

# RFID Based Toll Automation System

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[www.ijcseonline.org](http://www.ijcseonline.org)

Received: Mar/22/2016

Revised: Apr/02/2016

Accepted: Apr/15/2016

Published: Apr/30/2016

**Abstract**—Radio Frequency Identification (RFID) is an auto-identification technology which uses Radio Frequencies (between 30 kHz and 2.5GHz) to identify objects remotely. The automated toll collection system using Radio Frequency Identification (RFID) tag which emerges as a good solution to a manual toll collection system at toll gates. It is used for automatic toll collection at the tollgates and to detect the stolen car at the toll plaza which can help the police to find the stolen car. The RFID tag is a unique ID which is given by the RTO (Regional Transport Office) authority. With respect to these RFID tag ID, all the basic information about the customer and his history is stored. It stores information regarding the tolls, a particular user's vehicle passes and the amount deducted. The tag detection sensor in the reader creates the electromagnetic medium in which the incoming vehicle's RFID tag is detected, the toll amount will be deducted from his prepaid balance and the new balance is updated. Time and efficiency are a very major priority of the project in the present day. These make the toll plaza transaction more convenient for the public use, it saves a lot of time and it also helps to conserve the environment by reducing the pollution.

**Keywords**—RFID Reader, RFID Tag, Toll Collection, Prepaid Account, Toll Automations, RTO

## I. INTRODUCTION

The movement of the vehicle in the toll lane paths are getting congested, particularly on occasions when an inappropriate method is used for toll collection. The most effective method to increase the productivity, speed up the incoming and outgoing entry of a vehicle, and to minimize the likelihood of mixed up are an important issue to be illuminated at this point. An automatic toll collection framework is only the right answer for this issue. This thought can be executed by using the radio frequency identification (RFID) based toll collection system which will automate the toll collection and reduce the long queue in the toll lanes. Notwithstanding this, it can help in vehicle theft detection as well as can track vehicles. The users can get the benefits such as reduced fuel consumption, reduced emissions, reduced waiting time and much more. The management authorities can have faster and efficient service, better audit control, capacity expansion, cashless collection, proper account maintenance [1].

## II. EXISTING SYSTEM

Street tolls were collected customarily for a particular access (e.g. city) or for a particular base (e.g. streets, spans). Toll is a type of duty that users pay for the expense of street development and upkeep without raising duties on non-users. Toll is paid manually at a toll entryway; payments are for the most part made in cash. User pays a specific sum at a tollgate depending upon his vehicle. Three frameworks of tolls exist: open (with mainline obstruction toll courts); shut (with section/exit tolls) and all-electronic toll gathering (no toll stalls, just electronic toll accumulation gate entries at passageways and exits or at key areas on the

mainline of the road). On an open toll framework, all vehicles stop at different areas along the expressway to pay a toll. While this might spare cash from the absence of the need to build tolls at each way out, it can bring about movement clog, and drivers might have the capacity to maintain a strategic distance from tolls by leaving and re-entering the roadway. With a shut framework, vehicles gather a ticket when entering the interstate [2]. At times, the ticket shows the toll to be paid on the way out. Upon way out, the driver must pay the sum recorded in the given way out. Short toll streets with no middle sections or exits might have one and only toll court toward one side, with drivers going in either course paying a level expense either when they enter or when they leave the toll street. In an all-electronic framework, no money toll accumulation happens, tolls are typically gathered with the utilization of a transponder set before the gate when the vehicle comes too close to the transponder, the sum is deducted and the door will be opened. An all-electronic toll gathering, is presently the favored practice, being more productive, naturally neighborly, and more secure than manual toll collection [2].

## III. PROPOSED SYSTEM

Toll Collection System is one of the important activities carried out in the world. There are a lot of problems faced while collecting toll, especially in India. The aim of this project is to build a toll collection System which is automated and which implements the cashless operation. This project improves the strategy took and simplifies the procedure followed by travelers to pay toll at toll gathering stalls, such as making it automated, vehicle theft recognition and so forth. Every one of these exercises is

done utilizing single smart card (RFID label), hence sparing the endeavors of conveying cash and maintaining records manually.

**Automatic Toll Collection:** RFID technology helps to save time at toll plaza due to cashless operation. Radio frequency is used for identification. An RFID tag is installed on a vehicle. A unique number is attached to this tag. RTO or related authority will assign this. All basic information and amount user has deposited in his account for toll deduction are stored in accordance with this. At toll gate, RFID readers are installed. A particular amount is deducted from the account when a particular vehicle passes the toll gate and the new balance is immediately updated [3].

