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Sensor-Driven Emergency SOS App with Real-Time Location Tracking

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ABSTRACT: -*The "Sensor-Driven Emergency SOS App with Real-Time Location Tracking" is an Android application developed to provide immediate assistance during emergencies. Users can activate SOS alerts through various methods, such as shaking their device or pressing the volume-up button three times. Once triggered, the app sends SMS notifications that include the user's live GPS location along with a personalized emergency message.*
To maintain reliability, the application runs a background service that checks the GPS and internet connectivity every 30 seconds. If either service is disabled, it prompts the user to turn it on. In situations where both services are unavailable, the app automatically sends a simplified emergency message without location details.
Built in Java using Android Studio, the app leverages key Android APIs such as FusedLocationProviderClient, SmsManager, SensorManager, and Accessibility Services to ensure rapid, efficient, and responsive emergency communication. Its design prioritizes accessibility, low battery consumption, and straightforward usability in diverse emergency situations.
This system proves highly effective in real-time scenarios where swift action is critical. By offering multiple alert activation methods and performing automated background monitoring, the application delivers a dependable and user-friendly safety solution for unexpected emergencies.

keywords:-*Emergency SOS App, Real-Time Location Tracking, Android Application, GPS Integration, Shake-to-Trigger Feature, Volume Button Trigger, SMS Alert System.*

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I. INTRODUCTION

The frequency of situations where individuals face danger is steadily increasing, particularly among vulnerable populations such as women, children, and those with limited ability to protect them. During emergencies, including accidents, assaults, or medical crises, victims often experience panic or physical incapacitation, which can prevent them from unlocking their devices or accessing applications to request assistance.

Existing safety applications often fall short in these scenarios, as they rely heavily on stable internet connectivity and require direct interaction with the touch screen both of which may be impractical during urgent or high-stress situations.

To address these challenges, this research proposes a Sensor-Driven Emergency SOS Mobile Application that enables rapid, discreet, and reliable emergency communication. The application allows users to send emergency SMS messages containing their real-time GPS location using internet-based services. It incorporates four distinct activation methods: device shake detection, triple pressing of the volume-up key, tapping the SOS button in the app, and sending a standard SOS message when GPS or internet connectivity is unavailable. In addition, users can configure and send custom SOS messages to ensure personalized alerts.

The system continuously monitors the status of GPS and internet services, displaying pop-up notifications every 30 seconds if either service is disabled, thereby ensuring constant preparedness. A Safety Check-in feature allows users to set regular time intervals (ranging from 1 minute to 12 hours) to confirm their safety; if a check-in is missed, the app automatically sends alerts to emergency contacts.

The primary objective of this application is to provide a robust, intuitive, and accessible emergency tool that does not depend solely on touchscreen interaction or continuous internet access. By offering multiple activation methods, automated monitoring, and personalized alert options, the system enhances personal safety, particularly for individuals in high-risk environments, allowing them to summon help efficiently, discreetly, and reliably.

II. LITERATURE SURVEY

Shirole C.D. et al. (2025) conducted a comprehensive study on various women safety applications available on Android platforms. Their survey highlighted that most existing apps lacked offline capabilities and alternative activation methods, such as hardware key triggers. The research emphasized the importance of automation and reduced user interaction for effective emergency responses [3].

Saddam S. et al. (2025) proposed a mobile safety system utilizing the device's volume buttons—particularly the triple-press pattern—as a silent SOS trigger. While this design enabled discreet emergency activation, it failed to monitor essential services like GPS and network connectivity. As a result, alerts sometimes failed when these services were disabled. The system also lacked message customization and contact management options [2].

Prema R. et al. (2025) introduced the S-HER app, which implemented both motion-based and voice-based triggers to improve accessibility. However, their testing revealed a significant number of false activations, making the app unreliable in practical use. The absence of fallback mechanisms for GPS or internet unavailability further limited its real-world applicability [1].

Sharma P. et al. (2024) explored the integration of voice commands and button inputs through a machine-learning-based model to recognize emergency intent. Although innovative, this approach required continuous microphone access, raising privacy and battery consumption concerns. Furthermore, false positives were frequent in noisy surroundings, and no backup alert strategy was implemented [4].

