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Implementation Paper on Vehicle Accident Detection System

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Abstract - Road traffic accidents pose a serious threat to public safety and cause a large number of victims every year. Of course, in order to reduce these risks, the demand for traffic accidents must increase. This brief presents a new solution using technology to improve road safety. The collision detection system is designed to detect and alert police and emergency services in the event of a collision. The system uses a combination of sensors, cameras, and machine learning algorithms to accurately identify accidents, analyze their severity, and send important information to first responders; thus, reducing response time and potentially saving lives.

Key Words: public safety, emergency services, real-time, sensors

1.INTRODUCTION

In an era of rapid technological advancement and increased road safety, the evolution of car accidents has become a significant change. The system represents a solution designed to prevent, reduce and respond to one of the most important causes of traffic accidents and deaths. Car accident detection system is an intelligent system designed to monitor and detect accidents. Real car modification. Thanks to a combination of sensors, machine learning algorithms and cutting-edge technology, the system is able to identify collisions with exceptional accuracy and speed. This is a priority in traffic safety and provides potential benefits not only for drivers and passengers, but also for traffic in general and illnesses in emergency situations. This guide explores the importance of vehicle collision detection, including its components, how it works and its significant impact on road safety. This shows that we are constantly looking for new solutions to improve the health of people and society as a whole, aiming to reduce damage caused by accidents and create future safety and security for our roads.

2. Literature Review

In the paper [1], Rajvardhan Rish, Sofiya Yede, Keshav Kunal , Nutan V Bansode proposed a system that suggests that the m ain cause of accidental deaths is delay in medical assistance. T his situation can also be prevented by sending timely message s to authorities and emergency personnel. This system consists of GPS, GSM, accelerometer and Arduino. It usually detects changes in accelerometers and sends alerts to the nearest hospi tal, police station, family and friends when an emergency occu rs. The system uses the GPS module and Arduino to send the Google Maps link. When the vehicle detects the event, the veh icle sets the flag on the Arduino UNO until the difference is d etected with the help of the sensor. As long as there is no acci dent during the event, the device adjusts the sensitivity value a ccording to the measured value. When the sensor detects an ev ent or a bit is set, the Arduino activates the GSM module, whi ch manually records the victim's emergency contact signal and sends a pre-written message to the person.

In [2], Aarya DS, Athulya C.K, Anas.P, Basil Kuriakose, Jerin Susan Joy, Leena Thomas [2] proposed a system that suggest s traffic accidents as the cause of death. The time between the accident occurring and the delivery of emergency medical ser vices is an important factor in surviving the accident.

In the article [3] Kodali, R. and Sahu, S. [3] describes traffic a ccident detection and warning based on MQTT. The system is based on WiFi technology. The node MCU is used as the cont roller. However, unlike the other model 3, it uses a multimeter . The accelerometer constantly knows the X, Y and Z coordin ates of the vehicle, and the Node MCU uses the MQTT protoc ol to broadcast them to the LOSANT cloud platform. These re sults are transmitted to the LOSANT control panel and when a deviation from the predetermined values is detected, a system generated email is sent to the email address of the accident ve hicle. [4] describe a technique with lack of knowledge in remo te areas, which is reported to be a disadvantage of other syste ms. In the paper [4], they created a system that uses various se nsors such as temperature sensors, flame sensors, MEMS sens ors, and piezoelectric sensors. The use of these additional sens ors is an additional advantage of this model. When the MEMS sensor detects the situation, it alerts rescuers by sending a war ning message. The temperature sensor measures the vehicle's t emperature and sends an alert if the value exceeds the threshol d. A connected GPS modem transmits the vehicle's location.

There are many technologies today for shooting, {5}protectin g and tracking vehicles. In the past, crash data could be sent, b ut the location of the crash could not be determined. When cre

ating an airbag in a car, airbags are used to ensure safety and s afe travel [5]. The airbag system was introduced in 1968. TP MS is a system designed to control the pressure in a vehicle's pneumatic tires, allowing different operations such as requirin g low tire pressure for maximum traction, traversing difficult t errain and moving heavy objects, traction at slow speeds dow nhill, and entering soft surfaces. soil Maximum pressure is 15 to 45 PSI. Many other systems have also been proposed to fac ilitate combat. There are two sensors in the current system, the MEMS sensor being used to detect angles and the vibration s ensor being used to detect changes in the vehicle [5].

The Android app on your phone will send a message to the ne arest health center and your friend. The application also saves time by showing the exact location of the event [6]. The appli cation helps understand the situation on the road with the help of sensors mounted on the vehicle. This incident will be imme diately communicated to the relevant personnel so that faster a ction can be taken[6]. This document describes instant event d etection and alerting using smartphones. Every smartphone ha s many sensors embedded in its design. Our system uses some sensors found in all smartphones to create web applications f or remote monitoring. The system will enable faster response t imes to locate victims and support emergency services. When the system detects an accident, it sends an alert to the nearest f irst aid station, such as the police station, healthcare service an d ambulance drivers. It also provides update tracking for these emergency service providers[6]. The proposed system will de tect when an accident occurs and notify the nearest health cent er and record the location of the accident on the mobile phone using GSM and GPS modules. This area can be referred to by tracking systems to coincide with the geographical area of the region. Events can be detected thanks to vibration sensors, which are the main structure in the system [6].

