

# SOLVING VEHICLE EMISSIONS IN CITIES BASED ON RFID AND GPRS/GSM TECHNOLOGY

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**Abstract**—Time and efficiency are matter of priority now. RFID (Radio Frequency Identification) emerges as one of the converging technologies. While transportation plays an important role in urbanization, RFID is now key catalyst in signifying the merit of it. RFID plays major role in auto ID applications like RFID contact less smart cards used by bus riders, in Super market, Textiles and logistics chain management. This paper aims to understand the benefits of RFID technology in other countries and to identify possibilities extending it to Indian market.

The Global System for Mobile Communications (GSM) has been a great success in providing both voice and low speed data services. The Enhanced Circuit Switched Data on GSM (ECSD) is one of the major evolutionary steps to serve real time high speed data services.

Population explosion is the source of so many issues, one among them is transport. In this paper, we propose a novel method to tackle traffic related issues. Applications such as accident alert and traffic rule violation control are explained in this paper.

**Keywords:** *GSM and RFID Reader*

## I. INTRODUCTION

In this fast paced modern world we are facing a number of transport related problems. RFID technology can be effectively used to solve some of them. Some of the problems that require immediate attention are accident risk management, environment alert, traffic rule violation control, vehicle theft identification and traffic signal management. RFID tags are placed on the road giving area information and environment alerts (such as school zone, industry, market, bridge etc.). One RFID is placed in vehicle with owner info, RC book, insurance details, service details etc. to send vehicle identification to traffic information database. RFID reader will be placed with embedded controller in vehicle. Figures 1 and 2 show traffic light controls and accident alert system.

We used GSM module with embedded unit in the moving vehicle to transmit accident information to different points. Whenever vehicle meets with an accident, the system reads area information from RFID tags placed on the road and transfers this information to embedded module. The details are transmitted



to the specific numbers stored in database (Police station, Owner and Hospital) and transmits this emergency situation to owner, police control office and hospital through SMS.

Whenever the vehicle crosses the traffic signal area, the data from Vehicle tag is read and based on the traffic density, traffic signal is enabled. By this traffic problem is managed intelligently. If vehicle insurance is not renewed in time, the traffic police will be alerted by beep sound or voice message. Vibration/Impact sensors are added to trigger our system. Special zone information is programmed in active tag and this information is transmitted to RFID reader connected with vehicle embedded kit, it alarms driver about the zone.

## II. THE HARDWARE SYSTEM

### 2.1. Micro controller:

This section forms the control unit of the whole project. This section basically consists of a Microcontroller with its associated circuitry like Crystal with capacitors, Reset circuitry, Pull up resistors (if needed) and so on. The Microcontroller forms the heart of the project because it controls the devices being interfaced and communicates with the devices according to the program being written.

### 2.2. RAJBERRY PI:

The Raspberry Pi 2 delivers 6 times the processing capacity of previous and has an

upgraded BroadcomBCM2836 processor, which is a powerful ARM Cortex-A7 based quad-core processor that runs at 900MHz. The board also features an increase in memory capacity to 1Gbyte.

### 2.3. RFID:

Radio frequency identification (RFID) technology has been in use for decades. Only recently, lower cost and increased capabilities made RFID technology to be a commercially viable one. There seems to be developments in support of the movement of inventory tracking and supply chain management toward RFID.

### 2.4. TECHNICAL OVERVIEW:

RFID is an auto ID device like Barcode, Smart cards, Biometric technologies (Retinal scans) and optical character recognition etc. Special feature of this technology is that there is no need of line of sight reception as required in some other technologies.

In RFID systems the items are marked with tags. These tags contain transponders that emit messages readable by specialized RFID readers. Most RFID tags store some sort of identification number; for example a customer number or product code. A reader retrieves information about the ID number from a database, and acts upon it accordingly. RFID tags can also contain writable memory, which can store information for transfer to various RFID readers in different locations. This information can track the movement of the tagged item, making that information available

to every reader.

RFID tags fall into two general categories, active and passive, depending on their source of electrical power. Active RFID tags contain their own power source, usually an on-board battery. Passive tags obtain power from the signal of an external reader. RFID readers also come in active and passive varieties, depending on the type of tag they read. Then based on their frequency range of transmission they are classified as LF, HF, VHF and UHF tags.

### 2.5. GSM:

Global system for mobile communication (GSM) is globally accepted standard for digital cellular communication. GSM is a common European mobile telephone standard for a mobile cellular radio system operating at 900 MHz. Throughout the evolution of cellular telecommunications, various systems have been developed without the standardized specifications resulting in many problems directly related to compatibility. The GSM standard is intended to address these problems. In the current work, SIM300 GSM module is used. The SIM300 module is a Triband GSM/GPRS solution in a compact plug in module featuring an industry-standard interface. It delivers voice, data and fax in a small form factor with low power consumption

### III. DESIGN AND IMPLEMENTATION

In the current work we have designed

following operating points. One is on road unit, the second is vehicle unit, the third is traffic signal controller unit.

