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Automatic Toll Collection System using RFID and Vehicle Security System

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Abstract

Abstract : *The automated toll collection system using passive Radio Frequency Identification (RFID) tag emerges as a convincing solution to the manual toll collection method employed at tollgates. Time and efficiency are a matter of priority of present day. In order to overcome the major issues of vehicle congestion and time consumption RFID technology is used. RFID reader fixed at tollgate frame (or even a hand held reader at manual lane, in case RFID tagged vehicle enters manual toll paying lane) reads the tag attached to windshield of vehicle. The object detection sensor in the reader detects the approach of the incoming vehicle's tag and toll deduction takes place through a prepaid card assigned to the concerned RFID tag that belongs to the owners' account. This makes tollgate transaction more convenient for the public use. RFID based" framework gives paperless entry of toll doors with completely 'Auto Challan'. They help in diminishing toll entryways activity and stay away from unlawful section of vehicles through a toll door.*

Keywords: *RFID, Reader, RFID Card, Atmega 328, GSM Module.*

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1. INTRODUCTION

The main idea behind implementing RFID BASED TOLL COLLECTION SYSTEM is to automate the toll collection process their by reducing the long queues at toll booths using the RFID tags installed on the vehicle. In addition to this, it can not only help in vehicle theft detection but also can track vehicles crossing the signal and over speeding vehicles. This system is used by vehicle owners, system administrator. Other general advantages for the motorists include fuel savings and reduced mobile emissions by reducing or eliminating deceleration, waiting time and acceleration In an open toll framework, for example, a toll street, toll stations are situated along the office. Around 70% of the toll streets in the United States now utilize ETC.

Active wave Inc [3] has currently deployed a system of active tag vehicle monitoring solution. Active wave vehicle products have a range of 30 meters and

2. EXISTING SYSTEM

operate in the 916 – 927 MHz for the transmit operations and 433 MHz for the receive link. Active wave products are currently equipped with 256 Kbits of fixed memory. The tag is powered with are placeable 3V battery and the total weight is 14 grams. Elementary signals are shown with the help of blinking LEDs and beeping sounds. RFID tag which uses car battery power. The implementation is divided into the design of two modules the Vehicle Module (Active Tag) and the Base Module.The two modules communicate via RF modem connected to each module. Ordinarily, the majority of the clients utilizing money installment however the exchange will take longer time. For touch n go, it is more advantageous than money since client no more need to plan for little change or hold up in line at the money path to finish the exchange However, this strategy likewise needs a procedure to touch the screen and expend time too, yet it takes less time contrasted.

3. PROPOSED SYSTEM

This project deals with the simplification of procedure followed by passengers to pay toll at toll collection booths, like making it automated, vehicle theft detection etc. All these activities are carried out using single smart card (RFID tag), thus saving the efforts of carrying money and records manually [5].

Automatic Toll Collection: The RFID Readers mounted at toll booth will read the prepaid RFID tags fixed on vehicles' windshield and automatically respective amount will be deducted. If the tag is removed from the windshield then cameras fixed at two sites at toll plaza take snaps of the front and back number plate. Since every vehicle registration ID is linked to users account, toll can be deducted from the account bank directly.

Vehicle Theft Detection: When vehicle is stolen the owner registers complaint on the website with its registration ID and unique RFID tag number. Now when stolen vehicle passes by the toll plaza, the tag fixed on it is matched with the stolen vehicle's tag in the database at the toll booth.

Signal Breaking Avoidance: The vehicle ignoring the traffic signal will be detected by the RFID readers fixed at signal crossing and will be notified to the traffic police This can be done efficiently and great accuracy.

