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Research Paper

SafeWay: An Android Application based Automatic Vehicle Accident Detection and Messaging System

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Abstract: The research paper outlines the creation of vehicle accident detection and notification system that is based on an Android application. When a vehicle collision occurs, the system uses sensors and mobile technologies to notify the necessary parties, including emergency services, insurance providers, and worried family members. A predestined contact list will get an emergency alert message from the system when it has detected and appraise the relentlessness of a vehicle accident. The technology is proposed to be extremely accurate and effectual at detecting and responding to auto accidents. When a vehicle's velocity suddenly changes, the system employs a mix of accelerometer, gyroscope, and Global Positioning System (GPS) sensors to look for impending accident signs. After determining the accident's relentlessness using an algorithm, the system sends an emergency alert message to a predetermined contact list. The system has undergone testing and been shown to be reliable and successful in identifying vehicle collisions and transmitting emergency signals. The design and development of the system, its possible applications, and the benefits and difficulties of its adoption are all covered in the research paper. The paper also explores the possibility for more study to enhance the system.

Keywords: Android Application, Global Positioning System (GPS), Accident Detection System.

1. Introduction

Our lives are now easier thanks to the infrastructure's and technologies rapid progress. Due to inadequate emergency facilities, road accidents regularly result in significant loss of life and property, and the introduction of technology has significantly exacerbated traffic risks. Road accidents have massive financial implications as well as disastrous human consequences, thus it is crucial to create efficient plans to lessen their occurrence [1]. Vehicle accidents are one of the apex causes of death and serious injury across the world. Both people and insurance companies may undergo significant financial losses as a result of accidents. Therefore, it is decisive to create an automated system that can identify car accidents and notify the suitable parties.

A proficient answer to this problem is a smart phone application-based vehicle accident detection and alarm system. When a vehicle collision occurs, this system uses sensors and mobile technologies to notify the necessary parties, including emergency services, insurance providers, and anxious family members. This method is made to be simple to use, practical, and economical. The device also gives users the option of tracking the vehicle's location. The creation of a vehicle accident detection and notification system is one such approach. Such a system is capable of

detecting vehicle accidents and sending an emergency alert message to predestined contacts, enabling the injured parties to receive aid right away [2].

The design and development of the system, its prospective uses, and the benefits and difficulties of adopting it are all covered in this research. The research paper also explores the possibility for more study to improve the system. The rest of the paper is organized as follows, Section 1 contains the introduction of the proposed android application that is based on automatic vehicle accident detection and messaging system, Section 2 contain the literature survey portion of the paper, Section 3 contain the system design and implementation, Section 4 contain the potential applications of the proposed system, Section 5 discusses advantages and challenges of the proposed system, and Section 6 concludes the research work with future directions.

2. Literature Survey

According to a research from a survey of the literature, several systems have been investigated for road accident detection, monitoring, and notification throughout time.

Chaudhari et al [3] discussed about their Smart Accident Detection and Alert System proposal, they talked about

vibration sensors that are used to measure the vibration caused by a vehicle impact. The presence of a person inside the car will be detected by an ultrasonic sensor. If the sensor doesn't pick up someone's presence, their entire system won't go off. They discussed that the GPS module will be configured to get the accident's coordinates via a microcontroller that analyses vibration frequencies. The microcontroller utilizes the GSM module to send the coordinates to the emergency contacts by SMS as a Google Maps URL after receiving them from the GPS component.

Kattukkaran et al [4] proposed a method for accident detection and notification. Their method aims to identify accidents involving two-wheeled vehicles and deliver prompt medical assistance. They incorporate an accelerometer, a heartbeat sensor, and a Bluetooth-enabled smart phone into their system. With this most recent technology, accidents are quickly detected and reported to the hospital, police station, and the person's family. Accelerometer detects the angle of the vehicle along the X, Y, and Z axes. If the vehicle is rotated beyond a threshold angle, the heartbeat sensor detects the person's heartbeat rate. If the heartbeat rate is abnormal, a Bluetooth-connected smart phone notifies the hospital and the patient's family.

