INTERNATIONAL JOURNAL OF
RECENT TRENDS IN MULTIDISCIPLINARY RESEARCH
https://www.doi.org/10.59256/ijrtmr.20250502015
March-April 2025, Vol 5(02), 89-92.
ISSN No: 2583-0368

# IOT-Based Automatic Vehicle Accident Detection System

**P. Vamshi[1], E. Akshaya[2], L. Sapnil[3], K. Dinesh[4], K. Sushma[5]**
*[1,2,3,4] B. Tech, IV-Year, Department of Information Technology, CMREC Engineering College (UGC Autonomous), Hyderabad, Telangana, India.*
*[5] Assistant Professor, Department of Information Technology, CMR Engineering College (UGC Autonomous), Hyderabad, Telangana, India.*

OPEN ACCESS
Article Citation:
P. Vamshi[1], E. Akshaya[2], L. Sapnil[3], K. Dinesh[4], K. Sushma[5] "IOT-Based Automatic Vehicle Accident Detection System", International Journal of Recent Trends in Multidisciplinary Research, March-April 2025, Vol 5(02), 89-92.



Publishedby5thDimension Research Publication

**Abstract:** Road accidents remain a pressing global issue, causing significant injuries, loss of life, and economic setbacks. The delayed detection of accidents and communication to emergency responders often worsens these outcomes, highlighting the need for efficient and automated solutions. . An IoT-based Automatic Vehicle Accident Detection and Alert System has been developed to solve the identified problems by integrating superior sensors and real-time communications. The system employs an accelerometer module to continuously monitor vehicle dynamics, identifying sudden deceleration or impact patterns that signify a potential accident. Once an accident is detected, a NEO-6M GPS module accurately determines the exact location, and a GSM module instantly transmits SMS alerts to predefined contacts or emergency services, reducing response times and increasing the chances of saving lives. An Arduino Nano microcontroller acts as the system's core, seamlessly processing data from all sensors and managing the communication protocols. A DC-DC buck converter ensures stable and efficient power delivery, enhancing the system's reliability, even in adverse conditions. Compact and cost effective, this design can be easily adapted for various vehicle types, ranging from personal cars to commercial fleets. Moreover, the system lays the foundation for future enhancements, such as mobile app integration, cloud-based accident data analysis, real-time updates to stakeholders, and predictive vehicle maintenance. By bridging the gap between accident occurrence and emergency response, this innovation not only promises to save lives but also empowers stakeholders with data-driven insights to improve road safety and vehicle reliability.

**Key Words:** IoT, Automatic Accident Detection, Arduino Nano, Accelerometer, GPS Module, GSM Communication, Emergency Response System, Real-Time SMS Alerts, Vehicle Safety, Road Accident Prevention, Power Optimization, DC-DC Buck Converter, Cloud Integration, Vehicle Monitoring.

## 1. Introduction

The world faces road accidents as a major cause of mortality and injury because they prevent millions of people from surviving each year. Accident reporting delays together with rescue operations holdups frequently produce worse injury outcomes and increased fatality rates after accidents occur. The solution addressing road safety and emergency response time improvement comes through the deployment of an IoT-based automatic vehicle accident detection and alert system. The system achieves automatic accident detection through IoT technology integration with sensors and microcontrollers and communication

modules for fast emergency alerts to responders along with preestablished contacts. This automated reporting system delivers instant precise reports without human involvement thus creating an opportunity to safeguard more lives while minimizing accident-related harm.

A built-in accelerometer module enables continuous vehicle dynamic monitoring by this system. The sensor recognizes quick transitions that indicate possible accidents through speed modifications together with impacts. Timing conflicts between accident detection and an Arduino Nano trigger the sensor processing stage to activate the alert system.

A NEO-6M GPS module is employed to determine the precise location of the vehicle during the accident. This location data is then sent via the GSM module, which supports SMS communication to predefined contacts such as family members, friends, or emergency services. The message includes critical details, such as the accident's exact location, ensuring a prompt response. The system is powered by a DC-DC buck converter, which provides a stable power supply to all components, ensuring reliable operation even under challenging conditions like fluctuating vehicle voltage levels. The compact design of the system makes it easy to integrate into a wide range of vehicles, including personal cars, commercial fleets, and public transportation.

