

# Automatic Crash Notification System with Ambulance and Police Dispatch Support

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**Abstract**—Road Accidents are one of the leading causes of injuries and fatalities worldwide. A Major factor contributing to the loss of life during accidents is the delay in receiving timely medical and police assistance. In many cases, victims are unable to report the accident due to unconsciousness or severe injuries. Immediate emergency response is crucial in reducing fatalities and improving survival rates. The Automatic Crash Notification System (ACNs) is a hardware-based solution designed to detect vehicle accidents automatically and notify emergency services without human intervention. The system uses sensors such as an accelerometer and vibration sensors to detect sudden impact or abnormal vehicle movements. Process is automatic sever system were the generally air bag the resources of the approaches of the uses of System approaches potential basic system where public safety of the resource was the unknown strategy of the collision of the communication of the accident of prevention of the air bag strategy of the number of as Road traffic accident is a leading cause of fatalities, often exacerbated by delayed emergency response time, particular in remote areas. This project proposes the IoT-Based automatic crash notification system used approaches of the microcontroller devices of the critical app is used switch the overridden detailed genuine off free alarm of the reduced the rate of the potential solution to reduce real time approaches of the rates of the demons tared value of the cloud integrated rates of mortality.

**Keywords:** Vibration Sensor, Mayday notification, call, accelerometer sensor.

## I. INTRODUCTION

Road Accidents are one of the leading causes of injuries and fatalities worldwide. A Major factor contributing to the loss of life during accidents is the delay in receiving timely medical and police assistance. In many cases, victims are unable to report the accident due to unconsciousness or severe injuries. Immediate emergency response is crucial in reducing fatalities and improving survival rates. The Automatic Crash Notification System (ACNs) is a hardware-based solution designed to detect vehicle accidents automatically and notify emergency services without human intervention. The system uses sensors such as accelerometer and vibration sensors to detect sudden impact or abnormal vehicle content. By automating the accident reporting

process, the Automatic Crash Notification System plays a vital role in enhancing road safety and ensuring faster rescue operations. By transmitting real-time location data through technologies like GPS and wireless communication modules (GSM/IoT), emergency responders can reach the accident site quickly and provide necessary assistance. Once a collision is detected, the system automatically sends an alert containing the vehicle's location and relevant crash information to emergency response centers. Quick emergency response is crucial during the "golden hour," the critical time immediately after an accident when prompt medical treatment can significantly increase the chances of survival.

## II. LITREATURE REVIEW

Road Accident are a major global concern, used to promoting extensive research into system for timely detection and usage response. Various studies have explored the use of sensor-based technologies to overcome delays in the emergency assistance. However, existing system only alert predefined contacts, without direct integration into emergency service networks. This gap highlights the need for a more comprehensive solution that not only detects crashes accurately but also directly support mechanism.

Researchers proposed systems where vibration or impact sensors detect collisions and send the accident location to emergency contacts through a GSM module. These systems help authorities quickly locate the accident site and provide immediate assistance. This approach helps authorities quickly locate accident sites and respond faster. However, the system mainly focuses on sending alerts and does not include a complete emergency dispatch coordination mechanism. When an accident is detected, the system automatically sends notifications including the GPS location, time, and emergency message to selected contacts or emergency services.

This examines key studies in the field, focusing on both common aspects and notable differences among various approaches to detection and vehicle safety systems. Though this system works fine, it lacks the detection of rare minor accidents with no casualties. So, it will eventually result in waste of resources and time in the case of minor accidents. Furthermore, it uses Arduino UNO which is less powerful than the recent microcontrollers available in the market. Hence, we decided to only take the system architecture components which would be beneficial to our project in accuracy which are the

following: GSM, GPS module, accelerometer. Accident detection and messaging system will be stationed in vehicle itself which will be helpful during the time of accident as hospital, police and emergency contact can be informed immediately. The system is executed using GPS and GSM technology.

They proposed a system in which the accidents are detected with the help of in-built sensors in the smartphone and physical context information. The system comprises of a server and the software. The software acts as a sensing device as well as an interface for the third-party observer to contribute system.

### III. METHODOLOGY

The overall workflow of the proposed system includes data collection, preprocessing, technical indicator computation, LSTM model training, trend classification, and automated notification generation. Each module works sequentially to produce accurate stock trend predictions.



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### REQUIREMENT ANALYSIS

Identify key features: crash detection, location tracking, communication to emergency services, optional driver health monitoring. Set for acceleration/deceleration (e.g., sudden change > Xg-force). Use to avoid false positives (e.g., potholes vs. real crash). Implement logic to confirm crash before triggering alerts.

- Internet survey
- Use case Analysis
- Prototyping

### COMMUNICATION MODULE INTEGRATION

#### GSM/4G/5G Module:

Send SMS or data packets to emergency contacts or a central server. Include **voice call trigger** if needed for direct communication.

