

E-Wallet Authenticated Electronic Toll System

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Abstract: E-wallet Authenticated Electronic Toll Plaza is a technology enabling the electronic collection of toll payments using the RFID (Radio Frequency Identification) technology. This system is capable of determining if the car is registered or not, and then informing the authorities of toll payment violations, debits, and participating accounts. The most obvious advantage of this technology is the opportunity to eliminate congestion at tollbooths, especially during festive seasons when traffic tends to be heavier than normal. It is also a method by which to curb complaints from motorists regarding the inconveniences involved in manually making payments at the tollbooths. The E-Wallet Authenticated Electronic toll plaza is an effective and a digitalized way run the toll system on the highways.

The RFID (Radio Frequency Identification) tag is placed underneath the car while the RFID reader is placed on the ground near the toll plaza. It detects the tag and the uniqueness of the card is matched with the details on the cloud database for the further process. The proposed application has an advantage of an Android application by using which the user can recharge the amount and also can view the transaction history. The user does not have to maintain an appropriate balance in the E-Wallet but can recharge the E-wallet application when he has to set for a journey. After the detection of the amount the database is updated on the cloud as well the android application and the user receives a relevant SMS.

Keywords: Android Application, Cloud Computing, RFID Tag, RFID Reader, SMS.

I. Introduction

In our day to day life, we pay certain amount of tax through toll plaza to the government. The toll gates are mostly found on national highways and bridges etc., and we pay standing over a queue in the form of cash, although, the mobility of vehicles gets interrupted by this method which takes longer travel time, more consumption of fuel and also pollution level get increased in that region, instead of that the method commonly used by industries and in advanced countries is the Electronic Toll Collection System.

Electronic toll collection system is the technology that enables the automatic electronic toll collection from the prepaid account registered on the name of vehicle owner, determining whether the vehicle is registered or not and informs the toll authorities avoiding toll violations. Over last decades, electronic toll collection system has been implemented in United States and many other countries with a new improvement in it.

The purpose of the project is to improvise technique of implementing smart E-Wallet Authenticated Electronic Toll Plaza. The project deals with the convenience and versatility of an automatic toll plaza system using Radio Frequency Identification (RFID) technology and its disadvantages over manual toll based system. With the number of vehicles increasing every year, the time and fuel wasted on waiting at the toll plazas is ever increasing. Electronic toll plazas can eliminate this wastage of time, fuel and enhance the vehicle tracking.

The main objectives of this paper is that here we are using an android application to make the toll payment by linking our bank account to the application rather than connecting it directly to the cloud server for security reasons. Proving the app makes it easy for the traveler to recharge the E-wallet only when he sets on a journey. The traveler can logon through his user ID and his password to make the recharge or to check the list of his transaction. As the application provides various recharge options like debit, credit, net banking which makes the recharge facility easy for the User. The application is connected to the cloud with necessary information of the owner saved on the cloud data.

Meanwhile on the other side, the RFID(Radio Frequency Identification) tag is placed under the car and the RFID reader which is placed on the ground near the toll booth, scans the code from the tag which is underneath the car and sends it to the host computer to match the details which then connects to the cloud and deducts the amount from the cloud connected to the wallet. The user receives a relevant SMS after he passes the toll plaza.

II. Literature Review

William Vickrey the Nobel Economics prize winner, in 1959, was the first who proposed electronic toll system for Washington Metropolitan Area. Free flow tolling with fixed transponders undersides of vehicles and the readers were located under the highway surfaces. William Vickrey the Nobel Economics prize winner, in 1959, was the first who proposed electronic toll system for Washington Metropolitan Area. Free flow tolling with fixed transponders undersides of vehicles and the readers were located under the highway surfaces (1960s and 1970s)[1].

In the following, basic terminology necessary for the precise description of concepts and methodology for the development of services are defined [2]. RFID is an Automatic Identification and Data Capture technology (AutoID), enabling the automatic identification of objects equipped with an RFID transmitter [3]. While the basic functionality of RFID is the automatic remote identification of tagged objects, the technology offers a large variety of additional benefits and applications, utilizing the full range of technical capabilities and the versatility arising from a combination of the RFID technology with other information technologies, such as WLAN, Sensors and GPS Methodology for the Development of RFID.