The IoT-based Automatic Vehicle Accident Detection and Alert System addresses a critical global issue—road accidents and their aftermath. Accidents often result in delayed emergency responses, leading to increased fatalities and severe injuries. This project is designed to overcome such delays by providing a real-time, automated solution for accident detection and alerting, ultimately saving lives and minimizing the impact of accidents. The primary purpose of this project is to create an intelligent system capable of detecting accidents instantly through advanced IoT technology. Using sensors such as accelerometers, the system monitors the vehicle's dynamics to identify collisions or rapid deceleration indicative of an accident. Upon detection, the system sends immediate alerts containing precise GPS coordinates to predefined contacts and emergency services via GSM communication.

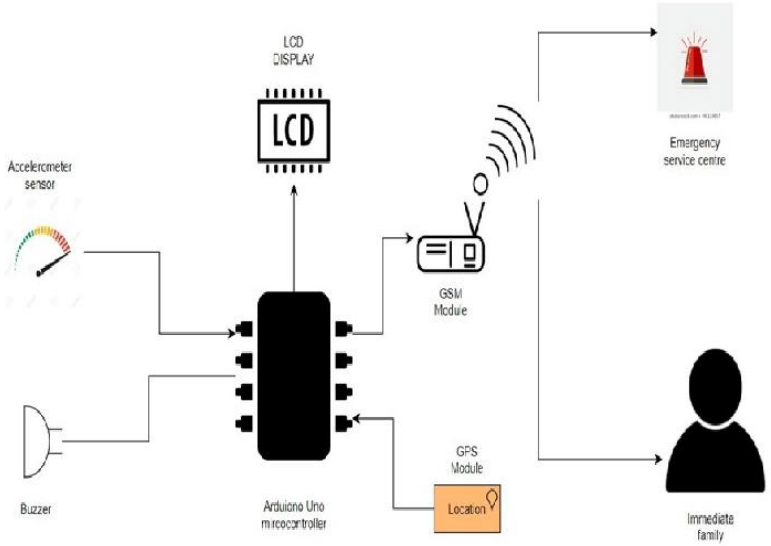
This solution is particularly valuable in remote or less-travelled areas where accidents might otherwise go unnoticed for extended periods. By automating the detection and notification process, the project eliminates the reliance on human intervention or bystanders, ensuring faster response times and enhanced road safety.

## 2. Research on the Technology of Accident Detection System

The project introduces an adaptable and affordable system which meets growing needs.

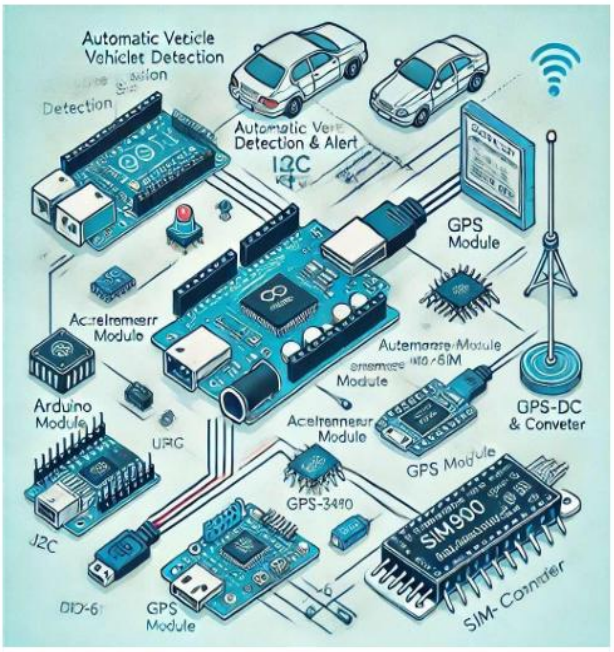
This solution serves as an adaptable system which works with multiple types of vehicles. Its modular structure enables engineers to use the system in various vehicles ranging from individual cars to business fleet vehicles thus enabling broad-scale deployment. The purpose also extends beyond immediate accident response by offering potential integration with mobile applications and cloud-based systems. This would enable features like vehicle health monitoring, accident history tracking, and advanced analytics for accident prevention. In essence, the project seeks to bridge the critical gap between accident occurrence and emergency response. By leveraging IoT technology, it not only ensures quicker and more efficient rescue operations but also contributes to the larger goal of reducing road accident fatalities and improving the safety of transportation systems globally.

