RFID AND ZIGBEE BASED INTELLIGENT TRAFFIC CONTROL SYSTEM

Bhargavi Yadav N 1, B Mohan Kumar Naik 2
1Department of Electronics and Communication Engineering
2Department of Electronics and Communication Engineering, New Horizon College of Engineering
Bangalore, India

ABSTRACT:

This paper presents an intelligent traffic control system to ensure smooth flow of traffic. Vehicle is equipped with special Radio Frequency Identification (RFID) tag, placed such that it is impossible to remove or destroy. RFID reads when a vehicle comes in the range, and counts the number of the vehicles on a particular path for a specified duration and determines the congestion and hence the green light duration. If the RFID-tag-read belongs to the stolen vehicle, immediately a message is sent along with the latitude and longitude details to the police control room using GSM SIM300 module and GPS. Also, the traffic signal is turned to red making the vehicle to stop at the traffic junction. In addition, when an ambulance with an emergency case approaches the junction, it communicates wirelessly with the traffic controller using ZigBee modules to turn ON the green light.

Keywords: LPC2148, ZigBee, CC2500, GSM SIM300, 8051 microcontroller, GPS, stolen vehicle, congestion control, traffic junction, ambulance vehicle.

[1] INTRODUCTION

India is the second most populous country in the world and is a fast growing economy. Because of more population the growth in the number of vehicles is increasing exponentially day by day. But the infrastructure growth is slow due to space and cost constraints [1]. As a result, India is facing terrible road congestion problems in its cities. Also, Indian traffic is non-lane based and chaotic. There are many issues related to increasing traffic such as accidents, numerous types of pollutions, time wastage and health related problems.

The major reasons for traffic problems are increase in the number of vehicles, violation in the traffic rules, various construction works and increase in the number of accidents. This is turn has an adverse effect on the economy of the country as well as the loss of lives due to ambulances getting stuck in traffic jams. Due to all these problems the increase in the
congestion level, especially at peak hours is one of the challenging works for the transportation specialists. But the existing methods for traffic management are not efficient in terms of the performance, cost and the effort needed for maintenance and support. To solve all the traffic related problems there is a need for efficient traffic management system. If a system for intelligent management of traffic flows is developed, the negative impact of traffic can be reduced to great extent. This includes technologies like ZigBee, RFID and GSM as they provide cost effective solutions. RFID is an emerging wireless technology that uses radio frequency electromagnetic energy to identify objects from a distance without requiring direct line of sight. A GSM modem is a highly flexible plug and play modem, which accepts a SIM card and operates just like a mobile phone controlled via AT commands. ZigBee is a transceiver module which operates at low-power to transmit and receive data from any standard CMOS/TTL source.

This paper proposes a smart and fully automatic traffic control system that will detect and control the congestion in real time, detect a stolen vehicle and also passes emergency vehicles smoothly with the use of passive RFID devices and ZigBee modules.

The paper is organized as follows. Section 2 describes the literature survey done in this area and their merits and limitations. Section 3 discusses about the current problems that exist in making way to an ambulance and other vehicles. It also tells of how the proposed model will overcome the problems faced in developing countries as well as developed countries. Section 4 gives the implementation details of the proposed model. Finally, section V concludes the paper with a highlight on the scope of the future work.

[2] LITERATURE SURVEY

Traffic congestion is a major problem in cities of developing countries like India. Growth in urban population and the middle-class segment contribute significantly to the rising number of vehicles in the cities [2]. In [3], priority based traffic lights controller using wireless sensor networks was discussed which was used to provide clearance to any emergency vehicle by turning all the red lights to green in the path of the emergency vehicle depending on the priority assigned to them. The advantage of the system is that it can control the traffic over multiple intersections but it has few drawbacks. Firstly, having sensors on all the roads is very costly especially when we are taking into consideration an economically poor country like India. Secondly, communication in wireless sensor network is still a research field and the data exchange between sensors is not reliable. Finally, the sensors need to be robust in order to survive in Indian weather.

In [4], traffic light control using image processing was proposed. This system used images to detect the vehicles. The image sequence captured by the camera is analyzed using digital image processing for vehicle detection, and according to traffic conditions on the road traffic light is controlled. This system showed that image processing is a better technique to control the state change of the traffic light and it is also more consistent in detecting the presence of the vehicle as it uses actual traffic images than those systems that used sensors. But there are many drawbacks such as installation problems and cost. Secondly, detecting congestion requires intelligent image processing techniques which in turn requires skilled
personnel with adequate software background. And more importantly during bad weather conditions due to wind, rain, fog etc. the images captured by the camera is distorted by noise and it becomes difficult for the system to identify the vehicles. Hence, it can’t provide 24X7X365 days surveillance.

In [5], it proposed a RFID and GPS based automatic lane clearance system for ambulance. The main focus of this paper was to clear the lane in which the ambulance is travelling by communicating wirelessly with the nearest traffic signal, so that the green light is turned ON and hence the traffic is cleared. The communication between the ambulance and the traffic light controller is done using transceivers and GPS. Here, the use of RFID in the ambulances distinguishes between the emergency and non-emergency cases. The system is fully automated and can be implemented for the ambulances in service of hospitals but it has a drawback that it can’t be implemented for Government ambulances because the system needs all the information about the starting point and the end point of the travel. But the Government ambulances don’t have a particular place from which they regularly leave to pick up the patients. And also, the system may not work if in case the ambulance needs to take another route due to some reasons.

