Automated Toll Collection using RFID

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Abstract— Many highway toll collection systems have already been developed and widely used in India. Some of these include manual toll collection, barcode reading, number plate recognition etc. All these have some disadvantages that lead to some errors in the corresponding system. Here we introduce brief review of toll collection systems in India and their disadvantages and advantages and aims to design and develop a new efficient toll collection system which will be a good low cost alternative among all other systems. This system is based in Radiofrequency identification. We use a RFID tag attached to a vehicle containing data about the vehicle. The RFID reader at the toll station will detect the tag while it passes through its range. There will be an amount of money pre recharged in the tag. The money corresponding to particular vehicle will be deducted and that will be displayed on LCD screen. If it is low balance or zero balance message sent to driver's mobile and that amount will be deducted whenever it is recharged again. Another sensor used to detect presence of substances like Spirit, Ganja, and Alcohol inside the vehicle. If the presence detected information is passed to the control room.

Keywords – RFID reader, RFID tag, Spirit Sensor

I. INTRODUCTION

Today we are in 21th century .In all over the world new scientific revolution are seen .We all are Indian citizen. In India we can see so many type of transportation facility and one of the main transportation is road transportation. In India where we observe more National highways . The infrastructure of roads are constructed by several companies. That companies collect amount from the vehicle passing on that newly build highway. In some highway tax collection system can be used .Many highway toll collection system have already been developed .some of them include manual toll collection ,bar code reading, number plate recognition etc .This methods are very inefficient. Time and efficiency are a matter of priority of present day. Here the major issue is vehicle congestion and time consumption .In this system each vehicle has to stop and pay tax .That means total time taken to vehicle is 60 seconds .So many wastage of time occur. Now we are introducing a new system for the development of the

toll collection. we used automatic toll collection using RFID. The automatic toll collection system reducing the long queues at toll booths using the RFID tags installed on the vehicle. The RFID reader is also fixed in toll booth. In addition in the toll booth we detect the passing of unauthorized vehicle. That is it detect presence of Sprit, Ganja, Alcohol. using the sprit sensor. Main aim of project is to collect toll automatically and detect the presence of Sprit, Ganja, Alcohol .

II. LITERATURE SURVEY

There are following toll collection systems presently used:

Manual toll collection This technique is not a technical method. It requires a toll collector or attendant. The toll collector himself classifies the vehicle, collects the toll, dispense the change, and provide receipt to the vehicle owner. All this process is time consuming due to manual intervention. Sometimes, when vehicle comes to booth, toll is charged manually by simply providing just receipt in which no description about vehicle is given, only toll tax amount is present. In this case, what happens, if a heavy vehicle comes to toll booth, Operator charges some amount greater than toll amount of light vehicle but receipt is provide for light vehicle. Thus manual collection can provide loss to the owner of booth

.B. Barcodes This method brings our attention to a new technology for an electronic toll collection. In this system, barcodes are mounted on the number plate of vehicles. The information related to that vehicle is embedded on the barcode. Barcodes are read by the barcode scanners present at toll booths. Thus this method reduces the efforts of human authority. Data information are also easily exchanged between toll authority and vehicle owner, hence providing a more efficient toll collection by less traffic and less possible human errors. But Optical systems at toll booth proved to have poor reading reliability especially when faced with inclement weather and dirty vehicles.

C. Automatic Number Plate Recognition Automatic number plate recognition is a mass surveillance method that uses optical character recognition on images to read vehicle registration plates. They can use existing closed-circuit television or road-rule enforcement cameras, or ones specifically designed for the task. They are used by various police forces as a method of ETC system on pay-per-use roads and to catalog the movements of traffic or individuals

DISADVANTAGES OF EXISTING SYSTEM

 \succ The processing algorithms are computation intensive.

➤ Image processing requires relatively more time and hence multiple readings have slow rate and hence reliability decreases.

The system is unable to identify plates due to dirty or damaged license plates, the presence of bumper stickers and similar text on a vehicle, and reduction of visibility caused by rain and fog.

➤ Low reliability because of the complexity involved in image processing.

This method typically requires highly reflective license plate.

> Manual toll collection is not reliable because any mismatch between toll can be possible through operator. This in turn causes loss to the owner. So he extends the period from government with increased price. Ultimately, common man has no choice to pay toll tax for that period.

➤ We need efficient optical system to verify the barcodes. Optical systems proved to have poor reading reliability in inclement weather environment and in rainy seasons especially when vehicles are dirty.

➤ Number plate recognition is a fully automatic recognition technique. It can lead to errors in billing due to false prediction.

