

IOT Based System for Monitoring the Operation Parameters of Vehicle

DABBARA JAYANAYUDU, Ph.D.

Associate Professor, Department of
Electronics and Communication
Engineering
Siddhartha Institute of Science and
Technology
Puttur, Andhra Pradesh - India
Email: d.jayanaidu@gmail.com

D. RAJYALAKSHMI

Undergraduate, Department of
Electronics and Communication
Engineering
Siddhartha Institute of Science and
Technology
Puttur, Andhra Pradesh - India
Email:
rajyalakshmidugginenni@gmail.com

C. SIVAPRASAD

Undergraduate, Department of
Electronics and Communication
Engineering
Siddhartha Institute of Science and
Technology
Puttur, Andhra Pradesh - India
Email:
chitrashivaprasad@gmail.com

K. TEJESH

Undergraduate, Department of
Electronics and Communication
Engineering
Siddhartha Institute of Science and
Technology
Puttur, Andhra Pradesh - India
Email:
kuntrapakamtejshreddy@gmail.com

G. RAMYA

Undergraduate, Department of
Electronics and Communication
Engineering
Siddhartha Institute of Science and
Technology
Puttur, Andhra Pradesh - India
Email: gudiramya134@gmail.com

N. SIDDARTHA REDDY

Undergraduate, Department of
Electronics and Communication
Engineering
Siddhartha Institute of Science and
Technology
Puttur, Andhra Pradesh - India
Email:
siddarthanasthadi@gmail.com

ABSTRACT:

The rapid growth of intelligent transportation systems has increased the need for reliable vehicle safety and condition monitoring solutions. This work presents an IoT-enabled vehicle parameter monitoring system designed to continuously supervise critical operational conditions and provide immediate alerts during abnormal situations. The proposed system employs an Arduino microcontroller interfaced with multiple sensors to evaluate engine temperature, vehicle vibration, obstacle proximity, and driver alcohol levels. Location information is obtained using a GPS module, while emergency notifications are transmitted through a GSM network. Real-time alerts are provided to the driver via an LCD display and buzzer, ensuring instant awareness of unsafe conditions. By combining automated sensing, wireless communication, and on-vehicle feedback, the system improves situational awareness, reduces accident response time, and supports safer vehicle operation in fleet management and smart transportation environments.

Keywords: IoT, Real-time Monitoring, Vehicle Safety, GPS Tracking, SMS Alerts

INTRODUCTION:

Increasing traffic density and long-distance travel have made vehicle safety and operational reliability critical concerns. Traditional vehicle monitoring approaches often depend on manual inspections or standalone electronic indicators, which may not identify issues at an early stage. Continuous tracking of parameters such as temperature, vibration, and driver

behavior is crucial to prevent accidents and mechanical breakdowns. Advances in IoT technology now allow the integration of affordable sensors, microcontrollers, and wireless communication to provide real-time assessments of vehicle health. By utilizing these technologies, intelligent monitoring systems can deliver timely alerts, help drivers make informed decisions, and support preventive maintenance strategies. These systems play an important role in improving overall safety, minimizing downtime, and enabling modern intelligent transportation solutions.

RELATED WORKS:

This study describes the development and deployment of a vehicle positioning system based on an ARM microcontroller. The system incorporates GPS technology to determine the precise real-time location of vehicles, supporting effective tracking and navigation. By utilizing the computational capabilities of the ARM platform, the system efficiently gathers and processes positioning data, delivering reliable and timely information for vehicle management. Such a system is especially valuable for fleet monitoring, route optimization, and improving overall transportation safety and operational efficiency.

[1].

This research proposes an Android-based vehicle monitoring and tracking system that utilizes the ARM7 microcontroller in combination with Controller Area Network (CAN) technology. The system allows real-time observation of vehicle parameters and accurate location tracking, which are conveniently displayed on an Android interface for user access. By integrating the processing power of ARM7 with

the reliability of CAN communication, the system enables efficient data collection, precise vehicle diagnostics, and timely alerts. This design offers a cost-effective and scalable solution for enhancing vehicle safety, facilitating maintenance, and supporting effective fleet management [2].

