Review Paper on Vehicle Crash Detection

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Abstract: *Speed is one of the basic reasons for vehicle accident. Many lives could have been saved if Emergency services could get accident information and reach in time. This project deals with Accident detection system when the accident occurs it uses various components and alerts the Rescue team for help. An efficient automatic accident detection with an automatic notification To the emergency service with the accident location is a prime need to save the precious human Life. The proposed system deals with accident alerting and detection. It reads the exact latitude And longitude of the vehicle involved in the accident and sends this information to nearest Emergency service provider. The goal of the project is to detect accidents and alert the rescue Team in time.*

The project aims to design and implement a real-time system to detect vehicle crashes and promptly alert emergency services to reduce response times and improve post-crash outcomes.

Keywords: Emergency services

I. INTRODUCTION

The development of a transportation system has been the generative power for Human beings to have the highest civilization above creatures in the earth. Automobile Has a great importance in our daily life. We utilize it to go to our work place, keep in Touch with our friends and family, and deliver our goods. But it can also bring

Disaster to us and even can kill us through accidents.

Speed is one of the most Important and basic risk factors in driving. It not only affects the severity of a crash, But also increases risk of being involved in a crash.

Despite many efforts taken by different governmental and non-governmental Organizations all around the world by various programs to aware against careless Driving, yet accidents are taking place every now and then. However, many lives Could have been saved if the emergency

service could get the crash information in Time. A study by Virtanen et al. shows that 4.6% of the fatalities in accidents could Have been prevented only if the

emergency services could be provided at the place of Accident at the proper time. As such, efficient automatic accident detection with an Automatic notification to the emergency service with the accident location is a prime Need to save the precious human life.

Vehicle crashes are a leading cause of fatalities and

injuries worldwide, necessitating timely detection and response to mitigate their consequences.

A Vehicle Crash Detection System addresses this issue by utilizing advanced technologies to automatically

identify crashes and initiate immediate assistance.This system leverages sensors, GPS, and communication modules to monitor vehicle dynamics and detect

collision events. When a crash is identified, it

automatically alerts emergency services with critical details such as the location of the incident and the

severity of the impact. Modern systems may also use machine learning algorithms to distinguish between

genuine crashes and false positives, ensuring accuracy and reliability.

PROBLEM STATEMENT:

This system should minimize response time

reduce false positives, and improve overall road safety while leveraging modern technology for seamless integration into vehicles and smart infrastructure

II. LITERATURE SURVEY

Research and technical papers

Accident detection and reporting system using GPS,GPRS and GSM Technology (@2012IEEE) : This paper proposes to utilize the capability of a GPS receiver to monitor the Speed of a vehicle and detect an accident basing on the monitored speed and send the Location and time of the accident from GPS data processed by a micro-Controller by Using the GSM network to the Alert Service Centre.

At high speeds the distance between starting to brake and a complete stand still is Longer. The braking distance is proportional to the square of speed. Therefore, the Possibility to avoid a collision becomes smaller.

There is a tabular column for predicting the maximum speed after considering the Deceleration factors. As such, if the speed is less than these maximum speeds, than It would be assumed that some other deceleration force worked on the vehicle to Reduce the speed and an accident has occurred.

Speedometer can also be used to find the speed drops in vehicles, but an analogue to Digital converter is required to acquire speed from it. So, a GPS is used to track the Speed of vehicle every instance.

The vehicle speed is calculated at every instance by GPS. If there is decrease in new Speed values then it raises an ALARM for accident detection. Then 5 secs will be Given to abort the emergency Else the emergency is sent to Alert Service Centre and Plot the location of accident by the GSM number received. There after rescuing the Individual.

eal time detection and reporting of vehicle collision (@2017IEEE):

This paper proposes to utilize the capability of Accelerometer and Gyroscope to Obtain the data and detect an accident basing on the orientation angle and orientation. Then send the location of the accident from GPS data processed by a micro-Controller by using the GSM network to the nearest hospital provided over the Network and alerts their family members too.