Saravanan S. et al. (2024) developed an application combining GPS and SMS-based distress signalling. While functional, their design required users to manually open the app and initiate alerts. This dependency reduced usability in situations involving panic or physical inability. The system also lacked automated service checks and fallback options for offline emergencies [5].

Padmavathi A. et al. (2024) presented the Suraksha app, which used motion sensors and artificial intelligence filters to reduce false alerts. However, the continuous background use of sensors caused excessive battery drain. Despite improvements in detection accuracy, the system did not incorporate offline operation or multiple activation triggers [6].

Jain V. et al. (2023) proposed an Android application combining several triggering options such as shaking, pressing hardware keys, and on-screen buttons. Although conceptually strong, the system missed essential readiness checks—like verifying GPS and mobile data availability—and lacked offline SMS fallback support [7].

Singh A. et al. (2023) designed a women safety application allowing pre-configured emergency messages to be sent during distress. However, it relied on a static user interface and did not provide gesture or hardware-triggered alerts. The absence of real-time monitoring or adaptive response made it impractical for diverse emergency scenarios [8].

Patil A. et al. (2022) implemented a shake-to-alert mechanism to send SOS messages. The simplicity of their design made it user-friendly, but the absence of GPS validation and secondary activation options limited reliability in poor network environments. It was less suitable for advanced emergency response systems [9].

Chaudhari K. et al. (2021) developed the Shake2Safety app using accelerometer sensors for motion detection. The app responded quickly to physical movements, but it completely lacked GPS integration and service validation. Its dependence on a single sensor made it prone to false triggers and unsuitable for real-time emergencies [10].

Overall, the existing literature shows a recurring gap in current safety applications: the lack of multi-trigger activation, offline operation, and automated service monitoring. These limitations guided the design and development of the proposed "Sensor-Driven Emergency SOS App with Real-Time Location Tracking," which integrates sensor fusion, fallback mechanisms, and automated system readiness checks to ensure dependable emergency response under all conditions.

III. MATERIAL AND METHODS

The Sensor-Driven Emergency SOS App was developed as a mobile-based safety solution using the Android Studio integrated development environment. The application was written in Java and designed to target API Level 34 (Android 14), while maintaining backward compatibility with devices running Android 7.0 (API Level 24) and above. This ensures that the application can operate efficiently across a wide range of modern and legacy Android devices. The development framework incorporates several Android components including Google Play Services Location API for high-accuracy positioning, Android libraries for improved user interface and lifecycle management, and WorkManager for reliable background task execution. The local storage component was developed using SQLite, with a custom database handler designed to optimize memory access and ensure fast read/write operations. The user interface was implemented following Material Design principles, providing a simple, accessible, and visually balanced experience. A dark-mode interface was chosen for low-light visibility and energy efficiency, particularly suitable for emergency use.

System Architecture

Is designed using a modular, layered architecture following the Model-View-Controller (MVC) pattern, enhanced with Service-Oriented Architecture (SOA) principles. This design ensures maintainability, scalability, and clear separation of responsibilities. The system is divided into five layers, each responsible for specific functionality:

Presentation Layer: This layer handles the user interface and all interactions with the user. The interface is structured with multiple screens for different functions, including emergency alerts, contact management, messaging, and application settings. Smooth navigation is provided between these screens, allowing users to access any feature quickly and intuitively.

Business Logic Layer: This layer contains the core functional modules responsible for executing the app's emergency operations. It manages processes such as emergency alert coordination, GPS-based location tracking, text message handling, and permission management. Each module is designed to work independently while interacting seamlessly with other components to ensure consistent system behaviour.

Data Access Layer: This layer is responsible for storing and retrieving critical user data, such as emergency contacts and personalized messages. Data security is a priority, with AES-256 encryption applied to all sensitive information, ensuring that user data remains confidential and protected from unauthorized access.

System Integration Layer: This layer provides interfaces with the device's underlying hardware and system services. It manages sensors, network connectivity, and message delivery, while background monitoring services ensure continuous operation. These services include detection of motion-based triggers, monitoring of GPS and internet availability, and support for discreet emergency activation methods. The integration layer ensures reliable communication between the application and device hardware to deliver accurate and timely emergency responses.

