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Intelligent Traffic Control Management System

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Abstract: This paper presents an intelligent traffic control system to pass emergency vehicles smoothly. Each individual vehicle is equipped with special radio frequency identification (RFID) tag (placed at a strategic location), and GPS for tracking the location, which makes it impossible to remove or destroy. We use RFID reader and PIC16F877A system-on-chip to read the RFID tags attached to the vehicle. It counts number of vehicles that passes on a particular path during a specified duration. It also determines the network congestion, and hence the green light duration for that path. If the RFID-tag-read belongs to the stolen vehicle, then a message is sent using GSM SIM300 to the police control room. In addition, when an ambulance is approaching the junction, it will communicate to the traffic controller in the junction to turn ON the green light. The main aim of the project is to design and develop the "Intelligent traffic control management system" it helps achieve maximum "green wave" and enhanced flow of traffic ensures diversion of traffic for faster movement of emergency service, smooth flow of traffic can ensure safety of both commuters and pedestrians.

Keywords: ZigBee, RFID, GSM, SIM300, GPS, PIC18F458, ambulance vehicle, stolen vehicle, congestion control, traffic junction.

I. INTRODUCTION

India is the country which is the second most populous in the World and is a fast developing economy. It is seeing horrifying road congestion problems in its cities. Infrastructure development is slow as compared to the development in number of vehicles, due to space and cost constraints [1].Also, Indian traffic is nonlane based and confused. 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 transportation as they provide more cost effective options [2].

Improvement in the quality of life along with substandard public transportation has resulted in spiralling growth of private automobiles. Traffic congestion has become one of the main problems which make a way to several other problems. A steady increase in metro-city population, the number of automobiles and cars increases hurriedly and metro traffic is mounting crowded which leads to the traffic congestion problem. Hence here comes technologies like RFID, GSM, Zigbee and GPS can be used in traffic control to provide cost effective solutions. Here we are conserving three applications of traffic control management system.

The first application and the most widespread problem is that traffic congestion. Many researchers have come across with different solution to the problem. Here we introduce a RFID technology [3] to overcome this traffic congestion problem. The second application in traffic management is detection of the stolen vehicle. This is also done using RFID technology. The stolen vehicle will be detected by the RFID tag which will be attached to the vehicle once the complaint will be registered in the control room. And the owner will get the information about his vehicle which has been stolen through GSM technology.

The third application is clearance for the emergency vehicle in that heavy traffic congestion. That is, the arrival of the ambulance is to be communicated to the nearest traffic signal, so that it can turn the light to green and hence clear the traffic. This communication is done using the wireless technology i.e Zigbee. The Green wave systems are most suitable to provide clearance to emergency vehicles during rush hours [4]. Many systems are used to implement the green wave systems. We have developed a cost effective system using Radio frequency identification (RFID) Technology [5][6],Global system for mobile communication (GSM) modules and latest high speed microcontrollers to achieve the desired results. we propose to make a system consisting of GPS broadcast signals from space that GPS receivers, use to provide three-dimensional location (latitude, longitude, and altitude) plus precise time.

The resultant offshoot of such a high automobile growth is that now Bangalore is one of the most accident-prone cities in India. This can be overcome by RFID technology in this system moreover, the ambulances often get stuck at the traffic signals where all other vehicles try to squeeze in to all the available space so as to move ahead as soon as the signal turns green. Unlike western countries, Indian cities cannot think of having separate lanes for emergency purpose due to lack of road planning and infrastructure.

Fig 1: Traffic in Bangalore city

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II. PROPOSED SYSTEM

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 in order to solve this problem we propose to introduce an intelligent traffic control system. As told above here we are considering three application, congestion control using a RFID technology here the RFID tag which will be attached to each vehicle and when it will come in contact with the reader it will send a message to the traffic signal pole to switch ON the green light depending on how many vehicle have passed in specific period of time, stolen vehicle detection is also done using RFID, once the vehicle is detected then the traffic light will be turned to red for a particular duration and simultaneously message will be sent to the owner of that particular vehicle if and only if the complaint about the theft is registered and the third application is the clearance for the emergency vehicle, here each emergency vehicle will be attached with ZigBee transmitter module and the receiver module will be implemented at the traffic junction. The buzzer will be ON when there is an emergency, then the signal will be sent from ZigBee transmitter to ZigBee receiver, soon it will make the traffic light to turn ON green till it loses the signal from the ZigBee.

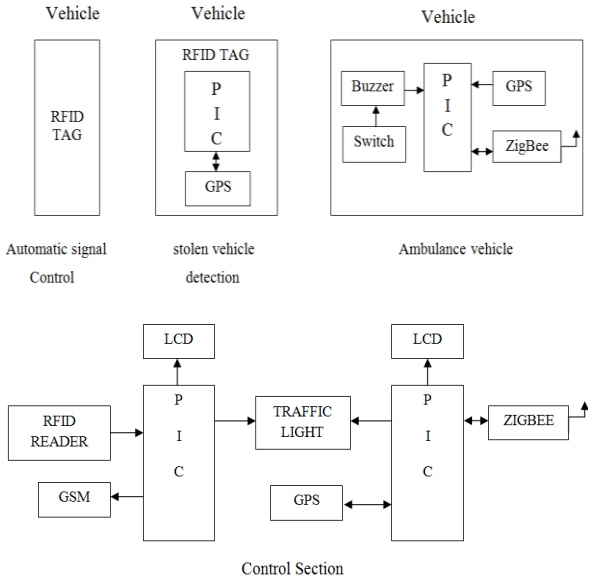

Fig 2: Block Diagram

III. WIRELESS COMMUNICATION PROTOCOL

A. ZigBee module:

ZigBee is a standard that defines a set of communication protocols for low-data-rate short-range wireless networking. ZigBee-based wireless devices operate in 868 MHz, 915 MHz, and 2.4 GHz frequency bands. The maximum data rate is 250 K bits per second. ZigBee is targeted mainly for battery-powered applications where low data rate, low cost, and long battery life are main requirements. In many ZigBee applications, the total time the wireless device is engaged in any type of activity is very limited; the device spends most of its time in a power-saving mode, also known as sleep mode. As a result, ZigBee enabled devices are capable of being operational for several years before their batteries need to be replaced. It is used to transmit and receive the data at 9600 baud rate.

