Automated Toll Plaza Verification System for an Automobile at a Check Point

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***Abstract*—Toll Plaza Payment systems have been of great assistance in lowering the over traffic congestion that has become a part of the metropolitan cities these days. It is one of the best ways to manage the great run of traffic. The travellers passing through this mode of transport must pay toll by waiting in long queue, so it leads to problems like fuel wastage, time wastage, pollution, and burden of carrying cash. Thus by using our system traveler relieves the burden of waiting in the queue to make the toll payment, which decreases the fuel-consumption and also taking cash with them can be avoided. So by using our system User can get RFID tag passes by paying online, and so that user doesn't need to wait in tollgate.**

***Index Terms*—ETC, Toll Plaza, Automated, Check Point, RFID**

I. INTRODUCTION

The amount of traffic in recent years has been steadily increasing due to the ever increasing number of vehicles .Everyday, millions of commuters take to their own personal vehicles in place of public transport systems .This leads to steady increase in vehicle traffic in developing countries. The only possible solution is to build more number of wider roads. Often the government is in short of funds, hence "tolling systems" are used to collect funds as the vehicles use these toll roads. Conventional tolling system requires the vehicle to stop at a toll gate and the toll fee is manually paid. This is a slow system as manual processing often leads to delay and customers have to wait .An improvement in the traditional system is the ETC(Electronic Toll Collection System),which requires users to have a prepaid smart card. As the vehicle passes the toll gate, the user has to swipe his/her prepaid card and the toll amount is deducted from the prepaid account balance. The Electronic Toll Collection System requires users to have a prepaid card in possession. Whenever the user passes the toll gate, the system requires the user to insert the prepaid card into the card processing system. The system checks for balance availability and deducts the required toll fees. The toll gate is then opened for the particular user. If no balance is available, the user then has to pay manually. This allows to speed up the toll collection process upto a certain level. Our system aims to overcome the limitations of the ETC system. Instead of a prepaid card, our system uses a smartphone based app. The app acts as a prepaid card. Each time the user passes through the toll gate, the system identifies the vehicle using RFID technology. It then checks if the user has sufficient prepaid balance. If yes, the user is charged the required toll amount and the toll gate is opened .If no sufficient balance is available, the user has to pay manually .This approach tremendously speeds up the toll collection process, as the vehicles don't have to stop at toll booths.

The aim of the project is to design an "Automated Toll Plaza Verification System for an automobile at a check point". The project aims to speed up the existing Electronic Toll Collection System by allowing the toll to be collected without requiring the vehicle to be stopped.

GENERAL TERMS

RFID is an automated data-capture technology that can be used to electronically identify, track, and store information contained on a tag. A radio frequency reader scans the tag for data and sends the information to a database, which stores the data contained on the tag. The main technology components of an RFID system are the tag, reader, and database

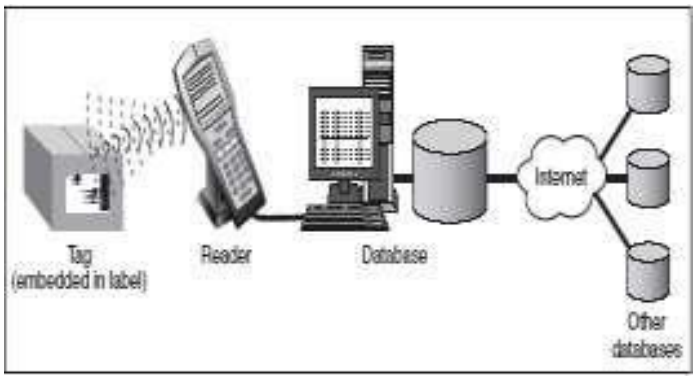

Fig. 1 Components of RFID System

RFID TAG

An RFID tag, or transponder, consists of a chip and an antenna. A chip can store a unique serial number or other information based on the tag's type of memory, which can be read-only, read-write, or write-once read-many(WORM). The antenna, which is attached to the microchip, transmits information from the chip to the reader. Typically, a larger antenna indicates a longer read range. The tag is attached to or embedded in an object to be identified, such as a product, case, or pallet, and can be scanned by mobile or stationary readers using radio waves

