



RFID: The analysis of impact on road transportation

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Abstract

The concept of RFID is that data from a tag are captured by a device that stores the data in a database. The base idea behind implementing RFID Based Toll System is to automate the toll collection process and their by reducing manual operation in toll booths and the long queues at toll booths using RFID tags installed on the vehicles. We can not only help the vehicle owners and system administrators from vehicle theft detection but also can track over speeding vehicles, and crossing the signals. The purpose of this study is to find the analysis of use of RFID especially in Transportation. Causing the avoidance of the fuel loss, saving of time in collecting toll, avoid financial loss, to monitor the traffic .It is of low cost, high security, far communication ability and efficient . RFID is an effective measure to reduce management costs and fees, at the same time, greatly reduce noise and pollutant emission of toll station.

Keywords: RFID, ETC, Real time toll collection, database, tag

1. Introduction

Nowadays, increasing traffic volume causes congestions commonly around the toll gate of highway. Therefore the new technique is urgently required to reform the problem of congestions. Automated toll collection system is one of the methods to solve the above conditions. The automated system is composed of several subsystems. The RFID technology, computer database, power supply, microcontroller, motor and inferred device are included. Automated system can bring the several sectors for toll gates as saving time and reducing the human workers. Developing the prototype model, which reproduces the operation states of various toll gate systems: passing time and waiting time. The RFID tag and RFID reader are contained in RFID technology. RFID means Radio Frequency Identification that consists of the tags which can be either active or passive tag. Passive tag do not have own power supply, much cheaper to manufacture and small coil antenna is used. On the other hand, active tag must have own power supply. It has longer range and larger memories. It can store additional information sent the RFID reader. RFID reader is an interrogator. It is placed at the toll gate on every single row where vehicles are passed. The reader contains an RF module, which acts as both transmitter and receiver of radio frequency signals. The reader generates the signal to receive the data from tag. The received signals send to the computer system which contains Graphical User Interface (GUI) and the database of all users. The ID number from the tag checks with the recorded database and deduces the toll tax. The computer and microcontroller are connected with USB cable. So, the PIC 18F4550 microcontroller is very compatible for system. The microcontroller will display the amount of deposits on LCD and the gate will open. The IR sensor senses the vehicle motion for closing gate automatically.

2. Literature review

There are two methods of collecting tax presently used they are First is the traditional manual method where one person

collects money and issues a receipt. The other one is the Smart Card method where the person needs to show the smart card to the system installed at the toll tax department to open the Gate. Drawbacks of Existing System Both the above mentioned method for collecting tax is time consuming method. Chances of escaping the payment of tax are there. It leads to queuing up of following vehicles. History of Automatic Toll Tax: Design and development of a "RFID Based Automatic Toll Plaza" which is based on microcontroller, RFID technology and load cell to save the time at toll plaza and having cashless operation As the name implies "RFID Based Automatic Toll Plaza" the key theme of our project is the automation. So here we will just take the overlook of what is mean by Automation. In simple words the Automation means the human being from the process with the machines. Before going further we just take the overlook of history of the toll plazas. So before the 90's decade the toll plazas were fully manual controlled. Means there are total four people for operating the Toll gate in this two people will be used for opening & closing of the gate & another two are for reception of the money & data keeping etc. Semi Automatic Toll plazas were launched after the introduction of Express ways in 1995, in which data is stored in computers and gate operation is automatic, only two personals are required for single booth. But here we are going to see the human less toll plaza. Active wave Inc has currently deployed a system of active tag vehicle monitoring solution. Active wave vehicle products have a range of 30 meters and 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 a replaceable 3V battery and the total weight is 14 grams. Elementary signals are shown with the help of blinking LEDs and beeping sounds. Smart key Access Control Systems have a client – server model based system with an SQL server handling multiple vehicle monitoring systems. They have designed a user interface using the Microsoft .NET Framework. Smart key also operate in the 900MHz band but have a small range of

30 meters. RFID based toll collection system uses active 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. These RF modules communicate over the ISM Frequency Range of 902 – 928 MHz.