This study introduces an Android-based vehicle monitoring and tracking system that employs the ARM7 microcontroller alongside Controller Area Network (CAN) technology. The system allows continuous observation of vehicle parameters and delivers accurate location tracking, which is presented on an Android interface for convenient user access. By combining the processing power of the ARM7 with CAN communication, the system facilitates efficient data acquisition, dependable vehicle diagnostics, and timely alerts, supporting enhanced safety, streamlined maintenance, and effective fleet management [3].

This paper introduces SafeTrax, an IoT-based smart system designed for collision prediction and real-time alert generation to enhance road safety. The system collects data from multiple sensors installed in vehicles and processes it to identify potential collision risks, providing timely warnings to drivers. By integrating Internet of Things technology with predictive analytics, SafeTrax improves driver awareness, reduces the likelihood of accidents, and supports safer transportation management. The approach demonstrates the effectiveness of intelligent, connected systems in proactive road safety solutions [4].

This paper presents an IoT-based framework for detecting vehicle over-speeding in real time, aimed at enhancing traffic safety and reducing road accidents. The system utilizes sensors to monitor vehicle speed and communicates the data through IoT technology to a central processing unit for analysis. When over-speeding is detected, timely alerts are generated for drivers and traffic authorities, enabling prompt corrective actions. The framework demonstrates the potential of integrating IoT with vehicular monitoring systems to promote safer driving practices and effective traffic management [5].



Fig2 - IoT-Enabled Real-Time Vehicle Over-Speed Monitoring and Alert System for Enhanced Traffic Safety

This paper proposes a real-time automatic speed control unit for vehicles aimed at enhancing road safety and improving traffic management. The system continuously monitors vehicle speed using sensors and automatically regulates it to prevent overspeeding, ensuring compliance with traffic limits. By integrating real-time control mechanisms with intelligent vehicle systems, the approach minimizes accident

risks, supports safer driving, and contributes to efficient traffic regulation in urban and highway environments [6].

This paper presents an integrated intelligent control system designed to promote both eco-friendly and safe driving in autonomous vehicles. The system combines real-time monitoring, predictive analytics, and automated control mechanisms to optimize driving behavior, reduce energy consumption, and enhance passenger safety. By intelligently coordinating vehicle dynamics and decision-making processes, the approach supports sustainable autonomous transportation while minimizing the risk of accidents, demonstrating the potential of smart control systems in next-generation vehicle technologies [7].



Fig3 - Integrated Intelligent Control System for Eco-Friendly and Safe Autonomous Driving

This paper proposes an IoT-based system for automatic detection of vehicle accidents and real-time visual situation reporting. The system employs sensors to detect collisions and abnormal vehicle behavior, while cameras and IoT communication modules transmit visual and situational data to emergency responders. By providing instant alerts and detailed incident information, the approach enhances accident response times, improves road safety, and supports effective traffic management in modern transportation systems [8].

This paper presents an IoT-based system for automatic accident prevention and speed control in electric vehicles. The system continuously monitors vehicle parameters such as speed, proximity to obstacles, and driver behavior, and automatically intervenes to prevent collisions. By integrating real-time data processing and automated control mechanisms, the approach enhances passenger safety, ensures adherence to speed limits, and contributes to the efficient and secure operation of electric vehicles in modern transportation networks [9].

This paper presents an IoT-based system for automatic vehicle speed control in restricted areas using RFID technology. The system identifies vehicles entering designated zones via RFID tags and automatically regulates their speed to comply with safety limits. By integrating real-time monitoring, automated control, and wireless communication, the approach enhances road safety, prevents

overspeeding in sensitive areas, and ensures efficient traffic management in controlled environments [10].

The study introduces an IoT-enabled system for vehicle tracking and monitoring, designed to improve driving safety and security. The system continuously observes essential vehicle parameters and location in real time, issuing alerts for abnormal behavior or potential risks. By combining sensor data with IoT communication, the system enhances driver awareness, enables timely responses, and supports effective management of vehicle safety and security within modern transportation networks [11].

