



(REVIEW ARTICLE)



Accident detection and alert system using global system for mobile communication

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Abstract

As vehicles getting to be progressively reasonable, there has been a surge in the number of vehicles on the streets on a normal all over the world. The quick advancement of innovation and framework has made our lives simpler these days. The start of innovation has moreover expanded the activity dangers and street mishaps take put routinely, which causes gigantic misfortune of life and property since of the destitute crisis offices. Mischances bring demolition upon casualties, causing the misfortune of valuable time and cash. It has been set up, after broad inquire about, that a lion's share of mishances ended up fatalities since of a need of communication to the concerned therapeutic specialists and the resulting need of quick restorative back. An accelerometer can be utilized in this investigate as a rollover or crash locator of the vehicle amid and after a crash. Moreover, the vibration sensor can be utilized in inquire about in arrange to check the vibration rates of any car.

This framework can demonstrate to be a lifesaver in separated zones where a mishap has happened and no one is around in arrange to report the mischance. Through this framework, a mischance can be recognized and a life can be spared by the fast reaction from the crisis administrations. An SMS will be sent to a part of the driver's family so that they can take quick activity to offer assistance individuals who have been traumatized by the accident.

Keywords: Accelerometer Sensor; Vibration Sensor; Arduino; GSM Module; LCD; Buzzer

1. Introduction

Road Accidents are a major global concern, causing countless fatalities and injuries every year. Delayed response to these emergencies can significantly worsen the outcome for victims. This project proposes an Accident Detection and Alert System (ADAS) using a GSM modem to address this critical issue. Street car crashes are a major public health issue as they bring about substantial loss of lives, property, and time. Clinical help given promptly will save many lives. The current response time to road accidents is often delayed due to factors like lack of awareness or delayed bystander intervention. This delay in initiating medical attention can have severe consequences for the injured. This ADAS leverages a GSM modem to create an automated system for accident detection and emergency response initiation. The system will be equipped with sensors to detect an accident and a GSM modem to transmit an alert message containing critical information to pre-programmed emergency contacts.

1.1. Significance of the Project

The significance of an accident detection and alert system lies in its potential to save lives and reduce the severity of accidents. By utilizing advanced technologies such as sensors, cameras, and AI, these systems can detect potential accidents in real-time, alerting relevant authorities or individuals to take immediate action. This can include dispatching emergency services, warning nearby drivers, or even triggering automated safety measures like braking or swerving.

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Such systems can be particularly beneficial in areas with high accident rates, poor infrastructure, or where human error is a common factor.

1.2. Scope of the Project

- **Technology Selection:** Determining the most suitable sensors, cameras, and AI algorithms for detecting accidents accurately and efficiently.
- **Data Collection and Analysis:** Gathering and analyzing real-world data on accidents to train the system and identify patterns that indicate potential hazards.
- **System Development:** Designing, developing, and testing the system's hardware and software components to ensure reliable and timely accident detection and alerts.
- **Integration and Deployment:** Integrating the system with existing infrastructure, such as traffic management systems or emergency response networks, for seamless operation.
- **Evaluation and Refinement:** Continuously monitoring the system's performance, evaluating its effectiveness in preventing accidents, and making necessary adjustments to improve its accuracy and reliability.

2. Literature Review

2.1. Android Application

2.1.1. Vehicle Accident Detection and Alert

Mr. C.P.Ratan et.al (2024) Proposed framework will permit get to as it were authorized individual so that no one can stole your vehicle. This get to is given through unique mark coordinating. Other than this framework will screen the parameters with respect to inadvertent circumstance utilizing microcontroller & sensors.

2.1.2. Accident detection and alert system using android application

Prof. A. K. Srivastava et.al (2024) Proposed framework employments different sensors and calculations to identify mishances, and machine learning calculations appear to be viable in moving forward precision. This capability is made conceivable by an assortment of sensors and calculations. Untrue alarms, protection issues, and the necessity for solid and tried and true communication systems are fair a few of the issues that still require to be settled.

2.1.3. Car accident detection and notification system using smartphone

Zainab S. Alwan et.al (2023) this proposed works meant on the later approaches are utilizing built-in vehicle programmed mishap discovery and notice framework. Whereas these approaches work fine, they are costly, support complex errand, and are not accessible in all cars. On the other hand, the capacity to distinguish activity mishaps utilizing smartphones has as it were as of late ended up conceivable since of the propels in the preparing control and sensors sent on smartphones.

