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# Electronic Toll Collection System and Theft Detection Using RFID

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***Abstract:*** **In this synopsis we will discuss RFID based Smart Toll Collection System as a solution to solve the traffic problems and also to maintain transparency of the toll collection system. Our aim is to make a digital toll collection system which will be less time consuming and automated. This project focuses on an electronic toll collection (ETC) system using radio frequency identification (RFID) technology. The proposed RFID system uses tags that are mounted on the windshields of vehicles, through which information embedded on the tags are read by RFID readers; the proposed system eliminates the need for vehicle owners and toll authorities to manually perform ticket payments and toll fee collections, respectively. Data information are also easily exchanged between the vehicle owners and toll authorities, thereby enabling a more efficient toll collection by reducing traffic and eliminating possible human errors. In addition, in this project we will measure weight of the vehicles using a weight sensor. Over weight transport will be blocked, they will not get access. In calculation, Economical analysis of the automatic toll collection system is also presented and is compared with the manual ticketing base system.**

**Keywords - Arduino, RFID,WIFI**

## I. INTRODUCTION

Now a day's traffic problem is a very severe problem in our country. In some countries every day we have to face traffic jam for several hours which is very annoying at the same time creating a huge trouble in our daily life. Traffic jam mainly causes for reckless driving and also for the rash of the vehicles in the road. For the reduction of traffic problem government has made many bridges, fly over's and bypass roads. People have to give toll when they pass these by any vehicle. Unfortunately, the toll collection system is manual in our country which takes many times to pass the vehicles and creating traffic jam. Here we introducing Electronic toll collection system using RFID technology which will be an automatic system, will not stop the vehicles as well as this system will help to reduce the traffic jam. Here, the payment will be taken from the bank account of the vehicle owner and he will receive a message from the server that the toll payment has been taken. In addition, our system will also help to solve the traffic severe crashes, which is mainly caused by over speeding as here we have used speed breaker to slow down the speed of the vehicles when RFID tag will read the information of the vehicles.


Figure .General RFID based toll tax image

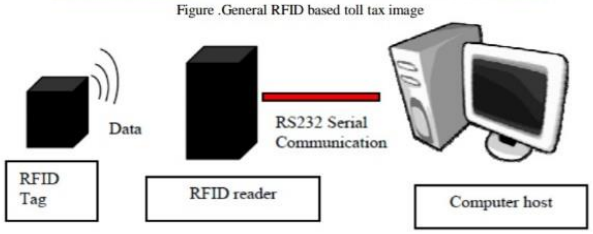


Figure: Complete RFID System

**Fig 1: electronic toll collection system**

## II. LITERATURE SURVEY

ETC (Electronic Toll Collection) is an electronic automatism toll collection system that was been researching by the world. Throwing information change between electronic labels that held vehicle and RPID antennas that was fixed the roadside or door frame, the centre control computer can identify the road user by the information stored in the electronic label and

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deduct the pike from the road user advance stored card or bank account. Its obvious advantage is no parking troll collection. Thereby it can significantly improve the dispose efficiency of the toll station and the traffic ability of toll road [1].

An ETC system based on RFID technology uses radio wave to identify cars passing through the toll collection site and automatically debits toll rate from the car owner's pre-paid account RFID technology and its application in highway ETC system is analysed in this paper. SNMP is a kind of protocol that has been widely used in network management system for many years. Because of its easy use and strong expansibility, SNMP is suitable for network management of ETC system. After introducing the basic knowledge of SNMP, this paper studies how to use SNMP to manage the RFID readers and the toll collection workstations remotely [2].

In order to solve the problems of high failure, different network standard and inconvenience in tradition Electronic Toll Collection System (ETC). This paper discusses the application of RFID-SIM card in Electronic Toll Collection System in expressway. Furthermore, it analyses hardware structures and connection among each module of the RFID-SIM cell phone's payment system, its application in ETC and some difficulties, and uses the electronic tag and conflict detection to deal with the uncontrollable distance of swiping card and conflict of swiping card in the application. Based the study it can sure the RFID-SIM card will have wide application prospects in ETC with its Convenience and intelligent [3].

This paper deals with the design of a radiofrequency identification (RFID) reader for electronic toll collection (ETC) systems. The ETC scheme herein considered comprises a planar antenna array as radiating element of the RFID reader. This reader is required to be capable of alternatively illuminating three (or more) road surface portions called coverage areas, where a transponder (tag) might be present. Coverage areas have to be well-defined in order to avoid collision. This paper treats with the design of the RFID reader, with special emphasis on the coverage area synthesis in the practical case of a limited size antenna array [4].

## III. OBJECTIVE

- According to statistics, about 65% of cars did not go through toll stations when using freeways at the time of flat-rate toll station and therefore did not have to pay tolls and results in a "Toll Equity" issue.

- In order to reach the goal of toll equity to all freeway users, which flat-rate toll station toll collection system failed to fulfill, the government decided to implement distance-based toll collection system.

