Gsm Enabled Vehicle Security System with Immobiliser Function

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***Abstract*—The global increase in automobile theft highlights the shortcomings of conventional security measures. In response, we present an advanced approach that combines mobile cloud-based control, RFID, GPS, GSM, and IoT to deliver multi-layered, real-time vehicle protection. This system uses a hybrid microcontroller architecture that combines an Arduino UNO and Raspberry Pi to enable remote immobilization, GPS tracking, secure RFID-based authentication, and real-time notifications through the Blynk mobile platform. This system provides a reliable and future-proof solution for car security for both individuals and enterprises, with cost, scalability, and ease of deployment at its core**.

***Index Terms*—Automobile Theft, Mobile Cloud-Based Control, RFID (Radio-Frequency Identification), GPS (Global Positioning System), GSM (Global System for Mobile Communications), Remote Immobilization.**

I. INTRODUCTION

Traditional automotive security systems, such key-based ignitions, mechanical locks, and independent alarms, have become less and less successful at discouraging sophisticated modern auto theft. To get around these fundamental protections, criminals now use sophisticated tools like relay attacks and key signal replicators.

Our team created a next-generation IoT-based vehicle security framework that integrates clever software automation with hardware interfacing to address these risks. With RFID for safe access control, GSM for immediate SMS warnings, GPS for location tracking, and the Blynk IoT platform for easy mobile app control, the system is based on a Raspberry Pi microprocessor and Arduino UNO. In addition to offering round-the-clock real-time monitoring and immediate notice in the case of unwanted entry, this guarantees that only authorized staff can enter or start the vehicle.

II. LITERATURE SURVEY

Numerous studies have aimed to develop efficient and secure vehicle security systems by leveraging IoT technologies. These research efforts serve as the foundation for this project and highlight the need for an integrated approach combining various modules.

[1] RFID-Based Digital Door Locking System (Soni et al., 2021) – This system utilized RFID and Arduino to permit access only to users with valid RFID tags. Though cost-effective and easy to build, it lacked GPS and remote access capabilities.

[2] GSM & GPS with Fingerprint Verification (Dey et al., 2019) – This project introduced biometric security and real-time tracking but did not support remote immobilization or IoT dashboard integration.

[3] Advanced Vehicle Security System Using RFID and GSM (Kumar & Mishra, 2018) – Integrated GSM with RFID to provide mobile alerts but lacked GPS-based location updates and IoT control.

[4] GSM-Based Vehicle Demobilizer and Tracker (Jimada-Ojuolape et al., 2023) – Enabled remote vehicle stoppage using GSM and basic tracking but suffered from vulnerabilities such as network jamming and limited feedback mechanisms.

These studies demonstrate the individual strengths of technologies like GSM, GPS, RFID, and biometrics, but also underline their limitations when used in isolation. Our system addresses these gaps by

integrating all these components into a single, cohesive IoT solution.

III. PROPOSED METHODOLOGY

The goal of the suggested GSM-enabled IoT-based car security system is to offer a complete defense against contemporary automotive dangers. To guarantee dependability and work delegation, it employs a dual-controller architecture that combines the Raspberry Pi and Arduino UNO. While the Arduino handles low-latency tasks like sending SMS notifications and interacting with the GPS module, the Raspberry Pi controls high-level functions like RFID authentication, user interface via Blynk, and cloud connectivity.

An RFID-based authentication system is the main component of the security mechanism. The RFID scanner checks the tag's unique ID against a list kept in the Raspberry Pi before allowing the user to start the car. If confirmed, the car's ignition is turned on; if not, it stays immobilized and a warning is set off.