**Vehicle Theft Detection:** When a police officer fills the web form regarding the theft of the vehicle, the TAG id of that vehicle will be blacklisted. If the RFID tag of vehicles that pass through toll plaza match with any of blacklisted RFID tags stored in the database, it will be reported to the police accordingly [3].

**Android Notification:** Android app notifies the amount deducted from the wallet at which toll and how much balance is remaining. The database can be connected with an android app so that when the toll is deducted from the users' account, they will get a notification on the android application. It will also help to store the information about the journey details. In this way, transparency is maintained and the notification will be sent to the user who has registered the complaint about the stolen vehicle when that stolen vehicle will pass the toll plaza and notification will also be sent to the police that stolen vehicle is found at a particular toll.

#### IV. METHODOLOGY

Whenever any person buys a vehicle, one first needs to get his or her vehicle enrolled at the RTO. RTO authorities won't just dole out a number plate, it will additionally give an RFID empowered smart card or a tag. A unique ID valid to use with that particular vehicle only will be stored in the card. In order to use that particular smart tag, an account will be also created. All transaction history must be maintained in the database. Users must add a basic minimum amount to this account [3].

When the vehicle will pass through the toll gate, the RFID tag installed on the windscreen of the vehicle will get activated by RFID circuit installed at the toll gate. Depending upon the balance available, toll will be deducted directly from an account or the user can add money to his account in case of insufficient balance. All the transactions are updated in the centralized database server.

On the other hand, if any vehicle is stolen and vehicle owner registers a police complaint regarding the stolen vehicle, that vehicle information such as RFID tag ID, etc. is stored in the database which is called as blacklisted RFID. Now when any vehicle that passes through the toll,

its RFID tag ID is matched with the blacklisted ID's stored in the database first, and if matched, will be easily identified as the ID assigned is unique [3].

All the toll plazas will be connected to each other along with the centralized server in the form of LAN. Updates of any sort of transaction will be immediately updated to the local database and the centralized server. Also, Android app will be connected so that the user can have all information regarding toll deduction and balance [3].

#### V. TECHNOLOGY USED

1. RFID Tag: A passive tag does not contain a battery. When radio waves are received which are generated by the reader, the coiled antenna attached to the tag forms the magnetic field and modulates the wave from chip to the reader. The tag is embedded on the windshields and is scanned using the radio waves [4].

2. RFID Reader: A reader creates an electromagnetic field in which the tag responds and helps the reader to interrogate the tag number and details. The reader converts the wave which is receive formed the tag into the digital data. The reader uses OPAMP as an amplifier to increase the range of the electromagnetic field. This digital data is then passed to the host server with the help of the serial communication [4].

3. USB to Serial Communication: The data is sent to the server with the help of the RS-232. It enables USB based computers to access and communicate with serial devices. With the help of the serial communication, the tag number is displayed in the data logger which creates the log file.

