags attached to the vehicle. It determines the network congestion, and hence the green light duration for that path is adjusted. When an ambulance is approaching the junction, it will communicate to the traffic controller in the junction to turn ON the green light. 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.

Index Term: *ZigBee, CC2500, GSM, SIM300, PIC16F877A, ambulance vehicle, stolen vehicle, congestion control, traffic junction.*

I. INTRODUCTION

INDIA is the second most populous Country in the World and is a fast growing economy. It is seeing terrible road congestion problems in its cities. Infrastructure growth is slow as compared to the growth in number of vehicles, due to space and cost constraints [1]. Also, Indian traffic is non-lane based and chaotic. It needs a traffic control solutions, which are different from the developed Countries. Intelligent management of traffic flows can reduce the negative impact of congestion. In recent years, wireless networks are widely used in the road transport as they provide more cost effective options . Technologies like ZigBee, RFID and GSM can be used in traffic control to provide cost effective solutions. RFID is a wireless technology that uses radio frequency electromagnetic energy to carry information between the RFID tag and RFID reader. Some RFID systems will only work within the range inches or centimeters, while others may work for 100 meters (300 feet) or more. The ZigBee operates at low-power and can be used at all the levels of work configurations to perform predefined tasks. It operates in ISM bands (868 MHz in Europe, 915 MHz in USA and Australia, 2.4 GHz in rest of the world). Data transmission rates vary from 20 Kilobits/second in the 868 MHz frequency band to 250 Kilobits/second in the 2.4 GHz frequency band . The ZigBee uses 11 channels in case of 868/915 MHz radio frequency and 16 channels in case of 2.4 GHz radio frequency. It also uses 2 channel configurations, CSMA/CA and slotted CSMA/CA [5]. The whole paper is grouped into 5 parts. Sections II talks about the literature survey. Section III discusses about the current problems that

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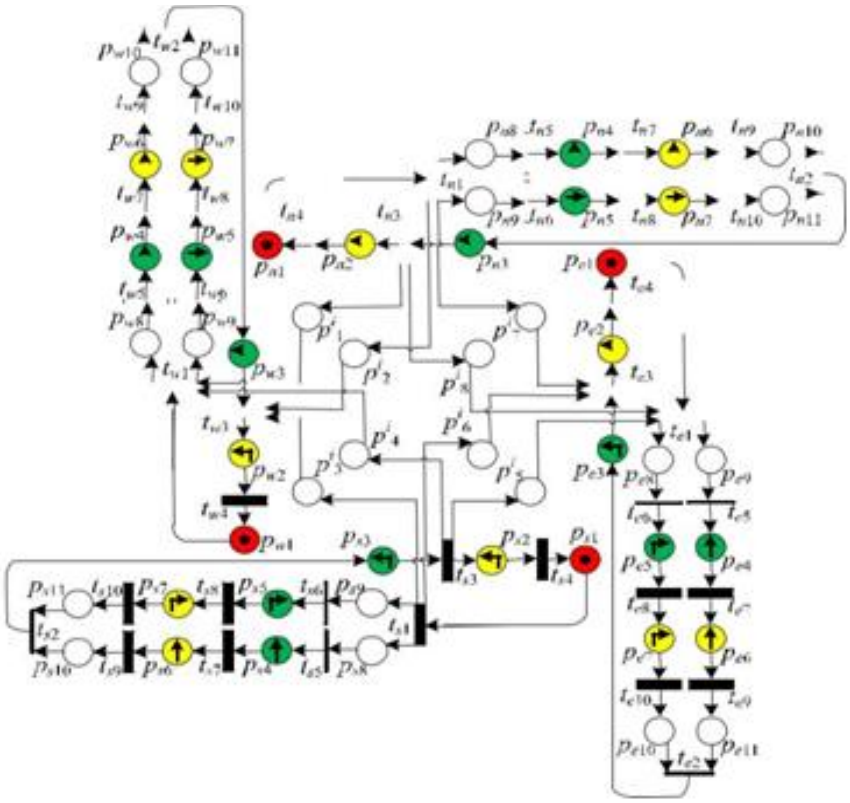
exist in making way to an ambulance and other vehicles. It also talks of how the proposed model will overcome the problems faced in developing Countries as well as developed countries. Section IV gives the implemen-tation details of the proposed model. Section V presents the enhancement of this work.