If the lengths in electronic lanes are same as in manual lanes, e-toll saves the vehicle time which has been registered, eliminates the stoppage at toll machine. Toll gates are very typically wider than the rest of the highway that reduced the need for them made it possible to fit toll roads into tight corridors [4]. Despite of these limitations, if delay at the gate is reduced, however, throughput increases. The greater the throughput is increased the fewer the lanes were required and the greater the fraction of automated lanes, the lower was the cost of operation was required for the short term, but for long term, the greater the registering and turning one's vehicle into e-toll, the faster vehicles were converted from manual toll [5-6].

Android is a software stack which is for only mobile devices. It includes an operating system, key applications. The Android SDK provides the tools. APIs necessary to begin developing applications on the Android platform using the Java programming language Android applications are written in Java programming language. They are not executed using the standard Java Virtual Machine. The Android SDK provides set of application programming interfaces (APIs). Android handset services are exposed and accessible to all applications. Android applications can share data among one another and also access shared resources on the system securely [7] Cloud computing has been cited as 'the fifth utility' (along with water, electricity, gas, and telephone) whereby computing services are readily available on demand, like other utility services available in today's society. The first step of studying research into cloud computing is to clarify the concept. Attempts to define cloud computing have come from different perspectives within practice and academia [8-9].

III. E-Wallet Authenticated Electronic Toll System Architecture

"E-wallet Authenticated Electronic Toll Plaza is a technology enabling the electronic collection of toll payments using the RFID(Radio Frequency Identification) technology. The RFID (Radio Frequency Identification) tag is placed underneath the car while the RFID reader is placed on the ground near the toll plaza. It detects the tag and the unique id of the card is matched with the details on the cloud database for the further process. The proposed application has an advantage of an android application by using which the user can recharge the amount and also can view the transaction history. The user does not have to maintain a appropriate balance in the E-Wallet but can recharge the E-wallet application when the user has to set for a journey. After the detection of the amount the database is updated on the cloud as well the android application and the user receives a relevant SMS. The user also gets a privilege of free passes. With the help of these free passes the user can cross the toll even if he fails to have enough balance in his account for the deduction of the toll tax, but the user has to pay the due amount. In case he has already used the free passes and still crosses the toll a relevant message will be sent to the RTO authorities along with the user details and the user will have to pay extra charges.

1. Working on host side

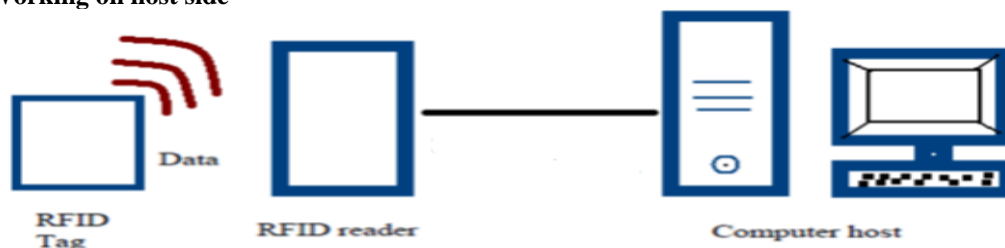


Fig.1 Toll Collection System on host side

RFID

Radio Frequency Identification (RFID) is a wireless technology which uses radio signals to identify tagged objects automatically and remotely. RFID authentication is a primary approach to secure an RFID system and make it privacy-friendly. Identifying a tag without authenticating it causes serious security issues.

i. RFID-tag:

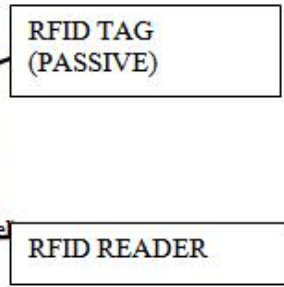
Tag- Transponder, better known as the tag, is a microchip combined with an antenna system in a compact package. The tag can be containing the detail information of the motorist. It can contain the license number, vehicle certificates, account number, person detail information like address, mobile number.



Fig.2 RFID tag



Fig.3 When RFID gets scanned (dummy mode)



ii. RFID-reader:

RFID Reader/writer contains an antenna to transmit and receive data from the tag. The reader also contains a decoder and an RF module. It could be mounted or built as a portable handheld device. The computer host acts as an interface to an IT platform for exchanging information between the RFID system and the end-user. This host system then converts the information obtained from the RFID system into useful information for the end user.



