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Real Time Emergency Alert and Rescue Co-ordination System

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Abstract: ***Emergencies such as road accidents, fires, medical crises, natural disasters, and other unexpected incidents occur without warning and require immediate response to prevent loss of life and property. In many developing and rural regions, existing emergency response systems rely heavily on manual communication methods such as phone calls and physical reporting. These traditional approaches often result in delays, misinformation, lack of coordination among rescue agencies, and increased severity of the impact. The absence of realtime data sharing and centralized monitoring further limits the efficiency of emergency management systems. To address these challenges, this project proposes a Real-Time Emergency Alert and Rescue Coordination System that integrates mobile computing, GPS tracking, cloud-based storage, and automated notification mechanisms to enhance disaster response efficiency. The proposed system is designed using a client-server architecture consisting of two primary modules: a User Module developed as an Android mobile application and an Admin/Authority Module implemented as a web-based dashboard. The user module enables citizens to register, log in securely, and send emergency alerts instantly with a single click. Upon triggering an alert, the system automatically captures the user's geographical coordinates using GPS technology. The latitude and longitude data, along with user details and optional image uploads of the affected area, are transmitted to a centralized server for processing and storage. In conclusion, the system provides a reliable, technology-driven platform that addresses the limitations of traditional emergency response methods. It contributes to saving lives, minimizing property damage, and improving disaster preparedness, especially in rural and disaster-prone areas. With further enhancements such as integration of IoT-based sensors, artificial intelligence for predictive analysis, cloud-based scalability, wearable device support, and drone-assisted monitoring, the system has the potential to evolve into a comprehensive smart disaster management platform capable of handling large-scale emergencies efficiently and effectively.***

Index Terms: Emergency Alert System, Disaster Management, GPS Tracking, Mobile Application, Rescue Coordination

I. INTRODUCTION

Emergencies such as road accidents, fires, heart attacks, earthquakes, floods, and other natural or man-made disasters can occur at any time and without warning. In such critical situations, immediate response and proper coordination areessential to minimize loss of life and property. However, in many regions, especially rural and semi-urban areas, emergency response systems are slow, unorganized, and highly dependent on manual communication methods.

Traditional emergency systems mainly rely on phone calls, word-of-mouth communication, or delayed reporting. These methods consume valuable time and may lead to confusion, misinformation, or lack of proper coordination among rescue authorities. The absence of real-time data sharing and centralized monitoring further worsens the situation.

Therefore, there is a strong need for a smart, technologydriven solution that can provide instant alerts, accurate location tracking, and efficient coordination between victims and emergency service providers. In many cases, victims depend on phone calls or manual reporting, which consumes valuable time.

There is a strong need for a system that:

- Detects emergencies instantly
- Shares real-time location
- Alerts nearby authorities automatically
- Reduces dependency on manual communication

With advancements in mobile computing, GPS technology, cloud computing, and internet connectivity, it is now possible to build intelligent emergency management systems. The integration of these technologies can significantly enhance emergency response efficiency.

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- Mobile Applications – Enable users to send emergency alerts instantly.
- GPS Tracking – Provides accurate real-time location of victims.
- Cloud Server andDatabase – Stores and manages emergency data securely.
- Image Upload Feature – Allows victims to share images of the affected area.
- Notification Systems – Sends alerts via SMS, app notifications, or email.

This project implements an Android application that allows citizens to register emergencies by sending messages or images. Nearby help centers such as police stations, hospitals, and rescue teams respond through a web platform.Emergencies such as road accidents, naturaldisasters, fires, medical crises, and other unexpected incidents occur frequently and often without warning. In such critical situations, the speed and efficiency of response play a vital role in saving lives, minimizing injuries, and reducing damage to property and infrastructure. However, in many regions, especially in developing areas and rural communities, emergency response systems face significant challenges due to lack of real-time communication, delayed information sharing, limited coordination among rescue teams, and insufficient technological support. These limitations often lead to delayed assistance, confusion, and increased severity of the impact. Currently, most emergency reporting systems rely heavily on traditional communication methods such as phone calls, manual reporting, or word-of-mouth information sharing. While these methods have been used for many years, they are often inefficient during large-scale emergencies because they depend on human intervention and are prone to delays and errors. Victims or witnesses may not be able to clearly communicate their location, the severity of the situation, or the type of help required. Additionally, emergency services such as police departments, hospitals, and rescue teams may not receive accurate or timely information, which makes it difficult to respond quickly and effectively.

II. PROPOSED METHOD

The proposed Real Time Emergency Alert and Rescue Coordination System is designed to overcome the limitations of traditional emergency management systems by integrating mobile technology, GPS tracking, cloud-based data storage, and automated notification mechanisms. The system ensures faster communication, efficient coordination, and accurate location tracking during emergency situations.

