RESEARCH PAPER ON E-TOLL SYSTEM WITH USER AND VEHICLE IDENTIFICATION

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ABSTRACT

Electronic Toll Collection is a technology that allows electronic payment of highway tolls. In the proposed system user will first generate the QR using aadhar authentication and vehicle registration details. At unmanned toll plaza user will first scan the QR code and the RFID tag of the vehicle will be automatically scanned. The system will then match the scanned data of QR code and RFID tag, where the data of RFID tag will contain its unique id along with vehicle information and the data of QR code will contain aadhar card details and unique RFID tag no. If the data is matched then the database will be automatically updated with vehicle and user details in real-time.

Keywords : - *Smartphone, Camera, Vehicle Detection, QR Code, RFID tag.*

1. INTRODUCTION

Time is very important in today's era, everything has automated but still we have to wait in a queue at toll plazas to pay the fee. This is because of the complex architecture of the toll system and still in India manual toll collection payment system is used. Manual toll collection system is most widely used collection method in India. It requires a toll collector or attendant and depending on the type of vehicle, toll payment is collected by the collector. The collector not only have to dispense change, accept sell scrip, tickets, and coupons, but also have to make an entry of the vehicle in the system and issuing receipt to the driver. Due to manual intervention, the processing time is high and due to this pollution also increases.

The main idea behind implementing this project is to automate the toll fee collection in toll plazas of highways to overcome the traffic problems, pollution and to reduce the fuel consumption. System used here is QR which is quick response code and RFID which is Radio Frequency Identification. User can generate QR code and he can show it via phone or print it on paper. In QR code all information about vehicle and owner of this vehicle is stored. Toll plaza is equipped with QR code reader and RFID readers. There will also be the facility of diversion for traditional payment if due to some technical issues automated toll collection system fails.

2. OBJECTIVES

2.1 Reduced vehicular congestion

Vehicles need not stop longer in toll plazas for paying the toll fees, the toll payment will be deduced from the vehicles account through UPI when the vehicles are moving. This makes the vehicles move faster in the toll area.

2.2 Time saving

Since there is no vehicular congestion or traffic due to the automated system, the vehicles need not wait in long

queues to pay the toll fee and there will be no traffic. This saves the precious time of many people who drive the vehicles.

2.3 Reduced Fuel Consumption

Vehicles need not stop at the toll plazas for the longer period of time. So this will automatically save fuel of the vehicle as the payment processing will be done faster.

2.3 Reduced Pollution

As there will be less fuel consumption due to less vehicular congestion so this will automatically reduce pollution to some extent.

3. RELATED WORK

Mr. V. B. Dharmadhikari has proposed a system Computer Vision Based Vehicle Detection for Toll Collection System Using Embedded Linux. This system was designed by using Raspberry pi. In this system, a camera captures images of vehicles passing through toll booth, that's how a vehicle is detected through camera. Depending on the area occupied by the vehicle classification is done. Further this information is passed to the Raspberry pi which is connected to web server. When raspberry pi comes to know that there is a vehicle, it access the web server and according to the type of the vehicle appropriate toll is charged [1].

Linda John, Debyani Mitra has proposed a system automatic toll collection using QR code. QR Scanning in this system is done by using web cam. Web cam captures the QR code, and if the QR code is correct means that person's vehicle is authorized and transaction is done. Then the barrier is automatically opened and the car is allowed to pass [2].

P. Mane has proposed a system RFID Based Automatic Toll Collection System. RFID is an automatic identification technology used here for collecting toll automatically. RFID tag will be attached to vehicles and the tags contain vehicle information. RFID detector are present at each toll plaza, that detects and scan the RFID tags [3].

YudhiKristanto, BagusPriambodo has proposed a system Application Design of Toll Payment using QR Code. This paper describe Electronic transaction. It aims to improve the time efficiency at the toll plazas using Android and QR code. These platforms serve as the automatic media access so that the transaction does not need to be served manually[4].

4. METHODOLOGY

Our system consist of two modules

1. User Application – Used Android Studio for making android application.
2. Toll Plaza System- Used Python for making QR scanner and collecting data from RFID scanner.

