Study of QR Code Enabled Toll Collection and Payment Gateway Integration

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Abstract: Android based application is used for the usage of generating the unique QR code which is encrypted using the algorithm. The application allows for the user to register and login using personal information and generate QR code by providing the vehicle details hence a unique QR code is generated for that vehicle, any number of vehicle can be added which belongs to that person. The application integrates a payment gateway which is approved by the government hence enables an ease of transaction. We have included many additional features like emergency SOS call button, SMS system which regularly updates the customer On each toll passage along with the balance amount. 24/7 support and road side assistance can be initiated within the application. With the payment gateway integration the user can recharge the wallet within the application hence enhancing the digital India scheme.Today, all most all toll plazas are operated manually. We often encounter traffic jams at almost all toll plazas due to this toll collection and the in-efficient training provided to the toll plaza workers. The QR code is encrypted using algorithm. In the present day RFID (Radio Frequency Identification) has been used for this purpose. In order to overcome the issues of RFID tags QR code is proposed.
Index Terms: Toll Plaza, QR code, Encryption, RFID.

I. INTRODUCTION

A toll road which fee is assessed for passages have been implemented to recoup the money spends for construction and maintenance of the road. Transportation has become a human life daily routine hence there is a probability that everyone would encounter a toll plaza at one point of their life. Manual toll collection system became out-dated due to the manpower required and number of drawbacks. Indian government has recently pushed for automatic toll collection using RFID technology this has several drawbacks. RFID uses radio waves to communicate with the receiver. An IR receiver is used to receive the pulse and a sends it to the controller, which transmits the vehicle through the RF transmitter located in the vehicle. Some of the existing system uses RFID tags while others use the GSM module and INFRARED technology. We have designed the system keeping in mind to reduce the cost and also to find a solution to the existing traffic congestions at the toll booths. We suggested the use of QR technology for the *payment of toll gate processing*. Recent trends in the market have shown an increase in the use of QR codes than can be scanned and read by camera in a smartphone. The QR code allows storing data, numbers and even using it for payment and transfer of money. Android based application is used for the usage of generating the unique QR code which is encrypted using the algorithm. The application allows for the user to register and login using personal information and generate QR code by providing the vehicle details hence a unique QR code is generated for that vehicle, any number of vehicle can be added which belongs to that person. The application integrates a payment gateway which is approved by the government hence enables an ease of transaction. We have included many additional features like emergency SOS call button, SMS system which regularly updates the customer On each toll passage along with the balance amount. 24/7 support and road side assistance can be initiated within the application. With the payment gateway integration the user can recharge the wallet within the application hence enhancing the digital India scheme.

II. LITERATURE REVIEW

Automated toll collection and check post system using Radio Frequency Identification (RFID) and Global System for Mobile Communication (GSM) module. The recognition is succeeded with the guidance of passive radio frequency. In this paper [1], vehicle particulars like unique ID is saved in RFID tag which is attached in the vehicle. Image process and GPS is combined with RFID and GSM module to create the system a lot reliable and secure. The hardware design of the paper consists of transmitter and receiver module. Transmitter module is fixed in the vehicle as an active tag. Receiver is the automated check post and e-toll control. ATmega328 Arduino controller is a 28 pin Arduino controller which has 32 bit natural working registers. The servo Motor SG90 type is used in this setup. The servo Motor is used for automatic gate operation whenever the motor receives the signal from the controller. SIM800 GSM is a communication device designed for global market. RFID uses radio wave to process the information from the devices. The bi-directional connection network with endpoints has been designed to use RFID to produce an electronic product code. An experimental study result has also been given at the end of the paper.

In paper [2], the toll collection system is designed primary for the use by GSM and GPS systems. The GPS is used to find the position of the vehicle. The GPRS kit should be installed in the vehicle in track the vehicle. Each GPRS system has a subscriber identity module. This system also incorporates geo fences of the toll plaza to get the information regarding the location of the toll plaza. The GPS and GPRS are integrated into an ARM microcontroller. In order for the GPRS system to work the system requires 1 GB of data and a stable network connection which should be switched on all the time. The system also requires a mobile tower to be located at the toll plaza to process the information of the vehicle in the rage of the tower. The system compares the position of the vehicle and when the vehicle is within the 5 meter radius of the toll plaza the database is updated and the amount is debited from the user's account which will be immediately followed by an SMS to the customer. The position of the vehicle or the GPRS SIM module is compared using the haversine formula, and if the vehicle is within the range of toll plaza, amount will be taken from the account.

