ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

Smart Traffic Control System for Emergency Vehicle Clearance

D.Aswani
Student,
Department of ECE,
Priyadarshini Institute of Technology,
Ramachandrapuram,
Tirupati, A.P., India.

C. Padma, (Ph.D)
Assistant Professor,
Department of ECE,
Priyadarshini Institute of Technology,
Ramachandrapuram,
Tirupati, A.P., India.

ABSTRACT:

Traffic congestion is major problem in cities of developing countries like India. The aim of this project is to pass emergency vehicles like VIP Vehicles, ambulances, fire trucks to their destinations at the earliest by using intelligent traffic control system. Meanwhile we can detect stolen vehicles by using this control system. Here we have implemented system by extending to all the roads in a multi-road junction. In this systemeach individual vehicle is equipped with special radio frequency identification (RFID)tag (placed at a strategic location), which makes it impossible toremove or destroy. We use RFID reader, NSK EDK-125–TTL, LPC2148 A system-on-chip to read the RFID tags attachedto the vehicle. It counts number of vehicles that passes on aparticular path during a specified duration. Depends upon the density of vehicles on the particular junction, the traffic signals will vary. In this project, RFID tags are the vehicles and the Reader which is at Traffic control room, receives the data when the vehicle is stolen and the GSM will Send the Message to the concern authority so that, the alert section is active. We can track the stolen vehicle by using this system.

In addition, when an ambulance is approaching the junction, itwill communicate to the traffic controller in the junction to turnON the green light and we can allocate the easiest way to the ambulances and emergency vehicles by using this RF communication. This module uses ZigBee modules on CC2500 and LPC2148 system-on-chip for wireless communications between the ambulance and traffic controller.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.

I.INTRODUCTION

Now a days we find many vehicles crossing the signals and the theft of vehicles, as well the ambulance struck in traffic. The ambulance in traffic is a major issue; it's difficult to approach the hospitals or the accident area. In this project, RFID tags are the vehicles and the Reader which is at Traffic control room, receives the data when the vehicle is stolen and the GSM will Send the Message to the concern authority so that, the alert section is active. Here MCU is the heart of the project and is present at the traffic junction and all the modules are interfaced to the controller.

GSM is responsible for the message sending. The Ambulance section is also included in it. If the RF Tx is fixed in the ambulance, the ambulance will give the signal to the transmitter and will give information wirelessly to the junction traffic lights to go green from RED Through the RF Technology. Such that the ambulance way gets cleared.

The traffic signal indication continuously glows to green as long as the emergency vehicle is waiting at the traffic lane.After the vehicle crossed the junction, automatically the traffic signals follow the previous pattern generation of traffic signals. Here stolen vehicle information is also sent through the GSM modem. The most effective application here is the congestion control, the number of vehicles on road will be calculated the RFID reader, as the vehicles are the TAGS. Where the vehicles density is very high the

ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

signal would go green from RED. This will be given for the single side of the junction.

II. EXISTING SYSTEM

Traffic is a critical issue of transportation system in most of all the cities of Countries. This is especially true for Countries like India and China, where the population is increasing at higher rate. For example, Bangalore city, has witnessed a phenomenal growth in vehicle population in recent years. As a result, many of the 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.

Some of the main challenges are management of more than 36,00,000 vehicles, annual growth of 7–10% in traffic, roads operating at higher capacity ranging from 1 to 4, travel speed less than 10 Km/h at some central areas in peak hours, insufficient or no parking space for vehicles, limited number of policemen. Currently video traffic surveillance and monitoring system commissioned in Bangalore city. It involves a manual analysis of data by the traffic management team to determine the traffic light duration in each of the junction. It will communicate the same to the local police officers for the necessary actions.

Fig 1: Traffic signals

Traffic Signal Controllers are the electronic equipment kept at the junction to control duration of traffic signals. The controllers are designed using microprocessor based control circuits, and can be operated in any one of the following modes e.g. Fixed Time mode, Demand Actuated Mode, Forced Flash Mode etc .Now the new existing system limited to only one road of the traffic junction. In this project we have extended to multi road junction.

