Virtual Toll Collection System

P. Banumathi[1],S. Dhivyabharathi[2], C. Selvakumar[3], N. Kiruba[4], C. Jeevitha[5]
[1]Professor, Dept of Computer Science and Engineering
[2]Assistant Professor, Dept of Computer Science and Engineering
[3, 4, 5]Dept of Computer Science and Engineering
[1, 2, 3, 4, 5] Kathir college of Engineering, Tamilnadu, India.

Abstract- *With the continued development and economic growth of our environment the country should be digitalized in every way possible. This paper gives a detailed vision of smart toll collection system. The aim of this paper and its result is to attain a smart toll collection system for highway situations. It brings the solution to the traffic congestion and also the toll gate time futility and fuel absorption. Every Vehicle that has to be registered in the RTO office must be attached with the RFID tag in the number plate of the vehicle. The data of each and every vehicle is recorded before it reaches the toll plaza. Individual users have the unique ID for their vehicles. This provides more security that proposes a design using RFID tag and Sensors. When the vehicle crosses the Toll Plaza the reader reads the tag and the tax amount will be detected from their account balance by the use of RFID and GSM module.*

Keywords- RFID Reader, RFID Tag, Anpr Camera, Server

I. INTRODUCTION

In our everyday life that is based on technology we usually visit toll plaza. At toll plaza we often face the problems like traffic congestion, time futility and fuel absorption. To overcome the above problems, it is necessary to speed up the process at toll plaza. Hence to overcome the problems faced at toll plaza we use RFID based toll collection system which is virtual therefore toll plaza can be ignored. This paper deals with the Check post and Toll Plaza Automation for a smarter traffic control and so it benefits the people in saving their time and wastage of petrol.

Some of the benefits are listed below:

- Fuel saving due to short or no stoppage at toll gates
- Short or no queuing of vehicles
- Smooth traffic flow
- Skipping of toll is not possible
- Ease of payment
- Quick and convenient service to vehicle owners
- Minimize processing time for toll collection
- Better scalability

We accomplish work of vehicle identification during collision by exchanging RFID numbers. In the proposed system RFID reader will read the RFID tags that are mounted on vehicles and the system will automatically deduct a specific amount of toll from the scanned tag id with the help of the database.

As there is no need for vehicles to stop and the toll authorities to manually collect the tolls. The rest of the paper is described as follows: Section II discusses the background study on various existing or proposed models, Section III discusses the hardware implementation, Section IV discusses the experimental setup and finally, Section V concludes the paper.

II. RELATED WORK

The research in the field of application of RFID system in the Toll collection system is increasing on huge scale. The main reason for such a huge usage for RFID is low cost and low maintenance of RFID system. Digitally RFID captures the radio frequency by means of RFID technology. In this method a RFID tag along with a unique code will be attached to the vehicle which emits Radio frequency signals. Every owner has to have an account with RFID tag which is attached to their vehicle. Whenever the vehicle reaches near the entrance toll gate the signals will be detected and passed to the controlling device. The automated toll collection is used with the help of RFID and ISM frequency ranges in the UK. They use Active RFID tags which has the high frequency range 902-928MHz. The Vehicle module has around Atmel 8051 microcontroller. This module contains an LCD panel,keypad and an RF modem connected to the microcontroller through Max-232 chip. The advanced toll collection is done using the IR sensor and weighing sensors are used. The automation of toll collection system has been done based on image processing. ANPR (Automatic Number Plate Recognition) system has been used for detection of vehicle. When vehicle arrives at the toll plaza a camera is used to capture the image of the vehicle's number plate. If vehicle is detected to be stolen at CSU (Central Server Unit) it will indicate TSC (Toll Collection Unit) not to open the blockade. [3] This system is considered as the cost efficient in the

present situation which uses the Arduino device and the GSM module. The use of Radio Frequency Identification (RFID) and Global System for Mobile communications (GSM) module is the main advantage of this system. The recognition is successfully processed with the help of passive radio frequency. This project has the vehicle Particulars like unique ID is saved as an RFID tag.[4] One of the major threats is privacy leakage during the authentication process RFID tag can be read from the distance of 10cm to 30m. There is a chance for an unauthorized reader to sense the tag and can be cloned.

