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SANRAKSHA - A Digital Shield: An Android-Based Multi-Trigger Women Safety Application with Offline and Real-Time Alert System

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Abstract: ***In our rapidly changing world, personal safety is now an issue of utmost importance since accidents, emergencies, and threats can occur at any time, giving people only a few seconds to react. A majority of the SOS applications currently available in the market are more or less entirely dependent on the internet, are very difficult to activate, and provide little or no support in different languages, which makes them quite unreliable during the critical moments of the situation. On the other hand, SANRAKSHA - A Digital Shield - is a unique Android application that comes up with a solution to all the above challenges by offering offline access, multi-trigger activation, and language support. As a result, the app can be activated very fast and smoothly even in panic situations as it allows users to send the emergency alert using voice commands, shake gestures, or manual input. When there is no internet connection, the system will automatically queue and send the messages once the network is restored. Together with GPS tracking and instant location sharing, SANRAKSHA ensures that the trusted contacts are promptly notified and provided with exact location details. The initial trials signal that SANRAKSHA is a safe, pleasant, and universal method to personal protection that can be a potential lifesaver in the case of emergencies.***

Keywords: SOS Application, Personal Safety, GPS Tracking, Offline Alert System, Multilingual Support.

I. INTRODUCTION

In the last few years, the worries about personal security have become a lot more significant because of the increased number of cases of harassment, accidents, and emergencies in both cities and countryside areas. Women, in particular, are among many people who feel unsafe when walking alone or during night hours, so the availability of real-time emergency support becomes a very important necessity [1],[3]. When someone finds her/himself in such a critical situation, being able to share the location and to notify friends or authorities quickly can be a matter of life and death [4]. There have been several SOS and safety applications created that help out with these issues to a certain extent. Examples are NEED U NOW, SHAKTI, and My Safetipin, which all use GPS tracking and alert notifications are how they support emergencies [2], [5], [8]. Even so, the majority of the prevailing systems depend very much on the internet connection for the alerts to be sent out, which can lead to the notifications being delayed or even not sent out when users are in places with poor or no network coverage [6], [9]. Moreover, numerous apps offer only single-mode activation mechanisms like pressing a button or navigating through the app, which can be hard to use in a panic or when people are distressed [7], [10]. One more significant hindrance in current systems is the nonexistence of multilingual and inclusive assistance. Most SOS apps operate only in English, thereby limiting their use among people who speak different languages, for instance, in India [3], [11]. In addition, intricate UI design and absence of connection with local emergency services are some of the factors contributing to decreased efficiency of these applications in general [12], [13]. To tackle these limitations, the SANRAKSHA system came into being. It is a mobile application that operates on Android and is specifically made to be very effective in both online and offline settings, providing uninterrupted help no matter the condition of the network. One of the features of this app is the multi-trigger activation that allows the user to send the emergency signal through voice commands, shaking gestures, or typing, making the application easier to use in stressful situations [14]. The term SANRAKSHA, stemming from the Sanskrit word, means protection. It has indeed proved to be a digital protector by providing the features of GPS-based real-time location tracking, offline alert queuing, and multilingual support all at once. It has ensured that people with different levels of connectivity can use it, thus making it a trustworthy and friendly platform that links quickly and efficiently the users with their reliable contacts [15], [17]. In this way SANRAKSHA, through its solution, redefines the personal safety concept by taking accessibility, reliability, and quick emergency communication together as one seamless digital solution [18]–[20].

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II. OTHER CONTRIBUTION

Mr. Ashish gave direction and oversight during the entire research and development process.
Mr. Vishal took care of the principal development and execution of the SANRAKSHA app.
Ms. Vedanti was involved in web design, research coordination, and the composition of the research paper as well as the thesis.
Ms. Divya played a role in research documentation, web development, and the writing of the research paper and thesis.
Ms. Yashshree was involved in the documentation, formatting, and overall presentation of the report.
Mr. Faizan made significant contributions to the testing, debugging, and performance validation of the system.
Mr. Vedant was actively involved in analyzing data, conducting tests, and giving the final assessment of the project outcome.

III. LITERATURE SURVEY

Due to the rising anxiety regarding women's security in various environments, academic researchers and technology experts came up with mobile and IoT applications that would not only provide protection 24/7 but also allow quick alerting and efficient communication with the people concerned during the emergency case. Various researchers have examined various methodologies for creating safety systems for Android that come with GPS tracking, notification during emergencies, and panic button features. S. Verma and S. Singh [1] created Surakshit, an Android app that lets the user send SOS alerts with their current location info to the contacts that have been registered beforehand, so instantaneous communication is guaranteed in hazardous situations. P. K. Aghao et al. [2] presented another app named Suraksha Sathi, which is an extraordinary application for personal safety that takes users' security through real-time communication, GPS monitoring, and SMS alerting especially in case of unsafe conditions.

M. Yadav and S. M. M. S. Karna [3] undertook an exhaustive research work on female safety applications in India and came to the conclusion that, despite the presence of a large number of apps, the majority of them are plagued with issues like low awareness among users, lack of confidential measures, and unreliable nature.