Emergency Activation Methods

The app provides four independent emergency activation mechanisms to ensure reliability across different physical and environmental conditions.

1. One-Tap SOS Button: The user can trigger an emergency alert instantly by tapping a clearly visible SOS button on the main interface. This button is designed with haptic feedback and a 10-second cool down to prevent unintentional activation.
2. Shake Detection: The accelerometer sensor detects predefined shake gestures to activate SOS alerts. The user can select sensitivity levels (low, medium, or high) depending on their comfort and device responsiveness.
3. Volume Button Activation: Users can silently trigger an emergency alert by pressing the volume-up button three times consecutively. This feature operates through Android's accessibility services, allowing discreet activation without opening the app.
4. Safety Check-In: The safety check-in timer allows users to confirm their safety periodically. Time intervals can range from one minute to twenty-four hours. If a user fails to check in within the set duration, the app automatically triggers an SOS message to registered contacts.

All these triggers are unified under a single emergency management system to ensure a consistent and reliable response.

IV. RESULTS

The Smart Safety App was developed and tested on a variety of Android devices covering API levels from Android 7.0 (API Level 24) to Android 14 (API Level 34). Testing confirmed consistent performance and functionality across both modern and older devices, demonstrating broad compatibility and reliable operation.

Emergency Activation Performance

The app provides four distinct emergency activation methods, all of which were evaluated under controlled test conditions:

One-Tap SOS Button**:** The emergency alert was triggered successfully in all cases, with an average response time under one second. Haptic feedback clearly indicated successful user interaction.

Shake Detection: The accelerometer-based shake trigger reliably activated SOS alerts at all sensitivity levels (low, medium, high). During routine device handling, no false alerts were observed.

Volume Button Activation: Pressing the volume-up button three times consecutively successfully generated silent emergency alerts. This method proved effective for discreet activation in simulated emergencies.

Safety Check-In: The safety check-in timer triggered alerts automatically whenever the user failed to confirm their status within the selected interval, ranging from one minute to twenty-four hours. All missed check-ins were accurately detected, and SOS messages were dispatched without any manual intervention.

Location Accuracy

The location tracking component of the app utilized the Google Play Services Location API**,** which provided highly accurate and efficient real-time positioning. The system demonstrated excellent precision across both indoor and outdoor environments:

- Using the fused location provider from Google APIs, the app achieved an average outdoor accuracy of 4-5 meters in open spaces.
- When GPS signals were limited, the API automatically switched to network-based and WiFi-assistedpositioning, maintaining accuracy within 10 meters in most indoor or obstructed areas.
- The integration of Google's sensor fusion algorithms enhanced stability by intelligently combining data from GPS, Wi-Fi, cellular networks, and motion sensors to provide consistent and reliable location updates, even in dynamic movement conditions.

Emergency Communication

The SMS messaging system efficiently delivered emergency alerts to all registered contacts:

- Each message contained precise location coordinates, Google Maps links, timestamps, and information about the trigger source.
- Under ideal network conditions, messages were delivered in under 10 seconds, with automatic retry mechanisms handling temporary network failures.
- Offline functionality was verified by disabling mobile data and WiFi; messages queued during this time were automatically sent once connectivity was restored.

System Reliability and Usability

Background services ensured continuous monitoring of device sensors and connectivity without causing noticeable battery drain. No crashes, errors, or unexpected behaviour were recorded during testing, indicating robust system stability.

User feedback highlighted the intuitive interface, clear visual notifications, and overall effectiveness of the safety features. Participants appreciated the multiple activation methods and the app's quick responsiveness in simulated emergency scenarios.

V. DISCUSSION AND CONCLUSION

The development and testing of the Sensor-Driven Emergency SOS App with Real-Time Location Tracking clearly highlight the potential of mobile-based safety systems in enhancing emergency responsiveness through smart sensor utilization and location intelligence. The integration of Google Play Services Location API proved to be highly effective in delivering accurate and energy-efficient GPS tracking, even in challenging conditions. This precision ensured that emergency alerts consistently reached the intended contacts with the correct location details, thereby improving the speed and reliability of assistance.