III. DESIGN AND HARDWAREIMPLEMENTATION

A list of the hardware components of our project is narrated in

Fig.1. RFID reader

RFID Reader*:* An RFID reader is a network connected device (fixed or mobile) with data banks and transceiver pairs that can help in identifying each RFID tags uniquely. In our system, it is planned to use the RFID system with a range of 5-8 meters which typically works on 860 to 960 MHz (Comply with the global, adopted all over the world UHF Gen2 standard – EPC global Gen2 ISO 18000-63). This frequency can support up to 15m.

Fig. 2. RFID Tag

RFID Tag*:*RFID uses radio waves to read and capture information, which can be stored on each tag uniquely and the tag is practically inexpensive and it can be easily mounted on vehicles. The tag is a Class 2 IR functionality and this has the read and write memory up to 65 Kb. Once it comes in contact (in the sensing range) with a reader, it sends a wake-up signal to the detector followed by the digital information stored on the circuit.

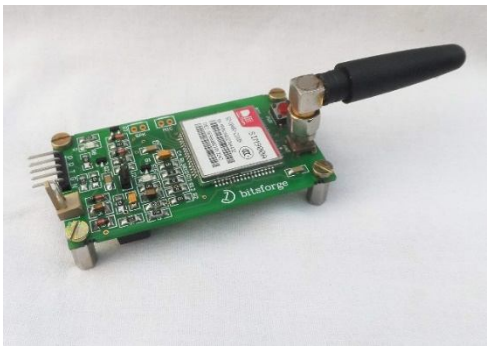

Fig. 3. GSM Module

GSM Module: GSM module can be used for sending the notification to all vehicles in the radius of 2km when the vehicle reaches the toll plaza about their toll charges and deduction. When the vehicle reaches the RFID reader and there is successful deduction and a notification message will be sent to the user through mobile and e-mail, this can be later extended to mass messaging internet-based server.

Fig. 4. ANPR Camera

ANPR Camera*:*The camera that is used in the vehicle number rechecking in the virtual toll collection system. It has the 2 mega pixels. The main advantage of this camera is that it has clear vision even at the nights. It can run on low power supply and this can be work at all weather Conditions. It can read in vehicle speed 0-120km/h. At this point a Waterproof camera is used. The number plate reading (ANPR) function is send the plate number text, related image and timestamp to the server.

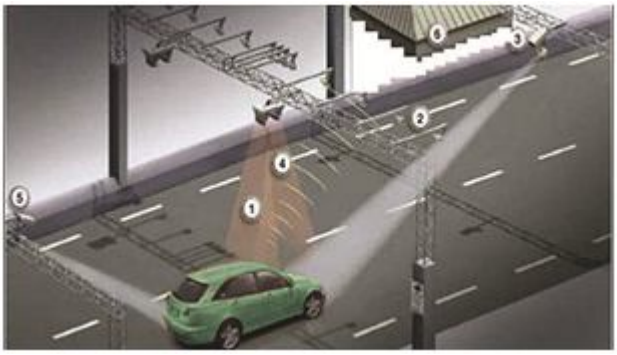

Fig. 5. A RFID based toll collection

Database:The database is a MYSQL table in 3rd Normal Form and thus we have used two different tables 1 and 2. The data is matched with two cases first with UID from RFID and then from vehicle number if matches then the payment transaction is initiated or else an error is generated and the number of the vehicle is captured by the Optical Character Recognition and the complaint is raised against the vehicle and actions will be taken according to the National highway rules.

IV. PROPOSED METHODOLOGY

In this model, we have built a suitable virtual Toll Collection System.