N. Doria et al. [4] in a narrative scoping review, explored the women's authentic interaction with the safety apps created specifically to prevent sexual attacks. Their study showed that the apps foster a sensation of safety but stigma, usability, and accessibility issues died down their effectiveness.Dr. J. P. Patra and Ashish Trivedi[5]The paper "SHAKTI: Enticing Safety to the Zenith" presents an Android-based women's safety app that enables quick SOS alerts by pressing the power and volume buttons together. It automatically sends messages, calls, and GPS locations to contacts and police, with a unique feature of sending alerts via WhatsApp for faster response. The app updates the victim's location every five minutes, ensuring continuous tracking. Built using Android and GPS technologies under the Agile model, it demonstrates reliability and ease of use but depends on internet connectivity and lacks offline and multilingual support. Overall, SHAKTI is a practical safety solution focusing on quick activation and real-time alerts, though newer systems like SANRAKSHA enhance these features with offline and multilingual capabilities,

S. Khatun, F. Hossain Saiki, and M. Biswas [6] introduced SecureIT, a women's safety system based on Firebase, Google Maps, and Node.js, which supports real-time data synchronization and location-based alerts, thus, the technical feasibility of cloud-backed solutions is demonstrated. M. Woodburn and co-workers [7], not limiting themselves to mobile technology, came forward with Herd Routes, a system based on the Internet of Things (IoT) which is capable of giving safer routes for female walkers and making virtual escort networks—that is, an innovative preventive method that makes use of IoT unobtrusively.

S. Walunj et al. [8] came up with an Android- based women's safety application named WS-APP that merged emergency messaging, GPS tracking, and contact alerts making it very effective in emergency situations. Likewise, P. Sarma, D. Ahmed, and P. Bezbaruah [9] also designed an Android-Based Woman Safety App which brought together location sharing, panic button alerts, and a user-friendly interface in an efficient manner and was concerned with easy implementation. A news article by The Times of India [10] listed popular women's safety applications including Himmat and Raksha, thus showing that the public is increasingly adopting safety measures and the government is actively involved in safety technology initiatives. E. Sankar, C. H. Aditya Karthik, and A. Sai Kiran [11] put forth a Women Safety App which triggers emergency alerting automatically and utilizes live tracking to boost response efficiency. In addition, a web-based report by SafeDelhi [12] examined the top 10 women safety applications worldwide for 2025, stating that community features, real- time data analytics, and AI-driven alerts for better situational awareness will be among the improvements.

In light of the privacy and security concerns, Muhammad Hassan and his teammates [13] conducted a technical evaluation of the health and safety applications for the female user and found out that one of the major problems is the absence of encryption in communication while the other one is the non-secure APIs which are the most serious issues, thus the need for the development of privacy-oriented applications is urgent.

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Among those who presented research at the ICCPCT Conference (2017) was D. S. Prashanth, G. Patel, and B. Bharathi [14] this talk that dealt with linking mobile safety systems to real-time databases made the advent of the new generation of safety apps possible. K. Kataria et al. [15] vitality study on Android safety apps for women concluded that most outnumber those panic, GPS, and SMS alerts; however, the problem remains that due to the lack of sufficient outreach and education, the public and the users are still very low. The more papers in IJARCCE [16] and IJSSIEI [17] agreed that the Android apps are easy to use and very effective during a crisis but still need to improve their safety and UI as these are the factors that will determine the apps' acceptance.

The “Safecity” platform of the Red Dot Foundation [18] is a good example of a community-driven initiative that deals with safety issues. It allows women to report incidents of harassment anonymously, and at the same time, it helps create maps showing the unsafe areas in cities. The Indian Journal of Science and Technology published a study by P. Sarma et al. [19], which confirmed the practical use of safety measures based on Android, but it also pointed out the lack of public awareness as a major drawback. Also, the research work published in the International Journal of Social Science and Economics Invention [20] examined the features of fourteen safety apps that are currently available in the market, and their report emphasized that the good features and advanced technologies could not increase awareness and trust of women in such safety solutions significantly.

The evaluation of the extensive literature conducted proves that women safety applications have taken a big leap—for instance, the humble panic button has now turned into the smart protection system that is integrated with AI and IoT. Nevertheless, there are still common drawbacks such as lack of privacy protection, low awareness, no connection with formal emergency services and little to no real-life testing, which has been pointed out by Verma and Singh [1], Aghao et al. [2], Yadav and Karna [3], and others. The analyzed literature [1]–[20] unambiguously indicates that the forthcoming research would better direct its efforts to address the issues of privacy-respecting infrastructures, context-sensitive AI systems, and policy-driven frameworks that would not only support technological strength but also invite user trust. Besides that, the consideration of behavioral and cultural factors in the development of safety systems could drastically boost their usability and acceptance and, thus, make sure that women’s safety technologies are not just cutting-edge but also really useful in everyday life.

