"Smart Vehicle Theft and Accident Detection with Location Tracking"

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Abstract- This project introduces a smart system designed to improve both vehicle security and driver safety. It uses dual fingerprint authentication to control door locking and engine start, ensuring that only authorized users can access or operate the vehicle. Along with theft protection, the system includes sensors that can detect sudden impacts or unusual vibrations to identify possible accidents. When an accident is detected, it instantly sends an alert message with the vehicle's live GPS location to emergency contacts. The system is built using a microcontroller (Arduino/ESP8266) and includes fingerprint, accelerometer, GPS, and GSM/Wi-Fi modules for real-time monitoring and communication. By combining biometrics, tracking, and automation, this project demonstrates how IoT technology can make vehicles safer and more secure.

Index Terms: Vehicle theft detection, accident detection, location tracking, IoT, smart vehicle security.

I INTRODUCTION:

The automobile industry has grown tremendously in recent years, with technology—especially Artificial Intelligence (AI)—transforming how vehicles operate and how safe they are. Despite these advancements, challenges like vehicle theft and road accidents remain serious global concerns. Every year, countless cars are stolen because of loopholes in traditional systems such as mechanical locks, duplicate keys, and basic alarms[1] Likewise, many accidents turn deadly because of delays in detection and the lack of timely communication that could connect victims to emergency services sooner[2] These ongoing problems show the need for a smarter system that can strengthen both vehicle security and passenger safety[3] Traditional tools like GPS trackers, steering locks, or alarms provide limited protection and are often easy to bypass[4] Similarly, most existing accident alert systems are slow and unreliable, failing to deliver real-time updates when they matter most[5] With modern AI and biometric technology, however, it's now possible to create systems that don't just react to problems but help prevent them[6]This project introduces an intelligent vehicle system designed to tackle both theft and accident response[7]It uses two fingerprint

sensors—one at the car's door handle and another at the ignition—to make sure only authorized users can access and start the vehicle. This two-step verification greatly reduces the risk of theft. At the same time, built-in sensors monitor for sudden impacts or unusual vibrations, automatically detecting accidents and sending real-time location data to emergency contacts or rescue services[8] The prototype is built around a microcontroller (Arduino or ESP32) integrated with fingerprint sensors, an accelerometer, a GPS module, and GSM/Wi-Fi connectivity for instant communication [9]By combining biometric verification, accident detection, and live GPS tracking, the system offers a smarter, more reliable approach to road safety[10]It not only strengthens vehicle security but also ensures faster emergency response—moving one step closer to the future of AI-driven, safe, and connected transportation.

Key feature:

- Dual Fingerprint Security
- Accident Detection:
- Real-Time Alerts:
- Live Location Tracking

The rest of the paper consists of six sections. Section I presents the introduction, section II contains the objectives Section III Block diagram. Section IV presents the methodology, section and components used, V presents the outcomes and application, and section VI presents the advantages and disadvantages, section VII summarizes the paper and presents the conclusion.

II OBJECTIVES:

- To develop a smart biometric system for secure car handle access detection.
- To design an engine ignition system integrated with biometric authentication.
- To design an accident detection mechanism using sensor and data analysis.
- To implement a location tracking feature that provides the vehicle's real-time position.

III BLOCK DIAGRAM:

The section explains proposed block diagram. The block diagram shows an integrated vehicle security and safety system centred around the ESP8266 microcontroller. Key components include a dual-layer fingerprint authentication

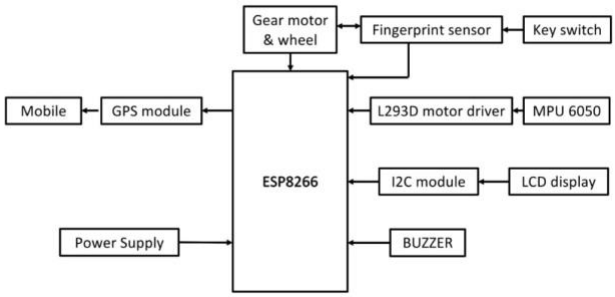

Figure 1: Block diagram of smart vehicle theft and accident detection with location tracking

The section explains proposed block diagram. The block diagram shows an integrated vehicle security and safety system centred around the ESP8266 microcontroller. Key components include a dual-layer fingerprint authentication for secure access, accident detection through the MPU6050 sensor, and real-time location updates via a GPS module. The system also features a buzzer for alerts, an LCD display for feedback, and wireless communication to a mobile device for emergency notifications, all powered by a dedicated power supply. This setup allows seamless coordination between security, accident sensing, and user communication components.

