International Journal of Academic Research and Development
ISSN: 2455-4197; Impact Factor: RJIF 5.22
www.academicsjournal.com
Volume 2; Issue 1; January 2017; Page No. 138-141

Benefits and applications of electronic toll collection system based on RFID

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Abstract
This paper focuses on an electronic toll collection (ETC) system using radio frequency identification (RFID) technology. Research on ETC has been around since 1992, amid which RFID labels started to be broadly utilized as a part of vehicles to computerize toll forms. The RFID framework utilizes labels that are mounted on the windshields of vehicles, through which data installed on the labels are perused by RFID perusers. The proposed framework dispenses with the requirement for drivers and toll specialists to physically perform ticket installments and toll expense collections, individually.
Information data are likewise effectively traded between the drivers and toll specialists, along these lines empowering a more productive toll collection by lessening activity and taking out conceivable human blunders.

Keywords: electronic toll collection (ETC), RFID, technology

Introduction

The Automatic Toll Tax systems have really helped a lot in reducing the heavy congestion caused in the metropolitan cities of today. It is one of the least demanding strategies used to arrange the substantial stream of activity. At the point when the auto travels through the toll door on any street, it is demonstrated on the RFID peruser that it has crossed the clearing. The requirement for manual toll based frameworks is totally lessened in this techniques and the tolling framework works through RFID. The framework in this way introduced is very catalyst diminishing the time and cost of explorers since the tag can be deciphered from a separation [4].

The primary thought behind executing RFID based toll gathering framework is to robotize the toll collection process their by decreasing the long lines at toll stalls utilizing the RFID labels introduced on the vehicle. What's more, it can help in vehicle robbery identification as well as can track vehicles traverse speeding vehicles. This framework is utilized by vehicle proprietors, framework manager. Other general favorable circumstances for the drivers incorporate fuel reserve funds and decreased portable emanations by lessening or taking out deceleration, holding up time and increasing speed. In the mean time, for the toll experts additionally get the advantages specified below [2]:

The Advantages for the Drivers Include

- Fewer or shorter lines at toll squares by expanding toll corner benefit turnaround rates.
- Faster and more proficient administration (no trading toll expenses by hand)
- The capacity to make installments by keeping an adjust on the card itself
- The utilization of postpaid toll explanations (no compelling reason to ask for receipts)
- Lowered toll collection costs
- Better review control by concentrated client account and
- Expanded limit without building more foundations.

Expanding number of vehicles out and about, result into number of issues, for example, blockage, mishap rate, air contamination and numerous other. Every single financial movement for various undertakings utilize distinctive techniques for transportation. Thus, expanding transportation is a quick effect on efficiency of country and the economy. Decreasing the cost of transporting asset at creation destinations and transport finished merchandise to business sectors is one of the critical key factors in financial rivalry. Programmed toll gathering is an innovation permits the mechanized electronic collection of toll costs. As it is contemplated by scientists and furthermore connected in different turnpikes, extensions, and passages require such a procedure of Automatic Toll Plaza. ATP is equipped for deciding whether the vehicle is enlisted or not, and afterward illuminating the administration focus going to process infringement, charges, and taking an interest accounts. The most astounding preferred standpoint of this ATP framework is that it is fit for dispose of clog in toll square, particularly amid those seasons when activity is by all accounts higher than ordinary.

The base thought behind executing RFID Based Toll System is to robotize the toll collection process and their by decreasing manual activity in toll stalls and the long lines at toll corners utilizing RFID labels introduced on the vehicles. Notwithstanding we cannot just help the vehicle proprietors and framework managers from vehicle burglary location yet in addition can track over speeding vehicles, and intersection the signs. Here we will see a few focuses with respect to reason behind picking this theme and what is the prerequisite of this kind of the task in our everyday life. Stay away from the fuel misfortune.

- Saving of time in gathering toll.
- Avoid budgetary misfortune.
- To screen the movement.
- According to the review of Karnataka Government, in Sept.2012 they have proposed to get the yearly toll collection around 2500 crores/year.

In any case, in the current circumstance they can gather just 900 crores of the toll esteem. Means there is loss of 600 crores because of human mistakes. Thus, in this circumstance we need to control this spillage. Presently the present framework we have with us on the high ways takes 1 moment to finish the toll collection process for one vehicle. With this programmed procedure, it will take only not as much as a moment. To finish the entire procedure. As there is decrease in time for finish of the procedure so in a roundabout way there will be no activity all things considered and as there is no movement so no fuel wastage

happens and the motivation behind outlining the roadways is accomplished i.e. lessening in travel time and additionally the cash misfortune will be diminished.

