

## **A Traffic Solution Using Adaptive Embedded System & RFID.**

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**Abstract :** In urban area, problem of traffic management is becoming more and more difficult. Traffic management problem can be solved using embedded system and RFID can provide good traffic related solution under different traffic density conditions. In implanting the system, GSM has been of good helps, in providing both voice and low speed data services. Increasing traffic on Indian roads, are increasing the traffic related problems. Large population of India leads to many problems one of them is increase in traffic. Application such as traffic signal control, parking lot management, accident alert are explained in this paper

**Keywords** – GSM, RFID and RFID reader.

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### **1. INTRODUCTION**

In the current world we are having number of transport related problems. Here RFID technology can provide solution to number of problems. Some of the problems which have been focused in this paper are traffic signal control unit, toll gate management unit, parking lot management. 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.

Whenever the vehicle entering in to the parking area, the reader identifies a vehicle and allots particular slot and also initiates bill creation at the time of exit. Almost similar concept is followed in Automated Toll gate system.

### **2. KILLER IDEA.**

While implementing this new way of solving the problem of traffic we are in need of developing different modules. These modules are used for different purposes. As well as these different modules are located at different places as per its requirement and use. So let us see all these modules in detail such as on road module, vehicle module, traffic signal controller module, parking slot controller module, tollgate module and finally alert receiver module [1].

#### **1.1. Vehicle module:**

These units consist of RFID reader, vehicle information RFID Tag, 8051 embedded module and GSM module. Here we have used 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 non-payment and also used to manage traffic signal in intelligent way. 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 [1].

#### **1.2. On road module:**

On road module is RFID tag which used to transmit all the details which are on road and off the road such as hospitals, schools, motels, hotels, bridges, turns on road, condition of road etc. Here we have used Ultra high frequency semi passive RFID module which covers nearly 50 meters of area with 64 Kbits of operating memory at 902 MHz range. Every module contains the information about its area of location as well as the alert

information which is to be sent to the driver. The information which is sent to the driver can be automatically changed for example if the bridge is damaged, road had been blocked, the driver has to take diversion due to damaged road etc. Therefore to indicate all the information on road we need large number of on road modules as its range of area is 50m.

1.3. Parking slot management module:

As the name itself suggest that this module may be used for parking arrangement related problems. In this module microcontroller based RFID reader, IR sensors and stepper motor are used. Here we have used microcontroller based RFID reader, stepper motor & IR sensors which are connected through serial port to a system. The controller based RFID with IR sensors is used to sense the incoming or outgoing car as well as to allocate parking area. As the sensor's has to sense weather the parking area is vacant or not. It produces a signal to the system that a particular area is free and also it indicates the number of vacant slots where cars can be parked. It sense whether the vehicle is parked at the correct place. It also provides the system information about how much time the car was parked, so that the module can calculate the parking charges.

The stepper is just used for opening and closing of doors when the cars comes in or goes out. This type of parking system is widely used in many European countries which provide cheap and much accurate parking management in a much lesser time. This system also avoids crowding of cars near the parking area. Parking issues are solved to a certain extent without using manpower.

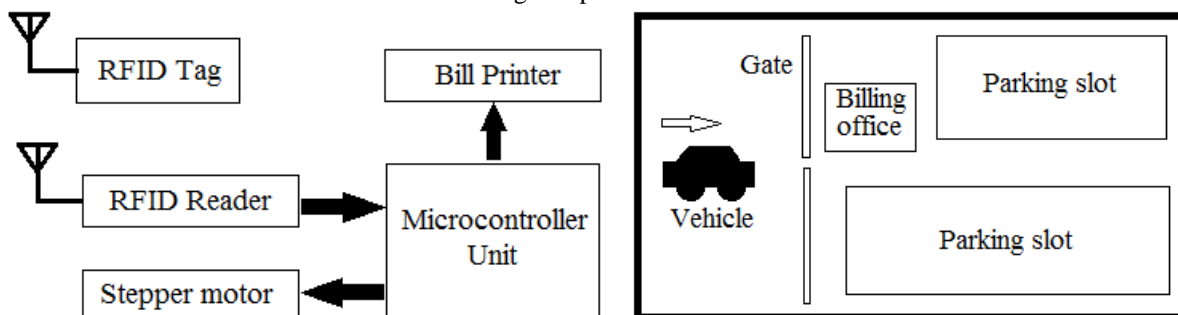


Fig.1. Parking slot management module.

