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Automatic Toll Collection System on Highways

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Abstract: At present toll booths are manually used by giving the bill and getting the receipts. Due to this system, it leads to heavy traffic in highways.

To overcome this issue the automatic toll collection system is introduced, this system will reduce the man power and traffic at low cost. This system uses efficient technique called Electronic Toll Collection using RFID modules. This will reduce the traffic.

When the vehicle enters the toll plaza, it will automatically

Does the process. From the RFID card the toll amount is deducted. The RFID card is rechargeable and account is stored on the records.

RFID reader reads a unique number from the RFID cards. Automatic Toll collection scheme employed helps in resolving the heavy congestion caused in metropolitan cities.

Keywords: Radio Frequency Identification (RFID); RF Modules; Toll Plaza; Electronic Toll; RFID Tags; Traffic Jams.

I. INTRODUCTION

Improvement in transportation systems gives us good lifestyle in freedom for movement. The economic condition of a nation is related to transportation.

Vehicles increasing causes number of problems such as congestion, rate of accident and others. Automatic toll collection is a technology that allows the automated electronic collection of toll costs.

The automatic toll e-ticketing system is the approach used for the vehicle when it reaches the toll plaza, this is detected by using Infrared Proximity Sensor.

With the help of RFID reader, RFID tag is used to read number plate of vehicles. To receive these pulses, an IR receiver is used number Through the RF transmitter is located in vehicle. At the toll plaza these RF signals are received by an RF receiver, which send data to a computer.

Depending on this information, appropriate toll tax is deducted from the pre-paid account of the vehicle's owners. The details of the payment is received in the owner's mobile. The toll gate is closed whenever the users account is low or the vehicle has no RF receiver. The advantage of this project is less traffic and no queues in toll plaza. This gives faster service. User can recharge RFID card by some amount and use this card whenever he/she travels.

II. EXISTING SYSTEM

In existing method, the vehicle has to be stopped at the toll booth and toll is paid as cash or using smart cards. This manual process leads to inconvenience. This leads to delay in the toll process and illegal toll gate entry. There is loss of fuel, use of paper and efforts in the management at toll plaza.

There are two methods of collecting tax presently used they are,

- 1) First is the traditional manual method where one person collects money and issues a receipt.
- 2) Second is the Smart Card method where the person needs to show the smart card to the system installed at the toll tax department to open the Gate.

In this paper, there is no way for theft detection. The present system we have with us on the high ways takes 1 minute to complete the toll collection process for one vehicle. To complete the whole process it will take less than a minute.

A. Automated Toll Plaza Verification System For An Automobile At A Check Point

Due to more number of vehicles there is a lot of traffic in the highways. It is the best method to manage the traffic. At present there is manual money collecting method in which the travellers must pay toll by waiting in long queue, so it leads to wastage of fuel and time.

In this method the traveller relieves the burden of waiting in the queue to make the toll payment. It will decrease the fuel-consumption and it saves time. By using this system User can get RFID tag by paying online.

