E TOLL SYSTEM USING IOT

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Abstract

Now a days, smart phone, tablet and iPad are becoming more popular. Most of the needs are fulfilled by the smart electronic applications. Smartphone, tablet and iPadhas been widely used by all users. With this trend, many people use their smartphone to do electronic transactions. In India most of the toll gates are operated manually. A person sitting at toll will collect tax from the driver and provide the receipt and then only the vehicle can cross the gate.

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Since this procedure can be slow, we often encounter traffic jams at the toll plazas on busy highways. The E-toll system based on IOT is about electronically paying the toll taxes without any manual intervention.In this, an account will be created for a user where theuser maintains a prepaid account and can specify their travelling details. So that toll tax is deducted automatically from the driver's/users account at toll plaza by reading the QR details. Electronic transaction of toll taxes can be done using this application and QR code, this reduce the processing time. Hence it is time efficient. If the balance in the owner's account is low, the toll gate remains closed. In such a case vehicle owner will have to pay the toll tax in cash and collect the receipt. Through this process of toll collection will save time, effort and man power. It also results in reduction of fuel waste at toll gate.

Key Words:QR code and scanner, IOT, Toll amount

1   Introduction

Time is the more precious in today's world, everything has been automated. But still in India we wait in long queue in toll plazas to pay the toll fee. This is because of the complex toll system architecture. And still in India manual toll collection system is used. Collecting toll taxes manually is most widely used method in India. It requires a toll collector or attendant. Based on the type of vehicle, toll tax is collected by the collector. Due to manual involvement, the time taken is high. Along with the increasing number of vehicles in major cities, using toll road is an option for smooth transportation to avoid traffic and to reduce travel time. E-Toll application is an automated electronic application;it works to improve the efficiency of the money transaction time at the toll gate, thus reducing queues of vehicles by utilizing the Android operating system and the QR Code as media access automatically, so no need to use manual service at toll gates. Design of QR Code is widely usedat the toll gate so as to speed up service for regular users of the toll gate. As for the so-called QR Code is a type of matrix codes or two-dimensional barcode which takes a text as input and its functions is to identify an object by parsing through the matrix. Data are encoded in both the vertical and horizontal direction;

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hence the QR code can hold up to 700 times more data than the ID barcode. That code is designed firstly for tracking automobile parts throughout production. Nowadays, its application has been broadened to the field of mobile communication. Smartphone users could decode a QR code easily and rapidly by a small program in a mobile device with a built-in camera. Closed system is toll payment occurred when the road users take a ticket at the toll gate entrance and does payment at the toll gate exit. When toll used make the payment only at the toll gate entrance is called as Open system. Withthis system, user can pay the taxes for all tolls in advance from anywhere there by no need to wait in a long queue at toll gate and no need to have cash in hand which is main motto of India Digital India. The materials used in this system consists of, an android application created using Android studio. The application is designed to create a QR code for given vehicle number. And the QR reader will scan QR code pasted in vehicle and debit toll amount from respective account. The requirements for this system involve Android studio, QR scanner and Servo motor. The android studio is a software platform used to create an application. This software is integrated with firebase cloud platform for efficient storage of user data and for authentication. The firebase provides 24*7 services. The QR scanner is used to scan the QR code of the user there by debiting toll tax from the account. The servo motor is fixed with toll gate, upon successful payment of road tax the gate will open. The servo motor used to open/close gate.

2   Related works:

Wen Chuan Wu [1] discussed about the system proposes an on-street parking fee payment mechanism based on the QR code of an E-bill. People can regard the code as a bill to pay their parking fee, where the parking information is recorded into a remote server by the fee collectors. Simulation results showed that the proposed mobile application provides a new mode for E-bill payment for on-street parking in India. Published in: Intelligent Information Hiding and Multimedia Signal Processing (IIH-MSP), 2014 Tenth International Conference.