2.1.4. AI Enabled accident detection and alert system using IoT

Rajeev Kumar Gupta et.al (2022) As the number of vehicles increments, street mishaps are on the rise each day. Concurring to the World Wellbeing Organization (WHO) study, 1.4 million individuals have passed on, and 50 million individuals have been harmed around the world each year. The key cause of passing is the inaccessibility of therapeutic care at the mishap location or the tall reaction time in the protect operation.

2.2. Global System for Mobile Communication

2.2.1. A Comprehensive Study on IoT Based Accident Detection Systems for Smart Vehicles

A. Khan Khattak et.al (2021) With populace development, the request for vehicles has expanded massively, which has made a disturbing circumstance in terms of activity dangers and street mishaps. The street mishaps rates are developing exponentially and so are the fatalities caused due to mishances. Be that as it may, the essential cause of the expanded rate of fatalities is due to the delay in crisis administrations. Numerous lives seem be spared with effective protect administrations. The delay happens due to activity blockage or unsteady communication to the therapeutic units.

2.2.2. IoT based car accident detection and notification algorithm for general road accidents

Shivani Sharma et.al (2020) With an increment in populace, there is an increment in the number of mishaps that happen each diminutive. These street mishaps are erratic. There are circumstances where most of the mishaps may not be detailed legitimately to adjacent ambulances on time. In most of the cases, there is the inaccessibility of crisis administrations which need in giving the to begin with help and opportune benefit which can lead to misfortune of life by a few minutes. Consequently, there is a require to create a framework that caters to all these issues and can viably work to overcome the delay time caused by the restorative vehicles.

2.2.3. MQTT Based Vehicle Accident Detection and Alert System

Ravi K Kodali et.al (2020) Proposed framework actualizes a combination of low-power sensors, a cost-effective microcontroller and a capable IoT stage to make an application that does not depend on people to work. The accelerometer sensor faculties any anomalous tilt in the vehicle and the ultrasonic sensor faculties the remove between the vehicle and another. With a combination of the information from these sensors, the framework recognizes a mishap and utilizing the lightweight MQTT convention for communication, transfers the information onto the effective Locant IoT stage.

2.3. Global Positioning System Modem

2.3.1. Accident Detection and Notification Using GSM And Live Location Sharing Using GPS

Prof. Pravin M. Tambe et.al (2022) This key must be utilized by the driver. If the mishap is exceptionally common, or the driver has fair hit the divider in a few cases like stopping the driver will press the key. This will let the small controller know that this is an ordinary chance and that the framework will not send an SMS. But if the driver is not in a position to press a button or if the mischance is a genuine mischance the driver will not press the key and the framework will send an SMS. The microcontroller recognizes joins to GPS modems. It will at that point send this data to the GSM modem.

2.3.2. Accident Detection and Alert System Using GPS and GSM

Saran Kirthic et.al (2022) Track vehicles utilizing different applications, which helps in securing individual vehicles, open vehicles, foot units and others. Assist on the street, the Mischance Rate is on the rise. This paper is around a framework that can be effortlessly recognized and caution the closest clinics and therapeutic administrations around a mischance. It moreover can pinpoint the area of the mishap so the therapeutic administrations can be coordinated promptly after it. The reason of this paper is to construct up a vehicle coincidental observing framework utilizing MEMS, GPS and GSM innovations. The framework contains accelerometers, MCUs, GPS and GSM Module support.

2.3.3. A Review Paper on Accident Detection System Using Intelligent Algorithm for VANET

Saad Masood Butt (2021) The approach of innovation has moreover rise the activity risks and the street mischance take put more than once which causes gigantic misfortune of life and property since of the destitute crisis offices. As of late, shrewdly transportation frameworks (ITS) have risen as a proficient way of progressing elucidation of transportation frameworks and upgrading travel security. Mischance location frameworks are one of the most viable (ITS) devices. The mishap recognized framework which based on Worldwide Situating Framework (GPS) and Worldwide Framework for Portable communication (GSM) can be finish in spite of the fact that one or a few sensors, the framework can assembles the data and facilitates of mischance spot at that point send this information to the salvages administrations center over a organize connect in most limited time, It spoken to as an occasion making a difference framework.

