

A Comparative Analysis of Advance Toll Tax Systems

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ABSTRACT: Many vehicles drive on the highway, and toll taxes must be collected as they pass by. However, this is a time-consuming operation, and poor management may result in long lines and pollution. By using Automation in Toll Collection, several solutions have been created to decrease the complexity of the operation. There are a number of systems available; we examine a few of them and look for areas where they might be improved. ATCSR is an RFID-based Automated Toll Collection System that collects taxes automatically. We use radio frequency to perform the identification in this case. An RFID tag will be attached to a car. This tag is just an exceptional distinguishing number. The RTO, or traffic controlling power, will be responsible for this. We will record all principal data, as well as the sum he has paid ahead of time for the TOLL assortment, as per this number. At the cost assortment office, a peruser will be decisively situated. The assessment sum will be taken from the vehicle's prepaid equilibrium at whatever point it goes through a tollgate. Another balance will be set up. On the off chance that one's equilibrium is insufficient, his refreshed equilibrium will be negative. To resolve this issue, we have a camera out and about that catches the image of the significant vehicle. Since vehicles are not expected to stand by, gridlock at cost squares is limited, and fuel utilization is brought down. This is a critical advantage of this framework.

KEYWORDS: Toll Collection, RFID, GSM, FASTag, Electronic Toll system.

I. INTRODUCTION

There are many highways on the route, each of which passes through a toll collecting system every 50 kilometers, with many vehicles passing through a single toll plaza. People's desire to arrive at their destination on time, combined with the fact that they must wait in a line (in conventional systems) to pass through a toll gate, necessitates stopping at the toll gate, handing over change to the toll gate manager, receiving the ticket, and returning change (if any), before the manager raises the gate to allow your vehicle to pass through.

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The whole traditional procedure takes a car anything from 15 minutes to 1.5 hours, depending on traffic circumstances. As a result, there is a need to create automated solutions that may assist decrease the process's complexity. Many individuals have created automated systems that allow vehicles to pass through toll gates without having to stop, as well as automatic payment options. We go finished some of the most common systems that might be useful in such a scenario. We'll also discuss the system's potential weaknesses, as well as what we might do to enhance such systems to make them more suitable for the issue at hand[1]–[5].

The quantity of traffic has increased in recent years as the number of cars has increased. Millions of individuals utilize their own cars instead of public transportation every day, causing traffic congestion in developing nations. An increase in the number of cars on the road causes a slew of issues, including traffic congestion, air pollution, and fuel waste. Toll roads are those on which you must pay a fee to travel. A toll tax must be paid in order to travel on the route. Only toll road users are subject to the toll fee. On a toll road, there may be more than one Toll Plaza at any same time. A toll road doesn't stay that way eternally. Tolls may be phased out after the building costs have been covered by toll income. On highways, all toll plazas are manually operated, with an operator collecting money from the driver and providing a receipt. This process may be lengthy, resulting in traffic bottlenecks at toll plazas on congested roads[1], [6]–[8]. Toll booths, on the other hand, have several lanes to keep traffic flowing as fast as feasible. On some lanes, you may pay with change or cash, but there are also fast lanes for people who have an electronic pass linked to their vehicle. Special detectors detect the electronic pass in your vehicle and deduct the necessary amount from an account connected to your electronic pass, such as a credit card or a bank account. Commuters often use these electronic permits to cross toll roads on a regular basis, avoiding huge lineups at toll booths to pay cash [9].

A. Toll Collection via Electronic Means

The ETC system (Electronic Toll Collection) is currently in use all over the world. The ETC system is used by a number of countries, including Canada, Poland, Japan, Italy, and Singapore. Some of the Electronic Toll Collection Systems in India owned by NHA (National Highways Authority of India) and operated by different toll management systems include the NH-6 toll road in Kharagpur, which is operated

by Toll Tax Toll Collection System, the Delhi Gurgaon Expressway in Delhi, which is operated by Metro Electronic Toll Collection Systems, and the Lucknow Sitapur Expressways Ltd in Uttar Pradesh, which is operated by Rajdeep - Toll Management System [10], [11].

