International Scientific Journal of Engineering and Management (ISJEM) ISSN: 2583-6129
Volume: 04 Issue: 05 | May – 2025 DOI: 10.55041/ISJEM03487
An International Scholarly || Multidisciplinary || Open Access || Indexing in all major Database & Metadata

ACCIDENT ANALYSIS USING IOT

Kunal Kumar Munda
UG Student
Computer Science and Engineering (Internet of Things)
Faculty of Engineering & Technology
JAIN (Deemed-to-be University)
Bengaluru, Karnataka, India
21btrco007@jainuniversity.ac.in

R.Panduranga Roa
Associate Professor
Computer Science and Engineering (Internet of Things)
Faculty of Engineering & Technology
JAIN (Deemed-to-be University)
Bengaluru, Karnataka, India
21btrco0@jainuniversity.ac.in

T.Vishnu Vardhan Gupta
UG Student
Computer Science and Engineering (Internet of Things)
Faculty of Engineering & Technology
JAIN (Deemed-to-be University)
Bengaluru, Karnataka, India
21btrco0@jainuniversity.ac.in

***Abstract*—This project aims to develop an intelligent accident analysis system using IoT technology to improve road safety and emergency response. The system is designed to detect accidents in real-time, monitor key driving conditions, and automatically send alerts to emergency contacts along with the location of the incident. It also records voice data after an accident, serving as a basic black box for post-event analysis. In addition to accident detection, the system tracks driving behaviour and environmental factors, displaying relevant information on a screen for the driver and uploading data to an online platform for remote monitoring. By combining automation, communication, and data sharing, this project offers a smart and efficient solution for accident management and analysis.**

Keywords: Accident Detection, IoT Monitoring, Emergency Alert System, Real-time Tracking, Smart Vehicle Safety

1.INTRODUCTION

Road accidents are a major concern globally, leading to significant loss of life and property. In many cases, delayed emergency response and lack of real-time information contribute to the severity of outcomes. With the advancement of IoT (Internet of Things) technology, it is now possible to create smart systems that can monitor vehicle conditions, detect accidents, and provide timely alerts to authorities and family members. This project introduces an IoT-based accident analysis system that aims to enhance road safety by detecting collisions, tracking vehicle location, and sending immediate notifications in the event of an accident. By integrating real-time data monitoring, automated alerts, and voice recording capabilities, the system not only aids in faster response but also supports post-accident investigation and driver behavior analysis.

2.REVIEW OF LITERATURE

Title: An IoT-based Framework of Vehicle Accident Detection for Smart City

Authors: Pankaj P. Tasgaonkar, Rahul Dev Garg, Pradeep Kumar Garg

Abstract: This study introduces an IoT-based framework aimed at detecting vehicle accidents within smart city environments. Utilizing sensors such as accelerometers, ultrasonic sensors, and GPS modules, the system captures real-time data to identify accidents. Upon detection, the system transmits location coordinates via communication modules and stores the information on the ThingSpeak cloud platform. This approach enables monitoring stations to promptly recognize accidents and dispatch emergency services to the incident location, thereby enhancing response times and potentially saving lives in urban settings.

Title: An IoT-Based Vehicle Accident Detection and Classification System Using Sensor Fusion

Authors: Kumar N., Acharya D., Divya Lohani

Abstract: This research presents an IoT-based system that not only detects vehicle accidents but also classifies them using sensor fusion techniques. By integrating data from various sensors, including those measuring speed, acceleration, and orientation, the system can distinguish between different types of accidents such as collisions, rollovers, and falls. Machine learning models, specifically Naïve Bayes, Gaussian Mixture Model, and Decision Tree, were employed to enhance classification accuracy. The Naïve Bayes model demonstrated the highest performance with a mean F1-score of 0.95, indicating its effectiveness in real-time accident detection and classification.

Title: Smart Ambulances for IoT Based Accident Detection, Tracking and Response

Authors: Amreen Ayesha, Komalavalli Chakravarthi

Abstract: This paper proposes a comprehensive system integrating IoT technologies to enhance accident detection and emergency response. The system employs vibration sensors and accelerometers to detect accidents, and upon detection, it utilizes GPS to determine the accident location. This information is then communicated to smart ambulances and the victim's emergency contacts, facilitating prompt medical assistance. The system aims to reduce response times and improve the efficiency of emergency services by ensuring accurate and timely information dissemination.

Title: IOT Based Automatic Vehicle Accident Detection and Rescue System

Authors: Pavan Biradar, Jagadish Kumar, Shivnath, Prashant, Rohini D.

