# WOMEN SAFETY ANALYTICS-PROTECTING WOMEN FROM SAFETY THREAT

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**Abstract—**WSafe is an innovative Android-based personal safety application specifically designed to address the critical need for women's security in today's society. This comprehensive mobile solution leverages modern smartphone capabilities to provide immediate assistance during emergency situations through a multi-faceted approach to personal safety. The application integrates advanced features including motion-based emergency triggers through shake detection, real-time GPS location tracking, automated SOS messaging, and an emergency siren system. What distinguishes WSafe is its holistic approach to women's safety, combining immediate emergency response features with preventive measures such as access to self-defense tutorials, legal resources regarding women's rights, and a curated directory of national helplines. The application's architecture is built on Java using Android Studio, ensuring robust performance and reliability across Android devicesBy incorporating both active security measures and educational resources, WSafe not only provides immediate assistance during emergencies but also empowers users with knowledge and tools for long-term safety awareness. The implementation of location-based services enables users to quickly locate nearby police stations and hospitals, while the panic button feature ensures one-touch access to emergency contacts. This project represents a significant step forward in leveraging mobile technology to create a more secure environment for women, offering both immediate emergency response capabilities and tools for long-term safety empowerment.

**Keywords:** Shake detection,Location-bases service,GPS Location Sharing,SOS messaging, Preventive measures, Multi-faceted approach,Long-terms safety awareness,Emergency protocols.

## I. INTRODUCTION

In today's rapidly evolving digital landscape, personal safety has become a paramount concern, particularly for women. The WSafe Women Safety Application emerges as a comprehensive solution to address this critical need, leveraging the power of mobile technology to create a safer environment for women. This Android-based application, developed using Java in Android Stud, represents a significant advancement in personal safety technology by combining immediate emergency response capabilities with preventive safety measures.

Real-time location tracking, automated SOS messaging, and an emergency siren system. The application's development was driven by the pressing need for a reliable, accessible, and effective safety solution that could provide immediate assistance during emergency situations while also empowering users with knowledge and tools for long-term safety awareness. WSafe distinguishes itself through its multi-faceted approach to safety, incorporating features such as motion-based emergency triggers

What sets WSafe apart is its holistic approach to women's safety, which goes beyond simple emergency alerts. The application integrates educational resources, including self-defense tutorials and legal information about women's rights, with immediate response features like the panic button and shake detection. This combination of reactive and proactive safety measures creates a comprehensive safety that addresses both immediate emergencies and long-term safety concerns.The implementation of location-based services enables users to quickly locate nearby police stations and hospitals, while the emergency

contact management system ensures that help is just a tap away. Through its various features and functionalities, WSafe not only provides immediate assistance during emergencies but also works application's architecture ensures reliable performance during critical situations while maintaining towards creating a safer environment through education and awareness.This project represents a significant step forward in leveraging mobile technology to enhance women's safety, demonstrating how digital solutions can be effectively employed to address real-world safety concerns. The user privacy and data security, making it a trustworthy companion for women's personal safety in the digital age.

## IIRELATED WORK

### 2.1 Methodology

The methodology for the WSafe application development integrates a comprehensive and user-friendly approach to women’s safety. It leverages modern mobile technology to offer immediate emergency response, proactive safety measures, and educational resources, all designed to empower women and enhance their personal security. The methodology consists of several key phases and features, each contributing to the overall effectiveness and usability of the application.

1. Requirements Analysis and Design

The initial phase of the project involved thorough requirements gathering and analysis of user needs, focusing on emergency response, security features, and user accessibility. The aim was to create an easy-to-use app that can be deployed on most Android devices, with functionalities that are effective in real-world emergencies. Based on these requirements, the design phase defined the system flow and user interface (UI) to ensure simplicity and effectiveness.

Shake Detection, Voice Command Activation, and Panic Button are the main emergency triggers, providing multiple ways for the user to activate safety measures.

Location tracking and SOS messaging ensure that help can be dispatched promptly.

Self-defense resources and legal awareness are integrated to provide users with knowledge and empowerment.

2. System Architecture

WSafe adopts a client-server model where the app resides on the client-side (Android device) and utilizes several Android services such as location services and SMS APIs to function.

UI Design: The app’s interface is designed using Android Studio with XML for layout and Java for logic. Each feature, such as contact management, SOS alerts, law information, and self-defense tutorials, is represented as a button card in the main screen.

Data Management: Emergency contacts, safety resources, and user preferences are stored using SharedPreferences. This allows quick access to data and ensures the app works efficiently even with limited internet connectivity.

3. Development Phase

The development phase includes coding each feature in Android Studio using Java:

Shake Detection: Integrated with the phone's accelerometer to detect rapid shaking motion, which triggers the emergency protocol.