3D environment modelling for the toll collection which directly affects the decision making part, in paper [3] the new toll gate approach is divided into perception, decision making and motion control. A deep natural network is used in perception. Virtual lanes are generated from the 3D environment result and an optional is selected. In motion control a collision free path is planned and transmitted to maneuver the vehicle. The automation driving vehicle receives the localization and mapping (SLAM) algorithm estimates the motion state of the vehicle. The traffic patterns are further understood and scanned to detect passable electronic toll collection gate. These virtual lines are generated only for the types of vehicle were this system can be implemented. Convolutional neural network (CNN) based algorithm is used for object detection to sense other vehicle, and ETC gates. YOLO algorithm a type of CNN with structure of Google Net, is divided into 24 convolutional layers with connected layers of 2. The determination of total queue length is calculated by first detect the neighbouring vehicle and correlate the distance of vehicle to the gate. The SLAM used to update or construct maps on an unknown environment. LSD-SLAM (Large Scale Direct Monocular) is applied to track and map by image intensities divided into three steps: tracking, depth map estimation and map optimization. The system takes a while to scan all the gates as the gates could be occluded by trucks or buses. The coordinates are interpreted and the best cubic coordinate origin and the ETC gate are selected. The motion control adopts an adaptive method. It receives a collision free trajectory data from path planning using curvature, yaw rate and velocity. In this approach LQR-PID algorithm is used. LQR can exactly pave a way to the optimum pole. LQR predicts an expectation as inputs to PID controller. PID is a classic control with strong adaptation and robustness. YOLO algorithm can detect most of the vehicles. ETC signs can also be detected using this algorithm. The proposed system is designed to be more universally usable, even without HD map and V2X. The V2X will make visual classification of ETC gate obsolete.

In paper [4], a proposed system is a web application and android application. The system is designed primarily for devices like smartphones, personal computers and all other devices which support web services. The main objective behind this paper is to design the application which provides an effective and easier way to payment of road toll. Keeping in mind the Indian condition the application contains QR code for recognition with centralized availability of data. Throughout the system it enables user to pay from the account created after reaching the toll booth. The system gives many advantages and assures and accurate collection of toll amount. This paper uses GUI for collection of toll, the real time monitoring and management is done. The architecture of the system uses user application to generate QR code which can be connected by GPS for the connection of toll plaza receiver. The data base of the system saves the details of the vehicle connected and other different toll collection. The server coordinates all the different activates of the application.

RFID is a dependable technology in paper [5], the RFID automatic toll gate system can automatically discover the vehicles of the identities, reading items in motion and tracing of the vehicles can be done by accurately by RFID. In this paper they have executed a framework which will punish for infringement of toll entryway and they believe it will prompt to a fastidious activity. The framework developed will help in reducing the number of mischance. The framework integrates the RFID, AVR microcontroller, the database creation and GUI outline. RFID tags are fixed and attached and through this the reader reads the data. The main aim of this paper is addressing the prevention of motorists and toll authorities manually perform ticket payments and also check driving without documents. This system proposes to identify theft vehicles. When the gate is automated it requires minimum human intervention hence efficiency can be improved.

The framework expands wellbeing. The paper also looks at the adequacy of toll stations and the road developments that limited to the toll road. RFID technologies implemented in the system adopt a kind of frequency chips which authenticates and authorizes protocol model used to guarantee system security. Accordingly, electronic toll collection system deserves deeply research whether from technology, economy or environment protection.

III. OBJECTIVES

The objective of QRCode Tag is to establish a system where the tag used for automatic toll collection is between two parties and an ease of use through a user focused application unlike the FASTTag existing application available as of now. The application will have added features to further support the user in his/her commute through the highways of India. Feedback from the user about the application, Report and issue about the highway. Emergency services that is available throughout and over the course of journey. A main account which will erase the third parties present in today's system. Generation of tag, adding and deletion of multiple vehicles.