4.2 MODULES

4.2.1 User application:

Users have to enter their Aadhar card number and vehicle registration number. From Aadhar card number user name and from vehicle registration number unique RFID tag number will be fetched from the database. Using these details QR code will be generated.

4.2.2 Toll plaza system:

At the toll plaza where the user will scan the QR code and RFID tag of the vehicle will be scanned, where the RFID tag will contain its unique ID along with vehicle information and QR code will contain Aadhaar details, UPI details

and RFID number, then system will match the scanned data of QR code and RFID tag. If the data is matched the transaction will be performed and the barrier will get opened. Otherwise, users have to pay toll tax manually.

4.2.2.1 Scanning RFID tag

RFID tags are already mounted on the windshield of vehicle by registration authorities of the state. Each RFID tag consists of a unique ID which will be scanned at the Toll plaza. The RFID reader consists of a radio frequency module, a control unit and an antenna coil which generates high frequency electromagnetic field. On the other hand, the tag is usually a passive component, which consists of just an antenna and an electronic microchip, so when it gets near the electromagnetic field of the transceiver, due to induction, a voltage is generated in its antenna coil and this voltage serves as power for the microchip, thus data gets exchanged between RFID tag and the reader.

4.2.2.2 Scanning of QR code

We have used raspberry pi camera module and python Open CV to make a QR scanner. To detect a QR code Open CV first convert the captured image into a grayscale image and threshold it so that there is only black and white pixels. Now OpenCV goes through every row and keeps a track of the number of white/black pixels it encounters. It also keeps a track of the order in which they are found. Whenever it finds something in the expected order it, assumes it has found QR and then it verifies the image and decode the data in string format.

4.2.3 Updating database:

After scanning the RFID tag, the reader stores tag unique ID in list format. The RFID unique ID is then converted into string format. The value we have written in QR code is a comma separated string value, therefore we have to convert the scanned value into string format. Now when both the values are in String format we can easily compare them. If the values scanned from QR code and RFID tag is matched then we take the current time stamp, that is the current date and time and using it we update the database. We have granted our android app and raspberry pi system read and writes access of our firebase database respectively.

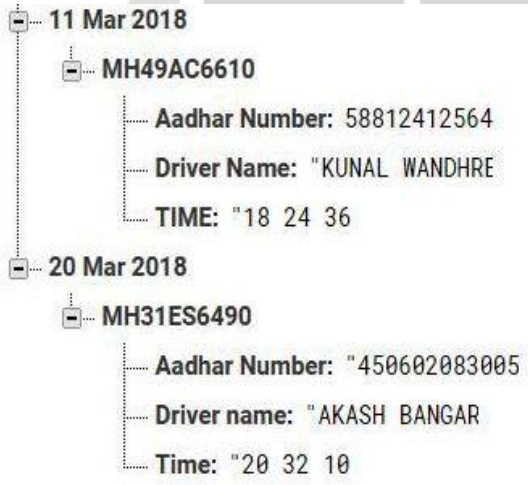

Fig - 1 : Updated Values in database.

In the database using current date we first create a node, then we create a child of that node using the vehicle registration number, now this has become a separate node. Under the vehicle registration number we make its child (Aadhar number, Driver Name, Time) and assign proper values to them.

3.2.2.3 Toll Layout

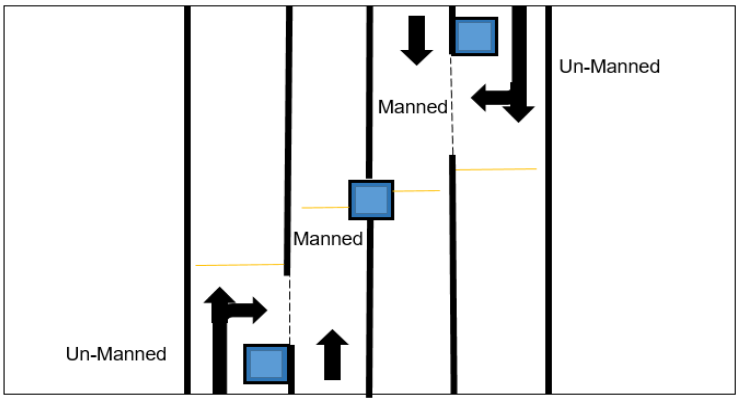

Fig - 2 : Layout of E-Toll Plaza on a highway.

