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## **AUTOMATIC TOLL COLLECTION SYSTEM USING RFID AND GSM TECHNOLOGY**

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### **Abstract:**

**Electronic toll collection systems worldwide typically rely on Dedicated Short Range Communication (DSRC) technology. This project proposes an Automatic toll collection system that utilizes GSM module technology to transmit transaction information to user's cell phones. This innovative approach aims to streamline toll collection on expressway networks.**

**The primary objective of this project is to design a system that automatically identifies approaching vehicles, records their number and time of arrival. If the vehicle belongs to an**

**authorized person, the system will automatically open the toll gate and deduct the required amount from their account. However, in the event of an illegal entry, the system will register the violation and emit a warning sound. Each vehicle will be equipped with an RFID tag affixed to the windshield, containing a unique identification number. When a vehicle passes through the toll gate, the corresponding toll amount will be deducted from the prepaid balance associated with the tag. The updated balance can be viewed on an LCD display. If a user's balance is insufficient, it will become negative. By facilitating data exchange between motorists and toll authorities, this system enhances toll collection efficiency by reducing traffic congestion, minimizing processing time, and eliminating potential human errors.**

**Keywords: modem, authorized, toll booth, motorists, authorities, human error.**

### **I. INTRODUCTION**

Automatic Toll Collection System Using GSM Technology and Arduino. This System is mainly based on the RFID Technology. Toll collection is Tax paying System by the vehicles at Highways. It Recognizes the authorized vehicles with the unique ID using a Tag. The database is taken from the RTO office, where the people get their details and vehicle register.

As, it is the current Toll System, which is time consuming, fuel consuming and an Inconvenient process. By eliminating these possible errors our project deals with the Advanced Toll Collection by using GSM and RFID Technology. The Average time taken by the Advanced Toll plaza is around 45-48 secs.

It has been evolved from many processes of toll collection, where the method includes Mainly Human activities and possible errors. By eliminating all the possible mistakes, this advanced Toll System helps to save the time and get the authorized user and vehicle to cross the toll.

The Advanced Toll System starts with the Motion Detection of a Vehicle By Infrared Rays, then RFID reader reads the Tag which is on the windshield of Vehicle. By the process Arduino the Tag details get verified by the database. If the details exists then it is an Authorised vehicle and a Green LED glows else a Red LED

In case of green light the Further process will be continued like Balance verification and SMS message to user's mobile. This process exists at every Highway Toll Plaza. Every Authorised vehicle go through the whole process else the vehicle will be viewed by the Higher Officials issued by the Regional Transport Office (RTO) of Respective Government.

### **II. RELATED WORK**

The purpose of this literature survey, is to know the work behind the project. And developing a system according to the requirements, the prior thing is to know the present system and observe the faults. Then, to begin a research project the most important

is understanding the topic automatic toll collection system, as this will help the researcher with needed additional information on the methodologies and technologies available and used by other researchers around the world. This literature work will provide the information regarding the project that has developed from the defects observed in the present system. And a better system compared to the results of the methodology that exists.

According to Aniruddha Kumawat and K shithija Chandra(2018) more ATCS is an Automated Toll Collection System using RFID and GSM, used for collecting tax automatically.

In this project we identify with the help of radio frequency. Every vehicle consists of specific ID ,which is unique from each other. This ID is placed on the wind-shield of the vehicle ,it will be referred by the RFID Reader and this process is captured by the camera of safe entry and exit.

According to Khadijah Kamarulazizi and Widad Ismail, (2019) this project focuses on an electronic toll collection (ETC) system using radio wave frequency identification (RFID) technology. This is a widely used process for Authentication of vehicles and the users, for safe and secure entries and avoid intruders and illegal entries.

Prof. Swapnil Gholap<sup>1</sup>, Sahil Mondkar<sup>2</sup>, Swapnil Khaire<sup>3</sup>, Mayur Mhatre (2020) In this each user is assigned a unique RFID card number for user identification. And each user will have their own unique username in RFID card for verification at RFID reader to identify the individual by RFID card number and username.

### III. WORKING PRINCIPLE

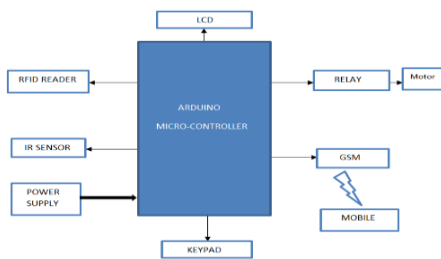


Fig:1 Block Diagram of Working

**A.METHOD:** The Automatic Toll Plaza Collection System with Advanced Technology Using GSM with a micro-controller. As there are two IR sensors, First one detect the Motion of the Vehicle then the RFID Reader will get activated and fetch the required details from

the Tag ,which is placed on windshield of a vehicle. The Controller will check the details of the user with the database from the RTO office. If the Vehicle is authorized then the RFID tag Recharge will get checked, if there is enough balance the vehicle move forward otherwise the required amount should be paid by the user. After balance verification the user get the message to their mobiles and IR sensor at end.

