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Smart Accident Information System

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ABSTRACT –

Autonomous vehicles require reliable and strong sensor suites and alert systems. This paper discusses the composition and performance of a sophisticated monitoring and alert system for automobile vehicle parameters. More automobiles have also proliferated to fulfill its demand of the enormous population. This increase in vehicles has led to an increase in the number of accidents. The accident prevention strategies currently in use are static and outdated. Furthermore, there is no dependable accident detection system available.

A microcontroller continuously monitors various automobile parameters. It stores the data logs, which include vehicle parameter information, in both a secure digital memory card and cloud storage. The system not only records vehicle data at regular intervals but also actively monitors for sudden accidents. In the event of a collision, the sensor can help authorities quickly and accurately analyze the incident. This enables emergency services to be alerted and dispatched to the exact location promptly. The system updates information whenever it detects any abnormal events.

A data recording system installed in vehicles collects critical information about how the vehicle is operated before, during, and after an accident. This system captures details such as the vehicle's speed, rate of acceleration, braking patterns, steering input, and whether the airbags were activated. Such as technology can be essential to enhancing vehicle safety, providing better emergency response for accident victims, supporting insurance companies in analyzing crash incidents, and contributing to improvements in road infrastructure to help lower fatality rates.

Key Words: Alert System, Vehicle Parameters, Accident Detection, Emergency Response, Real-time Alert, Airbag Activation, Data Recording System, Incident Analysis, Fatality reduction, etc.

1. INTRODUCTION

Transportation plays a major role in our daily lives. With the advancement in technology, it has made many tasks have become easier. However, the upward trend in the number of vehicles on the road has also led to a sharp increase in accidents.

Based on the World Health Organization's report (WHO), around 1.3 million people lose their lives in road accidents every year. Additionally, millions of people suffer injuries or long-term disabilities. Most accidents happen due to reasons like not maintaining a proper distance between vehicles, operating a vehicle under the effect of alcohol, or driving while tired. The MPU6050 sensor integrates a 3-axis gyroscope and a 3–axis accelerometer, making it suitable for detecting orientation, tilt, and sudden movements. It communicates with the Arduino via the I2C protocol using the SDA (A4) and SCL (A5) pins. Acceleration data along the X, Y, and Z axes is continuously read from the sensor. These values are processed to monitor the real-time orientation and any abnormal changes in motion, which may indicate rapid turns or skidding behavior in vehicles.

(Key words were: MPU6050, Collision Sensor, Arduino UNO, I2C LCD Display, I2C Communication)

Communication between the vehicles and the monitoring centre is established through a wireless link that relies on the International Mobile Communication Network. This setup involves the GSM base station controller, which enables real-time data transmission over cellular networks.

To determine the exact position of the vehicle is determined using a Global Positioning System (GPS) Module. GPS technology relies on a network of satellites positioned several kilometers above the Earth's surface. These satellites continuously transmit information related to orbit, time, position, and the specific satellite sending the data.

- A collision was detected by the IR sensor
- A fire sensed by the temperature sensor
- A tilt sensed by the tilt sensor
- A possible vehicle theft attempt

Once triggered, the microcontroller sends an emergency message through the GSM module to the registered contact numbers, helping ensure immediate response in a critical situation.

2. PROBLEM STATEMENT

The accident detection and vehicle alert system uses a GSM module, which helps to identify accidents using by collision sensor. A collision sensor comes in handy when we need to detect vibration. The collision sensor and Gyroscope (tilting) help to emit the signal towards the microcontroller. The controller forwards the warning message through the GSM module with the exact location.

3. Literature Survey

Minimizing accidents using an Accident detection system. The aim is to prevent accidents by tracking variations in the vehicle's speed, and the sensors can automatically detect a fall event or an accident. This system employs Arduino as the core controller to identify accidents and send notifications, based on the information gathered from sensors. Arduino, and the information from the GPS and GSM modules is relayed to the intended person, then it provides timely rescue assistance and protects lives.

Nowadays, numerous advanced technologies are accessible for vehicle safety and detection. In the past, accident information could be shared, but it was difficult to identify the exact accident location. Most vehicles are now furnished with airbags, which are designed to ensure passenger safety and provide safety during travel. The airbag system came into existence in the year of 1968.