This paper presents a GSM-based commercial automobile tracking system implemented using the PIC 18F452 microcontroller, combined with Google Earth embedded monitoring software for real-time vehicle tracking. The system transmits location data via GSM to a central platform, where it is visualized on Google Earth, enabling efficient monitoring of fleet vehicles. By integrating microcontroller-based tracking with web-based visualization, the approach improves vehicle management, enhances operational efficiency, and supports timely interventions in commercial transportation systems [12].

--PROPOSED METHOD--

The proposed IoT-enabled vehicle parameter monitoring solution overcomes the shortcomings of traditional safety methods through the combination of multiple sensing units on a single platform. An Arduino Uno serves as the central processor, gathering data from sensors that track temperature, vibration, obstacle proximity, and alcohol levels. The system continuously analyzes the collected data and detects abnormal conditions based on preset thresholds. Vehicle location is determined using a GPS module, while emergency notifications are sent via a GSM network to designated contacts. This comprehensive approach supports proactive safety management, rapid incident alerts, and enhanced operational reliability, making it well-suited for real-time vehicle monitoring applications.

Block Diagram1:

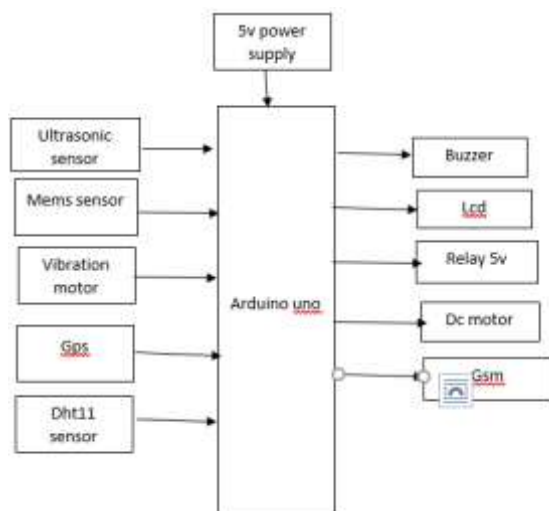


Fig4 -Block diagram

Fig. 4 The block diagram illustrates the architecture of an IoT-

based vehicle monitoring and alert system implemented using an Arduino Uno microcontroller. The system integrates multiple sensors, including an ultrasonic sensor for obstacle detection, a MEMS sensor for motion and accident detection, a vibration motor for feedback, a GPS module for real-time vehicle location tracking, and a DHT11 sensor for monitoring environmental temperature and humidity. The Arduino processes inputs from these sensors and triggers outputs accordingly: a buzzer for audible alerts, an LCD display for visual feedback, a relay-controlled DC motor for automated control, and a GSM module for sending SMS notifications in critical situations. A regulated 5V power supply ensures stable operation of all components. This design enables real-time monitoring, timely alerts, and automated responses to enhance vehicle safety and situational awareness.

Methodology

Principle of Functioning:

The system operates by continuously acquiring sensor data and analyzing it to determine vehicle safety status. The ultrasonic sensor measures the distance between the vehicle and nearby objects to prevent collisions, while the MEMS sensor detects sudden shocks or abnormal vibrations indicative of accidents. Engine and ambient temperature conditions are monitored using a temperature sensor. The alcohol sensor evaluates driver impairment levels to ensure safe driving behavior. All sensor inputs are processed by the Arduino controller, which triggers local alerts and transmits emergency notifications through the GSM module when critical conditions are detected. Real-time information is displayed on a 16x2 LCD to assist the driver in immediate decision-making.

Hardware & Alerts:

The hardware configuration includes an Arduino Uno integrated with multiple sensors, a GSM communication module, and a GPS receiver. The system activates a buzzer for immediate audible alerts and controls a relay-driven DC motor for automated responses when required. Sensor readings and system status are displayed on an LCD module, providing clear on-vehicle feedback. Remote alerts are sent via SMS to ensure rapid communication during emergencies, enhancing overall vehicle safety management.

