

Smart Real Time Accident Alert System

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ABSTRACT

Road traffic accidents are a major cause of injuries and fatalities worldwide, where the lack of immediate medical assistance significantly increases the risk of death. In many accident cases, victims are unable to call for help due to unconsciousness or severe injuries. To address this problem, this paper presents a Smart Accident Detection and Alert System that automatically detects accidents and sends emergency alerts without human intervention. The proposed system is based on a microcontroller-driven architecture integrated with an accelerometer and vibration sensor to continuously monitor vehicle movement and impact conditions. Sudden changes in acceleration and abnormal vibration patterns beyond predefined threshold values are used to identify accident occurrences. Once an accident is detected, the microcontroller processes the sensor data and activates a GSM module to send alert messages and initiate emergency calls. The alert includes real-time location information obtained from a GPS module, which helps emergency services and family members reach the accident site quickly. The system is designed to be cost-effective, compact, and reliable, making it suitable for real-time deployment in vehicles. By reducing dependency on manual reporting, the proposed solution ensures faster emergency response and timely medical assistance. This system can significantly reduce fatality rates caused by delayed rescue operations. The Smart Accident Detection and Alert System provide an efficient and practical approach to enhancing road safety and can be further extended with advanced technologies such as IoT and mobile applications.

Keywords:- Smart Accident Detection, GSM, GPS, Accelerometer, Microcontroller, Emergency Alert System, Road Safety.

1. INTRODUCTION

Road accidents are one of the leading causes of death and serious injuries across the world. In many accident cases, the main reason for loss of life is not the accident itself but the delay in receiving medical help. Victims may be unconscious, trapped inside the vehicle, or unable to contact emergency services. Traditional accident reporting systems depend completely on human intervention, which is not reliable in critical situations. To overcome this issue, the Smart Accident Detection and Alert System is proposed. This system automatically detects vehicle accidents and sends emergency alerts along with the exact location to predefined contacts and emergency services. The system works without human involvement, ensuring quick response and timely medical assistance. It is designed to be low-cost, reliable, and suitable for real-time implementation in vehicles.

Problem statement

In existing systems, accident reporting is mostly manual. If no eyewitness is present or if the victim is unable to use a mobile phone, emergency help may be delayed. This delay can result in severe injuries or death. Hence, there is a need for an automated system that can detect accidents instantly and alert emergency services with accurate location details.

Additionally, current systems lack real-time monitoring and reliable communication mechanisms during emergencies. Manual reporting increases dependency on human intervention, which is not always possible in critical conditions. There is also a need for a cost-effective, fast, and reliable accident detection system that can minimize response time and improve the chances of saving lives.

Objectives of the Paper

The main objectives of the Smart Accident Detection and Alert System are:

To automatically detect vehicle accidents using sensors
To reduce response time by immediately sending alerts
To provide real-time location information using GPS
To minimize human dependency during emergencies
To improve road safety and save human lives

To reduce false accident alerts using threshold values and confirmation delay
To provide dual alert mechanisms through emergency call and SMS.

2. LITERATURE REVIEW

Road traffic accidents are a major cause of fatalities worldwide. According to the World Health Organization (WHO), delayed medical assistance after accidents significantly increases death rates, highlighting the need for automatic accident detection systems.

Gupta et al. developed an accident detection system using GPS and GSM, where vibration sensors detect accidents and send alert messages with location details. However, the system may generate false alerts due to reliance on a single sensor.

Sharma proposed a system using accelerometers to detect sudden changes in vehicle motion and report accidents via GSM. While effective, the absence of a confirmation mechanism limits its reliability.

Kumar emphasized the use of embedded systems for road safety, stating that integrating multiple sensors improves accuracy and reduces false detection. The study also suggests future improvements using IoT technology.

Based on the literature, the proposed system improves reliability by using multiple sensors, confirmation delay, and dual alert mechanisms (call and SMS) with real-time GPS location.

3. SYSTEM FLOW

The Smart Accident Detection and Alert System consist of multiple hardware modules integrated into a single embedded system. The core components include accident detection sensors, a microcontroller, GPS module, GSM module, and alert mechanisms.