II. LITERATURE SURVEY

Traffic congestion is a major problem in cities of developing Countries like India. Growth in urban population and the middle-class segment contribute significantly to the rising number of vehicles in the cities. Hazel on roads eventually results in slow moving traffic, which increases the time of travel, thus stands-out as one of the major issues in cities. In, green wave system was discussed, which was used to provide clearance to any emergency vehicle by turning all the red lights to green on the path of the emergency vehicle, 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. In addition to the green wave path, the system track a stolen vehicle when it passes through a traffic light.



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In such cases, the queue of vehicles in a green wave grows in size until it becomes too large and some of the vehicles cannot reach the green lights in time and must stop. This is called over-saturation. The utilization of RFID movement control to maintain a strategic distance from issues that for the most part emerge with standard activity control frameworks, particularly those identified with picture preparing and shaft interference procedures are talked about. This RFID system manages multivehicle, multilane, multi street intersection regions. It gives an effective

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time administration plot, in which, a dynamic time plan is worked out progressively for the entry of each activity section. The constant activity of the framework imitates the judgment of a movement policeman on obligation. The quantity of vehicles in every segment and the directing are legitimacies, whereupon the estimations and the judgments are finished. The drawback of this work is that it doesn't examine what strategies are utilized for correspondence between the crisis vehicle and the movement flag controller. In, it proposed a RFID and GPS based programmed path leeway framework for rescue vehicle. The focal point of this work is to diminish the postponement in landing of the emergency vehicle to the healing facility via naturally clearing the path, in which, rescue vehicle is voyaging, before it achieves the activity flag. This can be accomplished by turning the movement motion, in the way of the emergency vehicle, to green when the rescue vehicle is at a specific separation from the activity intersection. The utilization of RFID recognizes the crisis and non-crisis cases, in this manner averting superfluous activity clog. The correspondence between the rescue vehicle and movement flag post is done through the handsets and GPS. The framework is completely robotized and requires no human intervention at the movement intersections. The impediment of this framework is it needs all the data about the beginning stage, end purpose of the movement. It may not work, if the rescue vehicle needs to take another course for a few reasons or if the beginning stage isn't known ahead of time. Movement is a basic issue of transportation framework in above all the urban areas of Countries. This is particularly valid for Countries like India and China, where the populace is expanding at higher rate as show in figure 1. For instance, Bangalore city, has seen an exceptional development in vehicle populace as of late. Therefore, huge numbers of the blood vessel streets and crossing points are working over the limit (i.e., v/c is more than 1) and normal trip speeds on a portion of the key streets in the focal territories are lower than 10 Km/h at the pinnacle hour. In, a portion of the primary difficulties are administration of in excess of 36,00,000 vehicles, yearly development of 7– 10% in rush hour gridlock, streets working at higher limit going from 1 to 4, travel speed under 10 Km/h at some focal regions in crest hours, inadequate or no parking spot for vehicles, set number of policemen. In, right now a video activity observation and checking framework charged in Bangalore city. It includes a manual examination of information by the activity administration group to decide the movement light term in every one of the intersection. It will impart the same to the nearby cops for the important activities.

III.PROPOSED MODEL

From the current problem section, it can be seen that, existing technologies are insufficient to handle the problems of congestion control, emergency vehicle clearance, stolen vehicle detection, etc. To solve these problems, we propose to implement our Intelligent Traffic Control System. It mainly consists of three parts. First part contains automatic signal control system. Here, each vehicle is equipped with an RFID tag. When it comes in the range of RFID reader, it will send the signal to the Other two pins are used to energize transreceiver. It is used
to transmit and receive the data at 9600 baud rate.

A. ZigBee Module CC2500

The CC2500 is a RF module and has transreceiver, which gives a simple method to utilize RF correspondence at 2.4 GHz. Each CC2500 is outfitted with the microcontroller (PIC 16F877A), which contains Unique Identification Number (UIN). This UIN depends on the enrollment number of the vehicle. A standout amongst the most vital highlights is serial

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correspondence with no additional equipment and no additional coding. Thus, it is a transreceiver as it gives communication in the two bearings, however just a single course.
(a)ZigBee module CC2500. (b)Pin outline of PIC16F877A. (c) GSM Module SIM300. (d) RFID reader– 125 kHz– TTL.

