International Journal of Modern Electronics and Communication Engineering (IJMECE) ISSN: 2321-2152
Volume No.-7, Issue No.-1, January, 2019

Automatic Traffic Light Control System and Stolen Vehicle Detection

A.Vijayalakshmi
Associate professor, Department of ECE
Sri Manakula Vinayagar Engineering College
Puducherry,India
E-mail: vijilakshan@gmail.com

Dr. L. M. Varalakshmi
Professor,Department of ECE
Sri Manakula Vinayagar Engineering College
Puducherry,India.
E-mail: varalakshmi@smvec.ac.in

C.Anusha
B.Tech, Department of ECE
Sri Manakula Vinayagar Engineering College
Puducherry,India
E-mail: anushacoumaran@gmail.com

Abstract-- The vehicle theft and the accidents due to the traffic density is increasing now-a-days. This proposed system controls the traffic density and detects the stolen vehicle. This system is also used to avoid the crowding of vehicles; preference is given to ambulance and detection of stolen vehicle. Each transport vehicle is furnished with Radio Frequency Identification Tag (RFID) to ascertain the aggregation of vehicles. IR Sensor is used to detect the density of traffic in the junction. Based on the count of vehicles, if the traffic density had inflated and detected by IR sensor, a green light is turned on and vehicles passed conventionally. If a RFID reader reads a tag of an ambulance, the signal is turned to green immediately. If a RFID reader reads a tag of a stolen vehicle, immediately a message is sent to police control room using GSM. When stolen vehicle is detected in the traffic signal automatically the signal lights turned to red color and shares the location to the police.

Keywords: RFID, IR Sensor, GSM, ambulance, stolen vehicle

I. INTRODUCTION

Researchers over the world are engaged in exploring different technologies to detect traffic congestion and making congestion management more efficient. There are a variety of technologies that are being used to detect the congestion of traffic. Most popular technology is the inductive loop system, the simplest detectors that count the number of vehicles during a unit of time. Using Airborne Camera and the image processing technology, GPS devices and webcam, Radar technology etc. congestion can also be detected. But these technologies have several drawbacks, such as installation problems and cost. The main causes for traffic congestion are the rapid increase in population, lack in awareness of traffic rules by the general public, no strict implementation of rules, etc.

Congestion in traffic is a serious problem nowadays. From city roads to highways, a lot of traffic problems occur everywhere in today's world. These frequent traffic problems have led to the rise of the need for an efficient traffic management method. Radio Frequency Identification (RFID) is emerging technology. Vehicle detection and counting can be done effectively using RFID technology [4]. There is a wide range of sensor technologies available for vehicle detection. One of the flexible types of sensors is the IR sensor.

II. RELATED WORKS

The traffic light control plays a vital role in any intelligent traffic management system. The green light sequence and green light duration are the two key aspects to be considered in traffic light control [7], [9]. In many countries, most traffic light structures fixed sequences and light length duration. Fixed control methods are however only suitable for stable and regular traffic, but not for dynamic traffic situations. Looking at the present state of practice, the green light sequence is determined without taking the possible presence of emergency vehicles into account. The vehicle tracking and locking system installed in the vehicle is used to track the place [1]. The place of the vehicle is identified using Global Positioning System (GPS) and Global System Mobile communication (GSM). These systems constantly watch a moving vehicle and report the status on demand [2].

Current traffic control techniques involving magnetic loop detectors buried inside the road, infra-red and radar sensors on the side provide limited traffic information and require separate systems for traffic counting and for traffic surveillance [3]. Bluetooth network architecture is proposed in order to monitor vehicular traffic flows near to a traffic light [5]. The proposed architecture is characterized by a novel algorithm in order to determine green times and phase sequences of traffic lights, based on measured values of traffic flows [8], [9].

Ambulance vehicles will be detected by using its unique license plate number and it will be transmitted using ZigBee to the traffic controller system and signal will be altered. If the stolen vehicle's number is identified it will send the information to the police control unit [5]. An increased volume of vehicles not only increases the response times of emergency vehicles, but it also increases the chances for them being involved in accidents. Vehicular traffic is endlessly increasing everywhere in the world and can cause terrible traffic congestion at intersections [6].