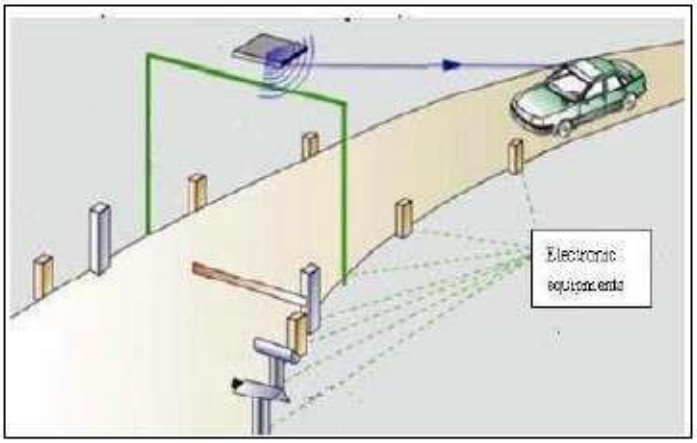
Tracking Over speeding Vehicle: Vehicle travelling above speed limit can be tracked with 100 % accuracy.

4. METHODOLOGY

Whenever any person buys a vehicle, one first needs to get his or her vehicle registered at the RTO office. RTO officials will not only assign a number plate to it but also

Rakhi Kalantri et al, / (IJCSIT) International Journal of Computer Science and Information Technologies, Vol. 5 (2) , 2014, 2582-2585will give a RFID enabled smart card or a tag. This card will have a unique ID feasible to use with that vehicle only.

They will also create an account for the use of that particular smart card and maintain transaction history in database. User needs to deposit some minimum amount to this account. Every time a



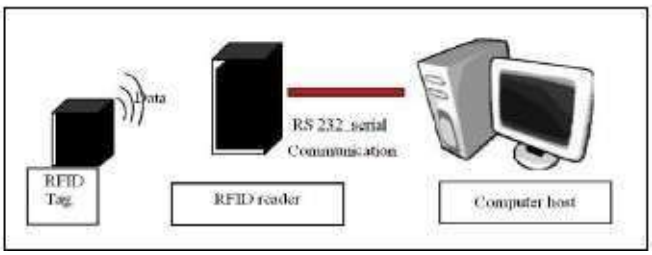
Fig,1. Working of Automatic TOLL Plaza

On the other hand, whenever any vehicle owner registers a complaint to RTO office regarding theft respective entry is made in the database. Now any vehicle arriving at toll booth with same ID as already present in stolen vehicle category will be easily identified as the ID assigned with it is unique. Updates of any sort of transaction will be immediately updated to local database and centralized server[8].

5. IMPLEMENTATION

The circuit is divided into two parts

1. Transmitter 2. Receiver



registered vehicle approaches the toll booth, first the Infrared sensors will detect the presence of the vehicle. It will in turn activate the RFID circuit to read the RFID enable smart card fixed on the windscreen of the vehicle. Transaction will begin, depending upon the balance available toll will be deducted directly or the vehicle will be directed towards another lane to pay tax manually. The software further updates the details in the Centralized database server. It also triggers mechanism to generate the bill and will be sent to user as a textmessage [7].

Fig,2. Transmitter Section

For transmitter section, the different commands signals are transmitted via RF transmitter module of 433 MHz. it has 4

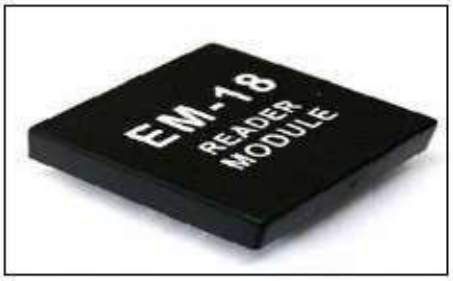
pins of antenna, Vcc, Gnd, & serial data input. Antenna,+5v & Gnd are connected to respective places and serial data input is generated from encoder IC HT12E. This encoder IC‟s function is to convert parallel data into serial data address lines of encoder are grounded because they are not used. Data lines are fed with command signals since four lines are available 16 different commands can be generated. The output modulating frequency is decided by resistor connected at OSC pin of the encoder. Currently because of 1.2Mohms resistor, it is 30 KHz. The output of encoder is fed to RF transmitter module is currently Roughly 100 sq. Ft. On receiver side the data is received by RF receiver module of 433MHz. This demodulated signal is fed to decoder for further decoding. If address send from encoder IC GND matches with decoder address then valid tone (VT) signal on decoder goes high, which indicates receives signal. The decoded by decoder is fed to uC for further control of relay. Uc requires mainly three things for operation. Which are power supply clock & reset Power supply provided to uC is +5v & GND on pin40 &pin20 respectively. On osc pin18 &19,a crystal oscillator is connected which generates clock for program execution for reset on pin9 & 10k resistor &10k capacitor is connect which reset controller on power up.