B. Fastag

In India, the Fastag electronic toll collection system is operated by the National Highway Authority of India. In 2014, the technology was tested on the Golden Quadrilateral between Ahmedabad and Mumbai as part of a pilot project. The system went online on the Delhi-Mumbai section of the Quadrilateral on November 4, 2014. In July 2015, toll plazas along the Golden Quadrilateral's Chennai-Bengaluru road started accepting FASTag payments. By April 2015, FASTag has been deployed in 247 toll plazas on key highways throughout India, accounting for 70% of all toll plazas in the nation. Out of a total of 366 charge plazas on national roadways around the country, 347 accept FASTag payments as of November 23, 2016 [12], [13].

C. Electronic Tolling Systems (ETS)

Electronic Toll Collection is a technique that collects toll payments electronically and enables for near-constant toll collection and traffic monitoring. As part of the system, automobiles are given an RFID chip-embedded sticker that allows for automatic money deduction at toll plazas. The first interoperable Radio Frequency Identification Device (RFID) technology based on Electronic Tolling System was introduced at Charoti Toll Plaza in Dahanu, Thane District, Maharashtra. Using the interoperable RFID-based system, vehicles would be able to travel through six toll plazas administered by three different road developers: Larsen and Toubro (L&T), IRB Infrastructure, and NHAI. NHAI plazas at the Narmada Bridge and L&T IDPL Plaza in Karjan, Vadodara, are among them, as are IRB toll plazas at Charoti, Bhagwada, Boriach, and Choriyasi. A pilot project for this has also been undertaken on NH-5 between Chandigarh and Parwanoo [14], [15].

D. Make a reservation with My Toll System

Book My Toll was created by Malola Innovations Pvt. Ltd. Malola Innovations is a start-up based in Hyderabad, India, that was co-founded by a group of IT veterans with 14 years of experience. Book My Toll is available to both smart phone and non-smart phone users. The Book My Toll system includes an Android app as well as a web interface for registering automobiles and adding them to the menu. When we look at various systems and how they are implemented, we find that the system is used at NHAI-owned toll plazas in India, and the Book My Toll system is currently being developed. Furthermore, every toll plaza will include at least one FASTag lane [9], [16].

- 2) RFID labels can be perused across significantly longer distances; a RFID peruser can peruse information from a tag from up to 300 feet away.
- 3) As the vehicle moves toward the distinguishing proof site, the modernized control unit close to the cost path gets the identifier signal and ascertains the cost to be deducted, charging the cost for the vehicle's record electronically.
- 4) This innovation empowers a vehicle to go past the output point ceaselessly, giving ideal accommodation to drivers while additionally accelerating traffic stream and diminishing how much HR required at expressway cost squares.
- 5) A smooth progression of traffic at cost entryways.
- 6) Toll assortment without the requirement for money.
- 7) Management costs are diminished.
- 8) Vehicle proprietors get advantageous and brief overhauling.
- 9) Vehicles that have been taken might be distinguished.

The article then, at that point, continued on to inspect RFID innovation. Radio Frequency Identification (RFID) is a shortened form for Radio Frequency Identification. The RFID System comprises of three fundamental parts: a RFID transmitter, a RFID beneficiary, and a handling machine (a PC). From that point forward, the article dives into detail on the numerous sorts of RFID labels (RFID transmitters). Dynamic labels and uninvolved labels are two kinds of RFID labels. Dynamic labels are utilized to send information that contains the RFID label's ID as well as some delicate coded data. Data that is delicate coded is re-writable and dynamic in nature. The delicate coded data in this issue articulation might contain the Global Position Coordinates of the vehicle to which the RFID tag is associated. The article then, at that point, talks about a miniature reproduction model of the genuine cost gathering framework, as well as the framework's plan[17].

The RFID peruser is utilized to get data from the framework's vehicle, which is then planned to the information base. The GSM module permits the entire framework to be associated through the Internet. The LCD framework is utilized to show data about the vehicle that has passed, like the RFID ID, the vehicle's number plate, the vehicle's present equilibrium, etc. The instrument for controlling the vehicle's section through the cost entryway is situated to one side of the microcontroller. The Motor Drive raises the framework's entryway, while the Alert Indicator sounds a caution on the off chance that an unapproved vehicle goes through the Toll Gate[17], [18].