3. Objective

The purpose of this study is to find the analysis of use of RFID especially in Transportation. Causing the avoidance of the fuel loss, saving of time in collecting toll, avoid financial loss, to monitor the traffic .

4. Methodology:

RFID (Radio Frequency Identification) is an automatic identification method, relying on storing and remotely retrieving data using devices called RFID tags or transponders.. RFID tags contain silicon chips and antennas to enable them to receive and respond to radio-frequency queries from an RFID transceiver. Passive tags require no internal power source, whereas active tags require a power source. The purpose of an RFID system is to enable data to be transmitted by a mobile device, called a tag, which is read by an RFID reader and processed according to the needs of a particular application. The data transmitted by the tag may provide identification or location information, or specifics about the product tagged, such as price, colour, date of purchase, etc.

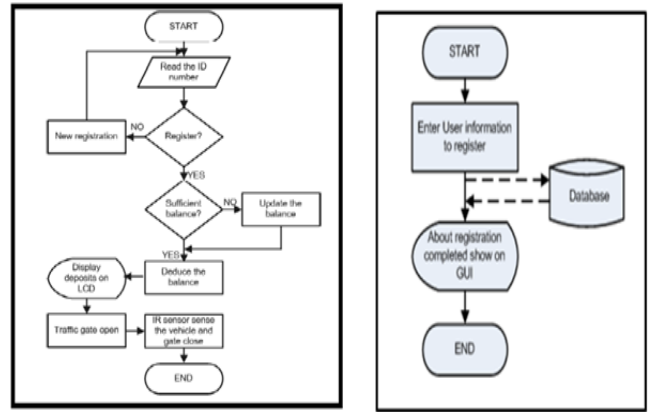
Considering the present toll collection system where each vehicle has to stop and pay taxes.

Suppose the manual toll collection system is very efficient then for one vehicle to stop and pay taxes total time taken is 60 seconds. And suppose 100 vehicles cross the toll plaza. Then, time taken by 1 vehicle with 60 second average stop in a month is: $60 \times 30 = 1800$ seconds

Yearly total time taken = $1800 \times 12 = 216200$ seconds = 6.0 hours

On average each vehicle that passes through the toll plaza has to wait 6.0 hours in engine start condition yearly. If on an average we take 100 vehicles pass through the toll plaza each day, then yearly 36000 vehicles pass through the toll plaza. And each year 36000 vehicles just stand still for 6.0 hours in engine start condition thereby aiding pollution and wasting fuel and money. This study is if the system is very efficient but what if the vehicle has to wait for 5 minutes. Considering 50 toll systems which will drastically increase and the wastage of fuel, money will increase and pollution will also increase

A FASTag is linked to an account where the user adds money. When the vehicle approaches the lane at a toll plaza, a sensor reads the tag attached to the front windscreen of the vehicle, deducts the fee and the gate opens. In a typical RFID system, individual objects are equipped with a small, inexpensive tag. The tag contains a transponder with a digital memory chip that is given a unique electronic product code. The interrogator, an antenna packaged with a transceiver and decoder, emits a signal activating the RFID tag so it can read and write data to it. When an RFID tag passes through the electromagnetic zone, it detects the reader's activation signal. The reader decodes the data encoded in the tag's integrated circuit (silicon chip) and the data is passed to the host computer.



Source: www.google.com

Fig 1: Flow chart for Toll collection and User Registration

RFID works on Fastag chip having stored information which helps to read data and deduct toll amount automatically. Currently ICICI bank, AXIS bank and Paytm have partnered with NHAI for fastag amount Transaction.