1.4. Traffic signal control module:

Normally the traffic signals changes from red green after certain time interval. That means every were the traffic signal are operated on time division bases. If there are more vehicles on a particular as compared to other, then also the traffic will be allowed to pass after a regular time allotted to every road. But here we can use a more advance and adaptive technique, which analyzes the amount of traffic on each road and then reduces the time of green signal on a particular road which consist of less number of vehicles. Here we have used microcontroller based RFID reader which is connected through serial port to a system. In this module we require large number of antennas which are placed on different roads for gathering information. By using such type of technique for traffic signal, more amount of traffic problems can be solved to a greater extent. This technique is most effective during peak hours of traffic, where the vehicle density problems cannot arise. Very important thing regarding this technique is that it is cost effective and can be widely used.

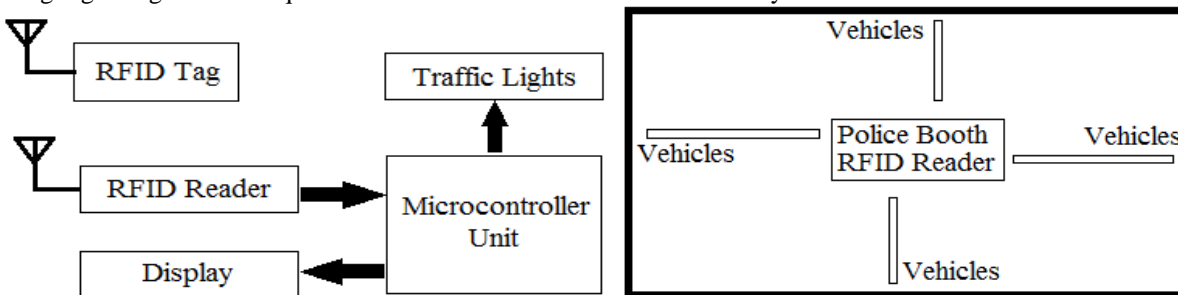


Fig.2. Traffic light controller module.

1.5. Toll gate management module:

In this module also a microcontroller based RFID reader and stepper motor is used. In this section when the car arrives near the toll booth, with the help of RFID reader the car information can be automatically collected. The car information can be its number, RFID number etc. If the car is authenticated then automatically bill is generated. So the toll gate can be made fully automated. In further scope we can also connected a camera, and take snapshot of car so that we can identify the no of persons in car, person driving the car etc. to catch hold certain criminal activities and criminals also.

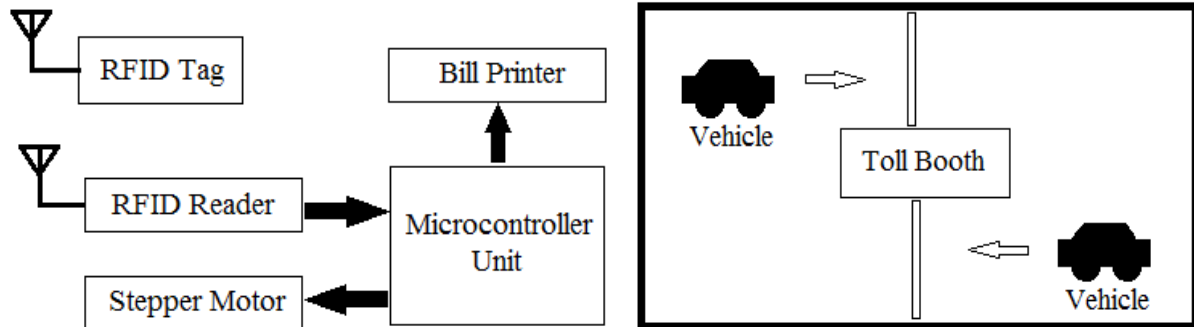


Fig.3 Toll gate arrangement.

