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RAKSHA : A Smart Human Rescue Android System for Real-Time Accident Reporting and Emergency Response

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Abstract: *This presents an Android-based smartphone application designed to automatically detect vehicular accidents and initiate emergency response actions. Upon detecting a crash, the system instantly retrieves the user's GPS location and activates an alarm interface. With a single tap, users can request emergency assistance, after which the application automatically calls the local emergency number and sends SMS alerts to predefined contacts. These alerts include crucial details such as location coordinates, number of passengers, and crash characteristics. The primary challenges in developing this system include achieving high crash detection accuracy under varying conditions while minimizing false positives, integrating with onboard vehicle systems for enhanced data collection, ensuring data privacy and cybersecurity, and maintaining minimal battery consumption. If these challenges are effectively addressed, the proposed automated crash detection and emergency alert system can significantly reduce emergency response time, enhance road safety, and serve as a low-cost, scalable solution capable of saving lives worldwide.*

Keywords*:* Android application, accident detection, emergency alert system, GPS tracking, crash detection, road safety, real-time monitoring

I. INTRODUCTION

Road accidents remain a leading cause of injury and death worldwide, highlighting the urgent need for efficient and automated emergency response systems. Traditional methods of accident reporting often rely on bystanders or delayed manual communication, which can significantly slow down the rescue process and reduce the chances of saving lives. To address these limitations, the proposed system introduces an intelligent Android-based accident detection and alert mechanism that leverages smartphone sensors, GPS technology, and real-time data transmission to enhance road safety and emergency management [1]. The system classifies detected incidents into two categories—Normal (requiring police or hospital notification) and Emergency (requiring immediate ambulance dispatch)—thereby optimizing resource utilization and improving response coordination. Upon detecting an accident, the application automatically captures the GPS location and relevant data,including optional photo uploads, and transmits them to a centralized server [2]. Through seamless API integration, the system ensures that alerts reach the appropriate authorities and emergency services quickly and reliably. Empirical results demonstrate the system's effectiveness in minimizing false positives and ensuring timely notifications. The inclusion of GPS-based situational awareness and image evidence helps responders assess the severity of accidents before arriving at the scene. Overall, this automated accident detection and alert system represents a scalable,low-cost, and practical solution to improving emergency response efficiency and reducing fatalities caused by delayed communication [3]. The system classifies accidents as Normal (police/hospital notification) or Emergency(ambulance dispatch), optimizing resource use and response. With automated location detection, photo uploads, and API integration, it ensures fast, reliable alerts. Empirical results show reduced false positives, with immediate central server notification and situational awareness via GPS and photos.

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II. BACKGROUND

Road accidents remain a major global safety concern, prompting extensive research into automated accident detection and emergency response systems. Several studies have focused on leveraging smartphones and embedded vehicle sensors to reduce emergency response time and improve post-crash survival rates.

Early accident detection systems primarily relied on vehicle-mounted hardware, such as airbag sensors and accelerometers, to identify collisions and trigger emergency alerts. Systems like eCall in Europe automatically contact emergency services when a severe crash occurs. While effective, such solutions require specialized vehicle integration and are limited to newer vehicle models, making them expensive and less accessible in developing regions.

With the widespread adoption of smartphones, researchers have explored mobile-based accident detection systems using built-in sensors such as accelerometers, gyroscopes, and GPS modules. Several Android-based applications utilize sudden changes in acceleration and orientation to detect potential crashes. Upon detection, these systems retrieve real-time GPS coordinates and transmit alerts to emergency services or predefined contacts via SMS or internet-based messaging. However, many of these systems suffer from high false-positive rates, especially during abrupt braking, pothole encounters, or phone drops.

To improve detection accuracy, some studies have incorporated machine learning techniques, including decision trees, support vector machines, and neural networks, trained on sensor data collected from real-world driving scenarios. These approaches have demonstrated improved crash classification performance but often introduce increased computational complexity and battery consumption, which limits continuous real-time monitoring on smartphones.

Other research efforts have emphasized emergency communication mechanisms, integrating automatic phone calls, SMS alerts, and cloud-based notification services. These systems often include location sharing and timestamped event logs but lack user interaction features such as manual emergency confirmation or passenger count reporting, which are critical in real-life emergency situations.

Privacy and security have also been highlighted as significant challenges in accident detection applications. Studies have discussed the risks associated with continuous location tracking and unauthorized access to sensitive user data. Proposed solutions include local data processing, encrypted communication, and permission-based access control, although practical implementation remains inconsistent across applications.

In contrast to existing approaches, the proposed Android-based automated crash detection system aims to combine real-time sensor-based detection, accurate GPS location retrieval, user-triggered emergency confirmation, and automated communication with emergency services into a single low-cost and scalable solution. By addressing key challenges such as detection accuracy, false alarm reduction, energy efficiency, and data security, the system seeks to enhance road safety and improve emergency response outcomes, particularly in regions with limited access to advanced vehicular safety infrastructure.

Smart Accident Detection and Early Warning System for Emergency Response and Risk Management:

This system integrates sensors and communication technologies to automatically detect vehicle accidents and issue early warnings to emergency responders. It minimizes response time by transmitting accident data such as location, impact severity, and vehicle condition to rescue teams for quick intervention.

