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# Smart Toll Booth System

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**ABSTRACT:** The primary emphasis of the paper revolves around an innovative Toll Management System that prioritizes efficiency, using Internet of Things (IoT) technology and relying on Radio Frequency Identification (RFID). The system's database comprehensively stores user account information and balances. Every vehicle owner is equipped with a distinct RFID, a card affixed to their vehicles holding a unique RFID number. The toll booth management system oversees the scanning of these cards as vehicles approach the toll booth, ensuring seamless monitoring. Subsequently, the system establishes a connection with the database to verify the validity of the RFID card. If the card is confirmed as valid and the user's account balance is adequate, the toll amount is deducted. The card scanner system then transmits a signal to the motor, enabling it to facilitate the vehicle's passage upon successful transaction. Upon receiving this signal, the system activates the motor, causing the toll gate to open for the respective vehicle. This entire process is orchestrated by a Microcontroller for precise control. Utilizing a Wi-Fi module, the system employs a Wi-Fi connection to link the toll system to a customized website, easing online verification. The verification process not only ensures the legitimacy of transactions but also aids in the identification of potentially stolen vehicles, triggering alerts as needed.

**KEYWORDS:** Toll Management System, IOT platform, RFID Microcontroller, Wi-Fi module.

## I. INTRODUCTION

In the modern era, the daily escalation in the volume of vehicles on the roads poses substantial challenges for business operations and extends travel durations. This sluggishness is a concern not only in urban centres but also on highways, where motorists are compelled to form queues exclusively for toll payment before accessing the road. The automated Toll Booth Management System proves to be a more efficient and organized alternative, obviating the necessity for individuals to endure protracted queues. [2] The utilization of RFID-based toll systems could mitigate corruption within profit administration agencies, concurrently leading to a reduction in operational costs. Consequently, implementing this approach is believed to be an effective means of controlling energy waste. [3] By employing RFID technology, the transition from manual toll collection to an automated system is helped in electronic toll collection. Instances of stolen RFID cards are scrutinized through RFID repositories integrated into toll booths at designated locations. This system enhances transparency within the overall toll collection process, as it eases online transactions. [4] For example, the tender broker who hired the toll duty collecting systems was constantly involved in fraud by concealing toll profit collection, still, the government has set up it to be profitable to effectively collect road duty. Thanks to the simple availability of real-time toll profit collecting data numbers using the IoT platform. [5] For the data storehouse and shadowing of blocked cards, a customized platform is employed, which keeps the data of the vehicle number, timings, date, gate number, and card checkup position for unborn references and surveillance, as well as the data regarding yearly risk income. [6] The Internet of Things (IoT) is principally a network of connected physical objects that allow for the exchange of data between them. [7] The foundation of our website is PHP, which is a user-friendly server-side scripting language. [8] Most criminal activities involve the use of stolen vehicles, and the illicit practice of transporting stolen cars across countries, regions, and borders has been a longstanding operation. [9] Hence, the combination of an RFID system and an IoT-grounded platform may be useful for detecting these vehicles and stopping their trespassing acts.



Figure 01: Toll Booth System [01]

