AN EFFICIENT CASHLESS TOLL COLLECTION SYSTEM USING RFID TAG

Pritesh A. Patil
Dept. of Information Technology,
AISSMS Institute of Information Technology
Pune, India
p.patil.k@gmail.com

Eshwari Nawale
Dept. of Information Technology,
AISSMS Institute of Information Technology
Pune, India
eshwaripune10@gmail.com

Samiksha Kadam
Dept. of Information Technology,
AISSMS Institute of Information Technology
Pune, India
samikshakadam03@gmail.com

Priyanka Patil
Dept. of Information Technology,
AISSMS Institute of Information Technology
Pune, India
priyankapatil8782@gmail.com

Shravani Talekar
Dept. of Information Technology,
AISSMS Institute of Information Technology
Pune, India
talekarshravani28@gmail.com

Abstract—In order to cut down the manual work at toll plazas, a Radio Frequency Identification (RFID) based concept is portage for the entire process within a second. The system uses passive tag which will have the particular number mapping the owner information; this useful detail is stored in congruence to that particular number.

ATCS known as "Automatic Toll Collection System" is a technology used to reduce the amount of time spent in toll queue, provide passenger leisure of plaza payment, illegal entry and to detect stolen vehicle. A reader antenna is normally assembled above the lane. It picks up the transponder's signal. The distinct number is then deliver to the globalize server through local area network, forth with plazas-location and lane information.

The system then matches that distinct number and specific reduction takes place through the e-wallet reference to correlated RFID tag that reside to the owners account. In case a robbed automobile passes through the plaza collection center, it is encounter and the proclamation is sent to the Police station of that area.

Keywords—ATCS; RFID; e-wallet.

I. INTRODUCTION

Introduction On highway, we all find single or multiple cabins where we a fixed allowance has to be paid.These cabins are known as tollbooths and the money we pay is the tax for using the road, called as toll road. Since then, most roads are constructed by the money raised by the state or national government through taxes. So, toll is a type of tax we pay the government for the maintenance of highways. When the automobile enter the plaza, a sensor fix on the plaza detects the label or a card encapsulated in the automobile. This tag is known as an RFID card. It consists of a distinct number each user and thus the information about the user. The system scans the card and validate all personalize information and then allows the person to go through the plaza after a fixed amount has been reduced from the user's bank account. Payment in the ATCS system is via wireless mode. There is an antenna at the plaza which establishes a wireless connection with the on-board unit when the RFID card of the automobile is detected, thus automatically deducting the amount from the account leading to cashless payment whose notification is post to the traveler.

One of the fastest way to get the payment without any destruction can be achieved here and no need of manual collection and operation at plaza barriers. The urgency for hand operated plaza systems is completely reduced in this process and the plaza system uses RFID. The details about the vehicles and the payment are stored in an RFID-based system which can be traced at any point of time. The RFID-based plaza collection system is to automatize the collection process by reducing the lengthy queues at the plaza using the RFID tags mounted on the vehicle. In addition, it can not only help detect vehicle theft, but also track vehicles passing the signal and vehicles driving at high speed. Another part is if RFID does not work, then using video camera license plate will detect and deduct the plaza amount.

The number plate of the vehicles is detected by means of a camera, using image processing technology at the plaza control point. Other general benefits for motorists include fuel savings and reduced mobile emissions by eradicating the delay also time required is less as compared to the hand operated system.

II. LITERATURE SURVEY

Kamarulazizi & Ismail, 2005 [1] the newspaper mentioned the assistance of Electronic Toll Collection System, often abbreviated as ETC, through the hand operated plaza collection system. It noted that the former helps to control traffic jams, which are generally caused by traffic during festivals. In addition, it also benefits operators, as it helps central auditing.

Chhoriya, Paliwal&Badhan, 2013 [2] was shown in the paper that the usage of image processing tools can be used for toll collection. The number plate on the vehicle can be edited and checked to fit any inventory in the database; in distinction to which plaza amount can be deducted, making it superior to hand operated toll collection.

Salunke, Malle, Datir&Dukale, 2013 [3]The following paper has highlighted the usage of RFID, i. H.Radio Frequency Identification, designed for toll collection, making the entire system simple and viable. The usage of ATCS extended to Automated Toll Collection System is an effective way to reduce government losses. The idea proposed in the work, because of its flexible nature and ease of implementation, had an influence over other electronic methods.

