Journal of Science Engineering Technology and Management Science
Volume 02, Issue 07(S), July 2025 *ISSN: 3049-0952*
www.jsetms.com *DOI:10.63590/jsetms.2025.v02.i07(S).696-704*

REAL TIME ACCIDENT DETECTION AND REPORTING USING IOT

[1] P.Swamy, [2] K.AKHILA, [3] D.VIJAYA LAXMI, [4]G.SADHALAXMI, [5] T.NAVANEETHA
[1] Assistant Professor, Department of Electronics And Communication , Princeton Institute of Engineering & Technology for Women, Hyderabad, India
[2,3,4,5] B. Tech Students, Department of Electronics And Communication, Princeton Institute of Engineering & Technology for Women, Hyderabad, India

To Cite this Article
P.Swamy, K.Akhila, D.Vijaya Laxmi, G.Sadhalaxmi, T.Navaneetha, "Real Time Accident Detection And Reporting Using Iot", Journal of Science Engineering Technology and Management Science, Vol. 02, Issue 07(S), July 2025,pp: 696-704, DOI: http://doi.org/10.63590/jsetms.2025.v02.i07(S).pp696-704
Submitted: 07-06-2025 *Accepted: 08-07-2025* *Published: 16-07-2025*

Abstract
Road accidents are a major global concern, leading to significant loss of life, property damage, and delayed emergency response. Traditional accident detection methods often rely on eyewitness reporting, which results in time delays that can worsen casualties. To address this challenge, this paper proposes a Real-Time Accident Detection and Reporting System using Internet of Things (IoT). The system integrates smart sensors such as accelerometers, gyroscopes, GPS, and vibration sensors with a microcontroller to detect sudden impacts, abnormal vehicle motion, or rollovers that indicate an accident. Once an accident is detected, the system automatically collects critical information including location coordinates, speed, and impact force, and transmits it to a cloud server through a wireless communication module (e.g., GSM/4G, LoRa, or Wi-Fi). This data is then instantly relayed to emergency services, nearby hospitals, and registered contacts, ensuring rapid response.The proposed IoT-enabled framework eliminates human dependency in accident reporting, reducing the time gap between accident occurrence and medical assistance. Additionally, the system can be integrated with traffic management systems for enhanced road safety and real-time monitoring. By leveraging IoT, cloud computing, and intelligent communication, this solution aims to minimize fatalities, improve emergency response times, and enhance overall road safety.

I.INTRODUCTION

Road transportation plays a vital role in human mobility and economic development, but it is also one of the leading causes of accidental deaths worldwide. Every year, millions of people lose their lives or suffer serious injuries due to road accidents, making it a critical public safety concern. One of the major reasons for the high fatality rate is the **delay in reporting accidents and reaching emergency medical services**. In many cases, by the time help arrives, victims may have already succumbed to injuries that could have been treated with timely intervention.

Conventional accident reporting relies heavily on bystanders, drivers, or passersby, which is both unreliable and time-consuming. In remote or less populated areas, accidents often go unnoticed, leading to further complications. Therefore, there is a pressing need for an automated system that can detect accidents in real time and instantly notify emergency responders without human intervention.The advancement of the **Internet of Things (IoT)**, combined with smart sensors and wireless communication, provides an efficient solution to this problem. By equipping vehicles with IoT-enabled devices, accidents can be detected through sudden changes in parameters such as velocity, orientation, vibration, and impact force. These devices, integrated with **GPS modules and communication networks**, can immediately transmit accident details including exact location, time, and severity to concerned authorities, nearby hospitals, and family members.

The proposed **Real-Time Accident Detection and Reporting System using IoT** not only reduces emergency response time but also enhances road safety by ensuring rapid assistance. Furthermore, the collected data can be utilized by traffic management authorities for analyzing accident-prone zones and improving infrastructure. This integration of IoT into intelligent transportation systems represents a step forward toward creating **smart cities with safer roads and reduced fatalities**.