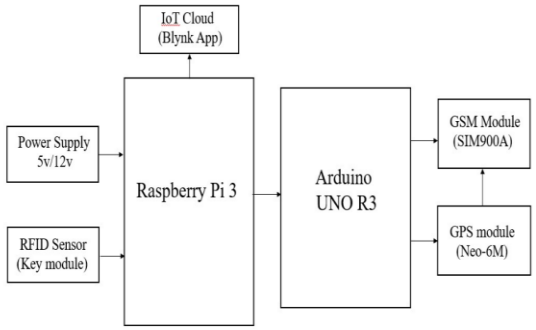


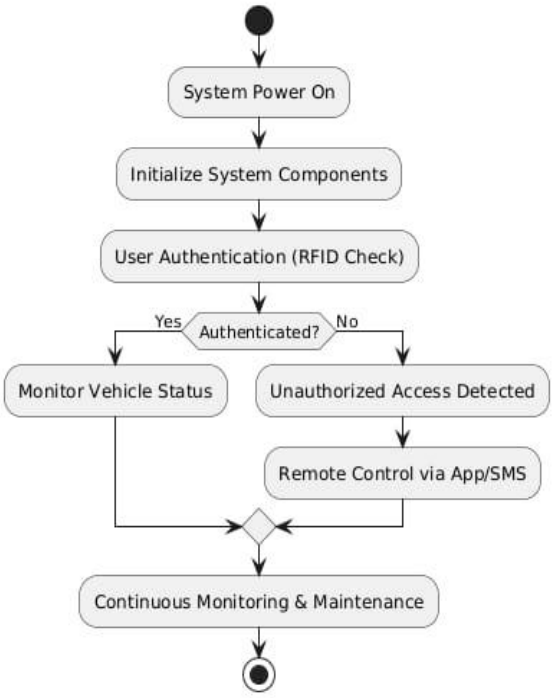
Fig: BLOCK DIAGRAM OF GSM ENABLED VEHICLE SECURITY SYSTEM WITH IMMOBILIZER FUNCTION

To alert the owner of the unwanted access attempt, the GSM module is turned on and sends an SMS to the registered number. The location of the car is simultaneously retrieved by the GPS module and added to the alarm message. The Blynk app, which enables remote ignition control and real-time monitoring, also notifies the owner. Even when the user is not in close proximity to the vehicle, this feature guarantees security.

A cloud dashboard that offers information about vehicle behavior, alert history, and current condition is also introduced by using Blynk. The system's modular design makes it extremely expandable for further integrations, including biometric authentication, camera monitoring, and cloud data analytics.

IV.FLOWCHART

The GSM-enabled IoT car security system's operational sequence is graphically represented by the flowchart:



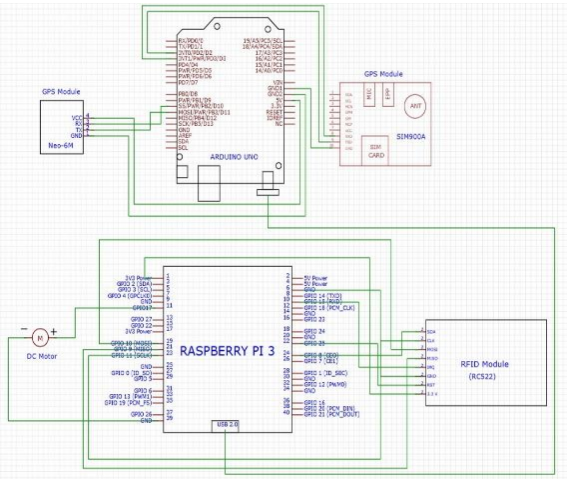
1. As soon as the Raspberry Pi and Arduino receive power, the system comes to life.
2. Every module, including the RFID reader, GPS, GSM & Wi-Fi, is set up and verified.
3. The system waits for the user to scan an RFID card as part of the user authentication process (RFID check). The UID is compared to the database that is kept on the Raspberry Pi.
4. Authenticated? The system tracks the status of the vehicle if the card is validated; if not, it indicates unauthorized access.
5. After granting vehicle access to the verified user, real-time tracking is carried out via the IoT dashboard.
6. The GPS coordinates are obtained and an alert is sent out through the GSM module.
7. The Blynk app or SMS commands can be used to remotely disable or control the vehicle.

8. The system stays operational, enabling upcoming access attempts and looping back to verify status updates.

For real-time vehicle protection, this logical flow guarantees an organized, automated, and secure operational cycle.

V.SCHEMATIC EXPLANATION

This schematic illustrates the complete setup of a Vehicle Security System that combines GSM, GPS, and IoT (Blynk App) functionalities using a Raspberry Pi 3 and an Arduino UNO R3. It visually explains how each module is connected and how they work together to secure the vehicle and allow remote control and monitoring.



The Raspberry Pi 3 acts as the main controller, interfacing with the RFID module (RC522), a DC motor (simulating the vehicle's ignition/engine), and communicating with the Arduino UNO. The RFID Module is connected to the Raspberry Pi using SPI communication lines, where important pins like SDA, SCK, MOSI, MISO, and RST are linked to specific GPIO pins on the Raspberry Pi. This setup allows the Raspberry Pi to authenticate RFID tags and enable or disable the ignition system accordingly. The DC motor in this schematic is controlled directly by the Raspberry Pi's GPIO pins. It acts as a simulation of the engine ignition. The use of PWM pins ensures smooth and reliable motor control.