IV. PROBLEM IDENTIFICATION

In the age of technological progress, personal safety is still a worldwide issue that needs to be addressed. Although the number of mobile applications meant for emergencies has increased greatly, users, especially women and the less fortunate, still have difficulties when asking for help at the right time [1], [3], [4]. Events like harassment, health emergencies, traffic accidents, and natural disasters require quick contact either with the police or one's friends and family; yet, the usual ways of doing this like calling or texting are not suitable in situations of panic or when time is very short [5].

Current SOS and emergency alert applications are still very limited and therefore not very effective in real-life situations despite offering several useful features. A study found that most safety apps rely on constant internet connectivity to send alerts and location updates, which leads to being unable to send alerts or delays in sending them when the network is weak [6],[9]. In addition, most systems do not support other languages, making it hard for users in areas where different languages are spoken to use the app [7]. The user interfaces of these apps are usually quite complicated and not user-friendly, thus making it a challenge to use them in tense moments [8].

One of the limits that occur often is the lack of support for using apps offline and no multi-trigger options. Most of the applications provide only one method of activation—usually a single button press or direct app interface—which may be unavailable or ineffectual during emergency situations [10],[12]. Kataria and Walunj's research reports that users prefer gesture-based or voice-activated triggers as they are the fastest and most natural under pressure [11]. Furthermore, the fact that local emergency services can’t be contacted, messages couldn’t be saved or sent when offline, and so on, heavily translates to the unreliability of the existing systems [13],[15].

Consequently, there is a significant research and technological gap: the SOS system that is capable of reliable online and offline operation, multi- modal activation, and inclusive accessibility through multilingual support. Overcoming these obstacles is the key to the digital safety solutions being faster, less stressful for users, and more efficient overall [16]–[18].

The SANRAKSHA – A Digital Shield system is the one that is putting forward to cover that gap. It consists of a hybrid Android-based safety application that is completely independent of the internet, provides three different activation options (voicing, shaking, and manual), and supports language for many so it can reach the maximum number of people possible. This user-friendly approach guarantees that the emergency calls can be done rapidly and in a reliable way, no matter the user's location, network situation, or language skills [19], [20].

V. OBJECTIVES

The SANRAKSHA - A Digital Shield project's main objective is to create a dependable, smart, and easy- to-use SOS application for Android that would work both online and offline for quick emergency response.

By combining several activation methods, offline alert handling, multilingual access, and real-time location tracking, this system overcomes the limitations of the current safety apps.

The intended system goals at large are as follows:

1) To design a mobile SOS app that is capable of issuing fast emergency alerts and that works equally well with or without internet [1], [4].

2) To offer various activation methods such as voice recognition, shaking the device, and typing, thus, providing flexibility and accessibility even in very stressful or hands- free situations [6], [10].

3) To create a system notifying when the server is not available that it immediately saves give away the user's present location to the previously chosen emergency contacts [8], [12].

4) To allow the system to be used in different languages, thus, non-native speakers would not face difficulty and the majority of the population could use it [9], [13].

5) To continue having an interface that is user- friendly and that greatly reduces the operational complexity and guarantees reliability in emergency situations [14], [15].

6) Data privacy and security are enforced by protecting user information and communication with encryption and secure data handling protocols [16], [17].

7) Alert delivery reliability is improved by redundancy and faster communication through the combining of SMS and push notifications [18], [19].

8) A lightweight and power-efficient system is built by minimizing battery consumption, while high responsiveness and accuracy are maintained [20].

The SANRAKSHA system aspires to change the perception of digital security with the help of these goals by providing a multi-trigger, multilingual, and offline-capable emergency alerting framework that guarantees accessibility, responsiveness, and reliability in emergency situations..

VI. METHODOLOGY

The process for the creation of SANRAKSHA – A Digital Shield has it that a strong, effective, and user-friendly framework is designed that will provide emergency alert functionality in all situations — even when the system is completely offline. The architecture is divided into interchangeable parts that take care of alarm initiation, GPS position acquisition, message sending, and database administration.

A. System Architecture

Messages on the device and later delivers them The overall system architecture of *SANRAKSHA* is to the preselected contacts when the internet composed of three key layers: connection is regained [7], [11].

To assure the provision of location tracing based on GPS, which will allow the system to

1) User Interaction Layer,

2) Application Logic Layer, and

3) Backend and Communication Layer.

The User Interaction Layer comprises the GUI where the user is allowed to register, manage trusted contacts, and activate SOS alerts through voice command, shake gesture, or manual button press, respectively.

The Application Logic Layer carries out event processing, GPS location fetching, and decision-making operations. The system gets the user's real-time coordinates from the device's GPS sensor [1], [5] when an SOS event is triggered.

