Vehicle accident alert system using accelerometer GPS and GSM

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***Abstract*—When an individual riding his/her bike, meets with an accident, there is a chance that the individual may suffer from a serious injury or expire instantaneously and there is no one around to help him. Well this system is a solution to the problem. The system acts as an accident identification system that gathers and sends this vehicle information that met with an accident, and conveys it to the nearest control room.**

***Keywords*—blood samples, morphological technique, segmentation, threshold, feature extraction**

I. INTRODUCTION

The rise of vehicular accidents has become a significant concern for communities worldwide, prompting the need for innovative solutions to enhance road safety. Among various technological advancements, the Vehicle Accident Alert System (VAAS) stands out as a crucial component aimed at reducing the response time of emergency services and improving the overall outcomes of road incidents. A VAAS is designed to automatically detect vehicular accidents and promptly notify emergency responders, effectively bridging the gap between injury and assistance. The statistics surrounding road safety are alarming, according to the World Health Organization, approximately 1.35 million people die annually due to road traffic accidents, highlighting the urgent need for improved systems to manage these emergencies. Recognizing this need, researchers and developers have focused on creating intelligent systems that utilize a combination of sensor technology, communication devices, and data processing to enhance the efficacy of accident reporting.

At its core, a VAAS functions through a network of advanced sensors installed in vehicles, monitoring driving conditions and behavior. These sensors, such as accelerometers, gyroscopes, and radar systems, assess the state of a vehicle and can detect sudden changes indicative of a collision. Once an accident is identified, the system activates an alert mechanism that promptly communicates the relevant information, including the vehicle's location, the severity of the impact, and potentially even the number of occupants involved, directly to emergency services. This automatic detection and reporting significantly reduce the time it takes for help to arrive at the scene, which can be critical in preventing death or reducing injury severity. The integration of Global Positioning System (GPS) technology is fundamental to the system, as it allows for precise location data to guide first responders. The ability to quickly relay this information aids not only in faster help but also in allocating the appropriate resources necessary for the incident, whether it be ambulances, fire services, or law enforcement.

Incorporating these advanced technologies into a cohesive system that operates seamlessly is a considerable achievement. Various types of VAAS are emerging on the market, including factory-installed systems in new vehicles, aftermarket installations for older models, and smartphone applications designed to provide alerts in case of accidents. Factory-installed systems, being integrated into modern vehicles, leverage the existing technological framework and usually offer several additional safety features, making them beneficial from a holistic standpoint. Aftermarket systems cater to a vast number of vehicles still in use, providing budget-friendly options for enhancing safety measures. Additionally, the increasingly ubiquitous nature of smartphones has led to the development of versatile applications that utilize built-in sensors and GPS capabilities, making them accessible to a wider audience. These systems cater to diverse demographics, ensuring that more drivers can benefit from enhanced safety measures on the road.

II. IMPLEMENTATION

In recent years, the rise of intelligent transportation systems has opened the door for innovative solutions aimed at enhancing vehicle safety and improving