Fig.4 RFID-reader

iii. Internal Working of RFID Reader

The RFID technology has two components – the reader and the tag. The reader has two parts – a transceiver and an antenna. The transceiver generates a weak radio signal that may have a range from a few feet to a few yards. The signal is necessary to *wake or activate* the tag and is transmitted through the antenna. The signal itself is a form of energy that can be used to power the tag.

The transponder is the part of the RFID tag that converts that radio frequency into usable power, as well as sends and receives messages. When the transponder is hit by the radio waves, the waves go up and down the length of the transceiver, oscillating. When a wire passes through any sort of magnetic or electric field, it can convert and conduct that field down its length. Like those flashlights, where one can shake them and a magnet goes back and forth through a copper coil, creating electromotive force.

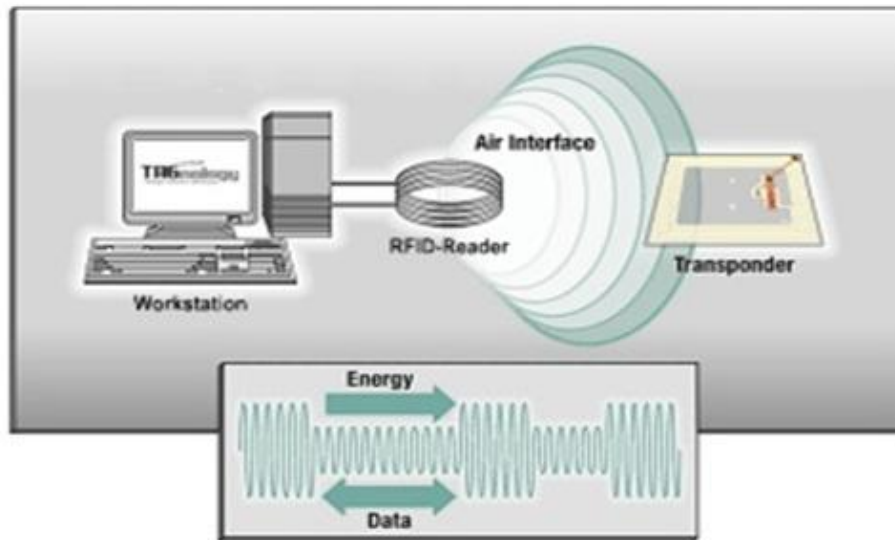


Fig.5 internal working of RFID Reader

Now that the RFID has some power to work with, it wakes up the transponder. The transponder immediately upon being woken up spews out all the information it has stored on it. This whole process can take as little as a few milliseconds. RFID tags come in a variety of shapes and sizes and are either passive or active. Passive tags are the most widely used, as they are smaller and less expensive to implement. Passive tags must be “powered up” by the RFID reader before they can transmit data. Unlike passive tags, active RFID tags have an on-board power supply (e.g., a battery), thereby enabling them to transmit data at all times.

2. ON Cloud Server

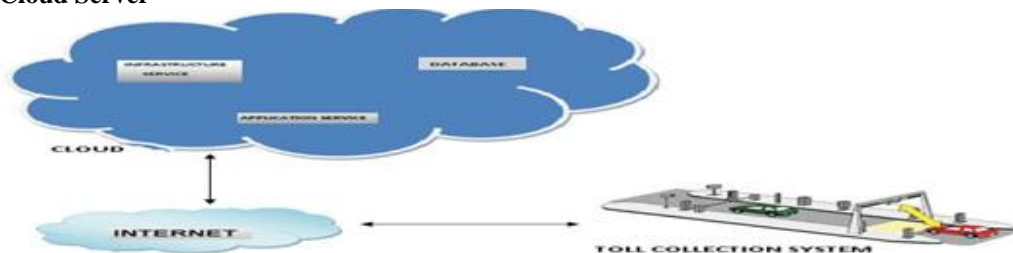


Fig.6 Cloud computing

Cloud Computing:

Cloud computing is a subscription-based service where you can obtain networked storage space and computer resources. The most important part of the equation is having internet access. The Cloud server database contains the vehicle owner’s details such as name, car number, license number, and other additional details of the owner.

IV. Experimental Results

In this section, the GUI is shown using NetBeans and MySQL in given Figure 7(a-d) & 8. Below as well as we are showing screen shots of android app which were used to deduct and credit the balance in wallet.