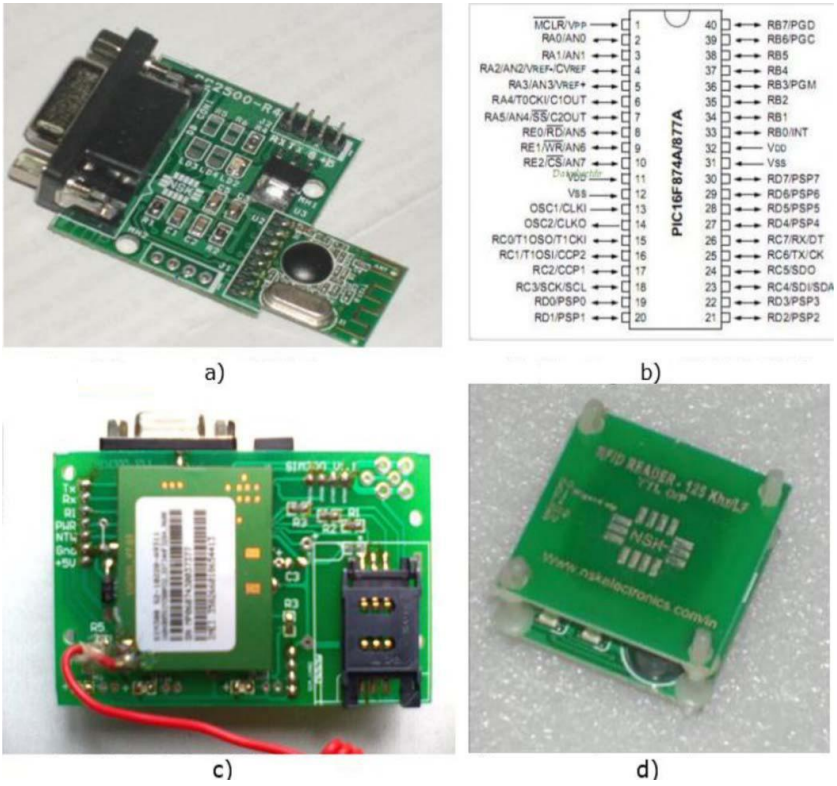

Fig. 2. PIN diagrams of different components used in our prototype.

Figure 4.1.a shows the image of transreceiver. Here, we uses CC2500 ZigBee module and it has transmission range of 20 meters.

B. Microcontroller (PIC16F877A)

Peripheral Interface Control (PIC) 16F series has a lot of advantages as compared to other series. It executes each instruction in less than 200 nanoseconds. It has 40 pins and has 8K program memory and 368 byte data memory. It is easy to store and send UINs. At the junction, it is easy to store large number of emergency vehicles. Before switching to green, it should satisfy all the conditions. Simple interrupt option gives the advantage like jump from one loop to another loop. It is easy to switch any time. It consumes less power and operates by vehicle battery itself without any extra hardware. Figure 2.b shows the PIN Diagram of PIC16F877A.

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C. GSM Module SIM 300

Here, a GSM modem is connected with the microcontroller. This allows the computer to use the GSM modem to communicate over the mobile network. These GSM modems are most frequently used to provide mobile Internet connectivity, many of them can also be used for sending and receiving SMS and MMS messages.

GSM modem must support an "extended AT command set" for sending/receiving SMS messages. GSM modems are a cost effective solution for receiving SMS messages, because the sender is paying for the message delivery. SIM 300 is designed for global market and it is a tri-band GSM engine. It works on frequencies EGSM 900 MHz, DCS 1800 MHz and PCS 1900 MHz. SIM300 features GPRS multi-slot class 10/ class 8 (optional) and supports the GPRS coding schemes. This GSM modem is a highly flexible plug and play quad band GSM modem, interface to RS232, it supports features like voice, data, SMS, GPRS and integrated TCP/IP stack. It is controlled via AT commands (GSM 07.07,07.05 and enhanced AT commands). It uses AC – DC power adaptor with following ratings DC Voltage: 12V/1A.

D. RFID Reader–125 kHz–TTL

Radio Frequency Identification (RFID) is an IT system that transmits signals without the presence of physical gadgets in wireless communication. It is categorized under automatic identification technology, which is well established protocol. The working of an RFID system is very simple. The system utilizes tags that are attached to various components to be tracked. The tags store data and information concerning the details of the product of things to be traced. The reader reads the radio frequency and identifies the tags. The antenna provides the means for the integrated circuit to transmit its information to the reader. There are two types of RFID categories, active and passive tags. The tags that do not utilize power are referred to as passive and they are driven by an antenna that enables the tag to receive electromagnetic waves from a reader. On the contrary, active tags rely on power and they have inbuilt power sources that enable it to send and receive signals from RFID reader. RFID range depends on transmit power, receive sensitivity and efficiency, antenna, frequency, tag orientations, surroundings. Typically, the RFID range is from a few centimeters to over hundred meters. RFID reader uses frequency 125 KHz with a range of 10 cm.