3. Proposed Approach and System Architecture

The Accident Detection and Alert System (ADAS) represent a transformative leap in vehicular safety, aiming to promptly identify accidents and facilitate immediate responses to mitigate their impact. This system is an integration of various advanced technologies, including sensors, data processing algorithms, and communication networks, working together seamlessly to enhance road safety. By providing real-time alerts to both emergency services and nearby vehicles, ADAS seeks not only to minimize injuries and fatalities but also to prevent secondary accidents that could arise from the initial incident.

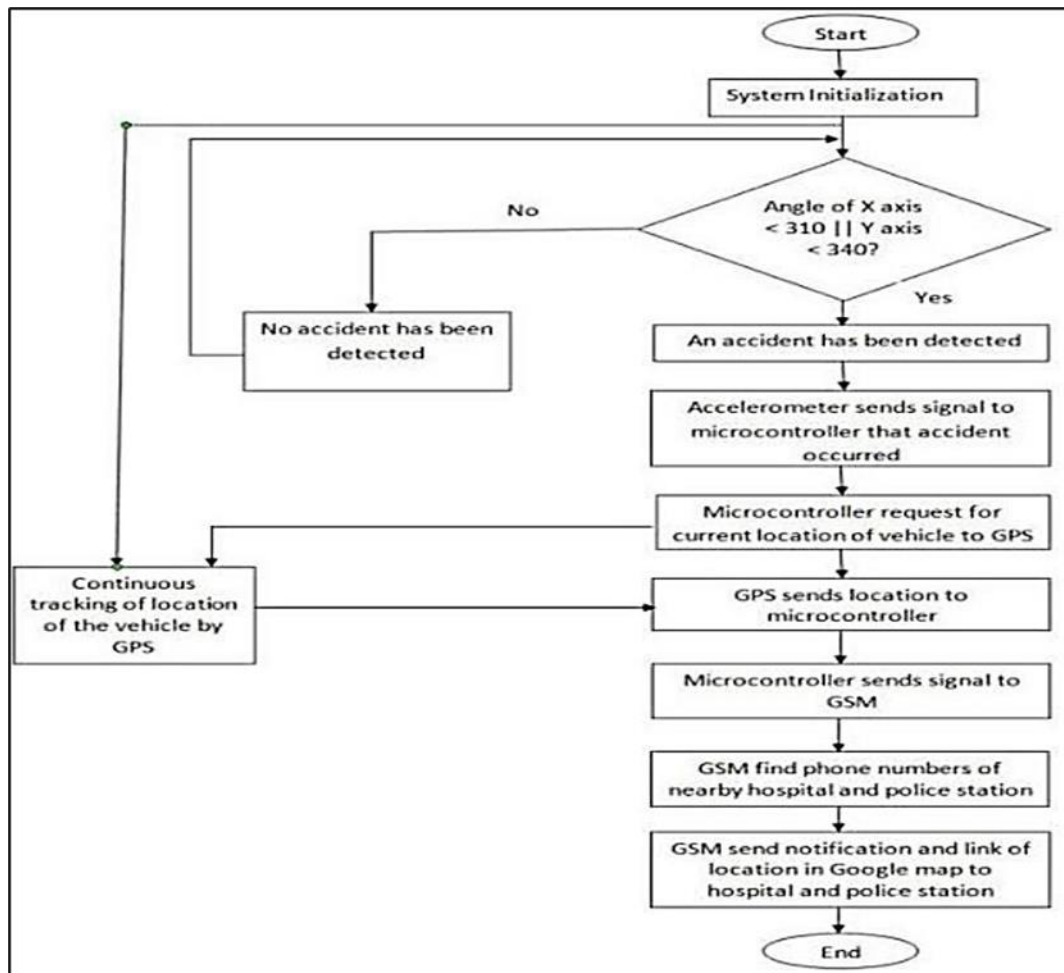


Figure 2 Workflow Diagram

At the heart of the ADAS is its sensor suite, which comprises accelerometers, gyroscopes, cameras, and GPS modules. Each of these sensors plays a critical role in monitoring vehicle dynamics and surroundings. Accelerometers are instrumental in detecting abrupt changes in speed, such as hard braking or rapid acceleration, which can signify a potential collision. Gyroscopes provide vital information about the vehicle's orientation and rotational movement, which is particularly important for assessing stability during incidents that may lead to rollovers. Cameras capture visual data that can help identify the severity of the accident and the presence of nearby obstacles or vehicles, while GPS modules provide precise location data, enabling emergency services to reach the accident scene swiftly and efficiently.