Review of Literature

There are two methods of collecting tax presently used they are first is the traditional manual method where one person collects money and issues a receipt. The other one is the Smart Card strategy where the individual needs to demonstrate the savvy card to the framework introduced at the toll charge division to open the Gate.

Both the previously mentioned technique for gathering charge is tedious strategy. Odds of getting away from the installment of duty are there. It prompts lining up of following vehicles.

Outline and advancement of a "RFID Based Automatic Toll Plaza" which depends on microcontroller, RFID innovation what's more, stack cell to spare the time at toll square and having cashless task. As the name suggests "RFID Based Automatic Toll Plaza" the key subject of our undertaking is the robotization. So here we will simply take the disregard of what is mean via Automation. In basic words the Automation implies the individual from the procedure with the machines.

Before going further we simply take the disregard of history of the toll squares. So before the 90's decade the toll squares were completely manual controlled. Means there are add up to four individuals for working the Toll door in this two individuals will be utilized for opening and shutting of the entryway and another two are for gathering of the cash and information keeping and so on.

Self-loader Toll squares were propelled after the presentation of Express courses in 1995, in which information is put away in PCs and door activity is programmed, just two personals are required for single corner. However, here we will see the human less toll square. Dynamic wave Inc [12] has at present conveyed an arrangement of dynamic label vehicle checking arrangement. Dynamic wave vehicle items have a scope of 30 meters and work in the 916 – 927 MHz for the transmit tasks and 433 MHz for the get interface. Dynamic wave items are at present outfitted with 256 Kbits of settled memory. The tag is controlled with a replaceable 3V battery and the aggregate weight is 14 grams. Rudimentary signs are appeared with the assistance of flickering LEDs and signaling sounds.

Shrewd key Access Control Systems [13] have a customer – server demonstrate based framework with a SQL server taking care of different vehicle observing frameworks. They have planned a UI utilizing the Microsoft. NET Framework. Keen key additionally work in the 900MHz band however have a little scope of 30 meters. RFID based toll collection framework [14] utilizes dynamic RFID label which utilizes auto battery control. The usage is partitioned into the plan of two modules-the Vehicle Module (Active Tag) and the Base Module. The two modules convey by means of RF modem associated with every module. These RF modules convey over the ISM Frequency Range of 902 – 928 MHz.

RFID-Based Electronic Toll Collection

RFID based toll collection system is used as a technology for fast and efficient collection of toll at the toll plazas. This is conceivable as the vehicles going through the toll square don't stop to pay toll and the installment consequently happens from the record of the driver. The electronic toll paths are set up with the uncommon recieving wires that persistently convey signals. These signs are utilized to naturally distinguish the vehicles that movement by them. To utilize the electronic toll office, the driver needs to set up a record and get an electronic transponder settled in the vehicle. These transponders generally known as the labels are typically fitted on the windshields of the vehicles [6]. The tag has all the data in regards to the supporter's record. The reception apparatus consistently conveys a radiofrequency (microwave) beat, which returns just when it hits a transponder. These heartbeats are returned once again from the transponder and are gotten by the radio wire. These microwaves reflected from the labels contain data about the transponder's number, benefactor's record, adjust, and so forth. Other data, for example, date, time, and vehicle check could be recorded relying on the necessity of the information required by the toll organizations.

In the wake of scrambling the substance of this microwave, the unit at that point utilizes fiber-optic links, cell modems or remote transmitters to 15 send it off to a focal area, where PCs utilize the special distinguishing proof number to recognize the record from which the cost of the toll ought to be deducted. This framework utilizes various innovations for its working. Figure 4 demonstrates the working of the electronic toll gathering framework with its parts. These segments may fluctuate contingent on the innovation utilized. As the vehicle enters the toll path, sensors (1) distinguish the vehicle. The two reception apparatus design (2) peruses a transponder (3) mounted on the vehicle's windshield. As the vehicle goes through the leave light window ornament (4), it is electronically arranged by the treadle (5) in light of the quantity of axles, and the ETC account is charged the best possible sum. Input is given to the driver on an electronic sign (6). On the off chance that the vehicle does not have a transponder, the framework groups it as a violator and cameras (7) take photographs of the vehicle and its tag for preparing [21].

Applications of RFID Based ETC System

The RFID innovation can drastically diminish vehicle lining at car toll squares, speed throughput, and essentially enhance the personal satisfaction for suburbanites and networks. Electronic toll gathering exchanges to happen under typical thruway driving conditions. Open street tolling kills square hindrances and makes another toll street outline that mitigates clog.

High inhabitance vehicle tolling is an augmentation of electronic toll collection. It is additionally an idea that is quickly picking up support with transportation organizations and organizers as it enables them to improve utilization of the regularly underutilized high inhabitance vehicle (HOV) or carpool paths. With high inhabitance tolling, single tenant vehicles (SOVs) can drive on carpool lanes for an expense.