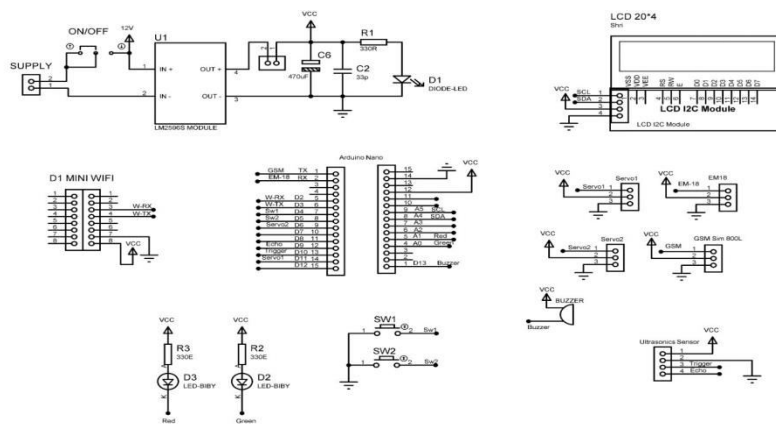


Figure 02: Circuit Diagram

## II. SYSTEM DEVELOPMENT

- Initialize the system by turning on the RFID reader, toll booth software, and database.
- When a vehicle approaches the toll booth, scan the RFID tag attached to the vehicle and retrieve the corresponding account details from the database.
- Deduct the toll fee from the account balance. If there is insufficient balance, request the driver to pay in cash or recharge the account.
- Store the transaction details, including the vehicle registration number, time of transaction, and toll fee, in the database.
- Monitor the transaction history and check for suspicious activity.
- If the system detects theft, alert the system administrator or the concerning authorities.
- Supply ongoing maintenance for the system, including software updates, hardware replacements, and database backups.

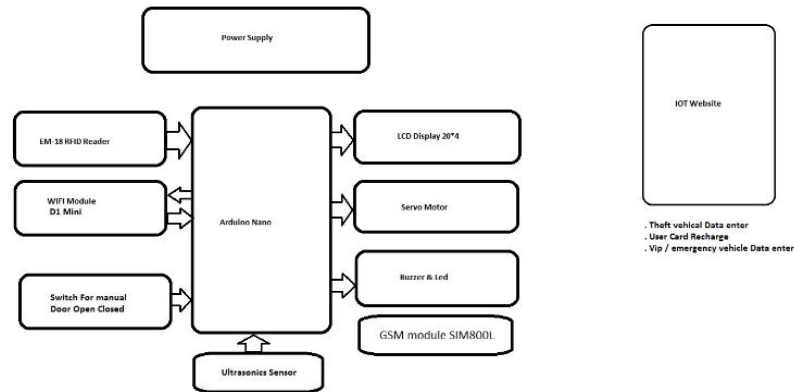


Figure 03: Block Diagram

### III. COMPONENT DETAILS

Table 01: Required Hardware &Software

HARDWARE	SOFTWARE
<ul style="list-style-type: none"> <li>• Arduino NANO</li> </ul>	<ul style="list-style-type: none"> <li>• Arduino IDE</li> </ul>
<ul style="list-style-type: none"> <li>• D1 Wi-Fi Module</li> </ul>	<ul style="list-style-type: none"> <li>• HTML/CSS/JavaScript/PHP</li> </ul>
<ul style="list-style-type: none"> <li>• RFID Tags</li> </ul>	<ul style="list-style-type: none"> <li>• Web Hosting</li> </ul>
<ul style="list-style-type: none"> <li>• EM-18 Reader Module</li> </ul>	
<ul style="list-style-type: none"> <li>• LCD Display (20*4)</li> </ul>	
<ul style="list-style-type: none"> <li>• Ultrasonic sensor</li> </ul>	
<ul style="list-style-type: none"> <li>• Servo Motor</li> </ul>	
<ul style="list-style-type: none"> <li>• GSM Module</li> </ul>	
<ul style="list-style-type: none"> <li>• Buzzer</li> </ul>	
<ul style="list-style-type: none"> <li>• LED</li> </ul>	

### IV. METHODOLOGY

- System Initialization: Initialize the smart toll booth system, including the RFID readers, the toll booth software, and the database.
- Vehicle Detection: When a vehicle approaches the toll booth, the RFID reader scans the RFID tag attached to the vehicle to identify the vehicle and retrieve its details from the database.
- Transaction Processing: The system checks the balance of the prepaid account corresponding to the vehicle and deducts the toll fee from the account. If the balance is insufficient, the system will prompt the driver for cash payment or ask them to recharge the account.
- Transaction Storage: The transaction details, including the vehicle registration number, time of the transaction, and toll fee, are stored in the database.
- Theft Detection: The system monitors the transaction history and checks for suspicious activity, such as repeated transactions or transactions at unusual times. If the system detects theft, it will alert the system administrator or the concerning authorities.



