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RFID-BASED HIGHWAY TOLL TAX COLLECTION

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Abstract - RFID (Radio Frequency Identification) based highway toll tax collection systems have gained significant popularity in recent years due to their efficiency, accuracy, and ease of implementation. This abstract provides an overview of the RFID-based toll tax collection system, highlighting its benefits and key components. The traditional toll tax collection process often involves manual collection of cash or tickets, leading to delays, long queues, and increased chances of errors. The RFID-based system offers a streamlined and automated solution to these challenges. It utilizes RFID technology to identify and track vehicles passing through toll booths, enabling quick and accurate toll tax collection. The key components of the RFID-based toll tax collection system include RFID tags, RFID readers, a backend database, and a toll plaza infrastructure. Each vehicle is equipped with an RFID tag, which contains a unique identification number and other relevant data. As a vehicle approaches the toll plaza, the RFID reader at the toll booth wirelessly scans the RFID tag and captures the necessary information.

Key Words: *GSM Module , SMS,RFID ,LCD Display*

1. INTRODUCTION

We all know that transportation is the foundation of any country's economy. The development of transport has led to the freedom of movement, industrialization of products and services, and a better way of life where we achieve high productivity, repetition and relationship. In fact, the economy of a country is closely related to the quality of transportation. It solves some problems such as the increasing number of cars on the roads, traffic jams, accident rates, and pollution. All businesses with different functions use different modes of transport. Therefore, increased transportation has a direct impact on the country's productivity and economy. Reducing the costs of transporting goods to the production site and bringing the finished product to market is an important part of the competitiveness of the enterprise. Auto Toll is a tool that allows automatic toll collection. Such systems are essential for the automatic transmission stations scientists are working on for use on many highways, bridges and tunnels. ATP can determine if the vehicle is registered and then notify the control center to prevent violations, withhold funds and participate in the account. The great thing about this ATP system is that it can clear congestion in call centers especially when traffic seems higher than normal.

LITERATURE SURVEY:

1) Annapoorna Shetty RFID-BASED TOLL PLAZA SYSTEM August 2022 RFID-based toll plaza system is the solution to the manual toll collection method. This method gets information about the vehicle passing through the toll gate and deducts toll tax from the owner's account. This can allow the vehicle to move straight without stopping on tollgates. This reduces traffic on highways where streams of traffic increase and cause traffic jams. This leads to a convenient way for the tollgate transaction and reduces waiting time, fuel consumption and also pollution levels.

2)Sabbir Ahmed, Tamkin Mahmud Tan, Anna Mary Mondol, Zawad Alam, Noshin Nawal, Automated Toll Collection System Based on RFID Sensor 2019 In this paper, RFID-based Automated Toll Collection System is introduced as a solution of the traffic problems and also to maintain transparency in the toll collection system. The proposed system aims to make a digital toll collection system that can eliminate the delay on toll roads, toll bridges and toll tunnel without cash and without requiring cars to stop. This paper focuses on an electronic toll collection system that uses radio frequency identification (RFID) technology to identify a vehicle specifically for collecting toll. The proposed RFID system uses tags that are mounted on the digital number plate of the vehicles, through which information embedded on the tags are read by RFID readers.

3)Sajal Menon, Don Tommey,**:** "Automated Toll Collection System Using RFID" 2013 In this we do the identification with the help of radio frequency. A vehicle will hold an RFID tag. This tag is nothing but unique identification number assigned. This will be assigned by RTO or traffic governing authority. In accordance with this number we will store, all basic information as well as the amount he has paid in advance for the TOLL collection. Reader will be strategically placed at toll collection center. Whenever the vehicle passes the toll naka, the tax amount will be deducted from his prepaid balance. New balance will be updated. Incase if one has insufficient balance, his updated balance will be negative one. To tackle this problem, we are alarming a sound, which will alert the authority that this vehicle doesn't have sufficient balance and that particular vehicle can be trapped. As vehicles don't have to stop in a queue, it assures time saving, fuel conservation and also contributes in saving of money

4) toll scheme has been introduced by Arthur B. Chiappetti to exclusively support authorized customers. Given automated user authentication, manual pickup operators are expected to control pickup operations. No forensic documentation is accessible for toll infringers because the toll company will not register the toll infringers' numbers plates. 'Patent for the collection of highway service by Bernard N. Riskin and Lambertville N.J.' Patents.