II.LITERATURE SURVEY

Research on automated accident detection and rapid incident reporting spans three overlapping domains: sensor-based crash sensing on vehicles or smartphones, communication backbones for timely alerting, and analytics for severity estimation and triage. Early work focused on thresholding inertial signals (accelerometer, gyroscope) to detect abrupt deceleration or rollovers. Studies showed that combining multi-axis acceleration with jerk (time derivative of acceleration) reduces false positives compared to single-threshold braking detectors. Later approaches fused GPS speed drops and heading changes to distinguish collisions from potholes or harsh braking, improving precision in urban settings.

Smartphone-based systems emerged as a low-cost alternative to embedded units. By leveraging built-in IMU sensors and GPS, these methods achieved acceptable detection accuracy without vehicle modification. However, authors consistently note challenges: sensor placement variability (pocket, mount, glovebox), sampling rate limits, and background app constraints that can delay alerts. Workarounds include adaptive thresholds tied to road class and speed, and on-device classifiers trained on user-specific motion patterns. Battery consumption and privacy (continuous location tracking) remain recurring concerns.

On-vehicle sensing with microcontrollers advanced the state of reliability by adding dedicated tri-axial accelerometers, gyroscopes, and sometimes airbag triggers or crash pulse proxies (delta-V). Integrations with OBD-II/CAN bus allow access to speed, brake status, and airbag deployment, enabling cross-validation of an impact event. Literature shows that sensor fusion (Kalman/Complementary filtering) stabilizes noisy IMU streams, while event buffering (pre/post-impact windows of a few seconds) preserves high-value context for severity inference.

Machine learning introduced supervised classifiers—SVMs, Random Forests, Gradient Boosting—to discriminate crashes from non-crash events such as speed bumps, railway crossings, or aggressive driving maneuvers. Datasets typically combine features like peak g, jerk peaks, vibrational spectral energy, GPS speed gradient, and yaw rate. More recent work explores lightweight deep models (1D CNNs and temporal CNN-LSTM hybrids) deployed at the edge to capture temporal dynamics without handcrafted features. Edge inference reduces latency and avoids continuous cloud streaming, a benefit highlighted in vehicular IoT settings.

Vision-based detection complements inertial sensing by analyzing dashcam feeds for collisions, near-misses, and anomaly trajectories. Research on optical flow and object tracking evolved toward deep detectors (e.g., YOLO-family backbones) fused with motion cues for impact recognition. While camera-only systems struggle under low light or occlusion, multi-modal fusion (IMU + video) significantly lowers false alarms and supports post-crash scene understanding (vehicle count, blockage, fire/smoke indicators). Computational demands and storage are the primary trade-offs, motivating pruning/quantization and event-triggered recording.

Communication architectures progressed from SMS/GPRS alerts to MQTT/HTTP over LTE/4G, NB-IoT, and LoRaWAN for cost-effective, wide-area coverage. Comparative studies show NB-IoT's strong building penetration and power efficiency for stationary assets, whereas LTE/5G excels for vehicular mobility and low latency. VANET research (DSRC/IEEE 802.11p, evolving toward C-V2X) demonstrates cooperative awareness—nearby vehicles receive hazard warnings within milliseconds—though deployment remains region-specific. Reliability literature emphasizes redundant channels (primary cellular + fallback SMS) and store-and-forward strategies for coverage gaps.

Severity estimation and triage have received attention through crash pulse analytics (integrating acceleration to estimate delta-V), biomechanics-inspired risk scores, and learned mappings from sensor features to injury likelihood (e.g., MAIS proxies). Some works integrate contextual priors—speed limit of the road segment, time-of-day, weather, and known black spots—to refine risk and prioritize dispatch. Studies on geospatial analytics show that aggregating anonymized incident data helps identify high-risk corridors and supports infrastructure interventions.

System design papers highlight end-to-end pipelines: edge detection, secure transmission, cloud ingestion, and notification orchestration to emergency services and trusted contacts. Best practices include message signing and TLS for data integrity, idempotent alerting to prevent duplicates, and human-in-the-loop cancellation windows to reduce nuisance calls. Several deployments integrate with hospital and ambulance dispatch systems, demonstrating measurable reductions in response time ("golden hour" gains) and improved outcomes when accurate location is provided.