Open street tolling gives toll experts the adaptability to set variable evaluating for toll administrations. Valuing writes incorporate premiums or rebates in light of the season of day and clog level. Variable valuing models can be pre-set up, or changed progressively, reacting to existing movement circumstances. Variable estimating enables the transportation expert to amplify the utilization of carpool lanes [17].

Working of RFID Based Toll Collection System

There are a wide range of sorts of RFID frameworks utilized around the world, however as a rule, a gadget utilized as a part of autos for toll-gathering purposes would

be a functioning transponder that stores a one of a kind serial number related with a client's close to home record. Numerous frameworks incorporate a uninvolved tag in the gadget too. At the point when the aloof label comes extremely close to a peruser, it advises the resting dynamic tag to wake up and communicate. This spares battery life, by enabling the dynamic tag to communicate just when inside scope of an investigator.

Here's the way such an answer would work: An auto pulls up to a path with a robotized toll-collection framework. The latent peruser in the toll stall continually emanates a flag teaching any transponders that enter the read field to awaken (a few frameworks utilize an electronic eye to decide when an auto has entered the corner). The dynamic tag in the auto (generally fastened to the windshield) enacts and communicates, say, serial number 12345678.

A peruser reception apparatus is normally mounted over the path. It gets the transponder's flag. The serial number is steered through a neighborhood to a PC, which generally sends the serial number, alongside toll-area and maybe path data, to a brought together PC that stores the driver's data. The framework at that point coordinates the ID number to a record and decrements that record by the suitable measure of cash.

Note that some toll-gathering frameworks are currently moving to detached ultrahigh-recurrence (UHF) innovation. The favorable position is that aloof UHF innovation is less expensive, and would not require substitution because of a dead battery, since uninvolved labels are without battery.

Most frameworks did not already use inactive labels, which were deficient to guarantee 100 percent read rates. Be that as it may, the innovation has now enhanced to the time when some transportation organizations-in Georgia, Denver, Utah and Washington State, for instance-have started utilizing it. With uninvolved innovation, the peruser discharges vitality that empowers the tag, which at that point reflects back a flag with the encoded serial number.