DISADVANTAGES OF EXISTING SYSTEM:

In the existing system it involves the manual effort to control the traffic systems. The normal traffic signals systems increase the time of travel, thus be notable as one of the major issues in metropolitan cities. Emergency vehicles like ambulance and fire trucks need to reach their destinations as the earliest. If they spend lot of time in the traffic jams, valued lives of many people may be in danger.

- Present system is completely a static case
- Vehicles must wait at the intersection for a predefined time until microcontroller switches green light for that lane.
- Exists no process of preemption.
- No green light service for priority based vehicles.
- No alarm/call for emergency
- No V2V Communication

From the past decades, management of traffic has been one of the biggest issues of modernization. Researchers have followed a long way to overcome the traffic crises. Right from the very beginning of “Manual Traffic Control” in which man power was required to control the traffic. Depending on countries and states the traffic polices are allotted to different areas to control traffic. These men carry sign board, sign light and whistle to control the traffic. They are instructed to wear specific uniforms in order to be easily identified by the drivers. After this came the traditional “Vehicle Actuated Control System” in which, lights are loaded with constant numerical value in the form of timers. The lights are automatically getting ON and OFF depending on timer value changes. The main disadvantage is that the algorithm for this control system does not change the green signal even if the traffic has already passed until the counter is complete, while not taking into account the number of vehicles waiting at red. Hence the density of the traffic does not matter.

ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

III. PROPOSED SYSTEM

This system is designed to overcome the disadvantages in the existing system. Now we are extending the existing system to the Multi-road junction. Here it contains four ways named as way1, way2, way3, way4. 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 Smart Traffic Control System.

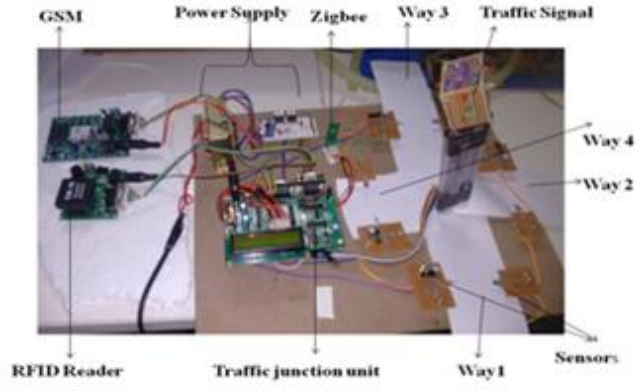


Fig 2: Proposed system

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 reads the RFID tags which having the information of the vehicle and IR Sensors will count the number of vehicles in that particular way. This pattern is applied to remaining ways. For example If the density of vehicles(RFID tags) are more in the way1 junction compare to the remaining ways then the green light duration will more at that particular junction. Here the functioning of traffic signal is based on the density of vehicles at selective ways. Here RFID Reader is at control section and RFID Tags are at vehicle section.

Fig 3: Showing High density way On LCD

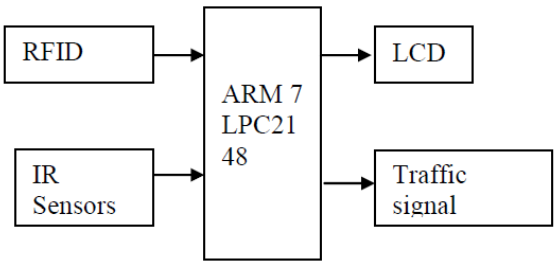


Fig 4: automatic signal control system

Stolen Vehicle Detection system

In this module, for testing purpose, we compare the unique RFID tag read by the RFID reader to the stolen RFIDs stored in the system. If a match is found, an SMS is sent specifying the RFID number by using SIM300 GSM module. The LCD display will indicate that INVALID VEHICLE as shown in below figure.

