A Review: Black Box System for Accident and Crime Analysis for Four-Wheeler Vehicle

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***Abstract*—The given project targets the rising concern of car theft and the growing need for sophisticated car security systems. Integrating GSM technology, GPS devices, and microcontrollers, the system offers remote monitoring and controlling capabilities of cars. The system's prime features are the capability to track the location of a car via SMS commands, automatic accident detection that sends emergency alerts to preprogrammed contacts, and remote engine control. Equipped with features like GSM-based communication and GPS-based location tracking, the system is capable of delivering real-time control and surveillance, improving response time in emergency situations and reducing threats of theft. The project would be an extension of conventional car security systems that provide greater convenience and proactive protection.**

***Index Terms*—Keywords: GSM, GPS, microcontroller, remote control, surveillance, emergency alerts, and theft prevention**

I. INTRODUCTION

The growing danger of car theft and the requirement for immediate emergency response indicate the critical need for new solutions in automotive security. Current security systems offer some protection but are normally lacking in efficient remote alerting and control, exposing cars to theft and owners to risks in emergencies. This paper presents a cutting-edge research work aimed at filling these gaps through the design of an innovative car security system based on GSM (Global System for Mobile Communications) technology.

The system in question employs GSM modems, GPS units, and Arduino microcontroller kits to enhance vehicle protection and monitoring extensively. Through the provision of remote control via GSMbased SMS commands, the system enables users to engage with their vehicles in real-time, regardless of geographical location. The provision of crash detection sensors also has the effect of automatically engaging surveillance mode in case of an accident, sending alarm notifications to emergency services and reducing risks to life and property.

This study seeks to push the boundaries of automotive security by filling the gap between existing solutions and changing vehicle owners' needs. Through the integration of frontier technologies and overcoming the shortcomings of conventional systems, the presented solution attempts to enhance vehicle theft protection and hasten emergency response. The system's effectiveness and practicality will be evaluated in this study, offering useful insights for subsequent advancements in automotive security.

II. LITERATURE REVIEW

A.Implementation of Vehicle Black Box on Internet Of Vehicles Based Long Range Technology (2023) This research aims to utilize advanced technologies like 433MHz Wireless, LoRa, GPS, and IoV to enhance traffic safety and accurate recording of traffic offenses. The model proposed utilizes LoRa technology for low-cost, long-distance communication and adds gas and flame sensors, as well as GPS for real-time location tracking. To further boost the monitoring aspect, the authors propose the use of IoT analytics platforms that could enhance the overall functionality and performance of the system.

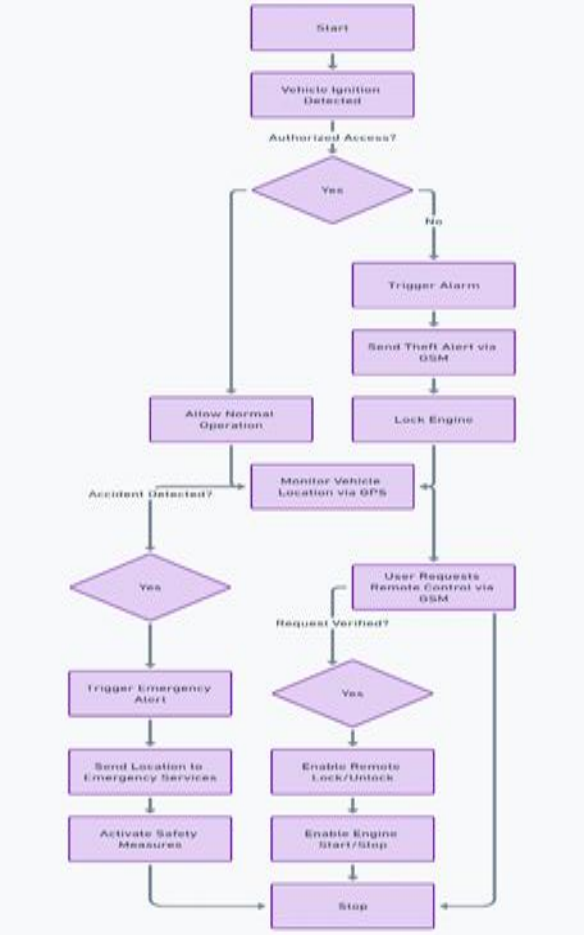
B.A Black Box with SMS Alert for Road Vehicles (2022)