The Arduino UNO supports the Raspberry Pi by managing the GPS module (Neo-6M) and the GSM module (SIM900A). The GPS module connects to the Arduino via simple serial communication (TX and RX pins). It sends real-time location data, which can be used whenever the system needs to alert the owner about the vehicle's position. On the other side, the GSM module is also connected to the Arduino. Its job is to send SMS alerts to the vehicle owner in case of unauthorized access.

To coordinate everything, the Raspberry Pi and Arduino communicate using UART serial communication. The Pi can send instructions to the Arduino whenever necessary, such as asking it to send an alert or fetch GPS data. Power is supplied through regulated 5V and 3.3V lines, making sure all modules operate safely.

VI. RESULTS

Under controlled circumstances, the GSM-enabled Internet of Things-based car security system was successfully deployed and tested. Only registered tags were able to start the car's ignition, demonstrating the system's successful RFID-based access control. Successful GSM and GPS integration was confirmed when unauthorized access attempts immediately resulted in SMS alerts with GPS coordinates. The Blynk mobile interface enabled users to remotely manage the ignition system and provided precise real-time system status displays. There was very little delay between sensor detection and mobile feedback, indicating that the Raspberry Pi, Arduino, and cloud were communicating effectively. All things considered, the system achieved its design objectives of offering real-time alerts, remote monitoring, and improved vehicle security.

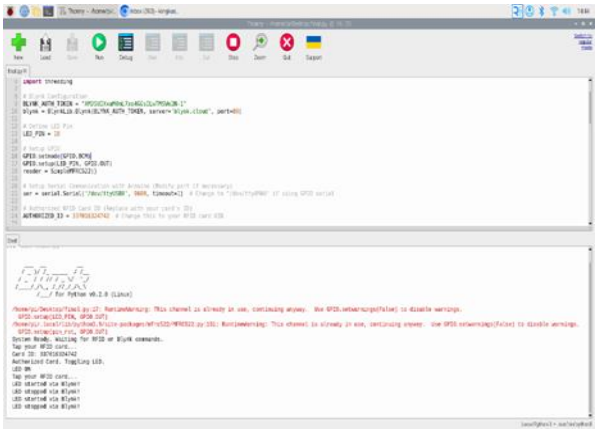


Fig: a) Execution of the code

This image output illustrates a notification received on the Blynk app, confirming the activation of the RFID-based vehicle ignition system. It highlights the successful integration of IoT-based remote control and monitoring, enabling users to manage vehicle security through their smartphone.

The system's immobilizer feature worked as intended, effectively stopping the engine from starting during any unauthorized attempts. This added an extra layer of protection and helped demonstrate the real-world value of the setup

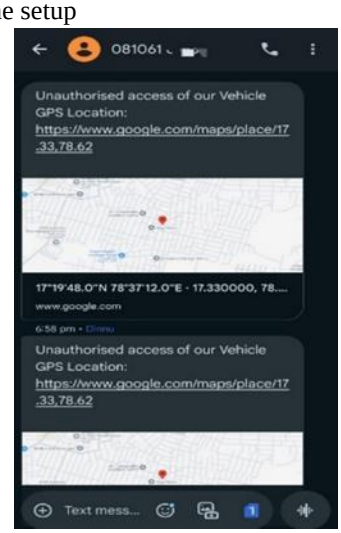


Figure: b) SMS Alert for Unauthorised access

The image captures an SMS alert generated by the GSM module when an RFID authentication is performed. It conveys a real-time message update to the registered mobile number, showcasing the GSM communication link that provides immediate security notifications to the user.

VII.APPLICATIONS

There are numerous applications for this GSM-enabled IoT-based car security system:

1. Personal Vehicle Security: Real-time location tracking and RFID-based access can help individual automobile owners protect their vehicles against theft.
2. Fleet management: By remotely tracking, monitoring, and controlling their whole fleet, logistics and transportation firms may improve operational effectiveness and vehicle safety.
3. Rental and Car-Sharing Services: By limiting access to automobiles to authorized customers, rental companies and shared mobility platforms may prevent abuse and illegal driving.
4. Emergency Services: For better response and coordination, police, ambulance, and fire department vehicles can be remotely tracked and operated.
5. Educational Institutions: This system can be used by campus-based transportation services to monitor the movement of institutional vehicles and provide safe access.
6. Corporate Vehicle Pools: Companies that manage a number of company cars can create usage data and automate access control for effective supervision.
7. Parental Monitoring: By keeping an eye on their kids' whereabouts, driving habits, and car access, parents can improve safety.
8. Integration with IoT and Smart Cities: For improved public safety, the system can be included into larger smart city frameworks and cooperate with urban mobility and traffic control systems.

