EMERGENCY AMBULANCE SERVICES WITH ACCIDENT PRONE AREA DETECTION

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Keywords:

Accident hotspot detection, real-time monitoring, incident response optimization, GPS, Sensors.

Introduction:

In urban areas, accidents are a common occurrence, with many being manageable, but some happen during low visibility at night. During such instances, it becomes challenging for ambulance drivers to locate accident sites solely based on citizen phone calls. Precise knowledge of the accident location significantly reduces the time between the accident spot and hospital, the primary aim of this paper being to minimize this time factor.

Many night time accidents result in unconscious victims, prolonging the time it takes to notify authorities. Saving this critical time can save lives. In line with this objective, an experimental setup is developed to automatically detect accidents without human intervention. Upon detection, the setup promptly transmits accident coordinates to the ambulance, facilitating quicker location finding. Additionally, a second setup, connected to the patient upon transfer to the ambulance, continuously monitors vital signs to ensure stability.

Objectives:

The main aim of our system is to detect the accident and send alerts to parents as well as hospital management. The proposed system uses the IOT for vehicle accident detection and alarming the authorities regarding accidents, vehicle tracking using GPS Modem.

In our country, many people have lost their lives by accidents because of casualties or improper communication. So, an automatic vehicle accident is implemented. To minimize deaths and to treat people with high injury due to accidents, immediate action would be taken by the rescue teams.

The project is built around the NodeMCU. The microcontroller provides all the functionality of the mail alert system. The vibration sensor, ultrasonic sensor transmitting information to the mail.

Methodology:

Hardware Setup: Arduino IDE: Utilize the Arduino Integrated Development Environment to write, compile, and upload code to the Arduino board.

GSM Module: Integrate a GSM module (such as SIM800L or SIM900A) to enable communication via the cellular network. This module allows sending SMS messages to notify authorities or emergency contacts about accidents.

GPS Module: Incorporate a GPS module (e.g., NEO-6M) to retrieve accurate geographic coordinates (latitude and longitude) of the vehicle's location. This information is vital for notifying emergency services and pinpointing the accident site.

ADXL335 Accelerometer: Connect the ADXL335 accelerometer to detect sudden changes in acceleration, indicating a collision or impact. This sensor measures acceleration in three axes (x, y, and z) and can detect vehicle movements indicative of an accident.

Flame Sensor: Integrate a flame sensor to detect the presence of fire or flames. This sensor can trigger alerts in the event of a fire-related accident, enabling prompt action to mitigate further damage.

ESP8266 NodeMCU: Include an ESP8266 NodeMCU microcontroller board for additional processing capabilities and wireless connectivity [2]. The NodeMCU can communicate with other devices and transmit data over Wi-Fi, enhancing the system's functionality and flexibility.

Sensor Integration:Program the Arduino board to read data from the ADXL335 accelerometer to detect sudden changes in acceleration, indicating a collision. Configure the flame sensor to detect the presence of fire or flames, triggering an alert in case of a fire-related accident.Utilize the GPS module to retrieve the vehicle's current coordinates and provide accurate location information in the event of an accident.

