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Jivan Savior-Car Crash Detection System

Priyanka Akash Avhad,
Lecturer,*Department of* Computer Technology
K K Wagh Polytechnic Nashik
India
paavhad@kkwagh.edu.in

Pankaj Sopan Gavhare ,
Student, *Department of* Computer Technology
K K Wagh Polytechnic Nashik
India
pankajgavhare04@gmail.com

Kartiki Ganesh Hasnale,
Student, *Department of* Computer Technology
K K Wagh Polytechnic Nashik
India
kartikihasnale@gmail.com

Mayuresh Ravindra Kulkarni ,
Student, *Department of* Computer Technology
K K Wagh Polytechnic Nashik
India
kulkarnilab72@gmail.com

Nikhil Sanjay Padvi,
Student, Department of Computer Technology
K K Wagh Polytechnic Nashik
India
padvinikhil08@gmail.com

***Abstract*—The Jivan Savior - Crash Detection System for Car is a mobile application designed to enhance road safety by detecting vehicle crashes in real-time and providing immediate emergency assistance. The system utilizes built-in vehicle and smartphone sensors, including accelerometers, gyroscopes, and GPS, to monitor sudden changes in motion, speed, and direction, which may indicate an accident. Upon detecting a crash, the system automatically sends emergency alerts to designated contacts and emergency services, including critical details such as the accident's location and severity. Existing crash detection solutions, such as in-built vehicle telematics systems and smartphone-based applications, often suffer from limitations, including high costs, hardware dependencies, and detection inaccuracies. The Jivan Savior system addresses these challenges by integrating advanced machine learning algorithms for improved accuracy, offering a cost-effective and userfriendly solution that works across various car models and mobile devices.**

Key features of the system include real-time crash detection, automated emergency notifications, post-crash data logging, battery optimization, and offline functionality for areas with poor network coverage This project aims to significantly reduce emergency response times, potentially saving lives and minimizing accident-related injuries.

Keywords- *Crash Detection, Emergency Alerts, Sensor Integration, Real-Time Monitoring, Vehicle Safety*

I. INTRODUCTION

Accidents are an unfortunate and unavoidable part of driving, leading to severe consequences such as injuries, fatalities, and long-lasting trauma. Road safety has become a major concern globally, and efforts are continuously being made to reduce the frequency of accidents and their impact on human life. In this context, modern technology plays a crucial role in making vehicles safer and reducing emergency response times. One such technological advancement is the **Crash Detection System**.

The **Jivan Savior - Crash Detection System for Car** is a mobile application designed to detect car accidents in real-time using the sensors installed in vehicles. It utilizes the vehicle's existing sensors such as the accelerometer, gyroscope, and GPS to track sudden changes in motion, direction, and speed, which may indicate an accident. Once an accident is detected, the system sends an emergency alert to designated contacts and emergency services with critical information, such as the car's location and severity of the crash. The proposed system aims to improve the response time of emergency services, potentially saving lives and minimizing damage during accidents.

II. RELATED WORK

In recent years, various studies and technologies have been developed in the field of crash detection systems. Some of the significant advancements and trends in this domain include:

1. **Smartphone-based Crash Detection:** Several studies and apps have shown the effectiveness of smartphones for crash detection using built-in sensors like accelerometers, gyroscopes, and GPS. One example is the study by K. H. Lee et al., which used machine learning algorithms to detect collisions based on smartphone sensor data. The study found that using accelerometer data was highly effective in detecting

high-impact accidents, especially in scenarios such as head-on collisions or rollovers.

2. **Telematics-Based Crash Detection Systems:** Many advanced vehicles are now equipped with telematics systems that monitor vehicle health, driving behavior, and crash detection. These systems gather data such as speed, acceleration, and braking patterns to detect crashes. A prominent example is General Motors' OnStar system, which can automatically notify emergency responders in case of an accident. However, such systems are typically only available in newer or high-end vehicles and require expensive hardware to function.