VIII.ADVANTAGES

1. Enhanced Security

The RFID-based ignition control ensures that only authorized users can start the vehicle, reducing the risk of unauthorized access.

2. Remote Control via Blynk

The integration with Blynk allows for remote monitoring and control of the vehicle through a smartphone app, providing convenience and quick action if needed.

3. Global Accessibility

The system can work globally, as long as there’s a GSM network available, ensuring that you can track the vehicle anywhere.

4. Real-Time GPS Tracking

The GPS module provides real-time tracking of the vehicle, allowing the owner to pinpoint the vehicle's location instantly if it gets stolen.

5. Easy Integration

The system is easy to integrate with other IoT devices and cloud-based services, which allows future upgrades and scalability.

6. Cost-Effective

Utilizing Raspberry Pi makes the system more affordable compared to traditional security systems,

with powerful functionalities available at a lower cost.

IX.CONCLUSION

An important development in contemporary car safety is the installation of an IoT-based vehicle security system with GSM capability. The system provides a strong, real-time security architecture that guarantees only authorized users may access the vehicle while permitting remote tracking and control by combining technologies like RFID, GPS, GSM, and mobile-based control via the Blynk platform. Future scalability and customization are supported by the modular design, which can adapt to changing user requirements and new security risks. In addition to satisfying the increasing need for intelligent vehicle protection, this initiative lays the groundwork for future advancements in the field of intelligent transportation systems.

REFERENCES

[1] Blynk Team, "Blynk IoT Platform," https://blynk.io/, Accessed: April 2025. The official documentation for the Blynk IoT platform, which was utilized in this project for remote control and monitoring.

[2] Raspberry Pi Foundation, "Raspberry Pi Official Documentation," https://www.raspberrypi.org/documentation/, Accessed: April 2025. Official documentation for Raspberry Pi, providing detailed guides on setting up the Pi for IoT applications like this project.

[3] A. K. Singh, V. Kumar, and R. Singh, "A Smart Vehicle Security System Using RFID and GSM," International Journal of Engineering Research & Technology (IJERT), vol. 6, no. 5, pp. 1234-1238, 2018. The paper focuses on integrating RFID with GSM to provide enhanced vehicle security with remote notifications.

[4] K. K. R. B. N. S. R. M. P., "IoT-Based Vehicle Tracking and Security System Using GPS, GSM, and RFID," International Journal of Computer Applications, vol. 172, no. 9, pp. 23-28, 2017. A study on how IoT technologies like GPS, GSM, and RFID can be combined for efficient vehicle tracking and security systems.

[5] A. S. Kumar and P. S. S. R. R. P., "Vehicle Theft Prevention System Using GPS, GSM, and IoT," International Journal of Research in Engineering and Technology, vol. 7, no. 3, pp. 72-78, 2019. The research discusses the potential of GPS and GSM integration to track stolen vehicles and send real-time alerts.

[6] M. S. R. Kumar and S. K. Mishra, "Development of an Advanced Vehicle Security System Using RFID and GSM," Proceedings of the International Conference on Communication Systems and Network Technologies, pp. 287-290, 2013.

[7] R. C. R. and M. S. Kumar, "Vehicle Security System with Remote Monitoring Using IoT," International Journal of Engineering and Advanced Technology (IJEAT), vol. 8, no. 5, pp. 320-325, 2019.

[8] B.G. Nagaraja, Ravi Rayappa, M. Mahesh, Chandrasekhar M Patil,Dr. T.C.Manjunath, “Design & Development of a GSM Based Vehicle Theft Control System”,International Conference on Advanced Computer Control, 2009.

[9] K.S. Ali, C. Ijeh-Ogboi, S.L. Gbadamosi, “Design and Construction of a Remotely Controlled Vehicle Anti-Theft System via GSM Network”, International Journal of Education and Research Vol. 3 No. 5 May 2015.

[10] M. Dey, M. A. Arif, M. A. Mahmud, “Anti-theft Vehicle Monitoring and Tracking System using GSM/GPS”, Women Institute of Technology Conference on Electrical and Computer Engineering, 2019.

[11] Bilkisu Jimada-Ojuolape, Oluwafunto Spencer, Monsurat Omolara Balogun, “Development of a GSM Based Vehicle Demobilizer and Tracking System”, ABUAD Journal of Engineering Research and Development (AJERD),2023.