Most of the traffic lights today feature a fixed green light sequence; the green light sequence is determined without taking the presence of the emergency vehicles into account [10]. Therefore, emergency vehicles such as ambulances, police cars, fire engines, etc. stuck in a traffic jam and delayed in reaching their destination can lead to loss of property and valuable lives.

III. PROPOSED SYSTEM

The developed system consists of three modules. First module contains automatic signal control system. The Time period of green light and red light is assigned on the basis of the density of the traffic present at that time. This can be done by using IR sensors. Once the density is calculated, the glowing time of green light is assigned by the microcontroller. The sensors which are present on either sides of the road detect the presence of the vehicles and send the information to the microcontroller. On the basis of that information, micro-controller will decide the glowing time of green light and red light. It means that the timing of the traffic lights is set according to the density of the vehicles.

Second module is for the emergency vehicle clearance. Here, each emergency vehicle contains RF transmitter module and the RF receiver will be implemented at the traffic junction. The buzzer will be switched ON when the vehicle is used for emergency purpose. This will send the signal through the RF transmitter to RF receiver. It will make the traffic light to change to green. Once the ambulance passed through, the receiver no longer receives the RF signal and the traffic light is turned to red.

The third module is responsible for stolen vehicle detection. Here, when the RFID reader reads the RFID tag, it compares it to the list of stolen RFIDs. If a match is found, it sends SMS 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 the police can take appropriate action.

BLOCK DIAGRAM OF PROPOSED SYSTEM

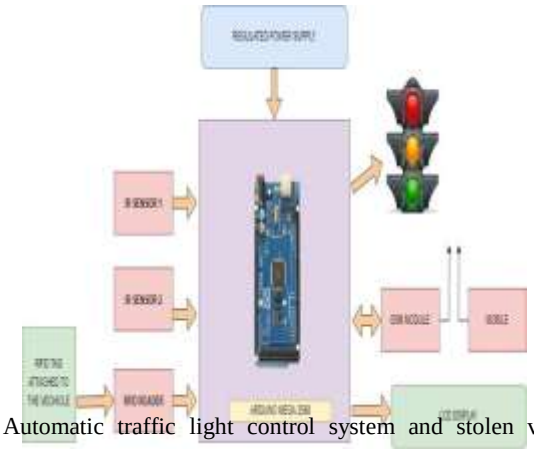

Fig. 1 Automatic traffic light control system and stolen vehicle detection

In Fig.1, two IR sensors are used to measure the traffic density. With the logic 1 or 0, it shows the traffic high or low. In traffic high condition, the green signal duration is made high. Similarly in traffic low condition, the duration of green signal is reduced. Here we use RFID TAG and READER, if RFID TAG cross the RFID reader path, using the Arduino mega 2560, the traffic light of particular path is made green. In stolen vehicle detection , when a theft vehicle's tag crosses the path, the reader reads the tag, then the information of the particular vehicle is send to control room using GSM SIM800.

A. Arduino Mega 2560

The Arduino Mega 2560 is a microcontroller board based on the ATmega2560. It has 54 digital input/output pins (of which 14 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC to DC adapter or battery to get started.

B. RFID Reader

Reader, as a scanning device, detects the tags that attached to or embedded in the selected items. It varies in size, weight and may be stationary or mobile. Reader communicates with the tag through the reader antenna, which broadcasting radio waves and receiving the tags response signals within its reading area. After the signals from tags are detected, reader decodes them and passes the information to middleware. The reader for a read/write tag is often called an interrogator. Unlike the reader for a read-only tag, the interrogator uses command pulses to communicate with a tag for reading and writing data. RFID reader sends a pulse of radio energy to the tag and listens for the tag's response.

The tag detects this energy and sends back the response that contains the tag‘s serial number and possibly other information as well. Historically, RFID readers were designed to read only a particular kind of tag, but so-called multimode readers that can read many different kinds of tags are becoming increasingly popular.

C. GSM 800L

SIM 800l is a complete quad-band GSM/GPRS solution in a SMT which can be embedded in the customer application. SIM800 support quad- band 850/900/1800/1900 MHZ, it can transmit voice, SMS and data information with low power consumption. With tiny size, it can fit into slim and compact demands of customer design. Featuring Bluetooth and Embedded AT, it allows total cost saving and fast time-to-market for customer application**.**SIM800 is designed with power saving technique so that current consumption is as low as 1.2 mA in sleep mode. SIM800 integrates TCP/IP protocol and extended TCP/IP AT commands which are very useful fir data transfer application.

