

Toll Pay: An Online Toll Payment Application

Nimith Thomas^{1*}, Justin Varghese², Sijin John³, Sinu Maria Kurian⁴

^{1,2,3}Student, Department of Computer Science and Engineering, St. Joseph's College of Engineering and Technology, Palai, India

⁴Assistant Professor, Department of Computer Science and Engineering, St. Joseph's College of Engineering and Technology, Palai, India

*Corresponding author: nimithth@gmail.com

Abstract: The increase in technological developments in many areas are helping various people in their daily life. Nowadays manual toll collection is becoming a burden for toll users, due to several reasons such as time taken for the toll payment, vehicle congestion, fuel wastage are some of the major problems. Toll pay app can help overcome these problems. The app generates a unique QR code for each of its users. The users are allowed to pass the toll station by scanning the QR code at the toll station. The scanning process is done by QR code scanner present in Toll employee app. Another Feature of the app is that whenever an ambulance reaches the proximity of a toll booth a notification is sent to the toll operators.

Keywords: Toll payment.

1. Introduction

The idea behind implementing online toll plaza payment is to automate the toll payment process thereby reducing the long waiting times at toll plaza using QR code generated by application. This system is used by vehicle owners, toll employees and ambulance drivers. Toll pay application is a mobile application which is used to reduce the problems associated with manual toll payment. QR code (QUICK RESPONSE CODE) is used to scan the embedded information [1].

The main objective of this application is,

- To Controls traffic at toll plaza.
- To reduce the pollution and fuel wastage at the toll plaza.
- To reduce manpower at the toll plaza.
- To reduce the time consumed during the process.
- To verify the payment of toll using QR code generated by application.
- To send a notification to toll plaza when an ambulance reaches its proximity

It is a user friendly app. Toll pay is an android application which is developed for lessening the over congestion that has become part of the metropolitan cities these days. This system makes the work easier at both sides (i.e. Toll user and collector), to keep track, as well as conduct amount payment in very efficient way. Global positioning system (GPS) technology is used to find the position of the vehicle as well as toll plazas accurately. When the destination toll is near to the user, an alert

message is sent to the user 500m before the toll plaza, a notification will be sent to the phone of the approaching user with Toll Name. Payment can be facilitated through mobile wallets. An electronic receipt is generated, with QR code which can be scanned by the QR readers at Toll Booth. The other objective is to use the GPS module of ambulance drivers phone to track the position of ambulance. This is done to generate a notification to toll plaza when an ambulance reaches at a 500m proximity of toll plaza.

2. Existing Systems

A. FASTag

FASTag is a electronic toll collection system in India. The system was first introduced in India on 4 November 2014[2]. It is operated by the National Highway Authority of India (NHAI). It uses Radio Frequency Identification (RFID) technology for making toll payments directly from the account linked to it. A RFID system uses tags, which are attached to the objects to be identified. The tags are available to users from official Tag issuers or participating Banks [3]. RFID tags can be of three types which are passive, active and battery-assisted passive. There are two parts in an RFID tag, an integrated circuit for storing and processing information [4]. It also includes either fixed or programmable logic for processing the data [5].

In this sensors were placed above roads, a sensor identifies the vehicle details and the details are sent to server, which is processed and toll is collected. RFID technology is an image processing technique in which tags are scanned by detectors as an image, afterwards the image is processed by the server and remaining task are finished regarding toll collection of particular vehicle [6].

3. Proposed Method

The system is divided into three modules:

- (1) Toll Payer app
- (2) Toll Employee app
- (3) Administration
- (4) Ambulance module

A. Toll payer app

The Toll Payer app is an android application for toll payers. The Toll payer or customer can use this application to register his details, view toll information, view toll rates and pay toll. This module is divided as

Registration Module:

To become a registered toll user, the user should register into the app using their details which involves Name, email id, Mobile number and password

Login Module:

By using their user id and password, they login into the app.

Update Details:

By using this module, the user can update his own details and password.

Adding Vehicle:

In this module the toll user can add the vehicle they own. The process involves details like vehicle number, vehicle type and vehicle name.