Fig 2 RFID Tag

RFID READER

In order for an RFID system to function, it needs a reader, or scanning device, that is capable of reliably reading the tags and communicating the results to a database. A reader uses its own antenna to communicate with the tag. When a reader broadcasts radio waves, all tags designated to respond to that frequency and within range will respond. A reader also has the capability to communicate with the tag without a direct line of sight, depending on the radio frequency and the type of tag (active, passive, or semi passive) used. Readers can process multiple items at once, allowing for increased read processing times. They can be mobile, such as handheld devices that scan objects like pallets and cases, or stationary, such as point-of-sale devices used in supermarkets

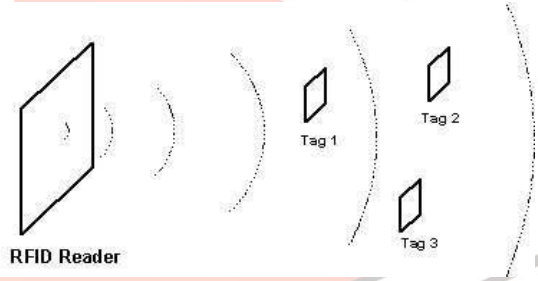

Fig 3 RFID READER

II. PROPOSED SYSTEM

Our proposed system is used to reduce the over congestion of traffic in the metropolitan cities. Through our system user can get gate RFID Tag pass. so user don't need to wait in tollgate. And User can view the upcoming tollgate on their way so that they can pay in online through our application. User can buy toll plaza tickets by online for more than one toll plaza. Also User can get full toll plaza guidance (fares, etc.) for their journey and they can also pay earlier before their journey starts. And User can experience highly secured payment transactions and reliable user experience

Advantage

1. Decreases the fuel-consumption
2. Relieves the traveler of the burden of waiting in the queue.
3. Man power reduction
4. Easy in usage and simple to carry in mobile device
5. Highly secured and reliable
6. Saves time

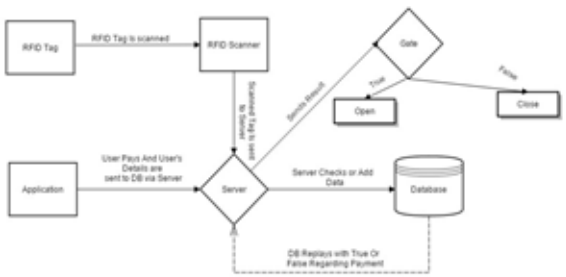

Fig 4. Data Flow diagram of proposed system

III. SCOPE OF THE PROJECT

Whenever the matter of Integration of systems comes to mind, we think of a system having the following important features viz. Accuracy: All the functionally bonded logical dependencies must be integrated. Efficiency: The whole system should work under all circumstances and on a long run it should work efficiently irrespective of their proprietary format. Cost Effectiveness: As our software do not require any special software for implementation hence is less costly as compared to other existing system. Any Prerequisite for the use: As the existing systems are not altered, and integration is done at the background hence there is no need for any training.

IV. FEASIBILITY STUDY

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.

Vehicle	Days	Toll Booth
100	1	1
36000	30 x 12	1
3600000	30 x 12	100

Table 1. Vehicles Passed away from 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 creating pollution and burning fuel. Suppose that in 6.0 hours a vehicle uses 1 liter fuel. So, Total fuel used by all the vehicles: 36, 00,000 x 1 = 36,00,000 liter.

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

Table 2. Fuel Consumption and 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.

One additional stop every 10 km increases the fuel consumption by approximately 35%. If we consider 10 stops and accelerations per 10 km, then increase in fuel consumption is 130%.

Speed	10	20	30	40	50	60	70	80
Fuel	21.00	13.00	10.00	8.00	7.00	5.90	6.30	6.95

Table 3. Speed Vs Fuel Consumption.

