REMUNERATION ASSORTMENT USING AUTOMATED RFID TOLL PLAZA

Mahesh Chandra Bhatt, Snehal Poddar, Vani Maheshwari, Garima Mathur
Department of Information Technology,
SRM Institute of Science and Technology,
Uttar Pradesh, India

ABSTRACT: ATCS referred to as Automated toll collection system by making use of RFID i.e. Radio Frequency Identification, serves the basic purpose of vehicle theft detection and toll collection in a faster more efficient way. The very basic component of the system is ARDUINO UNO. The need for new method/system arose to replace the manual means with Automatic Toll Collection, and also to specifically structure in Vehicle Theft Detection, Signal Breakage Avoidance, and Tracking Over-speeded Vehicles. The proposed system uses passive IDs placed on the wind shields or on the side of vehicles, through which the related information of the particular vehicle is being read by RFID Reader and tax gets cut accordingly. Also, it is a best alternative for saving the fuel and avoiding traffic scenario.

KEYWORDS— ATCS, ARDUINO UNO, RFID tag, Passive IDs, RFID reader, Toll collection.

INTRODUCTION :
From the beginning, the payment amount of toll on the highways was taken directly or indirectly. The advance technology which has developed at a huge level has overcome almost all the human requirement. Now the ways of using these technologies and implementations are very much secured and also the cost of RFID is becoming very low. This is the reason why the use of RFID is becoming common in people. This way can help the security checkers to catch the thief and will also reduce their work load. As we all know, so many vehicles cross the toll in a day. The manual system of collecting the toll is to stop the vehicle first, then receive the payment from the user and after the completion of payment successfully, the toll gate opens electrically or mechanically. So to reduce all this type of work load, we have introduced this system of RFID to make things more convenient for both users and employees.

GENERAL TERMS
RFID Tag: It is a collection of a chip and RFID chip inside. The chip has a unique id number for all the users and the format can be RO, RW and WORM i.e. Read Only, Read Write and Write Once Read-Many respectively. The Microchip contains an antenna, which transfers the information to the reader. The larger the antenna the longer is the range. There is a tag attached inside an object to identify and scan with the help of radio waves.

RFID Reader: There are two things i.e. (a reader and another one is the scanning device) which are needed to operate the RFID system, which in turn is used to read the tags. To get the information from the tag the reader makes the use of an antenna.

The RFID microchip tag can be charged by the means of power supply from car batteries. The tag is linked with a prepaid account of the particular user from where the tax amount gets deducted on successful passing by from a toll booth. Also, after passing from the toll booth, the proper SMS of amount deduction along with other details is received by the user as a sign of confirmation. Thus, the system plays a convincing role in eliminating manual labour for tax collection, thereby, increasing efficiency, accuracy, cost effectiveness. Also, it can be considered as one of the best ways to control traffic congestion at toll collection booths,

Section II defines the existing system , Section III contain the methodology for ATCS with flow chart, Section IV contain the implementation steps for ATCS and Section V concludes research work with future directions

EXISTING SYSTEM

The existing system required each vehicle to wait in long queues of vehicles in order to wait for their chance at the toll tax deduction area, and then move forward only after the accurate deduction of toll tax. The entire process requires manual functioning of data which is directly proportional to the amount of time consumed in processing each vehicles toll deduction process. Presently, there are 2 ways to collect toll at booths, the first one is entirely traditional process using manual labour where a person collects cash and accordingly provides a particular receipt in accordance to the toll deduction. The process comprises of scanning a smart card at the system already installed at the toll booth for opening the toll gate. Since the existing systems consume plenty of time in collecting toll from each vehicle, it becomes a massive need to find an alternative to the existing method so that the work gets easier and quick as well. The basic idea of elimination of specific constraints would be to make the toll collection sector more specific and accurate regardless of the vehicle passing by. The control of air pollution, vehicle theft detection, fuel and time management is the initial need of the hour, thus, the existing system requires changes for a better tomorrow

