
“AUTOMATIC TOLL COLLECTION SYSTEM BY GSM BASED”

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ABSTRACT: *In this paper design a module for the automation in toll tax payment using Radio Frequency Identification (RFID) systems and Load cell technology. Design of system, which automatically identifies an approaching vehicle to the toll plaza and record vehicles number and time to the system. It authenticates the owner of vehicle .If the vehicle belongs to the authorized person, it automatically opens the toll gate and a predetermined amount is automatically deducted from its account. This translates to reduced Traffic congestion at toll plazas and helps in lower fuel consumption and save approximately Rs 300 cares/year.*

Keyword: Microcontroller, IC L293D, DC MOTOR, LCD DISPLAY, ATCSR, RFID Reader, RFID Tag, Toll Collection, GSM, Camera.

1. INTRODUCTION

Manual toll based systems is time consuming and hectic. By using RFID toll system can be improve. The module of RFID system consists of a transponder, reader/writer, antenna, and computer host. The transponder is also known as the tag is a microchip combined with an antenna system in a compact package. The microchip contains memory and logic circuits to receive and send data back to the reader. These tags are classified as either active or passive tags. Active tags have internal batteries and passive don't. These tags are powered by the electromagnetic signal received from a reader at a time. The received electromagnetic signal charges an internal capacitor on the tags, which in turn, energies the chip.. The advantage of the transponder in this module over the previous system is that it reads only one target a time. The RFID tag is used as a unique identity number for account of a particular user. When a vehicle drives through the toll plaza, its driver has to scan his RFID tag. If the identity number is matched with the one already stored in the system data, the toll amount is deducted from his account. After this, the vehicle gets quickly access to drive through. This RFID based toll system also has some additional features, such as old user can recharge his account balance like mobile cell and new user can register him with the system. In the situation of tag is not identified the user then image of car is captured by camera and carryout the

2. THEORY OF TOLL COLLECTION

Any structure needs a huge amount of financial investment in building highways and roads are also not an exception. From the past money are collected from the taxes which may be direct or Indirect method. Indirect method, the expenses are compensated either by tax payment on fuel or

by budget allocation from the national income. The drawback of this Indirect method is that a number of tax payers, who do not use some of the roads and ways have to pay extra revenue. However in the other system called direct method, the tolls are taken directly from the drivers passing through the road or ways. The other three main reasons why tolling or road pricing, is implemented are listed below.

2.1 Finance/Revenue Generation

To get back the costs of building, operating and maintenance of roads, stateways, highways etc. Road pricing is becoming a more appealing means of funding transportation. Moreover, toll financing results in quick recovery of revenue that had invested.

2.2 Demand Management

To restrained the growth in demand on the transportation system, and to promote more use of public transportation and carpooling.

2.3 Congestion Management

The Congestion Management Process provides for the effective management of new and existing transportation facilities through development and implementation of operational and travel demand management strategies, and by providing information to decision-makers on system performance and the effectiveness of implemented strategies.

3. TYPES OF TOLL COLLECTION SYSTEMS

3.1. Open Toll System

In an open toll system, all vehicles stop at various locations along the highway to pay a toll. But it is suffered from drawback that driver can exist and re-entering the highway, traffic jam etc.

3.2. Closed Toll System

In this system vehicle owner has to collect a ticket when entering the highway. In some cases, the ticket displays the toll to be paid on exit. Upon exit, the driver must pay the amount listed for the given exit. In case of ticket lost, a driver must typically pay the maximum amount possible for travel on that highway.

3.3. Electronic toll collection System

no toll booths, only electronic toll collection gantries at entrances and exits or at strategic locations on the mainline of the road. as soon as the vehicle reaches near the Transponder the amount is deducted and the gate will be opened customer account which is debited for each use of the toll road.

4. DRAWBACKS OF EXISTING SYSTEM

The above methods for collecting toll tax is time consuming method. Chances of escaping the payment of toll tax are there. It leads to queuing up of following vehicles. Suppose the manual toll collection system is very efficient then for one vehicle to stop and pay taxes total time taken is 50 seconds. And suppose 200 vehicles cross the toll plaza. Then, time taken by 1 vehicle with 60 second average stop in a month is: $50 \times 30 = 1500$ seconds Yearly total time taken = $1500 \times 12 = 18000$ seconds = 5.0 hours .On average each vehicle that passes through the toll plaza has to wait 5.0 hours in engine start condition yearly. The figure is staggering if on an average we take 200 vehicles pass through the toll plaza each day, then yearly 72000 vehicles pass through the toll plaza. And each year 72000 vehicles just stand still for 5.0 hours in engine start condition thereby aiding pollution and wasting fuel and money. This study is if the system is very efficient but what if the vehicle has to wait for 5 minutes? This is a figure considering one toll plaza. If considering 50 toll systems the above figure will drastically increase and the wastage of fuel, money will increase and pollution will also increase.

