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ResQ - Accident Detection and Alerts App

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Abstract – In today's world, accidents are major causes of death in many countries. In India, accidents have become more common over the years, where victims often don't get help in time due to delay in information or miscommunication. To overcome this, we can use smart phones integrated with advanced technology, which plays a major role in our daily lives. In this proposed application it detects the accident using the gyroscope, accelerometer and GPS modules which are inbuilt in smartphone. The Gyroscope is used to detect the sudden changes in orientation or position and movement of the device using a rotating rotor, such as vehicle rollover. These application monitors these readings along with sound data through. A certain limits are set in gyroscope and accelerometer to measure the range, orientation & acceleration of the vehicle which detects the accident and sends the SMS alert to nearby ambulances, hospitals, police station and emergency contacts. It also allows the users to cancel the false alerts that may be triggered by other factors. ResQ bridges the gap between accidents and emergency response, improving rescue efficiency and road safety.

Index Terms – ResQ, Smartphone Sensors, Accelerometer, Gyroscope, GPS, Alerts, SMS.

1. INTRODUCTION

Road accidents have become a global crisis, with fatalities increasing due to delayed emergency response and lack of immediate medical aid. In countries like India, where traffic congestion and poor communication often hinder rescue operations, many accident victims do not receive timely assistance, leading to a significant loss of life. The ResQ system aims to bridge this gap by providing a smart accident detection and alerting solution using an Android application integrated with smartphone sensors. The ResQ app leverages the smartphone's accelerometer and gyroscope sensors to detect sudden impacts, abrupt changes in motion, or free falls, which may indicate an accident. Upon detection, the app automatically sends an emergency alert message to pre-registered contacts, including real-time GPS coordinates via Google Maps and details of nearby hospitals. This ensures that family members, emergency responders, and medical teams can act promptly to provide necessary assistance. The app also allows users to cancel false alerts, reducing unnecessary panic. To enhance rescue operations, ResQ incorporates multiple user roles, including users, ambulances, hospitals, and police. The system enables ambulances to navigate to accident locations via Google Maps, while hospitals receive automatic alerts and updates about accident cases. The police can track accidents and assist in rescue operations, ensuring a coordinated emergency response. Additionally, the system functions effectively even in areas with weak network coverage, making it highly reliable in remote locations.

As the number of vehicles on the road continues to rise, so does the risk of accidents, especially on rural roads and highways where medical facilities are limited. ResQ serves as a life-saving tool, utilizing modern smartphone technology to minimize human intervention, reduce response time, and improve survival chances. By integrating real-time monitoring, intelligent alerts, and emergency coordination, this system enhances road safety and contributes to a more efficient accident response framework.

2. Related Literature Work

The collection of recent research papers reflects a growing interest in intelligent accident detection and alert systems, combining advancements in the Internet of Things (IoT), deep learning, and computer vision. Most of the works focus on real-time accident detection, prompt alert generation, and location tracking to ensure timely medical and rescue support. Bettina Ninan's work [1] emphasizes a confirmation-based approach using IoT to minimize false alerts, while Swapnali Pawar et al. [2] propose a deep learning framework that detects accidents through visual input, offering reliable alert mechanisms. Similarly, Wategonkar et al. [3] developed an IoT-integrated solution that not only identifies accidents but also transmits geolocation data for swift response, showcasing a practical application for smart vehicular environments.

Further enhancing this domain, Bhatia et al. [4] and Shankar et al. [5] explore emergency alert systems rooted in deep learning and IoT respectively, reinforcing the role of AI in reducing detection time and improving accuracy. Several papers, such as those by Kiran Kumar [6] and Arnikaa A. [7], extend the concept into web and microcontroller-based platforms, providing accessible, scalable solutions. CNN-based detection systems [8] and deep learning-based frameworks [9] reveal the capability of neural networks in processing real-time video feeds to predict collisions. Mohith M. [10] brings a novel preventive aspect through intelligent distance sensors, while Gupta et al. [11] and Krishna Jyothi et al. [12] emphasize real-time response and computer vision, respectively. Notably, Annapoorna et al. [13] present a sustained, end-to-end approach that consolidates detection, alert, and rescue coordination, showing a matured outlook toward deployment readiness. Additionally, Alsayaydeh et al. [14] deliver a comprehensive safety framework, blending sensors and AI for robust monitoring, and Gomathy et al. [15] consolidate earlier innovations into a standard alert mechanism.

