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RescueNow: Real-time SOS and Predictive Women's Safety System

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Abstract - This paper presents a comprehensive women's safety application designed to address the growing concerns of personal safety through technological intervention. The system integrates multiple advanced features such as real-time SOS alerts, geofencing to detect high-risk areas, AI-driven crime predictions, and multiple SOS activation methods, including voice commands, shake detection, and button press. Additionally, the app employs silent recording functionality to gather evidence in distress situations and incorporates secure communication channels for contacting law enforcement. The application also supports community-driven safety ratings and crime reporting. Tested with real-world scenarios, the system demonstrates high accuracy in predictive analytics and provides a seamless, scalable solution for enhancing women's safety. This project contributes to the field of personal safety technologies by introducing a multi-faceted, AI-enabled framework for real-time risk mitigation.

Key Words: Women's safety, SOS alerts, AI crime prediction, geofencing, real-time GPS tracking, predictive analytics, Firebase Cloud Messaging, Twilio, silent recording, crime reporting.

1.INTRODUCTION

Women's safety remains a critical global concern, particularly with the increasing prevalence of violence, harassment, and assaults against women in both urban and rural areas. According to the World Health Organization (WHO), around 35% of women globally have experienced physical or sexual violence at some point in their lives [1]. In India, the National Crime Records Bureau (NCRB) reported over 445,000 crimes against women in 2022, emphasizing the urgent need for effective safety measures [2]. These rising figures demonstrate the growing risks that women face daily, highlighting the necessity for innovative technological solutions that can help mitigate these dangers.

Mobile applications have emerged as one potential avenue for enhancing women's safety by offering features such as SOS alerts and real-time GPS tracking. However, many of these apps lack advanced capabilities like offline functionality, automatic incident recording, and direct communication with emergency services. As Ramachandran & Singh noted in their review of mobile safety applications, most apps rely heavily on internet connectivity and are limited in their effectiveness during emergencies in low-connectivity areas [3]. This limitation can leave users vulnerable in crucial moments, especially in rural or remote locations where network access is inconsistent.

The AI-Based Women Safety Mobile Application seeks to overcome these challenges by integrating advanced features such as a one-tap SOS alert, real-time GPS tracking, and automatic audio-video recording during emergencies. This app not only connects users to their trusted contacts but also links directly to emergency services, including police, ambulances, and fire brigades, ensuring that help can be dispatched swiftly [4]. Designed to function even in offline environments, the app empowers women to take control of their safety regardless of connectivity issues, offering a more reliable and comprehensive safety solution.

In addition to these core features, the application incorporates artificial intelligence (AI) to enhance user experience and functionality. As Peters highlights, AI integration in safety apps can significantly improve response times and adapt to user behavior, offering customized safety recommendations [5]. By leveraging AI, the app can analyze user patterns and predict potential threats, enabling proactive measures to prevent incidents before they escalate [6]. Moreover, Browne emphasizes that the use of AI and real-time data analysis can increase the efficiency of emergency responses, making the application a vital tool in mitigating risks for women [7].

2. LITERATURE REVIEW

The Integrated Women's Safety Application is developed to improve personal security for women, featuring secure login, emergency panic alerts, safe route planning, and incident reporting tools. One of the major innovations in this application is the use of Geographic Information Systems (GIS) to detect crime hotspots, allowing users to steer clear of unsafe areas. The app works in conjunction with a mobile platform and a wearable device that can send emergency signals to selected contacts, law enforcement agencies, and nearby volunteers. Real-time tracking capabilities offer constant monitoring during emergency situations. Crime hotspot data is presented through heatmaps, providing a clear visual overview of high-risk zones. All information is securely stored in a Firebase cloud database, ensuring that data is synchronized in real-time across platforms. The system promotes community involvement in crime prevention and response and is designed to scale up for smart city applications. [8]

This Innovative Women Safety Application is an Android-based app designed to ensure women's safety by sending emergency alerts. The app utilizes GPS tracking to monitor a user's location in real-time and allows users to alert their

contacts or authorities by simply shaking their phone or pressing a button. Key features include a user-friendly interface, discreet alert activation, and emergency notifications. The app also provides live tracking of the victim's location, and contacts are promptly notified in case of danger. This system aims to reduce crime rates and enhance personal security. [9]

The paper titled "Mobile Application to Enhance Women's Safety Using Bluetooth Device" introduces a technological solution designed to improve women's safety. It proposes the use of a wearable smart device that incorporates a heartbeat sensor, GPS, GSM, and an SOS button. The device is capable of detecting abnormal changes in heart rate and automatically sending alerts, including the victim's location, to family members and local authorities in emergency situations. This system provides both manual (through the SOS button) and automatic methods for activating alerts, enabling women to receive assistance in dangerous scenarios without needing immediate user input. [10]