Fig 5: INVALID vehicle detection

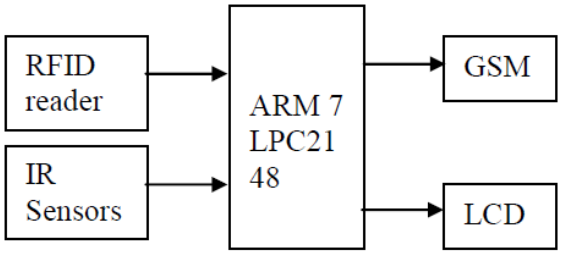


Fig 6: stolen vehicle detection system

Emergency Vehicle Clearance System

In this module, there are 2 parts; first part which is RF transmitter is placed in the emergency vehicle. When it comes into the RF range, it will transmit the signal.

ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

The signal contains the way that ambulance or any emergency vehicle selects. The transmitter contains LPC2148 microcontroller and ZigBee module. The microcontroller sends the commands and data to the ZigBee via serial communication. Second part is the receiver, which is placed at control unit.

It also contains LPC2148 microcontroller and ZigBee module. Here GSM send the message to the authorised number located at receiver section. This Message contains the information about the ambulance "WAY SELECTION". Based on that traffic signals will change. If the ambulance selects the way1 then the red light at way1 will change to green light until the ambulance exist from that way. It follows the same pattern for all ways. We can observe all messages like way selection and way exit **on LCD display.**

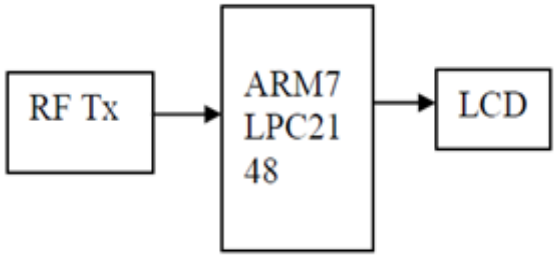


Fig 7: Emergency Vehicle section

Fig 8: LCD showing the way selection

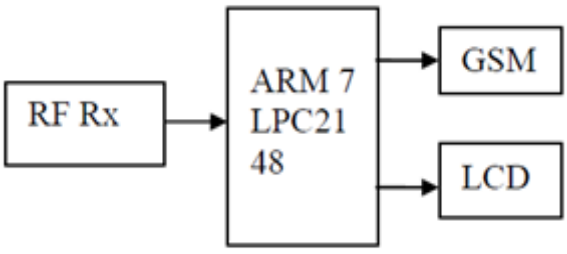


Fig 9: Control unit section

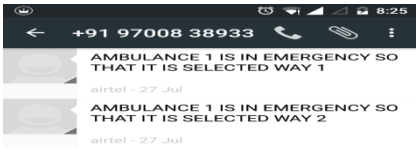
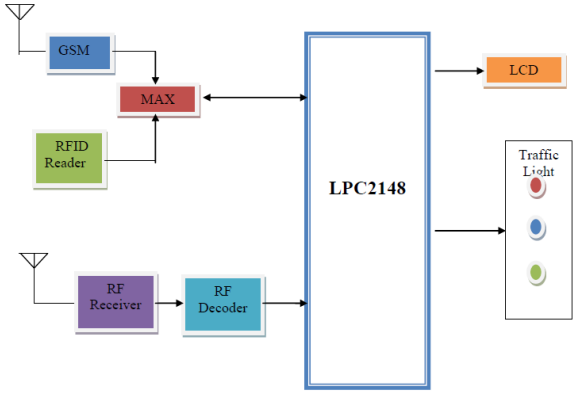


Fig 10: Received SMS

III. BLOCK DIAGRAM AND HARDWARES

Traffic Junction Unit:



Vehicles--→ RFID Cards

Ambulance Section:

