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Novel approach for Vehicle Clearance using Intelligent Traffic Control System (ITCS)

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Abstract

This paper contains an intelligent traffic control system. All vehicles are equipped with a radio frequency identification (RFID).An RFID reader can be used to read the RFID tags. NSK EDK-125–TTL, and PIC16F877A can be used to read the RFID tags. The number of vehicles passed during a specified duration is counted by the reader along with the network congestion and the green light duration. If an RFID tag associated with a vehicle that has been stolen, a message is sent to the police control room using GSM SIM300. In case if an ambulance is heading onto a junction, a communication is established with the traffic controller with the help of Zigbee modules on CC2500 and PIC16F877A to turn the green light ON. The model was examined different inputs in our wireless communication laboratory and experimental results were found as expected.

Index Terms— **PIC16F877A, GSM SIM300, ZigBee module, CC2500, An ambulance, A stolen vehicle, A traffic junction.**

I. INTRODUCTION

INDIA has the second largest population in the World. Day-by-day the road traffic problems are increasing. A fast growth in number of vehicles also causes the traffic congestion. Unlike other countries, Indian traffic is non-lane
Based and chaotic which needs a traffic control solutions. Wireless networks such as ZigBee, RFID and GSM can be used in traffic control since they are cost-efficient. RFID is Radio Frequency Identification to carry information between the RFID tag and RFID reader. A GSM accepts a SIM card and operates just like a mobile phone. The ZigBee can be used to perform some Pre-defined tasks at low-power. It operates in ISM bands (for e.g., 2.4 GHz in India).It uses 16 channels for 2.4 GHz radio frequency. CSMA/CA and

Slotted CSMA/CA are the two channel configurations that a ZigBee uses.

II. LITERATURE SURVEY

Cities in India face a severe problem called traffic congestion. Population growth and number of vehicles add more complexity to this and results in slow moving traffic, which is a major issue in metropolitan cities. Green wave system was introduced, for traffic clearance incase if any emergency vehicle comes into the path. This system turns all the red lights to green thus providing a complete green wave to the desired vehicle. In addition to it, this system will trace a stolen vehicle if it passes through a traffic light. The only and the major disadvantage is that, any disturbance in wave can cause traffic problems.

The RFID uses image processing and beam interruption techniques to avoid traffic problems. RFID deals with multivehicle, multilane, multi road junction areas. The real-time operation of the system follows the judgment of a traffic policeman on duty. The numbers of vehicles in each column are the proprieties along with the routing, where all the calculations and the judgments are done. The major demerit is that it does not discuss what methods are used for communication between the emergency vehicle and the traffic signal controller.

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A RFID and a GPS based automatic lane clearance system for ambulance is implemented. The aim of this work is to reduce the delay in which the arrival of the ambulance to the hospital by means of clearing the lane automatically. When the ambulance is travelling before it reaches the traffic signal, it can be implemented. This can be achieved by turning the traffic light to green in the path of the ambulance, when the ambulance is all set at a certain distance from the traffic junction. The purpose of RFID distinguishes between the emergency and non-emergency cases, and hence prevents the unnecessary traffic congestion. The communication between the ambulance and Traffic post is done through the transceivers and GPS. The system operates completely in a fully automated platform such that it requires no human involvement. At any traffic junction. The main disadvantage of this system is that it needs all the information about the starting point, the ending point of the travel. It may not work, if the ambulance needs to take another route for some reasons or if the starting point is not known in advance. Traffic is one of the major critical issues of transportation system in most of the populated cities in all Countries. This is especially true for countries like India and China, where the population is increasing at higher rate. For example, Chennai city, has seen a remarkable growth in vehicle population in recent years. As a result, many of the major roads and intersections are operating over the capacity and average journey speeds on some of the key roads in the central areas are lesser than 10 Km/h at the peak hours.

Some of the main challenges are management of more than 40,00,000 vehicles, annual growth of 10–12% in traffic, roads that are operating at a higher capacity ranging from 1 to 4, travelling speed less than 10 Km/h at some central areas in peak hours, insufficient or no parking space for vehicles, limited number of policemen. A manual analysis of data is required by the traffic management team to determine the traffic light duration at each point of the junction. It will communicate about the report to the local police officers to take upon the necessary actions.

III. PROPOSED SYSTEM

For the current problem section, we propose a technology called Intelligent Traffic Control System. It consists of three major parts. First part contains automated signal control. Here, each vehicle is fitted with an RFID tag. When an RFID reader reads it, a signal will be sent. The RFID reader will trace the number of vehicles passed and determines the congestion volume. Accordingly, it sets the green light duration for that path. Second part is for the emergency vehicles clearance. For each emergency vehicle a ZigBee transmitter module and the ZigBee receiver will be implemented at the traffic junction. The button will be turned ON when the vehicle is in use.

This will send the signal through the ZigBee transmitter to the ZigBee receiver. It will change the traffic light to green. When the ambulance passes through, the receiver receives no signal and the traffic light is turned to red. Now the third part is responsible for stolen vehicle detection.

Here, with the RFID reader reads the RFID tag, it compares the list of stolen RFID. If it matches, An SMS is sent to the police control room and changes the traffic light to red, so that the vehicle is made to stop in the traffic junction and local police can take appropriate action. List of components used in the experiment are CC 2500 module, PIC16F877A, RFID Reader–125KHz and SIM 300 GSM.