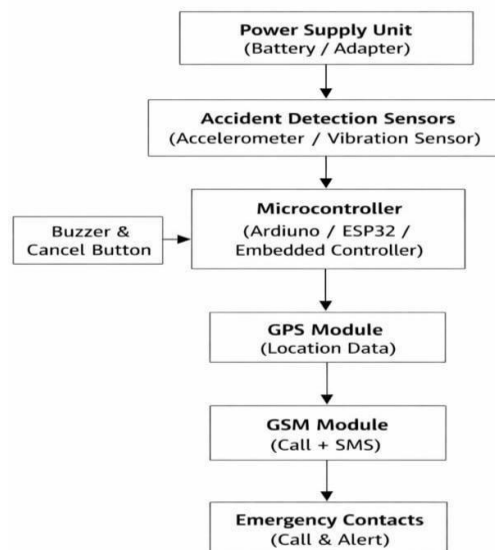


Fig -1: Smart Accidents Detection & Alert System with Call and SMS

The power supply unit provides regulated power to all modules. Accident detection sensors continuously monitor vehicle motion and impact conditions. The microcontroller processes sensor data and controls communication and alert operations.

The GPS module provides real-time location information, while the GSM module is responsible for making emergency calls and sending SMS alerts.

All the hardware modules are interconnected and mounted inside the vehicle in a compact manner. The sensors are placed at suitable positions to accurately detect collision and vibration. The microcontroller coordinates the functioning of all components and ensures proper data flow between sensors, GPS, and GSM modules. This integrated architecture allows the system to function efficiently in real-time conditions and provides a reliable solution for automatic accident detection and alert generation.

Accident Detection Sensors

Accelerometers and vibration sensors detect sudden changes in vehicle acceleration, tilt, or impact by comparing data with predefined thresholds. The microcontroller analyzes this data, and if limits are exceeded, a confirmation delay and buzzer alert are triggered to avoid false alarms. Using both sensors improves accuracy, allowing reliable accident detection and timely emergency response.

Microcontroller Unit

The microcontroller acts as the central processing unit of the system. It receives sensor data, analyzes accident conditions, manages delay and cancellation logic, and controls the GPS and GSM modules. The microcontroller

ensures accurate detection and reliable alert generation.

4. WORKING OF THE PROPOSED SYSTEM

The system remains in monitoring mode while the vehicle is in operation. Sensor data is continuously collected and analyzed. When a sudden collision or abnormal vibration is detected, the microcontroller temporarily activates a confirmation delay and buzzer alert. This step helps in avoiding false alerts caused by minor shocks or road irregularities.

If the driver does not cancel the alert within the given time, the system confirms the accident. After confirmation, the GSM module initiates an automatic emergency call to predefined contact numbers. This call ensures immediate attention from emergency responders or family members.

Following the call, the GPS module retrieves the exact geographical coordinates of the accident location. These coordinates are embedded into a Google Maps link and sent via SMS using the GSM module. The SMS includes accident information and precise location details, enabling quick and accurate rescue operations.

In addition, the system is designed to operate continuously with minimal power consumption, ensuring reliability during long vehicle operation. The alert mechanism works independently of driver intervention once the accident is confirmed.

This helps in ensuring that emergency notifications are sent even if the driver is unconscious or unable to respond. Overall, the automated working process improves emergency response time and increases the chances of saving human lives.

Advantages of the Proposed System

Automatic accident detection without human intervention
Dual alert mechanism: emergency call and SMS
Accurate GPS-based location tracking for quick rescue
Reduced emergency response time
Minimizes false alerts using threshold and confirmation delay
Alerts work even if the driver is unconscious or unable to respond
Low-cost, compact, and reliable design
Continuous monitoring with minimal power consumption

5. CONCLUSIONS

This paper presents a Smart Accident Detection and Alert System with integrated calling and messaging features to enhance road safety. The system automatically detects vehicle accidents, initiates emergency calls, and sends location-based SMS alerts without human intervention.

By reducing dependency on manual reporting and ensuring rapid emergency response, the proposed solution significantly improves the chances of saving lives. Future enhancements may include IoT integration, cloud-based monitoring, and mobile application support for advanced emergency management.

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