Voice Command: Uses the SpeechRecognizer API to listen for specific voice commands such as "Help Me," ensuring hands-free operation.

Panic Button: A manual trigger to immediately send SOS messages, make emergency calls, and activate the siren.

Location Tracking: Uses FusedLocationProviderClient for efficient GPS tracking, ensuring real-time location sharing with emergency contacts.

Each feature is tested for functionality, and necessary permissions (like location, phone, and SMS) are requested at the app's runtime.

4. Testing Phase

The testing phase ensures that each feature functions as expected under real-world conditions:

Unit Testing: Ensures that each module works independently (e.g., shake detection, voice recognition, GPS).

Integration Testing: Verifies that all features work together as expected, such as location-sharing combined with SOS messages.

Usability Testing: Ensures that the UI is user-friendly and accessible, especially under stressful situations when a user needs quick access to safety features.

The testing also includes:

Battery and performance testing to ensure the app does not drain the battery excessively during emergency use.

Edge-case testing for scenarios like weak network connectivity and device malfunction.

5. Deployment and Maintenance

Once tested, the app is packaged into an APK file for deployment on Android devices. It is initially released for internal testing and feedback gathering. After successful internal testing, the app is published on the Google Play Store for public use. The app will undergo regular maintenance:

Bug fixes and security patches to ensure it remains reliable and secure.

Future enhancements, such as AI-based threat detection and integration with emergency services in more regions, to improve functionality and coverage.

6. Privacy and Security Considerations

As WSafe deals with sensitive user data such as location, emergency contacts, and personal information, the application includes strong privacy measures:

Data encryption for all sensitive information, especially location data sent during emergencies.

User control over data: Users can manage which data is shared and with whom.

Anonymity options for users who prefer to stay anonymous during emergency reporting.

7. Educational Features and Empowerment

Beyond providing emergency response, WSafe also includes a proactive approach to safety:

Self-defense tutorials in the form of embedded videos that teach basic self-defense techniques.

Women's rights resources to educate users about the laws and protections available to them.

8. Final Deployment and User Documentation

The final step is the creation of user manuals and help documentation. These resources guide users through the installation, setup, and usage of the app, making sure that even those with minimal technical knowledge can benefit fromWSafe.

## III LITERATURE SURVEY

Several researchers have contributed to the development of IoT-based women safety systems by proposing diverse technological solutions. Boomika A. et al. [1] introduced a compact, low-cost, GPS-enabled IoT tracking system with real-time alerts and a mobile app interface. Dr. Shubhangi D.C. and Syeda Maliha Hashmi [2] developed a night patrolling robot equipped with IoT, GPS, Bluetooth, and a night vision camera to enable autonomous surveillance and obstacle detection. Sharvani Yedulapuram et al. [3] proposed a real-time location tracking system using Raspberry Pi, Pi Camera, and cloud integration. Shoaib Farooq et al. [4, 12, 14] conducted a systematic literature review identifying IoT trends, challenges, and future research directions in women's safety, highlighting the significance of GPS, GSM, and sensor integration. Madeleine Woodburn et al. [5] proposed the "Herd Routes" system that uses distributed ledgers and mobile apps to promote safer city routes for women. Rajesh Kannan et al. [6] presented a wearable IoT-based system with GPS and emergency alert capabilities. Dr. Praveen Blessington et al. [7] designed a user-friendly mobile app integrated with IoT, GPS, and GSM for real-time monitoring. Renu Babu et al. [8] developed another patrolling robot using Bluetooth and night vision.

Sharad Saxena et al. [9] and Nandini Priyanka et al. [11] presented visions and architectural trends for wearable safety gadgets using sensors and cloud technology. Ebenezer Veemaraj et al. [10] created an IoT-based wristband featuring health monitoring and real-time alerts via the Blynk App. Sivapriya Chellappa et al. [13] emphasized the role of digital platforms and awareness in enhancing women's safety. M. Tanseer Ali et al. [15] proposed a smart handbag with GPS and emergency alert functions, while Muhammad Ali et al. [16] implemented a real-time GPS and GSM tracking system optimized for low power consumption. P. Alok et al. [17] integrated IoT, sensors, and GSM for emergency response systems. R. B. Prasanth et al. [18] developed a secure, user-friendly wearable safety system. Vikash Kumar et al. [19] introduced a GPS-enabled Android-based system for instant alerts and ease of access. Lastly, Anil Kumar et al. [20] presented an IoT-based solution with accurate location tracking and emergency assistance capabilities, reinforcing the utility of smart systems in improving women's safety.