Power Requirements:

The system is powered using a regulated 5V DC supply derived from a 12V adapter. Voltage regulation ensures reliable performance of the microcontroller, sensors, and communication modules. Stable power delivery is essential for accurate sensor measurements, uninterrupted data processing, and consistent wireless communication during real-time vehicle monitoring.

Performance Comparison Table:

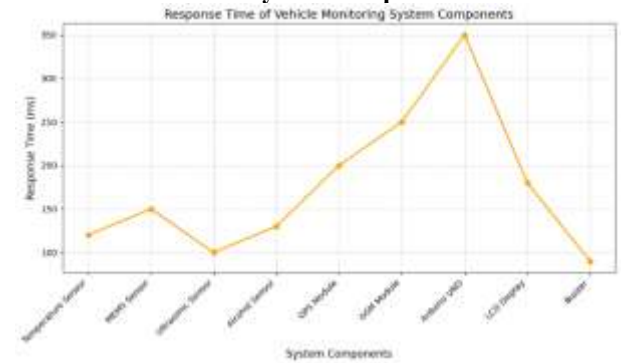
Parameter	Specification / Metric	Description
Central Controller	Arduino UNO	Serves as the primary control unit, acquiring, processing, and coordinating data from all connected sensors.
Engine Temperature Monitoring	Temperature Sensor (0–150 °C)	Measures the engine temperature to assess engine health and detect overheating conditions.
Vibration & Accident Detection	MEMS Sensor	Detects vibrations, sudden shocks, or impacts to identify potential accidents.
Obstacle Detection	Ultrasonic Sensor	Measures distance to nearby objects to prevent collisions and assist in safe navigation.
Alcohol Detection	Alcohol Sensor (MQ-3)	Detects alcohol levels to identify impaired driving and enhance safety.
Vehicle Location Tracking	GPS Module	Provides real-time vehicle location for tracking and emergency response.
Communication	GSM Module	Sends instant SMS alerts during critical events such as accidents, overheating, or obstacle proximity.
Local Display	16×2 LCD	Shows live sensor readings and system status for on-vehicle monitoring.

Table 1 Performance Comparison Table

Table 1 The proposed IoT Vehicle Parameter Monitoring System integrates multiple sensors and modules with an Arduino UNO as the central controller to ensure

comprehensive vehicle safety. The engine temperature is continuously monitored using a temperature sensor to detect overheating and prevent potential engine damage. Vibration and shock detection are achieved through a MEMS sensor, which can identify sudden impacts or accident scenarios. For obstacle avoidance, an ultrasonic sensor measures the distance to nearby objects, helping the driver navigate safely. Alcohol detection is implemented using an MQ-3 sensor to identify impaired driving, enhancing road safety. Real-time vehicle location is tracked using a GPS module, while critical alerts are sent to the driver or concerned authorities through a GSM module. A 16×2 LCD provides live display of sensor readings and system status, and a buzzer along with a relay-controlled DC motor delivers audible and physical alerts for immediate response. The entire system is powered through a regulated 12V supply, ensuring stable and reliable operation of all components. Collectively, this integrated system enhances driver awareness, facilitates timely emergency response, and supports intelligent vehicle monitoring applications.

Reaction time of the system components



Graph 1: Reaction time of system components

X-axis: Hardware Modules
Y-axis: Response Time (s)

Table 1: Comparative Analysis of Conventional Techniques and the Developed Approach

Parameter	Existing Methods	Proposed Approach (Our System)
Central Controller	Basic microcontrollers or vehicle electronics handling one function at a time, with limited integration.	Arduino UNO – capable of collecting and processing multiple sensor data simultaneously for real-time vehicle monitoring.
Engine Temperature Monitoring	Manual checks or standalone temperature gauges with no automated alerts.	Temperature Sensor – continuously monitors engine temperature and triggers alerts during overheating.
Vehicle Vibration / Accident	Standalone accelerometers or no system;	MEMS Sensor – detects abnormal vibrations and

