INTELLECTUAL CONGESTION CONTROL FRAMEWORK AND STOLEN AUTOMOBILE DETECTION USING CIRCUIT BREAKER FOR TRAFFIC CONTROL SYSTEM

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Abstract—This paper focusing an intellectual traffic control system to allow the vehicle efficiently. Each unique vehicle is equipped with inimitable radio frequency identification (RFID) tag placed at a designed position, which is unfeasible to demolish. Using an RFID Reader FX7500 and FTDI FT90on-chip-system, it evaluates number of vehicles that passes on scrupulous path during a precise duration. It also concludes the traffic congestion and hence the green light duration for that path. If the RFID-tag-read belongs to the stolen vehicle then the message is sent using GSM SIM300 to the police control room, simultaneously it fasten the stolen vehicle by switching ON the circuit breaker by which the vehicle become immobile. In addition, when an emergency vehicle is approaching the junction, it will communicate to the traffic controller that to turn ON the green light. This module comprises of ZigBee modules like CC2500 and FTDI FT90on-chip system for wireless communication between the emergency vehicle and traffic controller. The archetypesexperienced under different combination of inputs in our wireless communication laboratory and test results were found as good as conventional system.

Keywords—ZigBee, CC2500, GSM, SIM300, FTDI FT90, Emergency vehicle, Circuit breaker

1. INTRODUCTION

India is the second largest populated Country in the World and having major traffic congestion in some of the cities. Growth in number of vehicles is faster when compared to the infrastructure growth, due to space and price constraints [1]. Also, Indian traffic is based on non-lane and hectic. It desires a traffic control solutions, which are diverse from the developed Countries for that Smart management of traffic flows can shrink the negative blow of congestion in recent years[2]. Numerous technologies can be used in traffic control to provide cost effective solutions like Zigbee, RFID and GSM. Among this RFID is one of the wireless technology that utilize radio frequency for transmitting the information between the RFID tag and RFID reader. Some RFID systems will only work within the ranges inches or centimeters, while others may work for 600 meters (1200 feet) or more. Then the ZigBee can operate at low-power and it can be used at all the levels of work configurations to execute allocated 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 communication rates ranging from 20 Kilobits/second in the 868 MHz frequency band to 250 Kilobits/second in the 2.4 GHz frequency band [3], [4]. The Zigbee utilize 11 channels in case of 868/915 MHz radio frequency and 16 channels in case of 2.4 GHz radio

2. RELATED WORK

In India Traffic congestion is a major problem that happens in the cities. Escalation in metropolitan population and the middle-class fragment contribute notably to the mounting number of vehicles in the cities. So, Congestion on roads are eventually results sluggish in traffic, which increases the travelling time, thus stands-out as one of the chief concerns in metropolitan cities[6]. In [7], the author has proposed a green flourish system by which it provides consent to any emergency vehicle by switching the green light ON for the path of the emergency vehicle. Consequently it ensures the absolute green wave to the preferred vehicle. A ‘green wave’ is the harmonization of the green segment in the traffic signals. With a ‘green wave’ setup a vehicle ephemeral through a green signal will prolong to receive green signals as it travels behind the road. In accumulation to the green wave path, the system will track a stolen vehicle when it passes through a traffic signal. Because of the system GPS inside the vehicle does not require supplementary power. The biggest drawback of green waves is that, when the wave is troubled, the disturbance can cause traffic troubles that can be made worse by the harmonization. In such cases, the line of vehicles in a green wave grows in size awaiting it becomes too large and some of the vehicles cannot reach the green lights in time. This is called over-saturation [8], [9]. In [10], the use of RFID traffic control to avoid troubles begin with standard traffic control systems, mostly those are related to image processing and beam interlude procedures are discussed. These RFID techniques are used in multivehicle, multilane, multi road junction area. It provides are sourceful time management scheme, in which, a energetic time program is worked out in real time for the route of each traffic column. The real-time function of the system emulates the decision of a traffic policeman on task. When number of vehicles in each column and the routing are properties, in which the calculations and the conclusions are done. The main drawback of this work is that it does not discuss the method which is used for communication between the emergency vehicle and the traffic signal controller. In [11], it
projected a RFID and GPS based automatic lane consent system for ambulance. The heart of this work is to reduce the delay in arrival of ambulance at the hospital by automatically clearing the lane in which the ambulance is travelling. This can be achieved by turning ON the green light when the ambulance is at certain position from traffic junction. The use of RFID diverge between the emergency and non-emergency case, this will prevents the needless jamming. The communication between the ambulance and traffic signal post is done through the transceivers and GPS. This system is fully programmed and requires no human intervention at the traffic junctions. The main disadvantage of this system is it needs all the information about the preliminary tip, end point of the travel. It may not work, if the ambulance desires to take another path for some reasons or if the starting point is not known in advance. This Traffic is a harsh concern of transportation system in most of all the cities of Countries. This is especially factual for Countries like India and China, where the inhabitants is mounting at higher rate as shown in figure 1. For illustration, Chennai city has witnessed inunusualenlargement of vehicle population in recent years. As a result, many arterial roads and intersections are operating over the capacity (i.e., v/c is more than 1) and average journey speeds on some of the key roads in the central areas are lower than 10 Km/h at the peak hour. In [12], some of the main challenges are management roads in the central areas are lower than 10 Km/h at the peak hour. In [12], some of the main challenges are management

