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Automated Toll Collection System Using RFID

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Abstract- ATCSR (Automated Toll Collection System using RFID) is used for collecting tax automatically. In this we do the identification with the help of radio frequency. A vehicle will hold an RFID (Radio Frequency Identification Device) tag. This tag is nothing but unique identification number assigned to it. The reader will be strategically placed at toll collection centers. Whenever the vehicle passes the toll booth, the tax amount will be deducted from his prepaid balance. New balance will be updated. As vehicles don't have to stop in a queue, this translates to reduced Traffic congestion at toll plazas and helps in lower fuel consumption. This is a very important advantage of this system. An RFID tag is installed on each vehicle with read/write memory. A reader device reads this data when the vehicle is near the toll system, and compares it with the data in the computer database. This helps us to provide security since vehicles with RFID can be tracked easily. Apart from that we can conserve fuel and also reduce the amount of pollution.
Keywords: ATCSR, RFID Reader, RFID Tag, Toll Collection.

I. INTRODUCTION

The main idea behind implementing ATCSR is to automate the toll collection process there 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 and the system administrator. Other general advantages for the motorists include fuel savings and reduced mobile emissions by reducing or eliminating deceleration, waiting time and acceleration. Meanwhile, for the toll authorities also get the benefits mentioned below[4]:

1. Fewer or shorter queues at toll plazas
2. Faster and more efficient service (no exchanging toll fees by hand)
3. The ability to make payments by keeping a balance on the card itself
4. The use of postpaid toll statements (no need to request for receipts)
5. Lowered toll collection costs
6. Better audit control by centralized user account
7. Expanded capacity without building more infrastructures.

II. DRAWBACKS OF EXISTING SYSTEM

The existing method for collecting toll tax is a time consuming method. There are more chances of escaping toll payment. It leads to queuing up of following vehicles. Suppose the manual toll collection system is very efficient then for one vehicle to stop and pay taxes total time taken is 50 seconds. And suppose 200 vehicles cross the toll plaza. Then, time taken by 1 vehicle with 60 second average stop in a month is: 50x30= 1500 seconds[8].

Yearly total time taken = 1500x12 = 18000seconds = 5.0 hours

On average each vehicle that passes through the toll plaza has to wait 5.0 hours in engine start condition yearly. The figure is staggering. If on an average we take 200 vehicles to pass through the toll plaza each day, then yearly 72000 vehicles pass through the toll plaza. And each year 72000 vehicles just stand still for 5.0 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? This is a

figure considering one toll plaza[8]. If considering 50 toll systems the above figure will drastically increase and the wastage of fuel and money will increase and pollution will also increase.

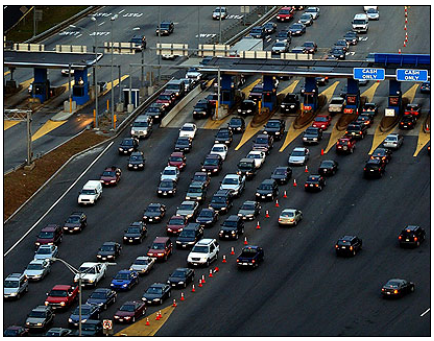


Fig 1:Traffic Jam at Tolls

Suppose, If there are 100 manual toll-taxes system and everyday 100 vehicles cross through each system, then No of vehicle that pass through one system yearly= 100 x 30 x 12 = 36,000. No of vehicle that pass through 100 system yearly= 100 x 36,000 = 36, 00,000[7].

Vehicle	Days	Tool booth
100	1	1
36000	30*12	1
3600000	30*12	100

TABLE 1: Vehicles Passed through Toll Booth in 1 year

This figure indicates that in one year each of the 36, 00,000 vehicles just stand still for about 6.0 hours in engine start condition which causes pollution and increases fuel consumption. Suppose that in 6.0 hours a vehicle uses 1 liter fuel, Total fuel used by all the vehicles: 36, 00,000 x 1 = 36, 00,000 liters[7].

Vehicle	Fuel consumption	Amount
1	1 lit	75/-
3600000	3600000 lit.	270,000,000/-

TABLE 2: Fuel Consumption and Amount Vehicle Fuel Consumed Amount

Assuming cost of 1 liter fuel = Rs.75 Total cost of fuel consumed by 36, 00000 vehicles = 75 x 36, 00,000 = Rs. 270,000,000/- The above is the money wastage under the consideration that the vehicle stops for 60 second at the toll system, and 100 vehicles pass through the toll plaza each day and there are 100 toll plazas. These figures are all in minimum.

