AUTOMATIC TOLL MANAGEMENT SYSTEM USING NFC AND MOBILE COMPUTING

Kajal Talele*1, Deepika Bharambe*2, Karishma Pawar*3, Prof. Amrapali Mhaisgawali*4

Department of Computer Science & Technology, Usha Mittal Institute of Technology, Mumbai, India.

ABSTRACT

The time and efficiency are important in toll collection systems. The uses of NFC technology are emerging day by day; the simplest application of NFC technology is within the contactless payment system. The use of Near Field Communication based smart card has been used for self-payment service. Considering the parameters like cost, more reliability, and increased security, NFC technology may be a best-fitted option for initiating the web vehicle toll payment system. In this, the NFC tag will be placed by toll authority having a unique identification number (UIN) and user details. An active NFC tag will be attached to the vehicle. When a vehicle passes through the tollbooth system, data on NFC will be read by NFC Reader and also sent to the server for checking (for verification). The server will check details and toll amount will be deducted from the user's wallet. The automatic toll collection system (ATCS) developed by using NFC technology.

Keywords: Near Field Communication (NFC), web application, contactless payment, ATCS, NFC tag, UIN, NFC Reader, smart card.

I. INTRODUCTION

Transportation has one of the major shares in any country’s economy. Improvement in transportation systems leads to an honest lifestyle through an extraordinary freedom for movement and manufactured goods and services, also as a better rate of employment levels and social mobility. Increasing transportation is an immediate impact on productivity of nation and the economy [1]. ATCS technology can check if a Vehicle is registered at toll system, and informing the management center about to process of participating accounts [1]. The most excellent advantage of this technique is that it’s capable of eliminating congestion in the tract, especially during those seasons when traffic seems to be higher than normal. This situation can be handled by using NFC Technology.

The improvement of the manual toll collection system [1] has become a necessity. In recent years the electronic toll collection (ETC) system has outpaced the manual system around the globe. In this ETC system radio frequency identification (RFID) system based smart card has been used to achieve the goal of easy and secured toll tax payment transaction and quick mobilization of the traffic. The paper proposes Architecture for receiving toll using Near Field Communication (NFC) technology. This system is important to improve superhighway management [2].

Near-field communication (NFC) is a set of communication protocols that enable communication between two electronic devices, often via NFC tags operating at 13.56 MHz [3]. Several NFC technology companies have come up with NFC phones or smartphones and other devices that come with NFC chips.

From the security point of view, the web application has access to a single central server rather than using large amounts of workstations due to this security is on a high level sever gives more reliability and scalability to the whole system, while simultaneously allowing management and administration from several locations.

II. LITERATURE SURVEY

Most toll plaza in India in manually operated. The average waiting time in this manually operated toll plaza in more than 10 minutes [urban mobility information] which costs a lot of fuel and time wastage. In Chattoraj’s paper, they tried to make an Attendance management system based on NFC identity cards which when swiped on corresponding smart phone or tab will add attendance into the...
attendance record present onto the cloud system. Further, these attendance records can be viewed and analyzed by authorities anytime and anywhere.

In this ETC system radio frequency identification (RFID) system based smart card has been used to achieve the goal of easy and secured toll tax payment transaction and quick mobilization of the traffic. RFID is an automatic identification method that transmits radio frequencies between the RFID reader and tags. The RFID system consists of an antenna, transceiver and a transponder. The antenna transmits radio frequency waves to trigger the transponder or tag and the transponder transmits the retrieved data back to the antenna. Barcode systems of object identification are now replaced by RFID because it usually has scanning problem, easy damaging of level and cost of equipment. RFID tag does not require direct contact and can work from a longer distance accurately [2].

RFID would be used to double authentication of the vehicle, along with OCR authentication, to check whether the number plate is read correctly. If any OCR read number plate doesn’t match with information stored in RFID tag, then the vehicle would not allow passing through the toll center and a proper response would be taken to ensure whether the vehicle is stolen or just a reading error by the officials present at the toll [3]. It designed the ETC system using RFID technology. It mainly consists of toll-gate, management system of toll station, management center, and bank and transmission network. The system of toll-gate control mainly is liable for controlling and managing electronic equipment installed in toll gate and RFID tags installed in vehicles. It verifies and records real-time information of vehicles through RFID tags that are put on vehicles as OBU and sends them to management system of toll station, and management system of toll station will process this details. [4]

III. EXISTING SYSTEM

In Current Scenario, now a day there are many toll collection centres in all highway roads. User has to wait in queue, he has to pay the tollgate amount and there are chances of misusing the money by tollgate people and its very time consuming. In the existing framework, as per the manual toll collection procedure, a driver needs to stop at a charging stall and pay the required expense specifically to a collector. The sum to be paid by each vehicle is determined by its characteristics or classification. In the manual toll payment system time consuming and many mischievous things may happen by manpower.

List of Disadvantages of the existing system:

- Managing toll details and collection of data is a difficult job.
- Need to count the collected toll amount every time.
- Manual entry expends additional time.
- It is hard to maintain bulk of record in manual.
- Lack of accuracy and error prone.
- No method to trace details.
- Human errors.

