DESIGN OF RFID BASED TOLL COLLECTION SYSTEM USING AUDUINO

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ABSTRACT

Manual toll systems in India are found everywhere at present. This paper focuses on an Automated Toll Collection System used for collecting tax automatically. The Main Objective of this project is to make digital toll collection system as automated. In this we do the identification with the help of radio frequency. A vehicle will hold an RFID tag. This tag is nothing but unique identification number assigned. This will be assigned by RTO or traffic governing authority. 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 collection center, the tax amount will be deducted from his prepaid balance. New balance will be updated. In case if one has insufficient balance, his updated balance will be negative one. As vehicles don’t have to stop in a queue, it assures time saving, fuel conservation and also contributing in saving of money. Automatic Toll Collection 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.

Keywords: Automatic toll collection system, Radio Frequency Identification (RFID), RFID Tag

[1] INTRODUCTION

In recent days people used to travel from one place to another. Most of the travellers wish to choose roadways because of cost effective and sophistication. Hence our government has made many bridges, fly over’s and bypass roads along with toll plaza’s. Most of these toll plazas are operated manually. Hence people may cross N number of tolls which are operated manually. The average waiting time in a manually operated toll plaza is more than 10 minutes. While passing 6 such tolls the total waiting time of a vehicle is 60 minutes (equal to 1 hour). This costs a lot of fuel and time wastage. It proves that the present system requires an improvement for its efficient service. Here we suggest an automatic Electronic Toll Collection system which will not stop the vehicle in tolls. This drastically controls the time and fuel wastage also reduces the pollution a little. This automatic ETC system uses RFID technology. The RFID tags placed in the vehicle has an UIN number which is used to achieve the cashless payment. The weight sensor (load cell) plays a vital role in determining the type of the vehicle. The arduino ATmega 328 has been programmed to calculate the toll tax according to the vehicle type without any human involvement thus makes it a more reliable system.
The main concept of the project is to avoid the long queue and the traffics in the toll plaza. The transportation process is improved in our country. By using the electronic toll plaza collection the vehicles doesn’t need to stand in a long queue. For this process he/she need’s to load the data in the RTO office while buying a new car or some other time. The RFID tag is placed in the bottom of the vehicle and proximity sensor is placed in the road. While the vehicle comes to the toll plaza the sensors detects the type of the vehicle and deducts the amount required for the vehicle from their prepaid toll account. After the deduction of amount the gate will be opened for the traveller. Incase of no money in the account the user can pay amount in the toll palaza and extra amount for future use. By using the RTO office’s database the vehicle’s will be detected easily and deducts the amount from their toll account.

[2] RELATED WORK

In [1], the automation of toll plaza has been done based on image processing. ANPR (Automatic Number Plate Recognition) system has been employed which uses a camera to capture the number plate of the vehicle and deducts the toll by matching it with the owner database. Similarly [18] also uses ANPR technology to detect the vehicle in toll plaza and collect the cash manually.

In [2], the system is based on infrared sensors. In this, the user has to get the IR transmitter from the main toll office. The transmitter will be charged by the store office and the data of the user will be stored in the microcontroller. When the car arrives at the toll plaza the user will have to mount the transmitter on the car and press a button to turn it on. It must be in the line of sight of the receiver. The receiver will confirm the data from the transmitter with the database and the amount of toll will get deducted. It uses a stepper motor for gate control.

In [3] also the system is based on the RFID technology. The controller used is PIC 18F4550 and has been connected with the system using USB. The RFID receiver senses the tag coming in its range and the amount gets deducted from the account of the owner after all the related information is checked from the database. The IR senses the vehicle motion for controlling the opening and closing of the gate. A stepper motor is used to control the gate.

[3] PROPOSED SYSTEM ARCHITECTURE

Radio-frequency identification (RFID) is method for Automatic Identification and Data Capture. It uses electromagnetic fields to automatically identify and track tags attached to objects. The tags contain electronically-stored information. Generally the tags are classified as active tags and passive tags.
The active tag consists of own battery and transmitter. The merit of active tag is its operating range is more than a passive tag. But its manufacturing and maintenance cost is high and also the lifetime is only for about 5-7 years. Hence passive RFID tags are widely used by this automobile world. Passive tag does not require battery for its operation. Instead it draws the power from the radio waves of the reader. It usually lasts for more than 10 years and cost is also affordable. This makes the popularity of passive tags in many applications. Unlike a barcode, the tag needs not to be line of sight with the reader. RFID systems consist of three components: an RFID tag or smart label, an RFID reader, and an antenna.