emergency response times after accidents. One such solution is the development of a Vehicle Accident Alert System that integrates accelerometer sensors, GPS technologies, and GSM (Global System for Mobile Communications) modules to provide real-time alerts in the event of an accident. The core component of this system is the accelerometer, which plays a crucial role in detecting sudden changes in velocity that are indicative of a collision. When integrated within the vehicle, the accelerometer continuously monitors its motion, measuring the forces acting on the vehicle in three-dimensional space. In normal driving conditions, these measurements exhibit a consistent pattern of movement; however, a significant spike in acceleration or deceleration, characteristic of an impact, can be easily identified when compared to predefined thresholds. Once such an event is detected, the system is designed to trigger a series of responses that utilize GPS technology for location tracking and GSM for communication. The GPS module, installed in the vehicle, provides accurate positioning data, allowing the system to determine the vehicle's exact coordinates at the time of the incident. This positioning information is crucial for emergency responders, enabling them to reach the accident site quickly and efficiently. The GSM module complements the functionality of the system by sending out alerts and notifications. Upon detecting an accident, the system can automatically send an SMS to pre-defined contacts such as family members, friends, or emergency services, containing the vehicle's GPS coordinates alongside a message indicating that an accident has occurred. For enhanced functionality, the system can be integrated with a smartphone application that provides additional features, such as real-time tracking and user alerts. The application can also serve as a platform for setting emergency contact numbers, allowing for easy customization according to the user's preferences. Beyond the hardware components, implementing effective software algorithms is vital to ensure the reliability of the system. This involves the formulation of specific logic to differentiate between normal driving conditions and potential accidents, where machine learning techniques can be employed to improve the accuracy of impact detection. Furthermore, software optimization ensures that power consumption remains low to facilitate prolonged operation without draining the vehicle's battery excessively. Additionally, the system's interface must prioritize user-friendliness to ensure that drivers can easily engage with the system, especially during stressful situations. A robust testing phase should be conducted to evaluate the system's performance under various scenarios, simulating different types of accidents and environmental conditions to fine-tune its responsiveness. This includes calibrating the accelerometer and validating the accuracy of the GPS and GSM components in real-world conditions. Maintenance considerations for the system should also be addressed, with a focus on regular software updates to enhance features and improve security against potential cyber threats that could compromise user data and system integrity. In conclusion, a vehicle accident alert system utilizing accelerometers, GPS, and GSM presents a comprehensive approach to increasing road safety and improving the outcomes of vehicular accidents. By employing these advanced technologies in a cohesive manner, the system not only detects accidents promptly but also ensures that help reaches the accident scene swiftly, ultimately aiming to reduce the severity of injuries and save lives.

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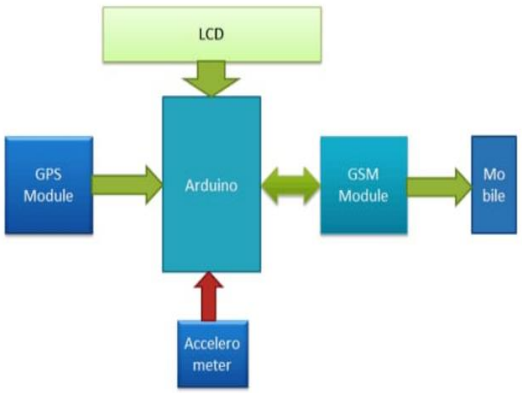

Figure 1: Block Diagram

III. MEDHODOLOGY

The development of a Vehicle Accident Alert System (VAAS) leveraging accelerometer, GPS, and GSM technologies entails a multi-faceted approach encompassing hardware selection, system design, software development, and testing procedures that collectively ensure functionality, reliability, and responsiveness in emergency situations. The methodology begins with hardware selection, where suitable components are chosen based on their

compatibility, accuracy, and reliability. The main hardware components include an accelerometer for detecting sudden changes in speed and direction, a GPS module for accurate location tracking, and a GSM module for wireless communication. The accelerometer can be selected from widely used MEMS (Micro-Electro-Mechanical Systems) sensors that can detect acceleration in multiple axes, typically the ADXL345 or MPU6050, which also includes a gyroscope function. The GPS module, such as the Neo-6M or u-blox NEO-M8N, is chosen for its capability to provide accurate positioning information alongside a data refresh rate suitable for real-time applications. Finally, for GSM communication, a GSM module like the SIM800L is acquired, which enables the system to send SMS alerts containing crucial information regarding the accident's location.

After the hardware configuration is established, the next step involves system integration, where all selected components are connected to a microcontroller, such as the Arduino or Raspberry Pi, which serves as the central processing unit.

To ensure the system works as intended, it undergoes rigorous testing and validation stages. This is crucial for assessing both the accuracy of the sensors and the reliability of the system's responses under various driving conditions. It may involve simulating different types of accidents—like sudden stops, collisions, or sharp turns—and monitoring the system’s ability to detect these events accurately. Testing should also take various environmental factors into consideration, such as differing road conditions and changes in vehicle weight, which might affect the accelerometer's readings. Validation of the GPS module is performed by comparing the coordinates received against known locations, verifying its accuracy in providing real-time positioning data.