## V. TESTING & RESULTS

[10] Our smart toll booth system with a theft detection system aims to improve the efficiency and security of toll plaza operations. [11] To begin with, RFID technology will be used to identify vehicles as they approach the toll plaza. Each vehicle will be assigned a unique RFID tag that will be scanned by the toll booth system to determine whether the amount left is sufficient after going through the database which has this information about the amount remaining the toll amount will be deducted from the remaining amount and if insufficient balance is shown in the database, then the vehicle can do manual payment. RFID tag when scanned and it is a theft car, then the database of our toll will be able to identify the theft vehicle as it would already be inserted by the admin which will change the vehicle type from normal to theft which will lead to a different lane and other vehicle will run smoothly reducing the traffic on the main lane. The system will incorporate a theft detection mechanism with the help of an RFID tag which is built in and unique to that vehicle and cannot be removed from that car making it possible to find the theft car once the admin receives the message that this car is stolen where he can change the type and then can easily be spotted in any toll once it passes through it and then the system can alert the authorities. [12] Thus our smart toll booth system with a theft detection system is designed to enhance the accuracy, speed, and security of toll collection operations.

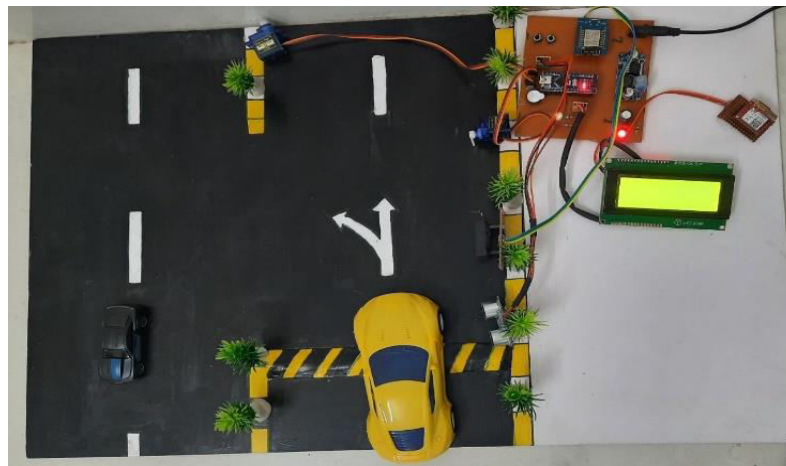


Figure 04: Testing Results

## VI. CONCLUSION

The RFID-based toll booth system using GSM is a practical and effective way to collect tolls. It decreases traffic congestion and the requirement for manual toll collecting. Additionally, the system offers precise, real-time transaction data that can be used for a variety of tasks, including traffic research and toll revenue management. GSM-based RFID toll booth systems can provide various advantages. The technology offers a simple and secure way for drivers to pay tolls while also reducing congestion and boosting efficiency. Vehicles can be quickly and easily identified as they approach the toll booth thanks to RFID technology, eliminating the need for manual involvement. Particularly during rush hours, this can reduce wait times and enhance traffic flow. The toll booth system can provide remote monitoring and management capabilities by incorporating GSM technology. This can assist in making sure the system is operating properly and can notify operators if there are any problems or malfunctions. GSM-based RFID toll booth technology is a practical and efficient method of collecting tolls. Both the need for manual toll collection and traffic congestion are reduced. The system also provides accurate, real-time transaction data that may be applied to several projects, including traffic analysis and toll revenue management.

The Smart Toll Booth system based on IOT using RFID for theft detection with a database has the potential to significantly improve toll collection systems and enhance security measures. The future scope of this technology is robust, and it will continue to evolve as technology advances. Some potential future advancements for this technology may include:

1. Artificial intelligence (AI) integration: Integrating AI into the toll booth system can enhance the accuracy of the system in detecting theft and fraud and improving traffic management.
2. Big data analytics: Collecting and analyzing substantial amounts of data can help identify patterns in toll collection that can provide insights to optimize the toll collection system.

3. Blockchain technology integration: Integrating blockchain technology can enhance security and transparency within the toll collection system, thus safeguarding against unauthorized access to data and transactions.
4. Biometrics authentication: Utilizing biometrics authentication can provide an additional level of security to ensure that only authorized individuals have access to the toll collection system.

Smart Toll Booth system based on IOT using RFID for theft detection with a database will have a promising future. The technology is likely to continue to evolve and offer enhanced functionality, security, and efficiency to our transportation systems, making transportation faster, safer, and more affordable.

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