

Arduino Based RFID Controlled Automatic E-TOLL Collection System

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Abstract:

This paper focuses on an electronic toll collection (ETC) system using radio frequency identification technology (RFID). Research on ETC was started in 1992, during which RFID tags began to be widely used in vehicles to automate toll processes. The proposed RFID system uses tags that are mounted on the windshields of vehicles, through which information embedded on the tags are read by RFID readers. This eliminates the need for motorists and toll authorities to manually perform ticket payments and toll fee collection. The Data of each vehicle crossing the toll gate is stored in the website. A LCD screen is also provided for user convenience. The toll Gate arena is monitored by means of a camera at all times. Data information are also easily exchanged between the motorists and toll authorities, thereby enabling a more efficient toll collection by reducing traffic jams and eliminating possible human errors.

Keywords: Arduino, RFID, ETC, LCD, I2C.

I. INTRODUCTION

With the movement of inter-State vehicles and goods, there is a need for toll gates. As there are unauthorized entries and overloaded goods vehicles at the toll gate increases the load on highways, Scientific tracking and monitoring system becomes a need of the toll tax department. The proper collection of toll fees can generate a huge quantum of funds for the maintenance of ageing bridges and the large road network. Hence to improve the toll tax collection system and to reduce the traffic at toll tax depots, the proposed method can be used. There are two ways of collecting toll tax in practice. First is the traditional manual method where one person collects the money and issues a receipt. The other one is Smart Card system where the person needs to show the smart card to the system installed at the toll tax depot to open the barrier. Both the above mentioned methods for collecting toll tax is time consuming. In the conventional methods, there are chances of escaping the payment of toll tax. It also leads to queuing up of the passing vehicles. By the realization of the above proposed system we can make the Toll Tax collection system more efficient and can reduce the traffic logging on the highways. This system will save a lot of time of the driver, passengers as well as of the tax collection authorities.. Hence we propose a No Queue Toll Tax Collection System.

II. BLOCK DIAGRAM

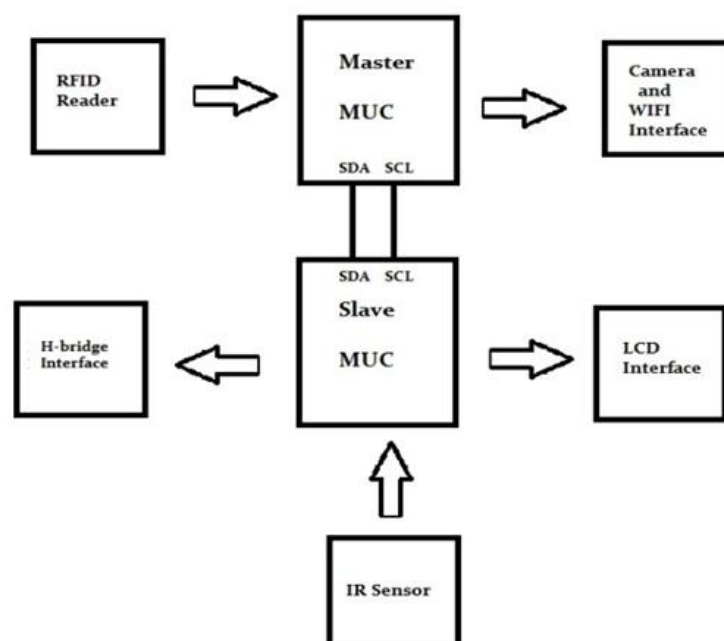


Fig 1: Block Diagram of the system

The block diagram of the system contains two microcontrollers, RFID device, Camera and WiFiModule , IR sensors, LCD interfaces and a H-Bridge .The H-bridge is used to control the movement of the gates. The camera to monitor the movement of the vehicles . The WiFi module is used to upload the data onto the server collected from the camera and also control the exchange of data between the server and the microcontroller. The LCD is used to display the messages for user convenience.

III. WORKING

Radio Frequency Identification (RFID) uses wireless radio-frequency electromagnetic fields to transfer data. The RFID tag which is attached to the vehicle is read by the RFID reader and hence it acts as per the set conditions.