IV METHODOLOGY:

The project works in different stages to detect theft or accidents and to track the vehicle in real time. It combines hardware components, sensors, and software programming using the ESP8266 (Node MCU) microcontroller.

1. Hardware Setup:

The main controller of the system is ESP8266 (Node MCU).

All other components are connected to it to perform different functions:

MPU6050 sensor: Detects movement, tilt, and sudden impact for accident detection.

Neo-6M GPS module: Tracks the exact location of the vehicle.

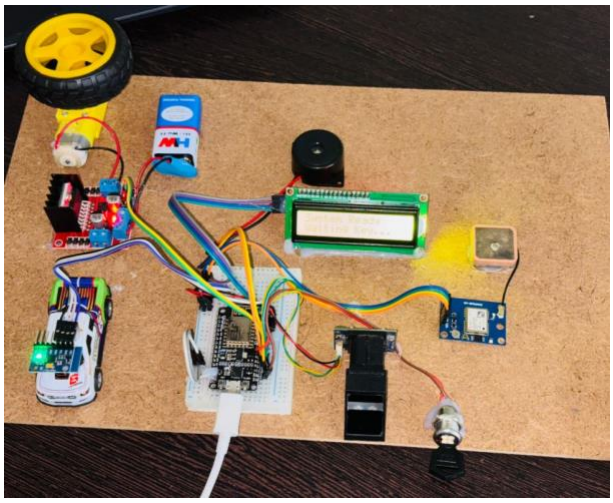

Figure 2: the hardware setup

R305 fingerprint sensor: Allows only authorized users to start the vehicle.

L298 motor driver: Controls the movement of the motor and wheels.

16x2 LCD display (with I2C module): Shows system status and GPS coordinates.

Key switch: Works as the ignition key.

Buzzer: Gives sound alert during theft or accident.

BO gear motor & wheel: Represents vehicle movement.

Breadboard, connecting wires, HW battery, and power supply: Help in connecting and powering the system.

2. Software Platform:

The system is programmed in Arduino IDE. The ESP8266 reads sensor data, checks conditions, and takes actions like: Sending alerts, Turning on the buzzer, or Displaying messages on the LCD. It uses AI logic to decide whether the situation is normal, theft, or accident.

3. Data Collection:

The system collects different types of data:

- Motion data from MPU6050 (acceleration, tilt, vibration).
- Location data from GPS module.
- Fingerprint data for driver verification.
- Vehicle data like ignition status and movement.

This data helps the system understand what is happening with the vehicle.

4. Event Detection:

Based on the collected data, the system detects events:

Theft Detection:

If someone tries to start or move the vehicle without fingerprint access, the system activates the buzzer and sends an alert.

Accident Detection:

If the MPU6050 senses a strong impact or sudden change in position, the system marks it as an accident and sends the location instantly.

Location Tracking:

The GPS module keeps updating the live position of the vehicle.

5. Communication and Alerts:

The ESP8266 sends real-time alerts to the user through Wi-Fi or IoT platforms.

Alerts include:

Theft warning

Accident notification

Vehicle location (with coordinates)
The user can also send commands like stopping the motor, buzzing the horn, or checking the vehicle's location.

6. Mobile and Web Application:
The mobile/web app helps the user, See the live vehicle location on a map. Get instant alerts for theft or accident. Control the vehicle remotely (lock/unlock, buzzer on/off, etc).

7. Testing and Evaluation:
The system is tested for different conditions:
Theft test: Unauthorized start or movement triggers buzzer and alert.
Accident test: Sudden shocks trigger accident alerts with GPS location.
Performance test: Checks how fast and accurately the system detects events.
After testing, adjustments are made to improve accuracy and speed.

V OUTCOMES AND APPLICATIONS:

OUTCOMES

- A smart vehicle system that starts only with authorized fingerprint authentication.
- Automatic location sharing in case of accident.
- Emergency notifications sent to owner and/or relatives instantly.
- Reduced risk of vehicle theft and faster emergency response in accidents.
- Practical IoT driven application for real-world vehicle safety.