R. Latha, C. Sivaraj, V. Sivaranjani and S. Vimaleeshwari [2]pro-

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posed a system that overcomes the main problem of vehicle traffic and time loss using RFID technology. RFID (Radio Frequency Identification) technologies utilize radio waves to automatically identify the tags that contain the information. And to manage payment service with RFID technology. The next level is to replace RFID with QR code which is less costly than RFID. Using QR code technology based on Tollgate E-payment processing is done to avoid too much standing time in the toll gate processing. LeMeniz s [3] work designed low cost and time efficient systemnamed as Electronic Toll Collection using RFID technology that RFID automatically collects the toll taxes from moving vehicles when they cross the toll plaza by capturing RFID tag details using radio waves. The main component of this system is RFID where the radio waves are used to find the moving vehicle. The RFID reader will scan RFID tag in the moving vehicle to access to the respective account. Linda John,Debyani Mitra, and SayliMores [4] system is to overcome traffic issues. During the rush hours, it is difficult for drivers to drive from congested places. To overcome the traffic problem by reducing waiting time, an embedded system is developed with QR code. Using Webcam, the system will capture the QR code and recognize it.The web cam will capture the code, it will recognize it, if every details are correct, then the vehicle is authorized. After this, the gateill be automatically opened and the car is allowed to pass the toll plaza. Web cam fixed at toll is video camera, which is used to capture image of the vehicle passing the toll. Pranoti Salunke, Poonam Malle, Kirti Datir and Jayshree Dukale [5]designed ATCS. ATCS is an Automated Toll Collection System used for collecting tax automatically. In this they do the identification with the help of radio frequency. A vehicle will hold an RFID tag. This tag is nothing but unique identification number assigned. The RTO members will assign this tag or governing authority. This number will act as unique key, information is stored with this as basic and the user has to pay amount in advance. RFID reader is placed at the toll gate plaza. Whenever the vehicle passes the toll, the reader will read the tag and get information. Automatically the amount will be reduced. Remaining balance will be restored. Incase of insufficient balance, he needs to pay at that time. To inform user about insufficient balance, we are alarming a sound, which will alert the authority and the user that this vehicle doesnt have sufficient bal-

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ance. The vehicle no need to wait at toll gate, so it reduces time and also saves fuel

3　Methodology:
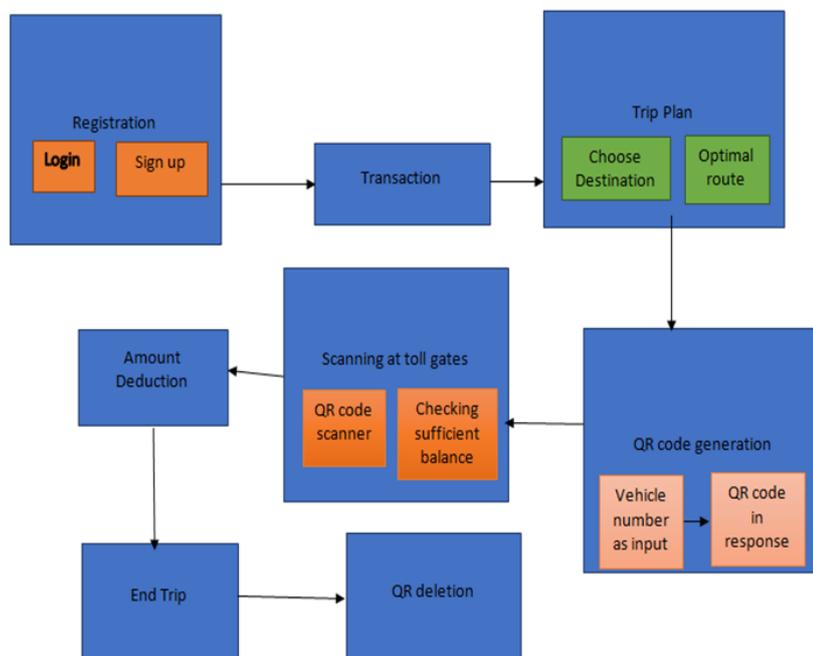
The initial step is registration consists of two options either to create account or login using existing account. After that, the transaction comes where the user can deposit money for their future use. During their travel, they have to specify their source and destination. The application will show the possible route between source and location along with toll taxes. The user can choose the optimal route from the list of available route. The next step is QR generation, for this user needs to give vehicle number as input. The system will generate QR code. The user can take print out of that QR or use it in the mobile itself. At toll gate, the QR scanner will be fixed, that fill read the QR. If the account has sufficient amount, the amount will be automatically debited and toll gate

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will be opened. Otherwise, the user has to pay in cash in order to open the toll gate. If user reached the destination or wish to end trip, the user can quit thus result in deleting the QR code.

