

# Automatic Toll Tax Using RFID

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**Abstract:-** Among the few things which characterize our glorious city of Mumbai is the amazing local transport system, which mainly comprises of the Railways and equally important ROAD TRANSPORTATION SYSTEMS which regulates the proper functioning of the local trains almost round the clock. Taking into consideration the large amount of traffic commuting everyday on roads the road transportation system is responsible for safe and sound transportation of the people of this perennially busy city which never sleeps. RFID Toll Road Payment systems have really helped a lot in reducing the heavy congestion caused in the metropolitan cities of today. It is one of the easiest methods used to organize the heavy flow of traffic. When the car moves through the toll gate on any road, it is indicated on the RFID reader that it has crossed the clearing. The need for manual toll based systems is completely reduced in this methods and the tolling system works through RFID. The system thus installed is quite expedient reducing the time and cost of travelers since the tag can be deciphered from a distance. Here Basic idea is to develop the automatic challan system that can check for signal break by any vehicle. The RFID Reader reads the information like vehicles no. and automatically send a report to the owner of vehicles and simultaneously an information is given on the site itself through LCD.

## I. INTRODUCTION

With the movement of inter-State vehicles and goods, there is rise in the number of toll roads and bridges. Which overall increases the load on highway roads. Hence scientific tracking and monitoring system becomes a need of the toll tax department. The proper collection of toll fees can generate a huge quantum of funds for the maintenance of aging bridges and the large road network. Hence to improve the toll tax collection system and to reduce the traffic at toll tax depots we will develop a system called **No Queue Toll Tax Collection System**.

### I. BACKGROUND OVERVIEW

#### A. Existing System

There are two ways of collecting toll tax being in practise at present. First is the traditional manual method where one person collects the money and issues a receipt. The other one is Smart Card system where the person needs to show the smart card to the system installed at the toll tax depot to open the barrier.

#### B. Drawbacks of Existing System

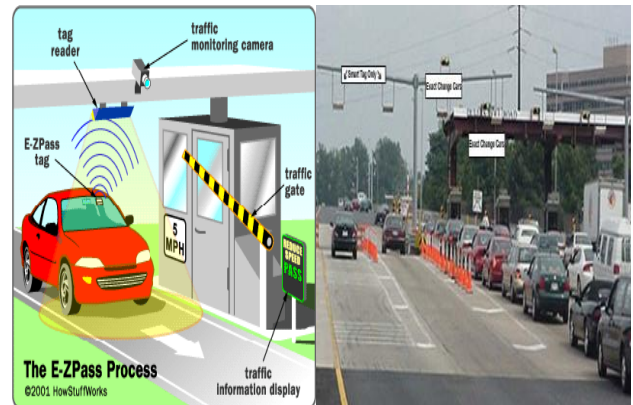
Both the above mentioned method for collecting toll tax is time consuming method. Chances of escaping the payment of toll tax are there. It leads to queuing up of following vehicles.

#### C. Proposed System

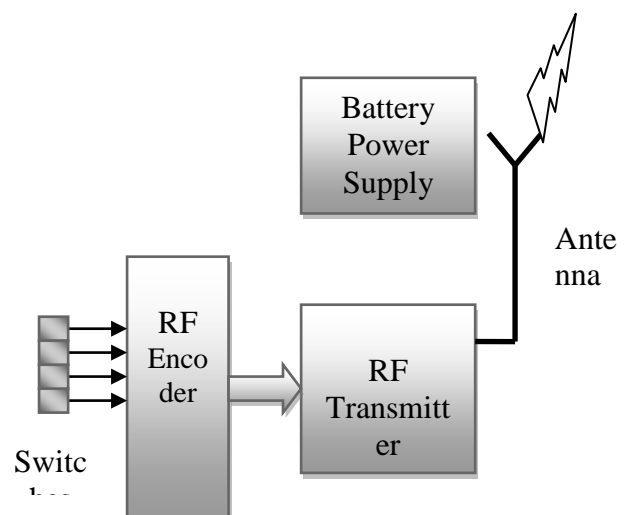
Each vehicle will be provided by an RF TX tag containing a unique ID. This tag will continuously emit RF signals. When the vehicle will reach at the toll booth the RF receiver will detect these RF signals. The signals are amplified and are passed to microcontroller. This microcontroller will display the id on LCD. Now, with the help of PC interface unit the data collected is passed to PC through serial port. Software developed will show all the details about the vehicle on the screen. Details like date, time and id will be stored in the access database. Based on these details a report will be prepared. At the end of the month the system will print the detailed bill and the total amount of the toll tax for the month will also be printed. This bill will be sent to the user for payment.

The following are the major advantages over current system...