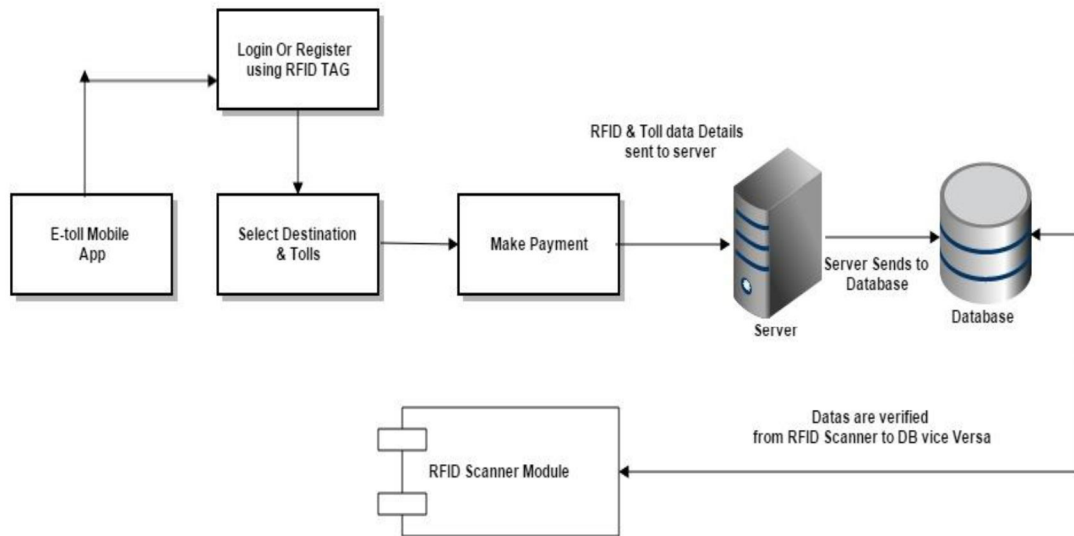


Figure 2.1 BLOCK DIAGRAM

B. Automatic Toll Gate System Using Advanced RFID Technology

Most of the Electronic Toll Collection (ETC) systems around the world are implemented by DSRC (Dedicated Short Range Communication) technology. Here the concept is of automatic toll tax payment system. The amount transaction information is sent to the cell phone through GSM modem technology. It is an innovative technology. Here in this concept, the data and information is easily exchanged between the people and toll authorities, therefore enabling a more efficient toll collection by reducing traffic and avoiding possible human errors.

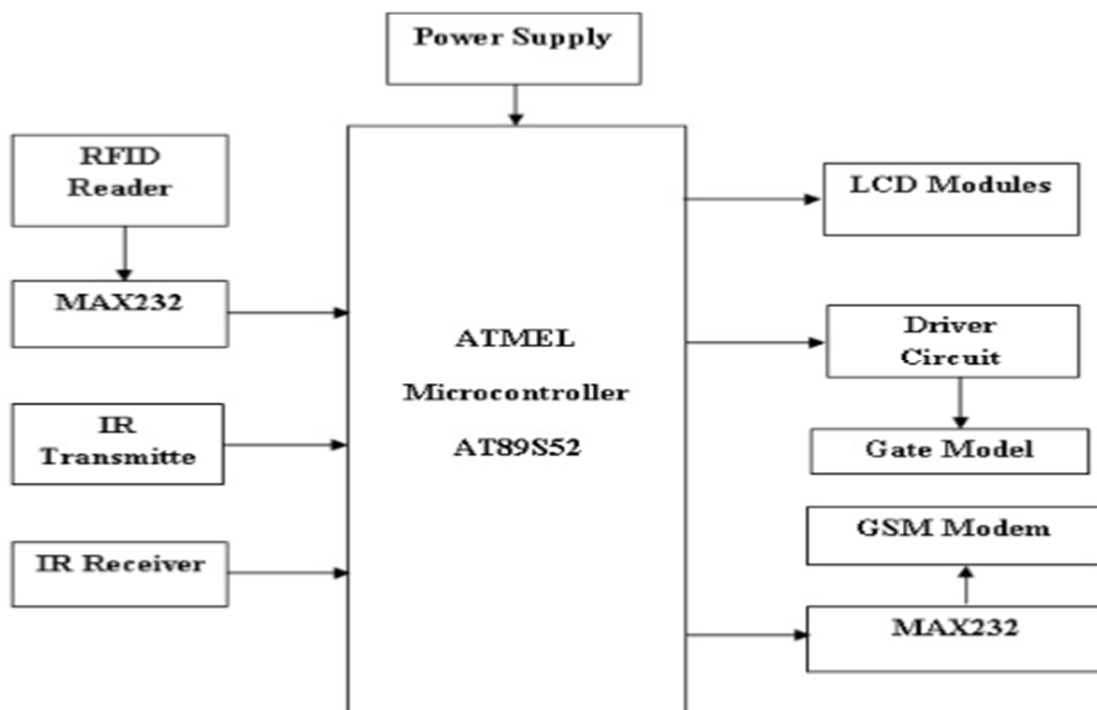


Figure 2.2 BLOCK DIAGRAM

C. Drawbacks Of Existing Method

- 1) Traditional toll collecting is a time consuming method.
- 2) Less accuracy, human users may make mistakes.
- 3) This method typically requires highly reflective license plate.
- 4) Corruption of money and payment in toll booths.
- 5) Handling of records.

