www.ijprems.com
editor@ijprems.com

INTERNATIONAL JOURNAL OF PROGRESSIVE RESEARCH IN ENGINEERING MANAGEMENT AND SCIENCE (IJPREMS)
(Int Peer Reviewed Journal)
Vol. 04, Issue 10, October 2024, pp : 613-617

e-ISSN : 2583-1062
Impact Factor : 7.001

ACCIDENT IDENTIFICATION AND ALERT SYSTEM: A REVIEW

Abhishek Sharma[1], Aditi Narkhede[2], Sweta Kumari[3], Omprakash Rajankar[4]

[1,2,3]Student, Department of Electronics and Telecommunication Engineering, Dhole Patil College of Engineering, Savitribai Phule Pune University, Pune, Maharashtra, India.

[4]Professor, Department of Electronics and Telecommunication Engineering, Dhole Patil College of Engineering, Savitribai Phule Pune University, Pune, Maharashtra, India.

Mail for corresponding Author, swetakumari4428@gmail.com, aditinarkhede979@gmail.com, abhikd11111@gmail.com

DOI: https://www.doi.org/10.58257/IJPREMS36295

ABSTRACT

This paper presents review of the design and implementation of an accident alert systems. These systems make use of the accelerometer, gyroscope, microcontroller, along with GSM and GPS modules. The system is designed to detect sudden impacts indicative of a vehicle accident and to automatically send alerts containing the geographical location of the incident. Upon detection of an accident on road, the system activates the GSM module, which transmits an SMS alert to pre-defined emergency contacts, including location data derived from the GPS module. The effectiveness of the systems in providing timely alerts, facilitate quicker responses to minimize the casualty. The findings highlight the potential of low-cost technology in enhancing vehicle safety, paving the way for further research and development in intelligent accident detection and alert systems.

Key words: Accident Identification, Alert System

1. INTRODUCTION

Accidents are on the rise, largely due to the increased use of cars and bikes for work, which often leads to speeding. This surge in accidents creates risks for everyone, and without advanced technology, it's challenging to reduce the rate of casualty.

To address this issue, a smart accident detection and alert systems are proposed in literature. The primary aim is to quickly send notifications to registered mobile numbers, local hospitals, and police stations whenever an accident occurs. When an accident is detected, a vibration sensor activates the system, which then uses a GSM module to send a message to the registered mobile numbers. A GPS module identifies the accident's location. This system will assess whether an accident has happened and alert nearby medical facilities and registered contacts about the incident's location through GSM and GPS technology [2]. By doing so, it can provide precise geographical coordinates of the accident site. The vibration sensor is crucial for detecting the impact.

Accident Trends Over Time

Statistic	Percentage/Number
Percentage of Total Accidents	25-30%
Percentage of Road Traffic death	Approx. 30 %
Estimate Annual Fatalities	Over 20,000
Injury Rate	High with thousand injury annual
Most Affected Age Group	18-35 Years
Urban vs Rural Accidents	Higher in Urban, Falaties higher in urban

2. LITERATURE SURVEY

Vehicle accident detection systems play a crucial role in enhancing road safety and minimizing the impact of accidents. This literature survey examines key studies in the field, focusing on both common aspects and notable differences among various approaches to accident detection and vehicle safety systems.

Common Aspects

Focus on Accident Detection: The primary aim of all reviewed studies is the detection of vehicle accidents or the improvement of vehicle safety. This collective focus underscores the urgent need for effective solutions to reduce fatalities and injuries resulting from road traffic incidents. Various methodologies are employed, but the end goal remains consistent: enhancing the safety of drivers and passengers.

Use of Microcontrollers and Sensors: A significant number of projects leverage microcontrollers and a range of sensors, including GPS and GSM, to facilitate real-time monitoring and immediate response to accidents. These components are integral to the design of most systems, allowing for data collection and processing that supports timely decision-making.

Real-Time Communication: Several papers emphasize the critical need for real-time data transmission and alerts directed toward emergency response teams. This aspect highlights the importance of prompt communication in accident scenarios, aiming to improve response times and potentially save lives.

