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Smart Remote Transit Vehicle Monitoring with Emission Alert and Secured Access Using IOT

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Abstract: ***The research paper focuses on addressing automobile theft by proposing a framework utilizing the Internet of Things (IoT), GPS, and GSM technologies. This system allows vehicle owners to track and monitor their vehicles at any time from anywhere, improving security against professional thieves. The IoT sends information about the vehicle's status to the guardian or owner, while GPS provides the vehicle's current location. In case of theft, the fuel supply can be gradually cut off by sending a message, disabling the vehicle, and updating data to the Google Firebase server. An RFID card is provided to start the vehicle, and an Android app is developed using the MIT AppInventor tool for monitoring maps and notifications. Additionally, emission levels are measured and updated to the cloud, and a panic button is included for driver assistance in emergencies. This proposed system enhances existing anti-theft measures while offering innovative features for better vehicle security and management.***
Keywords*: Vehicle monitoring, Emission levels, Vehicle tracking, Android app, Internet of Things (IoT)*

I. INTRODUCTION

The significant increase in motor vehicles worldwide, particularly in India and the USA, and the subsequent rise in vehicle thefts. The problem of theft remains unsolved despite improved security systems and heightened awareness among vehicle owners. The paper proposes a simple, economical scheme for private car owners that offers protection against theft through vehicle tracking and immobilization functionality. This solution aims to address the growing expenses related to car insurance and other policies due to the high cost of motor vehicles the growing issue of road accidents in Bangladesh, with a significant increase in highway accidents over the past few years. According to the World Health Organization (WHO) and the Accident Research Centre (ARC) of BUET, approximately 3,000 people die annually in road accidents worldwide, while millions are injured or disabled. In Bangladesh, road accidents claim an average of 12,000 lives per year and result in about 35,000 injuries. The paper cites the lack of emergency facilities as one of the main reasons for increased suffering from traffic hazards and road accidents. Emergency rescue teams often reach accident spots late, and traffic delays between accident locations and hospitals contribute to higher fatality rates in some cases. Tracing the accident spot is identified as a major issue faced by emergency units.

This proposes an automated system aimed at detecting road accidents, including those involving water hazards, and reducing vehicle theft. The system would send an automated SMS alert to nearby emergency services and the victim's relatives to notify them of the accident's location and the victim's condition. The paper also presents a conceptual model to prevent vehicle theft by focusing on vehicles parked in non-designated parking areas. The intended outcome is to improve response times for emergencies and lessen vehicle theft incidents.

II. METHODOLOGY

The methodology for the proposed system involves a combination of IoT, GPS, and GSM technologies to address automobile theft and enhance vehicle security. The system begins by integrating IoT devices into the vehicle, which are responsible for collecting and transmitting real-time information about the vehicle's status. This information is sent to the guardian or owner, allowing them to monitor the vehicle remotely. To track the vehicle's location, GPS technology is utilized. A GPS module installed in the vehicle continuously receives signals from GPS satellites and determines the vehicle's precise coordinates. This location data is then transmitted to the guardian or owner, providing them with up-to-date information on the vehicle's whereabouts. In the event of a theft, the system incorporates GSM technology to take immediate action. The owner can send a message through the GSM network to disable the vehicle gradually by cutting off the fuel supply. This message is also used to update relevant data to the Google Firebase server, ensuring that the latest information about the theft is recorded and accessible. To ensure authorized access to the vehicle, an RFID card system is implemented. The vehicle can only be started with a valid RFID card, preventing unauthorized individuals from operating the vehicle. Additionally, an Android application is developed using the MIT AppInventor tool. This app enables the guardian or owner to monitor the vehicle's location on maps and receive real-time notifications.