METHODOLOGY:

The RFID-based highway toll tax collection system using a GSM module consists of several components working together. These components include RFID tags, RFID readers, a GSM module, a backend database, and a toll plaza infrastructure. Each vehicle is equipped with an RFID tag, which contains a unique identification number and other relevant data. The RFID tags can be embedded in windshields or attached to vehicles in a suitable location. These tags should be securely affixed to ensure proper functioning.RFID readers are installed at toll booths or gantries along the highway. These readers are responsible for wirelessly scanning the RFID tags of approaching vehicles and capturing their information. The readers are connected to a central control unit or a backend server for data processing. A GSM module is incorporated into the toll tax collection system to enable communication between the toll plaza infrastructure and the backend database. The GSM module uses the cellular network to transmit data and commands to the database server securely.

OBJECTIVE:

Minimization of fuel wastage and reduced emissions by reducing deceleration rate, waiting time of vehicles in queue, and acceleration.
For Toll Operators, the benefits include lowered toll collection costs, better audit control by centralized user account and expanded capacity without building more infrastructures.

GENERAL TERM

RFID is an electronic data capture device that can be used for electronic identification, tracking, and information stored in tags. The radio frequency reader scans the symbol for information and sends the information to a database that stores the information contained in the
document. The main components of the RFID system are tags, readers, and data.

RFID TAG:

An RFID tag, or transponder, consists of a chip and an antenna. A chip can store a unique serial number or other information based on the tag's type of memory, which can be read-only, read-write, or write once read-many(WORM). The antenna, which is attached to the microchip, transmits information from the chip to the reader. Typically, a larger antenna indicates a longer read range. The tag is attached to or embedded in an object to be identified, such as a product, case, or pallet, and can be scanned by mobile or stationary readers using radio waves.

RFID READER:

In order for an RFID system to function, it needs a reader, or scanning device, that is capable of reliably reading the tags and communicating the results to a database. A reader uses its own antenna to communicate with the tag. When a reader broadcasts radio waves, all tags designated to respond to that frequency and within range will respond. A reader also has the capability to communicate with the tag without a direct line of sight, depending on the radio frequency and the type of tag (active, passive, or semi-passive) used. Readers can process multiple items at once, allowing for increased read-processing times. They can be mobile, such as handheld devices that scan objects like pallets and cases, or stationary, such as point-of-sale devices used in supermarkets.

BLOCK DIAGRAM:

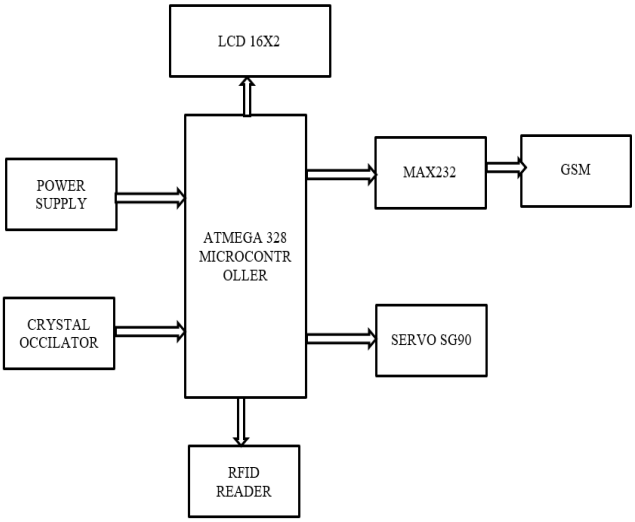


Fig 1 Block Diagram

WORKING:

This System is designed based on RFID, radio frequency identification technology and GSM to automate the collection of toll taxes on highways, RFID basically consists of two type RFID tags and RFID reader so here first RFID tag will contain a unique identification number that is associated with the vehicle and owner account information like owner nam ,etc. Next RFID Readers will detect and read the information stored on the RFID tags as vehicles pass by. When a vehicle with an RFID tag approaches an RFID reader, the reader scans the ta and retrieves the unique identification number. So here we have used the GSM module which will allow it to communicate with a central server database the GSM module uses the cellular network to transmit date and receive instructions. The RFID reader sends the scanned information along with the location and timestamp o the central server through the GSM Module. The central server receives the data from the RFID tag and processes it.it will retrieve associate owner account information and calculates the toll tax based on predefined rates ad distance traveled the central server deducts the calculated toll tax from the vehicle owner's account balance.if the balance is sufficient, the toll tax is deducted an the d remaining balance is updated accordingly. if the balance is insufficient an alert SMS will be sent to the vehicle owner "insufficient balance" Once toll deduction is done the central server sends a confirmation message back to RFID Reader through the GSM module. At the toll plaza gets barrier we have used servo so90. the RFID reader communicates with the microcontroller to determine whether the toll tax has been paid.if the payment is successful, the barrier opens, allowing the vehicle to pass, otherwise, the barrier remains closed, indicating that payment is pending this status will display on LCD.

APPLICATION:

Efficient Toll Collection: The RFID technology enables automatic and contactless toll collection. As vehicles equipped with RFID tags pass through toll plazas, the system automatically detects the tags and deducts the toll amount from the user's account. This eliminates the need for manual cash transactions or card swiping, leading to faster and more efficient toll collection.

Reduced Congestion: By eliminating the need for vehicles to stop and pay tolls manually, RFID-based systems contribute to reduced traffic congestion at toll plazas. Vehicles can pass through the toll booths at higher speeds, reducing queue lengths and wait times. This results in smoother traffic flow, especially during peak hours.

Improved User Experience: RFID-based toll collection offers a seamless and convenient experience for drivers. There is no need to carry cash or search for the correct change, as the toll amount is deducted automatically from the user's account. This enhances overall user satisfaction and promotes a positive commuting experience

FLOW CHART:

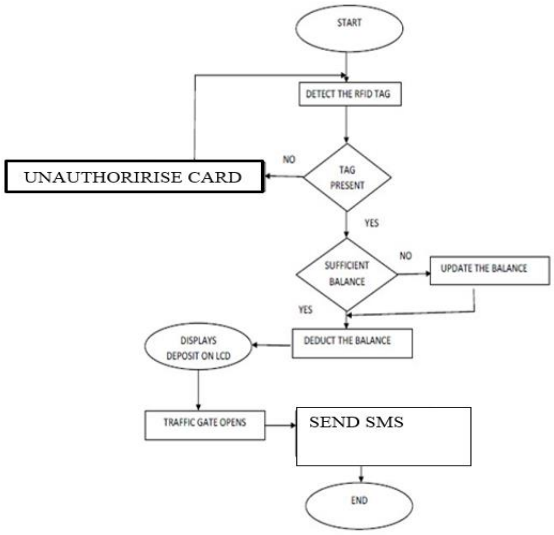


Fig 2 Flow Chart

ALGORITHM

1) Start.
2) Detect the RFID tag
3) Tag present
4) Sufficient balance.
5) Deduct the balance
6) Display deposit on LCD
7) Traffic gate opens
8) Send sms
9) END

ADVANTAGES:

- An electronic toll collection system is very fast and efficient mode for the collection of toll charges at the toll plazas.
- This saves a lot of time since vehicles passing through the toll plaza do not stop to pay the toll and the payment automatically takes place from the account of the vehicle