## IV. PROBLEM STATEMENT

Many decision points exist while approaching the plaza, at the plaza, and on departure from the plaza. The decision points can lead to vehicle merging, weaving, queuing, diverging and differential speeds. Diverging and weaving occurs on the approach to the plaza as electronic toll collection (ETC) users separate from cash paying customers, who then further diverge based on selected cash payment lane type, shortest traffic queue, and lane status (i.e., open or closed).

## V. METHODOLOGY

Electronic toll collection systems rely on four major components:

- Automated vehicle identification
- Automated vehicle classification
- Transaction processing
- Violation enforcement.

Automated vehicle identification (AVI) is the process of determining the identity of a vehicle subject to tolls. The majority of toll facilities record the passage of vehicles through a limited number of toll gates. At such facilities, the task is then to identify the vehicle in the gate area. Some early AVI systems used barcodes affixed to each vehicle, to be read optically at the toll booth. Optical systems proved to have poor reading reliability, especially when faced with inclement weather and dirty vehicles.

Most current AVI systems rely on radio-frequency identification, where an antenna at the toll gate communicates with a transponder on the vehicle via Dedicated Short Range Communications (DSRC).

RFID tags have proved to have excellent accuracy, and can be read at highway speeds. The major disadvantage is the cost of equipping each vehicle with a transponder, which can be a major start-up expense, if paid by the toll agency, or a strong customer deterrent, if paid by the customer.

Automated vehicle classification is closely related to automated vehicle identification (AVI). Most toll facilities charge different rates for different types of vehicles, making it necessary to distinguish the vehicles passing through the toll facility. The simplest method is to store the vehicle class in the customer record, and use the AVI data to look up the vehicle class. This is low-cost, but limits user flexibility, in such cases as the automobile owner who occasionally tows a trailer. More complex systems use a variety of sensors. Inductive sensors embedded in the road surface can

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determine the gaps between vehicles, to provide basic information on the presence of a vehicle. Treadles permit counting the number of axles as a vehicle passes over them and, with offset-treadle installations, also detect dual-tire vehicles. Light-curtain laser profilers record the shape of the vehicle, which can help distinguish trucks and trailers.

Transaction processing deals with maintaining customer accounts, posting toll transactions and customer payments to the accounts, and handling customer inquiries. The transaction processing component of some systems is referred to as a "customer service centre". In many respects, the transaction processing function resembles banking, and several toll agencies have contracted out transaction processing to a bank. Customer accounts may be post-paid, where toll transactions are periodically billed to the customer, or prepaid, where the customer funds a balance in the account which is then depleted as toll transactions occur. The prepaid system is more common, as the small amounts of most tolls makes pursuit of uncollected debts uneconomic. Most post-paid accounts deal with this issue by requiring a security deposit, effectively rendering the account a prepaid one.

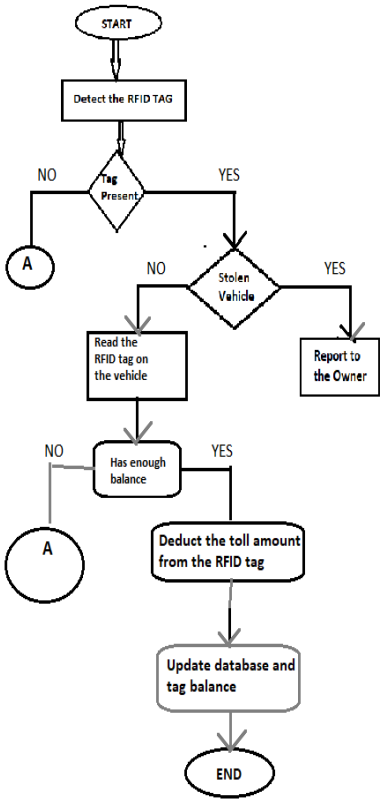


**Fig 2: working flow chart of electronic toll collection**

## VI. HARDWARE COMPONENTS

•Arduino Mega R3 2560
•Load Cell
•HX-711 Load Cell Amplifier
•RFID Reader
•LCD Display (16*2)
•SIM900A kit
•GSM Module

**Arduino Uno:**

**Fig3: Typical Arduino Uno**

The Arduino Mega 2560 is a microcontroller board based on the ATmega2560 (datasheet). It has 54 digital input/output pins (of which 14 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a ACto-DC adapter or battery to get started.

**LCD Display (16x2):**

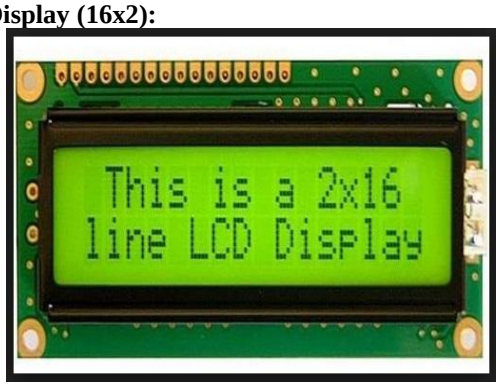


**Fig4: Liquid Crystal Display(16x2)**

A liquid crystal display (LCD) is a flat panel display, electronic visual display, based on Liquid Crystal Technology. A liquid crystal display consists of an array of tiny segments (called pixels) that can be manipulated to present an information. Liquid crystals do not emit light

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directly instead they use light modulating techniques. LCDs are used in a wide range of applications, including computer monitors, television, instrument panels, aircraft cockpit displays, signage, etc. They are common in consumer devices such as video players, gaming devices, clocks, watches, calculators, and telephones.