IV. RESULT

The Vehicle Accident Alert System using an Accelerometer, GPS, and GSM can significantly enhance vehicle safety and emergency response times. When a sudden impact or rapid deceleration occurs, the accelerometer detects this change and triggers an alert. The system then uses the GPS module to determine the vehicle's exact location and sends this information via SMS to emergency services or predefined contacts using the GSM module. This real-time communication ensures that emergency responders are alerted immediately with precise location data, reducing the time it takes to reach the accident site and potentially saving lives. The system helps eliminate human error, especially in situations where the driver may be unconscious or unable to call for help. It is cost-effective, as it relies on affordable components, and can be easily integrated into existing vehicles

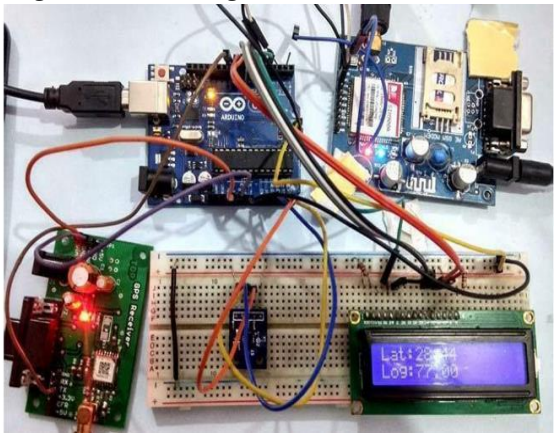

Figure 2: Result of Prototype

Figure 3: showing location on maps

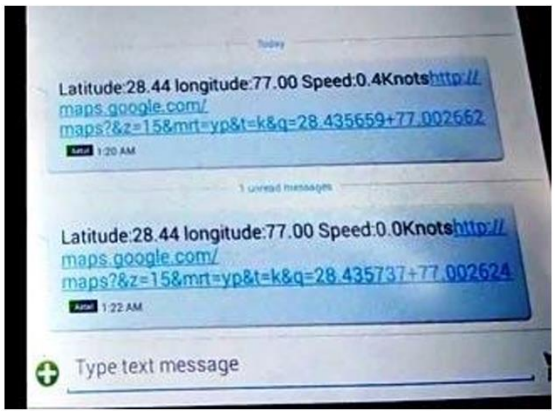

Figure 4: Occurred text message

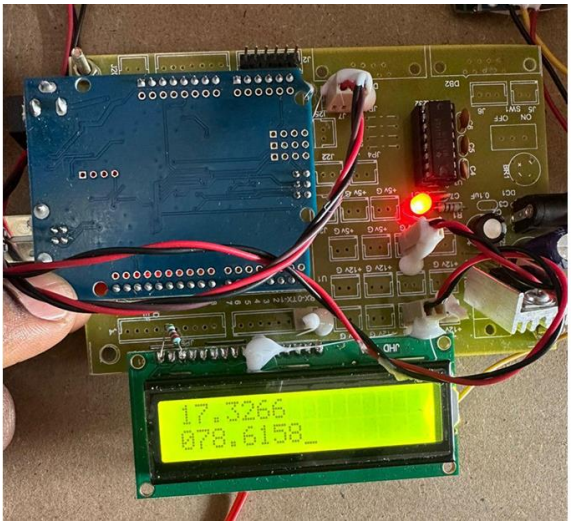

Figure 5: LCD Representation

VII. CONCLUSION

The automatic vehicle accident alert system using accelerometer, GPS, and GSM represents a significant advancement in enhancing road safety and reducing response times in the aftermath of an accident. This system, which integrates real-time data from sensors, provides an innovative approach to accident detection and emergency communication, offering a crucial tool in the prevention of fatalities and further injuries. The accelerometer, by continuously monitoring the vehicle's movement and detecting sudden impacts or abnormal changes in velocity, ensures that accidents are detected as soon as they occur. enhances the functionality of the system by allowing for instant communication with emergency services or designated contacts, such as family members or friends

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