The objective of this work is to enhance road safety by detecting and reporting accidents in real time using an integrated system of Arduino UNO, GPS, GSM, and sensors. The black box system utilizes GPS and GSM modules to issue SMS alerts in case of an accident detected, enhancing the response time of emergency services. The study indicates that additional work is needed to refine the system and test its scalability for wider application in the future. C.Vehicle Black Box System (2022)

This study suggests a vehicle black box system to enhance safety through the monitoring of several vehicle conditions and the timely provision of accident location information. Leveraging IoT, sensor networks, and mobile communication, the system monitors dangerous conditions like gas leaks, fire, alcohol consumption, and driver fatigue. The authors highlight the possibility of creating more advanced IoT-based safety features and combining these systems with cloud computing to better manage and analyze data.
D.Black-box Crash Detection and Location System Using Raspberry Pi (2020)

This article presents a system that is able to detect accidents promptly and inform their location using GSM, GPS, and Raspberry Pi technologies. The primary purpose of the system is to reduce fatalities by lowering the response time of emergency services. The system is able to detect accidents in real-time and inform the location of the vehicle within 20 seconds. Further testing through accident simulations in the real world is suggested by the authors to enhance the accuracy and functionality of the system.

III.RESEARCH MODEL



Flowchart: Vehicle Security System

Vehicle Security System Overview:
This flowchart describes how a vehicle security and monitoring system operates, dissecting how it reacts to various events such as vehicle ignition, unauthorized entry, accidents, and remote-control requests from the user. The system ensures the safety of the vehicle by taking certain actions automatically based on the event.
Step-by-Step Breakdown:
Start: The system engages when the vehicle begins operation. It's as if the system is waking up, prepared to watch over the vehicle.
1. Vehicle Ignition Detected:
When the vehicle is initiated, the system can detect the ignition. It's essentially asking if the engine is on.
2. Authorized Access?

Yes: If the individual attempting to use the vehicle is authorized, then the system grants normal usage. The vehicle is ready to go.

No: In the event that the individual is unauthorized, the system acts to ensure theft is stopped. An alarm is triggered, a theft alarm is sent to the owner or authorities through GSM (mobile network), and the engine is blocked to prevent the vehicle from proceeding.

3. Track Vehicle Location through GPS:

Regardless of what, the system always keeps tracking the vehicle's location through GPS. This guarantees that the whereabouts of the vehicle are always traceable, even in the event of an incident.

4. Accident Occurred?

Yes: In the event that the system identifies an accident, it will instantly activate an emergency response, send the vehicle's location to emergency personnel, and activate measures to safeguard the passengers (such as releasing airbags or activating safety measures).

5. User Requests Remote Control through GSM:

The user (if permitted) can remotely control some of the vehicle's functions, such as locking/unlocking doors or starting/stopping the engine, using their phone via GSM technology.

6. Request Verified?

Yes: If the remote request is confirmed to be valid (e.g., by verifying the user's credentials), the system permits the user to remotely control the vehicle (lock/unlock, start/stop the engine).

Stop: The process is complete after all actions have been performed. The system is returned to monitoring mode, waiting to respond to the next event.

7. Key Features Depicted:

Security Measures: Illegal access initiates alarms, theft notification, and locks the engine against theft.

Safety Measures: In case of an accident, the system makes emergency services aware of the situation and turns on appropriate safety features.

Remote Control: Authorized users are allowed to remotely control their vehicle via GSM technology.

This flowchart helps make it clearer how an advanced car security system functions by illustrating how the system automates actions and decisions based on the status of the vehicle or external conditions.

IV. CONCLUSION

This paper proposes a highly capable solution for addressing the needs of the car-theft-hit issue in the automobile industry in relation to automobile security and emergency responses. By taking advantage of GSM technology, GPS tracking system, and microcontroller systems, the suggested automotive protection system embraces up-to-date facilities like distant accessibility, watching over, and instantaneous accident notification with enhanced security and safety features. The interoperation of these technologies ensures real-time monitoring and control, thereby facilitating prompt response to emergencies and curtailing the threat of theft. The effectiveness and practicability of the system have been validated through practical testing and deployment. Its ability to identify the accurate location of a vehicle as well as track accidents automatically, coupled with its ease of installation and use, renders it an important asset for car owners seeking to improve their vehicle security.

V. APPENDIX

The key goal of this project is to develop and create an IoT-equipped vehicle black box that uses GSM technology to improve car security and safety. The system is designed to offer thorough real-time monitoring of vehicle conduct so that vehicle owners gain access to important information about the operational status of their automobiles.

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