IV. WORKING MODEL

A. Automatic Signal Control System

In this module, for experiment purpose, we have used passive RFID tags and RFID reader with frequency 125 KHz. RFID tag, when vehicle comes in the range of the receiver will transmit the unique RFID to the reader. The microcontroller connected to the RFID reader will count the RFID tags read in 2 minute duration. For testing purpose, if the count is more than 10, the green light duration is set to 30 seconds, if count is between 5 and 9, the green light duration is set to 20 seconds. If the count is less than 5, the green light duration is set to 10 seconds. The red light duration will be for 10 seconds and orange light duration will be for 2 seconds. Figure 3 implementation for automatic signal control and stolen vehicle detection system.

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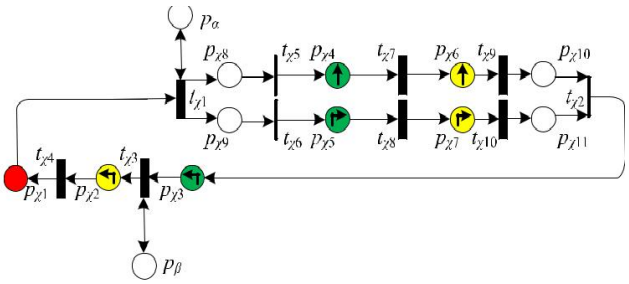

Fig. 3(a). Implementation for automatic signal control Graph

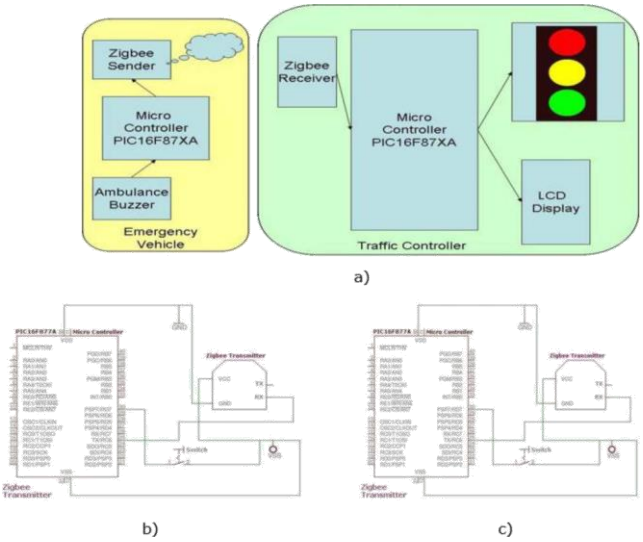

Fig. 3(b). Implementation for automatic signal control and stolen vehicle detection system. (a) Block diagram for automatic signal control system.

B. Emergency Vehicle Clearance System

In this module, there are 2 sections, initial segment which is ZigBee transmitter is set in the crisis vehicle. At the point Proposed model images transmitter and receiver. (a) Pole status at different condition. (b) Transmitter (ZigBee). (c)