II. LITERATURE SURVEY

We're at present taking a gander at a portion of the frameworks that have been made. The underlying paper portrayed a framework that was made considering the accompanying attributes:

- 1) Shorten the time it takes to gather tolls at the cost square.

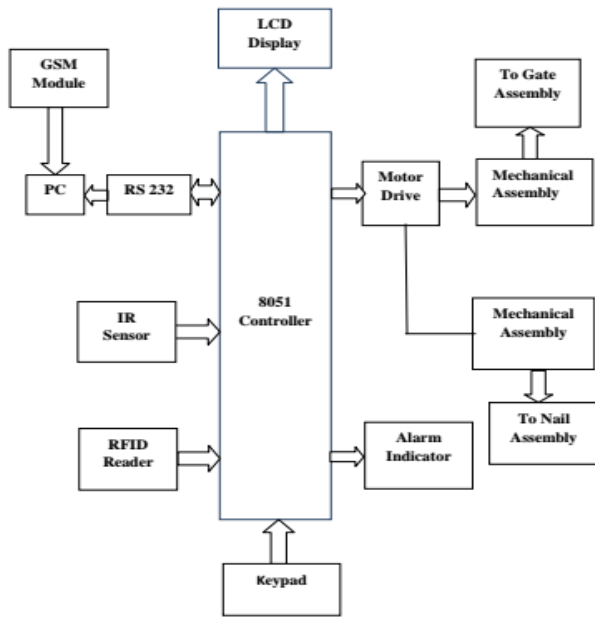


Fig. 1. Hardware Implementation of System in Paper

A. What Is the Purpose of Toll Collection?

Support and restoration are expected for each construction, building, or framework, which are, obviously, costly. Expressways and streets are not excluded from this standard. Interstate, street, scaffold, and passage development, augmentation, support, and activity costs have all been gathered straightforwardly or in a roundabout way previously. Costs are repaid under the previous backhanded methodology by fuel charge installments or financial plan distributions from public income. The inconvenience of this approach is that it requires a great deal of citizens who don't use specific streets and carriageways to pay more cash. The costs are gathered straightforwardly from the vehicles passing that street or road under the elective framework, known as the immediate technique [19], [20]. Coming up next are the other three significant motivations behind why tagging, or street evaluating, is utilized[21]–[24].

a) Finance/Revenue Generation: To recuperate the costs of the office's development, activity, and support. Street Transportation financing is turning out to be more appealing because of evaluating. Moreover, rather than hanging tight for charge assets to accumulate, cost subsidizing empowers undertakings to be finished sooner.

b) Demand Management: To control the speed of expansion in the transportation framework's interest and urge more individuals to use public transportation and carpool. Vehicles, for instance, are burdened to enter focal London, England, for the purpose of controlling interest nearby.

c) Congestion Management: Setting a charge for confined interstate limit in light of interest. The cost in this application ascends with respect to how much traffic. Drivers know nothing about the costs they force on others as an outcome

of the blockage they make without even a trace of such estimating.