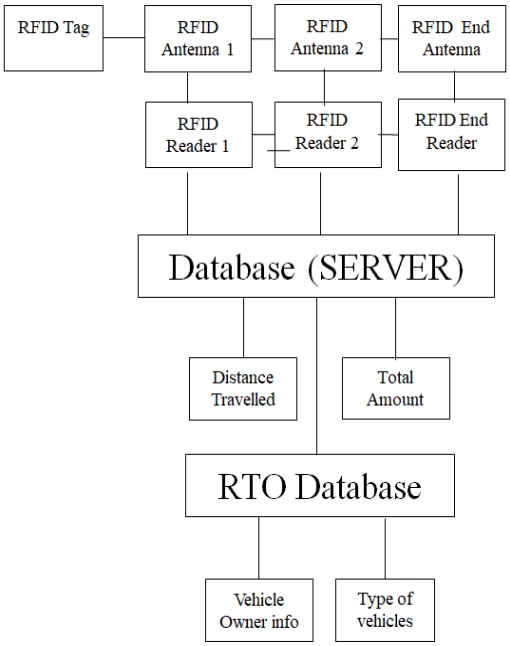

Fig. 6 Block Diagram of the System

In this system we use the RFID tag, RFID reader and ANPR camera for the detection. It saves the manpower costs.No stoppage of vehicles and time in the toll gates. It consumes less fuel and minimizes the time futility which helps both the government and the citizens. The main advantage of this system is that the user can pay the money according to the distance travelled.

V. EXPERIMENTAL SETUP

In our proposed model the virtual toll system is built and it is used to digitalize the environment. Our prototype the Virtual toll plaza is made up of RFID tag, RFID reader and the ANPR camera for high end recognition. We manually implanted the RFID tag in the vehicle by which the vehicle is identified. Once the vehicle enters the National Highways there will be a message that is sent by the GSM module as "Welcome to the National Highways". When the RFID tag reaches the RFID reader (Ultra high frequency Reader) it detects the vehicle through the RFID antenna and the database verification is done and ANPR camera is used to identify the number plate of the vehicle by which vehicle verification is done. In the database verification the vehicle owner information and the type of vehicle can be detected. During the verification if the RFID tag is not placed in the vehicle the details of the vehicle number that is captured by the ANPR camera is sent to the RTO server so that the complaint is registered against the vehicle for the illegal entry. Once if the vehicle enters the highway the RFID readers which are placed in the 5km distance so that the distance by which the vehicle travelled is identified. And if the vehicle is identified the distance is calculated automatically. And then if the vehicle leaves the National Highways once again the RFID reader reads the RFID tag at that time the the total amount for the journey and the distance travelled is calculated . And the GSM modele levaes the message os " Thank you for your journey ..! Visit Again..!" and the amount for the journey is deducted from the user account and the SMS is sent to the user for their money withdrawl. And if once this system is used the skipping of tolls and illegal activities can be avoided. Once if the user enters National Highways all the activites of the vehicles are recorded. Toll amount is also detected according to the distance travelled and the Citizens can also avoid the double payments . And the Man power costs and the power consumption and the Construction of the tolls can also be reduced and it can be done virtually.Meanwhile, the other cars can pass the toll gate without making any traffic jam in the road..

