Radio Frequency Identification(RFID) Based Toll Collection System

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Abstract— **Lot's of cars travel on the highway and toll tax needs to be collected from them as they pass by but it is a very tedious process and improper management can lead to high levels of waiting time, and pollution levels too. Many systems have been developed to reduce the complexity of the process by introduction of Automation in Toll Collection. There are a bunch of systems available, we compare some of them and also find the scope of further improvement in such systems.**

Keywords— **Toll Collection, RFID, GSM, Automation, Automatic,ARM7,Micro-controller System.**

I. Introduction

In our day to day life, we pay certain amount of tax through toll plaza to the government. The toll gates are mostly found on national highways and bridges etc., and we pay standing over a queue in the form of cash, although, the mobility of vehicles gets interrupted by this method which takes longer travel time, more consumption of fuel and also pollution level get increased in that region, instead of that the method commonly used by industries and in advanced countries is the Electronic Toll Collection System.

Electronic toll collection system is the technology that enables the automatic electronic toll collection from the prepaid account registered on the name of vehicle owner, determining whether the vehicle is registered or not and informs the toll authorities avoiding toll violations. Over last decades, electronic toll collection system have been implemented in united states and many other countries with a new improvement in it. By this we don't have to carry a handsome amount of cash with us relates to security as well. This system does not require any manual operation of toll barriers and collection of toll amounts, it is completely automated toll collection system. The vehicle owners are registered with their vehicles proper information and their account is created, where they can recharge their account with required amount. When the vehicle passes through the toll gate, the information is shared between RFID tag and RFID reader and the amount is deducted from the owners account. This method reduces the traffic congestion problems, also reduces the travel time and reduces the fuel consumption.

II. Block Diagram
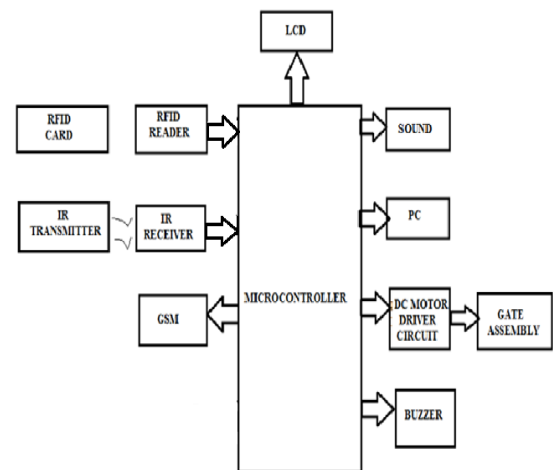
Block Diagram Description

1. Micro controller:
Micro controller senses the signal given from switches and decides the mode of operation i.e. recharge mode or toll collection mode. It fetches data from memory location and send it to output devices like display, motor driver and buzzer. At the same time it can accept data from Keypad for recharging options and from IR receiver to sense that vehicle has passed from toll collection booth.

2. RFID card:
RFID cards have diverse range of functions, while provides convenience, as the cards must simply be waived or tapped in front of a reader rather than swiped. These cards are used for applications as access control in security systems, time and attendance, network login security, biometric verification, cashless payment, and even event management.
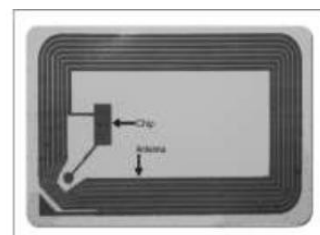
3. RFID reader:

An RFID reader is a device that is used to interrogate an RFID tag. The reader has an inbuilt antenna that emits radio waves; the tag responds by sends back its data.

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4. Liquid crystal Display:

It consists of Liquid Crystal display (LCD).The display is various messages like valid card, invalid card, access allowed, manual access etc. We are going to use 16x2 alphanumeric display.