B. Toll Collection Systems of Different Kinds

Cost expressways might open up to (mainline obstruction cost squares), shut (with section/leave tolls), or all-electronic (with passage/leave tolls) (no tollgates, just electronic cost assortment gantries at passageways and exits or at vital areas on the mainline of the street). In an open cost framework, all vehicles are expected to pay a cost at various focuses along the street. While not building tolls at each exit might set aside cash, it might make gridlock, and vehicles might have the option to sidestep expenses by leaving and reappearing the street. In a shut framework, when a vehicle enters the street, it gets a ticket. In specific occurrences, the cost to be paid at the exit is demonstrated on the ticket. The driver should pay the sum demonstrated for the specific exit after leaving. Assuming a driver's ticket is lost, the individual in question is typically expected to follow through on the most extreme cost for driving on that course. Short expressways with no middle of the road passageways or ways out may have only one cost square toward one side, with vehicles heading down either path paying a proper charge after entering or leaving. Mainline obstructions are situated at the two finishes of the expressway in a variety of the shut cost framework, and each exchange incorporates an incline cost that is paid upon takeoff or entry. A driver pays a level charge at the incline cost and one more level expense at the expressway's end in this occurrence; no ticket is required. Toll is typically gathered with the utilization of a transponder put before the entryway when the vehicle comes to approach the transponder the sum is deducted and the door is opened client account which is charged for each utilization of the expressway in an all-electronic framework, no money cost assortment happens. Autos and light trucks without transponders are permitted to travel specific expressways, and a bill for the cost due is shipped off the vehicle's enrolled proprietor; be that as it may, some expressways require all vehicles to be fitted with a transponder. Present day expressways frequently utilize a blend of the three, with various entry and leave accuses increased of mainline tolls once in a while. ORT, which utilizes all-electronic cost gathering, is at present the favored technique since it is more productive, environmentally well disposed, and more secure than manual cost assortment.

III. DISCUSSION

RFID (Radio Frequency Identification) is a data-capture technology that allows you to electronically identify, track, and store information on a tag. The data on the tag is read by a radio frequency reader and sent to a database, which saves the information. An RFID system's three main technology components are the tag, reader, and database.

- RFID Tag (or Transponder): An RFID tag consists of a chip and an antenna. A unique serial number or other information may be stored in the memory of a chip, which can be read-only, read-write, or write once read-many (WORM). Data is

sent from the chip to the reader through the antenna, which is attached to the microchip. A longer read range is generally associated with a larger antenna. The tag is attached to or implanted in an object that needs to be identified, such as a product, case, or pallet, and may be scanned by mobile or stationary scanners utilizing radio waves.

• **RFID Reader:** An RFID system needs a reader, also known as a scanning device that can read tags reliably and send the results to a database. A reader uses its own antenna to communicate with the tag. Any tags within range that are programmed to respond to that frequency will respond when a reader sends out radio waves. A reader may communicate with a tag without needing a direct line of sight, depending on the radio frequency and the kind of tag (active, passive, or semi passive) used. Readers may examine many items at once, cutting down on reading time. They may be mobile, such as pallet and case scanners, or stationary, such as supermarket point-of-sale systems..

IV. CONCLUSION

The installed frameworks stage was utilized to make a cutting edge arrangement of "Programmed Toll Collection using RFID." This exploration created and assessed an original RFID innovation in light of a microcontroller for this reason. Coming up next are a portion of the advantages of the gave confirmation framework: The check framework is made from an information base of RFID multifunctional card clients. The AT89S52 is a best in class microcontroller that fills in as a UI when a client presents a RFID card. The MCU peruses the card utilizing a RFID card peruser and afterward communicates the data to PC interacting/front end programming. This current undertaking's RFID security innovation assumes a basic part. The electronic cost gathering framework for interstates was planned utilizing a sort of radio recurrence chip. To guarantee framework security, trustworthiness, and time investment funds, underlying and process plans were made, as well as another RFID confirmation and approval convention engineering. Chipping away at this undertaking was a mind boggling opportunity for growth for us. It truly helped us in putting our specialized information procured all through our four years of designing into training. Via computerizing cost squares, we can have the best choice for limiting cash lost at cost courts by bringing down the labor supply required for cash assortment, as well as in a roundabout way diminishing rush hour gridlock, bringing about a reduction in cost square time. We consolidated techniques like Radio Frequency Identification in our undertaking. The RFID tag and peruser will be utilized related to one another to distinguish the vehicle's recognizable proof. The IR Transceiver is used to distinguish the presence of a vehicle at different places and will fill in as the cost square's entryway pass. We might represent computerization in cost square by effectively utilizing these techniques at different periods of our undertaking, which will diminish the general handling time by a couple of moments, which is incredibly fundamental, as well as help to limit cash spillage in an exceptionally cost proficient manner. Subsequently, fuel utilization is diminished and contamination is decreased.

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