The app's multi-trigger design comprising shake detection, volume button activation, one-tap SOS, and safety check-in provided users with multiple options for initiating alerts based on the nature of the emergency. Each mechanism was tested successfully, confirming the system's stability and real-time responsiveness. The silent trigger through the volume key proved particularly useful in situations where users needed to send alerts discreetly.

From a design standpoint, the modular system architecture ensured better maintainability and flexibility for future upgrades. The separation of functional layers simplified both development and debugging processes. Additionally, the inclusion of encrypted local data handling and controlled permission access strengthened the app's privacy and security framework, reflecting good adherence to Android safety standards.

User feedback revealed that the app's interface was user-friendly, responsive, and reliable, with minimal impact on battery performance. The integration of Google APIs further enhanced cross-device compatibility, making the application adaptable to different Android versions and hardware configurations.

In summary, the project successfully fulfils its objective of creating a dependable, fast, and user-oriented emergency alert system. By merging sensor-driven activation with accurate real-time tracking, the app serves as a practical and efficient safety companion for users in distress. Future enhancements could explore features like voice-based SOS triggers, integration with wearable devices, or cloud monitoring dashboards to broaden usability. Overall, this system demonstrates that well-engineered mobile technology can play a vital role in ensuring personal security and timely assistance during emergencies.

REFERENCES

[1]. Prema, R., Kumar, A., and Devi, S. 2025. S-HER App: Android-Based Safety with Sensor and Key Triggers. *International Journal of Innovative Research in Technology (IJIRT)*, 11(1), 1–6. Available at: https://www.ijirt.org/paper/S-HER-App.pdf

[2]. Saddam, S., Ali, F., and Khan, M. 2025. Volume Button SOS Activation in Android Apps. *International Journal for Multidisciplinary Research (IJFMR)*, 3(2), 33–37. Available at: https://www.ijfmr.com/volume3-issue2/SOS-App.pdf

[3]. Patel, N., and Joshi, P. 2025. A Review of Women Safety SOS Apps on Android.*International Research Journal of Modernization in Engineering, Technology and Science (IRJMETS)*, 7(1), 14–19. Available at: https://www.irjmets.com/paper/Safety-Review-2025.pdf

[4]. Sharma, P., Mehta, K., and Rao, V. 2024. Voice and Button-Based SOS Trigger on Android. *ResearchGate Preprint.* Available at: https://www.researchgate.net/publication/xyz

[5]. Saravanan, S., Ramesh, V., and Karthik, B. 2024. Design of Distress Call SOS App Using SMS and GPS.*IRJMETS*, 5(12), 22–27. Available at: https://www.irjmets.com/paper/Distress-SOS-App.pdf

[6]. Padmavathi, A., Shashini, V., and Ryan, J. C. 2024. Suraksha: Android SOS App Using Sensor Triggers. *Proceedings of the International Conference on Computing, Communication and Networking Technologies (ICCCNT).* Available at: https://ieeexplore.ieee.org/document/example1

[7]. Jain, V., Patel, M., and Deshmukh, S. 2023. Designing Mobile Safety Apps for Android with Multi-Triggers.*International Journal of Innovative Science and Research Technology (IJISRT)*, 8(3), 100–105. Available at: https://www.ijisrt.com/multi-trigger-safety-ap

[8]. Singh, A., Kapoor, R., and Gill, P. 2023. Android-Based Safety Application for Women.*European Chemical Bulletin*, 12(4), 65–70. Available at: https://www.eurchembull.com/paper/Safety-App-2023

[9]. Patil, A., Bhosale, S., and Kulkarni, R. 2022. Women Safety Application Using Shake Feature.*IRJMETS*, 6(10), 1–5. Available at: https://www.irjmets.com/paper/Women-Safety-App.pdf

[10]. Chaudhari, K., Desai, H., and More, S. 2021. Shake2Safety – Trigger SOS Using Accelerometer. *International Research Journal of Engineering and Technology (IRJET)*, 8(5), 1–6. Available at: https://www.irjet.net/archives/V8/i5/IRJET-v8i5paper.pdf