Privacy, security, and ethics are consistent themes. Continuous location and driving behavior raise user consent and data minimization issues. Proposed mitigations include on-device preprocessing (sending only event snippets), pseudonymization, purpose limitation, and configurable retention. From a security perspective, researchers advocate secure boot for edge devices, encrypted firmware updates, and anomaly detection for spoofed crash reports or SIM misuse.

Finally, recent trends move toward federated and personalized models—training crash/no-crash classifiers across fleets without centralizing raw data—alongside self-calibration techniques that adapt thresholds to a specific vehicle's mounting and suspension characteristics. Lightweight MLOps for edge (OTA model updates, shadow-mode evaluation) and explainability for decision audits are emerging as practical enablers for real-world, scalable accident detection and reporting in IoT-enabled intelligent transportation systems.

III.EXISTING SYSTEM

In the current scenario, accident detection and reporting largely depend on manual intervention or conventional systems that are limited in scope. Traditional methods rely on eyewitnesses, drivers, or passersby to identify an accident and notify emergency services. This process often introduces delays in communication, especially when accidents occur in remote areas with low traffic density. The delay in informing hospitals and ambulances directly impacts the survival chances of victims, as medical treatment during the "golden hour" is critical for saving lives.

Some existing systems incorporate basic vehicle tracking technologies such as GPS and GSM modules, which allow location sharing in the event of an accident. However, these systems are usually activated manually by the driver through emergency buttons or alerts. If the driver is unconscious or severely injured, these systems fail to function effectively.

Mobile-based accident detection applications have also been developed, utilizing the accelerometer and GPS sensors in smartphones to detect sudden deceleration or impact. Although cost-effective, these applications are highly prone to false alarms, such as when a phone is accidentally dropped, and they often suffer from battery drainage, background app limitations, and network dependency.

Advanced vehicles from premium manufacturers may include built-in crash detection features integrated with airbags and vehicle sensors. While these systems can automatically alert authorities, they are not available in most low- and mid-range vehicles due to their high cost, limiting accessibility for the majority of road users.

IV.PROPOSED SYSTEM

To overcome the limitations of traditional and existing accident detection methods, the proposed system introduces a Real-Time Accident Detection and Reporting framework using IoT. The system is designed to automatically detect accidents without human intervention and transmit critical information instantly to emergency services, hospitals, and family members.

The core of the system is built around an IoT-enabled microcontroller (such as Arduino, Raspberry Pi, or ESP32) connected with multiple smart sensors including accelerometers, gyroscopes, vibration sensors, and GPS modules. The accelerometer and gyroscope continuously monitor the vehicle's motion and detect sudden impacts, rollovers, or abnormal orientation changes. A vibration sensor strengthens the detection accuracy by identifying sharp shocks, while the GPS module provides the real-time location of the accident.

Once an accident is detected, the system triggers the communication module (GSM/4G/LoRa/Wi-Fi) to send an automated alert message. This alert contains essential details such as the exact location coordinates, time of accident, vehicle ID, and severity level. The data is transmitted to a cloud platform, which then relays it to emergency services, nearby hospitals, police stations, and pre-registered contacts. This reduces response time drastically and ensures that medical assistance reaches the victims within the golden hour.

To avoid false alarms, the system integrates a confirmation mechanism. When an accident is detected, the driver is given a short time window to cancel the alert if it is a false trigger. If no response is received, the alert is automatically dispatched. This balances system sensitivity with reliability.

Furthermore, the system can be linked with traffic management authorities for large-scale monitoring. Accident data collected over time can also be analyzed to identify accident-prone areas (black spots) and support infrastructure improvements. The proposed IoT system is low-cost, scalable, and adaptable, making it suitable for integration into both new and existing vehicles.