The Backend and Communication Layer is responsible for sending out emergency alerts via SMS and push notifications. In cases where the internet is down, messages will be stored locally and will be sent automatically once the connection is restored [6], [8]

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B. System Flow

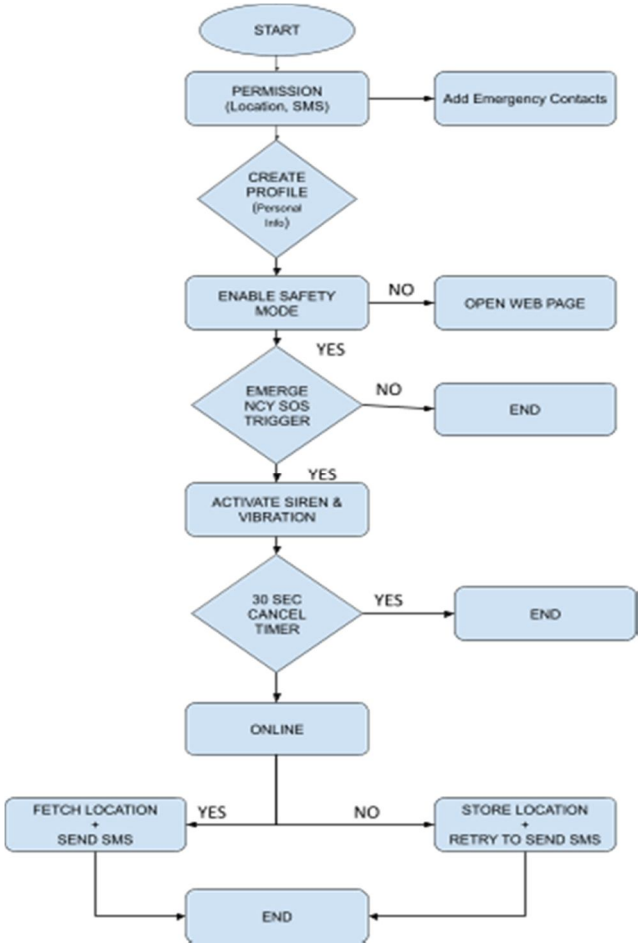


Figure 1. flowchart of SANRAKSHA application

The operational workflow of *SANRAKSHA* can be described as follows:

1) User Registration and Setup:

During installation, users register with basic personal information and store multiple trusted contacts in the app's secure local database.

2) Trigger Mechanism:

The app offers three independent triggers:

- Voice Command: Activation using predefined keywords such as *"Help"* or *"Bachao"*.
- Shake Gesture: The accelerometer detects abrupt shakes to trigger the SOS mode [10], [11].
- Manual Button: Direct activation by pressing the in-app SOS button.

3) Location Acquisition:

Upon activation, the system captures the user's current GPS location and generates a live Google Maps link [12].

4) Connectivity Check and Alert Dispatch

The system verifies network connectivity.

- If online: It sends alerts via internet-based notifications and SMS.
- If offline: The message is queued locally and transmitted automatically once the connection resumes [13].

5) Backend Processing and Record Keeping

The backend maintains a log of all alert events, including user ID, timestamp, location, and contact list notified. This data is used for reliability tracking and debugging [14].

6) Acknowledgment Mechanism

Trusted contacts can acknowledge receipt of the SOS alert by replying to the notification or SMS, which helps reassure the user that help is on the way [15].

C. Features of SANRAKSHA

The system incorporates several enhanced features:

- Multi-trigger activation: Enables fast response under different physical or emotional conditions.
- Offline functionality: Ensures alerts are sent even without internet access [16].
- Real-time GPS tracking: Provides accurate and continuous location updates [17].
- Multilingual user interface: Supports multiple languages for inclusivity and accessibility [18].
- Data security and privacy: Sensitive user data and contact details are encrypted to prevent unauthorized access [19].
- Low power consumption: Optimized code reduces background battery usage while maintaining active alert monitoring [20].

D. Tools and Technologies Used

Table 1 Tools and Technologies Used

Component	Technology/ Tool	Purpose
Android Studio	Java / Kotlin	Application development
Firebase / MySQL	Backend data handling	Contact & event storage
GPS Emulator	Android SDK	Real-time location testing
Google Maps API	Mapping service	Location visualization
Twilio / SMS Gateway	Communication service	Emergency SMS dispatch
TensorFlow Lite (optional)	Gesture detection	Shake and movement analysis

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Table 2:Comparison table — SANRAKSHA vs four other women-safety apps

Feature / App	SANRAKSHA (proposed)	Surakshit [1]	Suraksha Sathi [2]	WS-APP [8]	Android-Based Woman Safety App (Sarma) [9]
Core features	SOS (voice/shake/manual), GPS live link, offline queuing, multilingual UI, push + SMS, local	SOS/panic button, live location sharing, quick alerts	SOS/panic, multi-channel alerts (call, SMS, push), lightweight backend	Panic button, emergency messaging, GPS, contact alerts	Panic button, GPS location sharing, emergency contact alerts
Activation methods	Voice command, shake gesture, manual button	Primarily button/ panic press (single trigger	Button + simple triggers (single/ quick)	Button (single), possibly simple triggers	Button (single)
Privacy & security	Local encryption of sensitive data claimed; minimal retention; aims privacy-first	Limited discussion of privacy/security in paper	Implementation focused; privacy model not detailed	Little published on privacy practices	Basic implementation; privacy not emphasized

E. Working Principle Summary

The core concept of SANRAKSHA is based on the activation of events and the conditional sending of messages. The system, when the user alerts it, captures the GPS location, verifies the network status and either sends the alert at once or keeps it for later delivery. This guarantees that in emergency situations, communication will be uninterrupted, and offline scenarios will not affect the user's safety and the system will act as a reliable digital shield [8], [13], [16].