[3] PROPOSED WORK

From the literature survey, it can be seen that, existing technologies either deal with congestion control or emergency vehicle clearance. But so far, no effort has been made to handle all the problems related to traffic such as congestion control, emergency vehicle clearance and stolen vehicle detection. To solve these problems, hereby proposing an intelligent traffic control system. It consists of three parts.

First part contains automatic signal control system. Here, each vehicle is equipped with an RFID tag placed at a strategic location. When the vehicle comes in the range of RFID reader, it will send the signal to the RFID reader. The RFID reader will track the number of vehicles passed through for a specific period and determines the congestion volume. Accordingly, it sets the green light duration for that path. The second part is responsible for stolen vehicle detection. Here, when the RFID reader reads the RFID tag, it compares it to the list of stolen RFID’s. If a match is found, it sends SMS to the police control room and immediately 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. Also, the details like latitude and longitude of the junction is sent using the GPS.

Third part is for the emergency vehicle clearance. Here, each emergency vehicle is equipped with ZigBee transmitter module and the ZigBee receiver will be implemented at the traffic junction. When the vehicle is used for emergency purpose the buzzer will be switched ON. This will send the signal through the ZigBee transmitter to the ZigBee receiver. This makes the traffic light to change to green. Once the ambulance passes through, the receiver no longer receives the ZigBee signal and the traffic light is turned to red. The components used in the work are LPC2148 ARM7 microcontroller, NSK EDK-125-TTL RFID Reader, CC2500RF module, 8051 microcontroller, SIM300 GSM module and GPS.

The model consists of three parts as follows.

[4.1] AUTOMATIC SIGNAL CONTROL SYSTEM

For experimental purpose, passive RFID tags are used. When the RFID tag equipped in the vehicle comes into the range of the RFID reader, it sends the unique RFID number to the reader. The microcontroller connected to the RFID reader counts the number of vehicles for a specified duration. If the count in the number of vehicles is more than 10, the duration of the green light is set to 30 seconds, if the count is between 5 and 9, it is set to 20 seconds and if the count is below 5, it is set to 10 seconds. And the duration of red and orange light will be set to 10 seconds and 2 seconds respectively. [Figure-1] shows the block diagram for automatic signal control and stolen vehicle detection system.

[4.2] STOLEN VEHICLE DETECTION SYSTEM

In this module, when a stolen vehicle comes in the range of the RFID reader, the RFID reader reads the unique RFID tag and compares it to the list of the stolen RFID’s. If a match is found, the traffic signal is immediately turned to red for a duration of 30 seconds and also an SMS is sent along with the details of the RFID number, latitude and longitude of the location to the police control room using the GSM module and GPS. Using the latitude and longitude details the police can trace the location and hence it becomes easy for them to track the vehicle.

[4.3] EMERGENCY VEHICLE CLEARANCE SYSTEM

Figure: 1. Block diagram for automatic signal control system and stolen vehicle detection system
It consists of 2 parts. First part is the transmitter equipped in the emergency vehicle. It consists of 8051 microcontroller and a ZigBee transmitter module along with a switch. Second part is the receiver implemented at the traffic junction. Even this consists of an 8051 microcontroller and a ZigBee receiver. When the vehicle is used for an emergency case, the switch is pressed, this transmits the signal consisting of the unique id and the security code to the receiver. The receiver compares this security code with the security code stored in its database. If it matches, the green light will be turned ON till the vehicle passes through. [Figure-2] shows the block diagram for emergency vehicle clearance system.

![Ambulance Unit](image1)

Ambulance Unit

![Signal unit](image2)

Signal unit

[Figure: 2. Block diagram for emergency vehicle clearance]

[6] CONCLUSION AND ENHANCEMENTS

With the implementation of this system the manual effort and the time on the part of the traffic policeman is saved. As the whole system works automatically, it requires very less human intervention. With this system, traffic congestion can be detected and managed accordingly, a stolen vehicle can be detected by turning the signal to red and traced with the help of GPS. Also way is given to the emergency vehicles by clearing the lane by turning the
signal to green so that they reach their destinations at the earliest to save the precious lives of many people. Further enhancement can be done by using a longer range RFID readers.

REFERENCES


Author[s] brief Introduction

Bhargavi Yadav N is currently pursuing the M.tech degree in electronics and communication engineering at New Horizon College of Engineering, Bangalore.

B Mohan Kumar Naik, Senior Associate Professor, working at New Horizon College of Engineering, has 15 years of teaching experience and has done Ph.D in ECE stream. Has published more than 12 journals in various publications
Corresponding Address-

Bhargavi Yadav N  
No.62, 11th block, HC Police Quarters,  
Koramangala,  
Bangalore-560034.  
Mobile No: 8553521153.