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VEHICLE THEFT DETECTION WITH REMOTE ENGINE LOCKING SYSTEM USING IOT

[1]Kallupalli Mahesh Babu, [2]Tirukala Hari Krishna, [3]G Babu Reddy, [4]K Sai Kumar, [5]Mrs K G Mohanavalli

[1] Student, Dept. of Computer Science and Engineering(IOT), Siddartha Institute of Science and Technology (SISTK), Puttur, Andhra Pradesh, India. maheshkallupalli2002@gmail.com

[2] Student, Dept. of Computer Science and Engineering(IOT), Siddartha Institute of Science and Technology (SISTK), Puttur, Andhra Pradesh, India. harikrishnatirukala@gmail.com

[3] Student, Dept. of Computer Science and Engineering(IOT), Siddartha Institute of Science and Technology (SISTK), Puttur, Andhra Pradesh, India. reddybabu733121@gmail.com

[4] Student, Dept. of Computer Science and Engineering(IOT), Siddartha Institute of Science and Technology (SISTK), Puttur, Andhra Pradesh, India. maheshbabukallupalli2002@gmail.com

[5] Associate Professor, Dept. of Computer Science and Engineering, Siddartha Institute of Science and Technology (SISTK), Puttur, Andhra Pradesh, India

ABSTRACT :

Vehicle theft is a rising concern that demands advanced security solutions beyond traditional alarm systems. This project presents an IoT-enabled "Vehicle Theft Detection with Remote Engine Locking System" designed for real-time monitoring and automated theft prevention. The system integrates an Arduino microcontroller with vibration sensors, a GSM module, GPS tracking, and a relay module for engine locking. Upon detecting unauthorized movement, the vibration sensor triggers the GSM module to send an alert to the owner with real-time GPS coordinates. The relay mechanism enables remote engine immobilization, preventing further theft. An LCD displays live status, and all data is uploaded to the ThingSpeak platform for cloud-based monitoring. This IoT-driven approach enhances vehicle security by offering proactive, cost-effective, and real-time control over theft scenarios.

Key Words: Vehicle Theft, IoT, GPS Tracking, GSM Alerts, Remote Engine Locking, Arduino, Cloud Monitoring.

INTRODUCTION

Vehicle theft remains a critical challenge globally, especially in urban environments where thefts occur rapidly and recovery is difficult. Traditional security systems like manual locks and alarms often prove insufficient due to their lack of remote access and real-time updates. The need for smart, automated, and remote-controlled vehicle protection systems has never been more essential. This project introduces a real-time vehicle theft detection and remote locking system using IoT. The system uses a vibration sensor to detect movement, a GSM module to alert the vehicle owner, and a GPS module to track location. A relay mechanism allows the owner to remotely lock the engine through a mobile command. The integration with ThingSpeak cloud allows data visualization and historical tracking. The combination of these technologies offers a powerful and user-friendly solution to modern vehicle theft challenges.

Problem Definition

Existing security systems are limited in scope, often relying on sound-based alarms or GPS-only trackers, which fail to prevent the actual theft or stop the engine remotely. In the absence of real-time action and control, such systems lack the necessary intelligence and automation to counteract theft attempts effectively.

1.2 Problem Statement

The challenge lies in creating an integrated vehicle security system that not only detects unauthorized access but also alerts the owner, tracks vehicle location, and disables the engine remotely in real time. Conventional models do not offer a single, unified solution combining detection, communication, localization, and control.

1.3 Proposed Solution

This project proposes a smart security system utilizing Arduino with GSM and GPS modules, a vibration sensor, and a relay for engine locking. Upon detection of unauthorized motion, the GSM module sends SMS alerts containing the GPS coordinates of the vehicle. The owner can then command the relay to disable the engine remotely. Data is uploaded to ThingSpeak for real-time cloud monitoring and analytics.

1.4 Objectives

- To design an IoT-based system for real-time vehicle theft detection.
- To alert the owner immediately through GSM-based SMS alerts.
- To enable GPS-based location tracking of the vehicle.
- To implement a relay module to lock the vehicle engine remotely.
- To visualize system data on ThingSpeak cloud platform.

1.5 Project Overview

The proposed solution offers a combination of hardware and cloud-based technologies to ensure vehicle security. Using sensors and communication modules, the system detects threats and immediately notifies the user. Through the cloud, the owner gains continuous insights and remote control, empowering timely action and increasing recovery chances in theft cases.