Payment interface:

The toll payment can be done by the toll user through this module using their wallet. It contains details like, CVV number, expiry date of the card, type of card. It also contains a UPI gateway to conduct payment. The module is developed in a user friendly manner. A unique QR code is linked with the mobile wallet.

Paid Toll:

The QR code can be viewed from the application. Once the QR code is scanned by the QR reader in the toll employee module the amount is deducted from wallet and the vehicle is allowed to pass.

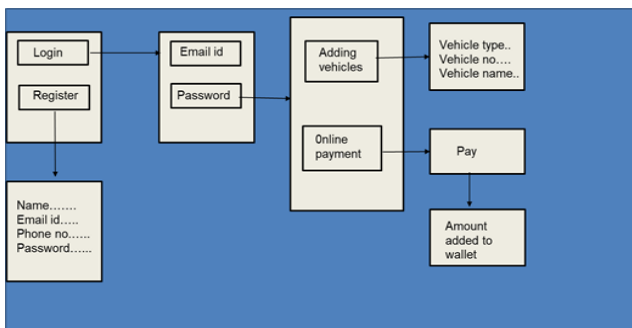


Fig. 1. System architecture of toll payer module

B. Toll employee app

The toll employee app allows toll employees to scan the QR code of toll users and verify whether payment is done or not. This module is further divided as,

Registration Module:

To become a registered toll employee, the employee should register into the app using their details which involves Tollbooth number, place, highway name and number of toll gates.

Login Module:

By using their Toll plaza name and password, they can login

into the app.

Update Location:

By using this the toll employee can adjust the latitudinal and longitudinal coordinates of the toll booth using the GPS module of the phone.

Scan QR code:

The employee scan the QR code generated in the customer toll app. The QR reader reads the code and verifies whether the code is matching or not. If it matches it shows the message matched.

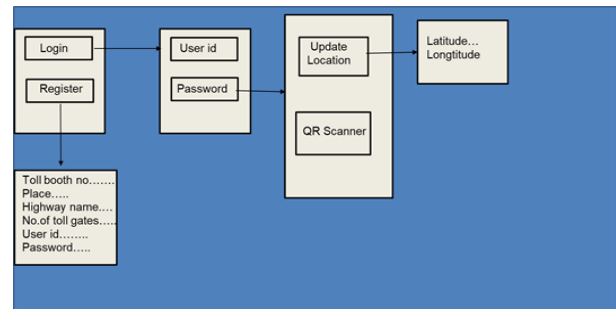


Fig. 2. System architecture of toll employee module

C. Administration

Administrator is responsible for overall control of the application. The admin is responsible for setting toll rates, handling toll payer information, adding toll locations, handling the database and maintenance of the application.

Login Module:

By using their admin id and password, they login into the app.

Admin home:

Using this section, the admin can set different toll rates specific to each vehicle types, add different toll locations, set different payment options.

D. Ambulance module

It is a part of the android application strictly for Ambulance drivers. The Ambulance driver can use this module to register his details, ambulance details and view toll information. This module is further divided as

Registration Module:

To become user of the app, driver should register into the app using their details which involves Name, email id, Address, Mobile number and ambulance registration number.

Login Module:

By using their user id and password, they login into the app.

GPS Sharing:

This module uses the GPS module of ambulance driver to track the location of the ambulance and provide information to the server side.

Location:

By using this module, the driver can view his current location and use it to navigate to destined location.

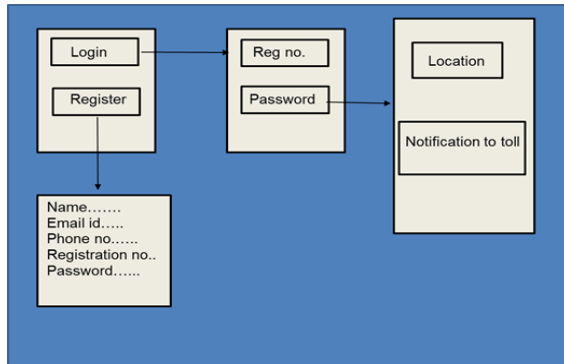


Fig. 3. System architecture of ambulance module

4. Software Implementation

The whole app is divided into 3 main modules each modules having its submodules. We have used bottom up programming approach to develop the application.

