

Toll Collection System using RFID

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Abstract: Manual toll system in India are found everywhere at present. This is the main reason for traffic at the toll booths. Each vehicle on an average needs to stop at the toll booths for about a minute for the payment of the toll tax. In order to control this traffic, we decided to work on the construction of a project which reduces the manual work. To overcome this issues we have design a proposed model which reduces the need of human efforts. Thus, save the human energy. In this project microcontroller has been used as CPU. Whenever the vehicle arrives at toll gate it goes for manual paying or smart card based paying. If he chooses to pay the toll money from the card he/she has to scan the card having sufficient balance using RFID reader. If he/she have sufficient balance then the toll amount get deducted from the card balance and toll gate opened and also updated in database along with date and time and if he has insufficient balance then the message displayed on LCD screen that owner has insufficient balanced and toll gate not opened. Therefore he has to switch to manual paying system.

Keywords: Smart card, RFID

I. INTRODUCTION

Transportation is the chief support of any country's economy. Enhancement in transportation systems result into the good lifestyle in which we achieve extraordinary freedom for movement, immense trade in manufactured goods and services, as well as higher rate of employment levels and social mobility [7]. In fact, the economic condition of a nation has been closely related to effective ways of transportation. Automatic toll collection is an advance Technology allows the automated show the smart card i.e. RFID card to the system installed at the toll tax department to open the Gate electronic collection of toll costs.

RFID based toll collection system have ability to determine if the vehicle is registered or not, and then informing the management center about to process violations, debits, and participating accounts [6]. The most excellent advantage of this system is that it is capable of eliminate congestion in toll booths, especially during those seasons when traffic seems to be higher than normal. Rapidly increasing number of vehicles on the road, result into number of problems such as congestion [5], accident rate, air pollution and many more. All economic activities for many different tasks use different methods of transportation. For this reason, increasing transportation is an immediate effect on productivity of nation and the economy [1].

There are two methods of collecting toll 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 [4] method where the person needs to read there smart card and toll amount automatically get deducted. Design and development of a "Toll collection system using RFID" which is based on microcontroller, RFID technology and RTC having cashless operation. As the name implies "Toll collection system using RFID" the key theme of our project is the automation using RFID and ease of toll collection at toll booths.

II. EXISTING SYSTEM

Manual toll collection methods typically collect toll payment from road users using the cash. Cash that is, Notes and/or coins is typically the most widespread method of payment (MOP). The cash MOP can include payment in local and foreign currency. Due to this traditional MOP the traffic at toll booths increases and time consumption is more due to long queues of vehicle waiting at toll booths.

III. PROPOSED SYSTEM

The basic idea behind this project is to simplify the procedure used by passengers at toll booths to pay toll tax by making it automatic using smart card i.e. RFID card [2]. By using this smart card we can also save the efforts of carrying records, managing long queue at toll booths and also efforts of carrying money.

RFID based Automatic Toll Collection: The RFID reader mounted at toll station will read the prepaid RFID tag (smart card) when user goes for Automatic toll system and automatically toll amount will be deducted [1]. And if the smart card does not have enough balance then vehicle have to switch toward manual toll system.

IV. METHODOLOGY

RFID is an abbreviation of Radio Frequency Identification, which is a Non-contact automatic identification technology [1]. Non-contact two-way communications are achieved by radio frequency method for identifying object and obtaining relevant data which has a unique advantage in data collection and data transmission. Compared to the traditional bar code, magnetic card and IC cards, RFID tag has the features of non-contact, reading speed, no wear, long

life, user-friendly and the security function. At the same time, these information of high-speed moving or stationary objects can be mass identified by RFID within a certain range and can be quick and easy operation.