GSM MODULE

GSM/GPRS module is used to establish communication between a computer and a GSM-GPRS system. **Global System for Mobile communication (GSM)** is an architectureusedformobile communicationinmostofthe countries. Global Packet Radio Service **(GPRS)** is an extension of GSM that enableshigherdatatransmission rate. GSM/GPRS module consists of a GSM/GPRS modem assembled together withpowersupplycircuitand communication interfaces (like RS-232, USB, etc) for computer. GSM/GPRS MODEM is a class of wireless MODEM devicesthataredesignedfor communication of a computer with the GSM and GPRS network. It requires a **SIM (Subscriber Identity Module)** card just like mobile phones to activate communication with the network. Also they have **IMEI** (International Mobile Equipment Identity) number similar to mobile phones for their identification.

Fig 3. GSM Module

EM-18 RFID CHIP-



Fig,4. EM-18 RFID CHIP

Features

Table 1: Features of RFID chip EM-18

RF transmit frequency	125KHz
Supported standards	EM4001 64-bit RFID tag compatible
Communications Interface	TTL Serial Interface,Weigand output
Communications Protocol	Specific ASCII
Communications Parameter	9600 bps,8,N,1
Power Supply	4.6V-5.5V DC +/- 10% regulated
Current Consumption	50mA<10mA at power down mode
Reading Distance	Up to 100mm,depending on tag
Antenna	Integrated
Size(L*W*H)	32*32*8mm

RFID based toll collection system is used as a technology for fast and efficient collection of toll at the toll plazas. This is possible as the vehicles passing through the toll plaza do not stop to pay toll and the payment automatically takes place from the account of the driver. The electronic toll lanes are set up with the special antennas that continuously send out signals.

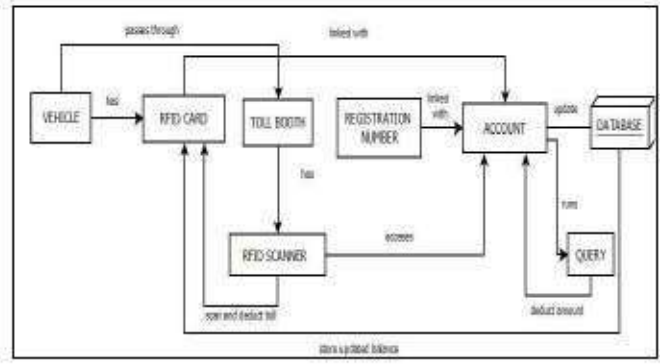


Fig.6. Implementation of RFID based toll collection

ADAPTER :

An adapter is a device that converts attributes of one electrical device or system to those of an otherwise incompatible device or system to those of an otherwise incompatible device or system. Some modify power or signal attributes, while others merely adapt the physical form of one electrical connector to another. An AC adapter, also called a "power cube" or "recharger", is a small power supply that changes household electric current from mains voltage (either 120 or 230 volts AC) to low voltage suitable for consumer electronics.

Fig. 5. Adapter

Working area

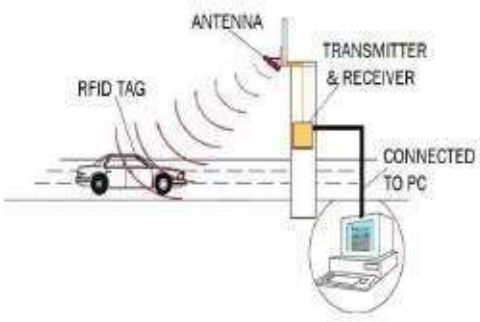


Fig.7: RFID based toll collection system

The main system components are as follows:
1) RFID tagged vehicle
2) Toll booth equipped with RFID scanners
3) Vehicle registration plate
4) Centralized database
5) LED
6)GSM Module
These components of the RFID based toll collection system