Sherif et al [5] talked of establishing a wireless sensor network to detect accidents on the road promptly. When an accident happens, the airbag impact sensor interrupts the node board. As soon as the interruption signal is received, the node board begins encoding the packet that has to be provided, which includes the vehicle plate number (which is composed of three letters and four numbers), the accident location (which includes the street and the sector), and the vehicle speed. The sensors show how many passengers were detected by the vehicle accident sensors right before the incident. The "help" message could be transmitted to the router in the event of an accident.

Devi et al [6] presented an automated accident detection and warning system based on smart phones and IOT. In which a Bluetooth-enabled android phone is made available. Their computer system stores the emergency contact information. The pressure sensor is used by the system to monitor the pressure value. The GPS system is set up to track or check the speed of the car. The change in tilt angle is checked using an accelerometer. Continuous monitoring is done for the three conditions. The three requirements are pressure value, vehicle speed, and tilt angle. If all three criteria are met, an accident is recognized, and the system promptly collects the GPS position and sends it to the closest hospital and police station for fast action.

Rishi et al [7] suggested implementing an automatic message system to monitor motion and detect collisions. As soon as the vehicle notices a sudden change in the threshold values using the measuring device detector, the Arduino-UNO's flag bit is set, signaling the presence of an accident. Set the measuring equipment detector's effective sensitivity level so that it can detect an accident or crash. Arduino-activates the GSM module, which has a manually saved signal of a friend of the accident sufferer, as soon as it detects an accident or a

change using a measuring instrument detector, and sends a pre-stored SMS to that choice.

Rajesh et al [8] developed a system in which the system was trained using a new dataset. The cameras are then integrated with the trained system to record footage of the moving cars. Their system determines whether an accident occurred or not by computing the likelihood. The GSM module is used to send a warning to the control rooms in the event of an accident. The camera module captures video of the moving traffic. The camera is set in place, usually in regions that are prone to accidents. Our deep learning algorithm predicts when an accident will happen, and it then immediately alerts the neighboring control rooms.

Patel et al [9] explained that by delivering an alarm message to the registered mobile phone via wireless communications, the accident alert system's primary goal is to decrease collisions following accidents. The GSM module will promptly send a message to the designated mobile phone in the event of an accident. When an accident happens, the Pressure sensor is activated, and information is transmitted to the registered phone number through GSM module. Locating the accident site will be much easier with the use of GPS technology. Their system's GSM and GPS modules will be used to determine whether an accident has happened and to notify nearby medical facilities and registered mobile phones of its position.

Baballe et al [10] spoke about Accident Detection System with GPS, GSM, and Buzzer, where they said that their system may be safer, saving around two-thirds of the lives lost in risky road accidents, particularly in isolated locations with little human activity. Their system's GPS tracker provides information about their precise position, allowing them to choose latitude and longitude. An SMS notice is promptly sent to the victim's relatives, as well as to any surrounding hospitals, ambulance services, and police stations. By using the location information, the ambulance could get to the accident site right away and the accident victim could get fast medical attention. Thus, a straightforward method to lower the incidence of accidents and quick alarm systems is obtained.

Chiddarwar et al [11] offered their method that uses the Internet of Things (IoT) for car accident detection and alerting accident professionals, vehicle tracking using GPS modem. They have devised an IoT-based accident alarm system and a following system that uses a GPS modem for their work. Therefore, IoT may transform how the framework connects and reacts for a variety of functions, especially in the case of an accident or a stolen car.

Doshi et al [12] they offered a model named 'Accilert' in which they explained how vehicle monitoring systems improve fleet management, which in turn results in significant financial gains. We can handle heavier loads in a specific amount of time with better scheduling or route planning. Vehicle tracking enhances safety and security, communication tools, performance monitoring, and

productivity when used for personal or corporate purposes. Their method will thus have a significant impact on how we live our daily lives in the years to come. The accident alarm and detection project's major goal is to lessen the likelihood that people will die in incidents that we can't prevent from happening. The paramedics can arrive at the specific spot whenever an accident is reported to enhance the likelihood of survival. They could become more significant in daily life in the future because to their car tracking and accident alarm features.

