IMPLEMENTATION OF AUTOMATED TOLL SYSTEM FOR HIGHWAYS AND BRIDGES

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Abstract- In this paper implementation of automated toll system for highways and bridges is proposed. Now a days, Vehicles are large in numbers. The tollbooth seems to become bottleneck to pass through the gates because of manual toll collection. The manual toll system is time consuming process and creates heavy traffic congestion at tollbooth and also it requires man power. In order to overcome this problem, we decided to automate the process of toll system using RFID and GSM Modem. By making process automatic ensures time saving and reduces traffic congestion, thereby users experience smooth pass at tollgate. The system is implemented using RFID Reader, Microcontroller, Servo motor and GSM modem. The RFID reader present at tollbooth will read the RFID tags attached on vehicles. RFID tags stores the vehicle's unique registration number. Sensed registration number can looked into cloud database for getting balance. If there is a sufficient balance in wallet, then toll charges can be deducted automatically and also transaction details are sent users via SMS.In case of insufficient balance, client can add money in wallet using android app.

Keywords: RFID, Arduino Nano, Servo motor, GSM Modem.

1.INTRODUCTION

The number of vehicles on the road is increasing day by day. The major roads have manual toll systems, where every vehicle has to stop and pay for toll tax. The waiting times of vehicles are significantly high because of manual interaction between user and toll collector and also this type of system creates traffic congestion and recourse wastage. So the objective was to give a solution of this delayed manual toll system by designing and implementing an automated toll system using RFID and GSM modem. The main objectives of this system are reducing traffic congestion, saving time, thereby improves the speed and the efficiency of the toll passage process.

The system also helps to track lost vehicles. If vehicles are under theft, then those vehicles can be tracked and found. If the theft vehicle passes the toll then a customer receives an SMS and also RTO admin will be sent a notification about the vehicle. And hence, this distinct feature helps to track the lost vehicle and track them easily. Therefore the overall system is user friendly, fast responsiveness and cost effectiveness with lesser delay for vehicles.

2. RELATED WORK

According to Khadijah Kamarulazizi and Widad Ismail, this paper focuses on an electronic toll collection (ETC) system using radio frequency identification (RFID) technology. This method automated the system and eradicated the need and hassle of manually paying the toll. Data information are also easily exchanged between the vehicle and the authority that is collecting the tax, thereby enabling a more efficient toll collection by reducing traffic and eliminating possible human errors. But this was limited to the local servers, so scalability and reach upto all tolls was not possible.

According to Atif Ali Khan, this paper focuses on a RFID based toll collection system using Atmel8051 microcontroller. This system is designed by using RFID active tag concept having long range and sufficient power for the RFID tag to ensure data transfer between two modules. The system was equipped with a 4×3 keypad and a display with 16×2 LCD. The two modules are vehicle module and base module; both are communicate via RF modem connected to each module. The RF modules communicate over the ISM frequency range of 902-98 MHz. The system facilitates vehicle monitoring, vehicle authentication and automated toll collection on the highways is proposed.

According to V. Sridhar and M. Nagendra, this paper focuses on a smart card based toll gate automated system using 8051 microcontroller. This system describes, the smart card removes handy cash-transaction to eliminate traffic at toll plaza and to save time. The main objective of the proposed system is to pay the toll tax using smart card. Smart card must be recharged with some amount and whenever a person wants to pay the toll tax, he need to insert his smart card and the amount is deducted using keypad.

3. SYSTEM ARCHITECTURE

The basic model of the system has been developed by using RFID and GSM modem. Every vehicle holds a RFID tag. The RFID Tag consists of unique vehicle's registration number. The RFID card reader will be placed at the tollbooth of the highways or bridges which can detect the RFID tag. Whenever a vehicle will enter the toll gate, the RFID reader will senses the tag attached on the vehicle and identifies the type of that vehicle and deduct the toll amount from the vehicle owner's account automatically. Afterwards, the vehicle owner will get the transaction details via SMS and also required information about the vehicle owner saved in cloud database.

This paper consists of two modules

- RTO Admin
- Vehicle Owner

RTO Admin: The RTO admin will manage country, state and cities as per requirements. Admin has the privilege to add, delete or update the details. Tariffs can be paid from the smart cards for easy use instead of hard cash. Suitable tariff is fixed for each city or place. Types of vehicles and its varieties are managed by the admin. The price amount of toll is fixed according to the vehicle respectively. Admin also register vehicle complaints based on customer vehicle theft. If the theft vehicle passes the toll then RTO admin will be sent a notification about the vehicle.

Vehicle Owner: The user logs into application using user id and password. User can deposit money in his account and payment will be deducted automatically at the toll stations. If amount is less than toll payment, then user has to pay amount through mobile app for toll payment. Each smart card can contain some amount through which the customer can make transactions while passing the toll. After passing the toll the amount which is deducted from user's account is sent to the customer in the form of SMS. This helps the user to know about the amount being deducted from his wallet.

3.1 DESIGN COMPONENTS

A. Radio Frequency Identification (RFID)

RFID is Radio-frequency identification uses to automatically identify and track tags attached on vehicles. RFID system consists of two components, RFID tag and RFID reader. The RFID tags that are used to electronically store information such as vehicle owner name, registration number, vehicle model type etc.