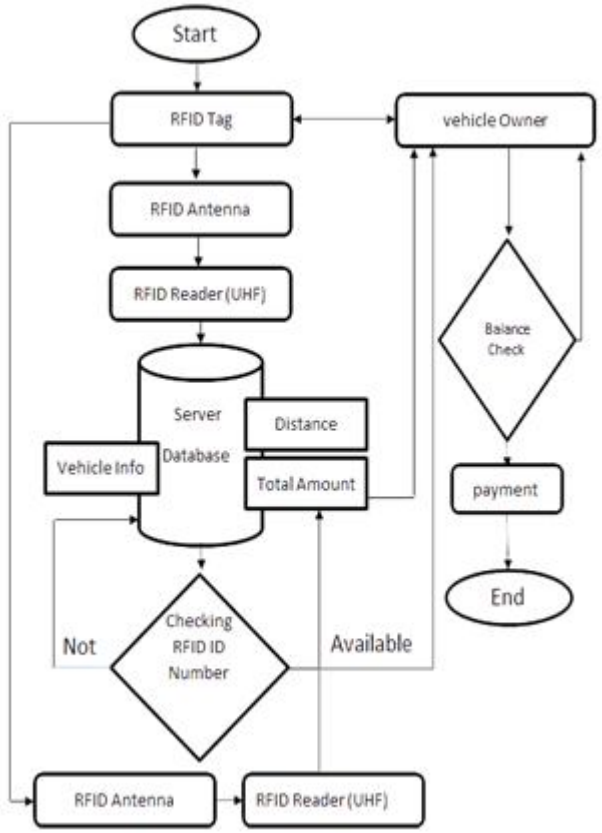

Fig. 7 Flow Chart of the System

VI. CONCLUSION AND FUTUREDIRECTION

The proposed system can be used to develop a completely digital and virtual smart toll collection system. In our country, manual toll plaza causes a lot of traffic. Besides, corruption in the toll plaza is an open secret. The proposed toll collection system can solve these problems efficiently. This RFID based toll collection system mainly depends on the RFID tags and RFID sensors. As most of the number plate of vehicles in has already been digitalized by government, Govt. can use the RFID tags of these number plates to detect the car and collect tolls without any need of stopping the vehicle. Information about the toll bill and account balances will be shared with the owners to ensure transparency in the toll collection. As a result, it will not only save the valuable time and extra payment but also eradicate corruption in the toll plaza.

Moreover, in future, additional features such as over speed detection and prevention, overload indication and prevention in bridge, privacy and intractability problems by using a salted hash function based algorithm to authenticate the RFID tag as well as the RFID reader, tracking vehicle which is stolen or involved in any accident etc. can be added in the system which will make the transportation system smarter and more secured. Thus, the proposed model can contribute to build a digital and smart road transportation system.

REFERENCES

[1] Pranoti Salunke, Poonam Malle, Kirti Datir, Jayshree Dukale, *"Automated Toll Collection System Using RFID"*, International Journal of Electrical and Computer Engineering (IJECE)Volume 9, Issue 2,PP 61-66(Jan. - Feb. 2013).

[2] Swati Sagar, JayshriJori, AishwaryaKale, Kalyani Khodade , Payal Mali*"Vehicle Counting and Automated Toll Collection System using Image Processing"*, International Journal of Computer Science and Network , Volume 5, Issue 2, April 2016

[3] Malvik Patel, Bharavi Joshi, Kajal Bhagat and Hetakshi Desai,Jekishan K. Parmar *"IOT BASED TOLL COLLECTION SYSTEM USING IMAGE PROCESSING"*. International Journal of Computer Engineering & Technology (IJCET),Volume 9, Issue 3, pp. 132–139,May-June 2018.

[4] Vishnupriya.R,Dr.N.P.Ananthamoorthy, *"Automatic Toll Collection System Using RFID & GSM Technology"*, International Journal of Advanced Research in Computer and Communication Engineering,Vol. 6, Issue 10, October 2017

Authors Profile

Dr. P. BANUMATHI: Presently working as a Professor in the Department of Computer Science and Engineering in Kathir College of Engineering, Coimbatore. She received BE, MCA, M.Phil, MBA and Ph.D in the year 1994, 2004, 2007, 2008 and 2015. She has 19 Years of teaching experience and 5 years of Industrial experience. Her area of interest is Artificial Neural Networks and Image Processing. She has presented 21 technical papers in various Seminars / National Conferences. She has presented 14 technical papers in International Conference. She has published 30 articles in International Journal. She is a member of Indian Society for Technical Education(ISTE) and Computer Society of India (CSI)

Mrs. S DHIVYABHARATHI: Presently working as an Assistant Professor in the Department of Computer Science and Engineering in Kathir College of Engineering, Coimbatore. She Graduated from KGiSL Institute of Technology in the year 2013 and had completed her Master's Degree in ME from Kathir College of

Engineering in the year 2015. Have presented and published papers in various national and international conferences and journals

C SELVAKUMAR: Pursuing Bachelor of Engineering in the Department of Computer Science and Engineering in the academic year 2016-2020 in Kathir College of Engineering, Coimbatore.

N KIRUBA: Pursuing Bachelor of Engineering in the Department of Computer Science and Engineering in the academic year 2016-2020 in Kathir College of Engineering, Coimbatore.

C JEEVITHA: Pursuing Bachelor of Engineering in the Department of Computer Science and Engineering in the academic year 2016-2020 in Kathir College of Engineering, Coimbatore.