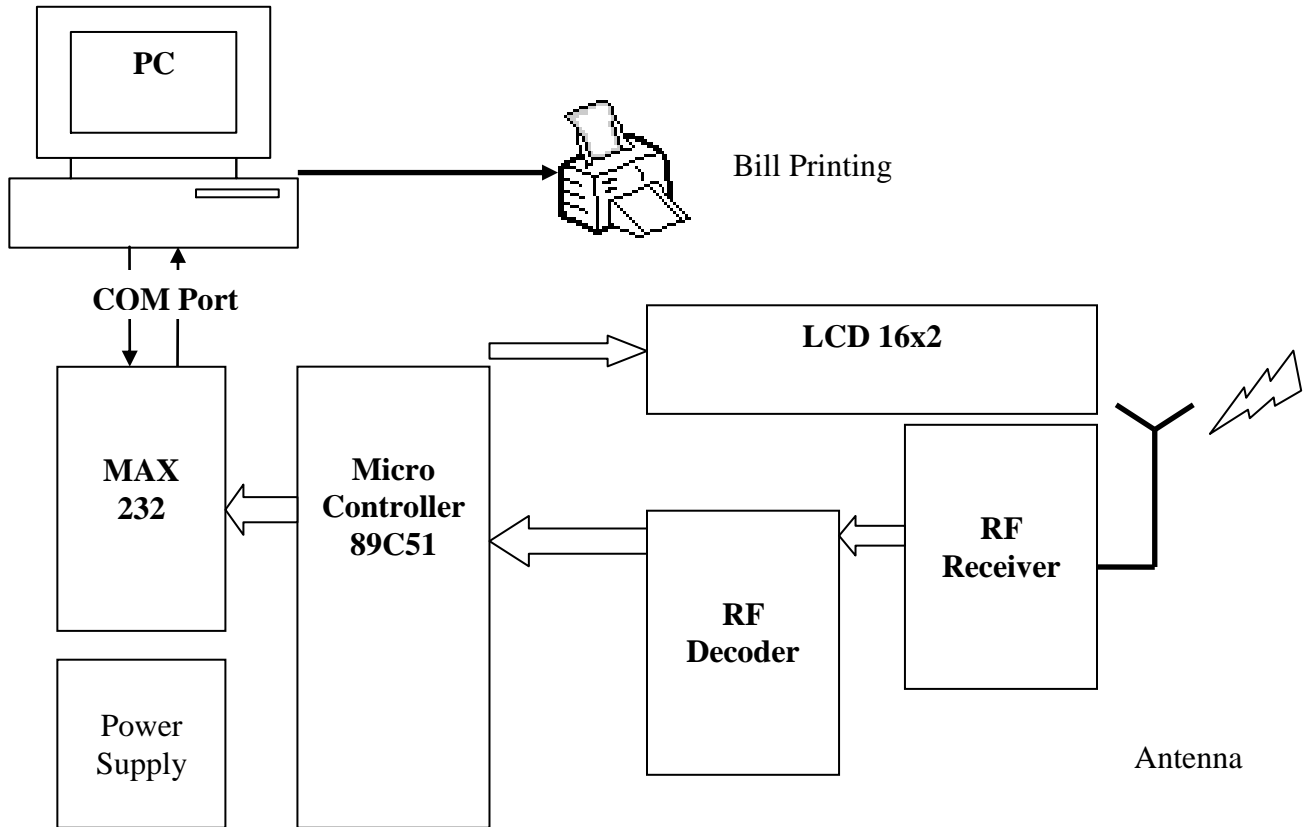
- Automatic collection of toll tax.
- Free flow of traffic.
- Time saving.
- Record maintenance.
- Problems with pursuing toll evaders.



The Base Unit



THE PROPOSED SYSTEM



The RF Transmitter in No Plate

A. Block Diagram

The Block Diagram of the system is attached behind.

B. Explanations of Blocks

The following are the brief explanations of the working principle of the various major blocks or sections used in 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.

• Microcontroller

This unit 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. The code will be written in Embedded C and will be burned or programmed into the code memory using a programmer. This unit requires +5VDC for it proper operation.

• LCD 16x2

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.

• MAX 232

This section will be used to convert TTL logic into RS232 logic and vice-versa. In TTL---logic 1 is +5V and logic 0 is 0V. In RS232---logic 1 is -10V and logic 0 is +10V. This unit will provide interface that is required to communicate microcontroller with RS232 based devices using serial communication link.

The MAX232 IC is dedicated for the logic conversion. This unit is also called as Logic Converter OR Level Converter. This unit requires +5VDC for its proper operation.

- **RF Encoder HT12E**

This unit is used to encode the 4-bit data before transmitting it in the communication channel. Basically it generates a serial bit stream of the parallel input data bits. It then sends data stream to RF transmitter unit. This unit requires +5V to 12V DC for its proper operation. This unit is used to decode the 4-bit after receiving it from the RF Receiver unit. Basically it generates a parallel data from the serial incoming bit stream. This unit requires +5 to 12VDC for its proper operation.