III. AUTOMATIC TOLL COLLECTION SYSTEM

To avoid the above drawbacks we can automate the toll collection system using RFID through his we can overcome the drawbacks.

A. Overview:

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 will 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 [4]. User 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.

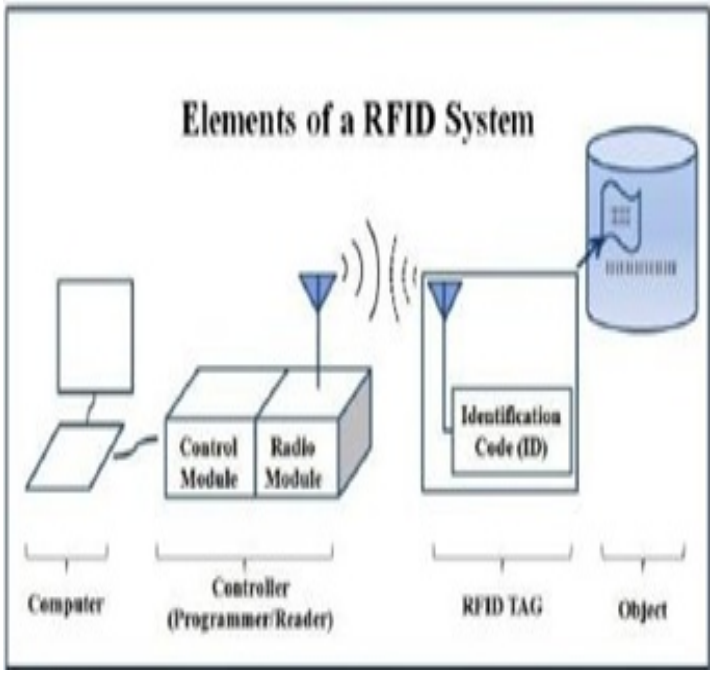


Fig.2:Elements of RFID System

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 text message.

