

A Review of AI-Based Women Safety and Emergency Response Systems

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Abstract—Women's safety applications have increasingly adopted mobile sensing, Global Positioning System (GPS), cloud services, and artificial intelligence to support emergency communication and risk awareness. However, existing systems differ considerably in their methods of detecting emergencies and responding to them. Some applications primarily provide manual SOS functions and location sharing, while others introduce voice activation, contextual risk assessment, offline communication, predictive analysis, or evidence collection. This paper reviews recent technology-based women safety and emergency response systems, with particular attention to their emergency triggers, use of artificial intelligence, location services, evidence collection, communication mechanisms, and limitations. The reviewed literature covers mobile applications, predictive safety systems, contextual monitoring, and cloud-supported emergency platforms. The analysis shows that current solutions have improved the speed and accessibility of emergency assistance, but several systems remain focused on individual functions rather than integrated risk detection and response. Important gaps remain in continuous behaviour analysis, anomaly detection, automatic triggering, reliable operation under limited connectivity, evidence management, and reduction of false alarms. Based on these observations, the paper discusses a proposed research direction for an integrated AI-based women safety platform designed to combine predictive risk assessment, multiple emergency triggers, location tracking, evidence collection, and automated emergency response.

Keywords—Women Safety, Artificial Intelligence, Emergency Response, Predictive Risk Assessment, GPS Tracking, Voice SOS, Anomaly Detection, Mobile Safety Applications.

I. INTRODUCTION

Women's safety remains an important social and technological concern, particularly in situations where a person may be unable to manually request assistance. Mobile applications have provided a practical way to share location information, contact trusted individuals, and initiate emergency alerts. However, many safety applications still depend on the user recognizing a dangerous situation and manually activating an SOS mechanism.

This limitation is identified in the literature as a central problem. Fear, panic, injury, or physical restriction may prevent a user from operating a smartphone during an emergency. Emerging research therefore focuses on reducing dependence on a single manual trigger by combining intelligent risk detection with multiple emergency activation mechanisms. Relevant research objectives include predictive

threat detection, user behaviour analysis, anomaly detection, voice-based SOS recognition, multiple emergency triggers, automatic evidence collection, location sharing, and an analytics dashboard.

Recent research demonstrates that women safety systems are moving beyond conventional panic-button applications. GPS tracking, voice commands, contextual information, offline SMS, cloud communication, and machine-learning techniques are being incorporated into different systems. The literature reviewed in this paper includes both AI-based and conventional mobile safety applications.

For example, Darekar et al. proposed a system combining Random Forest-based analysis, voice SOS, GPS tracking, and crime hotspot prediction [1]. Yadav et al. explored contextual risk assessment using GPS, motion, and environmental information [2]. Kanse et al. focused on offline SMS, shake-based triggering, and community alerts [3]. Other studies have investigated Android-based emergency systems, cloud communication, evidence collection, and predictive safety mechanisms [5]–[13].

Although these approaches address different parts of the safety problem, the literature indicates a lack of a common integrated framework combining proactive risk assessment, behaviour learning, anomaly detection, multiple emergency triggers, evidence collection, and automated response.

This review therefore examines the existing approaches, classifies them according to their major functions, compares their capabilities and limitations, and identifies research opportunities relevant to the development of integrated AI-based women safety systems.

II. REVIEW SCOPE AND METHODOLOGY

This paper is based on literature collected through a structured review of recent women safety applications, emergency response systems, predictive safety, location tracking, and AI-assisted emergency mechanisms. The source material contains 13 references drawn from recent journal publications in this area.

The review was organized around five aspects:

- Emergency activation mechanism
- Use of AI or machine learning
- Location and contextual information
- Evidence collection and emergency communication
- Limitations and research gaps

The studies were then grouped according to their dominant functionality. This approach allows systems with different technical implementations to be compared on common safety-related capabilities.

It should be noted that the supplied project documents do not record a formal systematic-literature-review search protocol, such as specific databases, search strings, inclusion/exclusion criteria, or a PRISMA procedure. Therefore, these details are not claimed in this paper. A formal systematic review would require these elements to be documented separately.

III. TAXONOMY OF EXISTING WOMEN SAFETY SYSTEMS

Based on the reviewed literature, existing systems can be broadly classified into the following categories.

A. Manual and Multi-Trigger Emergency Systems

The first category includes applications that primarily provide an SOS mechanism for emergency communication. Traditional systems use a button to initiate an alert, while newer applications add shake detection, voice commands, or other hidden triggers.