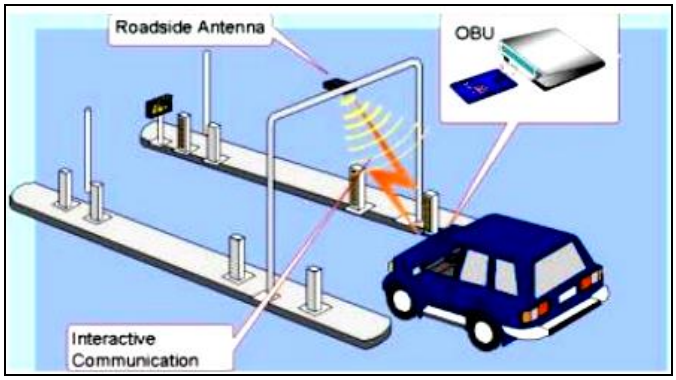

Fig 1: RFID technology for Electronic Toll Collection

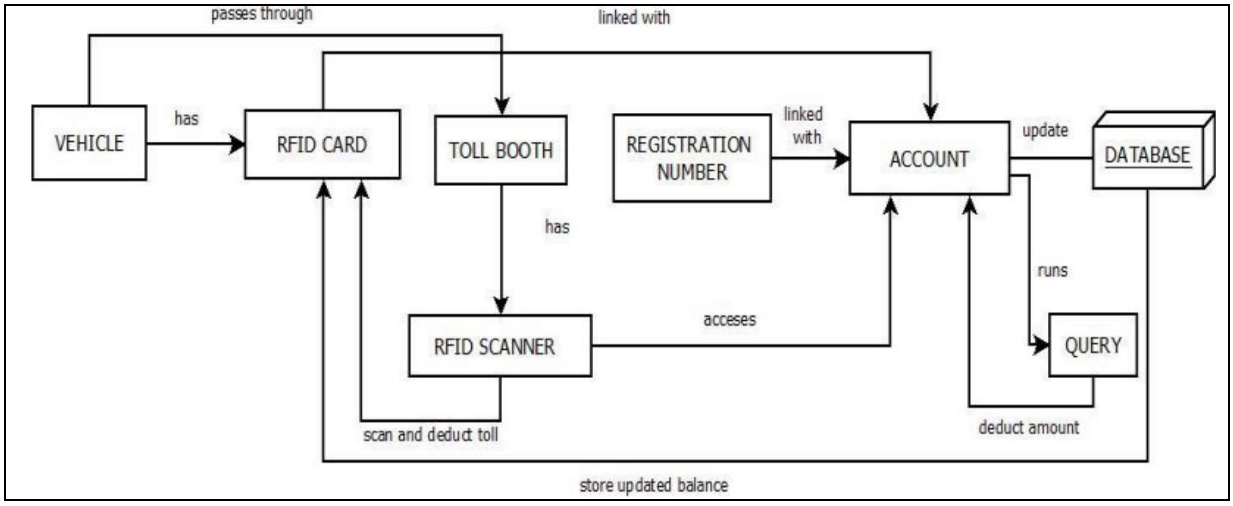

Fig 2: Architecture of RFID based toll collection system

Conclusion

The main benefits of RFID Toll Collection System are time consuming, fuel savings and traffic reducing. It has likewise the best advantage which is government isn't losing any income from toll collection. Additionally the additional choice of weight sensor will dependably assist the extension with avoiding any sort of undesirable mischances like scaffold crumple. Full security of extension will keep up by this weight sensor. Individuals will likewise get loads of advantages among them the fundamental advantage is fragmentary piece of toll charge will deduct as portion esteem. So no odds of individuals paying a round figure sum for portion esteem. The traffic free toll framework will add a decent impression to those individuals and they can appreciate the movement on this street by brief time.

References

1. ActiveWaveInc. http://www.activewaveinc.com
2. Taflove A. Advances in Computational Electrodynamics: The finite-Difference Time-Domain Method, Artech House, Boston, 1998.
3. Abdalla Mohammed Mohammed, Maryse Mamdouh Naguib Fahmy Nashed, Michael Essam Amin Nasr, Mohammed Gamal El Prince, Nour El Din Mohammed Nour El Din. Information and Communication Technologies Engineering Smart Road System. Uninettuno University – Helwan University, 2011.
4. Ganesh K Andurkar, Vidya R Ramteke. Smart highway Electronic Toll Collection system, International Journal of Innovative Research in Computer and Communication Engineering. 2015; 3(5).
5. RFID based toll collection system. IEEE third international Conference, 2011.
6. Grimes DM, Jones TO. Automotive radar: A brief review, Proc. IEEE. 1974; 62(6):804-822.
7. Priyanka Sharma, Vivek Sharma. Electronic toll collection technologies: A state of art review, an International Journal of Advanced Research in Computer Science and Software Engineering. 2014; 4(7):621-625.
8. Bhardwaj A, Tung NS, Shukla VK, Kamboj VK. The important impacts of unit commitment constraints in

power system planning. International Journal of Emerging Trends in Engineering and Development. 2012; 5(2):301-306.
9. Smart key Access Control System http://www.smartkey-rfid.com
10. The Basics of RFID, Veri-Logic, LLC, 2003.
11. Khali P, Michael CW, Shahriyar H. Toll Collection Technology and Best Practices, Project 0-5217: Vehicle/License Plate Identification for Toll Collection Application, 2007.
12. Grimes DM, Jones TO. Automotive radar: A brief review, Proc. IEEE. 1974; 62(6):804-822.
13. Don F. Electronic Toll Collection: An Introduction and Brief Look at Potential Vulnerabilities, in SANS Institute infoSec Reading Room, 1.4b ed., 2004.
14. Tung NS, Kamboj V, Bhardwaj A. Unit commitment dynamics-an introduction, International Journal of Computer Science & Information Technology Research Excellence. 2012; 2(1):70-74.
15. Lauren S, Mariko B. Electronic Toll Collection [Online], 2007. Available: 5TUhttp://www.atm.comU5T
16. Roberts CM. Radio Frequency Identification (RFID). Computers & Security, Elsevier, 2006.
17. Liu Bin, Lu Xiaobo, Gao Chaohui. Comparing and testing of ETC modes in Chinese freeway. Journal of Transportation Engineering and Information. 2007; 5(2):31-35.
18. Preet Khandelwal, Surya Prakash Ahirwar, Amit Bhardwaj. Image Processing Based Quality Analyzer and Controller, International Journal of Enhanced Research in Science Technology & Engineering. 2013; 2(7).
19. A Novel Chipless RFID System Based on Planar Multiresonators for Barcode Replacement Stevan Preradovic, Isaac Balbin, Nemai C. Karmakar and Gerry Swiegers, 2008.
20. Jerry L, Barbara C. Shrouds of Time: The History of RFID, AIM Publication, 2001.
21. Ayoub Khan M, Manoj S, Prahbu RB. A Survey of RFID Tags, International Journal of Recents Trends in Engineering. 2009; 1(4).