A. System Overview

The system consists of two main modules:

1) User Module (Android Application)
2) Admin/Authority Module (Web-Based Dashboard)

The User Module allows citizens to send emergency alerts instantly, while the Admin Module enables emergency service providers to monitor, manage, and respond to incidents effectively.

B. User Module

The user module is developed as an Android application that allows citizens to:

1) Register and log into the system securely
2) Send emergency alerts with a single click
3) Share real-time GPS location automatically
4) Upload images of the affected area
5) Receive confirmation and response updates

When an emergency alert is triggered, the system automatically captures the user's location coordinates and sends them to the central server for immediate processing.

C. Admin/Authority Module

The admin module is a web-based interface accessible to police stations, hospitals, and rescue teams. It allows authorities to:

1) View incoming emergency requests in real-time
2) Track victim location on a map interface
3) Analyze uploaded images and details
4) Assign nearby rescue teams
5) Update response status

This centralized dashboard improves coordination among multiple emergency service providers.

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D. Location Tracking Mechanism

The system integrates GPS technology to obtain the realtime latitude and longitude of the victim. The Haversine formula is used to calculate the shortest distance between the victim and nearby emergency centers. This helps in identifying the closest available help center and reduces response time. By integrating modern technologies into a unified platform, the proposed system enhances disaster preparedness, improves emergency response efficiency, and contributes to saving lives and reducing damage during critical situations.

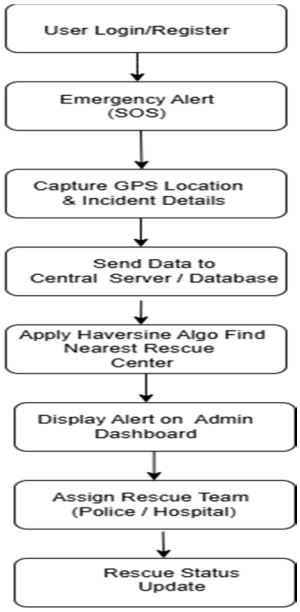


Fig. 1. Proposed Method

Author	Proposed Method	Gap Analysis
Ahmad Fauzi Iskandar et al(2019). disaster mobile time	HAPS-based web application infrastructure; alert in rural areas.	Focused mainly on communication for lacks communication real- and rescue coordination.
Philip B. Charlesworth (2019)	Autonomous aerial communication incoverage volcanic	Limited to volcanic incidents; no citizen-level alert system or GPS tegration. in emergency scenarios.
Diah Yuniarti(2018)	Broadband regulatory network centralized emergency platform.	Focused on communication and aspects; services lacks for disaster alert management.
Mohamed Alzenad(2018)	Airborne Communication Networks (ACNs) emergency support.	Infrastructure-oriented; does not include user interaction or real-time for tracking.
T.A.M.I. Aziz and Iskandar(2014)	LTE-based disaster emermitigation improved restoration.	Emphasis on network restoration; lacks contingency alert and coordiwith nation features. throughput
Lway Faisal Abdul-(2010) for	Interference-ratio to-noise emergency coordination	Signal analysis focused; not directly applicable to methodology communication systems. systems.

TABLE I
AUTHORS AND AFFILIATIONS

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III. SYSTEM ARCHITECTURE

The architecture of the proposed Real Time Emergency Alert and Rescue Co-ordination System follows a clientserver model. The system integrates an Android application, a centralized server, a database, and an admin web dashboard to enable real-time emergency communication and coordination.

A. Architecture Overview

The system consists of the following major components:

1) User Mobile Application (Android)
2) GPS Location Service
3) Centralized Server (Apache Tomcat)
4) MySQL Database
5) Admin/Authority Web Dashboard
6) Notification Module (SMS/Email/App Alerts)