B. Arduino Nano

It is a small, compatible, flexible and user friendly microcontroller board. It comes with an operating voltage of 5V.However input voltage can vary from 7 to 12V.It supports different ways of communication such as Serial protocol, I2C protocol and SPI protocol and it includes mini USB pin which is used to upload code. It has 22 input/output pins out of which 14 are used for digital pins and 8 are used for analog pins.

C. Servo Motor

Servo implies an error sensing feedback control which is utilized to correct the performance of a system. It also requires a generally sophisticated controller, often a dedicated module designed particularly for use with servomotors. Servo motors are DC motors that allows for precise control of angular position. They are actually DC motors whose speed is slowly lowered by the gears. The servo motors usually have a revolution cutoff from 90° to 180°.

D. GSM modem

A GSM modem is a specialized type of modem which accepts a SIM card, and operates over a subscription to a mobile operator, just like a mobile phone. From the mobile operator perspective, a GSM modem looks just like a mobile phone. When a GSM modem is connected to a computer, this allows the computer to use the GSM modem to communicate over the mobile network. While these GSM modems are most frequently used to provide mobile internet connectivity, many of them can also be used for sending and receiving SMS and MMS messages.
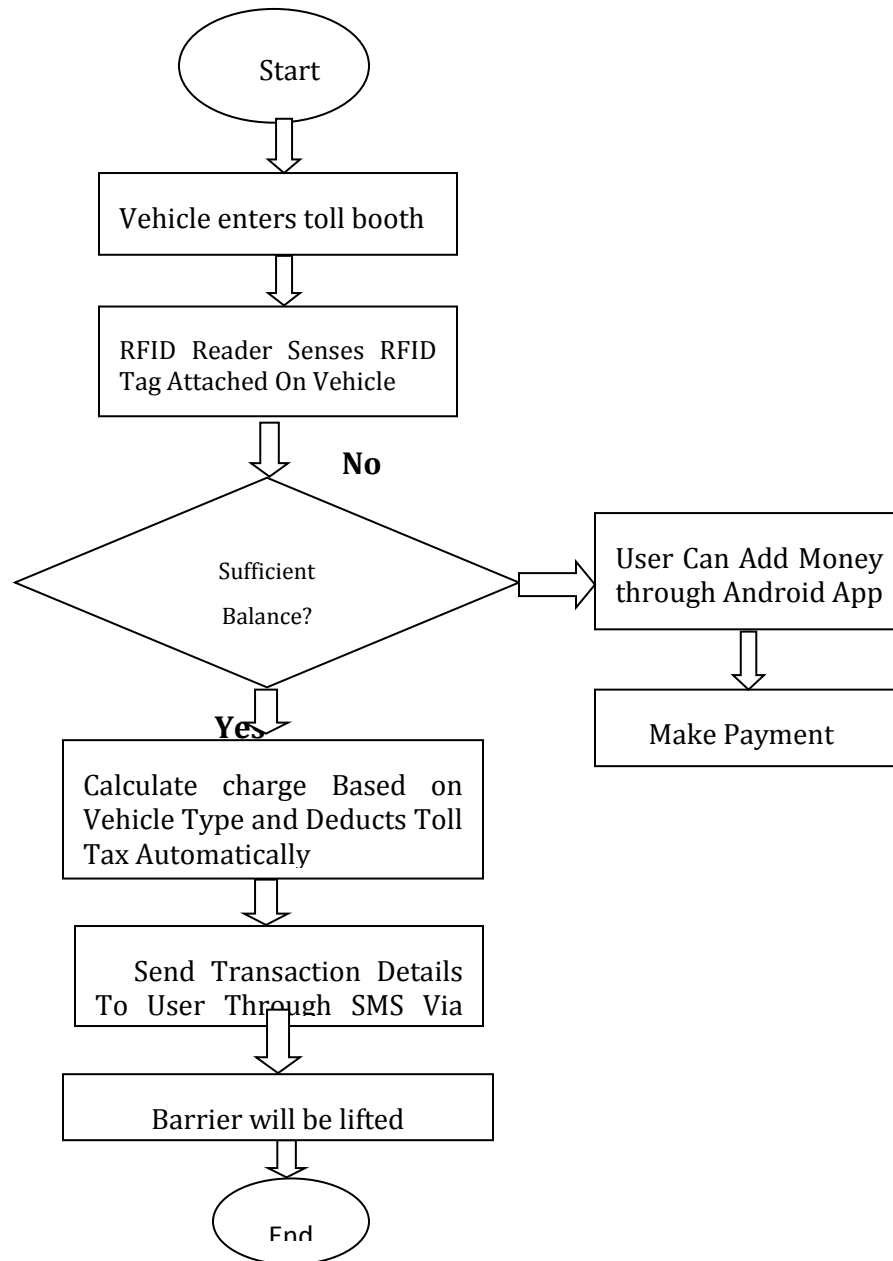
3.2 FLOW CHART

Fig-1: Flow chart of automated toll system

4. CONCLUSION

The development of this system is based on RFID and GSM Modem. The proposed technique is to provide a fast and harmless atmosphere for toll collection and to automatically deduct the toll amount and the transaction details can be send to the vehicle owner via SMS.User is provided with an android app for adding money into wallet incase of insufficient balance. Therefore, driver can enjoy smooth pass at tollgate without a pause for toll passage process. As a whole, the automated toll collection system is very beneficial and effective system.

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