International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

IOT-Based Vehicle Accident Detection and Emergency Alert System

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Abstract
This paper presents an IoT-based vehicle accident detection and alert system that detects accidents using g-force and vibration sensors. When an accident is identified, the system immediately sends an SMS with a location link and makes an automatic call to registered contacts using a GSM module. A buzzer and LED provide local alerts, while a manual emergency button enables user-triggered alerts. Accident data is also updated in a dashboard for monitoring. The system ensures fast emergency response, improving road safety and reducing casualties.

Keywords: Internet of Things (IoT), Vehicle Accident Detection, Emergency Alert System, Global Positioning System (GPS), Global System for Mobile Communication (GSM), Road Safety, Smart Transportation, Sensor-Based Monitoring.

1. Introduction

- Road accidents are a major global problem, causing a high number of injuries and fatalities every year. One of the main reasons for increased deaths is the delay in providing timely medical assistance to accident victims. In many cases, accidents occur in remote or less crowded areas where immediate help is not available. The lack of quick communication with emergency services increases the severity of injuries and reduces survival chances. Hence, there is a strong need for an automated system that can quickly detect accident and send alerts without human intervention.
- With the advancement of Internet of Things (IoT) technology, smart systems can now monitor real-time conditions and provide instant communication. IoT enables the integration of sensors, microcontrollers, and communication modules to build intelligent transportation solutions. By using sensors, vehicles can detect abnormal conditions such as high impact force and unusual vibrations, which are common indicators of accidents.
- The proposed IoT-based Vehicle Accident Detection and Emergency Alert System is designed to automatically detect accidents using g-force threshold analysis along with vibration sensing. When an accident is detected, the system immediately sends an SMS with a location link and makes an automatic call to registered emergency contacts using a GSM module. A GPS module is used to obtain the exact accident location, ensuring quick response from emergency services.

- In addition, the system includes a buzzer and LED alert mechanism to provide local alerts at the accident site. A manual emergency push button is also incorporated to allow users to send alerts in critical situations. Furthermore, accident details are updated and monitored through a dashboard interface for real-time tracking and record management.
- The implementation of this system reduces emergency response time and improves road safety. This work focuses on developing a reliable, cost-effective, and efficient IoT-based solution that enhances accident detection, communication, and monitoring, ultimately helping to save lives.

2. Literature Survey

- Several researchers have developed vehicle accident detection and alert systems using technologies such as GPS, GSM, and IoT to reduce emergency response time and improve victim survival rates.
- A GPS and GSM-based accident detection system was proposed using vibration sensors and microcontrollers to identify vehicle collisions. When a sudden impact is detected, the system sends the accident location to emergency contacts through SMS. This method improves response time but mainly relies on a single sensing parameter.
- Another study presented an Arduino-based system using accelerometer sensors to detect sudden changes in motion. When abnormal acceleration is observed, the system triggers an alert message with GPS location details. However, relying only on acceleration data may sometimes lead to false detections.
- An IoT-based accident detection system was developed for real-time monitoring, where sensors continuously track vehicle conditions and send data to cloud platforms. Alerts are generated and shared with emergency services and family members. While this system enables remote monitoring, it may involve higher cost and dependency on internet connectivity.
- Some research also focused on using MEMS sensors along with GPS and GSM modules to detect vehicle tilt and impact. These systems automatically send location details when an accident occurs, but they often lack additional safety features like manual alert options and local warning systems.
- Although existing systems provide effective detection and alert mechanisms, they have limitations such as false triggering, lack of multi-sensor validation, absence of call-based alerts, and limited user interaction. The proposed system overcomes these issues by combining g-force threshold detection with vibration sensing for improved accuracy, along with SMS alerts, automatic calling, a manual emergency push button, local buzzer and LED alerts, and a dashboard interface for real-time monitoring and data management.