Abstract: Addressing the critical need for timely emergency response in vehicular accidents, this study introduces an IoT-based automatic accident detection and rescue system. The system integrates accelerometers, gyroscopes, and GPS modules to detect accidents and ascertain their severity. Upon detection, it automatically transmits vital information, including the vehicle's location and condition, to nearby emergency response units and a centralized monitoring center. This real-time data transmission aims to expedite emergency services' arrival at the accident scene, potentially reducing fatalities and improving overall road safety.

3.PROPOSED METHODOLOGY

The proposed system introduces a comprehensive IoT-based accident analysis and alert mechanism that enhances vehicle safety and emergency response capabilities. At the core of the system is an Arduino UNO, which serves as the main controller, interfacing with multiple sensors and modules to monitor various driving parameters. An alcohol sensor is used to detect the presence of alcohol in the driver's breath before or during vehicle operation, helping to prevent driving under the influence. A MEMS sensor continuously monitors vehicle orientation and movement to detect accidents in real time based on sudden impacts or abnormal tilting. In the event of an accident, the system activates a GPS module to retrieve the exact location of the incident and uses a GSM module to instantly send an emergency SMS alert, including a Google Maps link, to predefined contacts. A voice module acts as a black box by recording audio data immediately after the accident for post-incident analysis. An ultrasonic sensor is placed at the rear of the vehicle to detect proximity of other vehicles and alert the driver to possible rear-end collisions. A potentiometer is used to simulate vehicle speed, while a push button simulates gear position changes; both of which are displayed on an LCD screen along with sensor readings and alert messages. All collected data, including accident status, speed, alcohol detection, and vehicle position, is transmitted to a NodeMCU, which uploads the data to the ThingSpeak cloud platform for real-time remote monitoring and future analysis. This integrated approach ensures not only timely alerting and tracking but also provides a detailed digital footprint of driving behavior and accident events.

4.DESIGN AND IMPLEMENTATION

- **Arduino Uno:**

The Arduino Uno is one of the most widely used microcontroller boards in the world of electronics, favoured for its ease of use, versatility, and large supportive community. It is an open-source platform that enables hobbyists, engineers, and students to create interactive electronic projects. As a key component of the Arduino ecosystem, the Arduino Uno is the perfect tool for prototyping and experimenting with microcontroller-based projects. This section provides a detailed overview of the Arduino Uno, its components, features, and applications, making it the ideal starting point for anyone interested in learning about embedded systems and electronics

1. Introduction to Arduino Uno

The Arduino Uno is a microcontroller board based on the ATmega328P microchip. It is designed to make the process of building electronics projects simple and accessible. Its low cost, user-friendly design, and flexibility make it a great choice for people at any level of experience. Whether you're a beginner just starting with electronics or an experienced engineer working on advanced projects, the Arduino Uno provides a platform to build and prototype with ease.

Arduino boards, including the Uno, are equipped with digital and analog pins, which allow them to interact with a wide range of external sensors, motors, LEDs, and other components. In addition to the board itself, the Arduino IDE (Integrated Development Environment) provides an intuitive interface for writing and uploading code to the board, making the process of programming the Arduino Uno straightforward.

2. Key Features of Arduino Uno

The Arduino Uno board is packed with essential features that make it easy to work with and extremely powerful for various electronic projects. Below are the primary features that make the Arduino Uno a popular choice for makers and engineers alike:

2.1. Microcontroller: ATmega328P

At the heart of the Arduino Uno is the ATmega328P microcontroller, a low-power, high-performance microchip produced by Atmel (now part of Microchip Technology). This microcontroller is capable of running at 16 MHz, which is sufficient for most small- to medium-sized projects.

. Power Supply

The Arduino Uno is flexible when it comes to powering the board. It can be powered through several options:

- **USB Power:** The simplest method is by connecting the Arduino Uno to a computer using a USB cable. This powers the board through the 5V pin and also allows for easy programming and data exchange with the computer.
- **External Power Supply:** For standalone applications, the Arduino Uno can be powered using an external 9V battery or a DC power supply via the barrel jack. The input voltage range for external power is 7V to 12V, and the on-board voltage regulator ensures that the microcontroller receives a stable 5V.
- **Vin Pin:** The Vin pin is used for providing an external power source, typically from a battery or adapter. This pin allows the user to bypass the on-board voltage regulator and use an external supply to power the board.

5.HARDWARE IMPLEMENTATION

The Arduino Uno works by running a program (called a sketch) that is uploaded from a computer via the Arduino IDE. Once the program is uploaded, the microcontroller begins executing the code stored in its memory.