3. **Vehicle-to-Vehicle (V2V) and Vehicle-to-Infrastructure (V2I) Communication:** These systems allow vehicles to communicate with each other and with infrastructure such as traffic signals. The goal is to prevent accidents by providing real-time data on the location, speed, and status of nearby vehicles. Research on V2V and V2I communication systems indicates that they can significantly reduce accidents and improve the overall traffic safety, but they still require further advancements to become mainstream.

4. **Machine Learning for Crash Detection:** Machine learning algorithms have been employed to improve the accuracy of crash detection. By analyzing historical accident data and real-time sensor data from cars, these algorithms can predict the likelihood of an accident based on driving behavior. A recent study by S. L. Nguyen and colleagues explored the use of deep learning algorithms to classify driving patterns and predict potential crashes before they occur.

III. IMPLEMENTATION

Crash Detection System involves integrating vehicle sensors and a mobile application to detect accidents and send real-time emergency alerts. The system continuously monitors sensor data from accelerometers, gyroscopes, and GPS to detect sudden changes in motion, direction, and speed that indicate a crash. When an accident is detected, the mobile application processes the data and sends an emergency notification to predefined contacts and emergency services, including the location and severity of the crash. The system is designed with features such as real-time monitoring, automatic alerts, data logging for post-crash analysis, and offline functionality to ensure alerts are sent even in low-connectivity areas. The implementation also includes integrating cloud storage for crash data, optimizing battery usage, and ensuring security measures for data privacy. The mobile application, developed for Android and iOS, provides a user-friendly interface for setting emergency contacts, configuring notifications, and reviewing accident history. The system is tested for accuracy, reliability, and performance to minimize false positives and ensure timely responses.

System Architecture

The system uses a combination of hardware (car sensors, smartphone sensors) and software (mobile application) to function efficiently. The overall architecture involves:

1. **Sensor Integration:** The car's sensors, including accelerometer, gyroscope, and GPS, continuously monitor the vehicle's movement. The smartphone sensors (accelerometer, GPS) also work in tandem with the car sensors to detect an accident.

2. **Data Processing:** The sensors send data to the mobile app in real-time. The app uses algorithms to detect significant deviations in motion patterns, such as sudden deceleration, rapid acceleration, or unusual movement, which may indicate a crash.

3. **Notification System:** Upon crash detection, the system triggers alerts and notifications to emergency contacts and services. The app can send SMS, push notifications, or even make voice calls depending on the available network.

Data Logging and Review: The system logs all relevant data related to the crash for future analysis, insurance claims, or legal purposes. Users can access this information via the app.

Technology Stack:

Component: Technology Used
Integrated Development Environments (IDEs): Android Studio (for Android app development)
Frontend:(React/Angular),.net
Backend (Server & APIs): Net or Python or Node.js
Database: MySql / MySQL / MongoDB (Secure storage for iris data)
Security: AES Encryption, SSL/TLS for secure data transfer.