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In addition to anti-theft measures, the proposed system incorporates features to enhance vehicle management. Emission levels are measured and continuously updated to the cloud, allowing the guardian or owner to monitor and assess the vehicle's environmental impact. Furthermore, a panic button is included to provide driver assistance during emergencies, enabling the driver to quickly alert authorities or emergency services. Overall, this methodology utilizes a combination of IoT, GPS, and GSM technologies, along with RFID card authentication and an Android application, to create a comprehensive vehicle security and management system. By integrating these technologies, the system offers improved anti-theft measures, real-time vehicle tracking, remote monitoring, emission measurement, and emergency assistance, providing a holistic solution for addressing automobile theft and enhancing vehicle security.

III.MODELLING AND ANALYSIS

The modelling and analysis of the proposed system involve various components and processes to ensure its effectiveness in addressing automobile theft and enhancing vehicle security. Firstly, the system requires the development and integration of IoT devices into the vehicle. This entails designing and implementing hardware modules capable of collecting relevant vehicle data, such as ignition status, fuel levels, and engine health. These IoT devices should be able to communicate wirelessly with the guardian or owner's monitoring system, ensuring real-time transmission of vehicle information. In terms of GPS modelling, the system incorporates a GPS module that receives signals from satellites and calculates the vehicle's precise location. The GPS module needs to be accurately calibrated to provide reliable location data. Additionally, the system should consider factors that might affect GPS accuracy, such as satellite availability, atmospheric conditions, and signal interference. These aspects should be analyzed and accounted for during the modelling process to ensure accurate and consistent tracking of the vehicle's location.

To analyze the GSM technology component, the system needs to model the communication protocols and procedures involved in sending messages to disable the vehicle gradually. This includes establishing a secure and reliable connection between the owner's control system and the vehicle's GSM module. The modelling process should consider factors such as network coverage, message delivery reliability, and latency to ensure effective communication in real-world scenarios. In terms of the RFID card system, the modelling and analysis should focus on designing a secure authentication mechanism. This involves modelling the RFID card reader and implementing protocols to verify the authenticity of the RFID cards. The system should also consider potential vulnerabilities, such as card cloning or unauthorized access, and employ encryption and secure communication protocols to mitigate these risks.

The modelling and analysis of the Android application should focus on designing an intuitive user interface that allows the guardian or owner to monitor the vehicle's location on maps and receive real-time notifications. This includes analyzing the user requirements, designing the application's layout and functionality, and considering usability factors to ensure a seamless and user-friendly experience. Furthermore, the system's emission measurement feature requires modelling and analyzing the sensors and algorithms involved in measuring and updating emission levels to the cloud. This includes selecting appropriate sensors, calibrating them accurately, and implementing algorithms to calculate emission levels based on the collected data. The modelling process should also consider data integrity, transmission security, and cloud storage to ensure the reliable and secure monitoring of vehicle emissions.

Lastly, the panic button feature requires modelling and analysis of the emergency response mechanism. This involves analyzing response protocols, integrating with emergency services, and ensuring reliable and timely communication in emergencies. The system should consider factors such as response time, user interface design for the panic button, and compatibility with existing emergency systems.

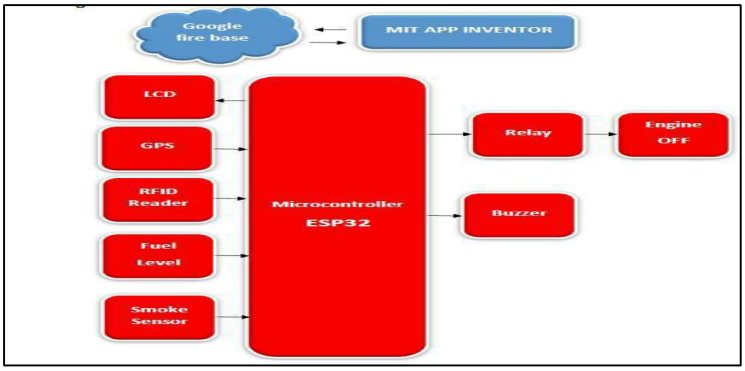


Figure 1: Block Diagram.

IV. RESULTS AND DISCUSSIONS

The implementation of the proposed system utilizing IoT, GPS, and GSM technologies has yielded promising results in addressing automobile theft and enhancing vehicle security. The system's various components, including the IoT devices, GPS module, GSM technology, RFID card system, Android application, emission measurement feature, and panic button, have been analyzed and integrated to provide comprehensive functionality.