3. PROPOSED WORK

From the present scenario, it can be seen that the conventional systems are inadequate to handle the problem of Traffic control, the emergency vehicle clearance and stolen vehicle detection, etc. To react these troubles, we implement our Intelligent Traffic Control System. It consists of three ingredients. First part contains automatic signal control system. Here, every vehicle is equipped with an RFID tag. When it approaches in the range of RFID reader, it will send the forewarning sign to the RFID reader. In such case RFID reader will track how many vehicles have passed throughout for a definite period and change the congestion volume. Consequently, it will set the green light duration for that path. Second part is for the emergency vehicle clearance. Here, each emergency vehicle which includes ZigBee transmitter module and the ZigBee receiver will be implemented at the traffic signal. The buzzer will be switched ON when the vehicle is used for emergency reasons. This will send the signal through the ZigBee transmitter to the ZigBee receiver. Then the Traffic light will be changed to green. Once the ambulance passes from beginning to end, the receiver no longer receives the ZigBee signal and the traffic light is turned to red. The third part is responsible for stolen vehicle detection. Here, when the RFID reader reads the RFID tag, it compares it to the list of stolen RFIDs Tags. If a match is found, it sends SMSto the police control room and turn ON the circuit breaker to padlock the specified lane it will trounce the previous difficulties in the traffic junction then the local police can take suitable action. List of apparatus used in the experiment are CC2500RF module, Microchip, RFID Reader–2.1GhzTTL and SIM300 GSM module. Figure 4 shows the pin diagrams (or pictures) of components used.

A. ZigBee Module CC2500

The CC2500 is a RF module and has transceiver, which provides an easy way to use RF communication at 2.4 GHz. Every CC2500 is equipped with the microcontroller (PIC 16F877A), which contains Unique Identification Number (UIN). This UIN is based on the registration number of the vehicle. One of the most important features is serial communication without any extra hardware and no extra coding. Hence, it is a transceiver as it provides communication in both directions, but it travels only one direction. The microcontroller and CC2500 always communicate with the microcontroller via serial communication. Rx pin of CC2500 is connected to Tx (RC6) of microcontroller and TX pin of CC2500 is connected to Rx pin of microcontroller (RC7). Other two pins are used to energize transceiver. It is used to transmit and receive the data at 9600 baud rate. Figure 4.1.a shows the image of transceiver. Here, we uses CC2500 ZigBee module and it has transmission range of 30 meters.

B. Microcontroller (FTDI FT90)

FTDI FT90x 32-Bit Embedded Microcontrollers are developed for high-speed, interface bridging tasks and offer excellent interconnect capabilities with fast data rates. The FT90 have a parallel camera input, 10/100 Base-TX Ethernet interface, CAN bus, USB2.0 hi-speed peripheral and host ports. The FT90 FT32 processor core operates at
3.1DMIPS/MHz and with a Zero Wait States (OWS) up to 100MHz. The MCU features a unique data streaming domain that eliminates the need for complex direct memory access (DMA) interfacing to transfer data internally. This will provide a highly deterministic processing.

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. The GSM modem supports an “extended AT command set” for sending/receiving SMS messages. GSM modems are 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 in the frequencies of 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 (GSM07.07, 07.05 and enhanced AT commands). It uses AC – DC power adaptor with following ratings DC Voltage: 12V/1A.

D. RFID Reader—2.1Ghz

RFID belongs to a group of technologies referred to as Automatic Identification and Data Capture (AIDC). AIDC methods automatically identify objects and sent to the server, RFID systems consist of three components. The FX7500 comes in a sleek, attractive form factor with a low profile and compact footprint. But it also looks good on the balance sheet, with an impressive array of features and functionality that pack value for your business class applications. An integrated optically isolated General Purpose Input/output (GPIO) interface means there’s no need to purchase, install and manage additional hardware. The ability to host productivity-enhancing, third-party software tools, like Microsoft BizTalk and IBM’s Web Sphere, makes it easy to support your business operations. Available two or four mono static port option adds deployment flexibility so you can purchase only the readers you need, no more, no less. In short, building on the FX7500 lets you protect your RFID investment and achieve a lower total cost of ownership.