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Aphale, Chaudhari&Bansod, 2014 [4] The article has introduced the usage of an ATMega328PU microcontroller, which is the centralized unit that regulate the proposed system that uses RFID to detect short - range tags and asks the database for the amount I would deduct from the account linked to the internet.

III. PROBLEM STATEMENT

Designing and developing an atomized toll booth based on RFID technology to save time at the toll booth and ensure cashless operation. The RFID reader affix to the Tollgate frame reads the mark on the windshield of the vehicle. The object recognition sensor in the reader recognizes the number plate number and the plaza collection takes place via an e-wallet which is referred to the relevant RFID tag belonging to the owner's account.

IV. OBJECTIVES

The distinct objectives of this system are to ensure:

1. To design RFID reader using 8051 microcontroller on Arduino kit.
2. To configure global RFID server to verify the vehicle information using passive tag.
3. To design the payment gateway for automatic payment of toll charges.
4. To notify the vehicle owner about the location of passing of vehicle.

V. PROPOSED METHODLOGY

A. Arduino

To make the project more accessible Arduino is used. .As Arduino works as a single board microcontroller. It helps in multidisciplinary aspect in the project. A software is also associated with it which consist of a compiler which compiles standard programming language along with this a boot loader is also present. It also provides open source development environment and a hardware platform. Environment is sensed when input is received from various sensors It also has the ability of controlling lights and other actuators. The main reason behind using it in the project it because it consumes low power.

B. RFID Tag

RFID tags are mainly divided as active tag and passive tag. The active tags are one with internal power supply. So it doesn't require any external source. Passive RFID tags require an external power supply. In proposed system we use passive RFID tags as they cost less and partly maintenance free. It is powered by using RFID readers. Here we use Class-0 Gen-1 RFID tags. C.

C. RFID Reader

Reader uses electromagnetic fields to automatically identify and track tags attached to objects. In this systemEM-18 reader module is used. It is a low cost low frequency(125 kHz) RFID reader. VI. SCOPE The main purpose of the system provides a base for implementing RFID based toll collection system to automate the toll collection process by monitoring vehicle at toll collection. Using this system, all problems related to manual toll fee collection will be eliminated, thereby achieving a higher efficiency rate per transaction.

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the toll collection process by monitoring vehicle at toll collection. Using this system, all problems related to manual toll fee collection will be eliminated, thereby achieving a higher efficiency rate per transaction.

Following are some highlighted scope:

- This project deals with the simplification of procedure followed by passengers for paying the toll at toll collection booths.
- RFID reader attached at Tollgate frame reads the tag attached to the windshield of a vehicle.
- The object detection sensor in the reader uncovering the approach of the incoming vehicle's tag and toll deduction can be taken place via e-wallet assigned to the concerned RFID tag that is associated to the owner's account.
- In case a stolen vehicle passes by the toll collection center, it is detected and the alert notification is sent to the Police admin module.
-