3. Existing System

- In existing vehicle accident detection systems, accident information is usually reported manually by witnesses or victims through phone calls to emergency services. In many situations, this process leads to significant delays in providing medical assistance, especially when accidents occur in remote or less populated areas. The lack of immediate communication with emergency responders can increase the severity of injuries and sometimes lead to loss of lives.
- Some existing technological solutions use GPS and GSM modules to detect accidents and send alerts. These systems mainly rely on vibration sensors or simple impact detection mechanisms to identify collisions. When the vibration level exceeds a predefined threshold, the system assumes that an accident has occurred and sends a notification message to predefined contacts. Although these systems

provide basic accident detection functionality, they often suffer from limitations such as false alarms, limited accuracy, and lack of real-time monitoring. In addition, many traditional accident detection systems operate independent without integrating

- Modern IoT technologies. As a result, they do not support continuous monitoring, cloud-based data storage, or real-time communication with multiple emergency services. These limitations reduce the effectiveness of the system in handling emergency situations efficiently.
- Therefore, there is a need for an improved system that integrates IoT technology with advanced sensors and communication modules to provide accurate accident detection and faster emergency alert mechanisms. Such a system can significantly reduce response time and improve overall road safety.

4. Proposed System

- The proposed system is an IoT-based Vehicle Accident Detection and Emergency Alert System designed to automatically detect accidents and provide immediate alerts to emergency contacts. It integrates sensors, a microcontroller, GPS, GSM module, and a monitoring dashboard to ensure accurate detection and fast communication.
- The system uses a combination of accelerometer (g-force) and vibration sensors to continuously monitor the vehicle's condition. The microcontroller processes this data and identifies an accident when the g-force exceeds a predefined threshold along with abnormal vibration. This dual-sensor approach improves detection accuracy and reduces false alerts
- Once an accident is detected, the GPS module retrieves the exact location of the vehicle. The GSM module then sends an SMS with a location link and also makes an automatic call to registered emergency contacts, ensuring immediate attention and faster response.
- In addition to automatic detection, the system includes a manual emergency push button that allows users to send alerts in critical situations. A buzzer and LED alert system is also activated during accident detection to provide local indication.
- Furthermore, the system is integrated with a dashboard interface where accident details are updated and monitored in real time. This helps in tracking, analysis, and maintaining records of incidents.
- The proposed system provides a reliable, cost-effective, and efficient solution that enhances accident detection, ensures quick emergency communication, and improves overall road safety.

5. Block Diagram

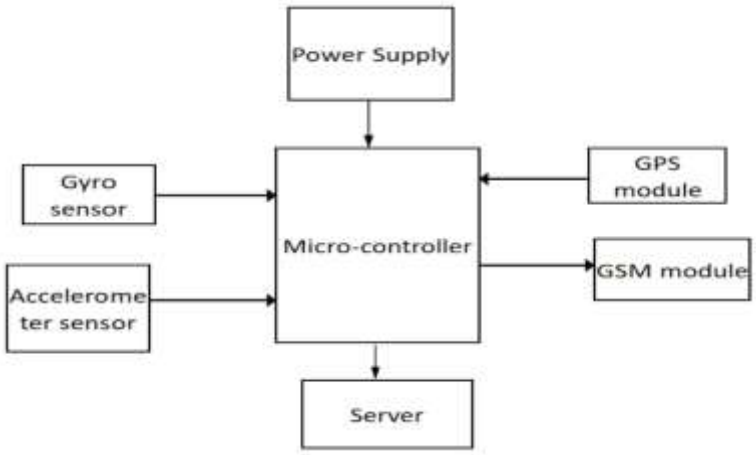

Fig. 1. Block diagram of the Existed Iot-Based Vehicle detection &Emergency Alert System