The main cycle of an Arduino sketch consists of the following:

- **setup () function:** The **setup()** function runs once when the board is powered on or reset. It is used to initialize settings such as pin modes (input or output), serial communication, and other setup tasks that need to occur before the program enters its main loop.
- **loop () function:** The **loop()** function runs continuously after the setup is complete. It is the heart of the Arduino program, where the main logic and tasks are executed. As long as the board is powered, the loop function keeps running in an infinite cycle.

4. Applications of Arduino Uno

The Arduino Uno is a versatile microcontroller board that can be used in a variety of applications. Its simplicity, low cost, and accessibility make it ideal for a wide range of projects. Some common applications of the Arduino Uno include:

5.RESULTS

Based on the provided abstract and introduction of the project on intelligent accident analysis system using IoT technology, here are the potential results:

Expected Outcomes
- Real-time Accident Detection: The system can detect accidents in real-time, reducing the response time and improving emergency services.
- Automated Emergency Alerts: The system automatically sends alerts to emergency contacts, including the location of the incident, ensuring timely assistance.
- Voice Data Recording: The system records voice data after an accident, serving as a basic black box for post-event analysis and investigation.
- Driving Behavior Tracking: The system tracks driving behavior and environmental factors, providing valuable insights for driver analysis and road safety improvement.
- Remote Monitoring: The system uploads data to an online platform, enabling remote monitoring and analysis of vehicle conditions and driving behavior.
Potential Benefits

- Improved Road Safety: The system can help reduce the severity of accidents and improve road safety by enabling timely emergency responses.
- Enhanced Emergency Response: The system provides accurate location information and alerts emergency services, ensuring faster response times.
- Data-Driven Insights: The system provides valuable data on driving behavior and environmental factors, enabling data-driven insights for road safety improvement.

Potential Applications
- Smart Vehicle Safety: The system can be integrated into smart vehicles to enhance safety features and provide real-time monitoring.
- Accident Investigation: The system's voice data recording feature can aid in post-accident investigation and analysis.
- Driver Behavior Analysis: The system can provide insights into driver behavior, enabling targeted interventions to improve road safety.

6. CONCLUSION

In conclusion, the IoT-based Accident Analysis System offers a comprehensive solution to improve road safety and enhance emergency response efficiency. By integrating multiple sensors, communication modules, and real-time data monitoring, the system provides accurate accident detection, immediate alerting, and valuable post-incident analysis. The incorporation of features such as alcohol detection, voice recording, and rear vehicle proximity alerts adds an extra layer of security and driver awareness. With cloud-based data storage and remote monitoring through ThingSpeak, the system not only aids in quick emergency response but also contributes to the analysis of driving behavior and accident prevention. This project presents a significant advancement in vehicle safety technology, leveraging IoT to provide both real-time and post-accident solutions for improved road safety.

7.REFERENCES

1. P. P. Tasgaonkar, R. D. Garg, and P. K. Garg, "An IoT-based Framework of Vehicle Accident Detection for Smart City," Journal of Advanced Transportation, vol. 15, no. 4, pp. 67-78, 2023.

2. N. Kumar, D. Acharya, and D. Lohani, "An IoT-Based Vehicle Accident Detection and Classification System Using Sensor Fusion," International Journal of IoT and Applications, vol. 12, no. 1, pp. 45-56, 2022.

3. A. Ayesha, K. Chakravarthi, "Smart Ambulances for IoT Based Accident Detection, Tracking and Response," International Journal of Engineering and Technology, vol. 8, no. 3, pp. 112-119, 2023.

4. P. Biradar, J. Kumar, S. Shivnath, P. Prashant, R. D., "IoT Based Automatic Vehicle Accident Detection and Rescue System," International Journal of Research in Engineering and Technology, vol. 6, no. 7, pp. 39-50, 2022.

5. M. M. Singh and A. Agarwal, "Vehicle Accident Detection and Notification System Using IoT," International Journal of Electrical Engineering & Technology, vol. 11, no. 2, pp. 130-135, 2023.

6. S. Jain, V. Singh, and R. Arora, "Real-Time Accident Detection System Using IoT," Smart Technologies and Applications, vol. 9, no. 1, pp. 67-75, 2022.

7. V. K. Gupta and S. Sharma, "Smart Vehicle Safety System Using IoT," International Journal of Research in Electronics and Communication Engineering, vol. 13, no. 4, pp. 92-100, 2023.

8. A. B. Patel, "IoT-Based Accident Detection and Emergency Response System for Road Safety," Journal of Transportation Engineering, vol. 21, no. 1, pp. 56-63, 2021.