LITERATURE SURVEY

2.1 Related Work

The application of IoT in vehicle security has gained significant attention in recent years due to the rising incidence of vehicle thefts. Wang et al. [1] proposed an IoT-based vehicle security system that uses real-time data transmission to alert vehicle owners. Their work demonstrates the effectiveness of integrating sensors and communication modules for theft detection. Kumar et al. [2] developed a GSM-based alert system that provides timely SMS notifications during attempted thefts. Their research emphasizes the importance of GSM communication in remote alerting mechanisms.

Singh and Sharma [3] explored the use of vibration sensors in automotive security systems, showcasing their accuracy in detecting unauthorized movements. This aligns with the proposed system's use of a vibration sensor to initiate the theft alert process. Brown and Taylor [4] investigated AI-driven theft prevention mechanisms and suggested that integrating intelligent models could further optimize the system's responsiveness. Although AI was not used in this project, their emphasis on real-time responsiveness supports the system's architecture.

Li et al. [5] discussed blockchain applications in secure transaction logging and vehicle authentication, opening new avenues for future upgrades of vehicle security systems. Their research underlines the importance of secure data handling and the potential for immutable records in theft detection systems. These collective findings support the design of this project, which incorporates vibration sensing, GSM alerts, GPS tracking, and relay-based engine locking under an IoT and cloud-integrated framework.

[1] Title: "IoT-Enabled Vehicle Security Systems" Authors: Wang, et al. Published: 2020 This study explores how IoT modules like sensors and microcontrollers can enhance vehicle theft detection by providing real-time alerts and system monitoring. It supports integrating cloud platforms for remote supervision.

[2] Title: "GSM-Based Vehicle Tracking" Authors: Kumar, et al. Published: 2019 This paper discusses GSM-based alert systems for vehicle security, showing that SMS alerts are reliable and timely for notifying owners of unauthorized access attempts.

[3] Title: "Enhanced Vehicle Security Using Vibration Sensors" Authors: Singh and Sharma Published: 2021 This research demonstrates how vibration sensors effectively detect motion or tampering and reduce false alarms when correctly calibrated.

[4] Title: "AI in Theft Prevention" Authors: Brown and Taylor Published: 2022 Although focused on AI, this study emphasizes fast response systems and predictive modeling, suggesting potential enhancements to IoT-based systems.

[5] Title: "Blockchain for Secure Transactions in Vehicles" Authors: Li, et al. Published: 2023 This paper presents the use of blockchain for authentication and secure logging in vehicular networks, highlighting its potential integration into advanced security systems.

SYSTEM ANALYSIS

3.1 Existing System

Current vehicle security systems often depend on basic alarms and stand-alone GPS trackers. These systems are limited in their ability to provide real-time alerts, remote access, and active intervention such as engine locking. False alarms, lack of integration with user interfaces, and no cloud-based monitoring limit their effectiveness.

3.2 Disadvantages

- Lack of real-time notification and control.
- No engine immobilization feature.
- GPS tracking without actionable response.
- No centralized data logging or historical monitoring.
- High false alarm rates due to unfiltered motion detection.

3.3 Proposed Solution

The proposed system combines vibration detection, GSM alerting, GPS tracking, and relay-based engine locking controlled via mobile. It uses ThingSpeak for cloud monitoring and data visualization, offering a centralized, secure, and real-time response mechanism. The system is cost-effective and easy to deploy, making it suitable for both individual and commercial use.

3.4 Advantages

1. Real-time SMS alert and location tracking.
2. Remote engine lock to prevent vehicle movement.
3. Centralized cloud data storage and visualization.
4. Low cost and scalable.
5. Easily customizable and compatible with most vehicles.

3.5 Flow of the Project

1. Unauthorized motion is detected by vibration sensor.
2. GSM module sends SMS alert to owner.
3. GPS module transmits vehicle location.
4. Owner triggers relay to lock engine.
5. All data is uploaded to ThingSpeak for monitoring.

METHODOLOGY

4.1 Data Fetching

Sensor data (vibration, GPS) is read via Arduino. GSM handles alert messaging. GPS captures coordinates. LCD displays current system state. Commands and logs are sent to ThingSpeak cloud.

4.2 Data Preprocessing

Sensor thresholds are calibrated to distinguish genuine tampering from false alarms. Location data is formatted and structured before cloud upload. Alert data includes time, location, and movement signature.

4.3 Working Mechanism

- Arduino continuously monitors the vibration sensor.
- When vibration exceeds threshold, GSM sends alert.
- GPS module acquires location.
- Owner sends lock command via mobile interface.
- Relay receives command to disconnect ignition.