III. PROPOSED SYSTEM

To overcome the traffic, delay of the existing manual method, proposed system is used. Automatic toll collection system provides the payment of the toll booth and the billing automatically. The proposed system will reduce the traffic in the vehicle queues, congestion and delay. This method is done by using RFID reader and the infrared proximity sensor. This sensor will sense the vehicle which enters the toll plaza. The RFID tags are used to read the number plates. The RFID receiver is placed in the vehicle. The RFID transmitter is placed in the toll plaza. It will sense the vehicle and collects its database and the amount is deducted. If the vehicle with no RFID receiver, the toll plaza gate will close automatically. If the amount in the account is insufficient, it cannot deduct the money. It will provide unique RF tag number. By using this number, if the vehicle is stolen can be found by checking with the given reference number. GSM module will sends the deducted message to the owner’s mobile number.

A. Block Diagram

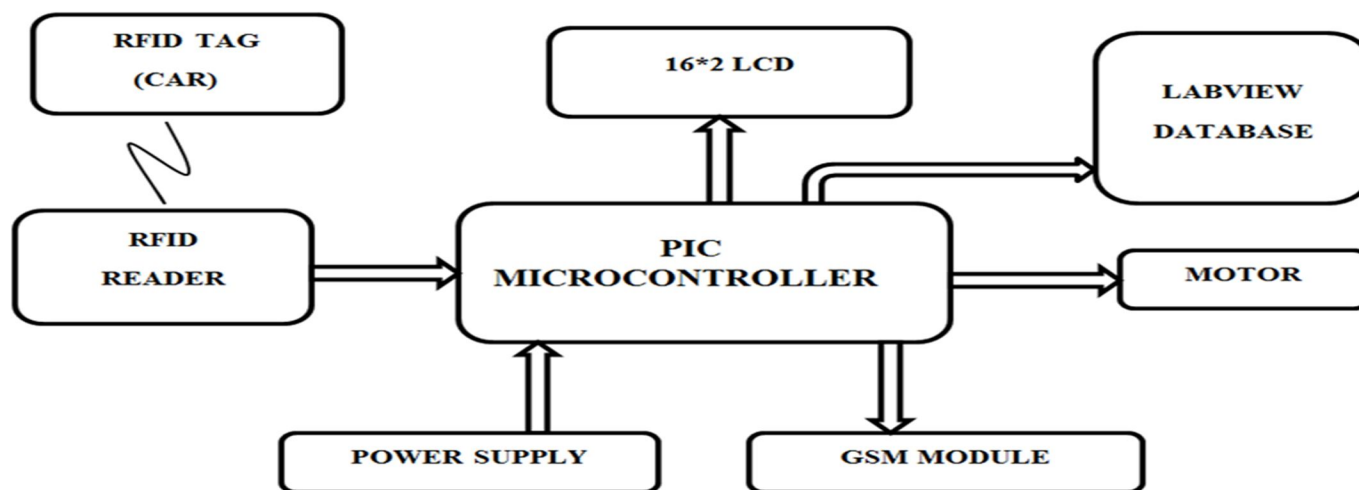


Figure 3.1 BLOCK DIAGRAM

B. Description

- 1) *Microcontroller*: It is the heart of complete system. They are used in automatically controlled products and devices, such as automobile engine control systems, remote controls, office machines and other embedded systems.
 - a) It reads the RFID card number from the RFID reader. This sends the data to the LCD so that the person operating can read various informative messages.
 - b) It also sends the data to the motor or buzzer depending upon the RFID card number and the balance.
- 2) *Lab View*: It is the main controlling software used. It holds the database of all the vehicles registered.
- 3) *RFID Cards*: Used for applications as access control in security system, cashless payment etc.
- 4) *RFID Reader*: A device which is used to interrogate an RFID tag.
- 5) *16*2 LCD*: It displays all the system generated messages coming from the controller. It provides interactive user interface. It also displays the present status of the system.
- 6) *Power Supply*: It supplies various voltage requirements of each units.
- 7) *Motor*: It is an IC which is used to drive the motor.
- 8) *Global System for Mobile Communication (GSM)*: It supports data transfer and voice calling in the range of 9.6kbps along with the transmission of SMS. It uses three digit wireless telephony technologies (TDMA, CDMA& GSM).It operates at frequency of 800MHz.