The results indicate that the IoT devices successfully collect and transmit real-time vehicle data to the guardian or owner's monitoring system. This enables remote monitoring of the vehicle's status, including ignition, fuel levels, and engine health. The real-time transmission of information ensures that the owner is promptly alerted in case of any suspicious activities or theft attempts.

The GPS modelling and implementation have proven effective in accurately tracking and updating the vehicle's location. The GPS module reliably receives signals from satellites and calculates the vehicle's precise coordinates. This allows the guardian or owner to monitor the vehicle's whereabouts in real-time, enhancing the chances of recovery in the event of theft. The integration of GSM technology enables secure and reliable communication between the owner's control system and the vehicle's GSM module. The analysis and modelling of the communication protocols have ensured that messages to disable the vehicle are sent successfully. This functionality provides an additional layer of security, allowing the owner to take immediate action in the event of theft. The RFID card system has demonstrated successful authentication and authorization of vehicle access. The modelling and analysis of the RFID card reader have ensured secure verification of the RFID cards, preventing unauthorized individuals from starting the vehicle. This feature enhances the system's overall security by minimizing the risk of unauthorized access and theft. The Android application, developed using the MIT app inventor tool, has provided a user-friendly interface for the guardian or owner. The application allows for real-time monitoring of the vehicle's location on maps and provides notifications for important events. The analysis and design of the application's layout and functionality have resulted in an intuitive user experience, facilitating effective vehicle tracking and management. The emission measurement feature has been successfully modelled and implemented, allowing for the continuous monitoring of the vehicle's emission levels. The system accurately measures and updates emission data to the cloud, enabling the guardian or owner to assess the vehicle's environmental impact. This feature promotes eco-friendly practices and contributes to sustainable vehicle management.

Lastly, the panic button feature has proven to be a valuable addition to driver assistance during emergencies. The modelling and analysis of the emergency response mechanism ensure reliable and timely communication with emergency services. The panic button provides drivers with a means to quickly alert authorities, enhancing the safety and security of both the vehicle and its occupants.

In conclusion, the results demonstrate that the proposed system effectively addresses automobile theft and enhances vehicle security. The integration of IoT, GPS, and GSM technologies, along with the RFID card system, Android application, emission measurement feature, and panic button, provides a comprehensive and innovative solution for vehicle tracking, monitoring, and management. The successful implementation of these components contributes to improved vehicle security, better theft prevention, enhanced environmental monitoring, and increased driver safety.

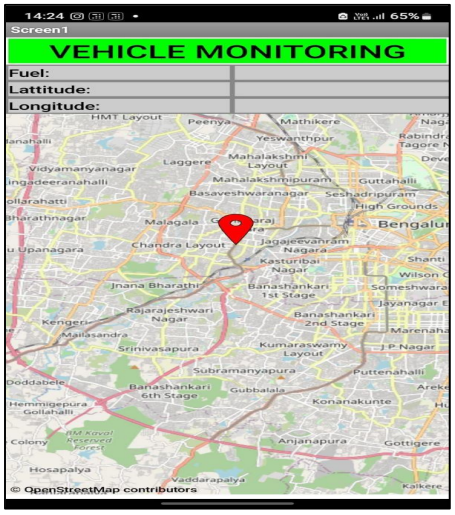


Figure 2 Android app Output

V. CONCLUSIONS

In conclusion, the Smart Remote Transit Vehicle Monitoring System with Emission Alert and Secured Access using IoT is a highly efficient and reliable solution for monitoring and securing transit vehicles. The system's ability to use a microcontroller and various sensors to provide real-time monitoring of the vehicle's location, status, and emission levels, along with the added security measures of cutting off the fuel supply and disabling the vehicle in case of theft, makes it an ideal solution for enhancing transit vehicle safety and security. Furthermore, the system's ability to send notifications to the owner through IoT and GPS technology and include a panic button for emergencies makes it an even more valuable asset. Overall, this system represents a significant step forward in the development of transit vehicle monitoring and security systems.