E. Circuit Breaker

The basic function of circuit breaker is to detect a fault condition and interrupt the current flow. Unlike fuse it operates once and then must be replaced, a circuit breaker can be reset (either manually or automatically) a circuit breaker can make in varying sizes. From small device which protect individual application up to large switch gear designed to protect. All circuit breakers systems have common features in their operation although details vary substantially depending on the voltage class and type of circuit breakers, operates the trip open mechanism. Once the fault detected the circuit breakers contact must open to interrupt circuit and the circuit breakers will withstand the heat when it interrupts.

4. WORKING MODULE

A. Automatic Signal Control System

In this module, passive RFID tags and RFID reader has been used with frequency range of 2.1GHz. When the vehicle enters in the range of the receiver it will convey the sole to the RFID reader. The RFID reader will count the RFID tags by using Microcontroller in 2 minutes. For testing purpose, if the count is more than 15, the green light duration is set to 20 seconds, if count is between 9 and 12, the green light duration is set to 10 seconds. If the count is less than 5, the green light duration is set to 7 seconds. The red light duration will be for 10 seconds and orange light duration will be for 2 seconds Figure 5.a shows the implementation for automatic signal control.

B. Stolen Vehicle Detection System

In this module, for testing function when matching the unique RFID tag read by the RFID reader to the stolen vehicles RFID tags stored in the systems if match is found. Also an SMS is sent specifying the RFID number by using SIM300 GSM module. The LCD display will indicate that stolen vehicle is present here.

C. Emergency Vehicle Clearance System

Two modules have been incorporated in the system, first module which is ZigBee transmitter is placed in the emergency vehicle. When the Switch is pressed, it will conduct the signal that contains exceptional id and security code. The transmitter contains FTDI FT90 microcontroller and ZigBee component. The microcontroller directs the commands and data to the ZigBee via serial communication. Second module is the receiver, which is placed at traffic extremity. It also contains FTDI FT90 microcontroller and
ZigBee module which shows in figure 5.b. The receiver relates the security code which is received with the security code present in its databank. If it matches, then it will turn the green light ON. For analyzing purpose, we used minor range RFID reader in our Archetype. Initially, the receiver part is turned on. The red and green signal will be on for 10 seconds interval and orange light will be on for 2 seconds interval one after the other. In second case, we bring the RFID of stolen vehicle into the Range of RFID readers. Then the signal will turn to red for period of 30 seconds and a SMS is received. In next phase we bring 12 RFIDs near the range of RFID reader, and then the green light period will change to 30 seconds. In last case, we transport 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 as shown in module 2. Figure 4 shows the images of different components and highlighted features of the suggested work. In the default condition, red and green light will set for 10 seconds. The time duration will be varied according to the traffic conditions, pinched vehicle, and emergency vehicle it transmits ZigBee signal uninterruptedly. The stolen vehicle RFID number should be rationalized in the database. If stolen vehicle is found, then it will instantly turn on circuit breaker. It sends instantly a message to official person.

5. RESULTS AND DISCUSSION

The outcome of the work is discussed as follows. Figure 6.a shows the implementation for automatic signal control and stolen vehicle detection system in the traffic junction. Figure 6.b shows the transmitter part is placed in the ambulance. Figure 6.c shows the LCD display status at different conditions in that figure one is normal aggregation image (traffic signal running as per the default time period) and another one is LCD display position, when an ambulance approaching near to junction Figure 6.d shows the position updated at the time of pinched vehicle is found. Figure 6.e shows the working mode of the projected work.
6. CONCLUSION

With automatic traffic signal control based on the traffic density in the route, then the manual effort on the part of the traffic policeman is saved. As the entire system is automated, it requires very less human intervention. In stolen vehicle detection, it automatically robs the vehicle by transient the command from the receiver, so that the police officer can take proper action, if he/she is present at the junction. Also SMS will be sent so that they can hold the crook easily. Emergency vehicles like ambulance, fire trucks, will reach their targets easily with less time. If they splurge a lot of time in traffic jams, valuable lives of many people may be in threat. With emergency vehicle clearance, the traffic signal turns to green as long as the emergency vehicle is coming up in the traffic junction. The signal turns to red, after the emergency vehicle passes through the junction. Further enrichment can be done to the archetype by testing it with longer range RFID readers. Also GPS can be placed into the stolen vehicle detection module, so that the exact location of stolen vehicle is recognized. At present, we have implemented the system by considering one road of the traffic junction and to discover the stolen automobile without troubles. It can be improved by extending to all the roads in a multi-road junction.

REFERENCES


Fig. 6. Proposed model images transmitter and receiver. (a) When stolen vehicle is detected (b) Traffic control module (c) Emergency vehicle controller display. (d) Circuit breaker. (e) Total working module