IV. SOFTWARE REQUIREMENTS

1) For this project we have used the following software for the development of the application that is available to the user.
a) Andriod Studio
b) Google Chrome
c) Microsoft Word
d) Notepad
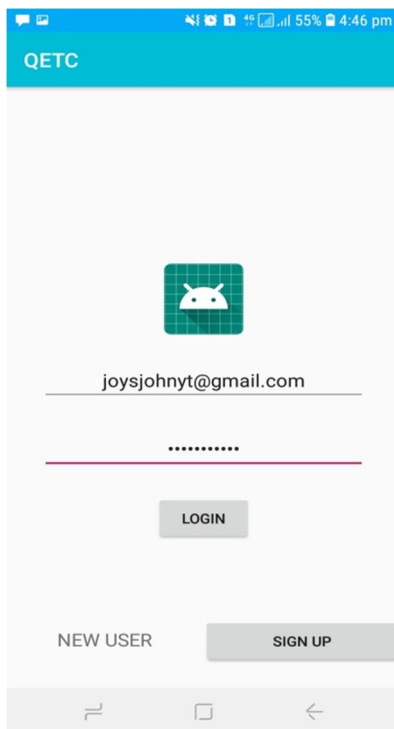2) We have made use of the following languages for the development of this application.
a) PHP
b) Java
c) Andriod

V. SYSTEM ARCHITECTURE
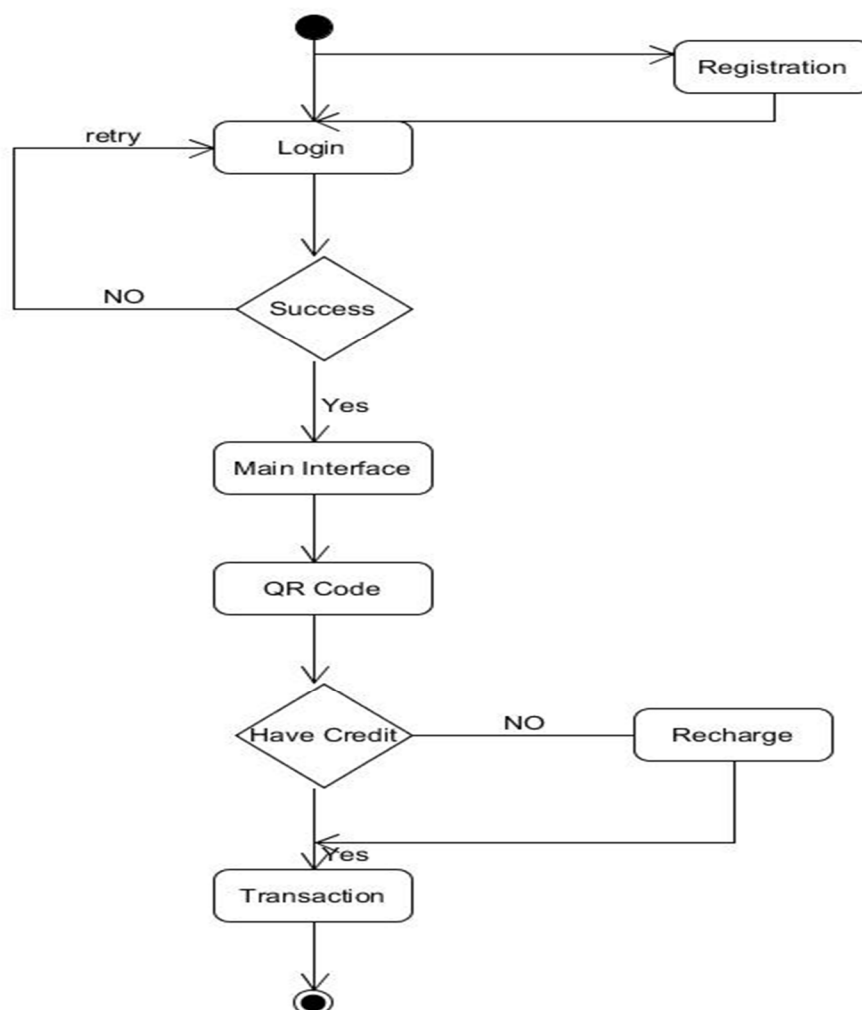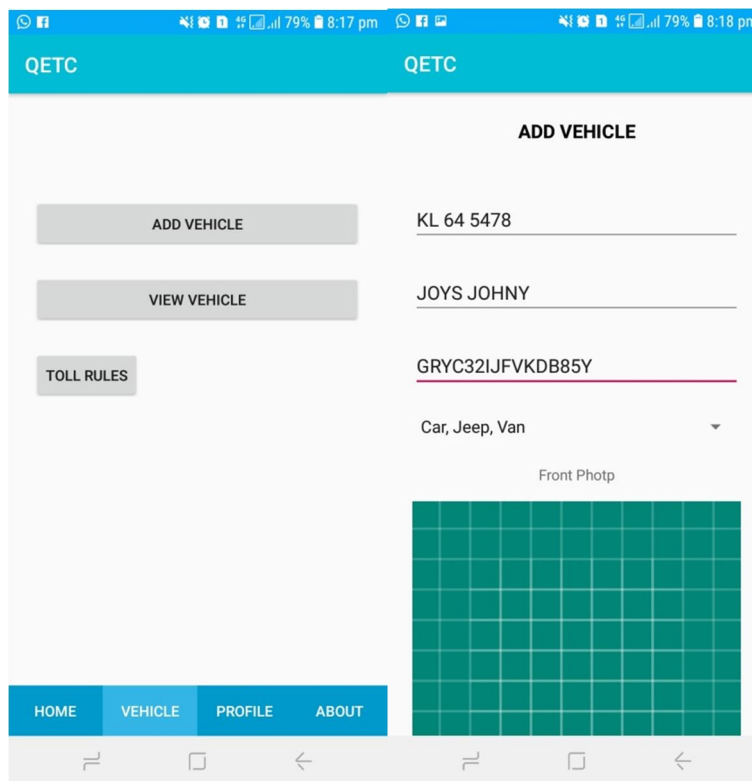
VI.   RESULT ANALYSIS

