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Women Safety Analytics –Protecting Women from Safety Threats

Dr. B Lokesh [1], Akshaya Peddininti [2], Ashrith Raj Uppala[3]
[1,3]UG Scholar, Dept. of CSB, Mahatma Gandhi Institute of Technology, Hyderabad, Telangana, India.
[2]Assistant professor, Dept. of IT, Mahatma Gandhi Institute of Technology, Hyderabad, Telangana, India.
Emails: *lokeshjoel@mgit.ac.in[1], pakshayacsb213249@mgit.ac.in[2], uashrithcsb213259@mgit.ac.in[3]*

Abstract
Women Safety Analytics – Safeguarding Women against Safety Risks is an end-to-end mobile application that ensures women's safety through real-time analytics, intelligent sensing, and machine learning. Built on Android Studio with Java for backend services and XML drag-and-drop for the user interface, the application offers a simple and effective platform for emergency response. Major features of the application are user registration and login, an emergency button that, upon press, directly shares the user's current location with pre-registered emergency contacts. The app also offers gesture-based alerts like a phone shake—to discreetly initiate location sharing. It also offers an audio trigger: upon detection of the word "Help" via the microphone, an alert is sent to the emergency contacts. The second part of the project uses machine learning to identify potential safety risks in public observation settings. In particular, the system can detect situations where a woman is single in a potentially risky environment and automatically raise alerts. This proactive capability utilizes image or video analytics to determine contextual risk and initiate timely response.By integrating mobile technology with smart analytics, this project seeks to deliver a complete solution to forestall and react to safety risks against women, ultimately to contribute to a more secure and safer environment.

Keywords: *Women Safety, Real-time Analytics, Emergency Response, Android Application, Java Backend, XML UI, Location Sharing, Gesture-based Alerts, Audio Trigger, Machine Learning, Intelligent Sensing, Risk Detection, Video/Image Analytics, Mobile Security, Contextual Risk Analysis, Safety Monitoring, Proactive Alert System, Emergency Contacts, Smart Technology Integration, Public Safety.*

1. Introduction
Women's safety has become an important issue globally, particularly in public and private areas, where violence, harassment, and cybercrime rates keep increasing. As technology advances at a high rate, solutions that utilize Internet of Things (IoT), artificial intelligence (AI), and mobile apps have advanced to increase the empowerment of women and their safety. The use of GPS tracking, real-time communication, and smart sensors in women's safety systems enables instant detection of emergencies and rapid response from authorities or emergency contacts. Gesture detection technology and smart sensors empowered by AI present new ways to identify distress signals with precision and initiate emergency notifications, thus lowering the response time and enhancing efficiency. Mobile apps specifically developed for women, like "SAKHI" and "Myguard," illustrate the everyday applicability of the technology in real life, offering capabilities from location sharing to live monitoring and voice commands. In addition, AI-integrated real-time surveillance systems assist in the detection and prevention of crime within public spaces, providing a secure environment for women . Despite such technological developments, issues like data privacy, system reliability, and accessibility are still widespread and need ongoing research and development. Research on crime against women stresses the need for integrating sophisticated GIS and crime analysis tools to comprehend and predict patterns of violence more effectively . Moreover, the changing digital scenario demands cybersecurity mechanisms specific to counter cybercrimes against women. In this paper, we study the design and

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development of an integrated women's safety application incorporating IoT devices, AI, GPS tracking, gesture recognition, and smart sensors for providing real- time communication and emergency alert services. With this research, our goal is to contribute to the development of intelligent, user-friendly, and secure security systems for both physical and cyber threats to women today.

2. Problem Statement

Women's safety remains a critical concern, with rising incidents of harassment and violence, especially in isolated or unsafe environments. Traditional safety measures often lack real-time responsiveness and rely heavily on user action, which may not be feasible in emergencies. This project aims to enhance women's safety using a smart, Android-based application powered by real-time alerts and Machine Learning. By integrating emergency triggers like button presses, phone shake, voice detection, and lone-woman recognition through camera surveillance, the system ensures swift, automated alerts and location sharing. This accessible, proactive approach empowers women with a reliable safety tool, potentially reducing response time and preventing harm.