6. Modified Architecture

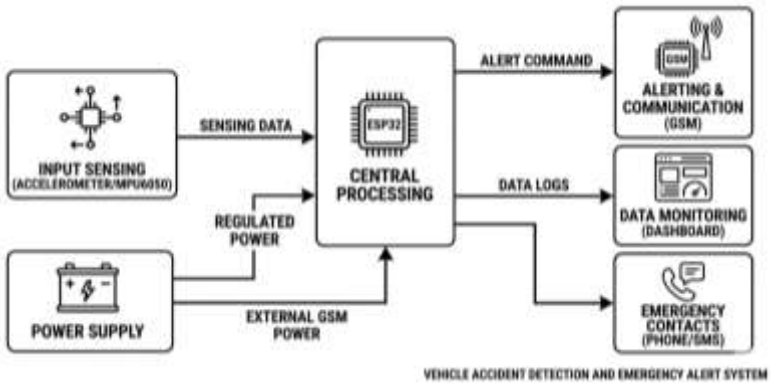

Fig. 2. Modified Iot-Based Vehicle detection &Emergency Alert System

7. Conclusion

- This paper presented an IoT-Based Vehicle Accident Detection and Emergency Alert System that automatically detects accidents using g-force threshold and vibration sensing. The system integrates sensors, a microcontroller, GPS, GSM module, and a dashboard interface to ensure accurate detection and fast communication.
- When an accident is detected, the system immediately sends an SMS with a location link and makes an automatic call to registered contacts. The inclusion of a buzzer and LED alert system provides local indication, while the manual emergency push button allows users to trigger alerts when needed. The dashboard enables real-time monitoring and record management of accident data.
- The implementation of this system significantly reduces emergency response time and improves the chances of saving lives. Overall, the proposed system is reliable, cost-effective, and efficient in enhancing road safety through quick detection, communication, and monitoring.

8. Future scope

- Although the proposed system provides an effective solution, further improvements can be made by integrating machine learning techniques to enhance accident detection accuracy and reduce false alerts.
- Additional sensors such as gyroscope and camera modules can be included to provide more detailed information about the accident, helping emergency services better understand the situation.
- The system can be further enhanced by improving the dashboard with mobile application support and cloud integration for advanced real-time monitoring and data analysis.
- Integration with smart city infrastructure, such as hospitals, police stations, and traffic management systems, can enable faster and more efficient emergency response.

References

1. Bibek Shresha, Gaurav Darlami, Nabin Upadhayaya, Bishal Singh, Sony Shrestha and K. C. Ranjit, “Vehicle Accident Detection and Message Conveyor,” Sustainable Intelligent Infrastructure, vol. 1, no. 2, pp. 108–114, 2025.
2. Suhas Sanap, Vedant Patil, Harshal Buchake, and Dr. Jeet Patil, “Design & Development of Arduino Based Vehicle Accident Alert System Using GPS, GSM Module, Distance & Force Sensor,” International Journal of Engineering Research & Technology (IJERT), vol. 13, no. 04,April 2024.

3. Rimsha Jamil Ghilzai, Ayesha Qadir, Urwa Bibi, and Muhammad Afzal, "An Enhanced Novel IoT-Based Car Accident Detection and Alert System," International Journal of Innovations in Science & Technology, vol. 7, no. 1, pp. 358–376, Feb. 2025.
4. Dheeraj Yadav, Kavita Verma, and Priyanka Pandey, "Automatic Accident Detection and Rescue System," International Journal of Computer Sciences and Engineering (IJRASET), 2025, Paper ID: 72687.
5. Vasireddy Satish and Pyla Karuna Sagar, "Real-time Accident Detection and Emergency Notification System for Mobile Devices," International Journal for Research in Applied Science and Engineering Technology (IJRASET), 2025
6. R. Jamil Ghilzai, A. Qadir, U. Bibi, and M. Afzal, "An Enhanced Novel IoT-Based Car Accident Detection and Alert System," International Journal of Innovations in Science and Technology, vol. 7, no. 1, pp. 358–376, 2025.
7. M. A. Sahraei and S. R. M. Al Mamari, "A Review of Internet of Things Approaches for Vehicle Accident Detection and Emergency Notification," Sustainability, vol. 17, no. 14, 2025.
8. M. Shafiulla, K. Abhishek, C. Barole, and A. H. S., "Novel Approach for Vehicle Accident Tracking Using IoT," International Journal for Research in Applied Science & Engineering Technology, vol. 12, no. 5, 2024.
9. S. Aslam, S. Islam, N. Nigar, and S. A. Ajagbe, "IoT-Based Automatic Vehicle Accident Detection and Visual Situation Reporting System," International Journal of Intelligent Systems, 2024.
10. D. Hadi Nassar and J. Mustafa Al-Tuwaijari, "A Review of Vehicle Accident Detection and Notification Systems Based on Machine Learning Techniques," Academic Science Journal, vol. 2, no. 2, pp. 105–126, 2024.