A. ZigBee Module CC2500

ZigBee Module CC2500 is a transceiver, which provides an easy way to use RF communication at 2.4 GHz. Every CC2500 is fitted with a microcontroller (PIC 16F877A), that contains Unique Identification Number (UIN). This UIN is based on the registration number of the vehicle. The most important features is that a serial communication without any extra hardware and no extra coding. The microcontroller (PIC16F877A) and CC2500 communicate through serial communication. Here, we use CC2500 ZigBee module and it has transmission range of 20 meters.

B. Microcontroller (PIC16F877A)

Microcontroller executes each instruction quickly. It has more pins and has a larger program memory with separate data memory. It is easy to store and send UINs. At the junction, a large number of emergency vehicles can be stored easily. Before switching it to green, it should satisfy all the conditions. The interrupt option allows a jump from one loop to the other loop. It is easy to switch at any time. It consumes only a less power and it operates by vehicle battery itself without any extra hardware.

C. GSM Module SIM 300

In GSM module, a GSM modem is connected with the microcontroller (*PIC16F877A).*This allows the computer to communicate with the mobile network by using GSM modem. Generally these GSM modems are used to provide mobile Internet connectivity, many of them can also be used to send and receive SMS and MMS texts. GSM modems are a cost efficient solution for receiving SMS messages, because the sender is paying for the message delivery.

SIM 300 is designed to evolve in the global market with a tri-band GSM engine. It works on frequencies EGSM 900

MHz, DCS 1800 MHz and PCS 1900 MHz 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. It uses AC – DC power adaptor.

D. RFID Reader–125 kHz–TTL

Radio Frequency Identification (RFID) is a system that transmits signals in wireless communication without the presence of physical gadgets. It is categorized under automated identification technology, a well-established protocol.

The RFID working mechanism is so simple. The system makes use of tags that are attached to various components to be tracked. The tags store all the data and information containing the details of the product of things to be traced. The reader reads the radio frequency and finds the tags. The antenna is responsible for the integrated circuit to transmit its information to the reader. There are two types in RFID. They are active and passive tags. The tags that do not consume 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 other hand, active tags depend only on power and they have an inbuilt power source that enables it to send and receive signals from RFID reader. RFID range depends on transmit power, receive sensitivity and efficiency, antenna, frequency, tag orientations, surroundings. Most probably, the RFID covers an area that ranges from a few centimeters to over hundred meters. RFID reader uses frequency 125 KHz with a range of 10 cm.

IV. IMPLEMENTATION

In this system, we have three modules as follows.

A. Automatic Signal Control module

For experimental purpose, we have used a frequency of 125 KHz. The RFID reader will read count in the RFID tags in a 3 minute duration. In case, if the count is more than 10 seconds, the duration of green light is set to 30 seconds and if the count is in between 5 and 9, the duration of green light is set to 20 seconds.

At last, if the count is less than 5, the duration of green light is set to 10 seconds. The red light will be for 10 seconds and yellow light duration will be for 2 seconds.

B. Stolen Vehicle Detecting System

In this system, we compare the unique
RFID tag and the stolen RFID by the RFID reader that is stored in the system. If it matches, the traffic light is turned to red at once for a duration of 30 seconds. Also an SMS is sent mentioning the RFID number with the help of GSM module. An LCD display can be used to indicate where stolen vehicle is present.

C. Emergency Vehicle Clearance Module

In this system, a ZigBee transmitter is fitted in an emergency vehicle. When the button is pressed, a signal will be transmitted. Each signal contains a unique id and a secret code. The transmitter with PIC16F877A microcontroller and ZigBee module sends a set of commands through serial communication. Now the receiver takes the charge which is placed at traffic pole. It also contains PIC16F877A and ZigBee module. The receiver compares the secret code received to the secret code that is present in its database. If a match is found, it will turn the green light on.

For instance, consider a short range RFID reader is our prototype. First, the receiver is turned on. The red and green signal will be on for 10 seconds while the yellow light will be on for 2 seconds duration one after another. Now, we bring the RFID of stolen vehicle within the range of an RFID reader. The signal will turn to red for 30 seconds and a SMS is received. Then, we bring 10 RFIDs within the range of RFID reader, and now the green light duration will be changed to 30 seconds. Finally, we bring an emergency vehicle carrying ZigBee transmitter into the range of ZigBee receiver, and then the traffic light will change to green till the receiver receives the ZigBee signal. By default, we set the red and green light for 10 seconds.

V. CONCLUSION

An automated traffic control system can considerably reduce the manual effort such that a traffic policeman can do an effortless work. Since the whole system works automatically, it requires only a small human involvement. Detecting a stolen vehicle by automatically turning the lights to red, The Police can take proper action. Otherwise, SMS can be sent to the next junction so that they can catch the stolen vehicle.

Emergency vehicles like ambulance, fire trucks, have to reach their destinations as soon as possible. Even if they spend a little amount of time in traffic, Lives of many people would be in danger. So, traffic clearance is must by changing the traffic light to Green as long as the emergency vehicle is waiting in the junction. The signal turns to red, only when those vehicle passes through. A GPS is placed in a stolen vehicle detection system, so as to find the exact location of stolen vehicle. Here we have implemented a traffic system by considering one Road but anyhow, It can be extended to all the roads in a multi-road junction.

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