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# *Human Accident Identification System Using Arduino*

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***Abstract***

*This paper presents an innovative accident prevention system designed to reduce the frequency of road accidents. The system integrates accident identification for vehicles and facilitates prompt response in the event of an accident occurrence. Utilizing Arduino technology, the system incorporates Global Positioning System (GPS) and Global System for Mobile Communication (GSM) modules. Additionally, an accelerometer is incorporated to measure vehicle velocity and tilt angle upon collision. Automated warnings are triggered when the vehicle exceeds predefined speed limits or experiences significant tilting. Furthermore, in the event of an accident, the system accurately identifies the vehicle's location using GPS coordinates and promptly sends SMS alerts via GSM. The system's low-cost design and user-friendly interface make it a practical solution for enhancing road safety.*

***Keywords:*** *GPS GSM Google Map Accelerometer; Arduino LCD.*

## INTRODUCTION

The advancement of modern technology has significantly improved our quality of life compared to previous decades. With the convenience and time-saving benefits it offers, people are increasingly reliant on vehicles for transportation. However, this surge in vehicle usage has also led to a corresponding increase in traffic-related hazards, resulting in a significant number of fatalities due to road accidents. According to data from the Indian Road Indian ministry of Road transport and Highway depicted in Figure 1, there has been a

downward trend in the number of accidents occurring between 2017 and 2020. Nevertheless, the figure still shows a substantial number of accidents, with nearly 136071 reported in 2016 alone. This underscores the persistent threat posed by road accidents despite efforts to mitigate them.

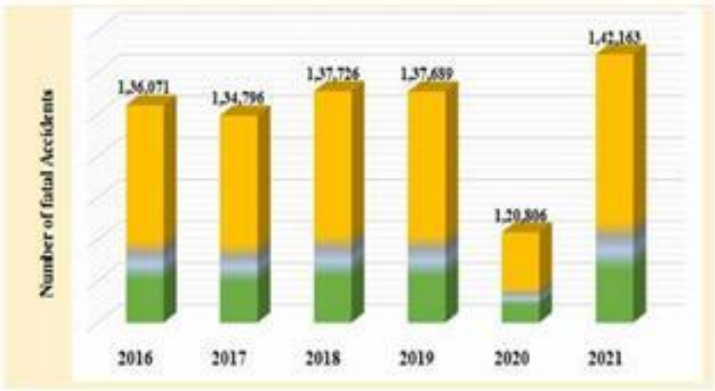


***Fig. 1. Accidents per year***

To address this pressing issue, this paper proposes a GPS and GSM-based system designed to monitor and mitigate road accidents. The system continuously tracks the latitude, longitude, and velocity of moving vehicles over time. By integrating an accelerometer, the system can accurately detect vehicle velocity. When the vehicle's velocity surpasses a predefined threshold specific to its geographical coordinates, calculated using real-time data from Google Maps, the system triggers an SMS alert using Arduino and GSM modules. This innovative approach aims to proactively prevent accidents by providing timely warnings to drivers, thereby reducing the risk of collisions and enhancing road safety.To enhance the effectiveness of the proposed system, an LCD display is incorporated to alert occupants inside the vehicle about potential dangers. This additional feature aims to increase awareness among passengers and drivers, thereby reducing the likelihood of accidents. By displaying real-time information about hazardous conditions or exceeding predefined safety thresholds, such as vehicle velocity, the LCD display serves as an effective warning mechanism. This proactive approach empowers occupants to take corrective actions and make informed decisions, ultimately contributing to the overall reduction of accidents on the road.

## BLOCK DIAGRAM

When the velocity and tilting values exceed predetermined thresholds, the system triggers an SMS alert via Arduino, providing real-time coordinates. These coordinates are simultaneously displayed on the LCD screen, as illustrated in Figure 2. This integrated

approach ensures immediate notification of potential dangers to both occupants inside the vehicle and designated recipients, thereby enhancing safety measures and minimizing the risk of accidents.

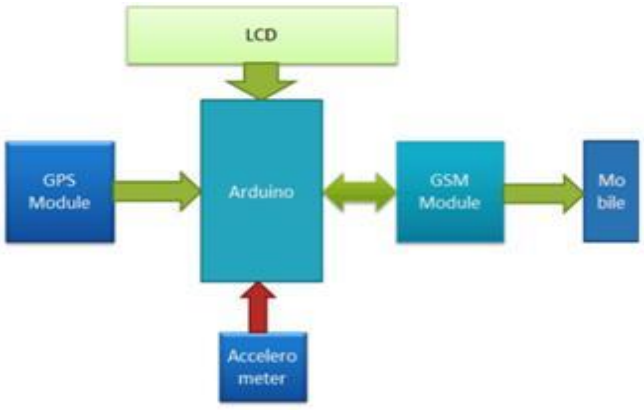


***Fig. 2 Block Diagram***

**SYSTEM DESIGN**

The entire system operates on the Arduino microcontroller as its central control unit. Upon receiving data from the sensors and GPS module, Arduino processes the information, decodes it, and executes the necessary operations. Figure 3 depicts the simulation circuit diagram of the system, illustrating the connection between Arduino, the main microcontroller unit, and various components such as the 10 DOF IMU Sensor (accelerometer sensor), GPS module, GSM module, and LCD display. This configuration facilitates seamless integration and coordination among the different modules, enabling the system to effectively monitor vehicle parameters, detect potential hazards, and communicate critical information to ensure road safety.