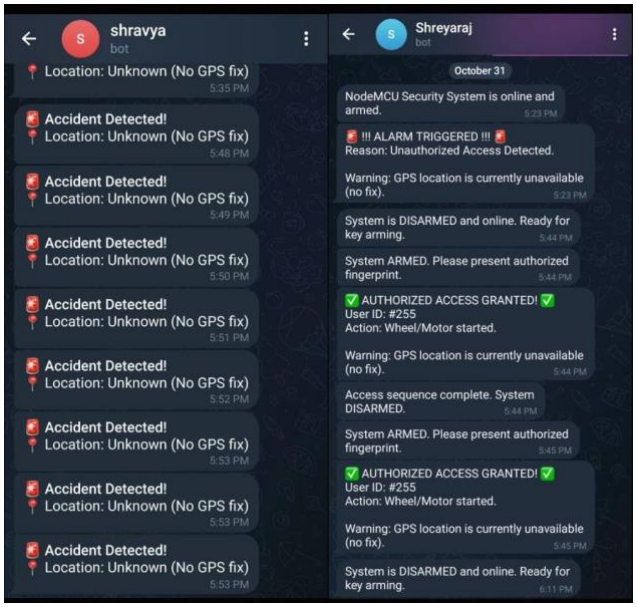

Figure 3: telegram notification

APPLICATIONS:

1.Personal Vehicle Security-Prevents unauthorized users from opening the car door or starting the engine. Dual fingerprint protection ensures even if someone breaks into the car, ignition is still locked. Protects against relay attacks (where thieves replicate key signals).

2. Fleet Management Systems-Companies managing taxis, buses, or delivery vans can secure vehicles so that only registered drivers can operate them. Helps track accidents in real time and alert central control. Reduces misuse of vehicles by unauthorized employees.

3. School & College Transport Safety-Only authorized drivers can access and start school buses. Parents & school authorities can get instant alerts in case of accidents. Real-time location tracking improves student safety and accountability.

4. Logistics & Goods Transport-Prevents hijacking of trucks carrying valuable goods. Dual theft protection ensures goods remain safe even if truck cabins are broken into. Accident + location alerts help logistics companies take immediate recovery actions.

5. Public Safety & Emergency Response-Accident detection can automatically alert nearby hospitals, police, or emergency contacts with live location. Helps reduce the "golden hour" delay after road accidents.
6. High-End Vehicle Protection-Luxury car owners can install this system as an anti-theft premium feature.AI can detect suspicious behaviour (like multiple failed fingerprint attempts) and trigger an alarm.

VI ADVANTAGES & DISADVANTAGES:

ADVANTAGES

1. High Security - Fingerprint/biometric authentication prevents unauthorized access.
2. Real-Time Location Tracking – GPS ensures stolen vehicles can be traced quickly.
3. Accident Safety – Automatic accident detection with instant alerts can save lives.
4. AI Smart Detection – Reduces false alarms by distinguishing between minor bumps and real accidents.
5. Two-Way Protection – Covers both theft prevention and accident safety in one system.
6. User-Friendly – Simple fingerprint start and automated alert system.
7.Cost-Effective for Students – Uses affordable sensors and modules available in the market.

DISADVANTAGES

1. Network Dependency – GSM alerts won't work in areas with poor mobile network coverage.
2. Initial Cost – Slightly higher compared to traditional lock/key security systems.
3. Maintenance Required – Fingerprint sensors and modules need proper handling to avoid malfunction.
4. Power Consumption – Continuous GPS and GSM tracking may drain battery quickly.

VII CONCLUSION:

The project aims to create a smart vehicle system that enhances security and safety by allowing the vehicle to start only after verifying the user's fingerprint. In the event of theft or an accident, the system automatically shares the vehicle's location and sends immediate alerts to the owner and designated contacts. This ensures a quicker response, reducing the chances of theft and improving emergency assistance during accidents. By combining IoT technologies, the solution offers a practical and effective way to protect vehicles and provide peace of mind to users in real-world situations.
This approach not only strengthens vehicle security but also creates a connected safety network that supports rapid communication during emergencies, making everyday transportation safer and smarter.

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