

Comparison of Different toll collections system's and RFID tool collection system

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ABSTRACT: This research paper is based on comparison of manual toll collection versus automatic toll collection systems and proposes idea of tool collection using RFID. ATCSR is an Automated Toll Collection System using RFID used for collecting tax automatically. In this we do the identification with the help of radio frequency. A vehicle will hold an RFID tag. In accordance with this number we will store, all basic information as well as the amount he has paid in advance for the TOLL collection. Reader will be strategically placed at toll collection center. Whenever the vehicle passes the toll booth, the tax amount will be deducted from his prepaid balance. We have camera on the way to capture the image of respective vehicle. As vehicles don't have to stop in a queue, this translates to reduced Traffic congestion at toll plazas and helps in lower fuel consumption. This is very important advantage of this system

Keywords –RFID Tag, Vehicle, Toll collection system, intelligent system, Active RFID reader

I. INTRODUCTION

A complete RFID system consists of a transponder (tag), reader/writer, antenna, and computer host. The transponder, better known as the tag, is a microchip combined with an antenna system in a compact package. The microchip contains memory and logic circuits to receive and send data back to the reader. These tags are classified as either active or passive tags. Active tags have internal batteries that allow a longer reading range, while passive tags are powered by the signal from its reader and thus have shorter reading range. Passive RFID have no internal power source and use external power to operate. These tags are powered by the electromagnetic signal received from a reader. The received electromagnetic signal charges an internal capacitor on the tags, which in turn, acts as a power source and supplies the power to the chip.

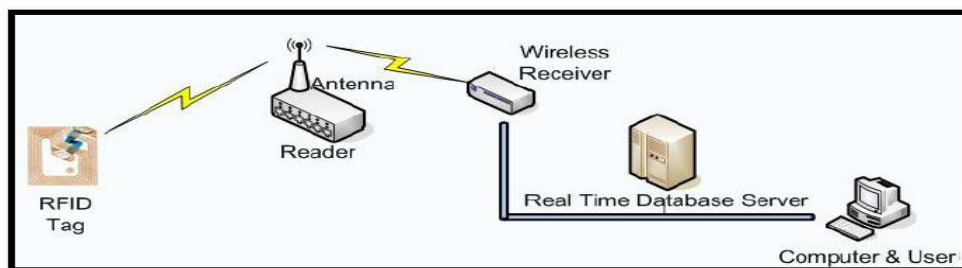


Fig no 1.

II. BACKGROUND OVERVIEW

Any structure, building or system needs maintenance and rehabilitation which are of course costly. Highways and roads are also not an exception. From the very past, the construction, extension, maintenance and operating costs of highways, roads, bridges and tunnels were collected directly or indirectly. In the older indirect method, the expenses are compensated either by tax payment on fuel or by budget allocation from the national income. The shortcoming of this method is that a number of tax payers, who do not use some of the roads and carriageways, have to pay extra money. However, in the other system, called direct method, the tolls are taken directly from the drivers passing that road or street. The other three main reasons why tolling, or road pricing, is implemented are listed below. a) Finance/Revenue Generation: To recoup the costs of building, operating and maintaining the facility. Road pricing is becoming a more appealing means of funding transportation. Moreover, toll financing allows projects to be built sooner instead of

waiting for tax revenues to accumulate. b) Demand Management: To moderate the growth in demand on the transportation system, and to encourage more use of public transportation and carpooling. For example, vehicles are charged to enter inner London, England, as a way of regulating the demand in the region c) Congestion Management: To place a price on limited roadway space in proportion to demand.

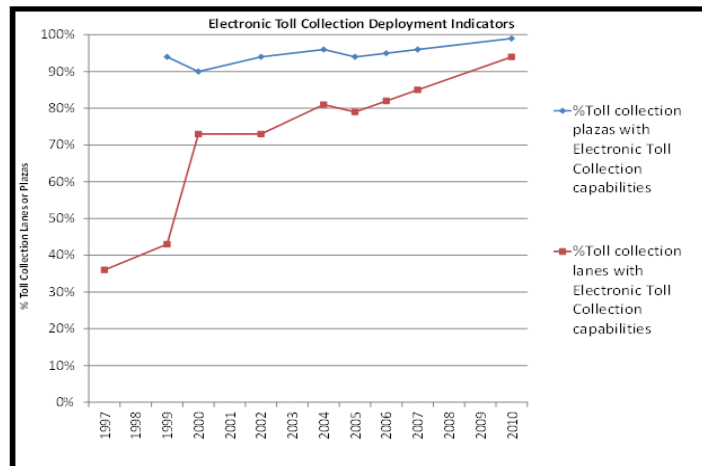


Fig no2.