5. PROPOSED TOLL SYSTEM

Each vehicle will be given an RF Transmission tag containing a unique ID . This unique ID can be assigned to the vehicle by authorize body of country like we can have this ID as the vehicle's number. This tag will continuously emit RF signals. When the vehicle will reach in the rang of

toll booth the RF receiver will detect these RF signals. This signals are amplified and provide for microcontroller. This microcontroller will display the ID on LCD. Now, with the help of PC interface unit the data collected is passed to PC through serial port. Software developed will show all the details about the vehicle on the screen at the toll booth. All the details like time, date address and ID will be stored in the database. Based on these details a report will be prepared. Message of less balance ,payment deduction or prepaid the account, etc. will be sent to vehicle owner by using GSM module present at toll booth.



Figure 1: Proposed System Model.

6. Hardware

6.1 Hardware Requirements

1.Microcontroller	:ATMEGA16
2.GSM module	:SIMCOM300
3.LCD display	: [16×2] Display
4.Rfid reader	
5.D.C. motor	: 6V 150rpm
6.IC 7805	: Voltage Regulator of ±5V DC.
7.adaptor	:12V DC
8.Power supply	:DC 5V Regulated

6.2. Block Diagram

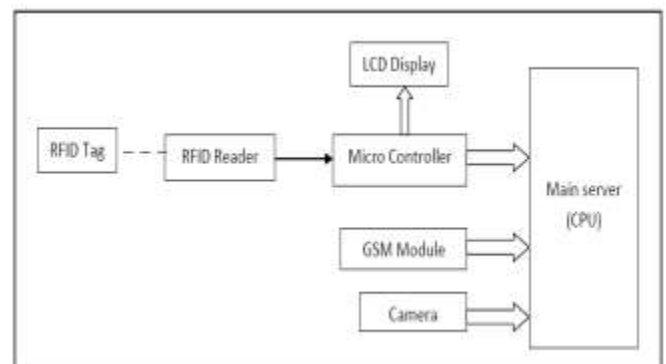


Figure 2: Automatic Toll Collection System using RFID

6.3. PIN CONFIGURATION:

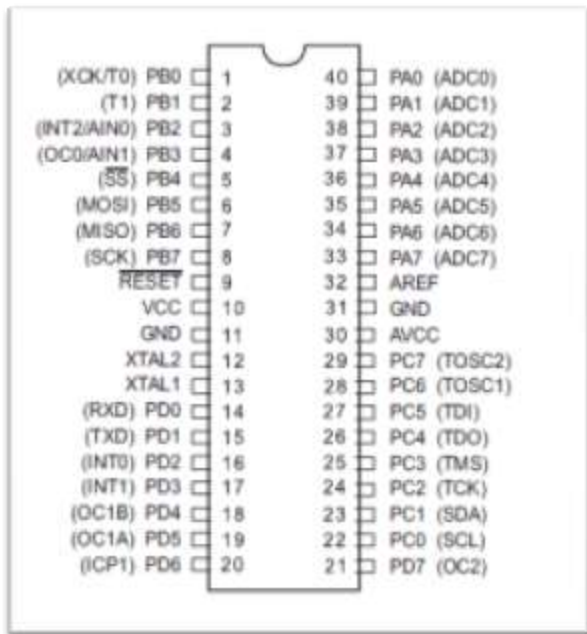


Figure 3: PIN Diagram of ATmega 16

6.4. REGULATOR IC 7805

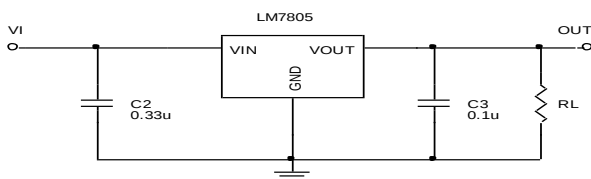


Figure 4: Regulator IC 7805

6.5. ARCHITECTURE

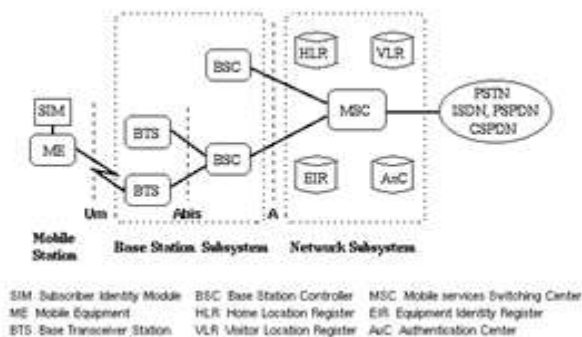


Figure 5: General Architecture of GSM network

6.6. CONNECTION BETWEEN MICROCONTROLLER (MC) AND GSM

For connection, Receiver Pin (Rx) of Microcontroller is connected to the Transmitter Pin (Tx) of

GSM Module and Transmitter Pin (Tx) of Microcontroller is connected to the Receiver Pin (Rx) of GSM Module. Also Ground Pin (GND) of both are connected