VII. WORKING PRINCIPLE

A vehicle is appointed with an RFID tag and a computer is linked to the Transceiver placed on the charging station. Whenever vehicle enters the range of the radio-telephone, locates the tag and decodes the code authorized to that specific tag. After receiving of acknowledgement of the code, it is sent to the computer located at the charging station. The computer then identifies the code and then automatically accesses the database, and if the vehicle has a registered prepaid account on toll station, the appropriate toll is subtracted from this account and the gate is open let the vehicle run over. And if the vehicle does not have a registered prepaid account or it is nondaily traveler, will have to go through the manual inspection station, which will be on a different lane. Using the database, we can refine having to send entire data from the tag which grant us to use tags with less demand for memory, i.e. we store only 4 or 6-digit code number in the tag. And this 4 or 6-digit code is affiliated with a database that is related with database that is present on your computer. Each Tag has a different code number. It also decreases Probability of errors and saves processing time. Fig. 1: System Architecture
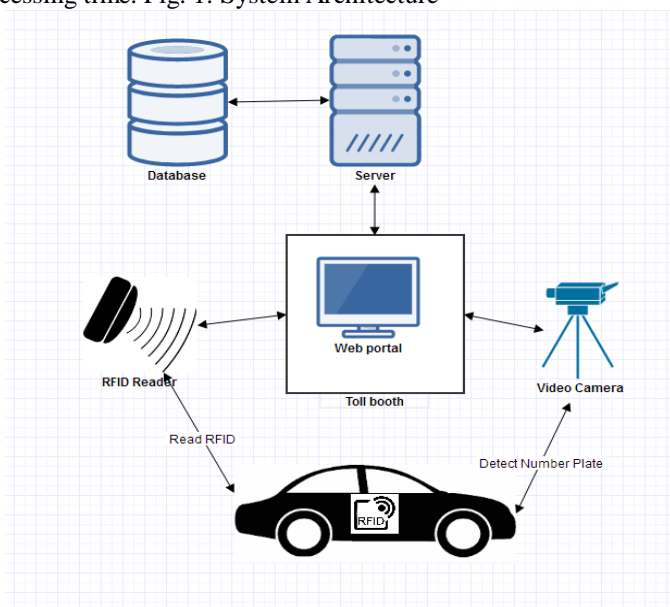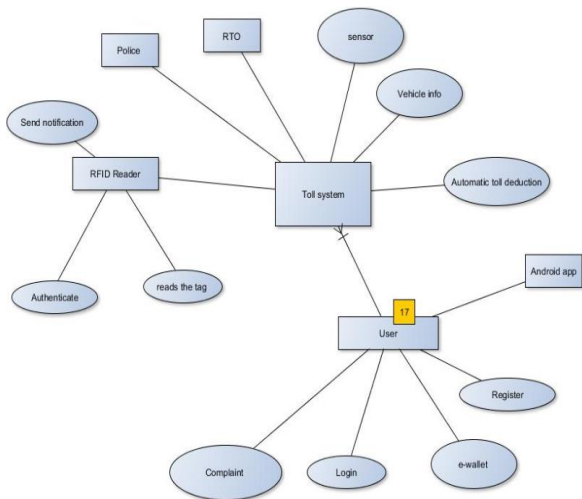

Fig. 1: System Architecture

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VIII. DATA MODEL AND DESCRIPTION
A. Data documented objects and Relationships

- ➤ Toll Admin: It is the entity that represents an authorized user of the system who has the central responsibility for handling the system and handling the database.
- ➤ User: The user is an entity that has all personal information as attributes. This is gathered in the user's database, which is handled by the central responsibility.
- ➤ RFID Reader: Reads the tag, authenticates the user and sends a notification after the appropriate deduction has taken place

XI. NAÏVE BAYES ALGORITHM
A. Naïve Bayes Classifier

In machine learning, Navie Bayes classifier naive Bayesian classifiers are a family of uncomplicated probability classifiers build up on Bayes theorem with strong (Naive Bayes is a method for building up classifiers: models that assigns class labels to instances of a problem characterized as vectors of defined values where class are labelled and taken from of a finite set. This is not one algorithm for teaching of classifiers, but a family of algorithms defines a general principle: all naive classifications Bayes presumed that the value of a particular function is not dependent on the value of other function, given the class variables. For example, fruit can be considered an apple if it is reddish,circle and about 10 cm in diameter. The naive Bayesian classifier treats eachother of these functions independently of each other so that the likelihood is that this fruit is an apple, inconsideration of the possible correlations among color, roundness and diameter characteristics. For some types of probabilistic models, naive Bayesian classifiers can be trained effectively in a controlled learning system. uses maximum likelihood method; in other arguments, it is possible to work with a naive Bayesian model without taking Bayesian likelihood or by utilizing Bayesian methods & independent assumptions between functions. Naive Bayes is a sort of classifier that uses the Bayes theorem.

In multiple practical applications, the parameter for naive Bayesian models likelihood for each class, such as the likelihood that a given record which belongs to a particular class. A class with the highest or largest likelihood is considered the most acceptable class also known as Maximum A Posteriori (MAP). The MAP hypothesis is:

$MAP(H) = max(P(H|E) =$
$Max((P(E|H)*P(H))/P(E)) =$
$Max(P(E|H)*P(H)) P(E)$

is evidence probability, and it is utilized to normalize the result.It residues same so, removing it won't affect. Naive Bayes classifier accepts that all the features are not related to each other. Presence or might be absence of a feature does not influence any other feature might be presence or absence.