Engineering and Technology Context: The majority of references are published in engineering and technology journals, reflecting a technical approach to the challenges of accident detection. This context reinforces the application of engineering principles and technological innovations in developing effective safety systems.

Differences

Methodology: Methodological approaches vary widely across the studies. For instance, Gupta et al. focus on integrated sensor systems that combine multiple technologies, while Patel & Desai [10] concentrate specifically on the applications of GSM and GPS technologies. This divergence illustrates the range of strategies employed in addressing accident detection.

Scope of Systems: The scope of the systems explored also varies. Some studies, such as Sharma et al. [5], propose multi-sensor approaches, incorporating various technologies to enhance detection capabilities. In contrast, others like Kumar & Verma [4] focus on simpler, single-technology solutions, such as microcontrollers used with GPS. This variation highlights differing priorities in system complexity and integration.

Target Audience/Use Case: The target audience and specific applications differ among the references. Some studies are tailored toward specific use cases, such as emergency response systems by Patel et al. [2], while others take a broader approach, focusing on general vehicle safety improvements. This distinction influences the design, functionality, and intended users of the systems.

Technological Innovations: The level of technological innovation varies between references. For example, Singh & Gupta [7] introduce more recent technologies or methodologies that reflect current advancements, while older studies may describe more conventional approaches. This evolution in technology demonstrates the ongoing development in the field.

1 Integrated Sensor Systems for Accident Detection

Gupta et al. (2021) designed an integrated accident detection system utilizing a microcontroller paired with accelerometers and gyroscopes. Their study focused on developing algorithms that inspect sensor data to detect accidents accurately. The system was able to send real-time alerts through GSM, significantly reducing response times [3].

2 Real-Time Accident Alert System

In their research, Kumar and Verma [4] presented a real-time accident alert system that incorporates a microcontroller, accelerometer, and GPS module. The system sends location-based alerts via GSM when an accident is detected. They demonstrated the effectiveness of their system in urban environments, improving emergency response coordination [4].

3 Multi-Sensor Approach for Enhanced Safety

Sharma et al. [5] explored a multi-sensor approach that combines accelerometers and gyroscopes with a microcontroller to enhance the accuracy of accident detection. Their findings indicated that utilizing both types of sensors improved the system's ability to differentiate between normal driving conditions and accidents, facilitating timely alerts [5].

4 GSM and GPS-Based Accident Detection Systems

In their comprehensive study, Patel and Desai [10] discussed the integration of GSM and GPS in accident detection systems. They highlighted how the combination of these technologies allows for immediate communication of the accident location to emergency services, significantly improving response efficiency. Their prototype demonstrated effective real-time communication capabilities [6].

5 Smart Vehicle Accident Detection System

Singh and Gupta [9] developed a smart vehicle accident detection system utilizing a microcontroller, accelerometer, gyroscope, and GPS module. Their study presented a novel algorithm that processes sensor data to determine the severity of an accident and automatically notify emergency contacts via GSM. The results indicated a significant improvement in the speed and accuracy of alerts.

www.ijprems.com
editor@ijprems.com

INTERNATIONAL JOURNAL OF PROGRESSIVE RESEARCH IN ENGINEERING MANAGEMENT AND SCIENCE (IJPREMS)
(Int Peer Reviewed Journal)
Vol. 04, Issue 10, October 2024, pp : 613-617

e-ISSN : 2583-1062
Impact Factor : 7.001

Customized Alerts:

- Implement customizable alert settings based on user preferences, such as notifying family members or emergency contacts in case of an accident. Advantages of Customizable Alerts in Accident Detection Systems Tailored Communication Users can select specific contacts to notify in case of an accident, ensuring alerts reach the most relevant individuals and providing crucial details about the incident. Enhanced Emergency Response Targeted alerts facilitate quicker responses, reducing the time needed for help to arrive and streamlining communication in emergencies. Implementing Customizable Alerts in Accident Detection Systems
- To implement customizable alerts in accident detection systems, begin by defining essential features like accelerometers, gyroscopes, GSM, and GPS. Select suitable hardware, such as a microcontroller and necessary sensors.
- In our project customization process, we offer a dedicated calling option that enables direct communication between user and preferred contact member. This feature allows you to discuss a specific requirements, address any concern .