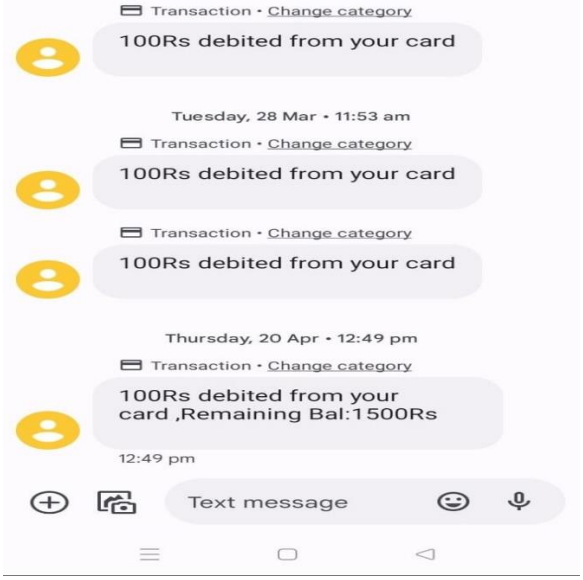
FUTURE SCOPE:

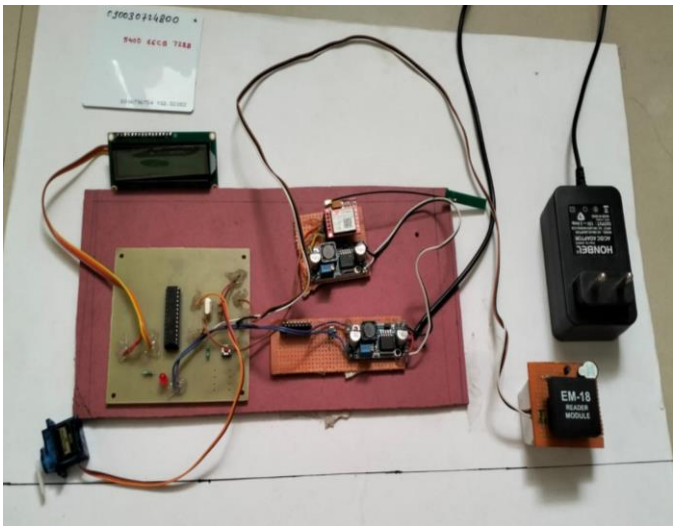
- **Automatic Vehicle Identification:** The automatic vehicle identification (AVI) component of this system refers to the technologies that determine the identification or ownership of thevehicle so that the toll will be charged to the corresponding customer.

- **Automatic Vehicle Classification**: Vehicle type and class may have differentiated toll amount. The vehicle type may include light vehicles like the passenger car or heavy vehicles like recreational vehicles. A vehicle's class can be determined by the physical attributes ofthe vehicle, the number of occupants in the vehicle, the number of axles in the vehicles and the purpose for which the vehicle is being used at the time of classification

- **Video Enforcement System**: When used for electronic toll collection, the video enforcement system (VES) captures images of the license plates of vehicles that pass through an electronic tollbooth without a valid electronic tag. Although the deployment of these technologies makes the initial cost of installation very high, but there exits huge benefits accompanied with such high investment. These benefits are discussed in the upcoming section.

RESULT :





CONCLUSION:

An RFID-based electronic seamless recording design concept is proposed for the highway. It has advantages such as low cost, high security, long communication and high performance. It not only improves the capacity of the highway, but also improves the toll collection process. Electronic parking meter using RFID is a good measure to reduce the cost and expense of toll management as well as reduce the noise and pollution of parking lots. Real-time toll collection and anti-theft solutions were developed in the creation of the Electronic Toll Collection (ETC) system. This reduces the manual labor and delays that often occur on the road. This toll system is environmentally friendly and can increase the capacity of the telephone line. Road safety is ensured by using the anti-theft solution module that prevents the passage of all illegal vehicles.

REFERENCES :

[1] RFID-based toll collection system 2011 IEEE third international Conference

[2] Active Wave Inc. http://www.activewaveinc.com

[3]Smart key Access Control System http://www.smartkey-rfid.com

{4] D. M. Grimes and T. O. Jones, ―Automotive radar: A brief review, Proc. IEEE, vol. 62,no. 6, pp. 804–822, Jun.1974.

[5] Klaus Finkenzeller, "*RFID Handbook: Radio-Frequency Identification Fundamentals and Applications".* John Wiley & Sons, 2000.