Vehicle Target Detection in Foggy Environments (Improved YOLOX):

This research focuses on enhancing object detection in poor visibility conditions using an improved YOLOX deep learning model. The system is designed to accurately identify vehicles in foggy or low-contrast environments, improving road safety and reducing collision risks through better computer vision techniques.

Android Application for Road Accident Detection and Notification:

An Android-based mobile application that detects accidents using smartphone sensors such as accelerometer and GPS. When an accident is detected, it automatically sends location details and alert messages to emergency contacts and nearby hospitals.

A Comprehensive Study on IoT Based Accident Detection Systems for Smart Vehicles:

This study reviews various IoT-based approaches to accident detection, highlighting sensor integration, communication protocols, and cloud-based analytics for smart vehicles. It emphasizes how IoT technologies can enhance safety through real-time monitoring and automatic alert mechanisms.

III. OBJECTIVE OF SYSTEM

- To develop an **Android-based application** for automatic vehicular accident detection.
- To **detect crashes accurately** using smartphone sensors.
- To **retrieve the GPS location instantly** when an accident occurs.
- To provide a **one-tap emergency alert system** for quick help.
- To **automatically call emergency services** after accident detection.
- To **send SMS alerts to predefined contacts** with accident details

IV. PROPOSED SYSTEM

SYSTEM ARCHITECTURE

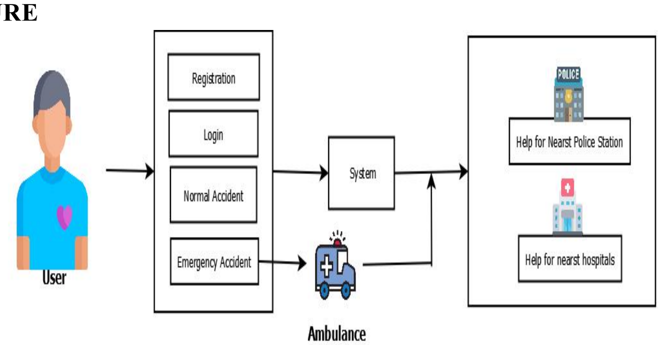

Fig 1. System Architecture

The user interacts with the Android application by registering and logging in. The app allows the user to report either a normal accident or an emergency accident. Accident details are sent to the system, which processes the information and automatically retrieves the user's location. In emergency situations, the system alerts ambulance services and provides assistance by identifying the nearest hospital and police station. This ensures quick emergency response and timely medical and legal support.

V. METHODOLOGY

- Users can register and log in securely.
- Users can choose symptoms (with language support).
- The system detects possible diseases based on the symptoms entered.
- Users can view the nearest hospitals on the map.
- Alarm scheduling is available for reminders (e.g., medicine).
- Users can view reports and history matching for previous detections.
- YouTube health-related links are suggested for educational awareness.

Where,

System S = {I, O, P, C}

Where,

I = Input

O = Output

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P = Processing
C = Constraints
Inputs (I)
I1 = User Registration Details
I2 = Login Credentials
I3 = Accident Detection Data (Sensor / User Selection)
I4 = GPS Location Data
I5 = Emergency Contact Details
Outputs (O)
O1 = Accident Detection Notification
O2 = Emergency Call Activation
O3 = SMS Alert to Emergency Contacts
O4 = Nearest Police Station Information
O5 = Nearest Hospital Information
O6 = Ambulance Alert
System Modules
S = {S1, S2, S3, S4, S5, S6, S7}
Where,
S1 = Registration Module
S2 = Login Module
S3 = Accident Detection Module
S4 = Location Tracking Module
S5 = Emergency Alert Module
S6 = Hospital and Police Locator Module
S7 = Ambulance Notification Module
Module Description
S1 = Registration Module
I = User Details (Name, Email, Password, Contact Number)
O = User Account Created
P1
User enters registration information.
System validates the entered details.
User data is stored in the database.
S2 = Login Module
I = Username, Password
O = User Dashboard Access
P2
System verifies login credentials from the database.
If credentials are valid, user login is successful.
S3 = Accident Detection Module
I = Sensor Data / User Accident Selection
O = Accident Detection Alert
P3
System monitors accelerometer and motion sensor data.
Sudden impact or abnormal motion is detected.
Accident event is identified and alert process starts.

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S4 = Location Tracking Module
I = GPS Data
O = Accident Location Coordinates
P4
System activates GPS service.
Current location coordinates (latitude and longitude) are retrieved.
Location data is prepared for emergency services.
S5 = Emergency Alert Module
I = Accident Information, Location Data
O = SMS Alert and Emergency Call
P5
System sends SMS alerts to predefined contacts.
Accident location and details are included in the message.
Emergency call option is activated.
S6 = Hospital and Police Locator Module
I = Accident Location Coordinates
O = List of Nearest Hospitals and Police Stations
P6
System searches nearby hospitals and police stations using location data.
Nearest emergency services are displayed to the user.
S7 = Ambulance Notification Module
I = Emergency Accident Alert

VI. CONCLUSION

Timely accident detection and rapid response are vital to saving lives. Smartphones systems are effective due to affordability and sensors, while advanced methods like ML and VANET improve accuracy. However, challenges remain—false positives, poor integration with emergency services, limited large-scale use, and weak smart city adoption. Future research should aim for reliable, real-time systems that integrate detection, prevention, and emergency coordination to strengthen public safety.

VII. ACKNOWLEDGMENT

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