The main system components are:

- a) RFID tagged vehicle
- b) Toll booth equipped with RFID scanners
- c) Vehicle registration plate
- d) Centralized database
- e) Cameras
- f) Laser transponders

C. Software Used

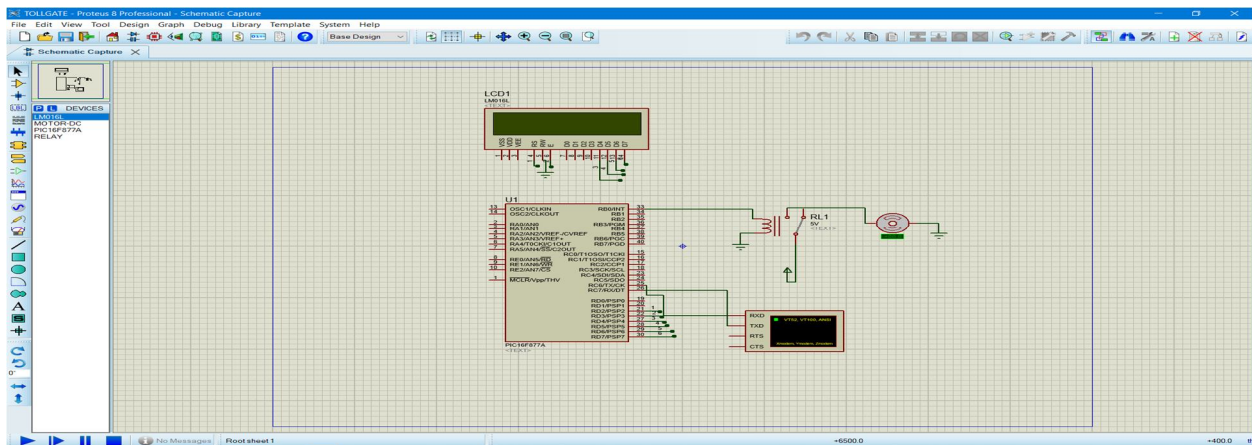
- 1) Proteus 8
- 2) MP Lab

D. Hardware Used

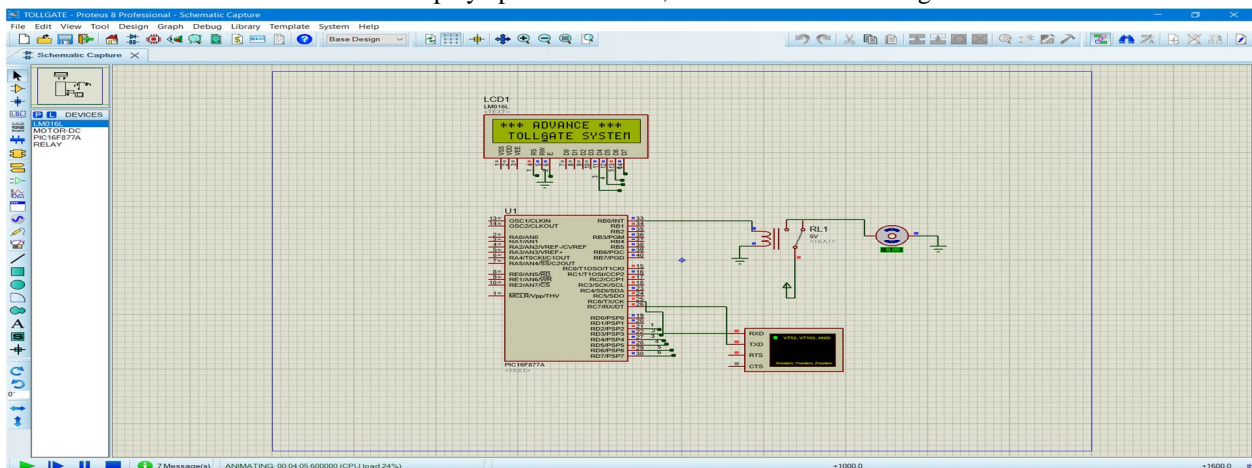
- 1) Microcontroller
- 2) RFID
- 3) GSM Module
- 4) LCD display
- 5) Motor driver
- 6) Power supply unit
- 7) Relay