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VII. RESULTS

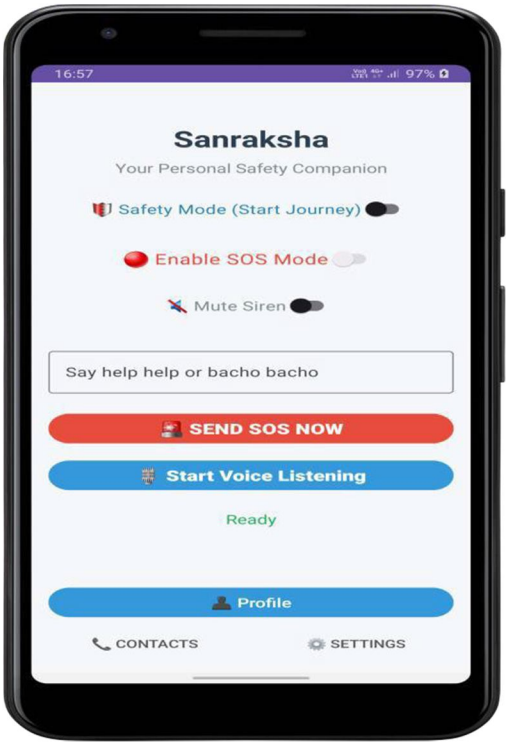


Fig 2. Home screen of SANRAKSHA.