**Global system for mobile (GSM):**

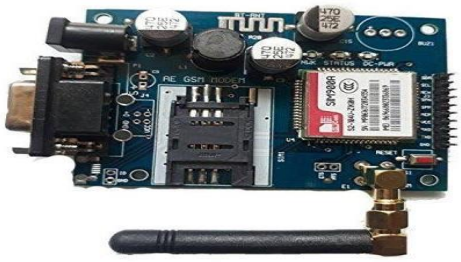

**Fig5: GSM module**

GSM stands for Global system for mobile communication formerly called as Groupe special mobile. This is a standard set developed by the European Telecommunication Standards Institute (ETSI) to describe technologies for second generation (or "2G") digital cellular networks. The GSM standard circuit initially was used originally to describe switched circuit network for full duplex voice telephony to replace first generation analog cellular networks.

**RFID Card:**

RFID stands for Radio-Frequency Identification. The acronym refers to small electronic devices that consist of a small chip and an antenna. The chip typically is capable of carrying 2,000 bytes of data or less.

The RFID device serves the same purpose as a bar code or a magnetic strip on the back of a credit card or ATM card; it provides a unique identifier for that object. And, just as a bar code or magnetic strip must be scanned to get the information, the RFID device must be scanned to retrieve the identifying information.

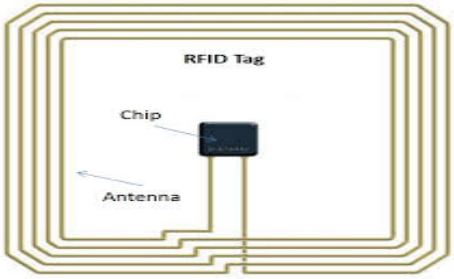


**Fig6: Inside a RFID tag**

## VII. WORKING

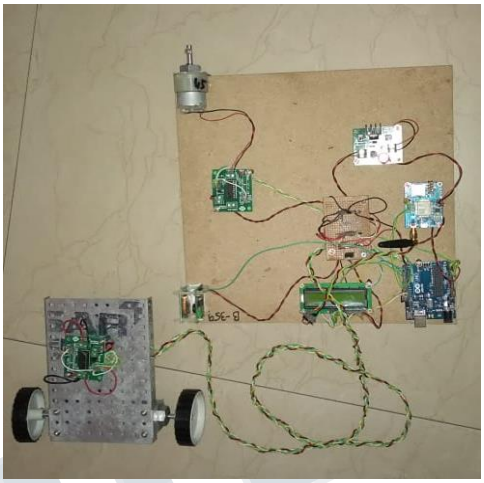

**Fig7: working model of ETC**

•Firstly, the RFID tag on the vehicle is scanned, if the tag is present then the vehicle moves to the further process.
•If the card has no complaints(stolen), then further moves on to the payment process. If the vehicle is stolen then the toll will remain closed and a message is sent to the vehicle owner through GSM.
•If the contains maximum amount to pay the toll fee then the amount is deducted and the toll gate opens for that vehicle.
•If the card contains insufficient balance then vehicle owner had to pay money at the toll and move on.

**Applications of RFID**

•Logistics and supply chain visibility.
•Item level inventory tracking.
•Race timing.
•Attendee tracking.
•Materials management.
•Access Control.
•IT Asset tracking.
•Tool tracking.
•Kiosks.
•Library systems.
•Laundry management.
•Interactive marketing.
•Real Time Location System (RTLS).

## VIII. APPLICATIONS

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

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## IX. 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.

## REFFERENCES:

[1] The Research and Application of RFID Technologies in Highway's Electronic Toll Collection System. (Xu Guangxian, Department of Electronic Information Engineering, Liaoning Technical University HuLuDao, China).
[2] Application of RFID and SNMP Technology in Highway Electronic Toll Collection System. Huiping Huang, Shide Xiao, Xiangyin Meng, Mechanical Engineering Department Southwest Jiao tong University Chengdu, China
[3] The Application of RFID-SIM in Electronic Toll Collection System. Yuhua Guo, Hong Li, Zhao Li Changsha University of Science and Technology, Changsha, Hunan 410076, China.
[4] Planar antenna array design considerations for RFID electronic toll collection system. Daniele Inserra, Wei Hu, and Guangjun Wen School of Communication & Information Engineering, University of Electronic Science and Technology of China, Chengdu – China.