Data transfer between the terminal and the monitoring center i s provided using the Global Mobile Communication System (GSM) network model and GSM base station, parking control. The Global Positioning System (GPS) uses satellites to determ ine the location of objects on the ground. GPS has satellites po sitioned several kilometers above the earth's surface. GPS sen ds messages containing the aircraft's trajectory, time, position, and accuracy [7]. GPS continuously collects latitude and long itude information from satellites and stores it in the microcont roller's buffer. Tracking is done by sending a message to the G SM device giving the location of the vehicle. The equipment u sed to send SIM messages is called the Global Standard for M obile Communications. The GSM module contains a global pa cket radio signal GPRS/GSM modem with a combination of p ower and communications ports. American Telephone (AT) c ommands are needed for GSM modules to work [7]. When the logic function of the sensor exceeds the upper limit, GSM is a ctivated and sends a message directly to the emergency contac t via the microcontroller. In addition, it is activated in case of a collision with the infrared detector, fire or theft with the ther mometer [7].

3. Methodology

The process used to create a traffic accident detection system consists of several important steps. First, general data collection is performed, which includes different types of car accidents and their associated characteristics such as location, severity, and environment. Then use this data to train machine learning algorithms, especially learning models such as convolutional neural networks (CNN) and support vector machines (SVM), to obtain sensing data from accelerometer readings, GPS coordinates, and video locations. Type event information. Following training, the system will undergo rigorous testing and validation to evaluate its performance in accurately identifying the situation while minimizing false alarms. Additionally, real deployment is simulated to ensure the robustness and reliability of the system under various conditions. Finally, suggestions that will increase the accuracy and performance of the system are evaluated and development and optimization are carried out.

3.1 Use Case Diagram

A use case diagram is a type of behavioral UML diagram that depicts the interactions between actors and the system being developed

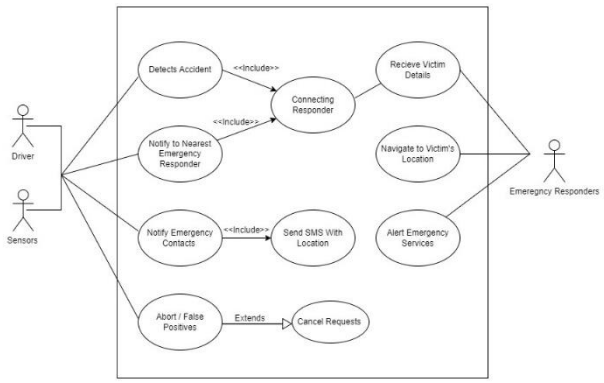

Fig -1: Use Case diagram of Vehicle Accident Detection System.

3.2. System Architecture

The Vehicle Accident Detection System's architecture comprises three main components: data acquisition modules to gather sensor data from vehicles, a central processing unit equipped with machine learning algorithms for real-time accident detection, and an alert mechanism to notify emergency services and relevant stakeholders upon detection of a potential

accident. These components operate in a distributed manner, ensuring efficient data processing and prompt response to critical events.

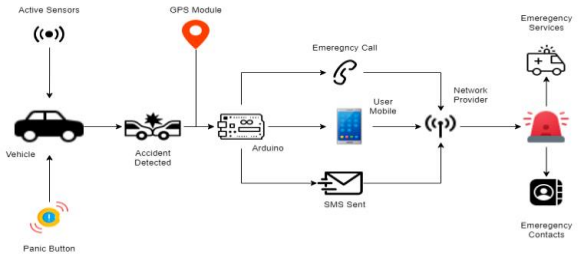

Fig -2: System Architecture of Vehicle Accident Detection System.

4. PROPOSED ARCHITECTURE

1. Component Initialization:
   a. Arduino Uno: The central microcontroller to which all sensors and modules are connected.
   b. MPU6050 (Gyro-sensor): Measures the orientation and detects if the tilt angle exceeds 60 degrees.
   c. YL99 Impact Switch: Detects sudden impacts indicating a potential accident.
   d. SIM800C (GSM Module): Used for sending SMS and making calls.
   e. NEO 6M (GPS Module): Fetches the geographical coordinates (latitude and longitude) of the device's location.
2. Sensor and Module Setup:
   a. Connect the MPU6050 to the Arduino to read gyroscope and accelerometer data.
   b. Connect the YL99 impact switch to detect impact events.
   c. Integrate the SIM800C GSM module to send SMS and make calls.
   d. Integrate the NEO 6M GPS module to retrieve location data.
3. Sensor Data Processing:
   a. Continuously read data from the MPU6050 to monitor the tilt angle.
   b. Monitor the YL99 impact switch for any sudden impacts.
4. Accident Detection Logic:
   a. If the YL99 impact switch is triggered or the MPU6050 detects an angle greater than 60 degrees, proceed to the next step.
   b. Implement debouncing for the impact switch to avoid false positives.
5. Location Retrieval:
   a. Upon accident detection, activate the NEO 6M GPS module.
   b. Fetch the current geographical coordinates (latitude and longitude) from the GPS module.
6. Communication Process:
   a. Use the SIM800C GSM module to send an SMS with the accident alert, including the GPS coordinates, to a predefined phone number.
   b. Wait for 10 seconds to ensure the SMS is sent successfully.
7. Emergency Call:
   a. After sending the SMS, use the GSM module to make a call to the predefined phone number.
   b. Provide a brief pause or tone in the call to indicate an emergency situation.
8. Reset and Monitoring:
   a. After the call is made, reset the system to continue monitoring for new incidents.
   b. Implement a delay or cooldown period to prevent repeated alerts from a single accident.

5. CONCLUSIONS

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