Sumathy et al [13] claimed that, especially in distant locations with little human activity, their Vehicle Accident Alerting and Detecting method may be a safer method and save roughly two-thirds of the lives from dangerous road accidents. The GPS tracker that is integrated into their system provides precise position data, including latitude and longitude. The SMS provides information on the accident's specifics, the patient's condition, and the car registration number via detecting crucial bio-signals. An SMS alert is issued right away to the victim's family members as well as the police station, ambulance service, and local hospitals. Using the location information, the ambulance could be dispatched right away to the accident site, where the sufferer may receive prompt medical attention.

3. Methodology and System Design

The technology is projected to be incredibly precise and helpful at detecting and responding to vehicle accidents. When a vehicle's velocity abruptly changes, the system employs a mix of accelerometer, gyroscope, and GPS sensors to look for potential accident signs.. To make it simple for users to set up and operate the system, it is also made to be user-friendly and understanding. There are several uses for the autonomous smart phone application-based vehicle accident detection and alarm system. Insurance firms might use it to keep an eye on the cars of their clients and notify them in the case of an accident. Emergency services may also use it to find and respond to car accidents right away. Families may also use it to follow the whereabouts of their loved ones and assure their safety.
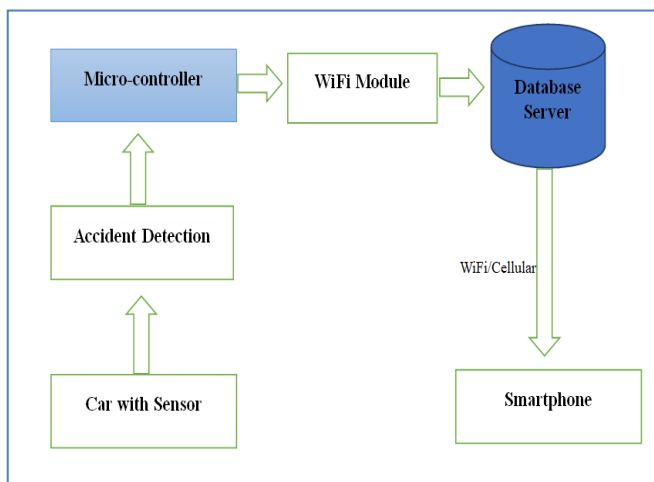

Figure 1. System Architecture of SafeWay

The proposed system uses the following methodology:
• To measure the vibration caused by the vehicle impact, a vibration sensor is used.
• An individual inside the car will be detected by an ultrasonic sensor.
• If the sensor doesn't identify a person's presence, the entire system won't go off.
• The GPS module will be configured to obtain the accident's coordinates via a microcontroller that analyses vibration frequencies.
• The microcontroller uses the GSM module to send the coordinates to the emergency contacts by SMS as a Google Maps URL after receiving them from the GPS component.

The sensors and mobile technologies that make up the autonomous smart phone application based vehicle accident detection and alarm system are its two main parts. When a car collision occurs, sensors are utilized to identify it, and mobile technology is used to notify the necessary parties. Gyroscopes are used to spot abrupt orientation changes, which may also be a sign of an impending collision. GPS receivers are employed to locate the car and give the warning system precise position data.
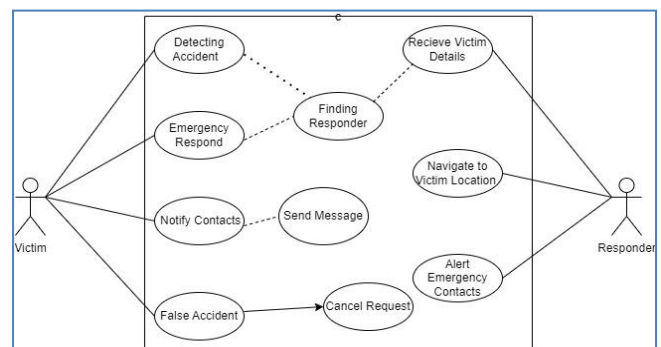
3.1 Use Case Diagram of SafeWay

