Optimal Integrated Operation Strategy For Highway Toll System With Wireless Technology

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Abstract- *An Automated Toll Collection(ATC)system is used in toll collection without making heavy traffic and without wasting a time of peoples by using RFID technology. by using this ATC system, it will save time, i.e. by removing long waiting line as no need to stop the vehicle and no need of manual Tax Payment. Most important part in this, the lost vehicle will be able to caught easily with help of RFIDs technology. The currently using toll system for collecting toll Tax is on the manually Payment. In which every vehicle is to stop at the Toll stop for tax payment and it can be takes about average minute of time and there can be issue of accurate payments. It resulted into heavy traffics, increasing in air and noise pollutions, and wasting time of people. by using Automated Toll Collection system no need to stop vehicle at the toll booths, it will be detect the RFID tag, which is attached with vehicles. After detecting RFID tag, the database on the ATC server will check the detail about the vehicle and generate Toll tax bill and notify to the vehicle owner about toll tax bill using the Android app named as E-Wallet by using this App the amount of toll tax is deducted from E-wallet. So there will not be any complecations as mentioned above. An RFID tag is attached with each vehicle with reads or write memorys. A RFID reader reads this data when vehicle is near to toll booth and compares it with the data in the ATC server databases, if Tag ID is in theft_database it means complaints is in police database about lost vehicle it will get automatically caught then allows the access by opening toll gate. But, ID is not in the theft_database list, toll tax is taken and gate get open .The system is developed by embedded system using micro-controller and associated devices and by using the Android app the Automatic transaction is takes place The system is connected to a ATS server. This allows to the system to reads and writes data from database and deduct money from the wallet..*

Keywords- Automatic toll collection (ATC) System, RFIDs, E-Wallet, theft_database, Toll Plaza.

I. INTRODUCTION

Automated Toll Collection(ATC)system is a technology that can enable the vehicle pass through the Toll Plaza without traffic conjuction. and it can allows to be make payment online using E-Wallet. this system can be contain the databases of vehical and its owner identified by the vehicular Tag i.e. RFID Tag .if the vehicle is registered on the system then it can be make transaction online. the advantages of the system is it can avoid the heavy traffic on the toll plazas specially on the festival season.this system is reduces human involment on the toll plazas. this system can in include l+arge databases, android E-Wallet app, RFID tags and Readers, reacharge vouchers.

An ATC system uses the radio frequency identification (RFID.) technology. RFID is a technology which can identifying technologies involves radios waves to automatically identifing entities. RFID technique is firstly introduced in the late 1948 from that day it can be included in many workspace and applications like industrial areas, companies, college libraries, college attendence and many more.In simple the RFID used for track, trace and identify objects.

In the ATC system not only RFID concept fully used in which Android E-Wallet App is used for online transaction or payment of the toll tax which can be generated by the ATC system. ATC generated Toll Tax can be depend on the vehicle types and also depend on the owners proffession i.e. owner is minister or other proffetion. we are mainly focused on the Android app which can be allow to make transaction online and avoid waiting time on the toll booths in this App the system can directly connected to the ATC server. when vehicle is pass through the toll booth and the tag are detected. the reader sent information about tag to the ATC server then the server can check the vehicle owners detail and their complications like theft vehicle or any other data about vehicle. if any complication is not detected by the system then system processed next work after checking ATC system generates Toll Tax bill and communicate with the Android app i.e. E-Wallet and notify about the toll tax. in this process the E-Wallet can checks the sufficient balance if sufficient balance is available then toll gate is automatically open if balance is not available then owner has to make recharge their Wallet. by using the E-Wallet app for toll system we are make our system more efficient and effective on traffic minimization on the toll plazas.

Figure 1:General RFID based Toll Tax system

A. RFID Tag:

RFID Tag are like the transponder which chan have chip ad antenna.the chip consist of unique ID or unique serial number also chip can be contain the other information depending on the memory of tag.the RFID Tag can be different types which ca be read only, read-writes or write-once-read-many.the antenna is can be attached to the microchip. the antenna can be transmit information chip to RFID reader.the RFID Tag can be verified by mobile or readers using radio waves.

Figure 2:RFID Tag (internal structure)

B. RFID Reader:

RFID Tag are like the transponder which chan have chip ad antenna.the chip consist of unique ID or unique serial number also chip can be contain the other information depending on the memory of tag.the RFID Tag can be different types which ca be read only, read-writes or write-once-read-many.the antenna is can be attached to the microchip. the antenna can be transmit information chip to RFID reader.the RFID Tag can be verified by mobile or readers using radio waves.

Figure 3:RFID Reader

C. GATE CONTROL:

The Gate Controller can be perform task of open and close the gate when it receive signals from the system.for that barrier gate we used stepper motor .its a electromechanical device. which converts electrical pulse into discreate movements. the shafts or spindles can rotate on the discrete step increment when electro signal pulse can be applied in the proper sequence.In which higher signal or 1 is paased the barrier get open and if the low or 0 is applied the barrier is get closed there are four types of stepper motors which will be given as follows :

1. Lavet type stepping motor
2. Variable reluctant stepper
3. Hybrid synchronous stepper
4. Permanent magnet stepper

II. LITERATURE SURVEY

In [1], In this article the research is based on the image processing, when vehicle passes via toll booth at that time camera which is placed on toll booth capture the rear image of the vehicle and recognizes the number plate of vehicle and matches to the database if it match then deduct the balance from that particular amount.