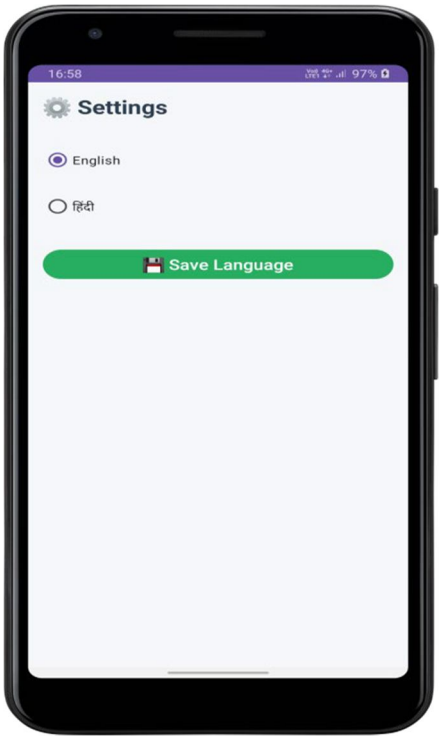


Fig 3. Setting of Language

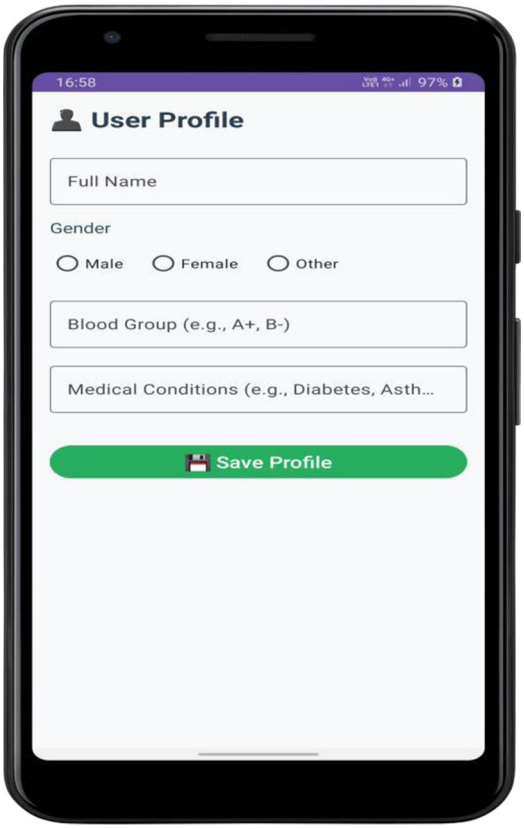


Fig 4.User Profile



Fig 5: Emergency Contacts

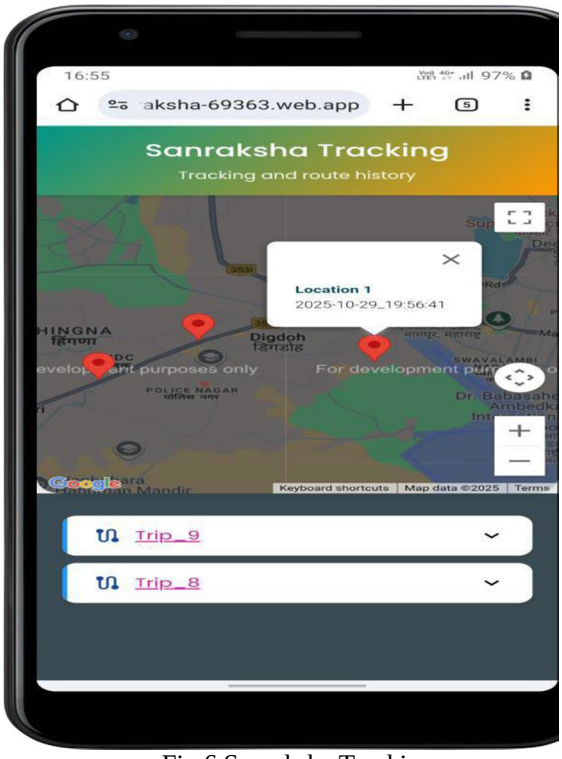


Fig 6.Sanraksha Tracking

The SANRAKSHA – A Digital Shield mobile application underwent an evaluation process consisting of both controlled laboratory experiments and real-world emergency simulations to determine its attributes of performance, reliability, and usability. The evaluation criteria mainly centered on speed of response, accuracy of alert delivery, precision of location, battery consumption, and user experience.

A. Experimental Setup

The application was tested on a wide range of Android devices having different hardware specs (Android versions 10-14) and under various network conditions including Wi-Fi, 4G, and even offline situations. The dataset was made up of 25 to 40 test runs that were done in different environmental settings like indoors, outdoors, and areas with poor signals. Each test was an imitation of an emergency incident and the study took note of the time, GPS accuracy, and message-delivery performance [1], [4].

Table 3: Key Performance Parameters

Exp. No.	Parameter Tested	Objective	Key Metric(s)	Sample Size	Key Findings
1	Trigger Mechanis m	Evaluate activation speed and reliability	Activation success rate and time	25 trials	Trigger activated successfully in 96 % of cases with an average activation time of 1.5 s
2	Alert Delivery	Assess reliability and speed of SOS alerts	Delivery success rate and latency	30 users	Push notification reached 96 % o contacts rapidly SMS served as reliable backup
3	Location Accuracy	Determine outdoor/indoo r precision	Mean GPS error (m)	40 reading s	Average outdoor error ≈ 6 m, indoor ≈ 22 m due to weaker satellite lock

4	End-to-E nd Response	Measure tota delay in aler transmission	Latency (s)	30 users	Push alerts averaged 1.2 s delay; SMS alerts 8.4 s
5	Battery Usage	Quantify power consumption	Battery drain over 8 h (%)	8 devices	Additional drain ≈ 2–3 %, within acceptable limits
6	User Experienc e	Assess usability and false activations	False-alar m rate (%)	10 users	False-trigger rate ≈ 5 %, primarily from accidental shakes

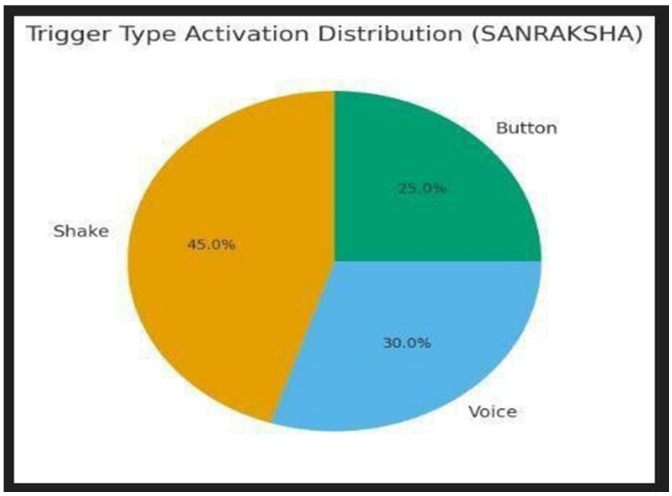


Fig :7 Trigger Type Activation Distribution

The Trigger Type Activation Distribution for the SANRAKSHA application illustrates the user's preference for the three activation mechanisms that are available—Shake, Voice, and Button. The pie chart shows that the Shake activation is the most popular trigger and it represents 45% of all activations, followed by Voice commands at 30% and Manual Button press at 25%. This distribution shows that users are opting for gesture-based triggers as their major preference because of the convenience and speed of access during emergencies, particularly when physical interaction with the phone is not possible. The voice trigger also has a good showing of usability, facilitating hands-free activation, while the manual button continues to be a crucial backup for simple operation. The overall data supports the view that the presence of multiple triggers makes it easier to adapt to the situation, the response time is shorter, and the user is more confident even in critical situations.