### TESTING & CALIBRATION

Measures the strength of price movements and helps identify overbought and oversold market conditions. RSI values typically range between 0 and 100.

### FAIL & REDUNDANCY RECOVERY

Add backup power (small battery) in case the vehicle's main power is cut. Ensure system reboots automatically after power loss. In modern systems such as aviation, power plants, autonomous vehicles, and data centers, redundancy is essential because by incorporating multiple of the Basic system of the independent components that perform the same function, the system can tolerate faults without interrupting operation.

### DATA PROCESSING

The algorithm performs the following tasks: Analysis acceleration patterns. Confirms whether the impact magnitude exceeds the crash threshold. Filters out normal driving disturbances such as potholes or sudden braking. If a crash is confirmed, the system immediately triggers the alert procedure.

### LOCATION ACQUISITION

Once a crash is detected: The system may also record additional information such as: Time of the accident, Vehicle speed before impact, Direction of travel. Location tracking is a crucial component of the Automatic Crash Notification System (ACNS). It enables the system to transmit this information to emergency responders. Accurate location tracking ensures that rescue teams can reach the accident site quickly.

This location data is continuously monitored and updated while the vehicle is in operation, allowing the system to keep track of the vehicle's movement and store the latest coordinates. When a crash is detected by the crash detection module, the microcontroller immediately retrieves the most recent GPS coordinates along with the time of the incident. These details are then prepared for transmission through a communication module such as GSM or LTE.

The system sends an emergency alert message containing the vehicle's location to predefined contacts or emergency services. In many implementations, the coordinates are also converted into a map link so that responders can quickly navigate to the accident site using digital mapping services. By providing accurate and timely location information, the location tracking module helps emergency teams reach the accident location faster, thereby improving rescue efficiency and increasing the chances of saving lives.

### CRASH-TRIGGERED LOCATION CAPTURE

The Crash-Triggered Notification System is an important component of the Automatic Crash Notification System that automatically sends an alert when a vehicle accident occurs. This system works by continuously monitoring the vehicle's motion using sensors such as accelerometers or impact sensors. These sensors detect sudden changes in acceleration, strong impacts, or abnormal vehicle movement that may indicate a crash. The sensor data is sent to a microcontroller, which analyzes the information using a predefined threshold to

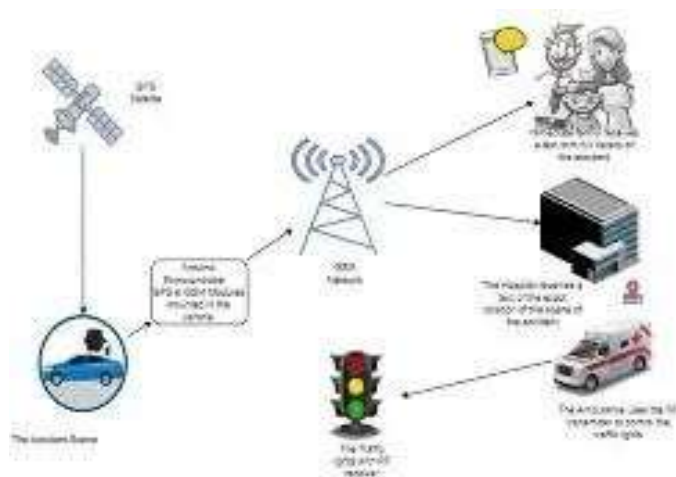
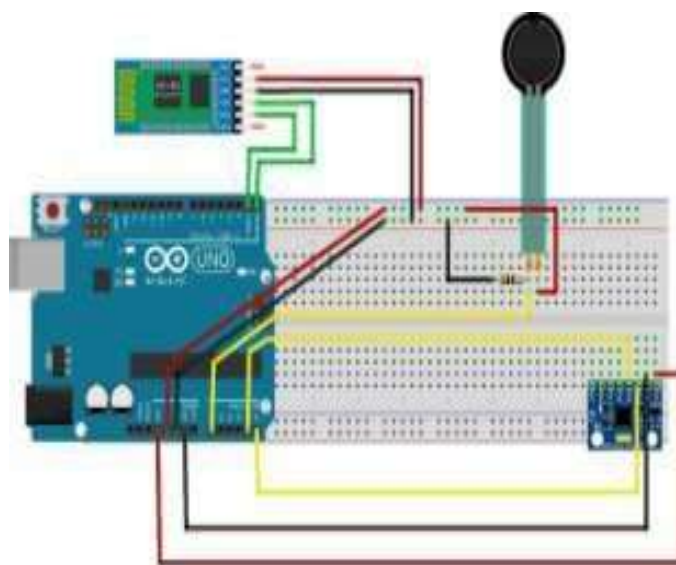
determine whether the event is a normal disturbance or a serious collision. When the detected impact exceeds the threshold level, the system confirms that a crash has occurred and immediately triggers the notification process. Once activated, the system collects important information such as the vehicle's GPS location, time of the accident, and sometimes the speed before impact. This data is then transmitted through a communication module such as GSM or LTE to predefined emergency contacts, rescue services, or monitoring centers. The alert message typically contains the accident notification along with the exact location of the vehicle to help emergency responders reach the accident site quickly.