III. DIFFERENT TYPES OF TOLL COLLECTION SYSTEMS

Three systems of toll roads exist: open (with mainline barrier toll plazas); closed (with entry/exit tolls) and all-electronic toll collection (no toll booths, only electronic toll collection gantries at entrances and exits or at strategic locations on the mainline of the road). On an open toll system, all vehicles stop at various locations along the highway to pay a toll. While this may save money from the lack of need to construct tolls at every exit, it can cause traffic congestion, and drivers may be able to avoid tolls by exiting and re-entering the highway. With a closed system, vehicles collect a ticket when entering the highway. In some cases, the ticket displays the toll to be paid on exit. Upon exit, the driver must pay the amount listed for the given exit. Should the ticket be lost, a driver must typically pay the maximum amount possible for travel on that highway. Short toll roads with no intermediate entries or exits may have only one toll plaza at one end, with motorists traveling in either direction paying a flat fee either when they enter or when they exit the toll road. In a variant of the closed toll system, mainline barriers are present at the two endpoints of the toll road, and each interchange has a ramp toll that is paid upon exit or entry. In this case, a motorist pays a flat fee at the ramp toll and another flat fee at the end of the toll road; no ticket is necessary. In an all-electronic system no cash toll collection takes place, tolls are usually collected with the use of a transponder placed before the Gate as soon as the vehicle reaches near the Transponder the amount is deducted and the gate will be opened customer account which is debited for each use of the toll road. On some roads automobiles and light trucks without transponders

are permitted to use the road a bill for the toll due is then sent to the registered owner of the vehicle by mail; by contrast, some toll ways require all vehicles to be equipped with a transponder. Modern toll roads often use a combination of the three, with various entry and exit tolls supplemented by occasional mainline tolls. Open Road Tolling (ORT), with all-electronic toll collection, is now the preferred practice, being more efficient, environmentally friendly, and safer than manual toll collection.

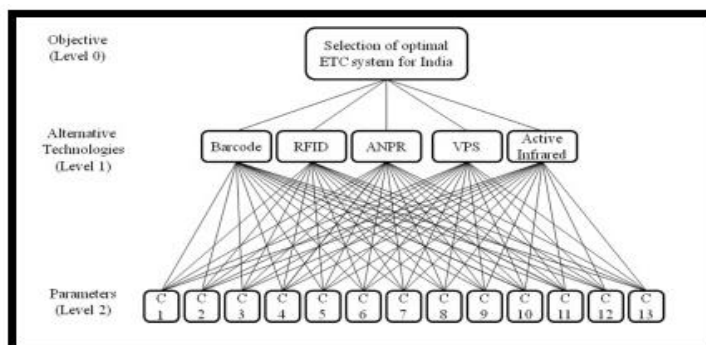


Fig no 3.

IV. DRAWBACKS OF EXISTING SYSTEM

The above mentioned method for collecting toll tax is time consuming method. Chances of escaping the payment of toll tax are there. It leads to queuing up of following vehicles. Suppose the manual toll collection system is very efficient then for one vehicle to stop and pay taxes total time taken is 50 seconds. And suppose 200 vehicles cross the toll plaza. Then, time taken by 1 vehicle with 60 second average stop in a month is: $50 \times 30 = 1500$ seconds

Yearly total time taken = $1500 \times 12 = 18000$ seconds = 5.0 hours

On average each vehicle that passes through the toll plaza has to wait 5.0 hours in engine start condition yearly. The figure is staggering if on an average we take 200 vehicles pass through the toll plaza each day, then yearly 72000 vehicles pass through the toll plaza. And each year 72000 vehicles just stand still for 5.0 hours in engine start condition thereby aiding pollution and wasting fuel and money. This study is if the system is very efficient but what if the vehicle has to wait for 5 minutes? This is a figure considering one toll plaza. If considering 50 toll systems the above figure will drastically increase and the wastage of fuel, money will increase and pollution will also increase.