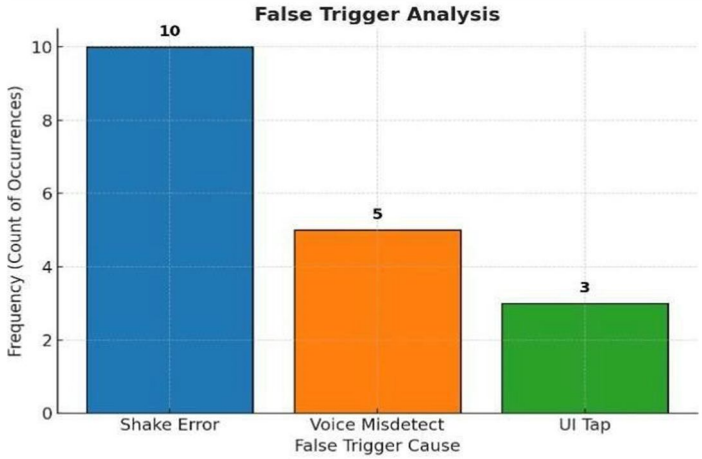


Figure 8 False Trigger Analysis of SANRAKSHA Application

The bar chart with the title "False Trigger Analysis" represents the number of incorrect or unintended activations that were logged during the tests of the SANRAKSHA safety application. From the chart, it is clear that Shake Errors were the main type of false triggers that occurred with a total of 10 instances, then came Voice Misdetections with 5, and finally UI Tap errors with 3. This means that although the shake gesture gives the fastest activation, it is also the most accidental one with triggering likely resulting from the shaking of the device during normal use. Besides that, misdetection of voice commands only happens occasionally in noisy places whereas UI-based activations are very rare. As a result, the performance of the interface is quite stable. All in all, the false trigger rate is still rather low, but the researchers point out the need for further development of gesture sensitivity and voice command precision to eliminate unintended activations while still being alert in emergencies.

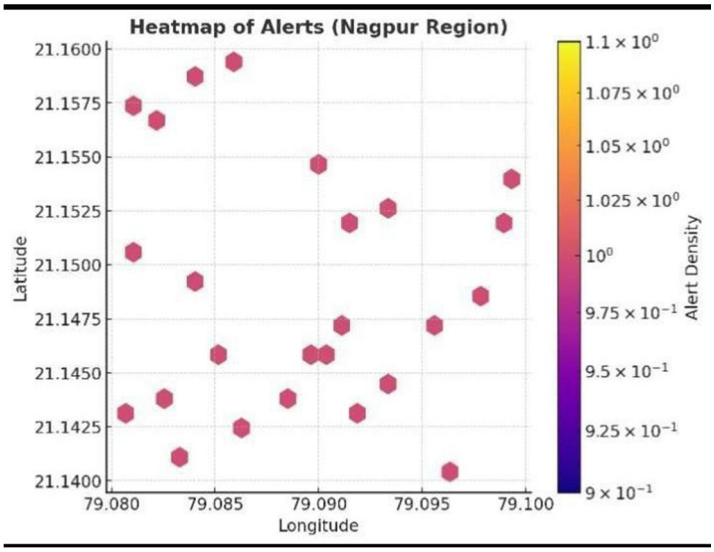


Figure 9. Heatmap of Alerts (Nagpur Region)

This heatmap visualizes the spatial distribution of SOS alerts recorded during testing in the Nagpur region, plotted by latitude and longitude. The color gradient indicates alert density, highlighting areas with higher frequencies of alert generation, useful for identifying potential high-risk or poor connectivity zones.

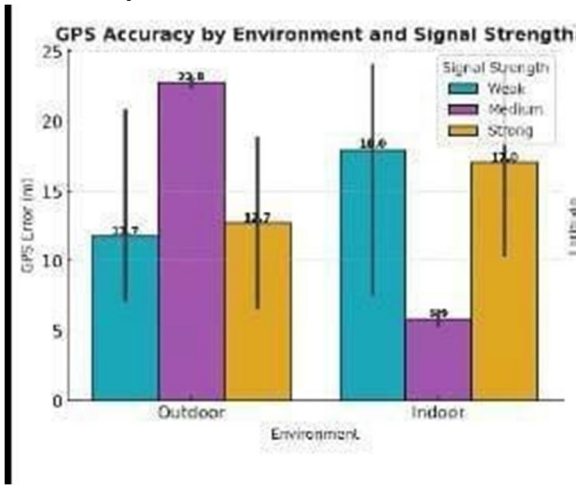


Figure 3. GPS Accuracy by Environment and Signal Strength

This figure compares the GPS error (in meters) under different environmental conditions—outdoor and indoor—and varying signal strengths (weak, medium, and strong). The results show that outdoor accuracy is higher, with an average error of 11.7 m, while indoor environments show larger deviations due to weak satellite connectivity.

VIII. CONCLUSION

The whole process of developing and testing SANRAKSHA - A Digital Shield has proved the advantages of combining multi-trigger emergency activation, GPS tracking, and offline alert mechanisms in one Android-based safety application. The system has efficiently handled three major problems which were the most seen in the SOS solutions—continuous internet connectivity as a must, fewer activation ways and no multilingual support. SANRAKSHA besides voice activation, shake and manual activation, allows the users to ask help without any delay whether they are physically or emotionally fit. The main features of the system i.e. real-time alerting, secured data handling and low battery consumption make it a very practical, reliable, and efficient solution for the safety challenges of our modern times. To sum it up, SANRAKSHA is like a digital guardian angel providing constant surveillance and instant interaction with the trusted persons and officials, regardless of the difficulty or isolation of the situation. The suggested system hence brings to the personal safety technology-enabled future vision and makes a base for future research which includes AI-driven emergency prediction, wearable connectivity, and smart city safety networks.