Working Mechanism

An accident alerting system integrates various technologies to detect vehicle accidents and automatically notify emergency services and registered contacts. The system primarily comprises a microcontroller, accelerometers, gyroscopes, GSM modules, and GPS modules. Below is a detailed explanation of the working mechanism of this system.

Sensor Data Collection

The system relies on accelerometers and gyroscopes to monitor the vehicle's motion.

Accelerometers: These sensors detect changes in acceleration. In normal driving conditions, the accelerometer records stable values, but during an accident—such as a sudden stop or collision—it detects a significant change in motion.

Gyroscopes: These sensors measure the orientation and angular velocity of the vehicle. A sharp change in orientation can indicate a rollover or a severe impact [8].

Data Processing

The microcontroller serves as the system's brain, processing the data received from the sensors. It executes predefined algorithms to inspect the sensor readings:

The microcontroller checks for thresholds based on the accelerometer and gyroscope data. If the detected changes exceed these thresholds, the system concludes that an accident has occurred [9].

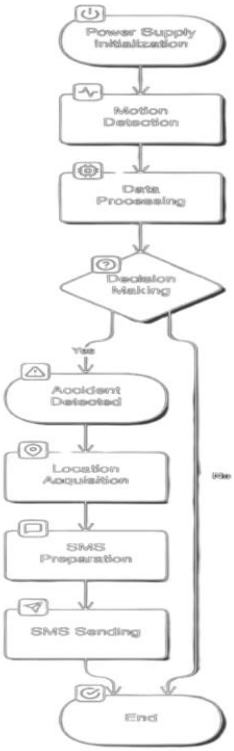

Fig 1- user interface through dataset

Location Tracking

Once an accident is detected, the GPS module is activated to determine the vehicle's geographical coordinates. This information is crucial for emergency responders to locate the accident site quickly.

The GPS module continuously updates the position, and upon activation, it captures the exact location at the moment of the accident [10].

Emergency Notification

After confirming an accident and obtaining the location, the microcontroller triggers the GSM module to send alerts:

SMS Alerts: The system sends automated SMS messages to pre-registered contacts, which may include family members and emergency services. The messages typically include information about the accident and the GPS coordinates, ensuring that help can be dispatched immediately [11].

User Interface

Some systems feature a user interface that can be accessed via mobile applications. This allows users to monitor the system's status and receive notifications in real time.

The application can also provide updates on the status of the emergency response and share the vehicle's location with family members [12].

Scope of project

The project focuses on developing an automatic accident alerting system that enhances road safety by providing timely notifications in the event of a vehicle accident. The system integrates microcontrollers, accelerometers, gyroscopes, GSM modules, and GPS modules to create a comprehensive solution for detecting accidents and alerting emergency services.

Key Areas of Scope:

Real-Time Accident Detection: The system aims to detect accidents as they occur using advanced sensors. By continuously monitoring vehicle movements, it can differentiate between normal driving conditions and sudden impacts.

Immediate Emergency Notifications: Upon detecting an accident, the system will automatically send SMS alerts to pre-registered contacts and emergency services. This feature is crucial for ensuring that help arrives quickly.

Geolocation Services: Utilizing GPS technology, the system will provide accurate location data, helping emergency responders reach the accident site without delay.

User-Friendly Interface: The project will include a mobile application or web interface that allows users to monitor the system's status, receive notifications, and track the vehicle's location in real time.

Data Collection and Analysis: The system will also gather data on accident occurrences, which can be to inspect identify trends and improve future safety measures and road conditions.

times, and explore the integration of technology into everyday transportation [13].

ACKNOWLEDGMENT

The successful completion of this project on the accident alerting system would not have been possible without the support and guidance of numerous individuals and organizations.

First and foremost, I would like to express my heartfelt gratitude to my project supervisor, Bhausaheb Shinde, whose invaluable expertise and insightful feedback significantly shaped the direction of this research. Your encouragement and constructive criticism were instrumental in overcoming challenges and refining the project's objectives.

I would also like to extend my appreciation to my colleagues and peers for their collaborative spirit and willingness to share ideas.