PROPOSED METHODOLOGY

In the proposed system, the idea refers to the safe environment in order to control the heavy flow of vehicle at the toll. The Capacitive Sensor senses the size of vehicle. The IR sensor, used to detect the object heat like vehicle, which in turn activates the GATE models. The GATE model is used as a means of opening and closing the toll gate when the vehicle passes through it. RFID reader reads the tag of the passing vehicles. Based on the numbers mentioned in the tag, the microcontroller is used to contain the required information of the particular vehicle. According to the amount displayed on the screen the payment will automatically get transferred from the vehicle holder's account and all information related to the transaction will be sent to the vehicle holders mobile associated with the account through GSM technology. The current status of the vehicle will then be displayed in the LCD.
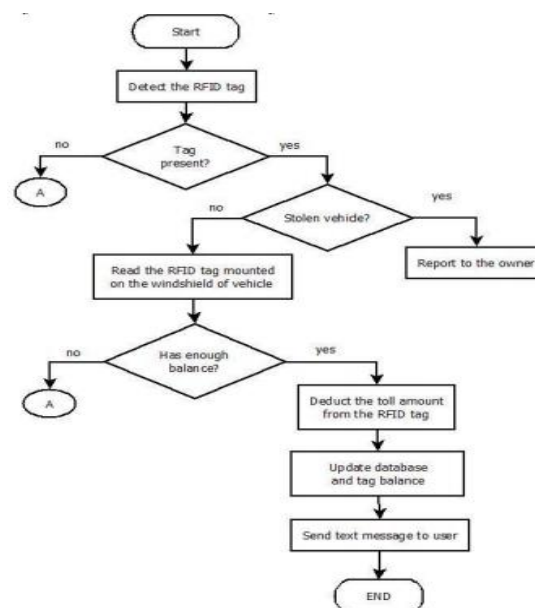

Fig. 1.Flow Chart of the Working System

This system is very much vulnerable to failure because of the use of the IR technology. Apart from that, the vehicle holder or the people with vehicle using the toll gate will pay cost of two piece RFID tags that are

used in this system. This system has been proposed to meet the required condition of the ATCS for the implementation. Features included are:

Replacement of manual toll payment: As explained above, the system will reduce the manual work because all the toll payment will be completed by the system itself. Also it will reduce the traffic jam which was just because of the long waiting lines in the toll. On another hand it will also save the fuel as the vehicles won't have to wait long for their turn.

Detecting Stolen Vehicle: In case the vehicle gets stolen from the owner, then they can register a complain through their RFID tag number in the office of the transport commissioner of the particular region or they can also register their complain through their website, so that whenever that stolen vehicle will pass through any of the toll gate, the fixed RFID tag placed on the wind-shield of the vehicle is matched with the tag of the stolen vehicle from the database present at the toll booth. It will be caught at that toll with help of that complain registered in the database.

Recharge the User Account: When the vehicle will reach the toll gate, it will get scanned by the system automatically. The scanner will read the information of that vehicle from the database. Now if the user already has the balance in his account the payment will be reduced directly from the account. But in case if the users balance is nil or not equal to the amount, then there is an option in this system which will recharge his card immediately so that he can pay the amount. The system contains different switches for the recharge i.e. one for the car and another for the trucks etc.

A. Hardware Requirements

The working and collaboration of any system depends upon the components used in the hardware of the system, keeping all constraints in mind.

ARDUINO board with ATmega328 micro-controller LM2596-DC-DC Step down Converter

RFID cards (125 kHz) LEDs

EM-18 RFID reader LCD Display (16*2) Buzzer

Servo motor

5V DC power supply SIM900 GSM module Jumper wires

SOFTWARE REQUIREMENTS

Only connecting the hardware according to the circuit dia-gram does not work really. Programming of the components according to the designed algorithm is also required so that the system functions desirably. Below is the detail of the used software for this particular system.

Arduino IDE

LANGUAGE USED

Embedded C: It is quite similar to C C++ with the libraries and function names being a bit different.It serves as a simple and easy language to make embedded systems work with reference to the coder's require-ments.

IMPLEMENTATION

This system is based on RFID automated payment system. That means the payment collection process will be easier and quicker as compared. And this possible with this system because it allows the vehicle to pass

the toll gate di-rectly without any stop as it deducts the money automatically from the account. The RFID microchip tag can be charged by the means of power supply from car batteries. The tag is linked with a prepaid account of the particular user from where the tax amount gets deducted on successful passing by from a toll booth. Also, after passing from the toll booth, the proper SMS of amount deduction along with other details is received by the user as a sign of confirmation. Thus, the system plays a convincing role in eliminating manual labour for tax collection, thereby, increasing efficiency, accuracy, cost effectiveness. Also, it can be considered as one of the best ways to control traffic congestion at toll collection booths.
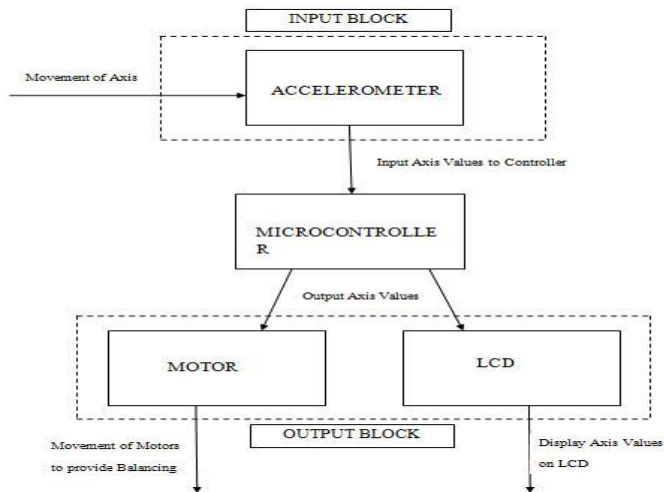

Fig. 2.Block Diagram

The toll lanes are electronically setup with special antennas that will continuously send out the signals which will in turn be used to identify the vehicles that will be travelling through those gates. To use this system the drivers will have to module an electronic transponder (tag) fixed in the top corner of the windshield of the vehicle. The tags will hold the entire user related information associated with the users account.
.