3. Literature Survey

Recent research on women's safety has extensively explored the use of IoT, AI, and mobile technologies to develop innovative protective systems. Sonia et al. [1] designed an IoT-based women protective system utilizing AI-enabled smart sensors, which demonstrated the potential of combining smart sensing and real-time alert mechanisms to enhance safety. Similarly, Agarwal et al. [2] developed "SAKHI," a women safety smartphone application that incorporates multiple security features such as GPS tracking and emergency alerts to provide immediate assistance. Navaneethakrishnan et al. [3] proposed "WoExP," an AI-based women security system focusing on artificial intelligence to improve threat detection and response. Artamadja et al. [4] emphasized designing safety applications specifically for emergency scenarios, addressing the need for quick, reliable communication between victims and responders. Gesture recognition as a method for discreet emergency signaling has been explored by Mohamed and Dahnil [6], who developed a gesture-based safety application, demonstrating the feasibility of hands- free activation of alerts. Mishra et al. [5] presented "Myguard," a mobile application with a user-friendly interface that combines GPS tracking and real-time communication to safeguard users. Other studies, such as Singh et al. [7], have developed real-time surveillance systems that leverage AI for crime detection in public spaces, providing proactive safety solutions. Meanwhile, Monisha et al. [8] focused on hardware and software integration to create comprehensive women safety devices. Several applications like "Abhaya" [9] and "WoSApp" [10] highlight the significance of mobile platforms in delivering accessible and scalable safety tools. Furthermore, research by Singh et al. [11] and Sankhwar et al. [12] discusses the implications of data quality and cybercrime on women's safety, underscoring the importance of secure data handling and cybersecurity. Explorations into crime analysis using GIS technology by Biswas and Chatterjee [18] provide insights into spatial patterns of violence against women, which can inform targeted safety measures. Kumar and Roshni [13] and Chaudhary and Sood [14] further stress the importance of cybercrime prevention strategies. Finally, Pattnaik et al. [16] offer a comprehensive overview of AI and machine learning solutions aimed at enhancing women's security, while Malkari et al. [19] introduced an integrated safety application that combines multiple technologies to deliver an effective protective tool.

4. Architecture of WSA

4.1.User Interface Module

The User Module is the primary interface through which users interact with the Women Safety Analytics system. Developed using Android Studio, this module includes a user-friendly front end built with XML drag-and-drop components and a Java-based backend for processing. It allows users to register themselves and log in securely, and also provides an option to set up emergency contact information. To ensure immediate and accessible safety features, the app incorporates multiple user-triggered mechanisms. These include pressing an emergency button, physically shaking the phone, or activating voice-triggered detection (such as specific phrases like "help"). Once a trigger is activated, the

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action handler retrieves the user's current GPS location, composes a detailed alert message that includes both the location and a distress signal, and sends this message via SMS to the predefined emergency contacts. This ensures that the user can alert trusted individuals quickly and discreetly in moments of danger. All user data, including contact information and event logs, are securely stored using services like Firebase or a similar solution (SOLife), enabling efficient management and retrieval of critical information when needed. (Figure 1)

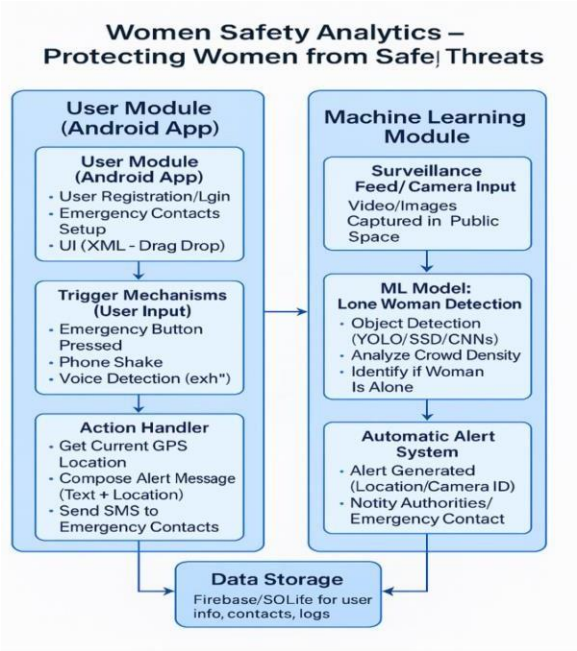

Figure 1 Architecture for Women Safety Analytics the Figure 1 illustrates System Architecture of Women Safety Analytics – Integration of User and Machine Learning Modules for Real-Time and Predictive Safety Measures