1. **Android Application:** Tools used: Android SDK (Software Development Kit), eclipseIDE (Integrated Development Environment), SQLite Database and Java. Features of the application: application includes a Login panel (module) where the user can give the license number or RFID number as input. Once the owner successfully Login a Dashboard appears which includes four sections.
 1. View details: Displays vehicle and owner details.
 2. Recharge : The amount to be recharged is entered; OTP is generated and received via SMS. Once the OTP is entered the amount successfully is added to the owner’s application account which gets deducted as the owner passes the toll.

3. Recent Toll Details: History of the toll transactions is displayed.
4. Logout: As the transaction's is completed the owner logs out.

SMS feature: The deducted amount is sent to the owner via SMS. Further the database is also updated after the deduction.

ADDING BALANCE ON APP

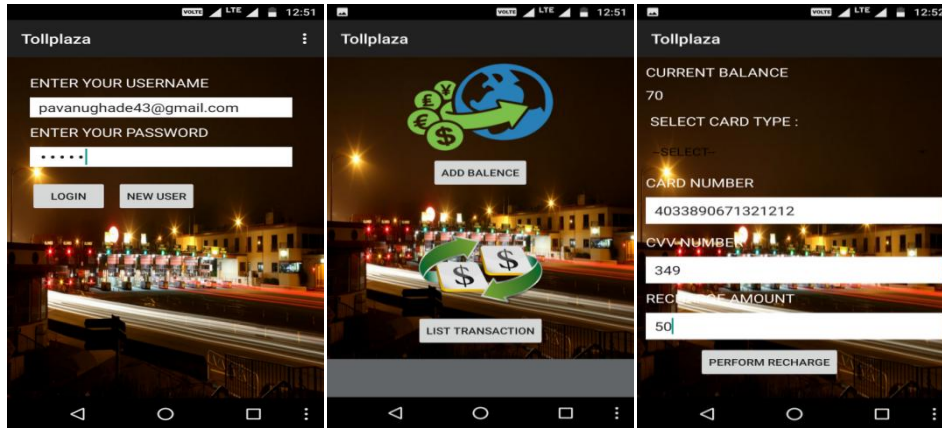


Fig.7.A Step:1

Fig.7.B Step:2

Fig.7.C Step:3

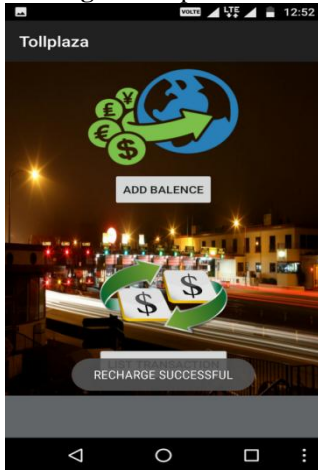


Fig.7.D Step:4

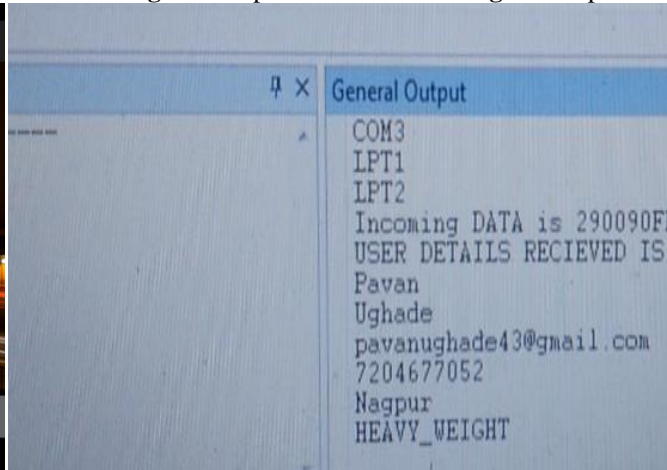


Fig 8.Data Displaying On The Host Computer

Fig.7.(A-D) adding balance on Android

V. Conclusion

RFID is one of the new technology emerged in ETC applications. This paper tells us about the application of ETC system on toll gates. This paper gives many advantages, such as waiting time of the vehicles, no traffic congestion, assured and accurate collection of toll amount, free from cash, minimum emissions which are harmful for living. This paper investigates how to use GUI for collection of toll, the real time management and monitoring is done. It has expanded capacity for vehicle without building the big infrastructures. It has improved efficiency and reliability of toll plazas and traffic abilities of Highways.

In terms of Future Enhancement:

GPS (global positioning system) tracker can be mounted on the RFID tag. This will help us to track the exact location of the vehicle.

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