IR receiver is used to sense that vehicle has passed the toll collection booth. The other alternative for infrared trans-receiver is optical sensor i.e. IR but the disadvantage is that it can be affected easily by the sun light or other lights. So there is possibility of false triggering. Also the disadvantage of using special color sensors like LASER beam is that it is visible to normal human eyes. To overcome all these points we have used infra-red sensor

5. IR Receiver:

IR receiver is used to sense that vehicle has passed the toll collection booth. The other alternative for infrared trans-receiver is optical sensor i.e. IR but the disadvantage is that it can be affected easily by the sun light or other lights. So there is possibility of false triggering. Also the disadvantage of using special color sensors like LASER beam is that it is visible to normal human eyes. To overcome all these points we have used infra-red sensor.

6. IR Transmitter:

IR LED is used as IR transmitter. Transmitter will be placed at the one side of the booth while receiver is at the other side. When the vehicle passes through the booth, IR rays going to receiver are cut and signal is send to microcontroller.

7. Motor Driver

Microcontroller output is 5 volts and DC motor requires 12 volts supply. Motor driver IC is used to convert 5v to 12v, which is required to drive the motor.

8. DC Motor

DC Motor is used to open the Gate barrier. This will be done when user has successfully performed the Rfid swap operation with sufficient balance.

9.Buzzer

Buzzer will be turned on when invalid card is shown at the RFID reader.

10. Switch

If some user doesn't have the RFID card and he doesn't want to purchase the card then he can pay the cash to the government authority persons at the toll plaza. Authority person will then press the manual switch to open the Gate.
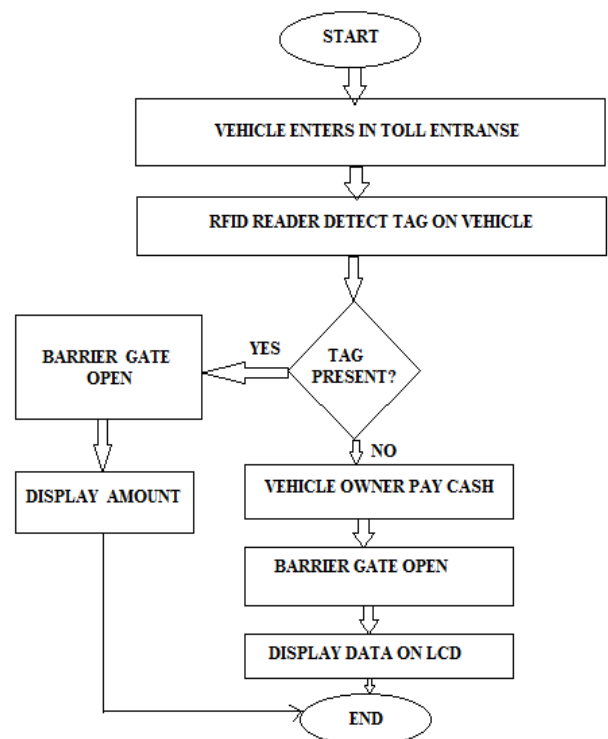
11. Keypad

Keypad is provided for the recharge option. Authority person can recharge the RFID cards

Fig. General diagram of RFID based Toll Collection System

III. Flow Chart

IV. Conclusion

RFID is one of the new technology emerged in ETC applications. This project tells us about the application of ETC system on toll gates. This project gives many advantages, such as waiting time of the vehicles, no traffic congestion, assured and accurate collection of toll amount, free from cash, minimum emissions which are harmful for living.

It has expanded capacity for vehicle without building the big infrastructures. It has improved efficiency and reliability of toll plazas and traffic abilities of High ways.

V. Future Scope

Designed a system to give complete solution for traffic and transport related problems such as Toll gate control, traffic signal control, traffic rules violation control, parking management and special zone alert using the latest RFID technology. It is proposed as a low cost optimized solution using RFID and GSM mobile technology. At the toll plaza, there will be a large LCD screen for displaying details of the transaction. At the same time, it will show:
1. Total cost of that road.
2. The duration of toll plaza.
3. And the remaining balances after each transaction.

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