Once data is collected, it is transmitted to a central processing unit that employs sophisticated algorithms to analyze the information in real time. This processing unit is essential for distinguishing between normal driving patterns and potential accidents. By establishing baseline behaviors under typical conditions, the system can effectively recognize deviations that may indicate an accident. The core of the ADAS lies in its accident detection algorithms, which leverage machine learning techniques to enhance accuracy over time. These algorithms analyze sensor inputs and identify events that significantly deviate from established norms, enabling the system to differentiate between minor incidents and severe accidents. This capability is crucial for ensuring that alerts are triggered appropriately, thereby improving response times and outcomes.

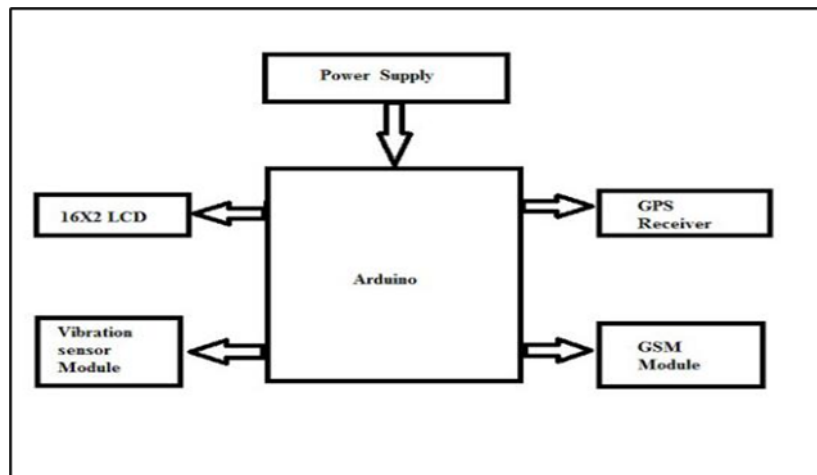


Figure 2 Block Diagram

This study represents a transformative leap in vehicular safety, aiming to promptly identify accidents and facilitate immediate responses to mitigate their impact. This system is an integration of various advanced technologies, including sensors, data processing algorithms, and communication networks, working together seamlessly to enhance road safety. By providing real-time alerts to both emergency services and nearby vehicles, ADAS seeks not only to minimize injuries and fatalities but also to prevent secondary accidents that could arise from the initial incident. At the heart of the ADAS is its sensor suite, which comprises accelerometers, gyroscopes, cameras, and GPS modules. Each of these sensors plays a critical role in monitoring vehicle dynamics and surroundings. Accelerometers are instrumental in detecting abrupt changes in speed, such as hard braking or rapid acceleration, which can signify a potential collision. Gyroscopes provide vital information about the vehicle's orientation and rotational movement, which is particularly important for assessing stability during incidents that may lead to rollovers. Cameras capture visual data that can help identify the severity of the accident and the presence of nearby obstacles or vehicles, while GPS modules provide precise location data, enabling emergency services to reach the accident scene swiftly and efficiently. Once data is collected, it is transmitted to a central processing unit that employs sophisticated algorithms to analyze the information in real time. This processing unit is essential for distinguishing between normal driving patterns and potential accidents. By establishing baseline behaviors under typical conditions, the system can effectively recognize deviations that may indicate an accident.