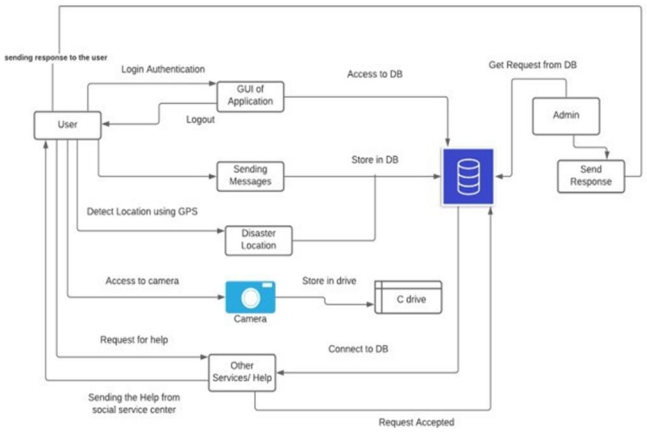


Fig. 2. System Architecture

IV. ALGORITHM

The Haversine formula is used to calculate the distance between two geographical points using latitude and longitude.The Haversine formula calculates the great-circle distance between two geographical points using latitude and longitude. It is widely used in navigation and location tracking. The haversine formula is a very accurate way of computing distance between two pointson the surface of a sphere using the latitude and longitude of the two points. Importantin navigation, it is a special case of a more general formula in spherical trigonometry,the law of haversines, that relates the sides and angles of spherical triangles Haversine function, given by hav() = sin2(/2), where =d/r.

$$hav(\theta) = \sin^2 \frac{\theta}{2} \qquad (1)$$

V. METHODOLOGY

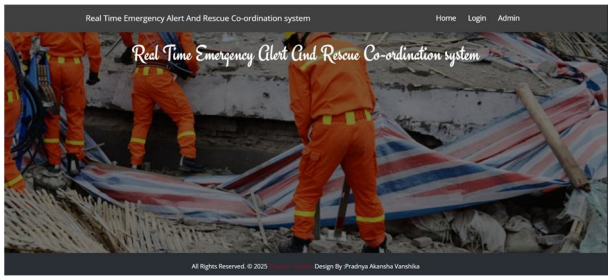
For any rescue co-ordination system, there should be a proper methodology to be followed by emergency managers and any individual. The National Governor's Association has set a methodology which are its four phases known as mitigation, preparedness, response and recovery. Multiple users can access the disaster detection and management system. After login and registration, users can access the camera to capture images where the incident has occurred and GPS to detect the location of the place. Images are stored in c/d drive. The users can send messages i.e. text messages for detailed information of incident and it is stored in a database. The users can also ask for help, transport, and contact social workers. The algorithm used in our system is Haversine Algorithm, in which we can compute the distance between two points on a sphere. The formula for calculating distance is hav() = sin2(/2), where =d/r. In our planned system, we have a dataset in which we stored user's login and registration information. We can also store previous disaster information in the database i.e. location of the incident happened, what type of incident it was, help for the victims, images of the incident place.

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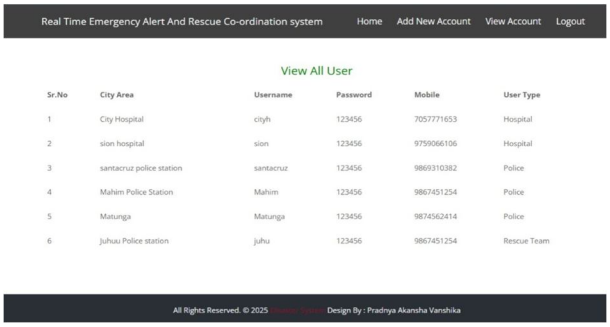
The main types of incidents that occur in nature include road accident, medical crises, fires etc. When a user triggers an emergency alert through the mobile application, the system automatically captures the user's GPS location coordinates (latitude and longitude). The alert request, along with uploaded images and user details, is transmitted to the centralized server. The server processes the request and stores the data securely in the MySQL database. Using the Haversine formula, the system calculates the shortest distance between the victim's location and nearby emergency centers. The nearest police station, hospital, or rescue team is notified instantly through the admin dashboard and notification module. Authorities can then respond and update the status of the emergency request in real-time.

VI. IMPLEMENTATION

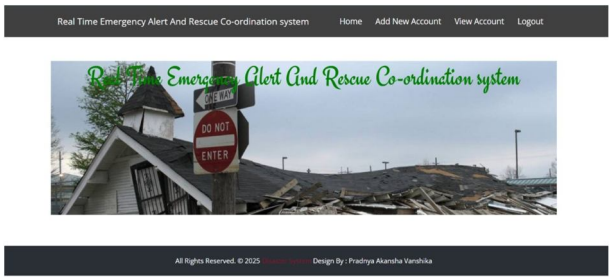
The system is implemented using Android for user interaction and a web-based platform for emergency response teams.Authorities can log in securely and monitor emergency situations through this centralized interface. The backend is developed using JSP and Servlets deployed on the Apache Tomcat server. Authorities can log in securely and monitor emergency situations through this centralized interface.











VII. CONCLUSION AND FUTURE SCOPE

The Real Time Emergency Alert and Rescue Co-ordination System has been successfully designed and implemented to address the limitations of traditional emergency management methods. The system integrates modern technologies such as Android-based mobile applications, GPS location tracking, centralized database management, and web-based dashboards to provide a fast and efficient emergency response mechanism.