Through IoT technology the Automatic Vehicle Accident Detection and Alert System works to both increase road safety while minimizing accident impact through fast accident detection along with communication systems.. The key objectives are: Accident Detection: To develop a real-time system that detects vehicle accidents using IoT sensors, such as accelerometers, by monitoring sudden changes in vehicle dynamics. Immediate Alerts: To ensure instant communication of accident details, including GPS location, to emergency services and predefined contacts via GSM technology. Reduced Response Times: To significantly shorten the time between accident occurrence and the arrival of rescue teams, thereby reducing fatalities and injuries. Scalability and Adaptability: To design a cost-effective solution that The system allows optimal integration for any type of vehicle over a wide spectrum from private automobiles to business fleets.. Vehicle Monitoring: To provide continuous monitoring of vehicle dynamics and health, enabling proactive safety checks and maintenance.



## 3. System Architecture

A computer system works as an embedded system because it executes defined tasks inside mechanical or electrical frameworks. An IoT-based Vehicle Accident Detection and Alert System uses an embedded system to execute real-time automated accident detection and alert functions by processing sensor data that is collected and transmitted in real-time. Time-efficient operation combined with reliability and efficiency characterizes the system design because it enables prompt detection and immediate response to accidents




## 4. Input Design

Initialization when the system is powered on, the Arduino Nano initializes the sensors (accelerometer, GPS, GSM modules) and continuously monitors the vehicle's motion and location. 2. Data Collection the accelerometer constantly tracks the vehicle's dynamics. It detects abrupt changes such as sudden deceleration or impact that might indicate an accident. The GPS module continuously provides the current location of the vehicle, updating the coordinates as the vehicle moves. 3. Accident Detection if the accelerometer detects sudden changes that meet the criteria for an accident (such as a rapid stop or collision), it sends a signal to the Arduino Nano for further processing.

## 5. Output Design

Alert Generation o Once the Arduino Nano receives the accident signal, it retrieves the vehicle's GPS location and prepares the necessary details for an alert message. o The GSM module activates to transmit an SMS which contains location data together with accident time and severity to preset emergency contacts, ensuring that rescue teams or family members are immediately notified.

Real-Time processing The embedded system processes sensor data in real-time, ensuring immediate detection and response to accidents. 2. Compact and Efficient o The system is designed to be compact, making it suitable for installation in various vehicle types without taking up excessive space or power. 3. Low Power Consumption o Embedded systems are designed for low power consumption, allowing them to operate efficiently without significantly affecting the vehicle's battery life. 4. Cost-Effective o The use of widely available components like Arduino Nano, GPS, and GSM modules makes the system cost-effective, making it accessible for implementation in both personal and commercial vehicles.

Real-time data processing through software enables the detection of vehicular accidents by sending alerts for the Automatic Vehicle Accident Detection and Alert System based on IoT technology. The Automatic Vehicle Accident Detection and Alert System functions through the Arduino Nano device which operates using Arduino IDE software development..

The software checks the accelerometer data for sudden deceleration or impact. When the vehicle experiences rapid slowing down (greater than a set threshold), this is flagged as a potential accident. The software then triggers the next sequence of actions.

## 6. Modules

1. GSM Module
2. ADXL1345 Module
3. GPS Module
4. DC-DC Module

## 7. Result

Upon detecting an accident, the software triggers the SMS alert system using the GSM module: • Fetching GPS Location: The software retrieves the vehicle's GPS coordinates (latitude and longitude) using the NEO-6M GPS module. These coordinates will be included in the SMS alert to inform emergency contacts about the accident's location. • Composing the Message: The software constructs an SMS message that includes: o A message indicating an accident has occurred. The vehicle's exact GPS coordinates (latitude and longitude). o Additional details, such as the severity of the accident or a predefined message. • Sending the SMS: The software sends the composed SMS to a predefined contact list using the SIM900 GSM module. This could include emergency services, family members, or a control center, depending on the configuration