CONCLUSION AND FUTURE SCOPE

In today's scenario, the need of the hour is to minimise load to a maximum extent keeping in mind all the specifi-cations and complications faced during the time of project development. When we develop any project module, we need to remember that the particular project could be a future scope to advancements in certain field. Automated toll collection system using passive RFIDs is an approach to problem solving in the toll collection sector and vehicle theft detection sector also. So, here we conclude that the our project module would effectively work as an automated toll collection procedure along with the identification of vehicle stolen that deals with recharge of the card on requirement as well as prohibiting unregistered vehicle to pass through the toll booth. The basic idea behind the development of the project is to keenly observe time and fuel constraints and then develop a system that could effectively be used in practical life for better and productive tomorrow. Along with the automated toll tax collection and theft detection technique, we can further reshape our project model to acquire something advanced such as informing the particular vehicle owner about the person who has stolen his/her car by certain identification methodologies. Also, we can implement the smart street lights along with the toll automation so as to conserve the electricity fuel. Our project initially could just be used for RFID based toll collection, but, keeping in mind the advancements of todays scenario, further any possible changes can be made and thats when the idea of vehicle theft detection caught our eye. Also, when we talk about technology, the very first thing that hits our mind is the basic purpose of quality over quantity. Thus, in a project the future advancements should be as such that they minimise the hardware components to an extent where nobody is required to look after a particular product as in whole, I.e. Initially, the super computer used to be of the size of any building, with emerging

technology, now we see that super computer in the form of laptops, desktop systems and tabs as well. Therefore, future endeavours play a very massive role in advancement of a project which shapes the current usage as well as the practical isolations and formalities of the existing working module.

- Signal Breaking Avoidance.
- Tracking the Vehicles with over the speed limit.

REFERENCES

1. F. Don, Electronic Toll Collection: An Introduction and Brief Look at Potential Vulnerabilities, in SANS Institute infoSec Reading Room, 1.4b ed. 2004.
2. The Basics of RFID, Veri-Logic, LLC, 2003
3. Rakhi Kalantri, Anand Parekar, Akshay Mohite, Rohan Kankapurkar in RFID based toll collection system.
4. Alberto Carini and Silvia Malatini., Automated Toll Plaza System using RFID, IEEE Transactions on Signal Processing, Vol.16, pp.1558-1563, 2008.
5. Das D.P, Panda,G. and Kuo,S.M., Research Trends in RFID Technol-ogy, IEEE Transactions on Signal Processing, Vol.15 No.8, pp.1434-1446, 2007.
6. Jiashu Zhang and Heng-Ming Tai., Modified Toll Collection System, IEEE Transactions on Signal Processing, Vol.5,pp.442-447, 2007.
7. N. Gabriel, I. Mitraszewska, K. Tomasz, The Polish Pilot Project of Automatic Toll Collection System, Proceedings of the 6P thP International Scientific Conference TRANSBALTICA, 2009.
8. D.D.E. Crispin, U.M. Aileen, G.S. Ricardo, J.M Jim, S.P. Hilario, Al-location of Electronic Toll Collection Lanes at Toll Plazas Considering Social Optimization of Service Times and Delays, Proceedings of the Eastern Asia Society for Transportation Studies, vol. 5, pp. 14961509, 2005.

AUTHORS PROFILE

Mr. Mahesh Chandra Bhatt pursed
Bachelor of Technology from Uttarakhand Technical University, Uttarakhand, India in 2014 and Master of Technology from Uttarakhand Technical University, Uttarakhand, India in 2016. He is currently pursuing Ph.D. and currently working as Assistant Professor in Department of Computer Science and Engineering, Department of Information Technology, SRM Institute of Science and Technology, Delhi NCR campus India since 2018. His main research work focuses on Wireless Networks, Network Security, Mobile Computing and Mobile cloud computing. He has 3 years of teaching experience.

Ms. Snehal Poddar pursuing Bachelor of Technology from SRM Institute of Science and Technology, Delhi NCR campus India.

Ms. Vani Maheshwari pursuing Bachelor of Technology from SRM Institute of Science and Technology, Delhi NCR campus India.

Ms.Garima Mathur pursuing Bachelor of Technology from SRM Institute of Science and Technology, Delhi NCR campus