Detection	only post-accident detection possible.	potential collisions in real time.
Obstacle Detection	Conventional parking sensors or visual inspection; limited range and alert types.	Ultrasonic Sensor – provides real-time obstacle detection with automatic warnings.
Alcohol / Impaired Driving Detection	Manual checks or periodic breathalyzers; no continuous monitoring.	Alcohol Sensor – continuously monitors driver’s alcohol level and alerts if impaired.
Vehicle Location Tracking	GPS devices without integration to alerts or cloud; only logs location.	GPS Module – provides continuous vehicle tracking and location data for fleet management.

Table 2 Existing vehicle safety systems are largely limited to single-function controllers, manual monitoring, and standalone sensors, providing only reactive safety measures with minimal integration. Critical parameters such as engine temperature, vehicle vibrations, obstacle proximity, and driver impairment are monitored partially or manually, while GPS tracking and alert mechanisms often lack real-time responsiveness. The proposed IoT Vehicle Parameter Monitoring System addresses these limitations through an integrated platform using an Arduino UNO as the central controller. It continuously monitors engine temperature, vehicle vibrations, obstacles, and driver alcohol levels, while GPS tracking provides real-time vehicle location. Alerts are communicated instantly via a GSM module, buzzers, and an LCD display. By combining real-time monitoring, automated notifications, and multi-sensor integration, the system enhances driver awareness, emergency response, and overall vehicle safety, making it suitable for intelligent transportation and fleet management applications.

RESULTS

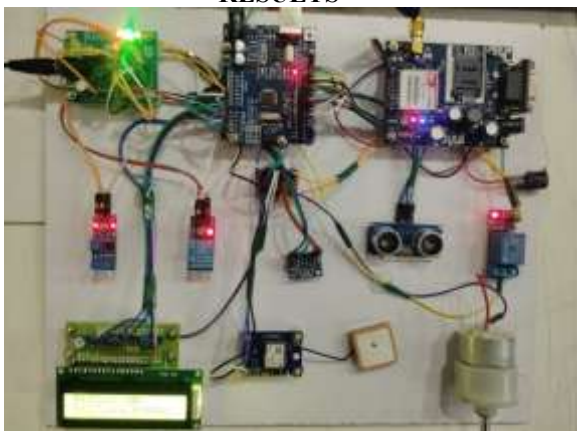


Fig4- Hardware Kit

Fig.4 The image shows an IoT-based vehicle monitoring system built around an Arduino Uno, integrating sensors such as DHT11, ultrasonic, MEMS, GPS, and an alcohol detector. It continuously tracks vehicle parameters, detects potential

hazards, and provides real-time updates via an LCD, while sending alerts through a GSM module during critical conditions. This prototype demonstrates an efficient approach to enhancing vehicle safety through real-time monitoring and automated alerting.



Fig5- Real-Time Temperature Monitoring and Alert System Using LCD and Microcontroller

Fig:5 The image displays an LCD module integrated with a microcontroller system, used for real-time temperature monitoring. The screen shows the current temperature reading as 35.5°C, accompanied by an alert indicating "TEMP HIGH!" This suggests that the system is programmed to monitor critical temperature thresholds and trigger warnings when the temperature exceeds safe limits. The LCD is interfaced with multiple wires, indicating connections to sensors and control circuitry, likely enabling automated responses such as turning cooling devices on or off. This setup demonstrates an effective implementation of a temperature monitoring and alert system, commonly used in applications requiring environmental control or equipment safety.



Fig5- LCD-Based Real-Time Temperature and Distance Monitoring System

Fig:5 The image shows an LCD-based sensor monitoring

setup, likely part of an IoT or embedded system project. The 16x2 LCD module displays real-time data, including temperature and distance readings. The display indicates a temperature of 33.7°C and a distance measurement below 25 cm, suggesting the system is actively monitoring environmental or object parameters. The LCD is connected to a microcontroller through multiple jumper wires, with a potentiometer on the module used to adjust the screen contrast. The setup also includes a sensor module, which appears to be providing the distance or temperature input to the microcontroller. This type of configuration is commonly used in projects for obstacle detection, temperature monitoring, or safety alert systems.