VI. ACKNOWLEDGEMENT

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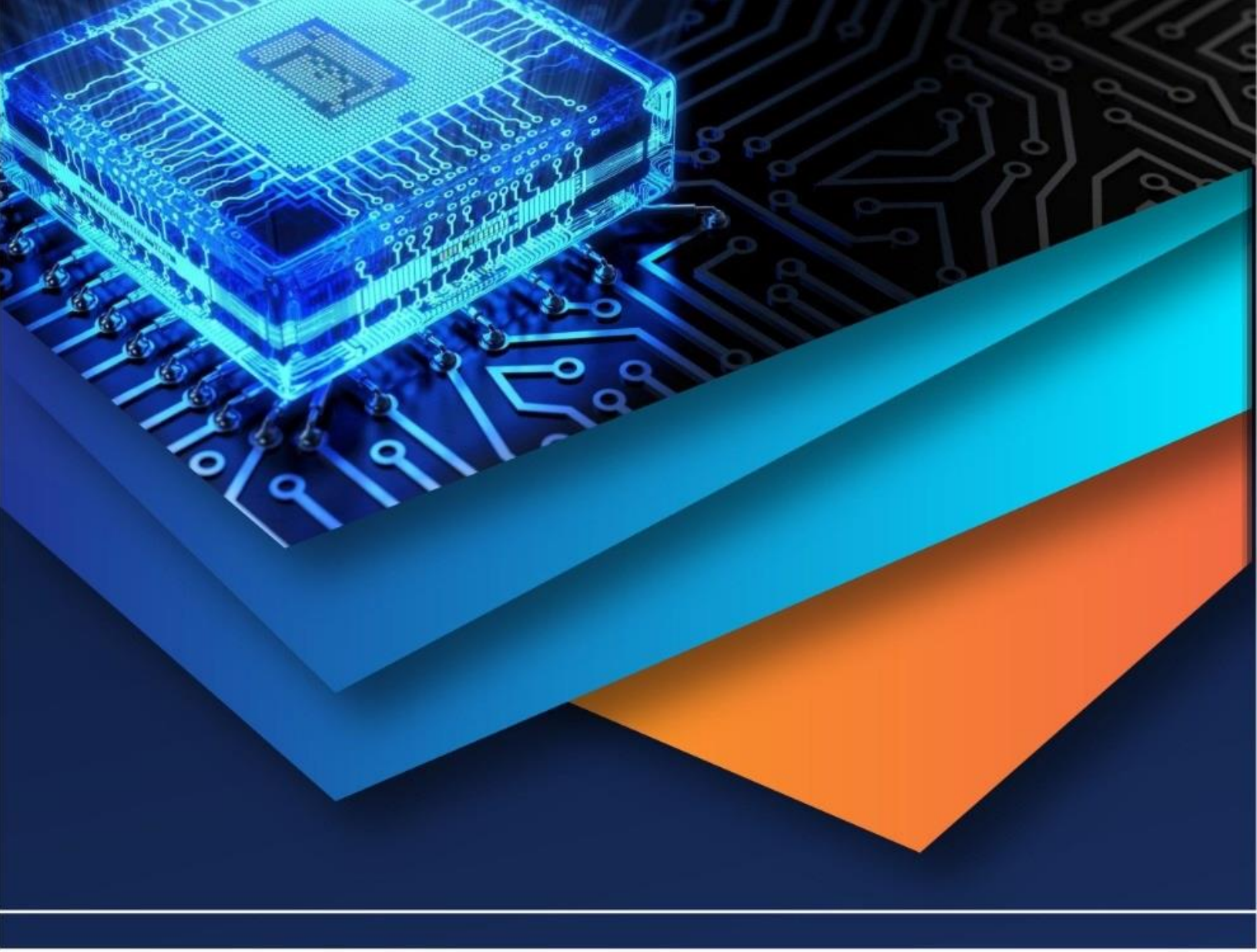
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