If the vehicle is unauthorized then ,it will be viewed by the higher Authorities.

**B.FLOWCHART:** According to the Flow chart ,at first the Vehicle enters the Toll plaza passing the sensor, then the RFID reader will read the all details of the vehicle by the Tag. The RFID reader is an Electronic Device that has consists of antennas and Transceivers that emit radio waves and receive signals back from the RFID.

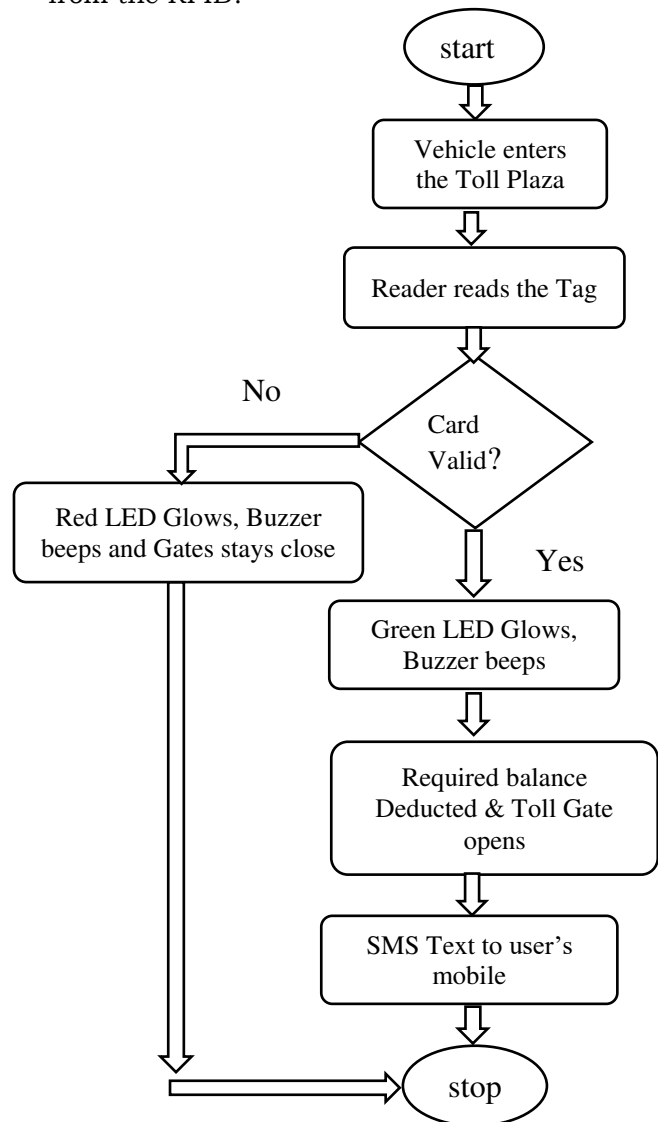


Fig :2 Flowchart

There are two possible ways i.e., either the tag or card is a valid or not. If it is Invalid a Red Buzzer will glow and the Buzzer beeps and gates get closed.

If the card is valid then it will go through the entire process like, Balance verification, the user has to pay the money through mobile and the user get the SMS to their mobile where, it will be indicated by the Green light and Beep Buzzer and the process ends Gates get opened.

At first, the vehicle enters the toll plaza by passing through the sensor. Then reader reads the tag, if the card is valid a green light glows and the buzzer beeps twice which indicates that it is a authorized vehicle. In case, the card is not valid a red light will glow, that indicates the user is unauthorized and an intruder, the gates will get closed.

The valid card will be get into the further process, i.e., the required amount get deducted from the balance or else the amount to be paid at the toll itself. And the SMS will be sent to the user, the gate gets open. Every vehicle will be Authenticated and verified by the process to reduce the illegal entries and intruders through the Toll plaza.

### C.COMPONENTS:

**Arduino UNO :** The whole process is Developed in this Micro-controller by using the software Arduino IDE. All the components are under the control of microprocessor, a sequence action get performs.

**IR Sensor :** By sending and receiving the Infrared rays after hitting an object, the motion get detected. This action helps vehicle to enter and exit the Toll plaza.

**RFID Reader :** This reader will get the information of the vehicle from the RFID Tag that is placed on the every wind-shield of the vehicle. Radio wave signals get transmitted and received by the Reader, Antenna and Transceiver.

**GSM Module :** This modem is used to send the SMS to the respected vehicle owner regarding money deduction. It will send fast message with solid signal Frequency band.

**Servo Motor :** The servo motor is used to allow and stop the vehicle as it rotates 180 degrees. As it controls the exit of every vehicle either to stop or move.

**LCD :** Liquid crystal diode, It is used to show the transactions of the user at the toll plaza. It

helps in eliminating the possible errors of Transaction.

