AN AUTOMATED TOLL GATE VEHICLE PASSING SYSTEM

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ABSTRACT

An Automated Toll gate Vehicle passing system aims at eliminating the delay on toll gate and avoiding traffic congestion on collecting tolls with the help of RFID technique. Time and efficiency is the major priority of present day. In order to overcome the major issues of vehicle congestion and time consumption in toll gates, RFID technology is used. Embedded System emerges as convincing solution to the manual toll collection method employed at tollgates and also identifies the theft vehicle. In our proposed project we mainly focus on three main modules. Toll gate lane changing, online payment and vehicle theft alert. This system is proposed under IoT concept. The IoT allows objects to be sensed or controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency and accuracy in addition to that it reduce human intervention.

Key words: Toll Gate, Tax, RFID, Card Reader, Microcontroller

1. INTRODUCTION

RFID reader fixed at tollgate frame reads the tag in each vehicle. The owner of the vehicle books toll through online payment scheme before approaching the toll booth using RFID tag number. The object detection sensor in the reader detects the approach of the incoming vehicle's tag and if it matches the database then the toll gate opens for the vehicles. This makes tollgate transaction more convenient for the public use. RFID cards have diverse range of functions, while provides convenience, as the cards must simply be waived or tapped in front of a reader rather than swiped. An RFID reader is a device that is used to interrogate an RFID tag. The vehicle owner who books toll through online will also be alerted with a low balance alert message if the balance is lesser than a prescribed amount. Electronic

tolling is cheaper than a staffed booth, reducing transaction costs for government agencies or private road owners. Therefore the proposed system helps in avoiding mistakes during manual transaction of money being paid and also ensures efficient recover from traffic congestion waiting in a long queue.

Theft vehicle alert is another feature to be discussed in the current system. If a vehicle is stolen the owner can inform the corresponding authorities to pass the information of the stolen vehicle to all the registered toll booths along with the RFID number. When the theft vehicle thereby crosses through any of the toll gate, the tollgate controller software indicates the vehicle was theft. If any vehicles RFID tag crossing vehicle with a beep sound and hence the vehicle theft can be caught with ease. The tollgate matches with the database of the stolen vehicle informed at the toll gate, and then an alarm buzzer fixed at the toll alerts the presence of stolen vehicle.

Another feature to be discussed is of tollgate lane changing. The current system for collecting toll is on the basis of manual transaction which consumes large amount of time. In this system each vehicle has to stop at the toll plaza for payment and there can be a problem of time delay and leads to congestion. In order to resolve this problem our proposed system helps to detect the intensity of incoming vehicles using IR sensors fixed at 300m away from the tollgate. Thus the sensor detects the total count of the vehicles approaching the toll plaza and allocates lane based on the type and intensity of vehicles. This would be helpful to avoid traffic jam on roads and wastage of time.

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 easiest methods used to organize the heavy flow of traffic. When the car moves through the toll gate on any road, it is indicated on the RFID reader that it has crossed the clearing. The need for manual Toll based systems is completely reduced in this method and the tolling system works through RFID. The base idea behind implementing RFID Based Toll System is to automate the toll collection process and their by reducing manual operation in toll booths and the long queues at toll booths using RFID tags installed on the vehicles.   Now the present system in high ways takes 1 minute to complete the toll collection process for one vehicle. With this automatic process, it will take just less than a minute to complete the whole process. As there is reduction in time for completion of the process so indirectly there will be no traffic as such & as there is no traffic so no fuel wastage takes place & the purpose of designing the highways is achieved i.e. reduction in journey time & also the money loss will be reduced.

2. BACKGROUND OVERVIEW

Tolls are often collected at toll booths, toll houses, plazas, stations, bars, or gates. Some toll collection points are unmanned and the user deposits money in a machine which opens the gate once the correct

toll has been paid. Toll roads have existed in some form since antiquity, with tolls levied on passing travelers on foot, but their prominence increased with the rise of the automobile, and many modern toll ways charge fees for motor vehicles exclusively. Hence each vehicle has to stop at the toll gate and make the payment manually with the toll booth operators which may consume large amount of time.

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 method where the person needs to show the smart card to the system installed at the toll tax department to open the Gate.

2.1 Problem Statement

Time and efficiency is the major priority of present day toll gates. They require vehicles to stop or slow down, manual toll collection wastes time and increase vehicle operating time. Criticisms of toll roads include the time taken to stop and pay the toll and the cost of the toll booth operators up to about one third of revenue in some cases. Automated toll paying systems help minimize both of these issues. The managing entities, whether public or private, may not correctly account for the overall social costs which may also lead to lose of money.