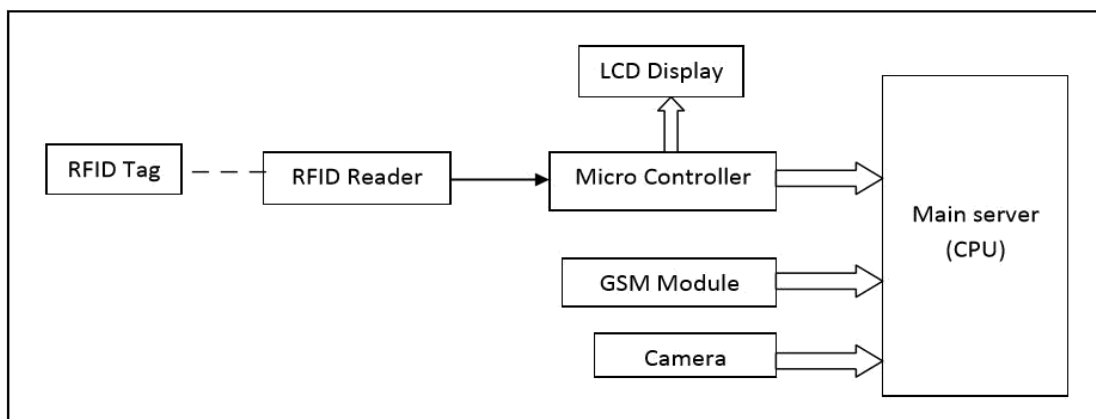
Fig no 4.

V. PROPOSED SYSTEM

Each vehicle will be provided by an RF Transmission tag containing a unique ID. This unique ID can be assigned to the vehicle by authority body of country like we can have this ID as the vehicle's number. This tag will continuously emit RF signals. When the vehicle will reach at the toll booth the RF receiver will detect these RF signals. The signals are amplified and are passed to microcontroller. This microcontroller will display the id on LCD. Now, with the help of PC interface unit the data collected is passed to PC through serial port. Software developed will show all the details about the vehicle on the screen. Details like date, time, address and id will be stored in the access database. Based on these details a report will be prepared. Message of payment deduction, less balance or prepaid the account, etc. will be sent to vehicle owner by using GSM module present at toll booth.

VI. ATCSR HARDWARE DESIGN

The basic block diagram in Fig outlines the concept of Automatic Toll Tax collection using RFID. A dedicated GSM module is interfaced to the main server which will send the SMS to car owner for deduction in balance or less balance or deposited balance amounts. Camera is there which will take image of car.



System Block Diagram

VII. WORKING

Consumers use an electronic “tag” (transponder) about the size of an audio tape cassette which is attached to a vehicle’s inside windshield, as vehicle approaches a toll line, an RFID Reader in the lane reads the consumer’s vehicle and account information embedded in the tag. Using high frequency radio waves, the technology sends the information to an in-lane computer that checks the data against a database of valid tags and active accounts, deducts the appropriate toll from the customer’s account, and SMS will be sent to customer’s registered mobile number.

SMS will have information regarding the net balance, deducted amount, date, time, etc. If the customer doesn’t have enough amount then car’s image will be taken by camera which is placed on the roadway or we can have buzzer for alarming it. Such customers can make to be in separate lane after crossing toll booth.

ATCSR users set up a prepaid account which is debited for each use of an equipped roadway, bridge, or tunnel. (The tags are particularly advantageous to fleet operators who otherwise would have to advance cash to drivers for tolls or engage in time-consuming cash reimbursement.) Each tag contains an identification number, data identifying the issuing agency, tag type, a description of the vehicle, etc. The tag ID, agency ID, and tag type are encoded by the vendor and cannot be altered.

The tag is based on read-write technology capable of storing highway entry and exit points for toll calculations in closed systems (i.e., where the toll is based on distance traveled). Vehicle gross weight for toll calculations based on weight or for checking maximum highway weight also can be obtained. Because the identity of ATCSR-equipped vehicles can be read while vehicles are in motion (up to 90kmph), ATCSR promises to eliminate lengthy traffic backups at toll plazas, caused by motorists stopping to pay the toll manually.

VIII. CONCLUSION

In order to implement contemporary system of “Automatic Toll Collection using RFID” the embedded systems plat form has utilized. For this purpose, a new RFID technology based on micro-controller was implemented and tested in this study. The verification system presented has the following advantages: The verification system consists of data base about the user of RFID multipurpose card.

By doing automation of toll plaza we can have the best solution over money loss at toll plaza by reducing the man power required for collection of money and also can reduce the traffic indirectly resulting in reduction of time at toll plaza.

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