Technology work as follows:
1. Automatic Vehicle Identification -- The automatic vehicle identification (AVI) component of this system refers to the technologiesthatdeterminethe identification or ownership of the vehicle so that the toll will be charged to the corresponding customer.
2. Automatic Vehicle Classification -- Vehicle type and class may have differentiated toll amount. The vehicle type may include light vehicles like the passenger car or heavy vehicles like recreational vehicles. A vehicle's class can be determined by the physical attributes of the vehicle, the number of occupants in the vehicle, the number of axles in the vehicles and the purpose for which the vehicle is being used at the time of classification (or some combination of these determinants). Some toll agencies use as many as 15 or more vehicle classes to assess tolls, although for toll collection applications, four or five classes are more typical.
3. Video Enforcement Systems -- When used for electronic toll collection, the video enforcement system (VES) captures images of the license plates of vehicles that pass through an ETC tollbooth

without a valid ETC tag. Although the deployment of these technologies makes the initial cost of installation very high, but there exits huge benefits accompanied with such high investment. These benefits are discussed in the upcoming section [7]. The flow chart for the proposed system is shown as follows:

Flowchart 1: Working of the RFID based toll collection system and theft detection system:

Figure

Figure 8: Working of system

Flowchart 2: Working of the RFID based toll collection system and theft detection system

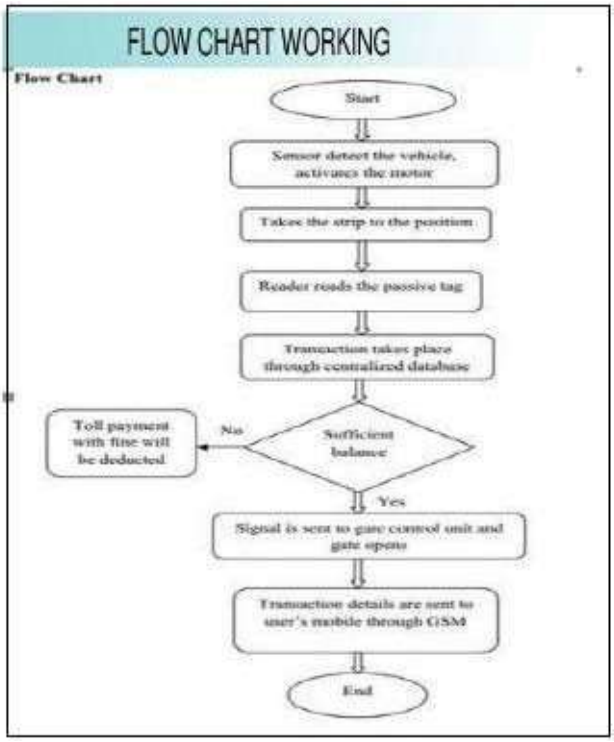


Fig.8. Working of system

ADVANTAGES AND DISADVANTAGES

Advantages

Whole process takes a matter of seconds to finish. Electronic framework records exchange, including the time, date, square and toll charge of every vehicle. Permit drivers to go through the framework at 55 miles for every hour (86kmph). The other favorable position found in a few nation is that the framework can be utilized as a part of stopping zones also. The primary point of interest is about the velocity pick

up. Since the charging is programmed, the street is less inclined to blockage.

Disadvantages

This framework requires less labor so business of movement control individuals may get diminished. In the event that the tag is harmed then framework will neglect to identify the approved vehicle proprietor.

CONCLUSION

The electronic toll collection system in expressway based on RFID, a design scheme was put forward. It has characteristics of low cost, high security,far communication distance and high efficiency, etc. It not only can improve technology level of charge, but also improve passage ability of expressway. Electronic toll collection system is an effective measure to reduce management costs and fees, at the same time, greatly reduce noise and pollutant emission of toll station.

In the design of the proposed Electronic toll collection (ETC) system, real time toll collection and anti-theft solution system have been designed. This reduces the manual labour and delays that often occur on roads. This system of collecting tolls is eco-friendly and also results in increased toll lane capacity. Also an anti-theft solution system module which prevents passing of any defaulter vehicle is implemented, thus assuring security on the roadways.

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