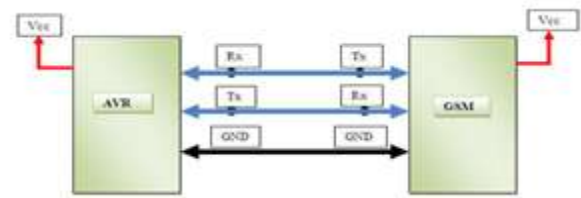


Figure 6: Interfacing of ATmega16 with GSM Module

7. WORKING OF AUTOMATIC TOLL COLLECTION:

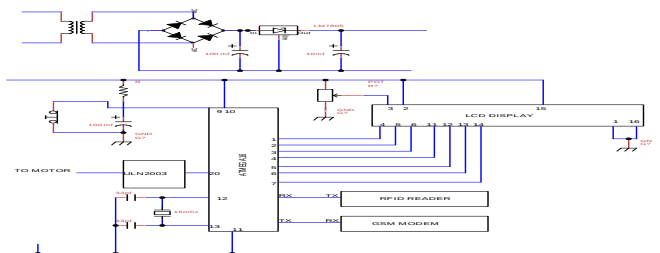


Figure 7: Circuit diagram Of RFID System

In RFID based toll deduction system a vehicle arrive in toll plaza range antenna send signals to tag and activate the tag, tag send back information to antenna. As data receive to antenna it sends to central server database. Server checks information of account consumer/driver, if account have credit more then required tax then tax is subtract from account and driver will pass the toll plaza. A transaction message also sends to consumer/driver that how much tax ispaid and remaining balance of account. Passing of vehicle and transaction of tax is completed within short time. The central server stores all information of transaction, which contain location of toll plaza, date, time and total amount payment of tax. If the credit of account is low then system generates In RFID based toll deduction system a vehicle arrive in toll plaza range antenna send signals to tag and activate the tag, tag send back information to antenna. As data receive to antenna it sends to central server database. Server checks information of account consumer/driver, if account have credit more then required tax then tax is subtract from account and driver will pass the toll plaza. A transaction message also sends to consumer/driver that how much tax is paid and remaining balance of account. Passing of vehicle and transaction of tax is completed within short time. The central server stores all information of transaction, which contain location of toll plaza, date, time and total amount payment of tax. If the credit of account is low then system generates RFID can provide an effective deterrent against car theft. A solution for this type I characterized by the following:

Attaching a tag to vehicle to be monitored for theft. Reading the tag ID at the vulnerable points (for example, at exit points, during starting of the ignition of an automobile, and so on). An application for this is automotive anti-theft immobilization. In this commercially deployed solution, an embedded reader located inside the car (for example, in the steering wheel) becomes activated when a driver turns the ignition key. This reader then attempts to read the valid unique code from a tag in its vicinity.



Figure 8: RFID Module

8. ADVANTAGES

8.1 Financial leakage control

As per survey it is clear that, for every year their will be the loss of 300crores of money from the gross toll collection value which is estimated up to 1500 crores. By utilizing fully automatic mechanism we can nearly able to control this financial loss.

8.2 Fuel saving

Due to automation of toll plaza their will be large reduction in the rush at toll plaza which will cause indirectly the saving of fuel.

8.3 Reduced man power

The basic aim of Automation concept is to reduce the man power & to increase the accuracy of the system. So we can able to achieve the same with our on built concept.

8.4 Reduced time for completion of process

The present system we have in work today consumes nearly 1 minute for each vehicle to complete the process of toll payment. With our automated toll plaza we can able to reduce the time consumption nearly up to 40-42 sec. which will be very important in today's era.

8.5 Cash free operation

Due to smart card mechanism that we have used for the payment. There will be no necessity of hand to hand cash transaction. So causing reduction in money loss.

9. DISADVANTAGES

9.1 Load sensing for long length vehicle becomes critical.

The load cell plate we can use in set up of project in actual is approximately 50 feet(15-16 meters). But if the vehicle having the length more than 50 feet come on the load cell plate then the system will not able to weigh the vehicle correctly. To overcome this problem we may keep the separate lane for such vehicles with fixed amount of toll amount.

9.2 If RFID fails whole system fails.

The RFID system we are here using for detecting the vehicle number means the vehicle identity which we are further using for storing into memory & also to display on the LCD. If the RFID fails to detect the correct identity of the vehicle the data regarding the vehicle will be wrong which will may create many problems & system fails because without vehicle identity load cell will not weigh the vehicle

10. CONCLUSION

The development of RFID based toll deduction system is proved that RFID technology have good results in implementing in different applications but the standard company have develop the framework of applications. In this toll deduction system RFID is used permitted frequency bands by using high power levels, then system will be successful. The companies which have permissions from the authorities because tag is use the bank account and registration numbers of vehicles. For this application passive tag are better then to active tag because of low cost and also radio signals environmental factors. For the future work RFID speed controlled system vehicle can be save from the accident due to high speed. Some works will be done auto steering system of vehicle which can be controlled by using RFID technology installed on the complete track. This will be beneficial if bus driver have serious problem of heart attack or other disease suddenly then control transfer to automatic RFID communication system. Some work must be on RFID communication range between the Reader/antenna and tag is limited in to few meters it will be extend to long range.

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