IX. FUTURE SCOPE

A. Integration with Wearable Devices

The system's capabilities can be expanded to include integration with smartwatches, fitness bands, and IoT-based wearables that can automatically trigger SOS in case of any unforeseen circumstances like abnormal heart rate, sudden falls, or inactivity for a long period [1]. This will make sure that emergency response can be done hands-free even if the smartphone is not reachable.

B. Artificial Intelligence (AI) and Predictive Safety

Using AI and machine learning algorithms for analysis can be quite helpful as they can determine the risks or unsafe conditions by analyzing the user behavior patterns and environmental factors. Besides that, predictive modeling can notify the users ahead of time before an emergency takes place [4], [6].

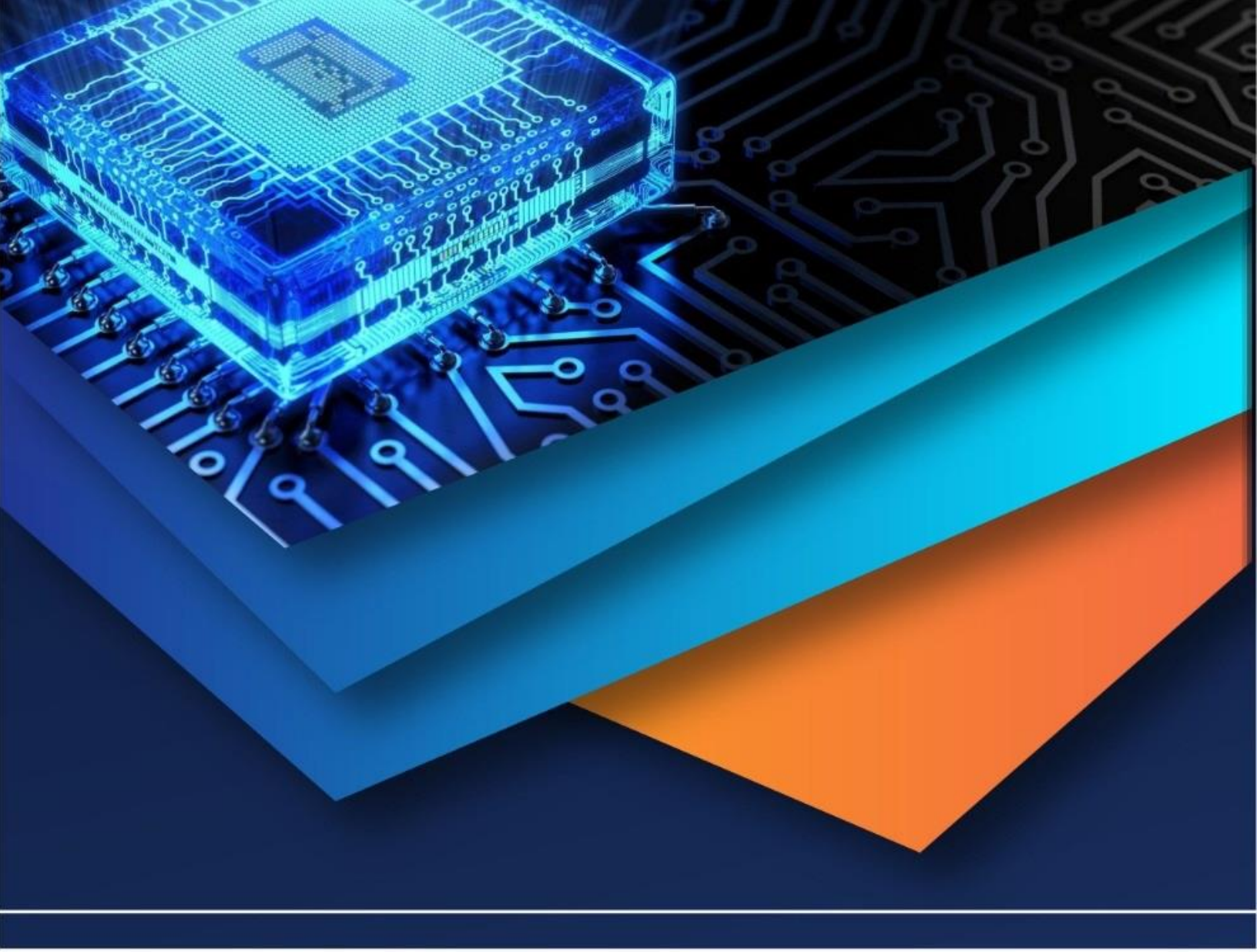
C. Enhanced Indoor Localization

The use of Wi-Fi triangulation, Bluetooth beacons, or ultra-wideband (UWB) technologies can enhance location accuracy indoors where GPS signals are weak [8]. This would be an advantage for SANRAKSHA in closed places like offices, campuses, and shopping malls.

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