4. Result and Discussion

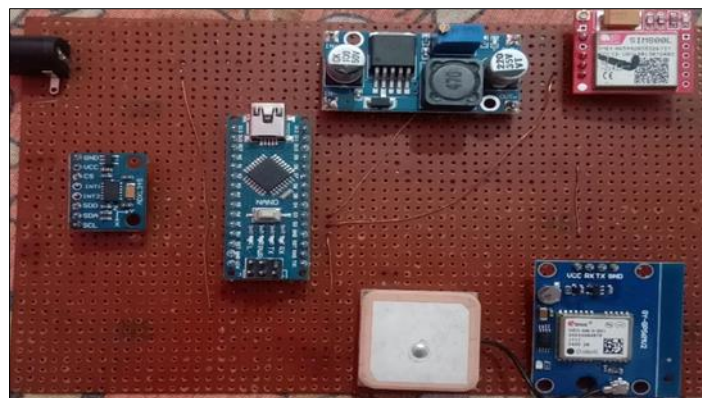


Figure 3 Main Circuit Board

Interfacing a GSM modem within an accident detection system significantly enhances safety by providing timely notifications during emergencies. The combination of a microcontroller, accelerometer, GSM modem, and optionally, a GPS module, creates a robust solution that can effectively monitor vehicular safety and respond to incidents. Through careful selection of components, thoughtful programming, and rigorous testing, developers can build a reliable and efficient system that serves as a lifeline in emergency situations.

The main circuit of the Accident Detection and Alert System is designed to integrate multiple components that work together to detect accidents and communicate alerts effectively. By combining a microcontroller, accelerometer, GSM modem, and optional GPS module, the system can provide timely notifications to emergency contacts, enhancing safety on the roads. Proper circuit design and component selection are crucial for the system's reliability and performance, ensuring it meets the demands of real-time accident detection and response. As technology continues to evolve, these circuits can be further enhanced to include additional features that improve their functionality and effectiveness in emergency situations.



Figure 4 Display of working System

The working display of the Accident Detection and Alert System effectively combines real-time monitoring, data processing, and communication to enhance road safety. By continuously monitoring acceleration, detecting potential accidents, retrieving location data, and sending timely alerts to emergency contacts, the system provides a comprehensive safety solution. The incorporation of visual indicators ensures that users are aware of the system's operational status, contributing to confidence in its reliability. As technology advances, further enhancements can be made to improve detection accuracy and response times, solidifying the ADAS as an essential tool for vehicular safety.

5. Conclusion and Future Work

The fundamental objective of this proposal work was to create a Mishap Discovery and Alarm Framework utilizing GSM Modem for giving a security towards our ones. The Vehicle Mischance Cautioning and Recognizing Framework might be a more secure framework, sparing around two-thirds of the lives misplaced in unsafe street mishaps, especially in inaccessible ranges with no human action. The GPS tracker connected to the framework gives data almost the correct topographical area that seem indicate the scope and longitude. The SMS alarm is instantly sent to adjacent healing centers, ambulances, and police stations, as well as the victim's family individuals. The rescue vehicle might arrive at the mishap spot quickly by utilizing the area points of interest and speedy restorative offer assistance seem be given to the casualty included in the mishap. In this way, a straightforward way is accomplished to diminish the recurrence of mishaps and quick caution frameworks, a low-cost way to spare high-cost lives. As considering security and security of vehicle and driver, this framework will play exceptionally vital part. With the dependable way to give caution utilizing android application & SMS caution, the restorative offer assistance can be given. With all these highlights, all the transportation frameworks will be more secure.

Our thought is utilized to distinguish mishap and robotize crisis help administrations. As a result, framework is sending SMS to the closest Crisis help benefit supplier from mishap area. The tall request of automobiles has moreover expanded the activity dangers and the street mischances. Life of the individuals is beneath tall hazard. This is since of the need of best crisis offices accessible in our nation. A programmed alert gadget for vehicle mischances. This plan is a framework which can distinguish mishaps in altogether less time and sends the essential data.

As a future work, a encourage investigation can be attempted to progress the exactness of location stage and decreases the likelihood of untrue positive signs that are created from being client is interior or exterior the car when the vehicle is voyaging at a moor speed. Hence, it is proposed that analysts explore in the field of "Activity Recognition" based on smartphone sensors, which is utilized to distinguish the current action of the client whether he is driving, strolling,

running. Too, a voice acknowledgment module can be developed and included to proposed framework to separate between airbag arrangement and generous commotion. Accomplishing this upgrade would increment the proposed framework unwavering quality and diminish untrue positive signs.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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