**10 DOF IMU Sensor (accelerometer)**

The IMU sensor, specifically a 10 DOF IMU Sensor, isemployed in this system to detect acceleration. Acceleration, a physical quantity, is measured by this sensor. Utilizing its capability to measure 3-axis accelerometer data, the sensor captures changes in acceleration as the vehicle tilts, indicating a potential accident. To prevent such accidents, it's imperative to calculate the vehicle's velocity. This can be achieved using the formula:

V = at

Where:

a = represents Accelerationunit: m/s^2

t =denotes time (unit: s)

V = signifies velocity (unit: m/s)

When a vehicle transitions from a stationary state and begins traveling at a steadily increasing speed, it undergoes acceleration along both the x and y axes. By measuring these accelerations over time, the velocity of the vehicle can be determined using the aforementioned formula. This approach enables accurate measurement of velocity, fulfilling the system's requirements effectively.

**Arduino Uno**

The Arduino Uno serves as the central processing unit in the system. It controls the flow of data between all the components, processes sensor data, and manages the sending of SMS notifications.

**GSM Module (SIM900A)**

The GSM module is used for communication purposes. It allows the Arduino to send SMS messages to predefined emergency contacts. The SIM900A module interfaces with the Arduino through serial communication. By sending AT commands, the Arduino can control the GSM module to send text messages.

**16x2 LCD Display**

The LCD display is used to provide visual feedback to the user. It can display messages such as system status, GPS coordinates, or confirmation of SMS sent. The Arduino communicates with the LCD display using the LiquidCrystal library.

**GPS Module (SIM28ML)**

The GPS module is used to determine the current location of the device. It continuously receives signals from GPS satellites and calculates the device's latitude and longitude coordinates. The Arduino communicates with the GPS module via serial communication and extracts the location data.

**Power Supply (12V 2A 24W)**

The power supply provides the necessary electrical power to the Arduino and all the connected components. It ensures stable operation of the system.

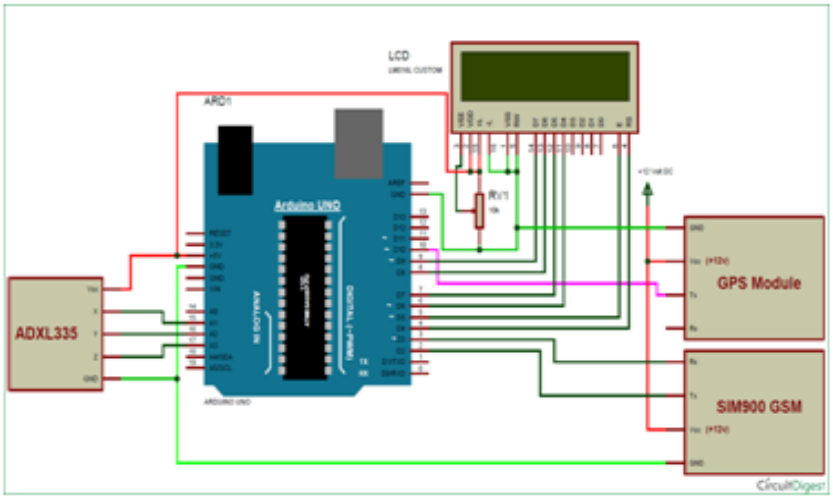


*Fig 3: Circuit Diagram*

**The algorithm for this mechanism is as follows**

**Initialization:** Upon power-up, the Arduino initializes all the components including the GSM module, LCD display, GPS module, and accelerometer.

**Sensor Data Acquisition**

The Arduino continuously reads data from the accelerometer and GPS module. It monitors the accelerometer data for sudden changes in acceleration and checks if the GPS coordinates indicate any unusual movement or location.

**Accident Detection**

If the accelerometer detects a sudden impact or abnormal acceleration patterns, and if the GPS coordinates indicate a significant deviation from the usual location, the Arduino determines that an accident has occurred.

**Notification**

Upon detecting an accident, the Arduino sends an SMS message to predefined emergency contacts using the GSM module. The message contains information such as the current GPS coordinates and a distress signal indicating an accident.

**Display Feedback**

The Arduino also updates the LCD display to provide visual feedback to the user. It may display messages indicating the status of the system, confirmation of SMS sent, or GPS coordinates.

**Continuous Monitoring**

The Arduino continues to monitor sensor data and remains ready to detect and respond to any further accidents or emergencies.

## CONCLUSION

In conclusion, the Human Accident Identification System using Arduino represents a significant advancement in leveraging technology for human safety. By integrating sensors and communication modules, it efficiently detects accidents and promptly notifies emergency contacts. While challenges such as accuracy and power consumption exist, ongoing improvements like machine learning integration and wearable design hold promise for enhancing its effectiveness. Overall, this system exemplifies the potential of embedded systems to mitigate risks and protect individuals in critical situations.

## FUTURE SCOPE

Integrate additional sensors such as heart rate monitors or temperature sensors to provide more comprehensive health monitoring capabilities.

Develop companion mobile applications to receive real-time alerts and provide users with a more interactive interface for managing emergency contacts and settings.
Implement machine learning algorithms to improve the accuracy of accident detection by analyzing historical data and identifying patterns indicative of emergencies.

**Result**

The Human Accident Identification System using Arduino detects accidents/falls through abnormal accelerometer readings and GPS data. When an accident is detected, it sends an SMS alert to predefined contacts via GSM. The system offers quick response and potential lifesaving assistance.

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