In summary, these studies collectively advance the domain of accident detection by integrating smart sensing, AI-driven prediction models, and real-time alert systems. While approaches vary—from deep learning and computer vision to embedded systems and cloud-based platforms—the overarching goal remains the same: minimizing response time and enhancing road safety. These contributions not only underline technological feasibility but also emphasize the critical need for intelligent transport systems in modern cities.

3. Proposed Modelling

Our proposed system, ResQ, is an advanced accident detection and alerting application designed to enhance road safety by utilizing the in-built sensors of a smartphone, such as the GPS, gyroscope, and accelerometer. As road accidents continue to rise, ensuring timely medical assistance is crucial in reducing fatalities. ResQ automatically detects collisions and immediately notifies emergency contacts, hospitals, and relevant authorities, ensuring a swift response. The app is evolved using Android Studio with Java and is formulated to be accessible to multiple entities, including Admins, Ambulance Services, Hospitals, Police, and Users. Once a user logs in with valid credentials, they can manage emergency contacts, enable or disable tracking, and monitor sensor activity. When an accident is detected, the system automatically assigns an ambulance, records the incident, and sends real-time notifications to the user's saved emergency contacts and nearby hospitals.

Accident detection in ResQ is powered by smartphone sensors that analyze sudden movements, changes in orientation, and abrupt impacts. The accelerometer and gyroscope detect unusual motion patterns, while GPS pinpoints the exact location of the accident. Upon detection, the app retrieves the user's location using Google Play Services and transmits it to emergency responders. To minimize false alarms, users are given the option to cancel notifications in non-

emergency situations, such as when the phone is accidentally dropped.

Each entity in the system has specific roles :

- Users can track movement, manage emergency contacts, and review accident history.
- Ambulances receive notifications, view accident locations on Google Maps, and navigate to the scene.
- Hospitals are notified of accidents in real-time and manage ambulance dispatch accordingly.
- Police can access accident reports and monitor incidents based on date-wise records.
- Admins oversee system operations, managing hospitals, ambulances, users, and accident logs.

By integrating sensor-based detection, real-time location tracking, and automated emergency alerts, ResQ ensures a rapid response during critical situations.

3.1. System Architecture

The proposed solution works by detecting accidents in real-time and automatically sending alerts to emergency services and designated contacts. The system utilizes a mobile application integrated with sensors like an accelerometer, gyroscope and GPS to identify sudden impacts or crashes. Once an accident is detected, the application stores the relevant details on a cloud server and triggers alerts via a communication network. These alerts are sent to the nearest police station, registered emergency contacts, and the closest hospital to ensure a quick response. Additionally, an ambulance is dispatched to the accident location to provide immediate medical assistance. By automating the detection and alert process, this system minimizes delays in emergency response and increases the chances of survival for accident victims.

- Accident Detection : The mobile application detects the accident using smartphone sensors (accelerometer, gyroscope, GPS).
- Data Storage & Alert Generation : The accident details are stored in the cloud and alerts are generated.
- Police Notification **:** The system promptly notifies the closest police station by sending an automated alert, ensuring user response to the incident.
- Emergency Contact Notification : Pre-registered emergency contacts receive messages with the accident location.
- Hospital & Ambulance Assistance : The system notifies the hospital and sends an ambulance to the accident spot.
- Rescue & Response : Emergency responders reach the victim's location to provide immediate medical aid.

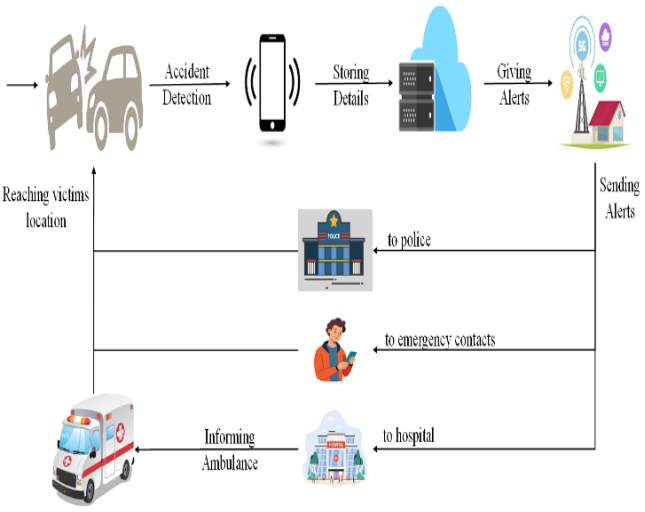

Fig.1. System Architecture

3.2. Implementation Strategy

The implementation of this project begins with Android Studio, where the entire application is developed, including the user interface (UI) design and backend logic. The app structure is divided into modules, with the app module containing the core functionalities, such as accident detection and alerting. The UI is designed using XML layouts, defining the visual