4. Methodology

In today's fast-paced world, professional growth and busy lifestyles have made people constantly on the move, especially in urban areas where speed and time are crucial. As a result, Road accidents have risen significantly in recent years, often caused by reckless or inefficient drivers. These accidents can be life-threatening if the victims do not receive timely medical assistance.

To overcome this problem, our project seeks to design a system capable of detecting road accidents and identifying their precise location using GPS technology. Once an accident is identified, the system will automatically send an alert via a GSM module to the nearest emergency service centre, ensuring that the victim receives prompt medical care. Additionally, the system integrates a heartbeat sensor to monitor the victim's heart rate. Heart rate monitoring, along with tracking body temperature and blood pressure, is fundamental to assessing a person's health condition during emergencies.

5. Components Modules

5.1. Collision Sensor

A ***collision sensor*** is an electronic device that senses a quick or a sharp change that happens suddenly deceleration, vibration, or impact forces on a vehicle's body and converts them into an electrical signal. This signal is used by the microcontroller to determine whether a collision has occurred.

5.2 Gyroscope (tilt sensor)

A tilt sensor (gyroscope) is a device used to measure the angular position of the vehicle relative to the ground or its usual upright position of a vehicle. It detects tilting, rolling, or rotational movements by sensing changes in angular velocity. In automobiles, a gyroscope helps determine whether the vehicle is turning sharply, climbing a slope, or rolling over during an accident. The sensor works based on the concept of angular momentum, how fast the target is rotating, which allows it to sense even slight changes in orientation.

5.3 Arduino-based Systems:

Arduino, an open-source electronics platform, has become a popular choice for developing accident detection systems on account of its flexibility and ease of use. The application of an Arduino-based Accident detection system that makes use of a collision sensor and tilt sensor to detect sudden changes in vehicle motion, triggering alerts in real-time. The modular nature of Arduino allows for work together both naturally with various sensors, providing a versatile platform for accident detection. Effortlessly, everything works together.

5.4. GPS module

The Global Positioning System (GPS) is a technology used to pinpoint the geographical position of any area on Earth's surface. The exact UTC device receives the coordinates from the satellite for each and every second, with time and date.

5.5. GSM Module

It serves the purpose of enabling communication between a computer and the GSM network. GSM (Global System for Mobile Communications) represents a standard communication architecture used globally for mobile networking.

BLOCK DIAGRAM:

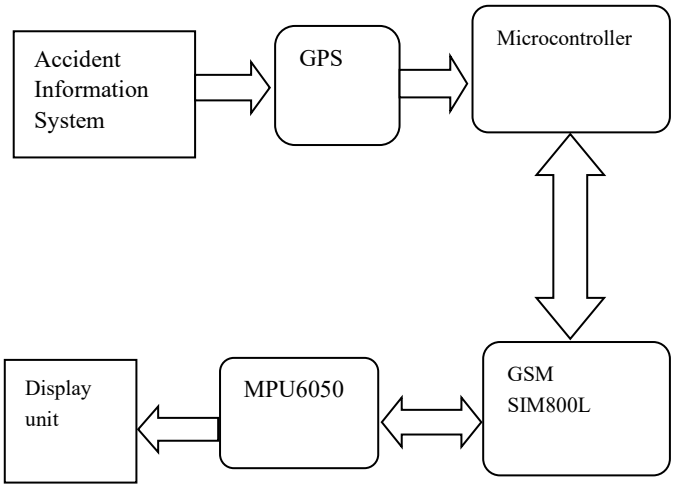


Fig 1. Block Diagram

6. PROPOSED SYSTEM:

The Arduino Uno microcontroller serves as the core processing unit, coordinating communication between integrated modules to achieve effective real-time data flow. A vibration or collision detection sensor determines the impact direction through tri-axial motion analysis, while a gyroscope sensor identifies vehicle rollovers or tilt conditions once the present roll threshold is reached. Pitch values, the weight, and centre of gravity of Vehicle inclination a key parameters in identifying collision events. The system employs vibration sensors that detect impact by monitoring voltage variations beyond a specified threshold. A buzzer is integrated to alert occupants and reduce false accident triggers. Within the buzzer's activation period. The GPS module acquires real-time coordinates of the vehicle's location. These coordinates are subsequently transmitted to nearby medical centres, law enforcement authorities, and the victim's residence for prompt emergency response. The hospital validates the accident occurrence at the specified coordinates, and through the GSM module, the system communicates the incident details to the registered family members.