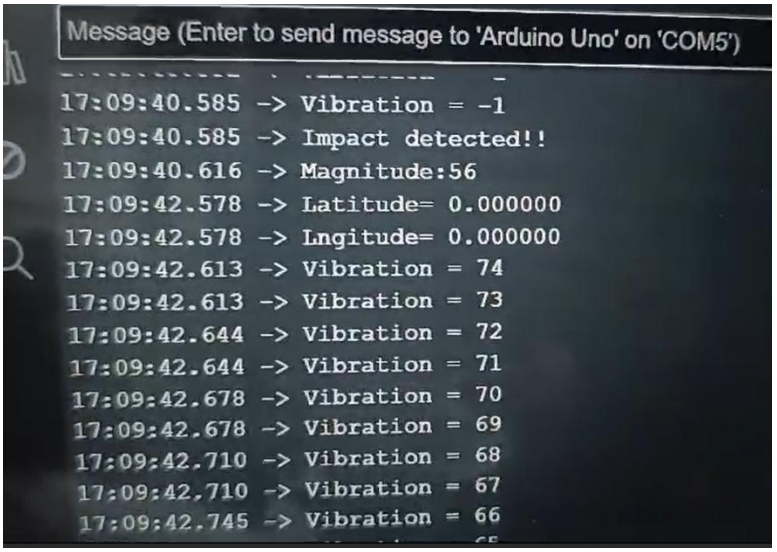



*Fig (a)*

**Acknowledgement**

- Our deep appreciation belongs to Dr. A. Srinivasula Reddy, the principal together with Dr. Madhavi Pingili, HOD of IT at CMR Engineering College for their ongoing guidance.
- Dr. MADHAVI receives our deepest gratitude. PINGILI, Professor, Internal Guide, Department of IT, for his constant guidance, encouragement, and moral support throughout the project.
- Our duty becomes incomplete without expressing gratitude to all reference authors and literature authors present in this project.
- All staff members together with our friends helped and coordinated throughout the project development process until its deadline completion. Our parents provided guidance throughout all our school steps for which we express our deepest gratitude.

## References

1. *Jayalakshmi R, Arunachalam S, Karthik P, "IoT-Based System for Detecting Accidents and Alerting Hospitals," 2024 International Conference on IoT and Smart Cities (ICISC), pp.45 51,2024.*
2. *Saida M, Basha K, Reddy T, "Vehicle Accident Alert and Rescue System," 2024 International Conference on Intelligent Systems and Applications(ICISA), pp.120-126, 2024.*
3. *Faisal, O. Farooq, S. Malik, M. T. Alam, S. Mondal and T. I. Anower, "A Smart Vehicle Alert System with Intelligent Vehicle Safety," 2024 International Conference on Signal Processing, Computation, Electronics, Telecommunication(IConSCEPT),pp.1-6,2024. Power*
4. *L. Kocharla, R. Tiwari, E. N. Vijaya Kumari, D. Shankar, G. A. Al-Salman and S. Kumar K, "A Data-Driven Approach to Vehicle Safety: IoT and ML Accident Detection," 2024 IEEE 9th International Conference for Convergence in Technology(I2CT),pp1-6,2024.*
5. *S. P. Vimal, J. B. J. Peter, U. Kavitha, G. Bhuvaneswari, G. Manikandan and R. Thamizhamuthu, "Automated Injury Detection and Alert Systems in Public Transportation Integrating IoT with Convolutional Neural Networks," 2024 2nd International Conference on Self Sustainable Artificial Intelligence Systems (ICSSAS),pp.1069-1074,2024.*
6. *B. Ninan, "A Confirmation Based Accident Detection System Using IoT for Smart Vehicles," 2024 IEEE 3rd World Conference on Applied Intelligence and Computing (AIC),Gwalior,India,pp.1136-1141,2024.*
7. *Talwandi P, Mehta R, Sharma A, "Autonomous Drone Communications for Search and Rescue," 2023 International Conference on Robotics and Autonomous Systems (ICRAS), pp.101-108,2023.*
8. *Srivastava S, Kumar A, Gupta R, "IoT-Based Road Accident Rescue System," 2022 International Conference on Emerging Trends in IoT and Computing Technologies (ETICT),pp.1-8,2022.*
9. *S. P. Shubham, M. Kumar, Rajkishor and S. Jain, "A Survey on IoT based Automatic Road Accident Detection," 2021 5th International Conference on Intelligent Computing and Control Systems (ICICCS), Madurai, India,pp. 1-7, 2021.*
10. *N. Parveen, A. Ali and A. Ali, "IOT Based Automatic Vehicle Accident Alert System," 23 2020 IEEE 5th International Conference on Computing Communication and Automation (ICCCA), Greater Noida, India, pp. 330-333,2020.*