In the existing system, According to the manual toll collection methodology, a driver has to stop at a charging booth and pay the required fee directly to a collector. The amount to be paid by each vehicle is determined by its characteristics or classification. In the manual toll payment system time consuming and many mischievous things may happen by manpower Fastag is yet another system used in tollgate which operated as an electronic toll collection system in India, operated by the National Highway Authority of India (NHAI). It employs Radio Frequency Identification (RFID) technology for making toll payments directly from the prepaid or savings account linked to it[3],Passive. However, using a system in which the RFID card is the only source of authentication presents a problem that if the RFID is misplaced by the holder, then it can be misused by someone with malicious intent.
IV. PROPOSED SYSTEM

Proposed idea, outline and execution of a web application and NFC application can be utilized for vehicle toll payment. In this project, the main aim is to demonstrate secure toll transaction with better interaction features in transaction through website and Android application which can improve the toll collection amount. With help of this project, transparency will be maintained towards all customers and toll agents. The fundamental concept is that the user having NFC enabled android mobile tap on NFC enabled toll tab at the toll booth, which reads the knowledge like NFC Id and automatically forwards a message to the owner of vehicles and simultaneously the request is forwarded to the server. The system offered a high transparency level in transaction and amount received. The system is in a position to develop the auto-generated message as acknowledgment for toll station, client. This system is necessary to improve expressway management.

Cars having the NFC tags which can be tapped through the Android app. As soon as the tag is read and the information is verified which is stored in the online database then a particular toll amount will be deducted through the card. Where the data in the database can be accessed by the admin. The record of blacklisted vehicles also stored in the database.

In system architecture diagram, on the home page user have to resister on website. In case, if user haven't register before then user have to fill registration details. on submitting, each details are verified and stored into database. For the existing users, there is three modules for login as following:

V. ADMIN PANEL (WEB APPLICATION): -

Admin will enter a valid user name and password and login to the toll collection system. Admin can view a total amount (Target amount) of the particular toll plaza and can manage the toll received at a toll plaza. Admin can view the collection (Received amount) received per month or year. Admin can view transactions made by a user per day or month.

1. Toll Plaza Manager (Web Application): -

Toll Plaza Manager will enter a valid user name and password and login to a toll collection system. Toll Plaza Manager will set a target amount for a particular toll plaza.

Manager will add new users and view the number of the vehicle passed through the toll plaza. The total amount received at toll plaza is displayed to the toll plaza manager. Toll plaza manager will recharge the user's wallet.

2. User (Android App): -

Users will enter valid user's credentials and the System will verify log in details. if credentials are matched with the database then the user can log in into the system successfully. Users can view and edit the profile. If there is not sufficient balance in wallet user can recharge the wallet.

Users can see a history of journey i.e, number plate, type of journey (single/return), amount, date and time. User can veiw a nearest toll plaza. User can see a transaction history in android app. In the end, the user will log out from the toll system.

3. Framework

The web application is developed to be hosted on a server directly or on a virtual machine. ASP.NET Framework is used for the web application development and the android part is developed using Android Studio 2019.

The tools used for the development of the website are C# and Visual Studio 2019 Community Edition. In this system, a central database can be implemented using MS-SQL 2014 for storing the toll fares, toll id, user data etc.

4. System Architecture

Following are the stepwise module architecture of automatic toll management system.
Fig-1: System Architecture

5. Experimental Results Of The System

To write NFC tag

Assign a UIN to NFC card
Login to Toll plaza manager

Swap NFC Card to read data

Amount deducted from wallet

Invoice sent to user’s mail
VI. RESULT ANALYSIS

Here taking a sample of vashi toll plaza based on its different factors and features. Following table is for Vashi Toll Plaza:

Data regarding vehicles passing Vashi Toll Plaza over the months.

<table>
<thead>
<tr>
<th>Type of vehicle/month</th>
<th>January</th>
<th>February</th>
<th>March</th>
</tr>
</thead>
<tbody>
<tr>
<td>Car</td>
<td>454</td>
<td>895</td>
<td>463</td>
</tr>
<tr>
<td>Truck</td>
<td>644</td>
<td>562</td>
<td>563</td>
</tr>
<tr>
<td>Container</td>
<td>465</td>
<td>223</td>
<td>233</td>
</tr>
<tr>
<td>Bus/Van</td>
<td>798</td>
<td>265</td>
<td>896</td>
</tr>
<tr>
<td>Blacklisted</td>
<td>20</td>
<td>26</td>
<td>25</td>
</tr>
</tbody>
</table>

TABLE I: - Table for No. of Vehicle passed through toll plaza per Month
Table II showcases various vehicle types passing through toll plaza and their frequency in any month, for example how many containers passed through the plaza in any month.

**Fig.1**: Bar Chart for No. of Vehicle Passed through toll plaza per Month.

From fig 1, If the construction company need to construct a road then the company can analysis a toll plaza database so that the company get an idea about how many vehicle passed through a particular
toll plaza or whether a heavy vehicle passed through a plaza. according to the analysis of vehicle data the civil engineer get an idea for which material will suit for road like it should be more rigid or elastic or need a more complex structure of cement for construction of road. This analysis is more useful for construction company.

ADVANTAGES OF PROJECT

- Reduction in fare-collection costs this is the big reason that transit authorities worldwide are introducing NFC payment systems.
- The cost of collecting cash from hundreds of fare-collection locations around a city is huge.
- This system doesn't require security person to guard the toll gate.
- This system doesn't need lot of manpower is expended counting coins and reconciling trips with the amount collected. The cost of this in many cities is, in fact, greater than the amount of money collected from fares. NFC eliminates virtually all of this expense.

VII. CONCLUSION

In this paper, from the above research and techniques used we conclude that the system provides a paperless passage for toll gate with fully automated toll collection. Hence the considered system provides an intelligent solution to the traditional & toll collection method.

VIII. REFERENCES