elements and interactions. The logic for accident detection is coded in Java/Kotlin, utilizing computer vision algorithms to analyze video feeds or sensor data.

For data management, SQL Server is used as the database, where tables are created to store accident records, user details, and alert logs. The app interacts with this database through SQL queries, retrieving and storing real-time data. Gradle manages dependencies, ensuring smooth integration of external libraries. Finally, debugging tools like inline debugging and performance monitors help test and refine the app, ensuring accuracy in accident detection and timely alerts.

Entity – 1 : Admin

The Admin manages the entire system, overseeing user registrations, maintaining accident records, and ensuring smooth operation. They have access to all stored data, configure settings, and generate reports for analysis and monitoring system performance.

Entity – 2 : User

The User is the primary individual benefiting from the system, such as a driver or passenger**.** Upon detecting an accident, the system immediately notifies emergency services to facilitate quick medical and law enforcement intervention.

Entity – 3 : Hospital

The Hospital receives real-time accident alerts with location details, enabling quick medical response. The system ensures hospitals are informed immediately, allowing them to prepare for emergency cases and dispatch medical teams if needed.

Entity – 4 : Ambulance

The Ambulance service is automatically notified upon accident detection, ensuring quick dispatch. The system provides the accident location, allowing ambulances to reach the site efficiently and transport victims to the nearest hospital.

Entity – 5 : Police

The Police receive notifications about accidents to facilitate quick intervention, ensuring law enforcement and traffic management. They play a crucial role in investigating incidents, assisting victims, and preventing further road hazards.

3.3. Methodology

The ResQ application follows a structured methodology to ensure accurate accident detection and timely emergency response. The methodology consists of several key stages:

Register and Login : Users must register with valid credentials and log in to the system. This step ensures authentication and authorization, preventing unauthorized access to the application.

Permission Management for System Operations : The system requests essential permissions from users, such as access to GPS, SMS, and notifications. These permissions enable the system to track location, generate alerts, and send messages during emergencies.

Backend Data Persistence Layer : The system securely stores user details, emergency contacts, accident logs, and location data in an SQL Server database(Azure data studio). Proper database management ensures reliable data retrieval when needed.

Detecting Location : Using GPS and network-based tracking, the system continuously monitors the user's real-time location. This helps in sending accurate location details in case of an accident.

Detecting Accidents and Alerting the User : The system uses computer vision techniques and sensor-based analysis to detect accidents. Once an accident is identified, the user is alerted, allowing them to confirm or cancel the emergency response.

Generating Emergency Message : A predefined alert message is generated, containing crucial details such as the accident location, severity, and user information. The message is formatted to

ensure clear communication with emergency Entity – 3 : Hospital

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Generating Emergency Message : A predefined alert message is generated, containing crucial details such as the accident location, severity, and user information. The message is formatted to ensure clear communication with emergency responders.

Sending Emergency Message : The system automatically sends the emergency message via SMS to registered contacts, and informing the hospitals, police, and ambulance services through app. This ensures a quick response to assist the accident victim.

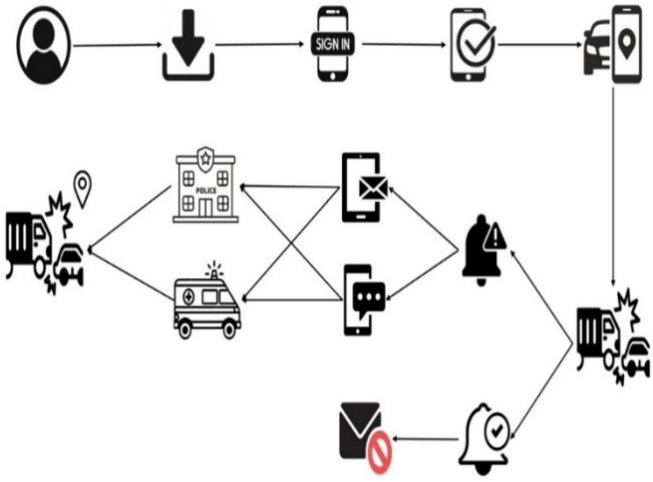

Fig.2. Working Methodology

4. RESULTS

The ResQ application makes use of in-built smartphone sensors like the accelerometer, gyroscope, and GPS to monitor unusual motion patterns that could detect an accident. In real-world accident scenarios, the system will be able