Infrastructure and storage:

MySQL is used as the database for storing user, toll and ambulance driver records and payment history. Firebase database is used to store map locations and plots in realtime. Geofire library was used to draw the circle with radius 500m around the toll location.

Development and Deploy:

Netbeans ide is used as the environment for developing and hosting admin website(server). It is also used to host mysql database. Heidisql was used to develop mysql database. All the design procedures of the app were done using android studio.

Programming Languages:

HTTP, XML and JSP was used to develop the server side (admin side). Java was used for developing application.

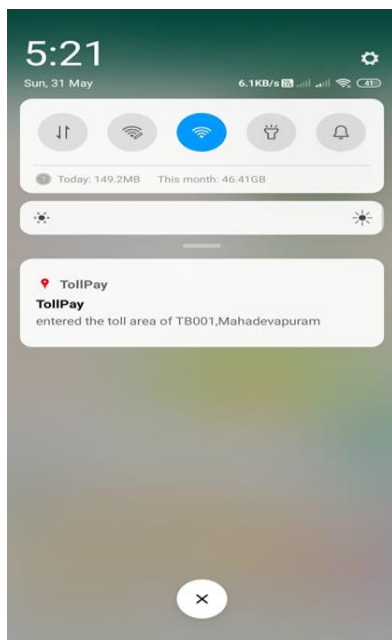


Fig. 4. Notification sent to user when a toll is nearby

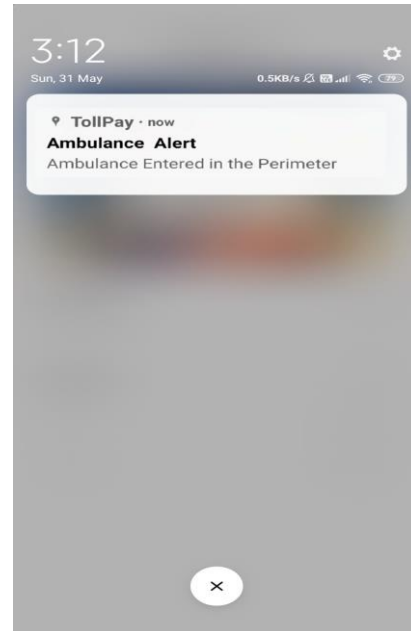


Fig. 5. Notification sent to toll when an ambulance is nearby

5. Conclusion

This paper presents our application “Toll pay” which is a online toll payment application by which we could pay toll through an android application. Toll pay app reduces the burden at both sides (toll user and toll employee) and allow to do toll payment in an efficient way. This app acts as a solution to reduce vehicle congestion, time and fuel wastage which are the major problems associated with manual toll payment. It is a user friendly application. It uses GPS location of app users to find the nearby tolls and alert the user through a notification. It also uses GPS Location of ambulance drivers to provide a notification to toll employees when an ambulance reaches its proximity.

Acknowledgment

This project is developed by final year undergraduate students in APJ Abdul Kalam Technological University, Kerala under the supervision of Asst. Prof. Sinu Maria Kurian.

References

- [1] R. Karthikayeni, P. Keerthika Bala, K. Vignesh, “Toll plaza payment using QR code,” IRJET, vol. 5, no. 4, 2018.
- [2] Fastag-wikipedia <https://en.wikipedia.org/wiki/FASTag#:~:text=The%20system%20was%20implemented%20on,Quadri%20lateral%20started%20accepting%20FAS%20Tag%20payments.>
- [3] What is FastTag: All you need to know <https://www.indiatoday.in/information/story/what-is-fasttag-all-you-need-to-know-1615824-2019-11-05>
- [4] K. Lakshmi Sudha, “Reversible Data Hiding using QR Codes, Android,” International Journal of Computer Applications.
- [5] Galande, Oswal, Gidde, Ranaware N. S. Bandgar, “Automated Toll Cash Collection System for Road Transportation,” IJCSMC, 2015.
- [6] Fathima G, Jayamala J, Keerthika, “Online toll payment application,” IJIEET, 2016.