A. The login page to which the application opens into. The secure login page allows for the registered users to access the application**.**

B. The home page where the user will be directed to after login. The home page will take the user to different features with the application such as adding vehicle, generating QRCode, report an issue on the highway, emergency dials and many more.
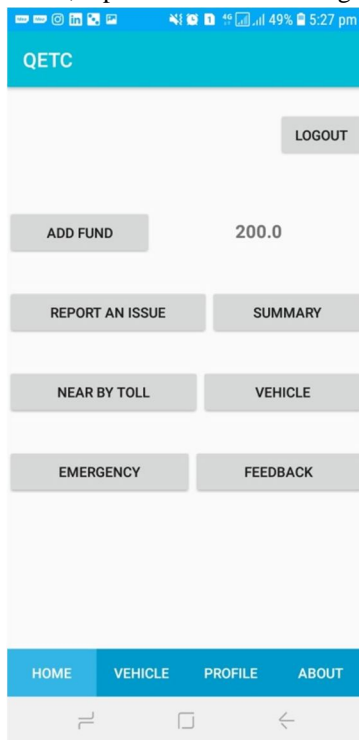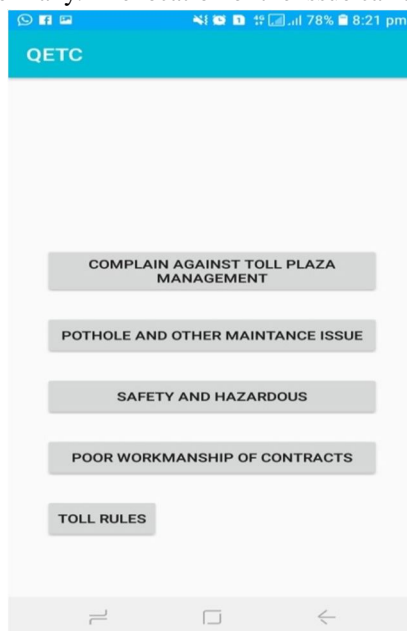
C. The vehicle tab will take the user to the important feature of the application where the user can add the vehicle, generate the QRCode Tag for that vehicle, view the number of registered vehicle and delete the vehicle where the QRCode Tag will also become invalid.