Design and development of a "RFID Based Automatic Toll Plaza" which is based on microcontroller, RFID technology and load cell to save the time at toll plaza and having cashless operation As the name implies "RFID Based Automatic Toll Plaza" the key theme of our project is the automation. So here we will just take the overlook of what is mean by Automation. In simple words the Automation means the human being from the process with the machines. Before going further we just take the overlook of history of the toll plazas. So before the 90's decade the toll plazas were fully manual controlled. Means there are total four people for operating the Toll gate in this two people will be used for opening & closing of the gate & another two are for reception of the money & data keeping etc.

3. PROPOSED SYSTEM

This proposed System is used for toll collection without making traffic congestion and waiting in long queue with the help of RFID technique. Also, by using this system, it will save time. This system helps to detect the intensity of incoming vehicles using IR sensors fixed 300m away from the tollgate and allocate lane based on the type and intensity of vehicles. For the process of online toll booking RFID tag has to be attached in all the passing vehicles. So the RFID reader attached on the toll gate will read the information from RFID tag and if it matches the database then the toll gate opens for the vehicles. It can also be used for monitoring and finding out theft vehicles crossing the toll booth using

RFID technique. This automation of Toll gate and vehicle tracking system is proposed to control the traffic in a very efficient and effective manner. This project gives the simplified procedure to passengers to pay toll at toll booths by making them automated, vehicle theft detection, signal breaking avoidance, tracking over speed vehicles. All these activities are carried using single RFID tag thus saving the efforts of carrying money and records manually

3.1 Automatic Toll Collection: The RFID Readers mounted at toll booth will read the prepaid RFID tags fixed on vehicles' windshield and automatically respective amount will be deducted. If the tag is removed from the windshield then cameras fixed at two sites at toll plaza take snaps of the front and back number plate. Since every vehicle registration ID is linked to users account, toll can be deducted from the account bank directly.

3.2 Vehicle Theft Detection: When vehicle is stolen the owner registers complaint on the website with its registration ID and unique RFID tag number. Now when stolen vehicle passes by the toll plaza, the tag fixed on it is matched with the stolen vehicle's tag in the database at the toll booth.

3.3 Signal Breaking Avoidance: The vehicle ignoring the traffic signal will be detected by the RFID readers fixed at signal crossing and will be notified to the traffic police. This can be done efficiently and great accuracy.

3.4 Tracking Over speeding Vehicle: Vehicle travelling above speed limit can be tracked with 100 % accuracy. RFID tag which uses car battery power. The implementation is divided into the design of two modules- the Vehicle Module (Active Tag) and the Base Module. The two modules communicate via RF modem connected to each module. These RF modules communicate over the ISM Frequency Range of 902 – 928 MHz.

4. METHODOLOGY

4.1Toll Gate Lane Changing

The current system for collecting toll is on the basis of manual transaction. In this each vehicle has to stop at the toll plaza for payment and there can be a problem of time delay and leads to congestion. Hence, this system helps to detect the intensity of incoming vehicles using IR sensors fixed at 300m away from the tollgate and allocate lane based on the type and intensity of vehicles.

4.2 Online Payment

RFID reader fixed at tollgate frame reads the tag in each vehicle. The owner of the vehicle books toll through online payment scheme before approaching the toll booth using RFID tag number. The object detection sensor in the reader detects the approach of the incoming vehicle's tag and if it matches the

database then the toll gate opens for the vehicles. RFID cards has diverse range of functions, while provides convenience, as the cards must simply be waived or tapped in front of a reader rather than swiped. The vehicle owner who books toll through online will also be alerted with a low balance alert message if the balance is lesser than a prescribed amount.

4.3 Vehicle Theft Alert

Theft vehicle alert is another feature in the current system. If a vehicle is stolen the owner can inform the corresponding authorities to pass the information of the stolen vehicle to all the registered toll booths along with the RFID number. When the theft vehicle thereby crosses through any of the toll gate, the tollgate controller software indicate the vehicle was theft. If any vehicles RFID tag crossing vehicle with a beep sound and hence the vehicle theft can be caught with ease. The tollgate matches with the database of the stolen vehicle informed at the toll gate, then an alarm buzzer fixed at the toll alerts the presence of stolen. Whenever any person buys a vehicle, first he/she needs to do her vehicle registered at the RTO office. RTO people will assign a number plate to it along with it they will give a RFID enabled tag. This card will have a unique ID feasible to use with that vehicle only. They will also create an account for that particular smart card and maintain transaction history in database. Transaction will begin, depending upon the balance available toll will be deducted directly or the vehicle will be directed towards another lane to pay tax manually. The software further updates the details in the Centralized database server. It also triggers mechanism to generate the bill and will be sent to user as a text message.
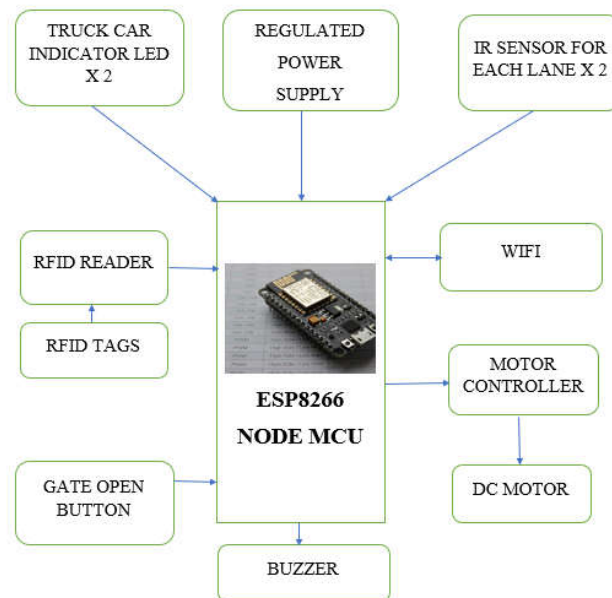
5. BLOCK DIAGRAM