Advantages
- A. The Naive Bayes algorithm is a fast, highly scalable algorithm.
- B. Naive Bayes can be used to classify Binary and Multiclass.
- C. It provides various types of Naive Bayes algorithms, such as GaussianNB, MultinomialNB, BernoulliNB.
- D. This is a simple algorithm that depends on the execution of multiple samples.
- E. Excellent choice for problems with text classification.
- F. This is a popular choice for the classification of spam e-mail. It can easily be trained on a small set of data. The Naive Bayes algorithm is a fast, highly scalable algorithm

X. FUNCTIONAL MODEL AND DESCRIPTION
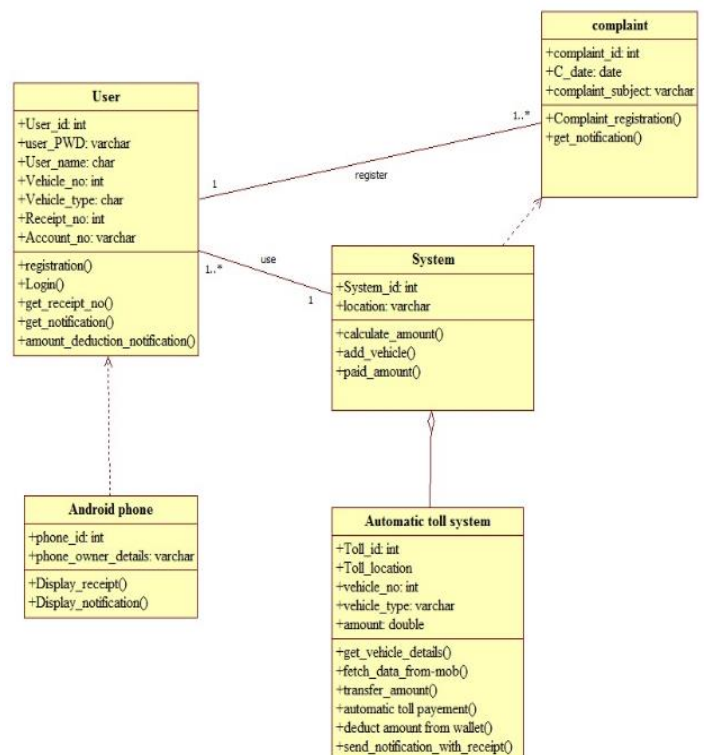
A. Non Functional Requirements
i) Interface Requirements
There are many types of interfaces as such supported by the ATCS viz., User Interface, Admin Interface.

ii) User Interfaces

The user interface will be friendly so user can grant access to the system.

➢ Login with valid user ID and Password.
➢ Automatic deduction of money from E-Wallet depending on vehicle type at toll centers.
➢ Video selection from any location.

iii) Admin Interfaces

➢ Vehicle registration by RTO admin.
➢ Toll registration by Super admin.
➢ Stolen vehicle registration by Police admin

iv)Constraints

Improper type of Number plate (Fancy, Damaged) cannot be detected.

B. Performance Requirements

i) Determination & Availability

➢ Back-end Internal Computers: The system will provide cache of all databases on redundant computers for automatic switchover.
➢ Internet Service Provider: The system will provide a contractual agreement with an internet service provider who can provide 99.999% availability space through their network facilities onto the internet.

ii) Usability

➢ Graphical User Interface: Graphical User Interface: The system will allocate a uniform look and ease through application on device.

iii) Accessibility

It provide multi language support.

iv)Performance

The performance can depend upon hardware components of thecustomer.

v) Security

Data Transfer: The system can automatically log out all customers after a period of inactivity. The system will confirm all transactions with the owner's account. It shall not leave any cookies on the customer's personal computer having the user's password. The system shouldn't leave any cookies on the customer's computer having any of the user's confidential information.The system shall automatically log out all customers after a period of inactivity. The system shall confirm all transactions with the owner's account. The system shall not leave any cookies on the customer's computer containing the user's password. The system shall not leave any cookies on the customer's computer containing any of the user's confidential information.

Data Storage: The system's back-end servers should not display a customer's password. The customer's password might get reset but not to be shown. The system's back-end servers should only be granted to authenticated administrators. The system's back-end databases should be secured by encrypted.

● CONCLUSION

We have decreased the common problem of skipping fees for paid tariffs by automatically keeping payments through E-Wallet. Long queues on the paid space and the need for human intervention are significantly reduced. The system will provide a smoother and safer journey for passengers.

Acknowledgment

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