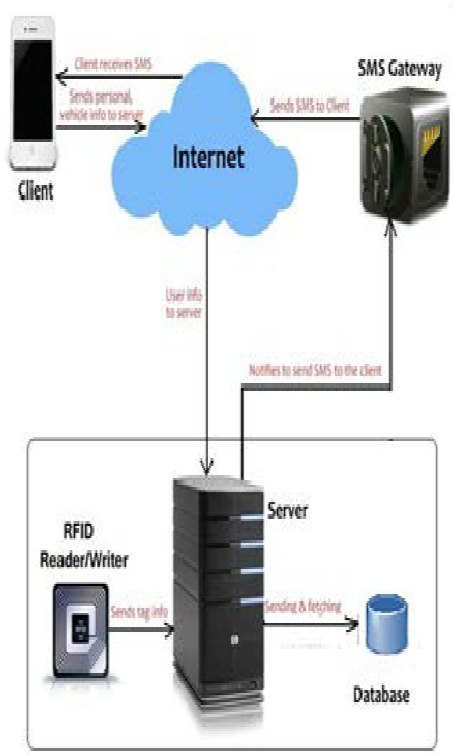


Fig.3:SMS Gateway

B. Operation

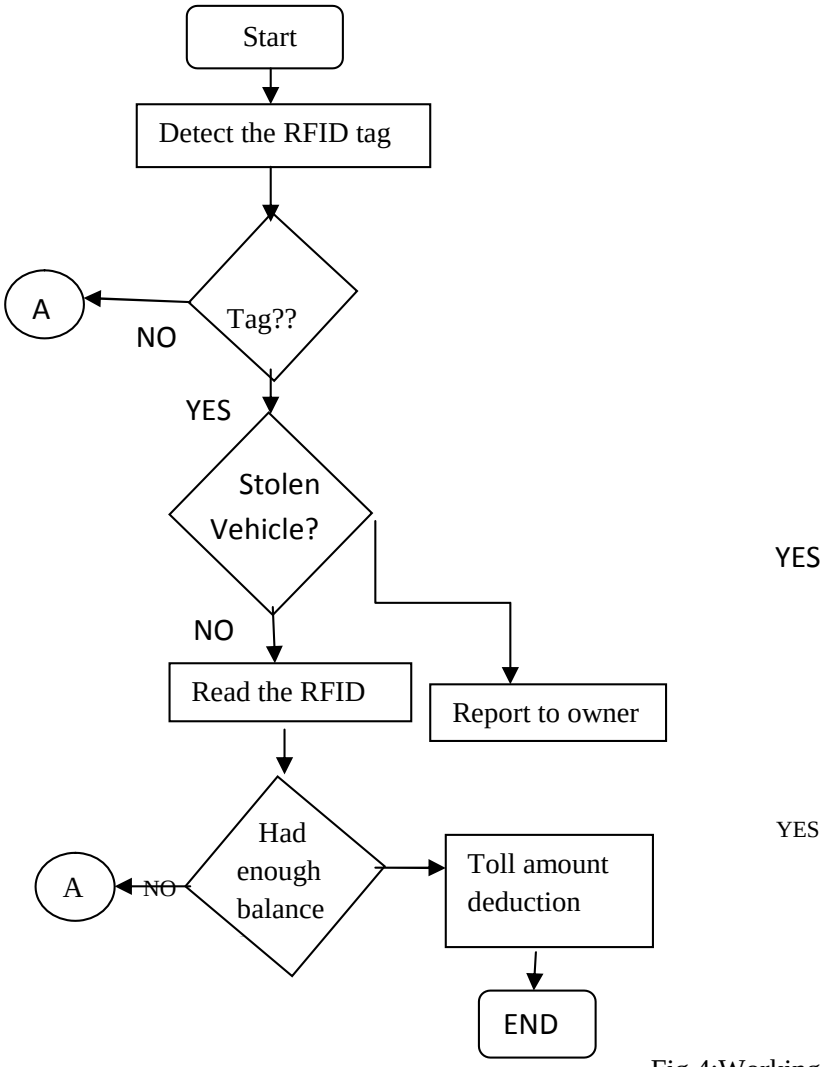


Fig 4:Working Procedure

When the vehicle crosses the sensor processing unit, the tag will be read by the RFID reader. The tag contains the unique identification number. Then data read by the RFID reader will be taken by Microcontroller which will process the data for authentication of authorized user[6].



Fig 5:Practical Working

If the user is a valid user then data will be sent to the processing unit. Then it checks the respective account of that user from the database to ensure weather the user has sufficient amount for toll payment or not. If amount is not sufficient to pay toll then user must have to recharge its account by paying manually. If sufficient amount then user is allow to pass by iron bar which will rise

up with the help mechanical assembly after receiving the permission signal from processing unit. If user is not valid then iron bar will remain down and appropriate action will be taken against invalid user.

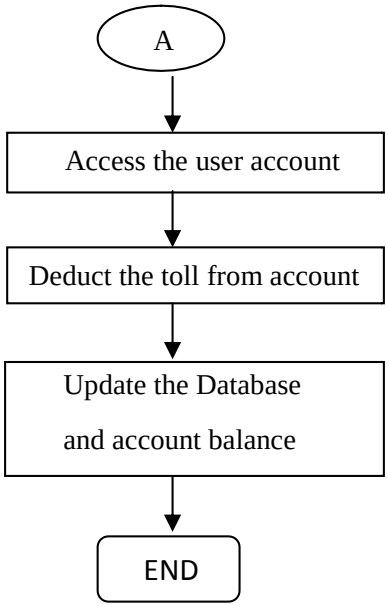


Fig6:Toll amount deduction

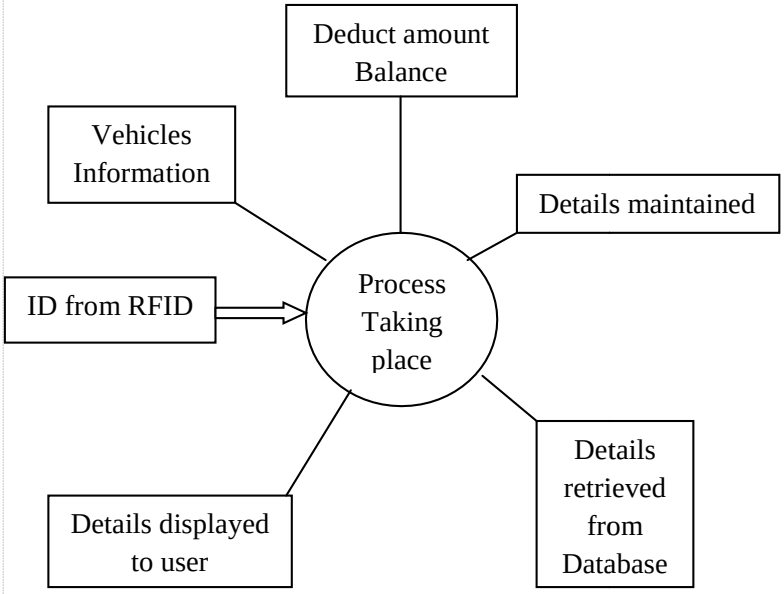


Fig7:Overall Process

When the user installs an RFID device on his vehicle, he will be provided with a card. This card will be used to debit the amount of money required to pay the toll fee when the vehicle passes through the toll gate. The user needs to keep topping up the amount on his card every time it reaches a certain minimum amount. Whenever the vehicle crosses an automated toll gate, the required fee is automatically debited from the card. An automatically generated message will be sent instead of a receipt to the user's mobile number.