V.SYSTEM ARCHITECTURE

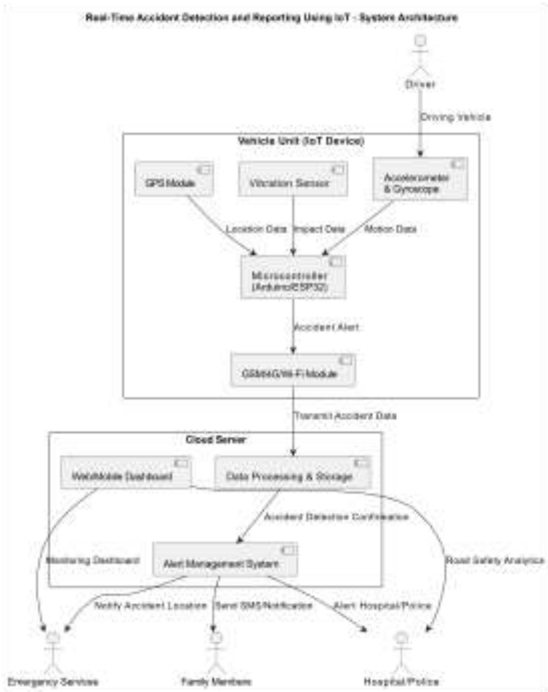

Fig 5.1 System Architecture

The proposed system architecture for Real-Time Accident Detection and Reporting using IoT is designed in three functional layers: the vehicle unit, the cloud server, and the end-user response layer. In the vehicle unit, various smart sensors such as the accelerometer, gyroscope, vibration sensor, and GPS module are connected to a microcontroller (e.g., Arduino, Raspberry Pi, or ESP32). These sensors continuously monitor the vehicle's motion, orientation, vibrations, and real-time location.

Whenever an accident occurs, the sensors detect abnormal conditions such as sudden deceleration, rollover, or strong vibrations, and this data is processed by the microcontroller. If the system identifies an accident, it immediately triggers the communication module (GSM/4G/Wi-Fi/LoRa) to send an accident alert.

The alert, which includes location coordinates, time of accident, vehicle ID, and severity level, is transmitted to the cloud server, which acts as a central processing and storage hub. In the cloud, the data processing unit validates and stores the accident details, while the alert management system ensures that false alarms are minimized and genuine accidents are quickly reported. A web and mobile dashboard is also available for monitoring and provides analytical insights, such as accident frequency and identification of accident-prone zones.

Finally, the processed information is delivered to the end-user layer, which consists of emergency services, hospitals, police, and family members. Emergency responders and nearby hospitals receive accident alerts with the victim's exact location, enabling immediate medical assistance within the "golden hour." Family members are also notified via SMS or mobile application, ensuring transparency and safety. In addition, road safety authorities can use the data for traffic monitoring, black-spot analysis, and infrastructure improvement. This layered architecture ensures automatic detection, reliable reporting, and fast emergency response, reducing fatalities and enhancing road safety.

VI.IMPLEMENTATION

Fig 6.1 kit board

Fig 6.2 Display Reading

Fig 6.3 Mobile Results

VII.CONCLUSION

Road accidents remain one of the leading causes of fatalities worldwide, and the delay in reporting and responding to such incidents is a major factor contributing to the loss of lives. The proposed IoT-based real-time accident detection and reporting system provides an effective solution to this challenge by integrating smart sensors, microcontrollers, GPS, and communication technologies. Unlike traditional methods that depend heavily on human intervention, this system automatically detects accidents and instantly communicates critical information such as location, time, and severity to emergency services, hospitals, police, and family members.

By reducing the gap between accident occurrence and medical response, the system enhances the chances of survival and ensures that help reaches victims within the crucial “golden hour.” Additionally, the cloud-based platform not only supports real-time monitoring but also facilitates data analytics for traffic management and black spot identification, thereby contributing to long-term road safety improvements.

The solution is cost-effective, scalable, and adaptable to different vehicle types, making it suitable for widespread deployment even in developing regions where advanced in-vehicle safety technologies are limited. Overall, this IoT-enabled framework represents a significant step toward intelligent transportation systems, helping to minimize fatalities, improve emergency response efficiency, and build safer road networks.