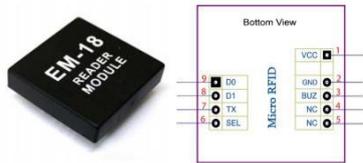


Figure 1: EM-18 RFID reader module

Whenever any person buys a new vehicle, first he/she need to do her vehicle registration at the RTO office. RTO people will assign a number plate to it along with it they will give a RFID enabled tag or RFID smart card. This card will have a unique ID probably use with that vehicle only. They will also create an account for that particular smart card and maintain transaction history in database. Owner of the vehicle needs to deposit some minimum amount to this account. Every time a registered vehicle reaches the toll booth activate the RFID circuit to read the RFID enable smart card. Transaction will begin, depending upon the balance available in account and toll will be deducted directly or the vehicle will be directed towards another lane to pay tax manually if card does not have enough balance. The software further updates the details in the Centralized database server. The balance deduction, servo motor movement is controlled using microcontroller. RTC provide real time operation of the system. Also there is Graphics User Interface which takes update of all the arrival of vehicles and feed it into excel sheet based on real time application as a result reducing the traffic gathering at the toll collecting booths.

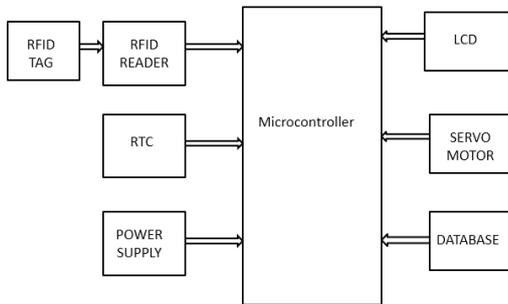


Figure 2: Block Diagram of proposed system

Microcontroller is the heart of the complete system. ATmega16 [6] is an 8-bit high performance microcontroller of Atmel's Mega AVR family with low power consumption. A RFID reader is a device which is used to interrogate an RFID tag. It reads the unique number from the RFID cards and sends it to the microcontroller. A real-time clock is a computer clock that keeps track of the current time. The DS1307 serial real-time clock (RTC) is a low power, full binary-coded decimal (BCD) clock/calendar plus 56 bytes of NV SRAM. A servomotor is a rotary or linear actuator. It is

generally used for control of angular movement, velocity and acceleration for various applications. It consists of a suitable motor coupled to a sensor for position feedback. This unit will supply the various voltage requirements of each unit. This will be consists of transformer, rectifier, filter and regulator. The rectifier used here will be Bridge Rectifier. It will convert 230VAC into desired 5V/12V DC.

A liquid-crystal display (LCD) is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals and in this system LCD used for displaying of vehicle number, balance before and after toll deduction [7]. The AT24C32/64 provide 32,768/65,536 bits of serial electrically erasable and programmable read only memory (EEPROM) organized as 4096/8192 words of 8 bits each. A programmer can create and use an application using the components provided by the Visual Basic program itself. The community of programmers developed third-party components. Communication Network System is a operations management platform which can process and transmission and control data of the system, and complete control and operation on data collection, sorting, filtering, packaging, forwarding and exchange, etc.

Flow of RFID based toll tax are:

1. Detection of vehicle
2. Display of money currently in account
3. Payment through RFID card
4. Display of money after deduction on LCD
5. Display of exit of vehicle on computer with date and time