D. IR Sensor

The amplitude response of infrared (IR) sensors based on reflected amplitude of the surrounding objects is non-linear and depends on the reflectance characteristics of the object surface. As a result, the main use of IR sensors in robotics is for obstacle avoidance. Nevertheless, their inherently fast response is very attractive for enhancing the real-time operation of a mobile robot in, for instance, map building tasks. Thus, it seems that the development of new low-cost IR sensors able to accurately measure distances with reduced response times is worth researching. IR sensor based on the light intensity back-scattered from objects and able to measure distances of up to 1 m is described. Also, the sensor model is described and the expected errors in distance estimates are analyzed and modelled.

IV. WORKING MODEL

A. Module I - Traffic control system

Fig. 2 Block diagram for Traffic control system

Fig.2 shows traffic light control system in which IR sensors are used to measure traffic density. If logic 1 is received from any of the sensor it means that the traffic is low. If logic 1 is received from both the sensors it means that the traffic is high. In traffic high condition, the duration of green light is made higher than the duration of green light in the traffic low condition.

B. Module II – Emergency vehicle clearance

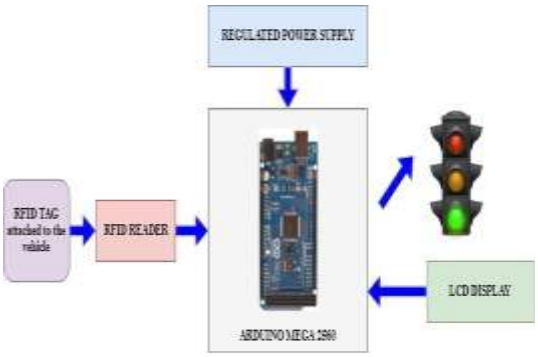

Fig. 3 Block diagram for Emergency Vehicle Clearance

In emergency ambulance clearance as shown in fig.3, RFID TAG and RFID Reader are used. When an emergency vehicle crosses the path the ID in the RFID TAG positioned at the vehicle is been detected by the RFID Reader. The ARDUINO Controller controls the traffic light. The traffic light changes to green signal until the ambulance passes by. Thus the emergency vehicle can pass the junction without any delay.

C. Module III – Stolen Vehicle Detection

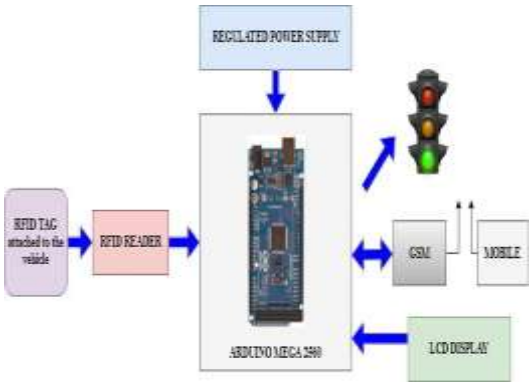

Fig. 4 Block diagram for Stolen Vehicle Detection

In stolen vehicle detection module shown in fig.4 RFID reader, RFID tags, GSM SIM800 are used. The intimation about the stolen vehicle is given to the control room. When the vehicle passes that path the RFID tag which is present in that particular vehicle is sensed by the RFID reader connected to

the ARDUINO controller. This information about the stolen vehicle is sent by GSM SIM800 to the control room via SMS.

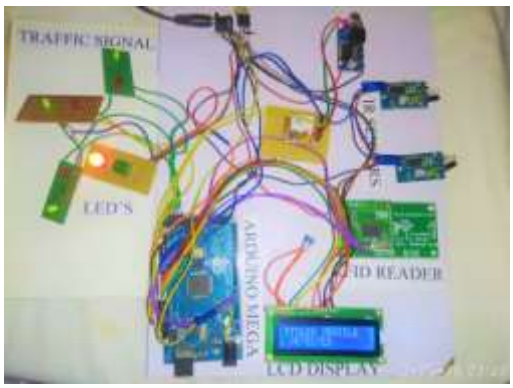

Fig. 5 Hardware implementation of Traffic control system

Thus the stolen vehicle can be easily tracked and identified for further action.Fig.5 shows the hardware implementation of the proposed Automatic traffic light management system.