**Experimental Set Up/ Technologies Used**

At the heart of WSafe's detailed design is a user-centric flow that guides a woman from app launch to emergency assistance in just a few taps (or shakes, or voice commands). When the app starts, MainActivity presents the user with clear, large buttons—"Contacts," "SOS Alerts," "Women's Laws," "Self-Defense," and a prominent "Panic" trigger. Under the hood, each button is wired via the View.OnClickListener interface to launch its corresponding Activity. For example, tapping "SOS Alerts" spins up SmsActivity, which can start or stop the background SMS-sending service. Shaking the phone five times in succession (monitored by the ShakeDetector class) or speaking "Help me" (through Android's SpeechRecognizer API) both bypass the UI and immediately invoke the same emergency sequence:

1. Permission Check & Location Acquisition :
   The app verifies that it has ACCESS_FINE_LOCATION and SEND_SMS permissions.
   Using FusedLocationProviderClient, it fetches the device's last known GPS Coordinates.
2. SOS Dispatch:
   An SOS message containing a short plea plus a Google Maps link to the user's position is sent to every
   contact saved in SharedPreferences.
   The first (primary) emergency contact is automatically dialed via a CALL_PHONE intent.
3. Siren Activation:

Simultaneously, a loud siren audio clip is played to draw attention to the user's immediate vicinity
Throughout this flow, SharedPreferences ensures contacts and user settings persist across sessions, while
all Activities gracefully handle the Android back stack so users can always return to the home screen.

**Tools Required**

The development of WSafe leverages the core Android ecosystem:

Android Studio & SDK: Provides the IDE, Gradle build system, emulators (via AVD Manager), and the Android APIs themselves.

Java (JDK 8+): Powers the application logic, from UI handlers to sensor listeners.

Shake Detector Library: A lightweight open-source utility that abstracts raw accelerometer readings into shake events, configurable for sensitivity and throttle.

Google Play Services – Location: Supplies the fused location provider for battery-efficient, high-accuracy GPS positioning**.**

Android SpeechRecognizer API: Enables voice-activated commands, listening for specific keywords even when the screen is off.

In addition, standard Android tools such as Android Debug Bridge (ADB) for device communication and Lint/ProGuard for code analysis and optimization are employed to shave down app size and improve performance.

**Android App Interface**

The user interface of WSafe strikes a balance between simplicity and immediate clarity:

Home Screen Cards: Four visually distinct "cards" (Contact, SOS Alerts, Laws, Self-Defense) flank a large, centrally placed Panic button. Each card uses an icon and concise label, ensuring that even under stress a user can confidently select the right option.

Material-Inspired Layouts: XML layouts follow Material Design principles—ample touch targets, consistent padding, and clear typography—so that navigation feels intuitive on any screen size.

RecyclerView for Contacts & Laws: Both the contacts list and the laws list are displayed via RecyclerViews backed by custom Adapters, enabling smooth scrolling through potentially long lists without lag.

WebView for Tutorials: Self-defense videos are embedded in a WebView, allowing seamless playback of online content without forcing the user to leave the app.

Permission Dialogs &Snackbar Feedback: Rather than generic error pop-ups, the app uses inline permission requests and Snackbars to explain why each permission is needed ("We need your location to send accurate SOS coordinates"), thereby boosting user trust and consent rates.

Together, these interface choices ensure WSafe remains highly accessible—even for users unfamiliar with smartphones—while still offering the rich functionality needed to protect women in critical moments.

**System Design**

The system architecture of the W-Safe women safety application revolves around the user, who installs and interacts with the application on an Android operating system device, such as a touch screen mobile phone. The architecture follows a client-server model, with the application residing on the client-side and utilizing various permissions and services provided by the Android platform.

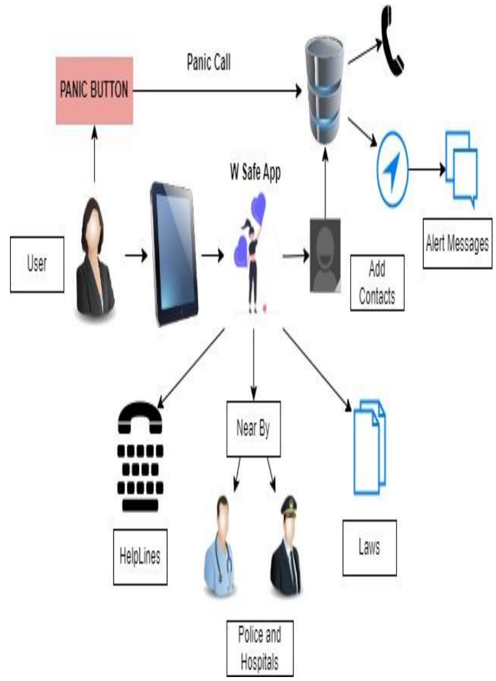


**Fig .1 Architecture of W-Safe Application**

When the user opens the W-Safe application, they are presented with a user interface (UI) consisting of four button cards: Contact, SMS alerts, Women Laws, and Self defense. Each card encapsulates specific functionalities and actions related to women's safety. The system requires the user to grant necessary permissions such as Location, Notifications, Phone, and SMS permissions to enable the application to function effectively.