Case 1- If the Vehicle is a legal entry, then the RFID sensor will send a signal to the Master Microcontroller (MUC), the Master MUC sends a command to the camera to take photographs and further upload it in the server. It also sends a signal to the Slave MUC to display the LCD. In this case the gate 1 will be open and gate 2 and gate 3 remains closed. The LCD display shows "Have a safe journey, Thank you".

Case 2- If the vehicle is an illegal entry, then the RFID sensor will send a signal to the Master MUC, the Master MUC gives the Command to the camera to take photographs and upload it in the server. It also sends a signal to the Slave MUC to display "please move to the next lane" on the LCD. It further sends a command to the H-bridge to open gate 2 and close gate 1. The illegal entry vehicle will be checked manually by a security squad. If the user is a registered one, he will be allowed through gate 3.

In case a runaway attempt is made through the gate ,an interceptor which would always be there ,would follow the law breakers ,also an automatic alert will be sent to the nearest police station .hence there will be more chances of getting busted.

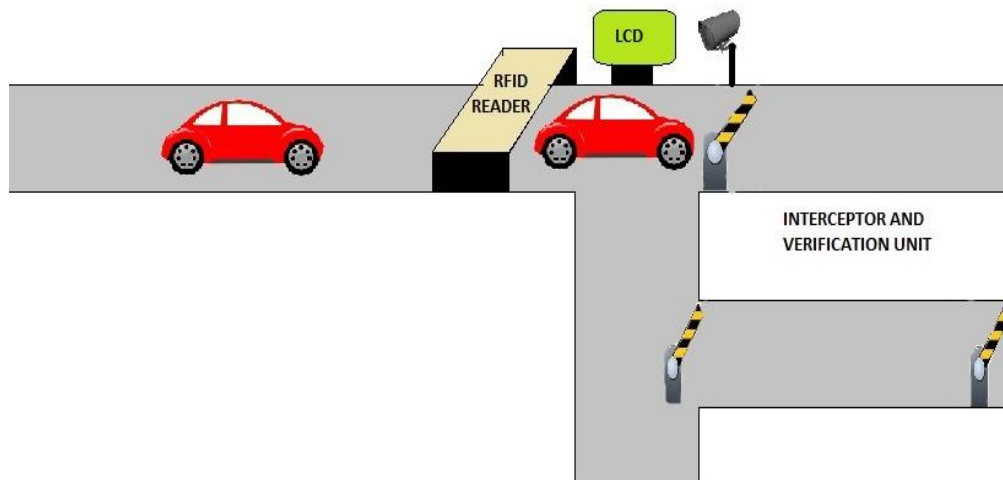


Fig 2: Schematic of the system

IV. SCOPE & APPLICATIONS

Only the imagination can limit the applications of the above proposed system.

- 1) Automated Vehicle Identification
- 2) Automated Vehicle Classification
- 3) Transaction Processing (Toll Calculation)
- 4) Can be used to trace the vehicle if the system is centralized

V. CONCLUSION

The proposed electronic toll gate system applies RFID technology .This increases the efficiency as RFID is known as a highly stable technology. The system is successful in reducing the logging of the traffic nearthe toll collection booth and also provide a secure and an user convenience.

VI. ADVANTAGES

The following are the major advantages over current system.

- 1) Automatic collection of toll tax.
- 2) Free flow of traffic.
- 3) Time saving.
- 4) Record maintenance.
- 5) Problems with pursuing toll evaders.

VII. ENHANCEMENTS

A. Limitations.

As generally all systems have some limitation, here are somelisted for the proposed system.

1. The proposed system will take care of only single toll depot. It is not the centralized system.
2. Multiple RF TX cannot work together.

B. Drawbacks.

This system has certain drawbacks also as listed.

1. Initial cost of setting is high.
2. RFID tags are not commonly used by common people.

C. Future Modifications.

There is always chance to improve the any system as research & development is an endless process. Our system is no exception to this phenomenon. The following improvements can be done.

- 1) Centralized system for toll tax collection among all the toll tax collectors.
- 2) ZigBee, RFID, Bluetooth or other technology can be used to avoid data confliction.
- 3) Image Processing can be implied and increase the applications of the system.

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