Figure 2. Use case Diagram of SafeWay

The current system improves on the following parameters of the prior systems:
• Hardware Independent: The current system relies little to no on external hardware and is thus wear-and-tear free because it is built on mobile-based sensors.
• Cost Effective: The present systems are costly and need a lot of upkeep. Due to this system's independence, using the application is less expensive and easier.
• Localized Real-Time Notifications: Alerts are delivered to the closest control station, such a police station, as soon as an accident happens. There are thus fewer late emergency services. A cellular network must be used since it is more efficient than a system for notification.
• Multiple Factor Consideration: The system will receive input from a variety of environmental factors and scenarios. Android device-based sensors are employed to determine these ambient data rather than IoT-based sensors. These traits work together to allow the detection and warning system to operate efficiently and with fewer false positives.

4. Experimental Result and Discussion

The system is linked to the vehicle internal devices, and the sensors are located within the vehicle. The system is designed is simple to use and insightful. The Android application must first be installed on the user's smart phone. The program then establishes a connection with the vehicle's onboard computer and downloads the sensor data. The information is then analyzed using an algorithm to look for immediate alterations in the motion of the vehicle that may be signs of an accident. When an accident is found, the system notifies the people on a predestined contact list through an emergency alert message. The technology is made to be very precise and efficient in detecting vehicle accidents and transmitting emergency signals [14].

This is the very first screen that shows up when the SafeWay application is launched. Five seconds later, the Home Activity is automatically accessed once it makes an appearance. Name of the program software is shown on the splash screen. The splash screen and user login screens show immediately after the application is launched. Any user may log in easily using the option on this screen as shown in the figure 3.
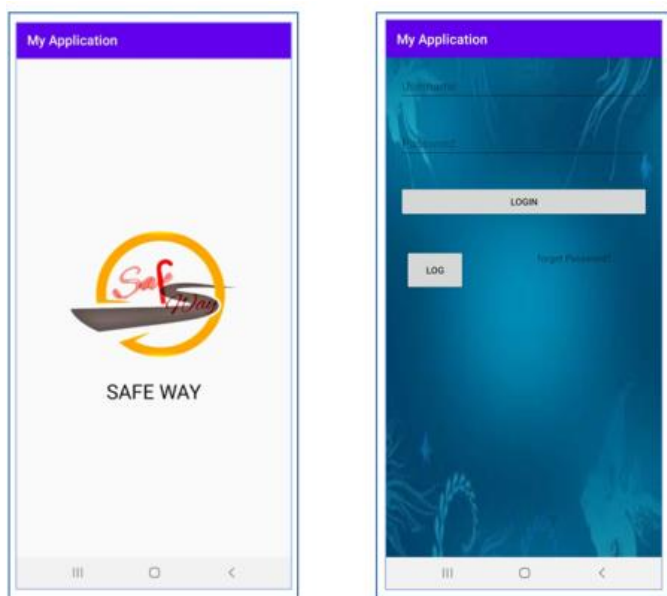

Figure 3. SafeWay: Android Application of Home and Login Page

After providing the login information, the program runs in the background and immediately launches the second screen if a casualty happens. The push button is shown on the SafeWay application's second screen. As seen in figure 4, when the button is pressed, the system sends an emergency alert message to a specified contact list.
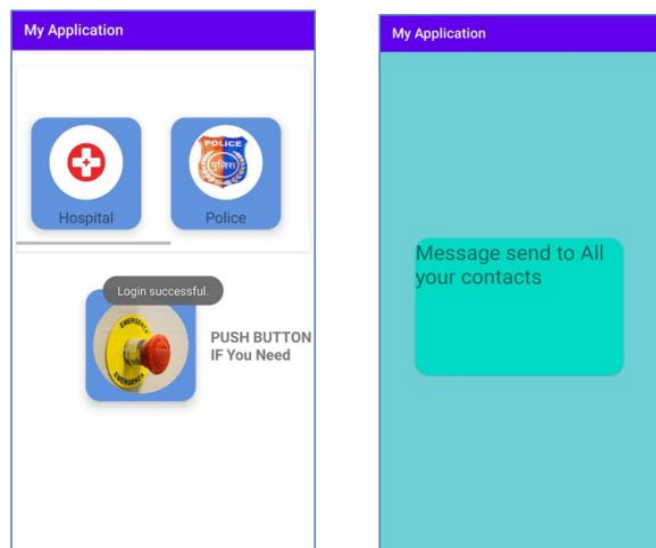