III. PROPOSED SYSTEM

The system we presents is designed and implemented using a micro controller called PIC 16F 877 A,RFID tag, reader, GSM,LCD and an MQ3 sensor for detecting stuffs like spirit ,Ganja, Alcohol etc attached to it. Basically system is based on vehicle detection using Radio frequency identification. In this system a RFID reader in the toll booth reads the information in the RFID tag which is recharged to a particular amount based on the type of vehicle, that is weather it is light or heavy, get deducted from the vehicle owner's account. When there is low balance or the balance is zero that info is passed to the vehicle owner's mobile using GSM. The LCD display will display the appropriate toll charged and that amount is deducted. When the vehicle with zero balance is passed through the gate more than once information about that vehicle is passed to the control room. Each time the vehicle with zero balance passes through the toll booth the amount is stored as negative balance. And that amount will be deducted in next recharge. Now

unlike other toll booth our automatic toll collection booth has a sensor, MQ3 that will detect the presence of Spirit, Ganja, Alcohol etc the vehicle and the information is passed to the control room

ADVANTAGES OF PROPOSED SYSTEM

 \checkmark This automatic toll collection system avoids the manual labor

 \checkmark This will avoid the traffic jam and lag created by manual toll collection

✓ High speed passage of car is possible (55 mph or 86 kmph).

✓ Wastage of fuel is substantially reduced.

 \checkmark Smuggling of spirit /ganja/alcohol etc will be caught

 \checkmark Security is an added advantage - The location of a stolen car can be notified to the concerned owner through the GSM module.

✓ Vehicle theft is avoided

 \checkmark Effective and low cost system compared to computer and other electronic toll collection systems.

✓ RFID system does not need Line Of Sight (LOS) unlike bar-codes or image processing based system. Thus it can be installed inside the car from where it is not visible, which saves tampering with the process in case of theft.

IV. MODULE DESCRIPTION

To implement the Automated Toll Collection System using RFID ,we have use 6 important modules. The modules are microcontroller, RFID reader, RFID card, LCD,GSM,Alcohol Sensor

A. Microcontroller

The microcontroller is the main part of the system. We can use PIC16F877A microcontroller . This particular microcontroller contains 40 pins and there are 33 pins for input and output . This microcontroller works at a range between 4.5 to 5.5 v.It is a 8 bit microcontroller. The PIC microcontroller PIC16f877a is one of the most renowned microcontrollers in the industry. This controller is very convenient to use, the coding or programming of this controller is also easier. One of the main advantages is that it can be write-erase as many times as possible because it use FLASH memory technology. PIC16F877A also have many application in digital electronic circuits.



RFID Reader

Radio frequency identifier can be used in this system. We install a RFID reader in the toll booth. RFID reader basically works with 5v.The RFID reader will be connected to the microcontroller. The RFID readers will have a range. The range of RFID reader is area where the radio frequency can be reached, when voltage passed to the RFID reader. When RFID tag get into that area, the data in the tag and that in the system is compared and calculate the amount for that particular vehicle



RFID Tag

RFID Tag is attached to the vehicle contains data about the vehicle. It is compared with the data in the toll booth. It determines the amount to be payed. RFID tag is a rechargeable module. Each time the vehicle pass through the toll booth a particular amount is deducted. When it is become zero balance, message is passed to the user. It become negative balance when a zero balance tag passed through the toll booth.



LCD

The LCD that we use here is a 16 pin LCD that would work on 5v.It is called 16*2alphanumeric LCD.LCD is used to display the amount that is to be Payed by the driver. The LCD will display the amount to be payed and the balance after deducting that money from user account



GSM

In this system we use a GSM of type SIM900A. This GSM may work simply on 12v dc. The GSM is a module which works similar to a mobile phone. It will have a sim card. The data from toll booth regarding low balance. The information that the vehicle is running in negative balance and the vehicle got the presence of Ganja, Sprit, and Alcohol is sent to the control room using the GSM



Spirit Sensor

Basically the system here senses spirit in the vehicle and passes that information to the control room using GSM. But the idea that is been presented in our project is to use a sensor to detect the presence of substances like ganja/spirit/alcohol etc using the MQ3 sensor. Sensitive material of MQ-3 gas sensor is SnO2, which with lower conductivity in clean air. When the target alcohol gas exist, the sensor's conductivity increases.



V.WORK FLOW DIAGRAM

The entire design and idea of the proposed system is illustrated here. Following are the figure giving a clear picture of the system.



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VI. CONCLUSION

In order to implement "Automatic Toll Collection using RFID" the embedded systems plat form has utilized. For this purpose, a new RFID technology based on microcontroller was implemented and tested in this study. Automatic toll collection system is effective and low cost system compared to computer and other electronic toll collection systems. This reduces the manual labor and delays that often occur on roads.

In the design of the Automatic toll collection system we have proposed a spirit sensor, that detect the presence of the alcohols. It can reduce Smuggling of spirit /ganja/alcohol etc.MQ3 sensor can be used in the system and **Vehicles** are blocked from passing through the toll booth.

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