To implement this system we have to change the layout of the current toll plazas. The above figure is the representation of the changes to be made in the current Toll plaza. For a 4-Lane road, a single manned Toll booth will be placed at the center of the road which will control the flow from both the directions. The unmanned toll booth will be placed aside of the manned toll booth. When user will proceed to the unmanned toll plaza, the QR code and RFID will be scanned and if the data from both is matched then transaction will be performed and the barrier will get opened and user will proceed. If there is any issue regarding fraud or any technical issue, the user will be diverged to manned toll plaza.

5. WORKFLOW

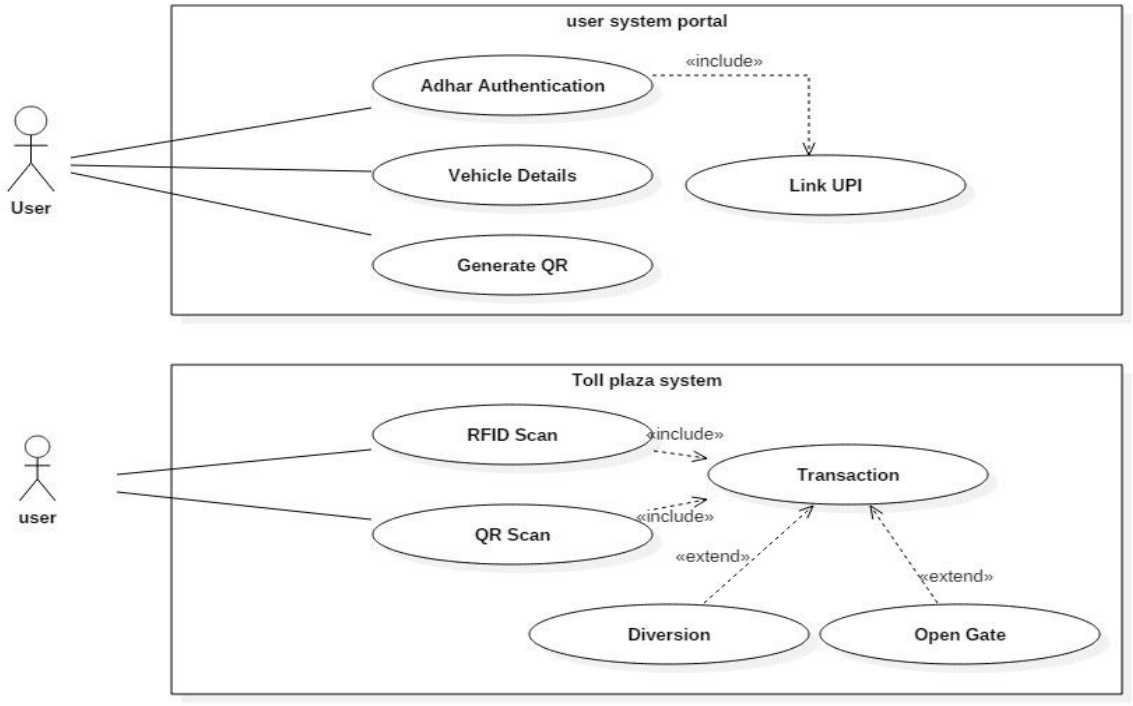

Fig - 3: Work Flow of E-Toll System

Authentication: User will first authenticate through Aadhaar card.
Vehicle details: User will then feed vehicle registration details.
Link UPI: Link bank account for payment transaction.
RFID scan: RFID tag on the windshield will be scanned automatically for vehicle details.
QR scan: User will manually scan the QR code for user details.
Transaction: If unique id no. from RFID and QR code is matched then the transaction will be performed. And money will be deducted from the linked bank account of the user.
Diversion: If there is any transaction, technical or user fraud issue the main barrier will remain closed and user will be diverse to the cash payment gateway.