### IV. RESULT

The project Automatic Toll gate system by using GSM module and Arduino, we have arranged the IR sensors, one at the front and another at back. These will detect the motion by infrared rays. A servo motor is connected for valid entries. These components are connected to the Arduino for the whole process and power supply is given to the Arduino.

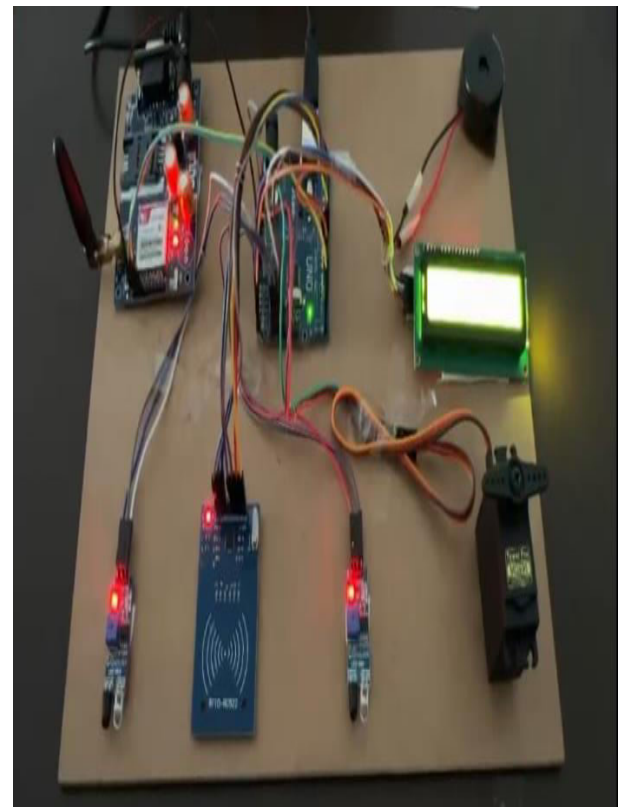


Fig:4.1 Automatic Toll collection System

Using card and placing in front of sensor is the first step of the whole process. We are using two RFID tags, where one card is authorized and another is unauthorized. For sufficient balance, a Green light will blink, Red light for insufficient balance. And an immediate buzzer sound will ring for the invalid entry.

## VII. CONCLUSION

Our project, Automatic toll Collecting System using GSM module and Arduino, In this case the IR sensor uses Infrared signals for communication purpose. RFID Reader, Antenna and Transceiver used for the verification and Authentication of the vehicles. And the GSM Modem for the communication purpose, which helps in safe transaction. Servo motor will help the Toll system with the entry and exit of the vehicles. The whole process of the Toll System get controlled by the microprocessor. This can be done by the software using Arduino IDE. Thus, by increasing the range and features of the components more reliable system can be achieved in further implementation for safe and secure Toll systems with more convenience and comfort process.

## VIII. FUTURE SCOPE

In Further process of the Advanced Toll collection System, this can be developed into controlling of overall characteristics of a vehicle. AS Additional features Overspeed control, vehicle weight , vehicle tracking system, accident prevention system at Highways many programs can be implemented. As, Infrared range is short by increasing the range and RFID Authentications with advanced technology these improvement in the characteristics of components can also helps in improvement of the Toll system. Thus, by adding additional features the Toll collection system can become more secure ,less time consumption, fuel consumption and safe for the Authentication of the vehicles as well as the user's.

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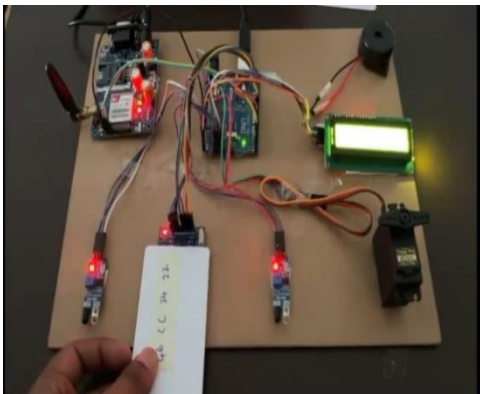


Fig : 4.2 RFID Reader reads the details on the Tag

This process will determine the Authorised vehicle, by verifying the database collected from the RTO. Further, it will check the sufficiency of balance and will be deducted. In case, of insufficient balance the user has to credit the required balance and an immediate SMS will be sent to the user.

## V. ADVANTAGES

1. It Saves the Time.
2. Authentication and Calculation.
3. Human errors can be reduced.
4. Smooth Flow.
5. Convenient.
6. Reduced Management Cost.
7. Theft Vehicles Can Be Detected.
8. Instant Services.
9. Pollution is reduced to a large extent.
10. Wastage of money reduced.

## VI. APPLICATIONS

1. RFID automated gate project can be used in the Toll collection plazas on Highway.
2. Automatic Vehicle Identification.
3. Video Enforcement System.
4. Vehicle Tracking.
5. RFID based automatic gates can be used in octroi collection booths for faster access.
6. Authentication of vehicles.
7. Used in Vehicle Number Recognition system.
8. Can be used in authorization of drivers.

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