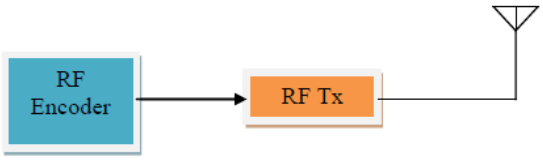


Fig 11: Block Diagram of the project

LPC2148 CONTROLLER

ARM7 LPC2148 is ARM7TDMI-S Core Board Microcontroller that uses 16/32-Bit 64 Pin (LQFP) Microcontroller No.LPC2148 from Philips (NXP). All resources inside LPC2148 is quite perfect, so it is the most suitable to learn and study because if user can learn and understand the applications of all resources inside MCU well, it makes user can modify, apply and develop many excellent applications in the future. Because Hardware system of LPC2148 includes the necessary devices within only one MCU such as USB, ADC, DAC, Timer/Counter, PWM, Capture, I2C, SPI, UART, and etc.

The LPC2141/42/44/46/48 microcontrollers are based on a 16-bit/32-bit ARM7TDMI-CPU with real-time

ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

emulation and embedded trace support, that combine microcontroller with embedded high speed flash memory ranging from 32 kB to 512 kB. A 128-bit wide memory interface and unique accelerator architecture enable 32-bit code execution at the maximum clock rate. For critical code size applications, the alternative 16-bit Thumb mode reduces code by more than 30 % with minimal performance penalty. Due to their tiny size and low power consumption, LPC2141/42/44/46/48 are ideal for applications where miniaturization is a key requirement, such as access control and point-of-sale.

Serial communications interfaces ranging from a USB 2.0 Full-speed device, multiple UARTs, SPI, SSP to I2C-bus and on-chip SRAM of 8 kB up to 40 kB, make these devices very well suited for communication gateways and protocol converters, soft modems, voice recognition and low end imaging, providing both large buffer size and high processing power. Various 32-bit timers, single or dual 10-bit ADC(s), 10-bit DAC, PWM channels and 45 fast GPIO lines with up to nine edge or level sensitive external interrupt pins make these microcontrollers suitable for industrial control and medical systems.

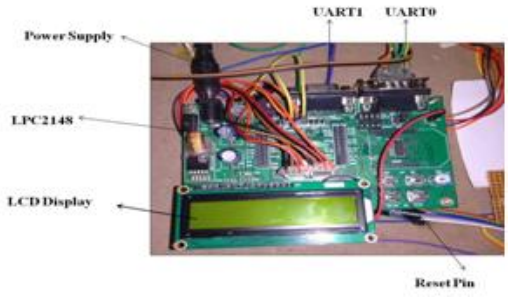


Fig 12: LPC2148 Board

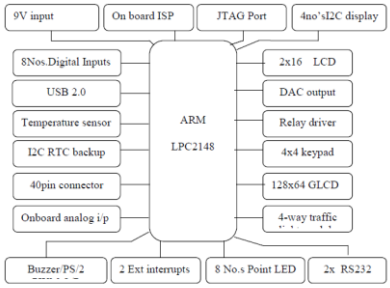


Fig4.3: General block diagram of ARM7 LPC2148

GSM MODEM

Fig 13: GSM Modem

It is a globally accepted standard for digital cellular communication. GSM is the name of standardization group established in 1982 to create a common European mobile telephone standard that would formulate specifications for a pan-European mobile cellular radio system operating at 900MHZ. Presently GSM supports more than one billion mobile subscribers in more than 210 countries throughout the world. The GSM commercial modem is an approved modem for embedded applications. It provides a 5v TTL compatible serial interface to host data terminal equipment. Call control is provided by using the Hayer AT command set. By sending a code from a transmitter GSM equipped mobile to other mobile which is a receiving GSM equipped mobile.