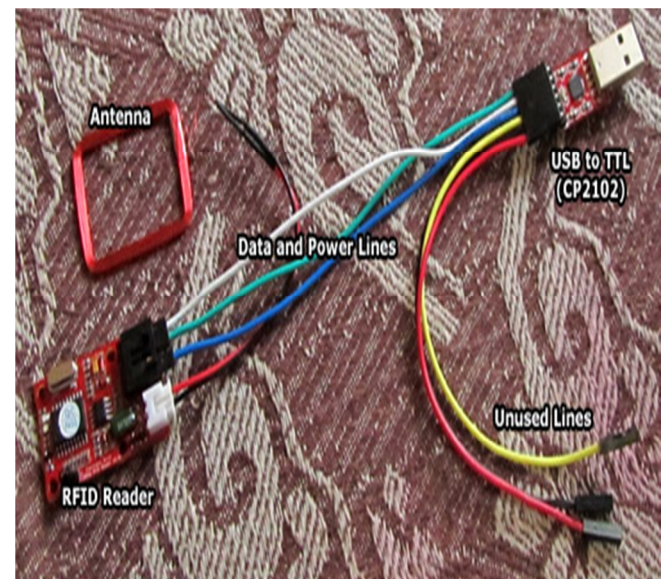


Figure 1 USB-TTL cable with RFID

4. RS-232 Data logger: The real-time information received from the serial communication is stored in a log file.

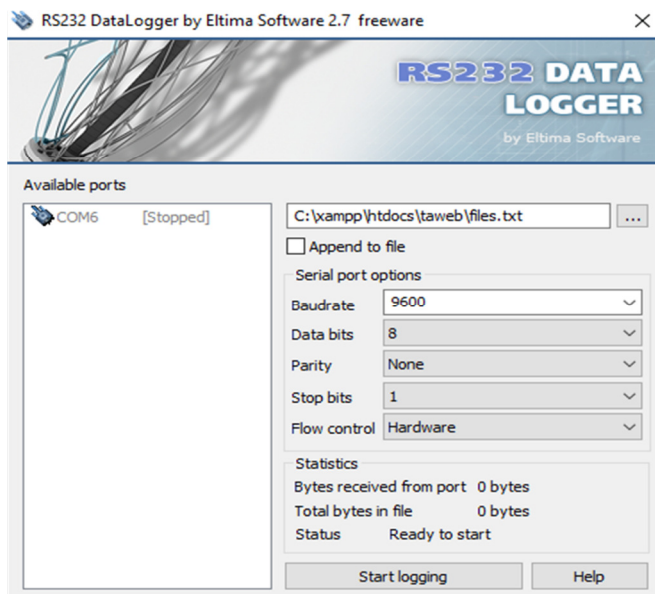


Figure 2 RS232 Data Logger

5 Eclipse: For building an android application and providing different functionalities to various stakeholders, eclipse is used.

**VI. IMPLEMENTATON**

RFID based toll accumulation framework utilizes technology which can be used for quick, faster and efficient gathering of toll at the toll gates. This will be easy for the vehicles which pass through toll gate but need not stop for paying the toll and the toll amount is automatically deducted from his account. The user can easily recharge their account through the web or android application, get the notification about his activities and details of user’s history are stored in the system.

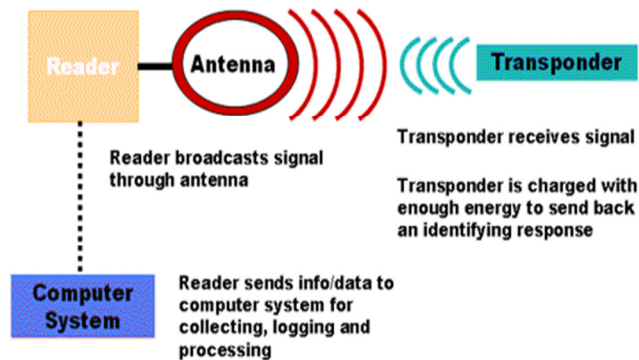


Figure 3 RFID Working [4]

The electronic toll lanes are set up with RFID readers that continuously send out signals which create the electromagnetic field. These signals are used to detect tags fitted on the windshields of the vehicles. To use the

electronic toll facility, the driver needs to set up an account and get an electronic transponder known as tag [3].

**EM-18 RFID CHIP**



Figure 4 RFID EM18 Module

The EM-18 reader module reception antenna persistently conveys a radiofrequency (microwave) beat, which returns just when it hits a tag/transponder. After hitting the tag, these pulses return to the reception apparatus. These microwaves reflected from the tags contain information about the transponder’s unique number, etc. Other data, for example, date, time, and vehicle check could be recorded relying on the prerequisite of the information required by the toll organizations. After that, the contents of this microwave are send off to a central location using fiber-optic cables, cellular modems or wireless transmitters, where computers use the distinguished identification number to recognize the account from which a particular amount of toll is to be deducted [3].

Table 1 Features of RFID EM18

|  |                      |
|--|----------------------|
| <b>RF frequency transmit</b>             | 125 KHz              |
| <b>Interface used for communications</b> | TTL Serial Interface |
| <b>Reading distance</b>                  | Upto 10cm            |
| <b>Antenna</b>                           | Integrated           |
| <b>Power Supply</b>                      | 4.6V-5.5V DC         |
| <b>Consumption</b>                       | 50mA<10mA            |
| <b>Size(L*W*H)</b>                       | 32mm*32mm*8mm        |

The digital data received with the help of the serial communication is observed in the hyper terminal as well as in RS232 Data Logger and the real-time data from RFID reader through RS232 serial communication is stored in a log file which is created and is passed to the MySQL database on the XAMPP server with the help of the PHP connectivity. The tag is searched in the database and accordingly the balance is deducted and notification is to send to the user on the android application. The notification will be sent to the police and user if the vehicle is a stolen vehicle. The user can also handle his account with the help of the android application. The user can view his profile,