The accelerometer detects the direction of vehicle collision by bi-directional axis and An axis towards gravitational force with full scale +/-8g. The collision of a vehicle Leads to a drastic change in vehicle speed and shows a direct impact on acceleration Force along that axis of crash. As the Z-axis is oriented along the gravitational force Direction, only X-axis and Y-axis of accelerometer is required to determine the Happening and direction of vehicle collision.

The gyroscope is used to calculate the tilt of collision vehicle and is given a full range Of +/- 500 degree/sec. Angle greater above 46 degree and below -46-degree results in Rollover of car. Other than the threshold f roll and pitch values, the weight and Centre of gravity of vehicle plays an important role in rollover. Once the threshold is Reached, the notification system will be activated informing the family and nearby Hospital about the occurrence of vehicle rollover.

In addition, they use GPS tracker too for recording false assumptions from the GPS Data acquired.

The notification system notifies the information to family emergency contacts and Nearest hospital. Notification system is activated once the threshold for detection is Reached. Location is identified by GPS.

Vehicle accident detection system by using GSM, GPS and Sensors (@2019, IRJET):

This paper proposes to utilize the capability of a Piezoelectric sensor to detect an Accident basing on the voltage produced by collision and send the location and time of The accident from GPS data processed by a micro-Controller by using the GSM Network to the Alert Service Centre.

The Piezoelectric sensor produces a DC voltage proportional to impacts on collision On vehicle. When the voltage increases above threshold value the sensors get Triggered.

The Latitude and Longitude are detected using GPS and it is sent as message to Rescue team through GSM module. The message is received by another GSM module. Google Map Module: It displays Google map shows you exact location of accident And its details. It gets detail SMS from accident location. Hence there is small Variation in co-ordinates .An OFF switch is also provided at times of need to avoid False message.
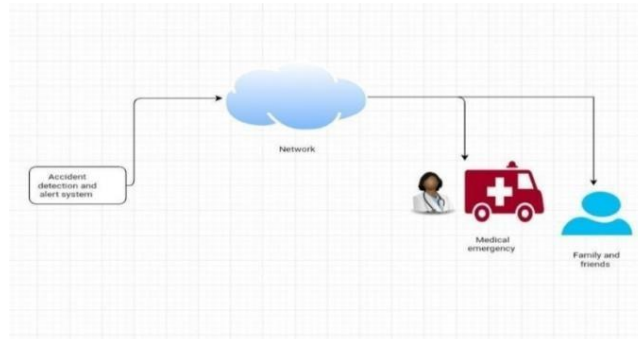
III. SYSTEM ARCHITECTURE

Fig -1: System Architecture Diagram

Arduino Nano is used as controlling unit, communicating between modules for Better information transformation at time. Accelerometer can be used for detecting the Collision direction from tri-lateral axis movements. Gyroscope can be used for Rollover collisions after a threshold of roll and pitch values, the weight and centre of Gravity of vehicle plays an important role in rollover. The device also confirms from Vibration sensors which detects the collision after a threshold voltage increase. Then a Buzzer is provided to abort the false detection of accident to the passenger. Within of Limited time of buzzer signal the GPS module collects the coordinates from Google Module

These co-ordinates nearby hospitals are alerted for emergency rescue call to Passenger. The hospital approves the accident by verifying the accident specified Location and confirms the accident. The saved personal members of family are Informed regarding the accident through GSM module.

Research methodology :

Problem Analysis

Literature Review: Study existing systems, technologies, and research on vehicle crash detection.

Problem Identification: Identify gaps in current methods, such as delayed response times or false alarms.

Objective Definition: Define clear goals for the system to address the identified gaps.

System Design and Planning

Requirement Analysis: Determine the hardware and software components needed, such as sensors, GPS modules, and communication tools.

Technology Selection: Choose suitable technologies,

including microcontrollers, IoT platforms, and machine learning algorithms.

Architecture Design: Develop a system architecture outlining data flow, crash detection mechanisms, and communication protocols.

Data Collection and Sensor Integration

Hardware Setup: Integrate accelerometers, gyroscopes, GPS, and GSM modules for crash detection and location tracking.

Data Acquisition: Collect real-world data from vehicle dynamics under different conditions (e.g., collisions, bumps, normal driving).