In [2], this system uses the infrared sensors . In that the each and every user has to collect the infrared sensor from the toll booth office. Whenever vehicle comes to the toll booth user has to mount it on the vehicle and turn it on . microcontroller senses the infrared sensors and deduct the balance from the account. User has charge the infrared sensor each time when travels.

In [3] also the system is based on the Radio Frequency Identification technology. In that RFID tag is mounted on the vehicle. When vehicle come to toll booth RFID tags are reads by the RFID reader and send its information to the database for the identification of the perfect user and deduct the amount from the particular account. And send the transaction messages to the user via GSM module .

III. UML DIAGRAMS

1.CLASS DIAGRAM:

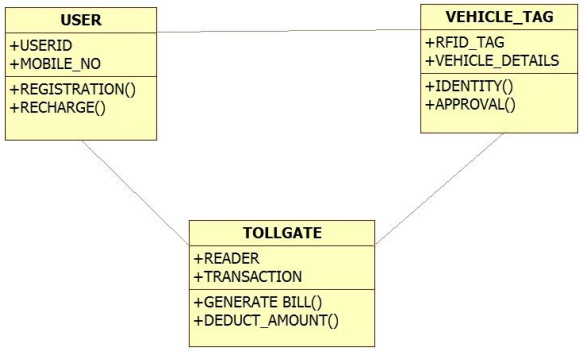

Figure 4:CLASS DIAGRAM

2.USE-CASE DIAGRAM:

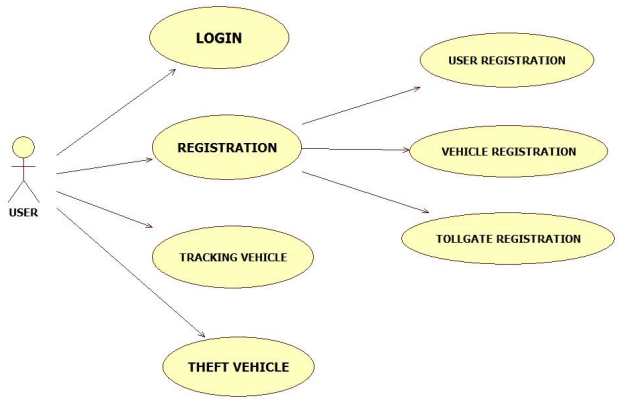

Figure 5:USE-CASE DIAGRAM

IV. MATHEMATICAL MODEL

System Description:

- Let S be the proposed system
- S= {{I},{O},{F}}

Where,

- I=INPUT
- O=OUTPUT
- F=FUNCTION

I= Reads RFID Tags(M)
O= Allows Vehicle(V) to pass the toll gate
F= Receiving message about deduction of balance

Let,
1. I= {v1;v2;v3….vn} (Various vehicle types)
2. R= {c1;c2;c3….cn} (Cash Deduction)

If I is a set of different vehicles and R is a set of fixed amount for different vehicles
Then,

- if vehicle v1 then only pay c1 cash and Output O is for v1 is generated
- if vehicle v2 then only pay c2 cash and Output O is for v2 is generated

Similarly,

- if vehicle vn then only pay cn cash and Output O is for vn is generated

V. GOALS

Electronic toll collection using android an adaptation of aims to eliminate the delay on toll roads by collecting tolls electronically.

VI. OBJECTIVES

A. *COLLECTION OF TOLL TAX*:

The biggest objective of the system is to collect the toll tax automatically and give the correct money to the admin by e-wallet system.

B. *EASY TO FIND OUT THEFT VEHICLES-*

Whenever user register the complaint about theft vehicle at that time this complaint also register on toll booth database , when stolen vehicle comes to the toll booth both barrier get closed and we can find the stolen vehicle.

C. AUTOMATIVE SYSTEM:

In that system user can register himself/herself using android application and makes entry into the database . it makes transaction very easy for automatic deduction of balance.

D. TIME SAVING

VII. ADVANTAGES

- Reduces the man power.
- Minimizes work stress
- Makes traveling more convenient, reduces travel times especially during festive seasons when traffic tends to be heavier than normal.
- Saves fuel and thus increases fuel economy
- Reduces wait time at toll booths

- Increase highway capacity. Processes 250 – 300% more vehicles per lane, reducing delays and traffic congestion
- Easy mounting, easy to operate [user friendly].

VIII. CONCLUSION

Android wallet is not replacement of Bank account but it is a technology offering various features. Android offers highly reliable data collection in harsh environments. Android technology can provide new capabilities as well as an efficient method to collect, manage, disseminate, store, and analyze information It not only eliminates manual data entry but also inspires new automation solutions. It fundamentally changes how processes are managed and how businesses operate. Android's attributes provide greater automated tracking capability than existing technologies, and thus create the opportunity to reduce abhor, improve inventory management and generate better market intelligence, leading to lower operational costs and increased revenue generation.

IX. FUTURE SCOPE

In future we are planning of making this system more accurate and user friendly. Also we will be probably implementing the facility of pre charging the users account. Also we will be looking to send user a transaction of full month which was held on previous month. Apart from these all the major modification that we are planning is to directly link the users credit card if he has not enough sufficient balance to make payment. Using feedback form users can give feedback their complaint and future modifications.

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