VIII.FUTURE SCOPE

The proposed IoT-based accident detection and reporting system lays the foundation for safer transportation, but it can be further enhanced with emerging technologies to achieve greater reliability and intelligence. One of the most promising extensions is the integration of Artificial Intelligence (AI) and Machine Learning (ML) models that can analyze sensor patterns and environmental conditions to not only detect accidents but also predict the severity of injuries and vehicle damage. This would help emergency services prioritize resources and provide the right level of medical response.

Another potential improvement is the adoption of Vehicle-to-Vehicle (V2V) and Vehicle-to-Infrastructure (V2I) communication, enabling nearby vehicles and traffic management systems to receive accident alerts instantly. This would help in reducing secondary collisions and ensuring better traffic rerouting around accident-prone areas.

The system can also be integrated with smart city platforms to support real-time traffic analytics, automated traffic signal control for ambulances, and collaborative road safety management.

In addition, the future system can leverage 5G and edge computing technologies to achieve ultra-low latency communication and on-device processing, ensuring faster response and reducing dependency on centralized servers. Wearable devices for drivers, such as smartwatches or health bands, could be connected to the system to monitor physiological signals like heart rate, oxygen levels, or consciousness state, allowing for driver health monitoring and early detection of emergencies.

Furthermore, large-scale deployment of the system would generate valuable data that can be used by government authorities and transport departments for infrastructure planning, accident hotspot detection, and policy-making to reduce road fatalities. Integration with blockchain-based secure data sharing could also be explored to maintain privacy and authenticity of accident records.

Thus, the system has the potential to evolve into a comprehensive intelligent accident management ecosystem, combining IoT, AI, 5G, and smart city infrastructure to significantly improve road safety, minimize casualties, and support sustainable transportation in the future.

IX.REFERENCES

[1] M. S. Alghamdi, “IoT-based accident detection and notification system for smart transportation,” International Journal of Advanced Computer Science and Applications (IJACSA), vol. 11, no. 5, pp. 341–347, 2020.

[2] S. K. Singh and D. S. Tomar, “Automatic accident detection and rescue system using GPS and GSM modem,” International Journal of Scientific & Engineering Research, vol. 5, no. 4, pp. 1221–1225, 2014.

[3] R. G. Engoulou, M. Bellaïche, S. Pierre, and A. Quintero, “VANET security surveys,” Computer Communications, vol. 44, pp. 1–13, May 2014.

[4] S. Jagtap and P. P. Mane, “Accident detection and ambulance rescue with intelligent traffic light system,” International Journal of Advanced Research in Computer and Communication Engineering (IJARCCE), vol. 5, no. 4, pp. 632–636, 2016.

[5] J. P. Benson, T. O’Donovan, U. Roedig, C. Sreenan, J. Barton, and S. Murphy, “Car-2-car communication: An overview,” in Proceedings of the 6th Annual Conference on Wireless On-demand Network Systems and Services, Snowbird, UT, USA, Feb. 2009.

[6] A. Mehmood, M. A. Shafiq, Z. Lv, and S. U. Khan, “Intelligent transportation systems: A comparative review,” Sustainable Cities and Society, vol. 65, pp. 102–148, Feb. 2021.

[7] M. R. Jabbar, B. S. Kumar, and R. Kumar, “Real-time vehicle accident detection and rescue system using IoT,” in Proc. International Conference on Smart Technologies for Smart Nation (SmartTechCon), Bangalore, India, Aug. 2017, pp. 1250–1255.

[8] A. Sharma and K. Verma, “IoT-based accident detection and alert system for vehicles,” International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE), vol. 7, no. 6, pp. 6014–6020, 2019.
[9] S. Zeadally, R. Hunt, Y.-S. Chen, A. Irwin, and A. Hassan, “Vehicular ad hoc networks (VANETS): Status, results, and challenges,” Telecommunication Systems, vol. 50, no. 4, pp. 217–241, 2012.
[10] K. Dar, M. Bakhouya, J. Gaber, M. Wack, and N. Lorenz, “Wireless communication technologies for ITS applications [topics in automotive networking],” IEEE Communications Magazine, vol. 48, no. 5, pp. 156–162, May 2010.