Research Article

DESIGN OF SMART TOLL CASH COLLECTION USING NFC READER

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ABSTRACT

The toll booth seems to become the bottleneck to pass through the gates due to their manual operations. This process may take time to pass the tollgate. In order to decrease this passing time, we decide to automate the process of a toll system by applying smart technology. This work would reduce the manual work and hence would make the passing of the vehicles much faster as compared to the traditional toll system. Every vehicle is tagged with the RFID tag, which has a vehicle's registration number in it and it can be sensed by NFC reader present at the toll booth. The NFC reader will send this information to the smart controller. Sensed registration number can be looked into the database for getting wallet balance and if sufficient balance is there then the toll charges can be deducted automatically and if the balance is not available, the message will be send to the user by detecting before few meters and user is directed to the payment toll and hot cash is collected.

Keywords - *Toll booth, RFID tag, NFC Reader, Smart controller.*

INTRODUCTION

Automation has become a part in our day to day life. Automation has to be implemented in order to reduce the traffic in the highly congested city. At present technology has become an internal part of the transportation and people tend to demand much more facilitates for their transport related activities. This concept of automated toll cash collection would reduce the human intervention and make the process more efficient and simple. The automated toll cash collection using NFC Reader uses simple components such as RFID Tag, NFC Reader and Controller to retrieve the information about the user from the smart controller and deducts the toll amount automatically from the user's account. It also gives information about the remaining balance after deducting the amount. This process of sensing the information is done before few meters. In case of insufficient balance, the user is redirected to the next lane and hot cash is paid. This system has also been enhanced to collect the toll cash for one way as well as for two ways.

Literature Survey

The first paper [1] explains the mechanism of the toll collection system. An RFID reader is a device which is used to communicate with the RFID tag. The reader has a receiver that exhales radio waves. The tag should answer back by sending the data. GSM module is used to relate entire system through the internet. When the vehicle passes through the tollgate, the LCD system displays the informationabout that vehicle. IR sensor is used to sense the presence of the vehicle. An alarm indicator shows the illegitimate crossing of vehicle through the tollgate. The RFID system uses RFID tags that are placed at the bottom of the vehicle, through which the information embedded on the RFID tags, are read by RFID readers. Data information can be easily exchanged between the motorist and the toll authorities. It helps in lower fuel consumption. The third paper [3] focuses on the GPS and GPRS. This paper proposing to create Geo fences use GPS by giving latitude and longitude boundaries of the toll plaza. The GPS is used here to find the vehicle's position. The GPRS kit in the vehicle is used to transmit the vehicle's location to the server. Each GPRS has a unique SIM, which is used to uniquely identify the vehicle. The position of the vehicle is checked against the Geo fences of the toll plaza, and if the vehicle comes in that range, the amount will be debited from the account of the vehicle owner. This is a complex system.

Existing System

The existing system collects the appropriate toll tax for each vehicle. This involves complex system which determines the weight and then the tax is calculated. This also detects the amount from the user's account automatically but does not check the

balance. If there is no balance in his/her account, the toll booth remains closed. This system has been enhanced to check the availability of balance in the user's account.
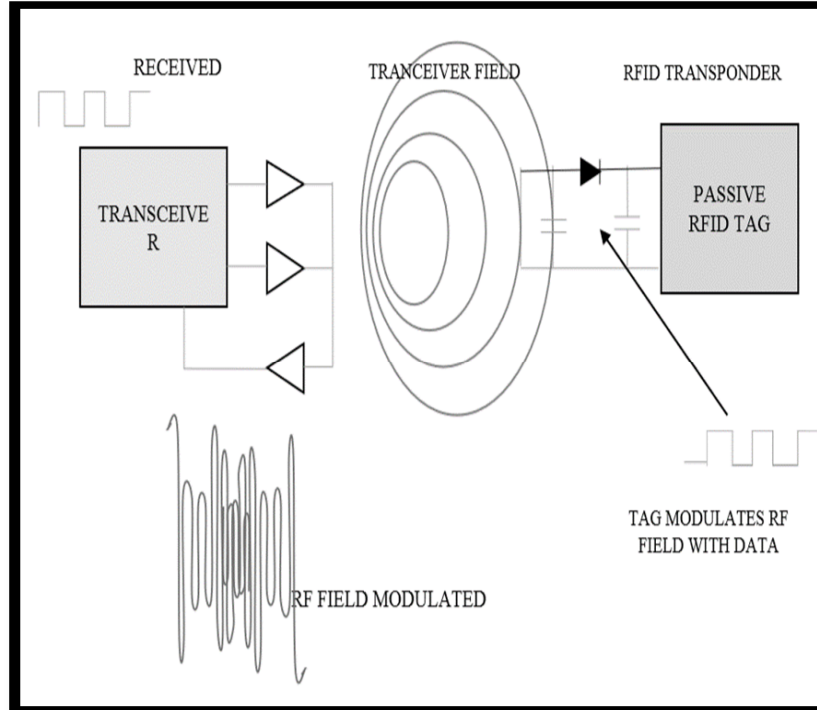