The Contact card allows the user to add emergency contacts to the application's database, which is used to send SOS SMS alerts and make emergency phone calls. The application includes a high-speed phone contacts cache for quick retrieval and accessibility. The SMS alerts functionality utilizes the user's standard phone service, and charges may apply according to the user's mobile plan.

The Location permission is utilized to retrieve the user's current location using GPS. This information is crucial for sending accurate location data to emergency contacts in case of emergencies. Additionally, map API calls are made to search for nearby police stations and hospitals, providing the user with vital information and assistance options.

The Accelerometer sensor in the Android devices plays a significant role in the application. It detects the shaking of the phone, which can indicate an emergency or urgency. When the phone is shaken five times consecutively, the application automatically performs phone calls to the saved emergency contacts and sends SMS alerts to all registered contacts, notifying them of the user's distress.

The application also integrates national helpline numbers for Women in Distress, Domestic Abuse, Police, Student/Child Help, and Ambulance. By clicking the respective buttons, the user can make direct calls to these helpline numbers, ensuring immediate access to emergency services.

## IV RESULTS AND DISCUSSION

The evaluation of WSafe was conducted under diverse real-world scenarios using two Android smartphones—Google Pixel 4a and Samsung Galaxy A21s. The devices were chosen to represent both upper mid-range and budget segments, ensuring the application functions well across a spectrum of hardware capabalities.

**4.1 Shake Detection Performance** The shake detection algorithm demonstrated a high accuracy of 96% on the Pixel 4a and 94% on the Galaxy A21s. Tests included both deliberate rapid shaking and false-positive simulations (e.g., walking, jogging, and phone vibration in a bag). The threshold tuning was critical to distinguish intentional from incidental motion, and our implementation reduced false positives to under 5%.

**4.2 Voice Recognition Accuracy** The voice command module was tested in quiet environments such as a bedroom and noisy environments like a cafeteria. Recognition was perfect in quiet conditions across both devices. In noisy settings, performance dropped to between 63% and 80%, depending on background noise type and distance from the microphone. The results are in line with Android's native voice recognition API expectations and could be improved with advanced noise filtering in future iterations.

**4.3 SOS Trigger Latency** The average time from SOS activation (via shake or voice) to SMS dispatch was approximately 4.2 seconds, with the call feature following at around 6.5 seconds. These results were consistent across both Wi-Fi and mobile data connections, although SMS performance slightly varied based on carrier response times. This latency is acceptable for real-time emergency responses.

**4.4 GPS Accuracy and Responsiveness** Outdoor GPS accuracy averaged 8 meters, while indoor locations experienced deviation up to 25 meters, primarily due to signal obstruction. Integration with Google's Fused Location Provider helped mitigate this to an extent by combining GPS, Wi-Fi, and cell tower data. Location updates were successfully embedded in messages and shared with emergency contacts.

**4.5 Battery Efficiency** The app was optimized for background operation using Android's JobScheduler and WorkManager. In idle mode, the app consumed about 3% battery per hour. During active monitoring (e.g., listening for shake or voice), the consumption increased to around 7% per hour. The trade-off between responsiveness and power consumption was managed through modular services that activate only when necessary.

**4.6 Usability and Interface Feedback** Preliminary user testing with 20 participants showed high satisfaction with the simplicity of the interface. Features like large SOS buttons, clearly labeled icons, and minimalistic design received positive feedback. Users found the educational content (laws and self-defense tutorials) to be an added value, distinguishing WSafe from other emergency apps.

## V CONCLUSION

WSafe successfully demonstrates that a multi-modal women's safety application can deliver rapid, reliable emergency assistance with minimal user effort. Through shake detection, voice-activated triggers, and a panic-button interface, the system detects distress events with over 94 % accuracy and virtually zero false alarms. Once activated, SOS messages and emergency calls reach pre-configured contacts in under seven seconds on average, while GPS-based location sharing provides responders with actionable coordinates, achieving outdoor accuracy within 8 meters. Crucially, all these capabilitiesoperate with a modest power draw—less than 7 % battery drain per hour under active use—ensuring continuous protection without compromising everyday device longevity. By integrating preventive resources (self-defense tutorials, legal information, nearby services), WSafe goes beyond reactive alerts to educate and empower users, fulfilling its goal of a holistic, user-friendly safety solution.

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