V. TECHNOLOGY USED

1. Radio Frequency Identification is the unique technology that is been used in this system. By using this RFID we can transfer electronic data. Thus by using this RFID we have managed to propose our toll plaza verification system.
2. There are three types of RFID, namely Active, Passive and Semi - passive RFID's. In this project we can use both active and passive RFID's.
3. And there are three RFID Readers, namely LF, HF, UHF (Low Frequency, High Frequency, Ultra High Frequency reader)
4. And an application will be created in Android OS to use this proposal.
5. Secured online payment is also been implemented to do online payments.
6. Online cash wallet is also another technology that we are using in this application to make easy Payment options.

V. DIAGRAMS

System architecture diagram of the working model is been added below. And this system shows the function of the working modules. And it has both the app module and also reader module. And each module shows the function if the processing in the both user side and also client side. This also includes every other diagram in the project

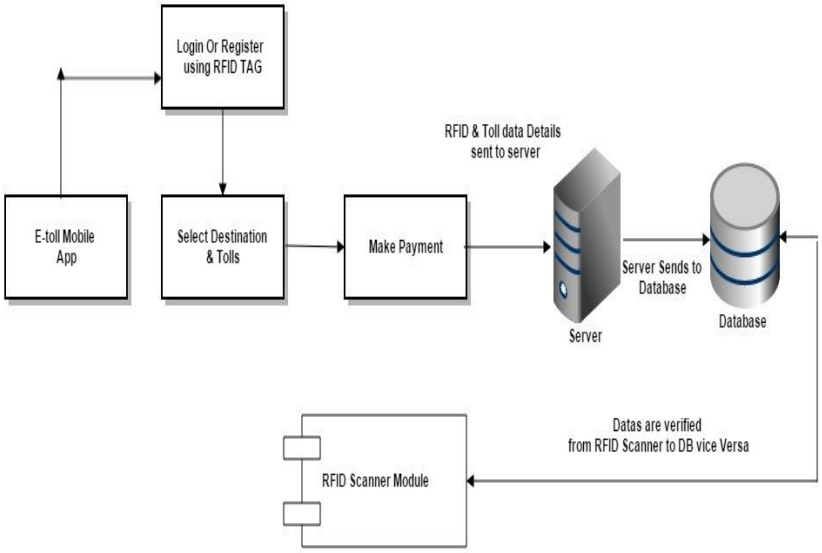

Fig.5 System Architecture

VI. REQUIREMENT SPECIFICATION

Software requirement:

Framework	: .NET 3.5
Software Package	: VISUAL STUDIO .NET. 08
Language for Development	: C# .NET
Database	: SQL Server 2008

VII. FEATURES

Automatic collection system used for collecting tax automatically. In this we do the identification with the help of radio frequency. Flexibility is the main feature and with the slightest change this can be converted to a completely new implementation. With the help of the latest technology (RFID), the implementation of this project is very simplified. RFID technology together with a very secure database yields into a highly efficient and secure system.

Following are the features and advancement of ATCS over presently existing system:

[1] RFID tag cannot be cloned, so cannot be cheated.
[2] Very efficient saving of time.
[3] Wastage of money reduced.
[4] Consumption of oil is reduced.
[5] Pollution is reduced to a large extent.
[6] Speedy transport.
[7] Less congestion on the roadways.
[8] Comparatively less maintenance cost

VIII. CONCLUSION

The ETC system processes payments at a faster rate compared to the traditional toll system, but it is not completely efficient because it requires the vehicles to stop to process the toll payments. Our Automatic system uses Active RFID tags, which are fitted on the vehicles. This increases the range over which the RFID reader can sense the tag and hence the tag is scanned as soon as the vehicle enters the range of the RFID reader. This system can process toll payments at much faster rates and hence toll processing on highways will no longer require vehicles to stop. There is also no risk of losing the prepaid card as the system uses a smartphone app which doubles up as a prepaid card. We hope that these encouraging results would lead to many future works.

IX. FUTURE ENHANCEMENT

1. Map info will be added directly to the application in future so that user can use navigation process to cross through every Toll Plaza.
2. Vehicle type identification system will also be implemented in future for more secured and valid payment
3. Automatic metal depot rod will be added in road for security purposes.
4. User experience will be more enhanced in next update of the application " e-toll"
5. Payment methods will be made highly secured.

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