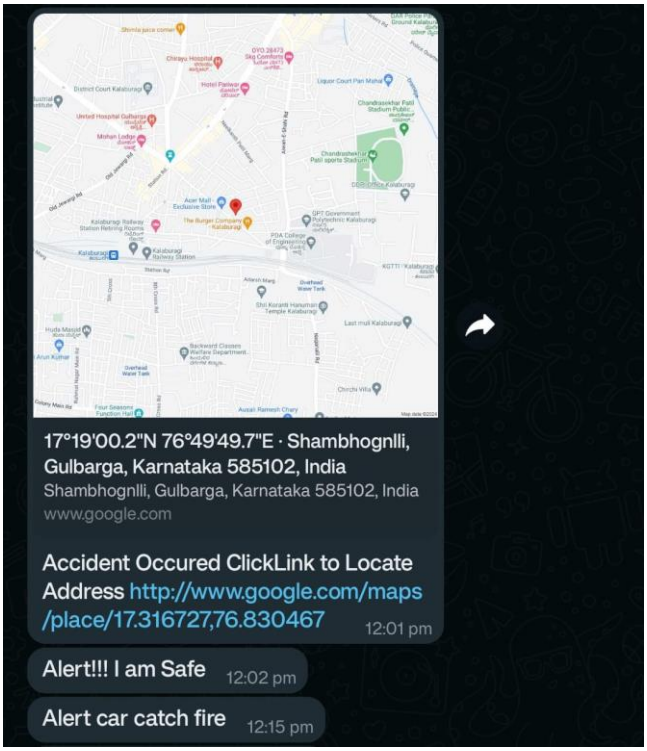
Data Processing and Decision Making: Develop algorithms to process sensor data and determine whether an accident has occurred based on predefined criteria (e.g., threshold values for acceleration change or flame detection).

Implement decision-making logic to prioritize different types of alerts (e.g., collision detection versus fire detection) and determine the appropriate actions to take in each scenario.

Alert Generation and Communication: When an accident is detected, trigger the GSM module to send SMS alerts to predefined contacts, such as emergency services or designated individuals. Include relevant information in the SMS alerts, such as the vehicle's current location (latitude and longitude) obtained from the GPS module and details about the detected incident (collision or fire).

Wireless Communication and Remote Monitoring :Utilize the ESP8266 NodeMCU to establish Wi-Fi connectivity and enable remote monitoring and control of the system. Implement features for wireless data transmission, allowing real-time monitoring of sensor data and system status via a web interface or mobile application.

Testing and Optimization: Conduct thorough testing of the hardware system to ensure accurate detection of accidents and reliable communication with external devices, Optimize the system's performance by fine-tuning sensor parameters, adjusting algorithms, and addressing any potential issues or limitations.



Conclusion:

The SMS subsystem of the framework has been demonstrated, wherein SMS messages are sent via the GSM module to pre-stored numbers in the database. These messages contain detailed information about the accident location. Upon retrieving the stored contact numbers of users, the system dispatches SMS alerts containing accident location links through the GSM module. GSM (Global System for Mobile Communication) serves as the backbone for mobile communication in numerous countries .When a user clicks on the accident location link, the location is displayed on Google Maps. This enables users or rescue teams to dynamically identify the shortest route to reach the destination. Additionally, an ambulance is dispatched to the accident location to provide emergency medical assistance. The results and testing section is segmented into two parts, showcasing the framework's uniqueness and the accuracy of the results obtained.

Scope for future work:

This system can be interfaced with vehicle airbag system that prevents vehicle occupants from striking interior objects such as the steering wheel or window. This can also be developed by interconnecting a camera to the controller module that takes the photograph of the accident spot that makes the tracking easier. The implementation of IoT hardware for detecting accident-prone areas and enhancing emergency ambulance services encompasses a range of innovative technologies and devices. IoT sensors, such as accelerometers, gyroscopes, and GPS modules, can be deployed in vehicles and along roadways to continuously monitor traffic conditions, speed, and vehicle behaviour. These sensors gather real-time data on factors like sudden braking, rapid acceleration, and collisions, which are critical indicators of accident-prone zones. Edge computing devices process this data locally to provide immediate insights and reduce latency, ensuring timely response. Smart traffic cameras equipped with AI capabilities can analyse live video feeds to detect traffic congestion, accidents, and hazardous conditions. These cameras can be strategically placed at intersections and high-risk areas to provide continuous monitoring. IoT gateways serve as central hubs, aggregating data from various sensors and devices, and transmitting it to cloud platforms for advanced analytics and predictive modelling. These cloud platforms leverage machine learning algorithms to identify patterns and predict potential accident hotspots. The integration of GIS mapping technologies enables precise visualization of these areas, facilitating better planning and resource allocation.

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