The paper explores the creation of a women's safety application developed using machine learning and Java within the Android Studio platform. This app incorporates audio sensing, geolocation, and cloud storage to identify potential threats and enhance user security. It continuously monitors ambient sounds and employs a TensorFlow Lite model to detect dangerous situations. In the event of a threat, the app triggers alerts and begins recording audio and video if the user does not respond. The location data is then sent to emergency contacts and local authorities. Additionally, the app displays nearby safe locations and is designed to be secure, reliable, and easy to use. Future enhancements may include improved threat detection capabilities and real-time integration with law enforcement agencies.[11]

The paper outlines an Android-based women's safety app developed to assist women in emergencies by connecting them to the nearest police station and sending alerts via WhatsApp. The app utilizes GPS to track the user's location, which is shared with police and emergency contacts. It also allows the user to update their WhatsApp status for broader visibility. Unique features include real-time tracking of nearby police stations and direct emergency calls. The app was tested in various locations to ensure efficiency.[12]

The paper introduces "Suraksha," an Android application aimed at enhancing women's safety through location-based services for emergencies and medical needs. It integrates the Google Maps API to locate nearby hospitals and assess crime levels at the user's location within India. Notable features include the ability to send alerts via SMS and calls to five registered contacts in emergencies. The app leverages GPS to provide information on medical facilities and crime data, though the crime database is limited to 2015. Future updates will focus on improving emergency response capabilities and expanding the crime data coverage.[13]

The paper titled "Women's Safety System by Voice Recognition" proposes a smartphone-based solution to enhance women's safety. The app utilizes voice recognition, GPS tracking, and messaging modules to send alerts to pre-registered contacts during emergencies. In case voice recognition fails, alternative triggers such as phone shaking or pressing a button can activate the system. The app also records audio for evidence and continuously tracks the user's location via GPS. The authors aim to overcome limitations in existing safety apps by ensuring hands-free and automatic activation when a woman is in danger.[14]

The paper introduces a smart safety solution for women, utilizing the KNN algorithm and IoT. The system, wearable and powered by Raspberry Pi, features a fingerprint sensor as a panic button, GPS for tracking, and a camera to capture images of potential attackers. When triggered, it sends an SOS message and helps the user locate the nearest safe area. The system is designed to be user-friendly, with machine learning predicting safe locations based on the user's coordinates. The goal is to improve women's safety through a discreet and easy-to-use interface.[15]

The paper outlines a women's safety system leveraging IoT technology, incorporating components like an Arduino UNO, GSM, GPS, accelerometer, a panic button, and a buzzer. In emergencies, pressing the panic button triggers the system, sending the user's location to predefined contacts and local police via GSM and GPS. The IoT module provides continuous location tracking, while the accelerometer detects falls. Additionally, the buzzer alerts nearby individuals for immediate assistance. This portable system is designed to enhance women's safety by continuously tracking and communicating their status in dangerous situations.[16]

3. SYSTEM DESIGN

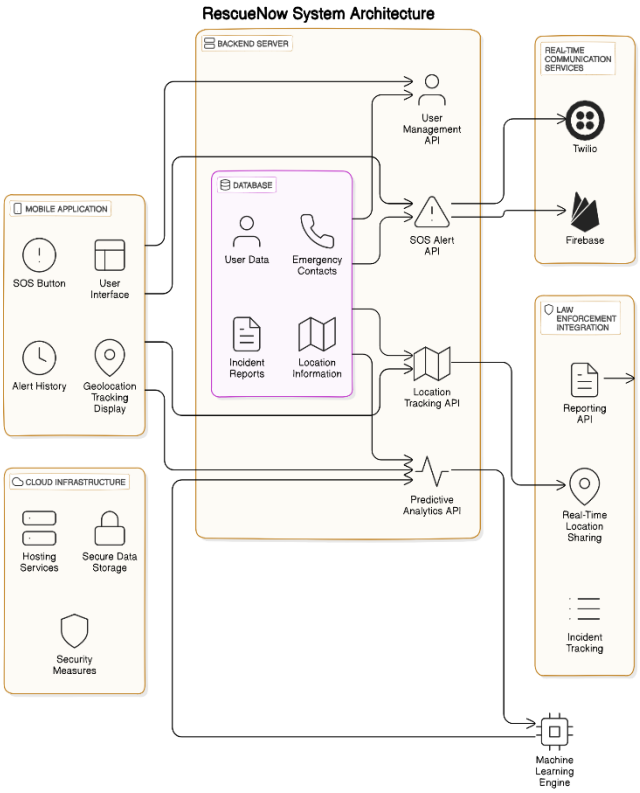


Fig 1: System Architecture

The "RescueNow System Architecture" is designed to facilitate an emergency response system, focusing on women's safety through a combination of mobile applications, cloud infrastructure, backend servers, and real-time communication services. Here's an explanation of each component in the system:

- Mobile Application: This is the user-facing part of the system. It includes key features like the SOS button, user interface for interaction, alert history for past emergency notifications, and a geolocation tracking display that shows the user's location. When a user presses the SOS button in an emergency, the mobile app initiates the alert.