4   Existing system

The existing system is to automate the toll process using RFID. Each vehicle will contain the RFID transmitter that transfers the information about the vehicle. The RFID receiver is integrated with the computer at toll gate. Whenever information comes to the receiver it will take the necessary action. The information is stored in the database. (Vehicle no. account status, etc.). The RF Receiver at toll collection centre will receive the data from vehicle RFID tag by communicating with it whenever the tag comes near the range reduce the amount of toll as per the taxes. The camera in the toll gate will capture the image of passing vehicle for security purpose. The automatic debiting from account used to reduce the traffic at toll plaza. The vehicle owner has to create an account by providing RFID tag details. The RFID tag consists of chip and antenna, the chip contains the details about vehicle and account. The antenna is used to transmit the details stored in the tag using radio waves to the RF reader at the toll gate. RFID reader can directly communicate with the tag without any line of sight. But it depends on type of tag used and wavelength of radio waves.Another improvement in the system is which requires users to have a prepaid smart card. When vehicle pass through the toll gate, the user needs to swipe their prepaid card to open the gate and the toll amount is deducted from the prepaid account balance for that particular toll. The Electronic Toll Collection System requires users to maintain a balance at their account by depositing some amount. The amount will be automatically reduced when the vehicle passes through toll gate.

4.1   Drawbacks of existing system:

The existing system uses RFID to collect vehicle information. The cost of RFID reader and tag is very high and integrating them into the vehicle results in more cost involvement. And also, RFID need a database for the technology to be really effective. The RFID

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readers needs proper normalized database. If its not present, then it will not work properly.

5   Proposed System:

The Existing System finds many drawbacks in case the vehicles waiting in toll plazas are more in number. The RFID tags needs to be installed with RFID chipsets that is costly. Thus, the E Toll System finds more investment in case of large number of vehicles. On analysis of the existing system, there are some alternative systems that may find a feasible and optimal solution. These changes are made on the Existing system and implemented on this project. The RFID chips are to be scanned by RFID reader that is so costly to set in each toll plazas. The alternative solution in this project is replacing RFID tags with QR codes. QR codes are easily created and scanned. QR is short for Quick Response (they can be read quickly by a cell phone). They are used to take a piece of information from a transitory media and put it in to cell phone. The QR Codes can be seen in a magazine advert, on a billboard, a web page or even on t-shirt. A QR which is quick response code is matrix type code that is used to store any kind of information and can be accessed even through a smartphone or using QR scanner. In this process, known as mobile tagging, the smartphone's owner points the phone at a QR code and opens a barcode reader app which works in conjunction with the phone's camera. Now a day, most of the smart phones have QR scanning feature which is very big advantage. Even a small phone can be used to scan QR code. Only 19% of consumers have ever scanned a QR code. Thus in this project, the users need not carry any other things other than a smartphone. This change results in the success of the project of E Toll System and reduces Environmental Pollution and Fuel Wastage while waiting to pay in Toll Plazas.

6   Implementation:

The application is based on Android operating system build using android studio software. The code written on android will help the user to create an account. The user is validated based on Vehicle

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number, Aadhar number and license number. The details will be stored in the firebase which is cloud platform for authentication and efficient usage. Another way is to sign in using existing account. After successful sign up, user can make transactions to their account, this one is optional. On travel, user needs to select source and destination. The toll tax between two locations is calculated and shown to user. If user made transaction earlier, no need to pay in this module. Others, needs to pay. The QR code is generated using vehicle number is stored in users account. At each toll, the QR code is scanned using QR scanner and corresponding account details are extracted and amount will automatically debited from the account. This project consists of five modules

6.1   Account Information:

This module is created using android studio. It is mainly for credential details. The user needs to create an account in order to access this. The new user needs to register with name, date of birth, Aadhar details, address, license number and vehicle number. These data will be stored in a cloud, the cloud storage is to motivate remote logins and remote application usage, because if the data locally stored, the user will not be able to access their account from anywhere. For this purpose, firebase data storage is user, which provides authentication and continuous service for 24*7. Next time, the users can directly signup using their login credentials. Strong authentication is maintained using firebase. After login to the account, user can access the service. In order to provide continuous service, the application is always connected to the cloud storage.