B. RFID:

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. The range of the RFID depends on the frequency.

C. GSM:

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. 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. Here the Rx pin of the GSM is connected to the Tx pin of the microcontroller.

D. GPS:

The Global Positioning System consists of 24 satellites, that circle the globe once every 12 hours, to provide worldwide position, time and velocity information. GPS makes it possible to precisely identify locations on the earth by measuring distance from the satellites. GPS allows you to record or create locations from places on the earth and help you navigate to and from those places. When a GPS receiver is turned on, it first downloads orbit information of all the satellites. This process, the first time, can take as long as 12.5 minutes, but once this

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information is downloaded; it is stored in the receivers memory for future use. Even though the GPS receiver knows the precise location of the satellites in space, it still needs to know the distance from each satellite it is receiving a signal from. That distance is calculated, by the receiver, by multiplying the velocity of the transmitted signal by the time it takes the signal to reach the receiver.

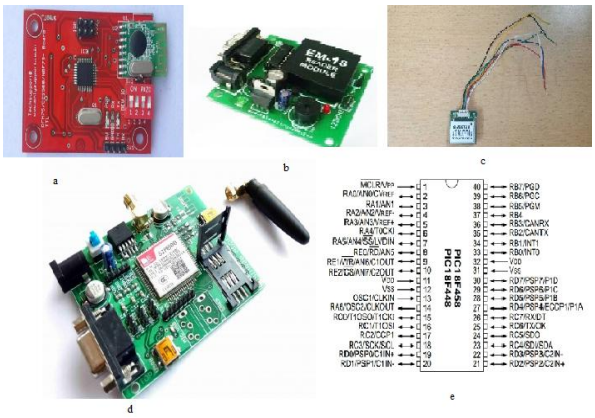

Fig 3: a-ZigBee module, b-RFID module, c-GPS module d-GSM module, e-PIC18f458

E. PIC Microcontroller (18F458):
This microcontroller is basically 40 pin IC's. PIC (Peripheral Interface Controller) is a family of Harvard architecture microcontrollers made by Microchip Technology to control peripheral devices. PIC is very cost effective, that is the different model PIC's are available with proportional cost. There is chance to choose the PIC suitable for the application. When operated at its maximum clock rate a PIC executes most of its instructions in 0.2 microseconds or 5 instructions/ microsecond. The PIC microcontroller has a number of inbuilt modules like ADC, CAN that increase versatility of micro controller.

IV. WORKING MODEL

Working is divided into 3 parts as follows:

A. Automatic Signal Control to overcome Traffic Congestion:
In this project, each Junction is connected with RF-Reader to detect the unique Rf-Id Tag(passive RF-Id), which is connected in the vehicle. So, if any vehicle is coming in the range of RF-Reader the reader start counting the vehicle for every 20sec and the signal will switch to green for 15sec when the count is more than 4 vehicle, if the count is less than 4 vehicle the green signal will be for 8sec and if the vehicle count is equal to 4 then the green signal will be equal to 12sec, this process will be cyclic and it avoids the traffic jam. Gps will also be connected to the vehicle which is inbuilt that cannot be removed or destroyed.

B. Stolen Vehicle Detection
In this part when any vehicle is coming in the range of RF-Reader which is connected in each Junction, its reads the Unique RF-ID tag of the vehicle and compares it with the list of stolen Unique RF-ID tags, if match is found, it sends the sms to owner that the stolen vehicle is detected and changes the traffic light to red, so that the vehicle is made to stop at traffic Junction and same status should update on the lcd for stolen vehicle detected.

C. Emergency Vehicle Clearance
In this part Each Emergency Vehicle contains Zigbee transmitter and Zigbee receiver will be connected at the traffic Junction. The buzzer will be switch ON when the vehicle is used for emergency purpose. This will send the signal through the Zigbee transmitter to Zigbee receiver to make the traffic light to change to green. Ones the ambulance passes through, the Junction Zigbee receiver no longer receives the signal and then the traffic light is turned to red. The ambulance is connected to GPS also to find its location for better causality help.

V. RESULT

The implementation of intelligent traffic control system reduces the problem of traffic congestion by using RFID in each vehicle, the theft vehicle can be easily detected with the help of RFID and it can be tracked with the help of GPS which connected in the vehicle and at the same time the message will be sent to the owner about the theft vehicle detected using GSM, the emergency vehicle can be easily passed when it is in emergency case due to the communication between the traffic pole and the emergency vehicle so that the emergency vehicle can reach its destination on time without any traffic delay.

VI. CONCLUSION

With automatic traffic signal control based on the traffic density in the route, the manual effort on the part of the traffic policeman is saved. As the entire system is automated, it requires very less human intervention

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