## ACCURACY AND RELIABILITY

Accuracy and reliability are critical factors in the effective operation of an Automatic Crash Notification System. The system must accurately detect crash events and provide precise location information to ensure that emergency responders receive correct and timely alerts. To achieve high accuracy, the system uses reliable sensors such as accelerometers and GPS modules that continuously monitor vehicle movement and location. Advanced algorithms are applied by the microcontroller to analyze sensor data and distinguish between actual crash events and normal driving disturbances such as sudden braking, potholes, or sharp turns. This helps to reduce false alarms. In addition, the GPS module communicates with multiple satellites to obtain accurate geographic coordinates of the vehicle.

## IV. RESULT & DISCUSSION

It transfers the information to the Bluetooth module which then sends data to the android application. This application runs on a smartphone and retrieves location details from the network provider and sends message to concerned authority. Accelerometer: This 3-axial component acquires the data about the current acceleration of the car along three orthogonal axes. The accelerometer is also used to calculate the speed of the vehicle for the Accident Detection module. Gyroscope: The Gyroscope senses the rotation/tilt of the car and reads the data after processing in degrees per second. This rate of rotation is used for evaluating if the car has rotated to its side or flipped completely. Force Sensor: The force sensor located at the front side of the car detects the impact force of the accident.



## DISCUSSION

The developed Automatic Crash Notification System demonstrates the potential to reduce emergency response time after road accidents. One of the major advantages of this system is its ability to automatically send alerts without requiring human intervention, which is particularly useful when the driver or passengers are unconscious or unable to call for help.

The combination of sensors and communication modules allows the system to accurately detect crash-like conditions and immediately transmit the location of the accident. This can help emergency responders reach the accident from a technological perspective, ACN systems rely on accurate sensors to detect impact severity, vehicle orientation, and occupant safety.

The integration of accelerometers, gyroscopes, and telematics allows the system to determine whether a collision has occurred and transmit essential data, such as location, vehicle type, and crash dynamics, to emergency responders. This ensures that the medical team is better prepared before reaching the scene.

However, the system also faces challenges. False alarms due to sensor misreadings can burden emergency services, while poor network connectivity in remote areas can delay notification. Privacy concerns regarding vehicle data transmission are also important considerations for widespread

adoption. Future developments could address these challenges through AI-based crash detection algorithms, vehicle-to-vehicle (V2V) communication, and encrypted data transmission to enhance both reliability and user trust.

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Socially and economically, the ACN system reduces post-accident costs by enabling.

## V. CONCLUSION

The Automatic Crash Notification System successfully demonstrates a practical solution for improving road safety and reducing emergency response time. The system can detect vehicle crashes in real-time using sensors, accurately determine the location via GPS, and immediately notify emergency contacts through GSM communication. Testing confirmed that the system responds quickly to simulated accident scenarios and reliably transmits the required information.

This eliminates delays caused by human inability to call for help, making it especially useful in severe accidents. While minor false alerts may occur due to strong vibrations unrelated to crashes, the system's performance proves its potential as an effective safety tool. With further enhancements—such as advanced sensor fusion, integration with mobile applications, and cloud-based monitoring—the system can be widely implemented in vehicles to save lives and improve road safety standards.

If you like, I can also draft highlighting real-world improvements and applications for your project—it will make your report look more professional. Do you want me to do that? Get smarter responses, upload files and images, and more than space. By leveraging real-time data from sensors and GPS technology, the system reduces response times, potentially saving lives and minimizing the severity of injuries.

Moreover, its integration with modern communication networks ensures that critical information is transmitted

efficiently, supporting quicker decision-making in emergencies. As vehicle technology continues to evolve, implementing ACN systems represents a proactive step towards smarter, safer transportation and demonstrates the potential of technology to mitigate the human and economic costs of road accidents.

While challenges such as false alarms, network limitations, and data privacy remain, ongoing advancements in AI, telematics, and secure communication are likely to address these issues. Overall, implementing ACN systems not only protects drivers and passengers but also contributes to broader societal benefits, including reduced medical costs, faster emergency care, and improved public safety. As adoption grows, ACN technology will continue to play a crucial role in creating smarter, safer roads worldwide.

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