V. CONCLUSION

With automatic traffic signal control based on the traffic density in the route, the manual effort by the traffic policeman is reduced. With stolen vehicle detection, the signal automatically turns to red, so that the police officer can take appropriate action. Also SMS will be sent so that they can prepare to catch the stolen vehicle at the next possible junctions. Emergency vehicles like ambulance, fire trucks, etc. reach their destinations at the earliest. Thus the proposed density based control of traffic light system saves considerable amount of time and also prevent the excessive traffic jams, leading to smooth traffic management system.

REFERENCES

[1] Gargi Beri, Pankaj Ganjare, Amruta Gate, Ashwin Channawar, Vijay Gaikwad, 'Intelligent Ambulance with Traffic Control', International Journal of Electrical, Electronics and Computer Systems, vol.4, Issue 2, 2016

[2] Andrew Phan and Frank P. Ferrie, 'Interpolating Sparse GPS Measurements Via Relaxation Labeling and Belief Propagation for the Redeployment of Ambulances', IEEE Trans. Intelligent Transport System, vol.12, no.4, 2016

[3] Devika M D, 'Intelligent Traffic Management for Ambulance and VIP Vehicles', International Journal of Innovative Research in Science, Engineering and Technology, vol.5, Issue 8, 2016

[4] Papa Rao Nalajala, Rotala Umarani, Naroju Mounika, 'Design of intelligent road traffic control system for ambulance using RF and GSM technology', International Journal of Advanced Trends in Computer Science and Engineering, vol.5, no1, 2016

[5] Rajeshwari Sundar, Santhosh Hebbar, and Varaprasad Golla, 'Implementing Intelligent Traffic Control System for Congestion Control, Ambulance Clearance, and Stolen Vehicle Detection', IEEE Sensors Journal, vol.15, 2015

[6] Swarup Kulkarni and Dr.Roshani Ade, 'Smart Driving of a Vehicle Using Model Predictive Control for Improving Traffic Flow', IEEE Trans. Intelligent Transport System, vol.15, no.2, 2014

[7] B. Pavitra, B Santosh Kumar, 'An Implementation of Green Wave System for Emergency and Stolen Vehicles', International Journal of Engineering Trends and Technology, vol.16, no.3, 2014

[8] Mario Collota, Antonio Messineo, Giuseppina Nicolosi, Giovanni Pau, 'A Self Powered Bluetooth Network for Intelligent Traffic Light Junction Management', WSEAS Transactions on Information Science and Applications, vol.11, 2014

[9] Naroju Mounika, Mittal.A.K and Bhandari.D, 'A novel approach to implement green wave system and detection of stolen vehicles', Advance Computing Conference (IACC), 2013 IEEE 3rd International conference, 2013

[10] Sarika B. Kale, Gajanan P. Dhok, 'Design of Intelligent Ambulance and Traffic Control', International Journal of Innovative Technology and Exploring Engineering (IJITEE), vol.2, Issue- 5, 2013.

AUTHOR'S BIOGRAPHIES

A.Vijayalakshmi received her B. E. degree in Electronics and Communication Engineering from Madras University during 1998. She got Master's Degree in ECE from Pondicherry University. She has submitted thesis in the area of Wireless Sensor Networks at Sri Chandrasekharendra Saraswathi Viswa Mahavidyalaya University, Kanchipuram. She is presently working as Associate Professor in the Department of Electronics and Communication Engineering at Sri ManakulaVinayagar Engineering College, Puducherry. She has 19 years of teaching experience. She has published fifteen papers in international journals and presented many papers in national and international conferences. Her area of interest includes Wireless Communication, Network security, collaborative mobile agents and information processing. She is a life member of ISTE.

Dr.L.M.Varalakshmi is currently working as Professor in the Department of Electronics and Communication Engineering at Sri Manakula Vinayagar Engineering college affiliated to Pondicherry University, Puducherry, India. She has completed her B.E. in Electronics and Communication Engineering from Thiagarajar College of Engineering, Madurai and M.Tech. in Electronics and Communication Engineering and Ph.D from Pondicherry Engineering College, Puducherry. She has more than 20 years of experience in teaching in engineering colleges. Her Research interests include Cryptography and Multimedia security. She is a life member of ISTE.