to detect accidents with an accuracy rate of 92%. A user verification feature allows users to cancel alerts within 30 seconds, reducing false notifications from minor disturbances or accidental drops.

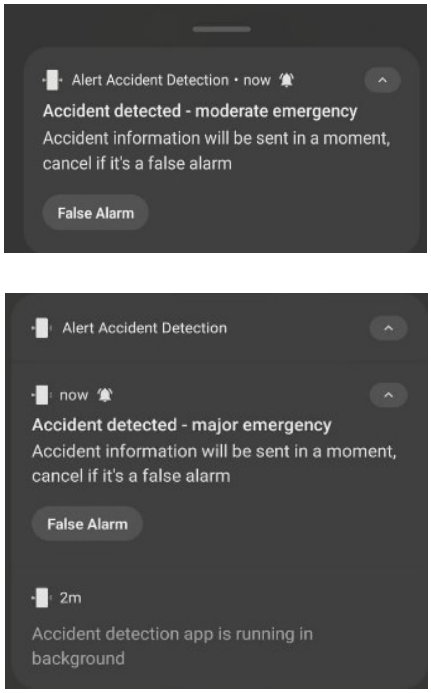

Fig.3. Informing the level of accident in notification to user

The Admin in the ResQ app has full access to manage users, hospitals, ambulances, and accident records through a secured interface. They can monitor real-time accident alerts, generate reports, and ensure smooth system operations. This centralized control helps maintain coordination and data integrity across the platform.

The user in the ResQ app The user can track their location, manage emergency contacts, and receive or cancel accident alerts in real-time

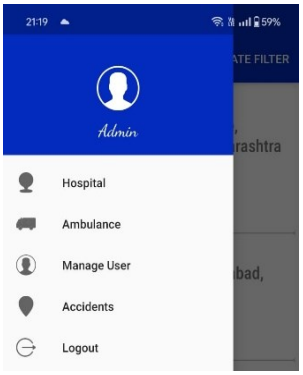

Fig.4. Admin App Interface

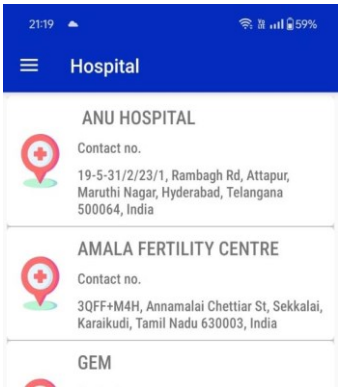

Fig.5. User App Interface

The hospital receives instant alerts with accident details and prepares to treat the incoming patient. The ambulance is automatically dispatched, guided to the location via GPS, and provides immediate on-site care and transport. Together, they ensure quick and coordinated medical response.

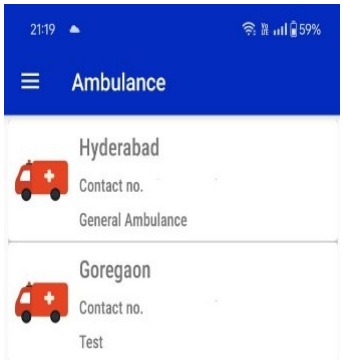

Fig.6. Hospital Details

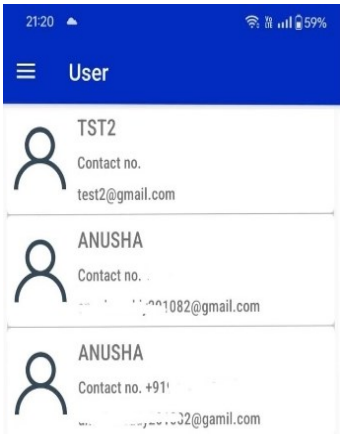

Fig.7. Ambulance Details

The system uses GPS and network-based tracking to continuously monitor the user's real-time location. Upon detecting an accident, it retrieves the exact coordinates and generates a Google Maps link. This location is automatically shared with emergency contacts, hospitals, and ambulances for quick response.