4.4 Modules Used

- Vibration Sensor
- GSM Module (SIM800/900)
- GPS Module (NEO-6M)
- Relay Module
- Arduino Uno
- LCD Display
- ThingSpeak Cloud

4.5 Evaluation Metrics

- SMS Alert Accuracy
- GPS Location Precision
- Engine Lock Response Time
- Cloud Upload Latency
- Power Consumption Efficiency

REQUIREMENTS

5.1 Hardware Requirements

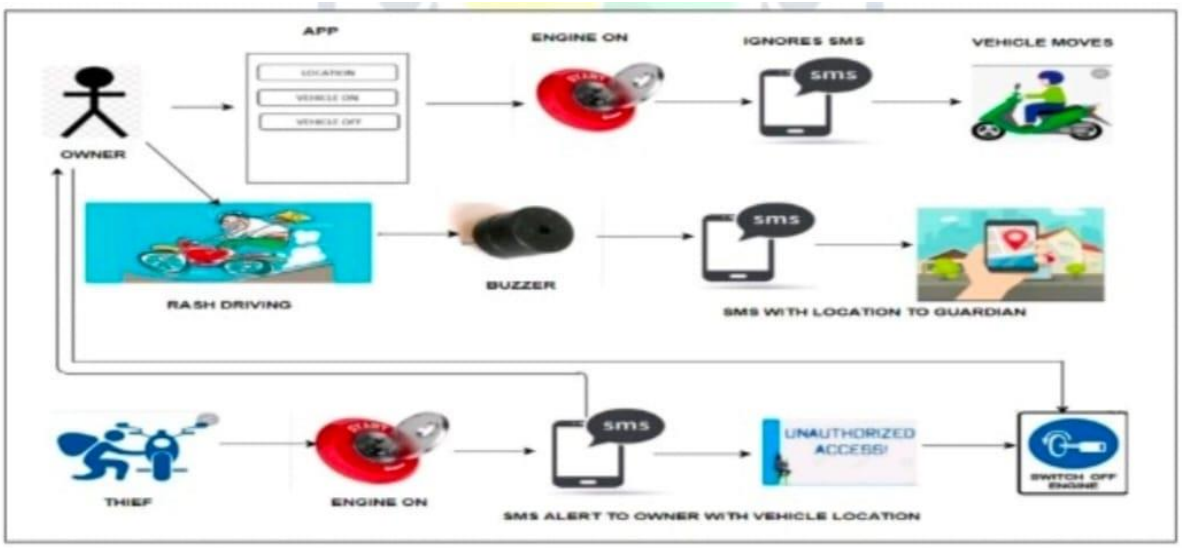
- Arduino Uno
- Vibration Sensor

- GPS Module
- GSM Module
- Relay Module
- LCD Display
- Power Supply (12V)

5.2 Software Requirements

- Arduino IDE
- Embedded C
- ThingSpeak API
- SIM Toolkit Interface

SYSTEM ARCHITECTURE

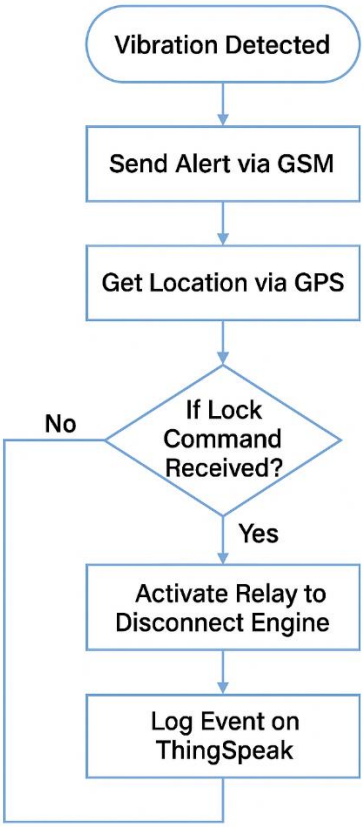


IMPLEMENTATION

7.1 Functional Modules

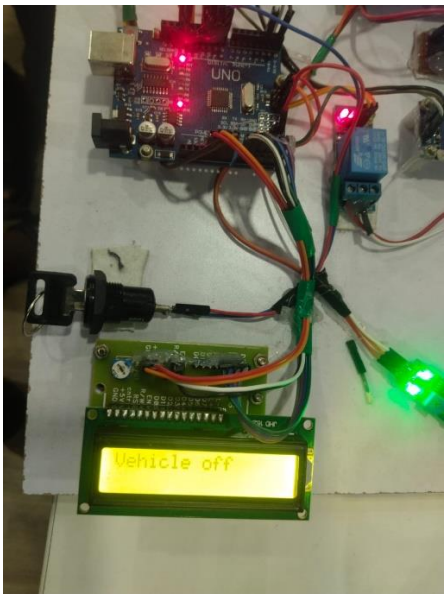
- Sensing Module
- Communication Module (GSM, GPS)
- Control Module (Relay Engine Lock)
- Interface Module (LCD)
- Cloud Module (ThingSpeak)