Source: www.google.com

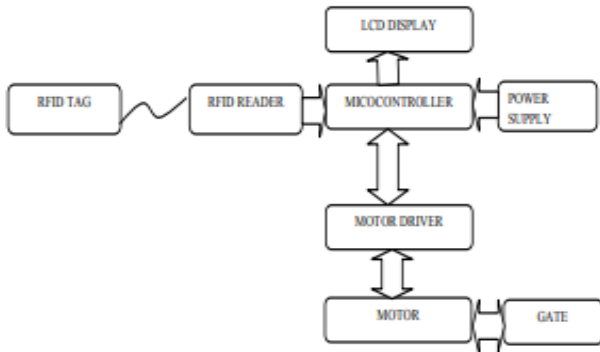
Fig 2: Working Of RFID

Flow of RFID based toll tax are

- Detection of vehicle
- Weighing of vehicle
- Display of toll
- Payment through RFID card

Whenever any person buys a vehicle, first he/she needs to do the vehicles registered at the RTO office. RTO people will assign a number plate to it along with it they will give a RFID enabled tag. This card will have a unique ID feasible to use with that vehicle only. They will also create an account for that particular smart card and maintain transaction history in database. Owner of the vehicle needs to deposit some minimum amount to this account. Every time a registered vehicle approaches the toll booth, first the Infrared sensors will detect the presence of the vehicle which 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 text message . On the other hand, whenever any vehicle owner registers a complaint at

the RTO office regarding theft of the vehicle 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.



Source: www.google.com

Fig 3: Block diagram of RFID Toll tax.

RFID uses the followings

- RFID card: This is one of the most important part of the project. RFID cards are used for applications as access control in security system, cashless payment etc.
- RFID reader: A RFID reader is a device which is used to interrogate an RFID tag. It reads the unique number from the RFID cards and sends it to the microcontroller.
- Microcontroller: The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 4K bytes of In System Programmable Flash memory. The device is manufactured using Atmel’s high-density non-volatile memory technology and is compatible with the industry- standard 80C51 instruction set and pin out. Microcontroller is the heart of the complete system. It is actually responsible for all the process being executed.

It will monitor & control all the peripheral devices or components connected in the system. In short we can say that the complete intelligence of the project resides in the software code embedded in the Microcontroller. The controller here user will be of 8051 family. This unit requires +5VDC for it proper operation. Microcontroller is the CPU of our project. The various functions of microcontroller are:

- Reading the RFID card number from the RFID reader.
- Sending this data to the LCD so that the person operating this project should read various informative messages.
- Sending the data to the motor or buzzer depending upon the RFID card number and balance inside the car.
- LCD: It is called Liquid Crystal Display. We are going to use 16x2 character LCD. This will be connected to microcontroller. The job of LCD will be to display all the system generated messages coming from the controller. LCD will provide interactive user interface. This unit requires +5VDC for it proper operation. This module is used for display the present status of the system.
- Power Supply: This unit will supply the various voltage requirements of each unit. This will be consists of transformer, rectifier, filter and regulator. The rectifier used here will be Bridge Rectifier. It will convert 230VAC into desired 5V/12V DC.
- Motor driver: Motor driver is an IC which is used to drive the motor.
- DC Motor: Motor is used to open the gate.



Source: www.google.com

Fig 4: Working of RFID Toll Collection

5. Observations and findings

The technology of RFID is the best arrangement at toll plaza by decreasing the labour required for gathering of cash and furthermore can lessen the traffic in toll plaza. In our undertaking we have presented the methods i.e., Radio Frequency Identification (RFID). This procedure will incorporate the RFID tag which can be utilized to recognize the vehicle personality. The IR mechanism is utilized for recognizing the nearness of vehicle at various areas which will go about as the door go to the toll court.

6. Conclusion

RFID technology is of low cost, highly secured, far communication ability and more efficient. Electronic toll collection system using RFID is an effective measure to reduce management costs and fees, at the same time, greatly reduce noise and pollutant emission of toll station. 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 as well as security on the roadways.

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