Figure 1. Block Diagram
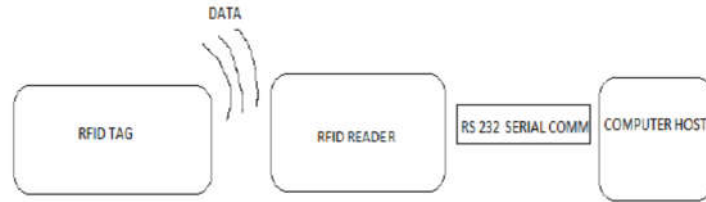
6. IMPLEMENTATION


Figure 2. Hardware Assembly

EM-18 RFID CHIP

Figure 3. EM-18 RFID Reader Module

RFID based toll collection system is used as a technology for fast and efficient collection of toll at the toll booths. This is possible for the vehicles passing through the toll plaza need not stop to pay toll and the payment automatically is deducted from the account of the driver. The electronic toll lanes are setup with special antennas that will send out signals continuously.

These signals are used to identify the vehicles that travel through them. To use the electronic toll facility the drivers need to setup an electronic transponder (tag) fixed in the vehicle. These transponders (tags) are fitted on the windshield of the vehicle. The tags have all the information regarding the users account. The antennas continuously send radio frequency pulses which returns only when hits a tag.

These pulses are returned back from the tag and are received by the antenna. These reflected pulses from the tags contain information about the driver number, drivers account, balance etc. After encrypting the contents of this pulse the unit uses cellular modems or wireless transmitters to send it off to a central location where computers use the unique identification number to identify the account from which the cost of the toll should be deducted.
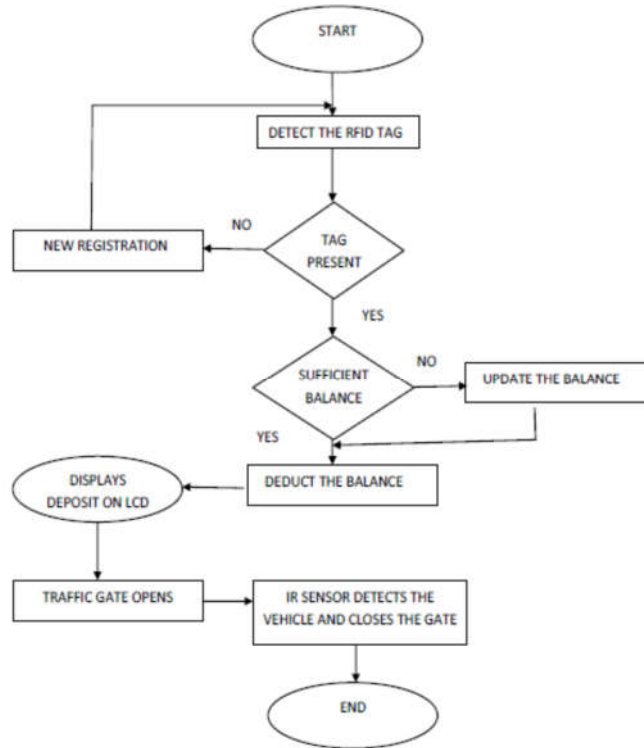
Flowchart 1: Working of the RFID based toll collection system

7. CONCLUSION

The Automated Toll gate Vehicle passing system in expressway based on RFID, a design scheme was put forward. It is low cost, high security, far communication and efficiency, etc. It not improves the passage ability of expressway but also improve the technology level of charge. Electronic toll collection system using RFID is an effective measure to reduce management costs and fees, at the same time, greatly reduce noise and pollutant emission of toll station. In the design of the proposed Electronic toll collection (ETC) system, real time toll collection and anti-theft solution system have been designed. This reduces the manual labour and delays that often occur on roads. This system of collecting tolls is ecofriendly and also results in increased toll lane capacity. Also an anti-theft solution system module which prevents passing of any defaulter vehicle is implemented, thus assuring security on the roadways.

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