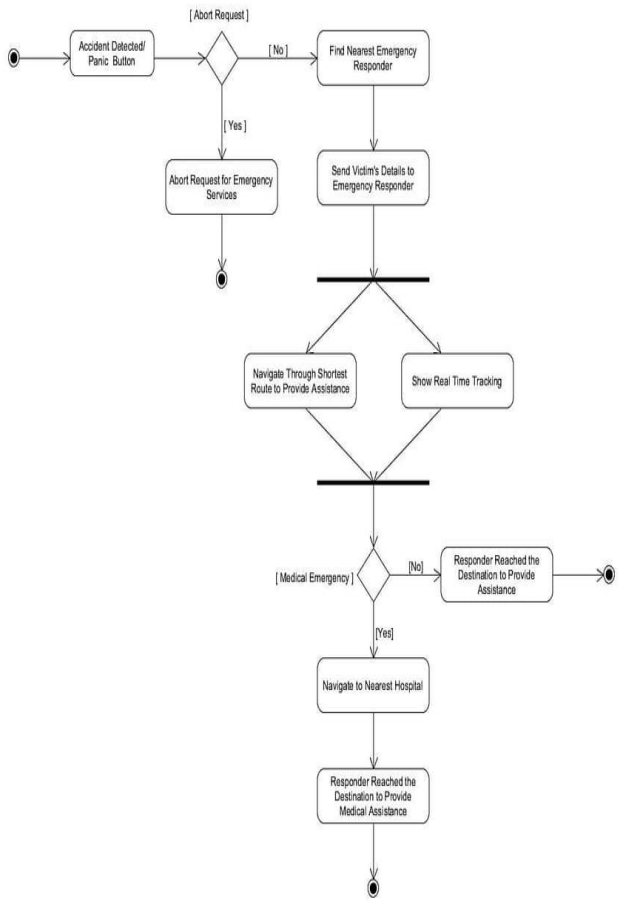

Fig. 1.System Architecture for Jivan Savior-Car Crash Detection System

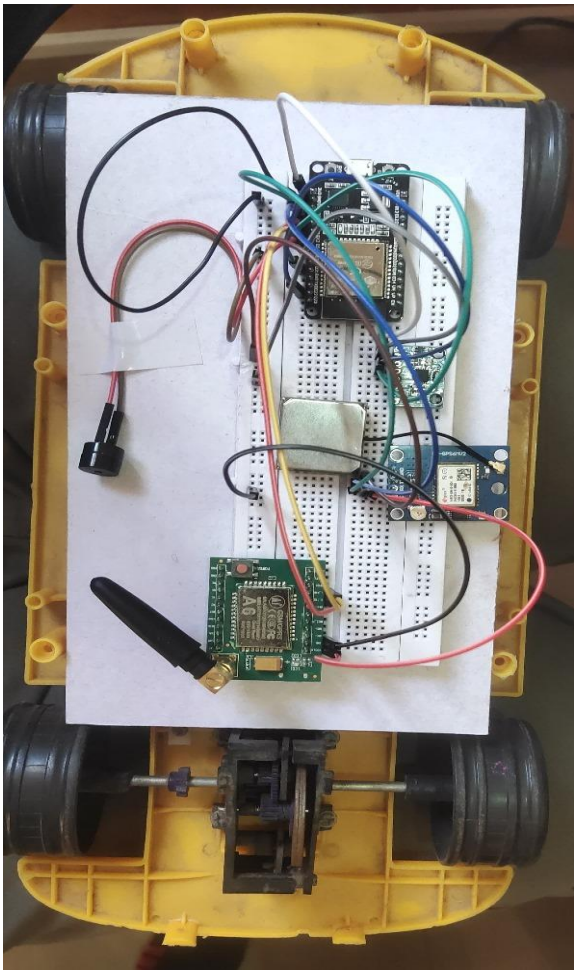

Fig. 2.Car with Sensors

IV. COMPONENTS

System Components:

Crash Detection System consists of several key components that work together to detect accidents and provide emergency responses.

Hardware Components

Component & Description

A6 GSM Module: Used to send and receive messages and calls.

NEO-6M GPS Module: Provides location data (latitude and longitude).

ESP32: A microcontroller that can connect to the internet.

Buzzer: Produces sound when activated (for alerts or notifications).

V. CONCLUSION

The **Jivan Savior-Crash Detection System for Car** is an innovative approach to enhancing road safety and reducing fatalities caused by car accidents. By leveraging mobile technology, sensors, and real-time crash detection algorithms, this system aims to detect accidents as soon as they occur and immediately notify emergency services, thereby ensuring timely help and reducing the impact of accidents.

This project not only highlights the importance of timely emergency response in minimizing crash-related injuries but also demonstrates how mobile technology and sensor integration can significantly enhance vehicle safety. The combination of real-time monitoring, automated emergency alerts, and seamless integration with existing mobile platforms makes the system user-friendly and highly effective in its function.

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