**Arduino UNO**

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language (based on Wiring), and the Arduino Software (IDE), based on Processing.

**RFID Reader**

In order for an RFID system to function, it needs a reader, or scanning device, that is capable of reliably reading the tags and communicating the results to a database. A reader uses its own antenna to communicate with the tag. When a reader broadcasts radio waves, all tags designated to respond to that frequency and within range will respond. A reader also has the capability to communicate with the tag without a direct line of sight, depending on the radio frequency and the type of tag (active, passive, or semi passive) used. Readers can process multiple items at once, allowing for increased read processing times.
RFID Tag

An RFID tag, or transponder, consists of a chip and an antenna. [7] A chip can store a unique serial number or other information based on the tag’s type of memory, which can be read-only, read-write, or write once read-many (WORM). The antenna, which is attached to the microchip, transmits information from the chip to the reader. Typically, a larger antenna indicates a longer read range. The tag is attached to or embedded in an object to be identified.

CSC-125, 125 KHz RFID Clamshell cards are water proof and provide best reading range with 125 KHz RFID readers. Clamshell cards are very popular in Access control applications but can be used in wide range of RFID applications. They are lowest cost RFID cards available currently in the market. They have 26bit factory written ID that cannot be changed, though selected number sequences can be supplied for volume orders. These are Read only tags.

Power Supply Unit

All the components require DC power supply hence the 230V AC domestic power is converted into DC by using rectifiers. Initially the 230V AC is stepped down to 12V AC by the transformer. This is further converted in 12V DC with the help of bridge rectifier. The arduino requires only 5V DC to operate. Hence LM7805 regulator is used to regulate the 12V DC into 5V.
[4] WORKING PRINCIPAL

In this paper we have used automatic toll collection system by using a RFID tag. By the proposed method has simple procedure to collect the toll payment to passenger without wastage of time. A passive tag is an RFID tag that does not contain a battery.

![Fig 5: The Proposed System of RFID toll tax collection](image)

The power is supplied by the reader. The main advantage of a passive tag is that the tag functions without a battery. Passive tags have a useful life of twenty years or more. The tag is typically much less expensive and smaller. The proposed system features are as follows. Automatic toll collection system uses passive RFID technology (passive tag). A passive tag is an RFID tag that does not contain a battery. The power is supplied by the reader. The main advantage of a passive tag is that the tag functions without a battery. Passive tags have a useful life of twenty years or more. The tag is typically much less expensive and smaller. RFID toll tax collection shown in fig 5. Once the RFID is recorded near toll gate, the gate opens the amount will be deducted from the car owner account which is linked with the RFID tag code. We are also including vehicle theft detection scheme in this project. For identifying the theft vehicle near toll plaza, the owner of the car need to register a complaint in nearest police station with RFID tag code. So that the code will be sent to all toll plazas and will be updated in the toll system. So that the authorities at the toll plaza will make use of vehicle theft mode, then whenever the theft vehicle passes through this toll plaza then the device gives a message stating that the vehicle is theft. The experimental results are shown in below figures.
The detection of RFID number is shown in above. The amount deducted is also shown in below figures.

Fig 6. Displaying of theft Vehicle
[5] CONCLUSION

RFID is not replacement of Bar code but it is a technology offering various features. RFID offers highly reliable data collection in harsh environments. RFID technology can provide new capabilities as well as an efficient method to collect, manage, disseminate, store, and analyze information. It not only eliminates manual data entry but also inspires new automation solutions. It fundamentally changes how processes are managed and how businesses operate. RFID’s attributes provide greater automated tracking capability than existing technologies, and thus create the opportunity to reduce abhor, improve inventory management and generate better market intelligence, leading to lower operational costs and increased revenue generation.

REFERENCES