4.2.Machine Learning Module

The Machine Learning Module adds an intelligent, proactive layer of safety to the system. It leverages real-time data from surveillance feeds or camera inputs located in public spaces. These video streams or image captures are analyzed to detect potentially dangerous situations automatically. At the heart of this module is a machine learning model specifically trained for "lone woman detection." Using advanced object detection techniques like YOLO (You Only Look Once), SSD (Single Shot Detector), and convolutional neural networks (CNNs), the system identifies whether a woman appears to be isolated in a public setting. In addition to object detection, the system also assesses crowd density to determine if the woman is in a vulnerable situation. When such conditions are identified, the automatic alert system is triggered. It generates an alert containing the camera ID and location data and sends it to nearby authorities or emergency contacts, ensuring timely intervention. All relevant data is synchronized with the central data storage system to maintain detailed records for future analysis or reference. (Figure 2)

5. Results

Figure 4 Illustrates the App's Emergency Alert Dashboard, Highlighting Active Alerts, User Status, And Contact Notification History, Providing Clear Visual Feedback to the User and Enhancing Overall Situational Awareness

The screenshot displays a "Women Safety App" interface, highlighting a key emergency feature. When a phone shake is detected, the app prompts the user with a dialog titled "Emergency Triggered!" asking whether to send an emergency alert to their contacts. This quick-access feature ensures immediate response in dangerous situations, enhancing user safety with just a simple gesture. (Figure 5)

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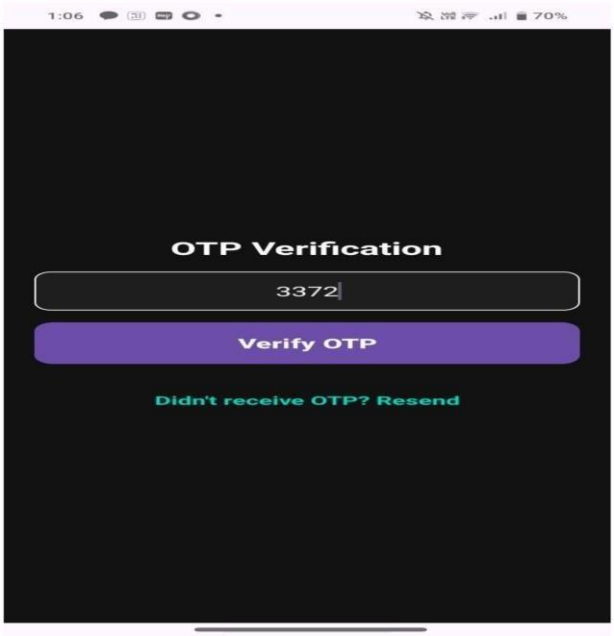

Figure 5 OTP Verification Screen with a 4-Digit Input Field, "Verify OTP" Button, and a Resend Option for User Authentication

The OTP Verification screen ensures secure user authentication by prompting the user to enter a 4-digit code sent to their registered contact. It includes a clear input field, a “Verify OTP” button, and a convenient option to resend the code if not received. (Figure 6)

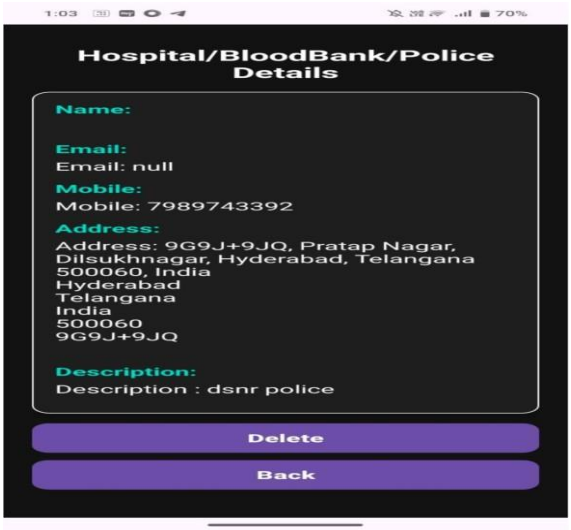

Figure 6 Hospital/Blood Bank/Police details Dashboard Displaying Name, Email, Mobile Number, Address, and Description for the Selected Entry