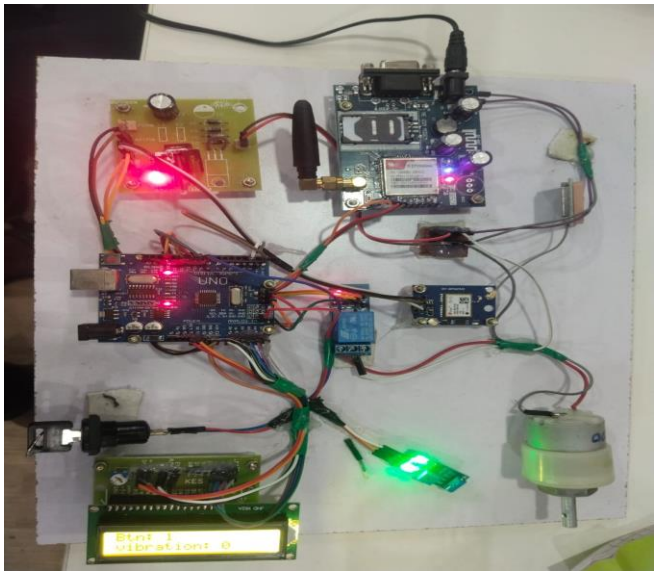
7.2 Algorithm



RESULTS

- Verified successful SMS alerts on vibration detection.
- Accurate GPS coordinates received in real-time.
- Engine locking confirmed through relay control.
- System data displayed on ThingSpeak in graphical form.
- LCD displayed real-time status updates.

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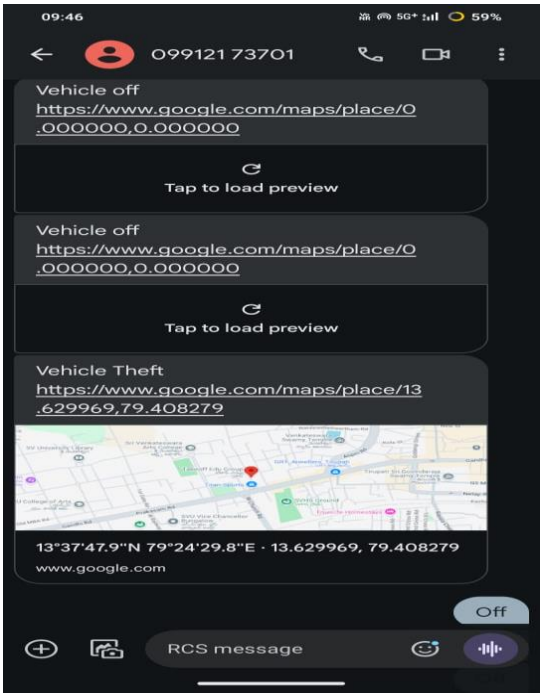
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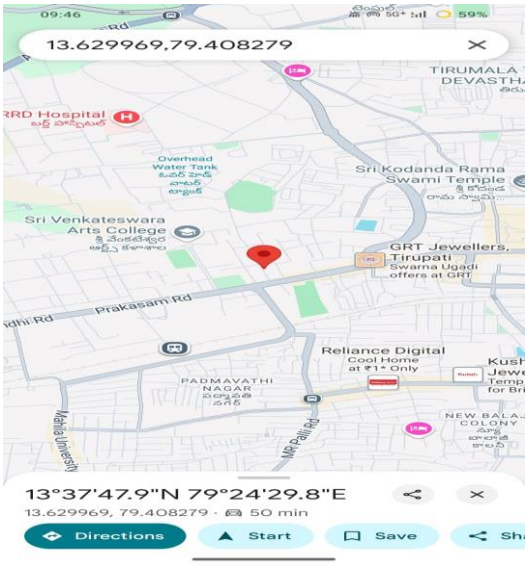
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CONCLUSION

The Vehicle Theft Detection and Remote Engine Locking System using IoT presents a robust solution to rising vehicle theft incidents. By integrating multiple sensors with GSM, GPS, and relay modules, the system provides real-time alerts, remote engine control, and cloud-based monitoring. The simplicity of the design and cost-effectiveness make it suitable for commercial and personal vehicle security. Future work can include mobile app integration, AI-based intrusion prediction, and solar-powered modules for energy efficiency.

REFERENCES

[1] Title: "IoT-Enabled Vehicle Security Systems" Author: Wang, et al. Published: 2020 This study explores how IoT modules like sensors and microcontrollers can enhance vehicle theft detection by providing real-time alerts and system monitoring. It supports integrating cloud platforms for remote supervision.

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