6.2   E Toll wallet load:

The next module is e-wallet load. It is same as Ola money or paytm, where users can have account and put money for their future use. This module is created to avoid last minute money loading (in case of emergency, if user dint have money in hand, they can use this amount to travel). It is mainly carried out by third party vendors who maintain account summary details. The user can deposit/load some money to their account before travelling and can make use of this during their travel. It is just an optional for the user. But it

is more advantage in emergency situation.

6.3 Trip Details:

The third module is trip details module where user can specify their travelling details. The user needs choose the starting point and ending point (From and to location).Because the application is connected to firebase, it is possible to integrate Google maps to the application. With this, the user will have two ways to specify their travelling location. Either they can manually specify the location or choose the location using map. After choosing the location, the application will display the fare details which includes toll amount. The fare amount is the sum of toll amount of all the tolls in their path. Depending upon the location chosen, the application will display the possible routes which may be more than one along with the toll amount. The user can select the route. It is up to them. But mostly, the suggested one will be with lower toll amount. If user wants to visit any another place, they can choose accordingly. After selecting the route, the application will direct the user to payment.

6.4 Servo motor:

This is the last part. It involves hardware component servo motor. The servo motor will be connected to the toll. After the successful QR reading and withdrawal, the servo motor will open the toll gate and allow the vehicle to pass through. In case of insufficient amount, the user needs to complete the transaction either through app or with currency. The servo motor will operate toll for each vehicle. After the vehicle crossed the toll gate, the motor will close the gate in order to restrict upcoming vehicles.

6.5 Payment receipt:

This module consists of two divisions. One is for payment for those who does not maintain e-wallet. The user can make their payment with third party. The user needs to enter their credit/debit card details or it may be via net banking so that the toll amount will be loaded to the users account and will be reduced from users account

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during each toll booth where the QR is scanned. Even though the user maintains an e-wallet, if balance amount left is insufficient, the user needs to make pay the remaining account, and then only user can generate QR code. The second division is to generate QR code. Here the user needs to specify the vehicle number to generate QR code. The vehicle number will act as unique key to access to users account. Whenever, the vehicle passes through toll gate, the QR reader in the toll will scan the QR code and find the vehicle number by decoding the QR and will debit toll amount from the account associated with the vehicle number.Because every detail stored in the cloud, it is possible to access users account from anywhere. If the user end their travel or travel with another route, the remaining amount will stay in their account. They can user it in the future.

7   Result

The outcome of this application is to reduce human involvement in toll amount processing and to reduce fuel waste which leads to environmental protection. With the app, the need for cash/currency will be minimal which is motto of digital India to promote online (digital) transactions. Tourism, Highway and Transport department of our country will be benefitted from this by paying taxes electronically. Because, it will reduces corruption activities of the employees. It saves time of drivers because; with this they no need to wait so long in the toll gate. From users point of view, this application helps users to make digital transactions, reduced time and efficient fuel usage. From government point of view, this system helps them to reduce manual intervention in toll gate. It also used to keep track of vehicles. They can trace the activity of a user which may be used for legal investigation.

8   Conclusion Future works:

This E-toll system is designed to reduce the fuel wastage at toll plaza and also for efficient and faster toll processing. This will results in less manual intervention at the toll gate. For further improvement, the QR scanner can be designed in such a way that it can detect QR in a car from 200 metres. So that, it will further

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reduce the processing time. The servo motor designed to allow only one vehicle at a time. There by, it will stop other vehicles to pass by.In future, Google map direction can be integrated with this application. With this feature, the user can get the direction and nearby services like hotels, hospitals etc. So the application will be useful in emergency cases. This application can be used by travels (who provides vehicle services) to pay the toll in advance by registering with their travels vehicles. In such case, single user which is owner of travels will maintain account and provides access to their vehicles.

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