6. HARDWARE IMPLEMENTATION

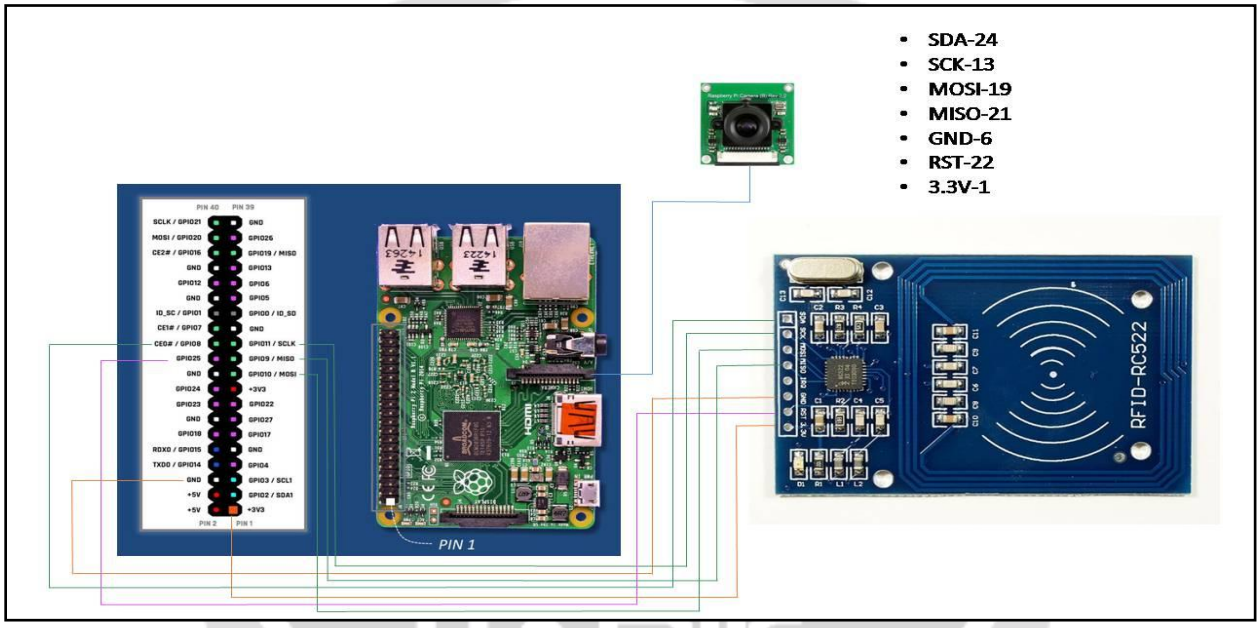

Fig - 4: Hardware Implementation

7. RESULTS

On user side: In this E-toll system the user will first generate the QR code using Aadhaar number, vehicle registration details as shown below:

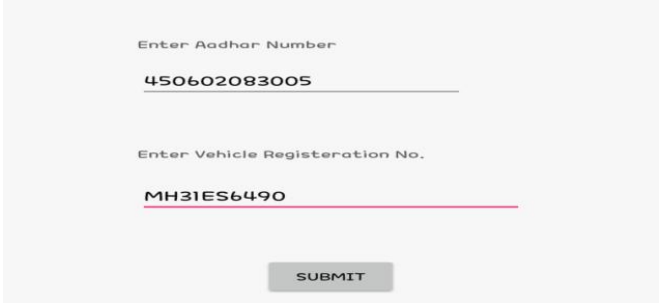

Fig – 5: Authentication

After valid authentication of Aadhaar card number and vehicle number, user will then generate QR code as shown in below fig – 8.

Fig - 6: QR Code Generation

8. CONCLUSION

This Project concludes that by using Quick Response code and RFID tag scanning we can save more time. Using QR code we can easily store user details in small space and it is much secure if we add encryption techniques in it. Using RFID tags vehicle identification can be done properly. Automatic Toll Collection provide flexibility, reliability and easy use that control the traffic and make collection of toll easy.

9. REFERENCES

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