- **The RF Transmitter**

This unit performs very significant roll i.e. it is responsible for the modulation (ASK, CF-434MHz) of the message or data to be transferred. Once the data is modulated then is transmitted or launched in Air by the help of the antenna. The baud rate is generally 1200bps and the range will be up to 100 ft. This unit requires +5V to 12V DC for its proper operation.

- **The RF Receiver**

This unit performs very significant roll i.e. it is responsible for the demodulation of the message or data after reception from air. This section is internally constructed with Amplifier unit, Filter unit, Peak Detector, Sample and Hold circuit and Level Shifter. This unit requires +5VDC for its proper operation.

- **PC Serial Port Controlling**

Serial Port of PC is also referred as RS232 Port. The connector is of type 9 pin D-Type Male connector. Generally we will use only pin-2 (Rx), pin-3 (Tx) and pin-5 (GND) for any type of communication system. In the software part we can use any one of the following methods... **Using MSComm Control ActiveX** - The MSComm control provides serial communications for our application by allowing the transmission and reception of data through a serial port. MSComm is used as a serial port software interface. MSComm provides us the software interface and insulates us from the functioning of the underlying hardware. **Using System.IO.Ports Namespace** - this is part of .net framework. This is an intrinsic way of serial port communication. In this namespace we will use SerialPort Class. This class provides synchronous and event-driven I/O, access to pin and break states, and access to serial driver properties.

- **Database Manager**

A database management system (DBMS) consists of software that operates databases, providing storage, access, security, backup and other facilities. Databases are designed to offer an organized mechanism for storing, managing and retrieving information. They do so through the use of tables.

We can use any one of the following software & technology for database managing... **MS Access 2007** - Access allows us to manage our information in one database file. It is easy to use. It is portable as can be easily copied & paste to any other system and can run without installing the software. **MS SQL Server 2000** - it is rather complex at installation part and easy to use. The database developed on it can not be easily copied and paste on another system. Also it requires the software to be installed to use the database files.

### C. Technology & Programming Languages

As microcontrollers are the core of these days digital circuit design in industry, this system uses it for the centralized operation and digital processing. The technology used here is embedded technology which is the future of today's modern electronics. The followings are the various Programming Languages & Technologies that are going to be used in the proposed system...

*For Embedded System...*

- Embedded Technology,
- 8051 Family Based Controller,
- Embedded C - Keil Compiler,
- Eagle Software for PCB Designing,

*For PC System...*

- VB.net 2008 Based Application Software,
- Serial Communication Protocol,
- MSAccess2007 Based Database,
- Crystal Reports,

### D. Project Development Methodology or Steps

The following will be development steps so as to achieve the working Prototype Model of the above proposed system.

- Defining the Problem,
- Understanding the Need & Usability in industry and society (Market Analysis),
- Developing Block Diagram,
- Designing Circuits of individual blocks,
- Testing circuits in LAB & Finalizing,
- Developing PCB on PC,
- Getting the PCB printed from market,
- Soldering the components,
- Performing various Basic Experiments to test the PCBs,
- Developing Flowchart for the entire process,
- Writing actual Software Program,
- Compilation & Burning,
- Testing and Debugging,
- Developing Flowchart for PC Side Software,
- Developing Data Flow Diagram,

- Writing actual code.
- Finally Running the system and,
- Documentation.

## II. SCOPE & APPLICATIONS

Only the imagination can limit the applications of the above proposed system.

- Automated Vehicle Identification
- Automated Vehicle Classification
- Transaction Processing (Toll Calculation)
- Can be used to trace the vehicle if this system is centralised.

## III. CONCLUSION

By the realization of the above proposed system we can make the Toll Tax collection system more efficient and can reduce the traffic logging on the highways. This system will save a lot of precious time of the driver, passengers as well as of the tax collection authorities. By the realization of the above proposed system one can learn many aspects of a digital electronics circuit. This will give the complete knowledge of designing microcontroller based system and developing embedded software. We will also learn the software development strategies and various programming techniques for PC based applications.

## IV. ENHANCEMENTS

### A. Limitations

As generally all systems have some limitation, here are some listed for the proposed system...

- The proposed system will take care of only single toll depot. It is not the centralised system.
- Multiple RF TX cannot work together.

### B. Drawbacks

This system has certain drawbacks also as listed...

- This system will increase the stationery cost.
- A person is required to print and send the bill to the user.

### C. Future Modifications

There is always chance to improve the any system as research & development is an endless process. Our system is no exception to this phenomenon. The following improvements can be done...

- Centralised system for toll tax collection among all the toll tax depots.
- Monthly bill can be automatic send by Email or the bill amount can be informed by SMS to the user.
- Zigbee, RFID, Bluetooth or other technology can be used to avoid data confliction.

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