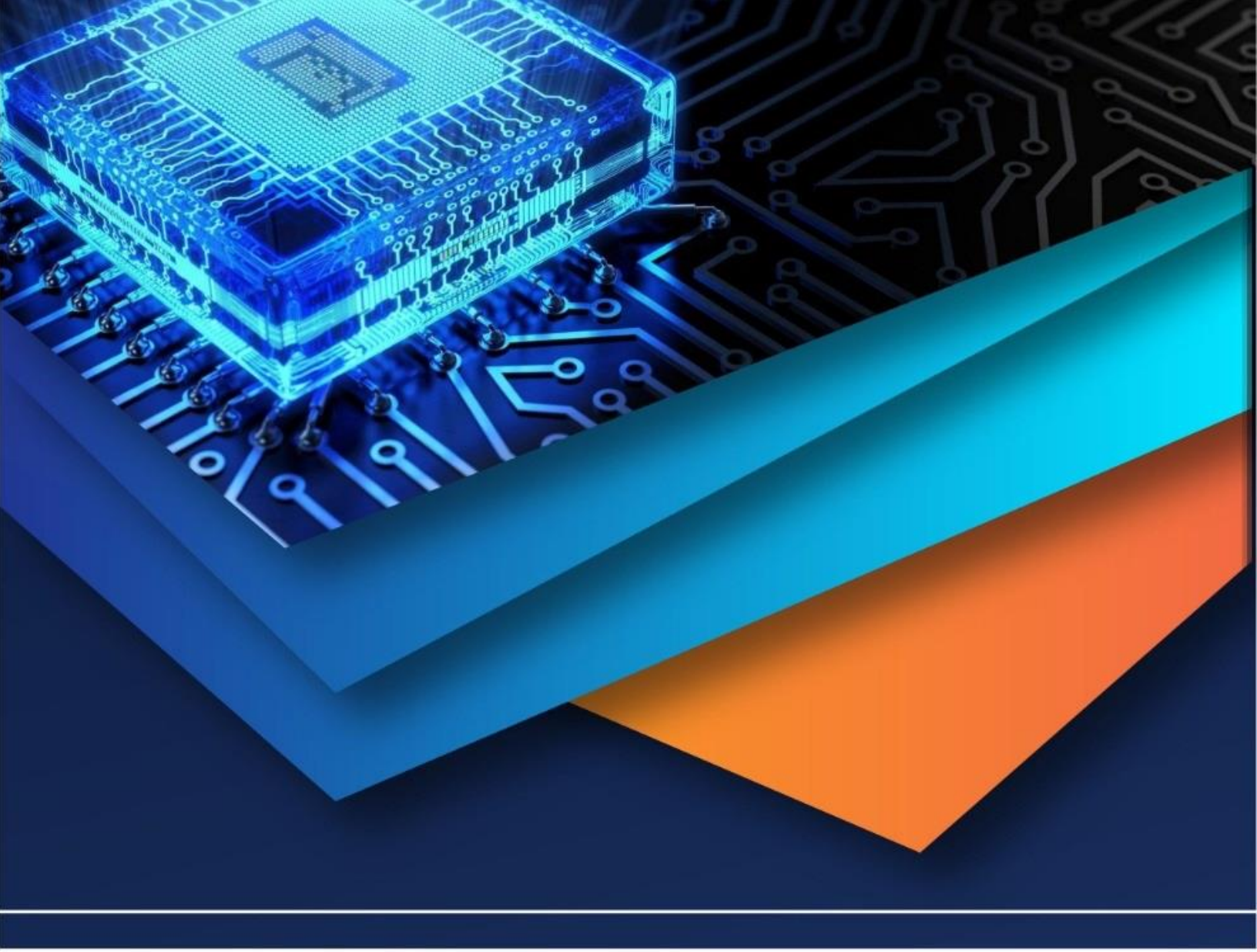
The proposed system enables users to send emergency alerts instantly along with real-time location coordinates and images of the affected area. The centralized server processes the request and notifies the nearest emergency service providers such as hospitals, police stations, and rescue teams. By using distance calculation techniques such as the Haversine formula, the system ensures that the closest available help center is identified, thereby reducing response time.

Compared to existing manual reporting systems, the proposed solution minimizes human error, enhances coordination among multiple agencies, and ensures structured data storage for future analysis. The implementation demonstrates that real-time communication and automation significantly improve disaster response efficiency.

Overall, the system contributes to saving lives, reducing property damage, and improving disaster preparedness, especially in rural and disaster-prone areas. With further enhancements such as IoT integration, artificial intelligence, and cloud scalability, the system has the potential to evolve into a comprehensive smart disaster management platform.

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