The add vehicle page will have the user to upload photos of the car as well as RC. The generation will happen based on the class of vehicle selected.

D. The report an issue page is accesible from the home page of the application. The report an issue has a consolidated four issues that are commonly found during the travel in the highways. The issue will take to a issue reporting page where the user can comment the issues and upload visual evidence if any. The location of the issue can also be inserted.

E. The emergency tab will allow the user to access the emergency dial which has a variety of emergency services all integrated into a single page window. This helps in user to dial and contact different services and also the selection of appropriate emergency services.
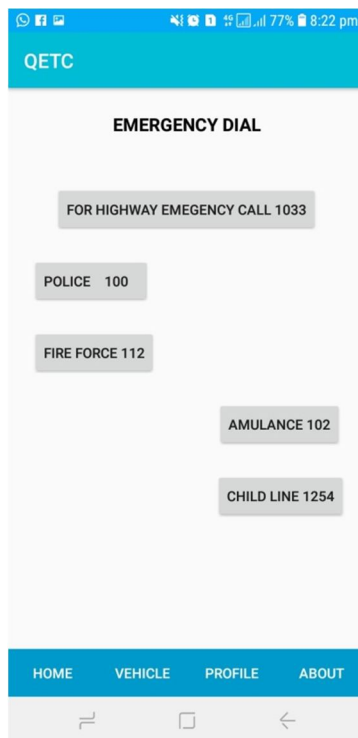
F. This application allows the user to recharge the tag from the application itself hence reducing the third party system and helps with the integration of bank accounts into the tag. This imrpves the trust in the tag system and the government as they are no longer required to memorize a 13 digit bank account number or obliged to any banks for that matter. The payment gateway is integrated into the system which will recharge the main account from which the toll amount will be deducted.
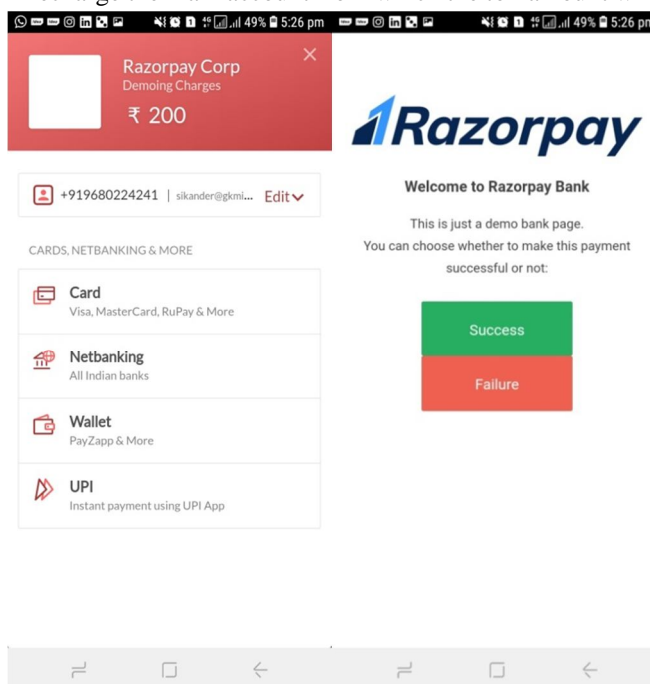
VII. CONCLUSION

In today's world it is important that the application for a particular system be user-friendly and should be designed in such a way the burden on the user should be greatly reduced. When a new technology like QRTag is been proposed instead of the existing technology, the proposed system should cover all the demerits of the existing system. The user application was one such system where the user had limited access due to the system design. We proposed a new system and a new user application for it. The user application added many features which help the user in his/her daily commute to the highways. The application generated the QR code for the application that can be activated from the RTO of the user. Many new features can be added to the application at a later stage or updated based on the feedback that the user submits.

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