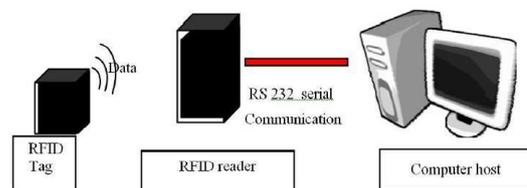


Figure 3: Hardware Assembly

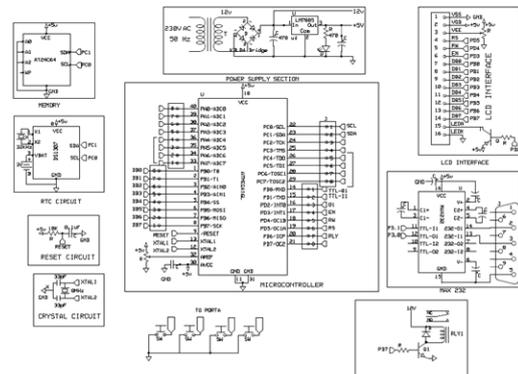


Figure 4: Circuit Diagram

Flowchart 1: Working of RFID based toll collection system

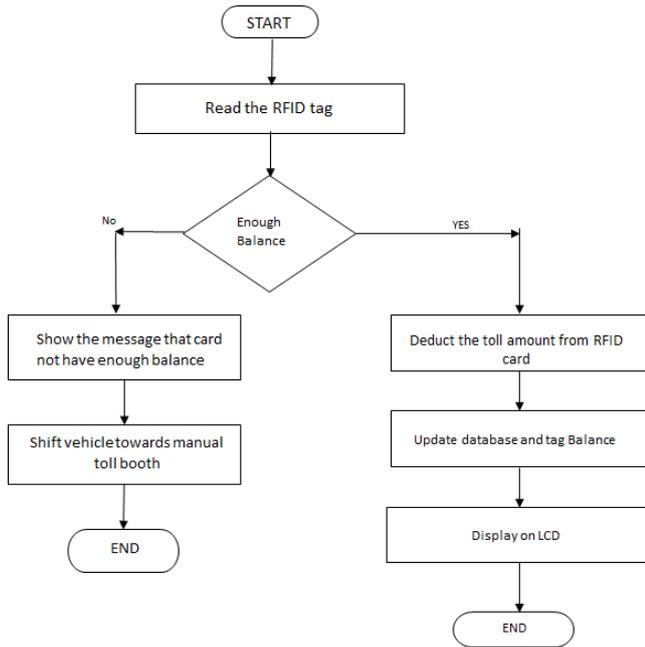


Figure 5: Working of system

V. ADVANTAGES

1. Shorter queues at toll plazas by increasing toll booth service rates.
2. Faster and more efficient service.
3. The ability to make payments by keeping a balance on the card itself.
4. Minimization of fuel wastage and reduced emission by reducing deceleration rate, waiting time of vehicle in queue, and acceleration.
5. Lowered toll collection costs.

VI. DISADVANTAGES

1. During rainy seasons some problems may occurs.
2. Continuous check on balance by user for efficient use of system.

VII. APPLICATION

1. Automatic Toll Collection.
2. Vehicle Theft Detection.
3. Signal Breaking Avoidance.
4. Tracking Over speeding Vehicle

VIII. FUTURE SCOPE

This project describes RFID toll collection system with ATmega microcontroller. Since the RFID used in this project has low range (passive RFID card), so the system works only if the vehicle is near the toll booth. Using RFID that has high range (Active RFID) can help solve this problem so the vehicle can be detected from the distances and vehicle owner can pass the toll plaza without reducing the speed of the vehicle. With slight modification in design this can be easily achieved.

There are lots of future aspects which can be achieved using this technology:

1. No violating of traffic rules.
2. Adding image processing technique.
3. Instant recharging for defaulters.
4. Implementing RFID technique in automated parking.
5. Implementing RFID technique to detect lost vehicles.

IV. CONCLUSION

At the ending of this project, the conclusion that came out is that, to implement modern system of toll collection a new technique which is RFID based came into light. The RFID safety is a key important things about this project. Strong and verified design were kept in the project, and reliable RFID technique was used for identification and authorization of vehicles. This project is reliable and easy way to collect toll comparing to manual one. The proposed model will significantly improve travelling through highways by reducing wastage of time and fuel. This system can easily collect toll from people without even making them stay at the toll booths for long time. This is achieved by using wireless technique of data transfer from vehicle to microcontroller and from microcontroller to vehicle.

This system will definitely help both the ends i.e. toll authorities and the people in form of cost, time, increased speed and better convenience and security. Due to implementation of this technique at the toll plazas of India, the problem of long queue and need for human intervention will be reduced. This idea of toll collection also reduces fuel consumption and pollution.

So, it is clear from this report that RFID based toll collection system is not only better than manual system but is the good enough technique.

VIII. REFERENCES

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