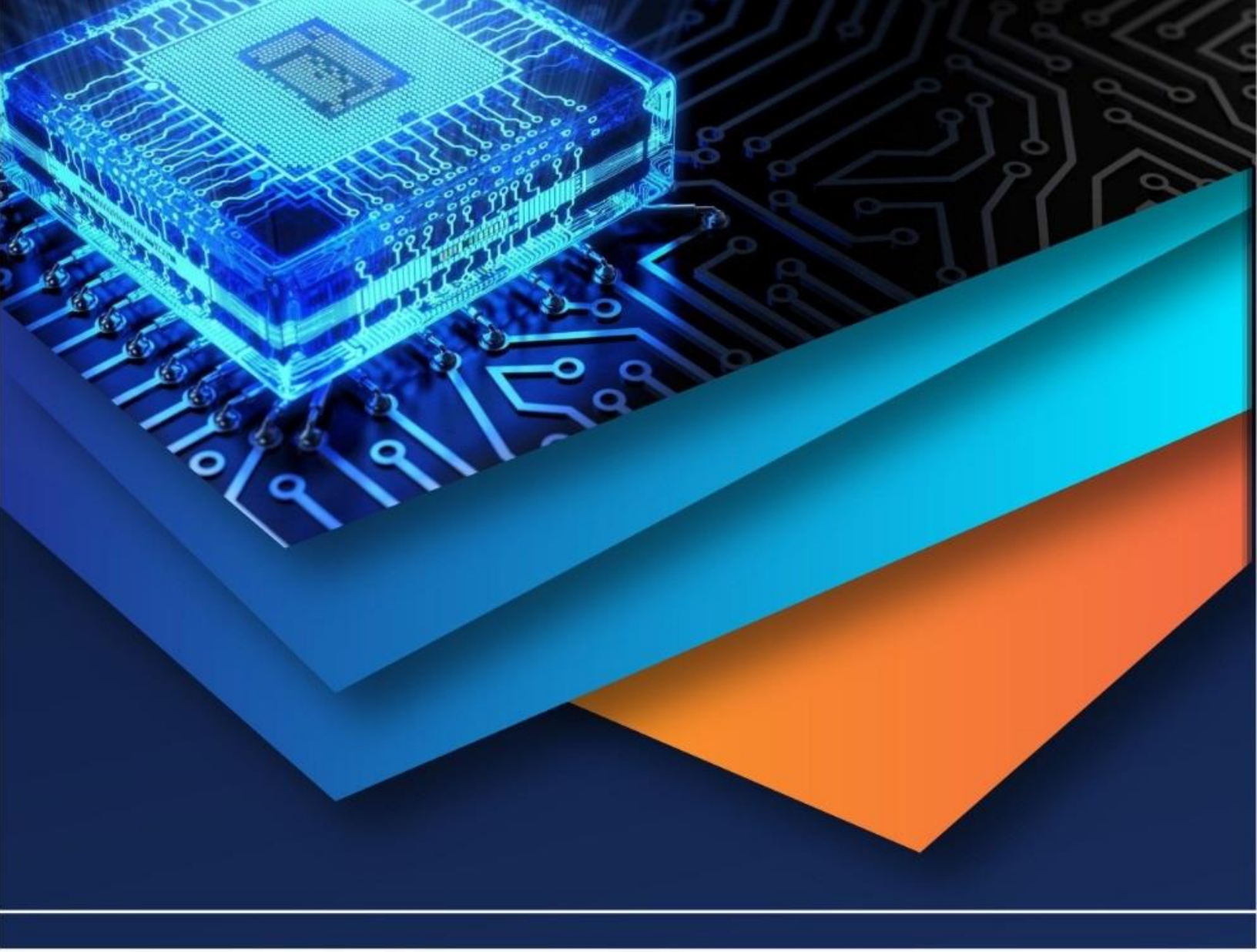
IV.CONCLUSION

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. We can also save the time.

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 labor 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. This also reduce the fuel consumption which are now under the threat of exhausting.

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