Fig 14: Communications through GSM

RF COMMUNICATION

Radio frequency (**RF**) is a frequency or rate of oscillation within the range of about 3 Hz to 300 GHz. This range corresponds to frequency of alternating current electrical signals used to produce and detect radio waves. Since most of this range is beyond the vibration rate that most mechanical systems can respond to, RF usually refers to oscillations in electrical circuits or electromagnetic radiation

IV. SOFT WARE DESIGN TOOLS

KEIL SOFTWARE

Keil compiler is software used where the machine language code is written and compiled. After

ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

compilation, the machine source code is converted into hex code which is to be dumped into the microcontroller for further processing. Keil compiler also supports C language code.

PROLOAD

Proload is software which accepts only hex files. Once the machine code is converted into hex code, that hex code has to be dumped into the microcontroller placed in the programmer kit and this is done by the Proload. Programmer kit contains a microcontroller on it other than the one which is to be programmed. This microcontroller has a program in it written in such a way that it accepts the hex file from the keil compiler and dumps this hex file into the microcontroller which is to be programmed. As this programmer kit requires power supply to be operated, this power supply is given from the power supply circuit designed above. It should be noted that this programmer kit contains a power supply section in the board itself but in order to switch on that power supply, a source is required. Thus this is accomplished from the power supply board with an output of 12volts or from an adapter connected to 230 V AC.

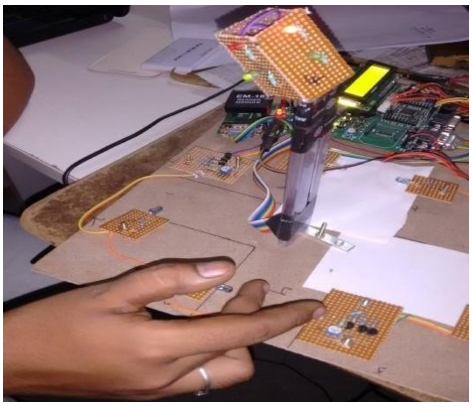
V. EXPERIMENTAL RESULTS

WHEN NO TRAFFIC

Fig 15: Showing 4 ways one by one on LCD display when there is no traffic

SIGNAL CONTROL SYSTEM

(A)



(B)

Fig 16 (A & B): Showing high density way

According to Vehicle counting.

Here we are using our finger instead of the vehicle near IR Sensor. It counts the no. of vehicles on the particular way. It showing the high density way.

STOLEN VEHICLE DETECTION

Fig 17:Invalid vehicle detection and SMS sending

It is showing the invalid vehicle on LCD after reading the particular RFID of the vehicle. If it is invalid immediately SMS will be sent to the authorized person mobile number as showing in the Fig18. If it is valid vehicle, it shows on the LCD display.

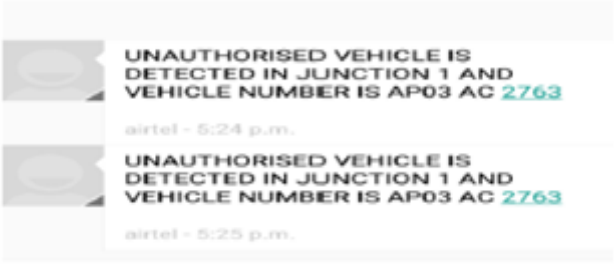


Fig 18: Received SMS on the mobile

ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

EMERGENCY VEHICLE CLEARANCE

Fig 19: way selected, SMS sending and way existence

When emergency vehicle or VIP vehicle enters into the frequency range, we can get the way selection of the vehicle by RF tx which is at the vehicle as showing in the above fig . And also we can get the SMS to the mobile about the way selection of the vehicle as showing in the above fig. We can also get the existence of the emergency vehicle and VIP vehicle by RF Rx which is at control section as showing in the fig