#### 1.6. Alert receiver module:

This module is just a normal mobile phone which receives different alerts. When the car meets with an accident then due to the high frequency vibration sensor in this module get activated and it gives signal to the microcontroller. Due to this signal from sensor the microcontroller in vehicle send alert message to police station, hospital etc. through GSM module. It comes under embedded system which gets or gives short messages regarding car information, alert to police station, hospital etc.

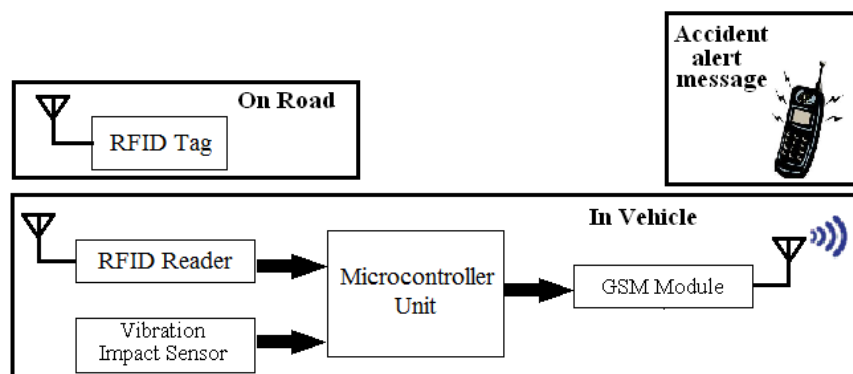


Fig.4 Accident alert system.

### 3. IMPLEMENTATION

Project is implemented using LPC 2148(Arm 7),if any further modification is required for additional features, ARM 7 is better than 8051 .In Accident alert system unit, RFID Reader ,GSM module and vibration sensors are Interface with LPC 2148. In case of accident, vibration sensor generates large amplitude signal, which indicates accident has been taken place. Location of accident information is given by RFID reader .accident location information is send through GSM module. Location of accident is received with help of RFID reader and tag located at road side.

GSM module is connected to transmitter (Tx) of microcontroller serial port and RFID is connected to receiver of microcontroller serial port. Digital camera will record the accident, which can be utilized for studying the accident. Digital camera is also connected to system.

When vehicle is near to public places like hospital, school, market place, temple, RFID will give information regarding location, speed and safety instructions.

In traffic signal management unit, RFID tag is placed inside the vehicle. Information regarding Vehicle, its insurance and P.U.C test is stored and other vehicle related details are also included. Location of vehicle can be traced and in case of adverse situation information can be given to driver.

In traffic signal management, RFID reader near the signal can get information regarding the number of vehicles on different roads, with the help of RFID tags present inside the vehicle, Depending on vehicle present on different roads, timing of traffic signals can be varied, so that stop time of the vehicle at the signal can be reduced.

In parking slot management system, RFID reader can get information about number of vehicles, and size of vehicle, and at the exit gate, again the vehicle information can be read by RFID reader from the tag present inside the vehicle and the computer system at the parking can generate the bill for parking. At some airport, parking bill is generated on basis of stay time of vehicle in parking slot, accordingly bill is generated.

#### **4. CONCLUSION**

In this project we have designed a system for toll gate management, parking slot management, efficient traffic signal management, and alert messages at the public places as well at critical areas. In developed country like U.S, U.K, Germany and Japan traffic speed limit and guide lines to driver on Express High way and on ordinary road is provided using RFID, GPS and GSM technology. System can be installed at grass root level as well as at express highway at low cost.

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