Figure 4. SafeWay: Android Application Push Button and Message Notifies Page

The SafeWay, a vehicle car accident detection and alarm system based on a smart phone application is an effective solution to this issue. This system employs sensors and mobile technology to alert emergency agencies, insurance companies, and concerned family members when a car collision happens. The SafeWay system sent an emergency alert message to a predetermined contact list, as shown in the figure 5.
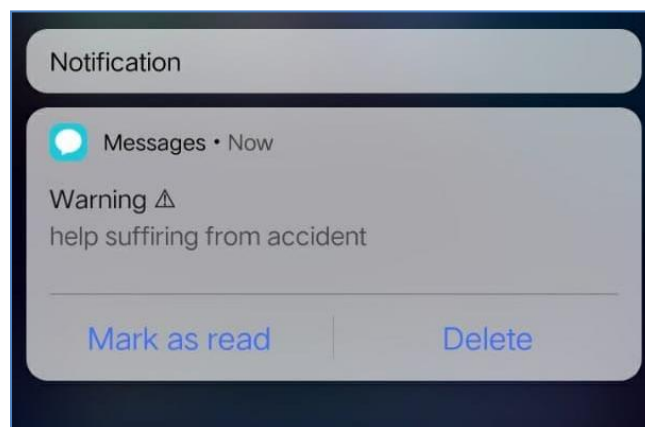

Figure 5. SafeWay: Android Application Alert Message Receive on Emergency Number

5. Potential Applications

The following actions and services are included in the application for accident detection and informing concerned parties [15]:

- Localization: Immediately after a collision, accident notifications are transmitted to the closest control station, such as a police station. As a result, there are fewer emergency services that arrive late. Utilizing GPS enables accurate location findings that make it easier for the rescue squad to get to the accident scene.

- Rescue notifications: An alerting system alerts the victim's contacts and the area's closest residents so that urgent monitoring or assistance may be provided.
- Multiple factors are taken into account: The system uses a variety of environmental circumstances and factors as input in order to achieve accuracy for accident detection and to decrease the false positive scenarios. Android device-based sensors are used to calculate these environmental parameters.

6. Advantages and Challenges

There are various benefits to the autonomous smart phone application-based car accident detection and alarm system [16].

- It is handy and easy to use because a smart phone can be used to set it up and utilize it.
- It is inexpensive since no additional hardware or installation fees are needed.
- It offers the capability to track the position of the car, which may be helpful for families and emergency services.

There are some difficulties with the system, though [17].

- The system's accuracy is reliant on the precision of the sensors, which may be impacted by elements like temperature and vibration.
- The system's ongoing need for a data connection also limits its use in places with scant or nonexistent data coverage.
- Even slight incidents could not be picked up by the system, which might lead to false alarms or missed notifications.

7. Conclusion

An efficient and responsible method for detecting vehicle accidents and sending out emergency alert messages is the automatic vehicle accident detection and messaging system based on Android applications. When a vehicle's velocity suddenly changes, the system employs a mix of accelerometer, gyroscope, and GPS sensors to look for potential accident signs. The system can be rapidly set up and attuned because it is designed to be user-friendly and instinctive. The system has undergone testing and been shown to be trustworthy and effective in identifying vehicle collisions and transmitting emergency signals. The research paper discussed about an android application based automatic vehicle accident detection and messaging system and named it SafeWay. When a car collision occurs, the system uses sensors and mobile technologies to notify the necessary parties, including emergency services, insurance providers, and anxious family members. The method is made to be simple to use, practical, and economical. The device also allows for the tracking of the vehicle's location. The design and implementation of the system, its potential uses, and the benefits and challenges of adopting it were all covered.

Conflict Of Interest
There is no Conflict of Interest.

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