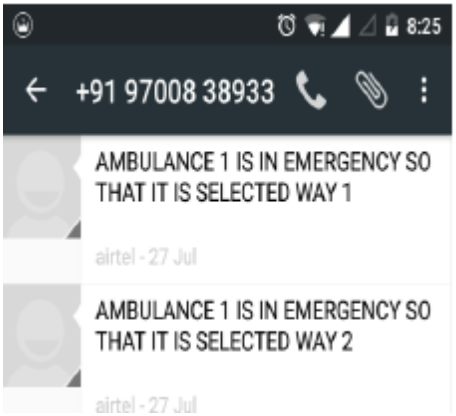


Fig 20: Received SMS on the mobile

VI. CONCLUSION AND FUTURE ENHANCEMENT

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. With stolen vehicle detection, we can find out the location/junction of the vehicle. And also SMS will be sent to the authorised person. so that they can prepare to catch the stolen vehicle at the next possible junctions.

Emergency vehicles like ambulance, fire trucks, need to reach their destinations at the earliest. If they spend a lot of time in traffic jams, precious lives of many people may be in danger. With emergency vehicle clearance, the traffic signal turns to green as long as the emergency vehicle is waiting in the traffic junction. The signal turns to red, only after the emergency vehicle passes through. Further enhancements can be done to the prototype 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 known

FUTURE SCOPE:

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 interactions by using IOT devices.

With the help of Internet of Things [IOT] we can easily monitor the traffic signals density and emergency vehicles enter and exit on a website.

Another application of IOT devices is we can easily control the traffic signals also. Depends on our requirements when VIP persons visit, with in a fraction of time intervals also we can reset the signals as previous.

REFERENCES

1. RajeshwariSundar, SanthoshsHebbar, and VaraprasadGolla, “Implementing Intelligent Traffic Control System for Congestion Control, Ambulance Clearance, and Stolen Vehicle Detection, IEEE Sensors, VOL. 15, NO. 2, February 2015

2. Geetha.E, V.Viswanadha, Kavitha.G, “Design of an Intelligent Auto Traffic Signal Controller with Emergency Override,” International Journal of Engineering Science and Innovative Technology (IJESIT) Volume 3, Issue 4, July 2014

3. N. Ahmed Surobhi and Abbas Jamalipour, "M2M-Based Service Coverage for Mobile Users in Post-Emergency Environments," IEEE Transactions On Vehicular Technology, VOL. 63, NO. 7, September 2014.

4. Xue Yuan, XiaoliHao, Houjin Chen, and Xueye Wei, "Robust Traffic Sign Recognition Based on Color Global and Local Oriented Edge Magnitude Patterns," IEEE Transactions On Intelligent Transportation Systems, VOL. 15, NO. 4, August 2014.

5. S. Sharma, A. Pithora, G. Gupta, M. Goel, and M. Sinha, "Traffic light priority control for emergency vehicle using RFID," Int. J. Innov. Eng. Technol., vol. 2, no. 2, pp. 363–366, 2013.

6. A. K. Mittal and D. Bhandari, "A novel approach to implement green wave system and detection of stolen vehicles," in Proc. IEEE 3rd Int. Adv. Compuer., Feb. 2013, pp. 1055–1059.

7. K. Sridharamurthy, A. P. Govinda, J. D. Gopal, and G. Varaprasad,"Violation detection method for vehicular ad hoc networking,"Security Commun. Netw., to be published[Online]. Available: http://onlinelibrary.wiley.com/doi/10.1002/sec.427/abstract8

8. ZigBee Specifications, ZigBee Alliance IEEE Standard 802.15.4k2013, 2014. [Online]. Available: http://www.zigbee.org/Specifications.aspx

9. Traffic Congestion in Bangalore—A Rising Concern. [Online]. Available: http://www.commonfloor.com/guide/trafficcongestion-in-bangalore-arising-concern-27238.html, accessed 2013.

10. A. K. Mittal and D. Bhandari, "A novel approach to implement green wave system and detection of stolen vehicles," in Proc. IEEE 3rd Int. Adv. Comput., Feb. 2013, pp. 1055–1059.

11. Traffic Solution. [Online]. Available: http://phys.org/news/2013–05-physics-green-city-traffic-smoothly.html, accessed 2013.