Preprocessing: Filter and preprocess the raw sensor data to remove noise and prepare it for analysis.

Algorithm Development

Crash Detection Algorithm: Develop and test algorithms to analyze sensor data and detect crashes based on thresholds or patterns.

Machine Learning Integration (Optional): Train models to differentiate between genuine crashes and false positives using labeled datasets.

System Implementation

Prototype Development: Build a working prototype integrating all hardware and software components.

Software Programming: Code the system logic for data collection, crash detection, and alert mechanisms.

User Interface: Design a mobile app or dashboard for users to view crash alerts and status updates.

Testing and Validation

Simulated Testing: Test the system under simulated crash scenarios to evaluate its accuracy and reliability.

Real-World Testing: Deploy the system in vehicles to assess performance in real-world conditions.

Performance Metrics: Measure detection accuracy, false positive rates, response time, and system robustness.

Optimization and Deployment

System Optimization: Fine-tune algorithms, sensor sensitivity, and communication protocols for better performance.

Deployment: Install the system in vehicles and integrate it with emergency services or fleet management systems.

Documentation and Reporting

Document the research process, design decisions, and findings.

Provide recommendations for future improvements and scalability.

This methodology ensures a structured approach to developing a robust and reliable Vehicle Crash Detection System.

IV. RESULT

Accurate Crash Detection:

The system successfully detects vehicle crashes with high precision by analyzing sensor data (accelerometers, gyroscopes).

Threshold-based and machine learning algorithms effectively distinguish between genuine crashes and false alarms.

Timely Alerts:

Automated alerts are sent to emergency services and predefined contacts immediately after a crash is detected. The GPS integration ensures the exact location of the crash is shared for faster response times.

Reliable Communication:

The GSM or IoT-based communication module ensures seamless transmission of data, even in remote areas.

User Interface Functionality:

The mobile application or dashboard displays real-time crash data and allows manual alert cancellation in case of false positives.

Improved Emergency Response:

Reduced average response time by promptly notifying authorities, leading to potentially life-saving interventions

V. FUTURE SCOPE

- Integration with autonomous vehicles
- Advanced data analysis
- IOT smart city integration
- Global positioning and nevigation enhancement

REFERENCES

[1]. T Kalyani, S Monika, B Naresh, Mahendra Vucha, Accident Detection and Alert System, IJITEE, March 2019(Base paper).

[2]. Parag Parmar, Ashok M.Sapkal, Real time detection and reporting of vehicle Collision, IEEE,2017.

[3]. Md. Syedul Amin, Jubayer Jalil, M.B.I.Reaz, Accident Detection and Reporting System using GPS,GPRS and GSM Technology, IEEE,2012.

[4]. Gowshika B, MadhuMitha, G,Jayashree,Vehicle accident detection system using GPS, GSM modem, IRJET,2019.

[5]. Notification,IEEE,2016. Sayanee Nanda, Harshada Joshi, Smitha Khairnar, An IOT Based Smart System for Accident Prevention and Detection,IEEE,2018.

[6]. Norsuzila Yaacob, Ainnur Eiza Azhar, Azita Laily Yusofl, Suzi Seroja Sarnin, Darmawaty Mohd Ali and Ammar Anuar, Real Time Wireless Accident Tracker Using Mobile Phone,IEEE,2017.

[7]. S.Sonika, Dr.K.Sathyasekhar, S.Jaishree, Intelligent accident identification system Using GPS, GSM modem,DARCCE,2014.

[8]. Dhruvesh H.Patel, Parth Sadatiya, Dhruvbhai K. Patel, Prasann Barot, IoT based Obligatory usage of Safety Equipment for Alcohol and Accident Detection,IEEE,2019.

[9]. Ajith Kumar.A, Jaganivasan.V, Sathish.T, Mohanram.S,Accident detection and Alert system using GPS&GSM,IJOPAAM,2018.

[10]. Shadman Sakib, Mohammad Sayem Bin Abdullah,GPS-GSM based Inland Vessel Tracking System for Automatic Emergency Detection and Position Notification,IEEE, 2016