Fig.1. Operation of RFID

Proposed System

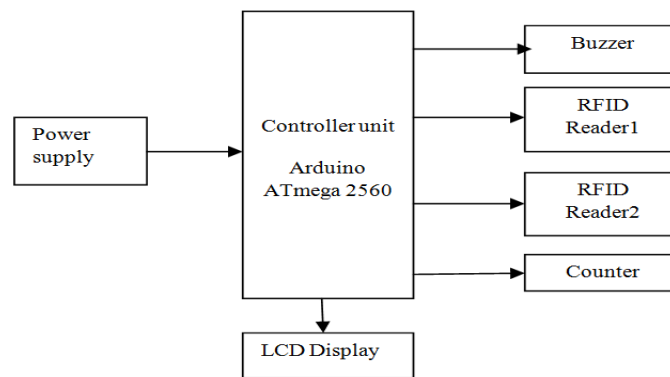The proposed system's main objective is to check the balance in the user's account.
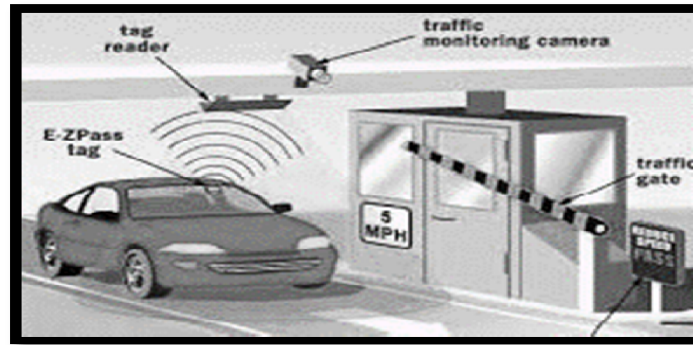

Fig.2. Block Diagram

Fig.3. Toll gate activity system

Component Description

EM -18 RFID Reader

Fig.4. EM-18 RFID Reader

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EM-18 RFID reader has some specifications such as:

1. Operating Distance : 10 cm,
2. Operating Voltage   : 5 volts
3. Operating Frequency : 125 kHz
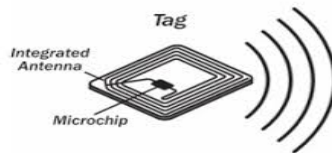4. Current Consumption : <50 mA

RFID Tag

Fig.5. RFID Tag

A RFID tags are electronic gadgets that can be attached with the product, person, anima or many more for their identification or tracking using radio waves.
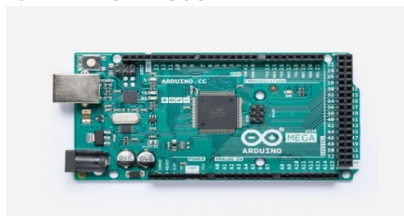
ARDUINO ATMEGA 2560

Fig.6. Arduino ATmega 2560

The Arduino Mega 2560 is a microcontroller board. It has 54 digital input/output pins, 16 analog inputs, 4 hardware serial ports, a USB connection, a power jack and a reset button.

LCD DISPLAY

Fig.7. LCD Display

A 2×16 LCD is used as an output device. It shows the information about the balance and also if sufficient balance is not there it displays a message to move to the manual lane.

RESISTOR

Fig.8. Resistor

A resistor is a passive two terminal component that resist the flow of circuit element. In electronic circuits, resistors are used to reduce the current flow, adjust signal levels, to divide voltages, bias active elements and terminate transmission range. Resistance is measured in Ohms. Here resistor is used to resist the current flow to the LCD display so that proper brightness is obtained.
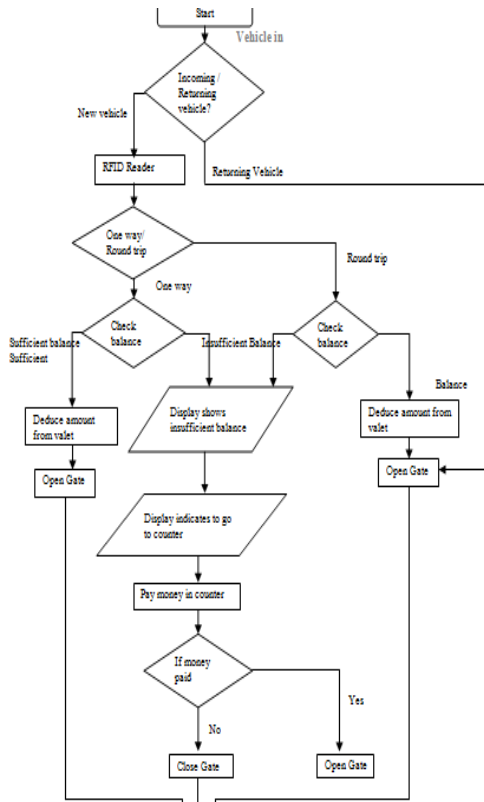
FLOW CHART

Fig.9. Flow Chart

Result And Output

Fig.10. Output

Here we are deducting the amount for one way as well as for two ways. If the amount is not sufficient, it displays insufficient balance and move to the hot cash lane.

Conclusion

Hence this Design of Automated Toll Cash Collection system using NFC Reader is implemented with the help of ARDUINO ATmega2560.This system has been proposed in order to overcome the timing constraint in the toll booth. It also reduces the traffic in near the toll booths. In addition to this smart controller is used which holds the entire database of the user .This system also facilitates the use of different lanes for to and fro of the vehicle and also the manual lane. Therefore this avoids confusion by separating the lane.

Future Work

As a future implementation GPS and GPRS system can also be included in order to improve security and also the toll booth can be made in contact with the police station so that theft of the vehicle can be easily detected. The system as a whole would increase the efficiency of the toll collection system.

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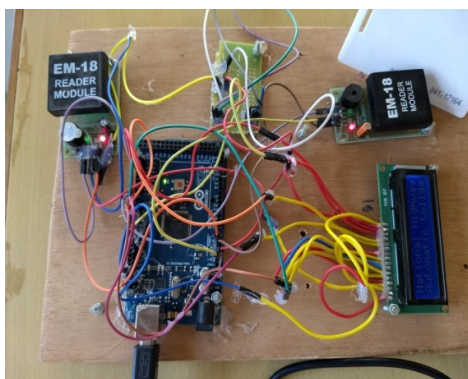Toll Collection System."Traffic & Transportation, 2008, pp.119-121.