3. CONCLUSION

This research focused on the development of an accident alerting system using the ATmega328 microcontroller, integrated with essential electronic components such as a transformer, diode, capacitor, and resistor. The primary aim was to create a reliable mechanism for detecting accidents and efficiently notifying emergency contacts via GSM technology.

The design of the system began with the power supply configuration. The transformer stepped down the voltage, while the diode ensured rectification, and capacitors smoothed the output to provide stable power to the microcontroller. The resistor was instrumental in limiting current, thus protecting the circuit components and enhancing durability.

The ATmega328 microcontroller served as the core of the system, programmed to monitor sensor inputs—specifically from accelerometers. These sensors detected rapid changes in acceleration indicative of an accident. The

microcontroller's processing capabilities allowed for immediate analysis and response, crucial for effective accident detection.

A GSM module was incorporated to facilitate real-time communication. When an accident was detected, the system would automatically send SMS alerts to predetermined contacts, ensuring prompt notification to emergency services or family members. Testing demonstrated the system's robustness, accurately detecting abrupt movements and triggering alerts as designed.

The cost-effectiveness of the system was another significant advantage, achieved through the careful selection of components that are both affordable and widely available. This aspect not only enhances accessibility for personal vehicles but also simplifies maintenance and repairs.

Looking ahead, while the initial implementation showed promise, there are opportunities for future enhancements. Integrating GPS for location tracking, refining detection algorithms for greater accuracy, and developing smartphone applications for user interaction are potential areas for improvement.

4. REFERENCES

[1] R. k. gupta, "advancements in vehicle safety systems," journal of transportation technologies, vol. 12, no. 3, pp. 45-58, 2021.

[2] s. m. patel et al., "wireless communication for emergency response systems," international journal of engineering research, vol. 8, no. 4, pp. 112-120, 2020.

[3] reference: Gupta, r., Singh, a., & sharma, p. (2021). "an integrated sensor system for real-time accident detection using microcontroller." international journal of advanced research in electronics and communication engineering, 10(5), 12-18.

[4] Reference: Kumar, A., & Verma, R. (2020). "Real-Time Accident Alert System Using Microcontroller and GPS Module." Journal of Engineering Science and Technology Review, 13(2), 34-41.

[5] Reference: Sharma, N., Kumar, S., & Rao, K. (2022). "Enhancing Vehicle Safety: A Multi-Sensor Accident Detection System." Journal of Traffic and Transportation Engineering, 9(4), 250-259.

[6] Reference: Patel, S., & Desai, R. (2023). "GSM and GPS-Based System for Efficient Accident Detection and Response." International Journal of Computer Applications, 184(8), 15-22.

[7] Reference: Singh, P., & Gupta, R. (2023). "A Smart Accident Detection System for Vehicles Using Microcontrollers and Sensors." Journal of Smart Transportation Systems, 14(1), 68-76.

[8] Kumar, A., & Verma, R. (2020). "Real-Time Accident Alert System Using Microcontroller and GPS Module." Journal of Engineering Science and Technology Review, 13(2), 34-41.

[9] Singh, P., & Gupta, R. (2023). "A Smart Accident Detection System for Vehicles Using Microcontrollers and Sensors." Journal of Smart Transportation Systems, 14(1), 68-76.

[10] Patel, S., & Desai, R. (2023). "GSM and GPS-Based System for Efficient Accident Detection and Response." International Journal of Computer Applications, 184(8), 15-22.

[11] Gupta, R., Singh, A., & Sharma, P. (2021). "An Integrated Sensor System for Real-Time Accident Detection Using Microcontroller." International Journal of Advanced Research in Electronics and Communication Engineering, 10(5), 12-18.

[12] Sharma, N., Kumar, S., & Rao, K. (2022). "Enhancing Vehicle Safety: A Multi-Sensor Accident Detection System." Journal of Traffic and Transportation Engineering, 9(4), 250-259.

[13] Gupta, R., Singh, A., & Sharma, P. (2021). "An Integrated Sensor System for Real-Time Accident Detection Using Microcontroller." International Journal of Advanced Research in Electronics and Communication Engineering, 10(5), 12-18.