IV. SIMULATION

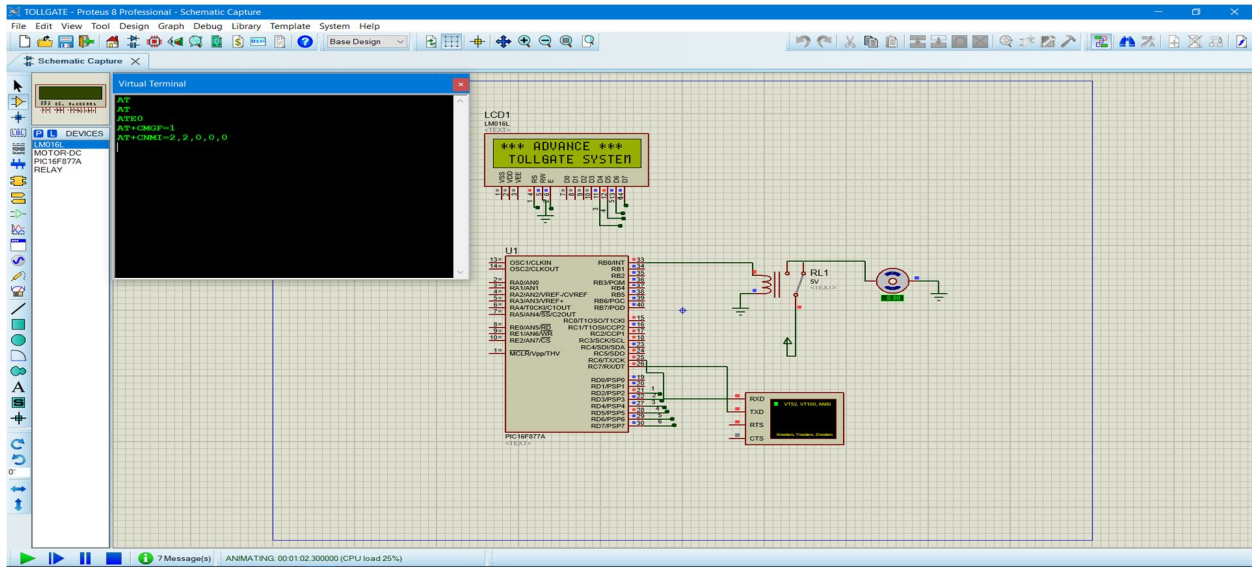
Initial simulation window



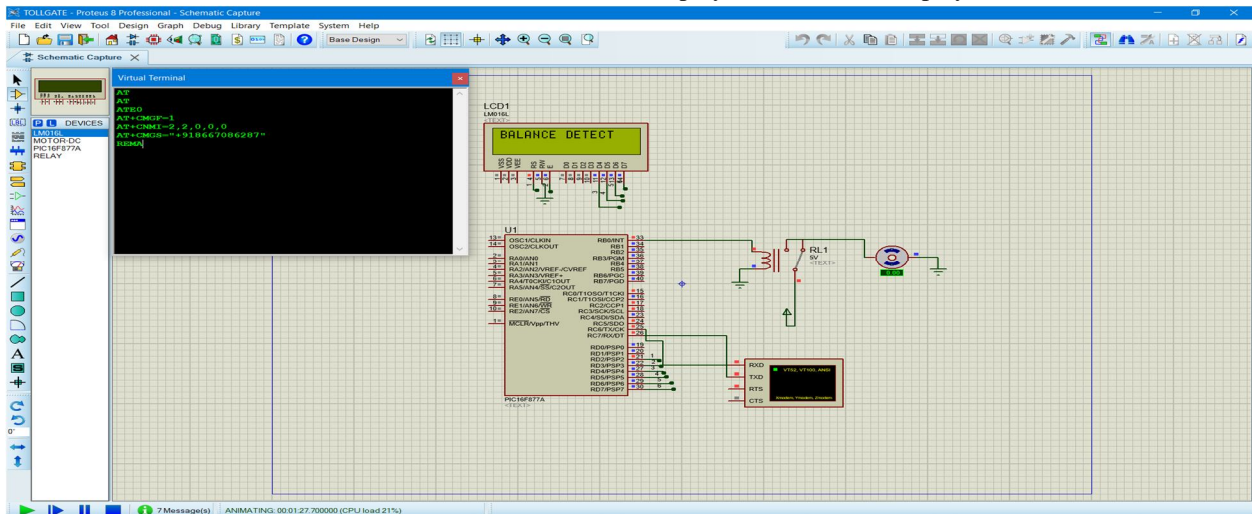
When the play option is clicked, the motor starts running.



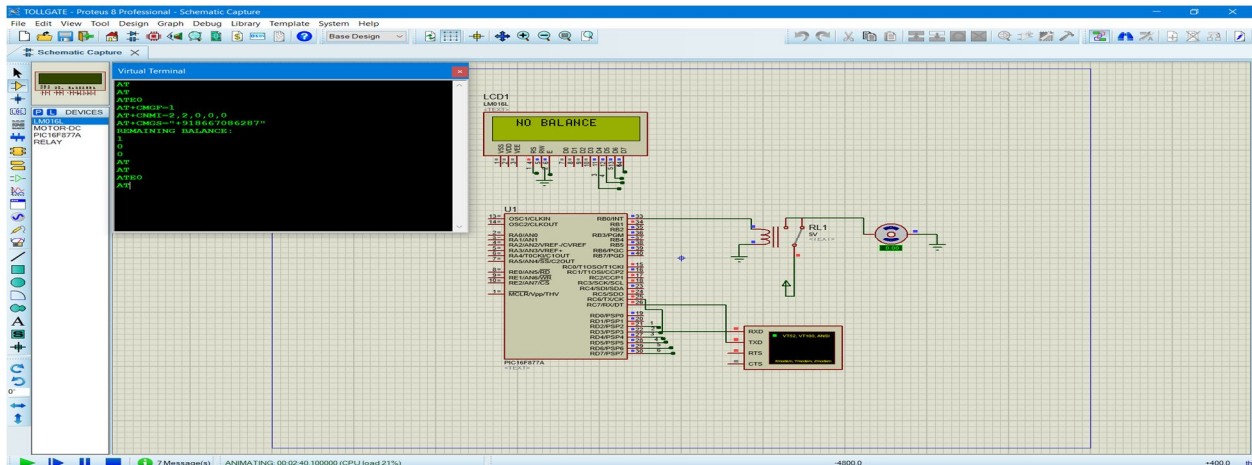
Once the motor starts running, debugging is done in the virtual terminal by entering the unique ID of the vehicle as input.



The amount is detected from the user account and displays it in the LCD display of the toll booth.



The motor stops running when the user account has insufficient balance for the payment of tax. The LCD available will display "NO BALANCE".



V. CONCLUSION

This method is cost efficient and best efficient way for transportation of vehicles in the toll plazas. It will not improve the passage ability of expressway but the technology level of charge is improved. Electronic toll collection system using RFID is a very good way to measure, to reduce costs and fees simultaneously. Additionally it will reduce noise and pollutant emission from vehicles of toll station. In the proposed method, Electronic Toll Collection (ETC) is used. Thus the proposed system is more efficient toll collection by reducing traffic and eliminating possible human errors. An anti-theft solution system module is used to deduct the theft vehicle, this will result in giving a higher possible security on the roadways.

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