The figure 6 showcases a user-friendly dashboard designed to display essential details for organizations such as hospitals, blood banks, or police departments. The interface presents key information including the name of the institution, contact email, mobile number, physical address, and a brief description, all organized in a clear and accessible format. This dashboard enables users to quickly access and verify crucial contact details, facilitating efficient communication and coordination during emergencies or routine inquiries. The clean layout and structured presentation ensure that users can easily find the information they need with minimal effort. (Figure 7)

Figure 7 Admin Panel Dashboard for Managing Hospital, Police, and Blood Bank Records

This image displays the Admin Panel interface of a management application designed for healthcare and emergency services. The panel provides administrators with clear, easy-to-use options to add new records for hospitals, police stations, and blood banks, as well as view existing entries across these categories. Each function is accessible via prominently placed purple buttons, ensuring quick navigation and efficient management. The inclusion of a logout button at the bottom enhances security by

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allowing admins to safely exit the system. The clean, minimalistic design ensures that users can perform administrative tasks swiftly, supporting the effective coordination and maintenance of critical service information. (Figure 8)

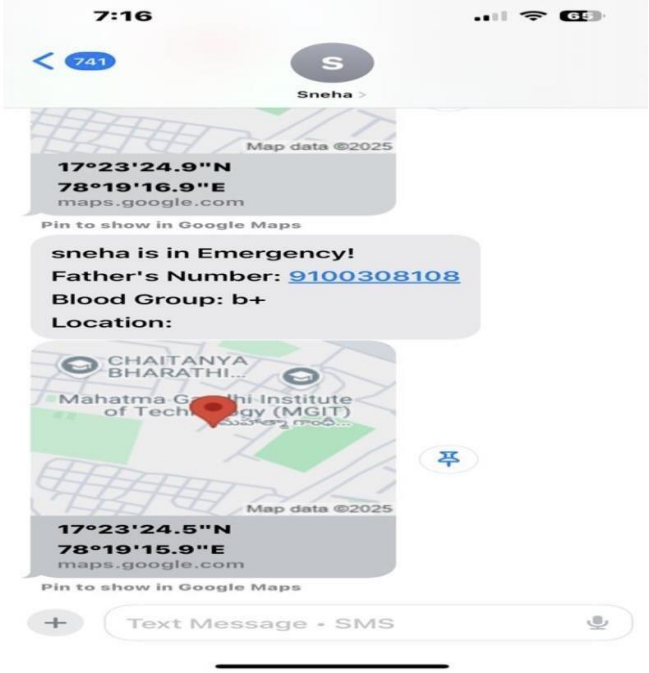

Figure 8 Emergency Alert Message Displaying Critical Information and Contact Details

This image shows a mobile SMS conversation where an automated emergency alert has been sent regarding an individual named Goutham. The message clearly states that Goutham is in an emergency situation, providing his father's phone number and Goutham's blood group (B+), along with a prompt for the recipient to view the location via a Google Maps link. Such emergency messages are crucial for quickly informing contacts or authorities, enabling immediate assistance and coordination. The inclusion of essential details like contact number and blood group ensures that responders have the necessary information to act swiftly in critical situations

Conclusion

The "Women Safety Analytics" project meets the pressing demand for women's safety through the integration of mobile technology and smart analytics to provide an active and accessible protection system. The application, built with Android Studio, has a Java-based backend and an easy-to-use XML interface that caters to essential features such as user registration, login, emergency alert activation through button press, shake-based alert triggers, and audio cue detection. These elements provide support for sending users' live location and alerts to specific emergency contacts in time during a time of distress. Besides these responsive safety features, the app has a machine learning feature geared towards preventing situations where a woman seems to be alone and possibly in danger. Upon detecting such situations, the system automatically sends alerts, providing increased capabilities for preventive intervention. This blend of features offers a two-layered safety net—reactive and proactive—empowering people through both immediacy and intelligence. The system's focus on simplicity, real-time response, and intelligent detection makes it work under diverse use conditions and remain available on mainstream Android devices. In conclusion, Women Safety Analytics is a practical and significant deployment of new technology to an urgent social problem.

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