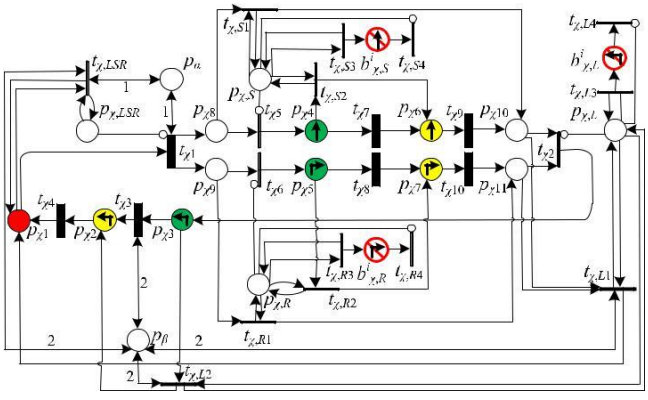

Fig .4.Traffic Light Controlling graph

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LCD display at receiver.Detailed image of receiver. (e) When stolen vehicle is detected. (f) Working model.when the switch is squeezed, it will transmit the flag. The signal contains one of a kind id and security code. The transmitter contains PIC16F877A microcontroller and ZigBee module. The microcontroller sends the summons and information to the ZigBee through serial correspondence. Second part is the collector, which is put at movement post. It additionally contains PIC16F877A microcontroller and ZigBee module. The recipient thinks about the security code got to the security code introduce in its database. In the event that it matches, at that point it will turn the green light on. For testing reason, we utilized short range RFID peruser in our model. To start with, the collector part is turned on. The red and green flag will on for 10 seconds term and orange light will be on for 2 seconds length consistently. Furthermore, we bring the RFID of stolen vehicle into the scope of RFID peruser. At that point the flag will swing to red for term of 30 seconds and a SMS is gotten. Thirdly, we bring 12 RFIDs into the scope of RFID peruser, and after that the green light length will change to 30 seconds.

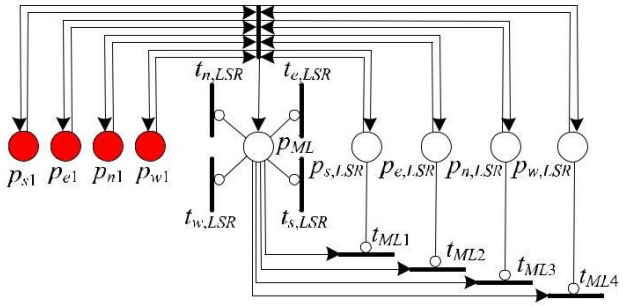

Fig.5. A LiveLock Preventional Model Graph

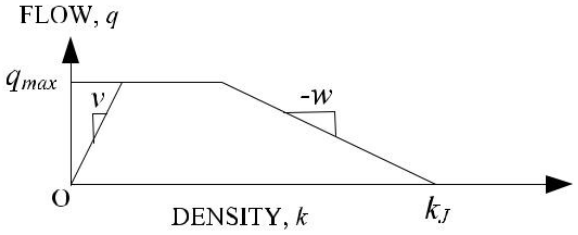

Fig.6. Flow-density relationship for the generalized CTM [22].

Fourthly, we bring a crisis vehicle conveying ZigBee transmitter into the scope of ZigBee recipient, and after that the movement light will change to green till the collector gets the ZigBee motion as appeared. demonstrates the pictures of various parts and featured highlights of the proposed work. demonstrates the flag post introduced in intersection. In the default condition, red and green light will set for 10 seconds. The day and age will be shifted by the activity conditions, stolen vehicle, and crisis vehicle. Figure 5.b demonstrates the transmitter part is put in the rescue vehicle. It transmits ZigBee flag constantly. Figure 5.c demonstrates the LCD show status at

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various conditions (in that figure one is typical conjunction picture (movement flag running according to the default era) and another is LCD show status, when a rescue vehicle drawing close to intersection. Figure 5.d demonstrates the real associations of various segments like RFID, GSM, ZigBee, interfacing diverse microcontrollers. Figure 5.e demonstrates the status refreshed at the season of stolen vehicle is found. The stolen vehicle RFID number ought to be refreshed in the database. On the off chance that stolen vehicle is discovered, at that point it will instantly turn on red light in the flag. It sends promptly a message to approved individual. Figure 5.f demonstrates the working model of the proposed work.

V.CONCLUSION AND ENHANCEMENTS

With programmed movement flag control in view of the activity thickness in the course, the manual exertion with respect to the activity policeman is spared. As the whole framework is robotized, it requires less human mediation. With stolen vehicle identification, the flag naturally swings to red, so the cop can make suitable move, on the off chance that he/she is available at the intersection. Additionally SMS will be sent so they can plan to get the stolen vehicle at the following conceivable intersections. Crisis vehicles like emergency vehicle, fire trucks, need to achieve their goals at the most punctual. On the off chance that they invest a ton of energy in congested roads, valuable existences of numerous individuals might be in risk. With crisis vehicle leeway, the movement flag swings to green as long as the crisis vehicle is holding up in the rush hour gridlock intersection. The flag swings to red, simply after the crisis vehicle goes through. Assist upgrades should be possible to the model by testing it with longer range RFID perusers. Additionally GPS can be set into the stolen vehicle recognition module, so the correct area of stolen vehicle is known. As of now, we have executed framework by thinking about one street of the activity intersection. It can be enhanced by stretching out to every one of the streets in a multi-street intersection.

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