Fig6 Digital Monitoring System for Real-Time Temperature and Fall Detection

The image shows a digital monitoring system equipped with a 16x2 LCD display, indicating real-time temperature readings and fall detection status. The display reads a temperature of 33.1°C and shows an alert message, “FALL DETECTED!”, suggesting the system is capable of identifying sudden falls. The setup includes a compact microcontroller circuit connected to sensors through jumper wires. The circuit likely integrates a temperature sensor and an accelerometer or gyroscope to detect abrupt changes in motion, making it suitable for applications in elderly care, patient monitoring, or safety alert systems. The LCD provides a simple and immediate visual feedback of both environmental and safety parameters.

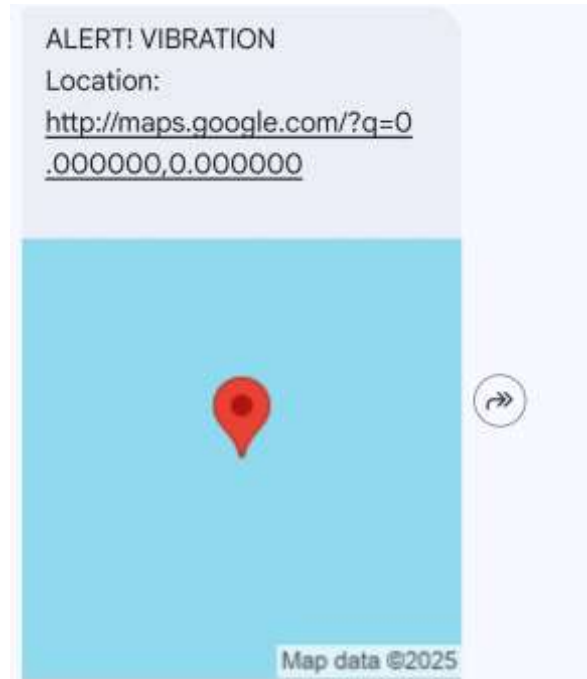


Fig6- Automated Vibration Alert System with Real-Time GPS Notification

The image depicts an automated alert notification generated by a vibration monitoring system. The system sends a real-time SMS alert indicating a detected vibration event, along with a link to the geographical location of the occurrence. The coordinates shown in the link are (0.000000, 0.000000), which corresponds to the intersection of the Equator and Prime Meridian in the Gulf of Guinea, likely representing a default or uninitialized GPS reading. A Google Maps preview pin is displayed on a map background, illustrating the intended feature of location tracking. Such notifications are typically used in IoT-based vehicle or structural monitoring systems for rapid incident response.

CONCLUSION

This work presents a practical and efficient IoT-based vehicle parameter monitoring system that enhances road safety through continuous supervision and automated alerting. By integrating multiple sensors, wireless communication modules, and real-time feedback mechanisms, the system enables early detection of unsafe conditions and rapid emergency response. The use of cost-effective hardware components makes the solution scalable and suitable for deployment in personal vehicles and fleet management systems. Future enhancements may include cloud-based data analytics and AI-driven predictive maintenance to further improve vehicle safety and performance.

REFERENCES

- [1] M. Jyothi Kiran, S. Ravi Teja, “Vehicle Health Monitoring Systems,” International Journal of Engineering Research and Applications, Vol. 2, Issue 5, September-October 2012, pp. 1162–1167.
- [2] Zhang Wen, Jiang Meng, “Design of Vehicle Positioning System Based on ARM,” Department of Physics & Electronic Information Engineering, Neijiang Teachers College, China.
- [3] Esha Naryal, Prabha Kasilwal, “Real-Time Vehicle

Health Monitoring and Driver Information Display System Based on CAN and Android,” *International Journal of Advance Foundation and Research in Computer*, Vol. 1, Issue 11, November 2014, ISSN 2348-4853.