Implementation and working details:

Key Components:

- Arduino
- GPS Module
- GSM Module
- Vibration sensor and Gyroscope
- Power supply
- Connecting wires
- PCB

This paper aims to design and implement an intelligent mobile-based accident detection system that leverages embedded sensors such as the GPS and accelerometer to identify collisions resulting from abrupt speed variations. The application process data obtained from multiple sensor sources to achieve high-accuracy accident detection. Upon sensing a sudden vibration or impact, the system triggers an alert notification to the user. In the absence of user feedback, it initiates automatic communication by transmitting emergency alerts and location details to the nearest medical centres, police departments, and registered emergency contacts.

Flow Chart:

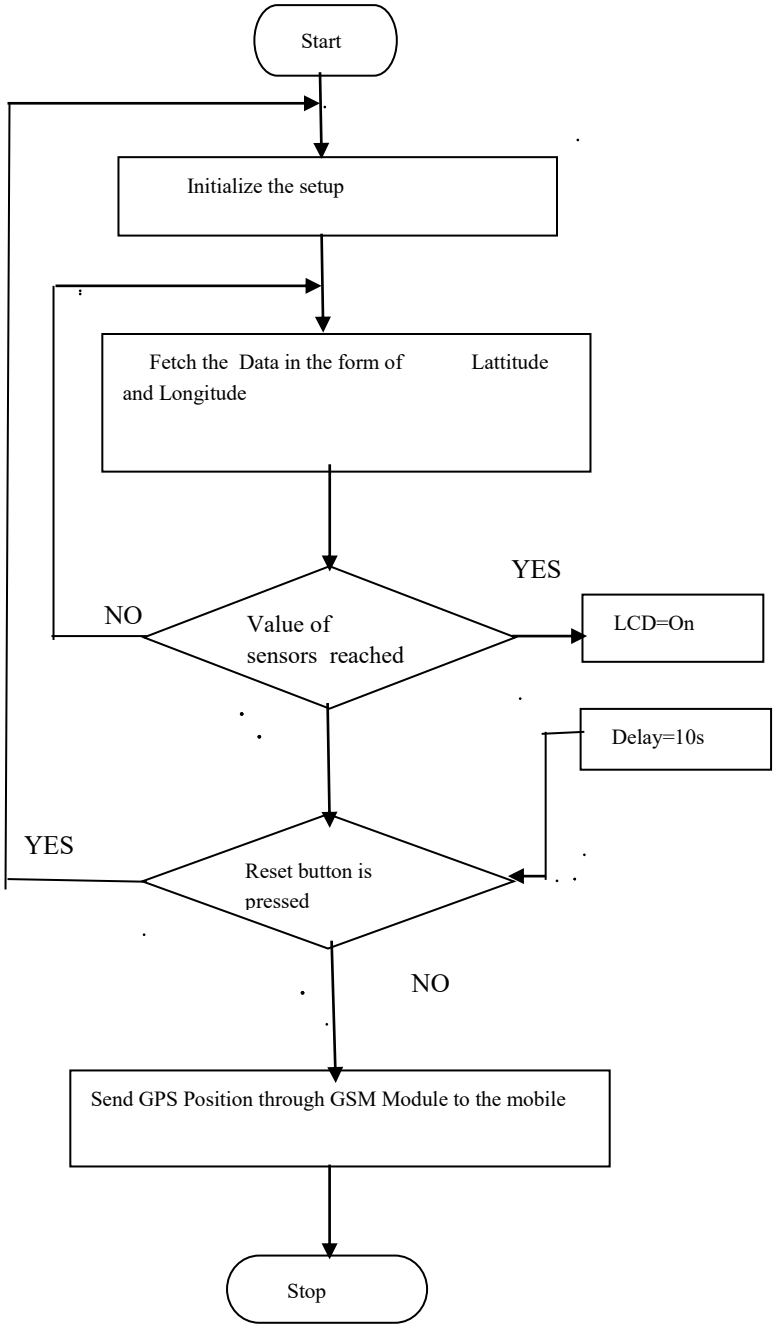
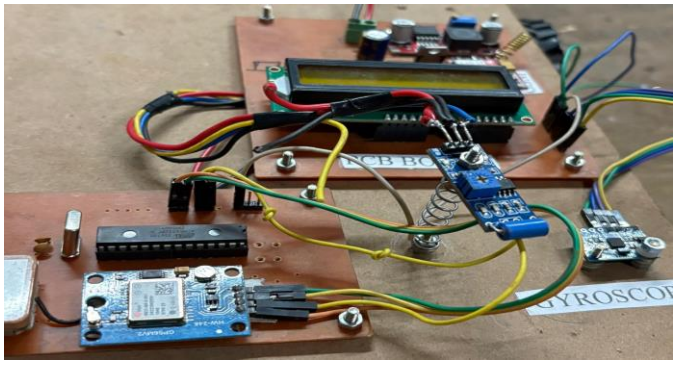
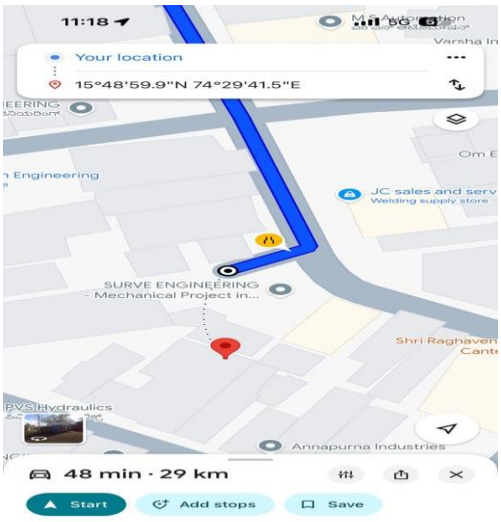