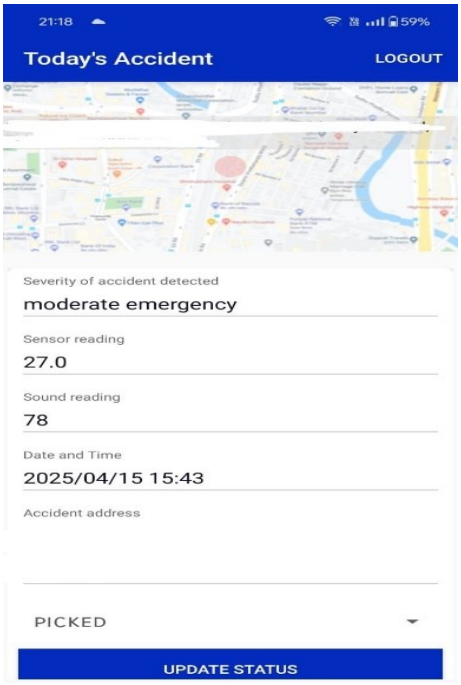

Fig.8. Accident Detection

Once an accident is detected, the system generates an emergency message containing the user's location and details. This message is automatically sent via SMS to emergency contacts, hospitals, police, and ambulance services.

Fig.9. Message is sent to emergency contacts

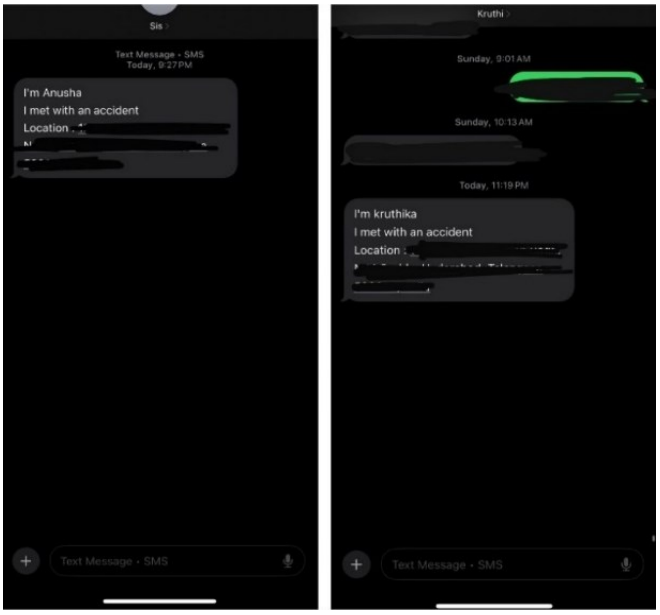

Fig.10. SMS alerts to Emergency contacts

5. Future Scope

The future scope of the accident detection and alert application includes several enhancements to improve accuracy, efficiency, and user experience. AI-based accident severity analysis can help determine the impact level and prioritize emergency responses. Enhanced GPS tracking can improve location accuracy, ensuring faster assistance from medical and law enforcement teams.

Cloud-based data storage can be integrated to maintain accident records, allowing authorities to analyze trends and improve road safety measures. Machine Learning algorithms can refine detection accuracy by reducing false alarms and learning from past incidents. Automated notifications to emergency services can ensure quick response times, minimizing the risk of delays.

User customization features, such as selecting emergency contacts or setting personalized alert preferences, can enhance usability.

6. Conclusion

The Accident Detection and Alerts application is designed as for Android using Java and ASP .Net. The project required significant effort, but it

provided valuable learning experiences and satisfaction to the team. While the system functions effectively, further improvements can always be made.

The system is designed to improve road safety by identifying accidents in real time and initiating immediate response to reduce delays in assistance by sending real-time alerts to emergency services and the victim's family. It integrates a GPS tracker to pinpoint the exact accident location and automatically sends notifications via SMS to hospitals, ambulances, police stations, and family members. This enables quick emergency response, potentially saving lives, especially in remote areas.

The application, named "ResQ", uses a smartphone's accelerometer to detect accidents, GPS technology to track location, and predefined emergency contacts to send alerts. The goal is to provide a fast, efficient, and cost-effective way to respond to road accidents and improve public safety.

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