- Database: This component stores critical data such as user data, emergency contacts, incident reports, and location information. These data points ensure that when an SOS alert is triggered, the system knows who to contact and where the user is located. The data is essential for real-time response and incident tracking.

- Backend Server: The backend manages the core functionality of the system. It handles user management API for authentication and user details, the SOS alert API for sending emergency alerts, and location tracking API for monitoring real-time user movement. The backend also includes a predictive analytics API, which uses a machine learning engine to analyze data and provide insights, such as predicting high-risk areas or users' behavior patterns.

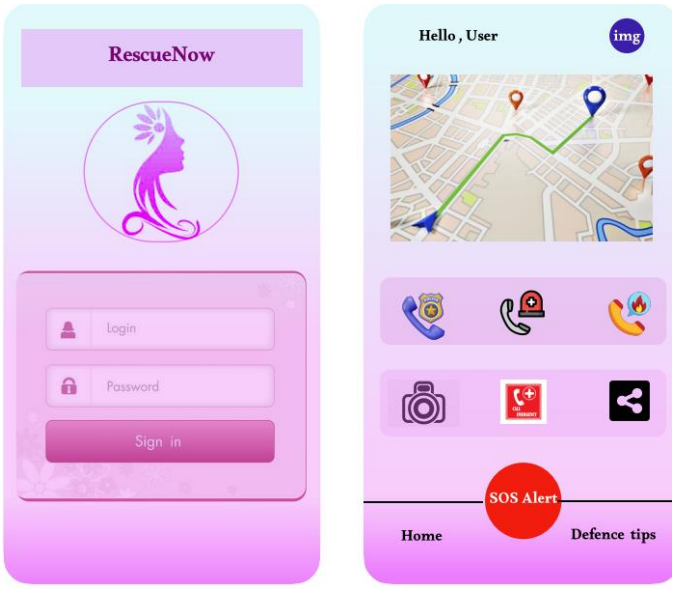
- Real-Time Communication Services: Services like Twilio and Firebase are used for sending notifications and enabling real-time communication. These services ensure that when an SOS alert is triggered, emergency contacts, authorities, and volunteers receive timely notifications and location updates.

- Law Enforcement Integration: The system integrates directly with law enforcement agencies via a reporting API. This allows for the immediate sharing of critical information like real-time location, incident tracking, and reports, ensuring that authorities can respond quickly and effectively.

- Cloud Infrastructure: The system relies on cloud-based services for hosting, secure data storage, and security measures. This ensures that all data is safely stored and can be accessed and synchronized in real-time, providing robust scalability and security for the application.

- Machine Learning Engine: This component supports the predictive analytics API, analyzing patterns and helping the system learn from historical data to enhance its predictive capabilities. This could include identifying crime hotspots or predicting the likelihood of future incidents based on user behavior and environmental factors.

4. EXPECTED OUTCOME



1.Login Screen:

- Contains fields for username and password.
- A sign-in button is provided for users to access the app.
- The design features a logo and a feminine touch with purple and pink colours, reflecting the app's focus on women's safety.

2.Main Dashboard:

- User greeting ("Hello, User") at the top.
- Map display showing user's location with markers, likely for tracking.
- Emergency contact buttons for quick access to police, ambulance, fire services, and other emergency contacts.
- Icons for camera (potentially for recording incidents), and emergency contact sharing.
- Large SOS Alert button at the bottom for immediate help.
- Navigation options like Home and Defence tips at the bottom, offering additional safety-related resources.

5. CONCLUSIONS

The AI-Based Women Safety Mobile Application serves as a crucial solution for enhancing women's security by offering features such as real-time SOS alerts, continuous location tracking, and automatic audio and video recording during emergencies. Designed to respond quickly and effectively in critical situations, the app empowers users to take immediate action.

Its AI capabilities allow the app to learn from user behavior, improving its functionality over time. This adaptability ensures the app remains relevant and effective in complex and evolving environments. Future updates could include

predictive safety analysis and better integration with law enforcement, further boosting the app's effectiveness.

Ultimately, this app contributes to broader efforts to improve women's safety, fostering a more secure environment through technology, community collaboration, and continuous development.

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