Fig 2: Accident Information System

7. Future Enhancement

The developed system is designed to detect road accidents and assist in giving first aid treatment to victims at the accident location. By using modern technological improvements, it is possible to reduce accident risks through alert mechanisms that can automatically slow down or stop the vehicle, helping to avoid serious crashes.





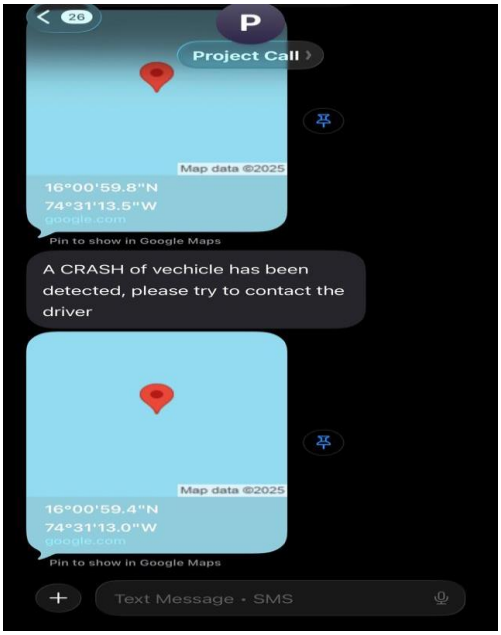


Fig 3: Accident details and location of the accident

Result

The developed application aims to support individuals who cannot manually request help during an emergency. It automatically sends an alert message with real-time location data at the time of an accident, allowing emergency responders to provide timely and efficient aid.

Conclusion

The proposed Smart Accident Information System is designed to save lives by quickly identifying road accidents. It is simple to use, even for non-technical individuals, and consists og both hardware, including sensors controlled through an Arduino module mounted in the vehicle, whereas the software functions as an Android application on the driver's smartphone that provides detailed location mapping. Overall, the system is cost-effective, secure, and user-friendly, helping to reduce casualties caused by road accidents.

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