[4] T. Narendra Kumar, S. Sivaji, “Android-Based Vehicle Monitoring and Tracking System Using ARM7 and CAN Technology,” *International Journal of Engineering and Advance Technology (IJSEAT)*, Vol. 3, Issue 4, April 2015, ISSN 2321-6905.

[5] Manali Shilimkar, “Survey Paper on Vehicle Tracking System Using GPS and Android,” *International Journal of Advanced Research in Computer Engineering & Technology (IJARCET)*, Vol. 3, Issue 11, November 2014.

[6] A. Anusha, “Vehicle Tracking and Monitoring System to Enhance the Safety and Security Driving Using IoT,” 2017 *International Conference on Recent Trends in Electrical, Electronics and Computing Technologies (ICRTEECT)*, July 2017.

[7] Mayuresh Desai, “Internet of Things Based Vehicle Monitoring System,” 2017 *Fourteenth International Conference on Wireless and Optical Communications Networks (WOCN)*, IEEE, February 2017.

[8] Navod, “Vehicle Monitoring, Controlling and Tracking System by Using Android Application,” *International Journal of Technical Research and Applications*, Vol. 4, Issue 1.

[9] Prasanth, “Advanced Vehicle Monitoring and Tracking System Based on Raspberry Pi,” 2015 *IEEE 9th International Conference on Intelligent Systems and Control (ISCO)*.

[10] Gupta, S. K., Verma, A., Singh, P., Sharma, R. K., “SafeTrax: Smart Collision Prediction and Alert System Using IoT for Road Safety,” *IEEE Internet of Things Journal*, 2025.

[11] Maurya, A. K., Singh, D., Kumar, R., “IoT-Based Framework for Vehicle Over-Speed Detection,” *IEEE Sensors Journal*, 2024.

[12] Basha, M. S., Krishna, K. M., Kumar, S. S., “Real-Time Automatic Speed Control Unit for Vehicles,” *IEEE Transactions on Intelligent Transportation Systems*, 2024.

[13] Zadeh, A. Y., Khayyam, H., Mallipeddi, R., Jamali, A., “Integrated Intelligent Control Systems for Eco and Safe Driving in Autonomous Vehicles,” *IEEE Transactions on Intelligent Transportation Systems*, Vol. 25, Issue 12, 2024, pp. 19444–19456.

[14] Aslam, N., Phillips, W., Robertson, W., Siew, W. H., “An IoT-Based Automatic Vehicle Accident Detection and Visual Situation Reporting System,” *Journal of Advanced Transportation*, 2024.

[15] Pande, A. S., Pathare, A. A., Thorat, R. D., Kandalkar, A. C., Rode, A. B., Mokal, V. A., “IoT-Based Automatic Electric Vehicle Accident Prevention and Speed Control,” *International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)*, Vol. 4, Issue 7, 2024, pp. 355–357.

[16] Satyanarayana, K. N. V., Yaswanthini, G., Kartheeka, P. L., Rajkumar, N., “IoT-Based Vehicle Speed Control Automatically in Restricted Areas Using RFID,” *International Journal of Engineering & Technology*, Vol. 7, Issue 3.31, 2018, pp. 72–74.

[17] A. Anusha, “Vehicle Tracking and Monitoring System to Enhance the Safety and Security Driving Using IoT,” 2017 *International Conference on Recent Trends in Electrical, Electronics and Computing Technologies (ICRTEECT)*, July 2017.

[18] Junaid Ali, Shaib Nasim, Taha Ali, Naveed Ahmed, Syed Riaz un Nabi, “Implementation of GSM-Based Commercial Automobile Tracker Using PIC 18F452 and Development of Google Earth Embedded Monitoring Software,” *Proceedings of 2009 IEEE Student Conference on Research and Development (SCOReD 2009)*, 16–18 Nov, 2009, UPM Serdang, Malaysia.