#### A. Section 1 - On road unit:

In this unit we have 'N' number of RFID tags to transmit general area information and alert on special zones like school, hospital, weak bridges and zigzag bends etc., UHF Semi passive tag is used in our application. Its coverage is a maximum of 50 Meters with 64 Kbits of memory operating at 902 MHz range. The location information and driver alert information are stored in this tag. The alert information can be dynamically changed like damage in bridge, condition of road and new changes in road (one way or two ways and other diversion indications) etc.

#### B. Sections 2 - Vehicle unit:

These units consist of RFID reader, vehicle information RFID Tag, 8051 embedded module and GSM module. Here we have used SIM 300 GSM module to transmit alert data to the mobile receivers already configured. RFID reader and GSM are connected to receive and transmit of the serial port in embedded module. The total controller program is developed in embedded C language and is downloaded into the memory for operation. Here we use semi passive tag to transmit vehicle database like insurance details (renewal date and expiry date), RC book and license etc., to traffic organizers. This data is collected in the RFID reader enabled traffic signal areas. This controls traffic issues like

insurance nonpayment and also used to manage traffic signal in intelligent way.

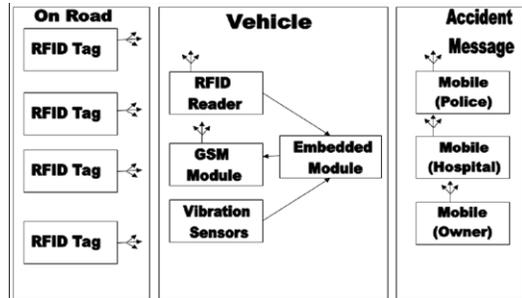


Fig: Accident Alert System

Digital camera also connected with our embedded module to take photos about accident and it can be sent as MMS. This will be useful for investigation and for security reasons to avoid theft in accident place.

#### C. Section 3 - Traffic signal control unit:

The conventional traffic signal controller works on the principle of Time division. It is rigid method and does not consider traffic density in a particular direction. Here we are proposing a low cost modified adaptive architecture with RFID enabled system. In this module we are using Atmel C52 microcontroller as a base unit and RFID reader is connected with serial port of the system. We use external antenna based readers. Instead of using single antenna, array of antennas used here to give better results. The general time division based traffic signal management will create massive traffic problems in peak hours. But our system is adaptive system based on vehicle density calculation. It will give perfect solution for the traffics problem faced by previous one.

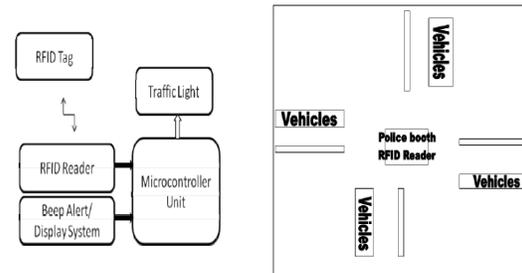


Fig: Traffic Light Controller

#### D. Alert receiver unit:

This unit is nothing but alert receiving mobile phones programmed in the embedded module. It may be owner of the vehicle, the hospital emergency care and the police station information number. Short script message or voice message will be sent to the receivers.

## IV. IMPLEMENTATION

We have used RAJBERRY PI BCM2836 microcontroller as a base device. GSM module and RFID reader is connected with serial port of the controller. Whenever vehicle meets with an accident the vibration sensor triggers the embedded module for rescue operation. Embedded module gets area information from RFID reader module and the alert information is sent through the GSM module. RFID reader gets area information from RFID tags on the road unit.

RFID reader is connected to Receiver (Rx) of the serial port and GSM Module is connected to transmitter (Tx) of the serial port. Special zones like School, Hospital, Zig Zag bends and weak bridge etc., are programmed in the RFID tag and whenever vehicles



crossing that area, embedded module will alert the driver to reduce acceleration. This will control accident ratio.

In addition to embedded module one special RFID Tag is placed inside vehicle to transmit vehicle information. In the traffic signal management system RFID reader and display informer unit are connected with serial port of the microcontroller. If vehicle insurance, pollution test, FC is not proper, the alert system will produce beep sound and vehicle number is displayed. Then the traffic police can easily alert the driver / owner.

Traffic signal is managed by counting the number of vehicles crossing the reader area in a particular time interval. Here the data collected by the antennas are given to the reader via multiplexer switch. This method will save RFID reader usage and money. By this we can manage the traffic intelligently.

#### V. CONCLUSION

In this project we have designed a system to give complete solution for traffic and transport related problems such as accident alert, traffic signal control, traffic rules violation control and special zone alert using the latest RFID technology. It is proposed as a low cost optimized solution using RFID and GSM mobile technology. This is in line with the developed countries like USA, England, German and Japan, where RFID, GPS and GSM technologies are widely used for traffic management. But in India we have not implemented any automated system

for transport management due to prohibitive cost. Keeping this in mind we have proposed this system at low cost.

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