Singh et al. proposed an Android application supporting one-touch SOS, shake detection, voice commands, GPS tracking, and multimedia recording [5]. Kanse et al. similarly introduced multiple emergency mechanisms together with offline SMS and community alerts [3]. These approaches reduce the dependence on a visible on-screen SOS button.

B. Location and Contextual Risk Systems

A second category uses location and environmental information to provide risk awareness. Yadav et al. proposed contextual risk assessment using GPS, motion patterns, and environmental information [2]. Such systems attempt to determine whether the surrounding circumstances indicate a potentially unsafe situation.

Location-based systems can also identify potentially risky areas. Rastogi et al. describe a system that provides SOS alerts and identifies crime-prone areas through map-based red-zone representation [9].

C. Voice and Audio-Based Detection

Voice-based mechanisms provide an alternative when the user cannot interact directly with a mobile interface. Darekar et al. incorporated voice SOS functionality into their system [1]. Other reviewed work also considers voice detection as a possible trigger.

Audio-based approaches, however, must handle background noise, variations in speech, accents, and unintended activation. These factors make reliable distress recognition more difficult than simple keyword detection.

D. Predictive and Evidence-Based Systems

Another category combines emergency response with prediction or evidence collection. Pawar et al. developed RescueNow with GPS tracking, silent audio-video recording, multiple SOS triggers, and machine-learning-based prediction of crime-prone zones [12].

This category is particularly relevant to proactive safety because it attempts to provide assistance before or during an emergency rather than simply sending a manually generated alert.

E. Integrated and Cloud-Supported Systems

Recent systems increasingly combine mobile applications with cloud services and multiple communication mechanisms. SecureHer, for example, integrates one-tap SOS, live GPS tracking, audio evidence recording, encrypted communication, and an AI-based safety chatbot [7].

SAHA similarly combines a mobile application with a portable hardware device and supports online and offline operation through technologies such as ESP32, GSM/GPS, and voice detection [6].

IV. LITERATURE ANALYSIS

A. AI-Based Women Safety App

Crime-hotspot prediction paired with voice-triggered SOS forms the core contribution of the system proposed by Darekar et al. [1]. A Random Forest model is used to flag potentially dangerous zones from historical crime records, while a CNN-based voice module allows hands-free activation, and GPS handles live positioning.

According to the publisher's summary, the system also incorporates a safe-route recommendation feature alongside these three components.

The reliance on historical crime data, however, is also its main constraint: the model has no mechanism for learning what is normal for a specific individual, so behaviour that is unusual for that person but occurs outside a known hotspot may go unflagged.

B. Contextual Risk Assessment

Rather than waiting for a manually triggered alert, the system proposed by Yadav et al. [2] attempts to score risk continuously, combining GPS data, motion patterns, and environmental conditions into a single danger metric.

This represents a departure from purely reactive designs, since risk is being estimated ahead of any explicit SOS event, and the use of multiple contextual variables (rather than a single triggering action) is what makes the approach relevant to predictive safety more broadly.

What the model does not do, though, is close the loop into a full response mechanism—evidence collection, automated alerting, and longer-term behaviour modelling are all left as open extensions.

C. Offline and Community-Based Safety

An offline-first design philosophy underlies SafeHer, the platform proposed by Kanse et al. [3]: built on Flutter with a FastAPI backend, it is designed so that emergency communication keeps working even without a stable internet connection. One-tap SOS, shake activation, a fake-call function, and community-based alerts are all layered on top of this offline capability.

Given that emergency applications cannot assume continuous connectivity, this design choice is a meaningful one. Community alerts, however, raise their own set of questions around privacy, consent, and the possibility of misuse or false reporting, which the offline design alone does not resolve.

D. AI Tools and Safety Platforms

Unlike the single-purpose applications discussed elsewhere in this review, the work by Tyagi et al. [4], presented as SheShield, is itself a review—surveying and

recommending AI tools applicable to women's safety rather than proposing one specific emergency system.

Its value lies in mapping out technologies that could feed into future safety platforms. Identifying suitable tools is, however, a different problem from integrating prediction, activation, evidence handling, communication, and privacy protection into one functioning system—a gap this type of work does not attempt to close.

E. Android-Based Emergency Response

The design rationale behind the Android application described by Singh et al. [5] centres on giving the user more than one way to raise an alarm: one-touch SOS, shake detection, and voice commands are all supported alongside GPS, SMS, sensor data, and multimedia recording.

Multiplying the number of possible triggers matters precisely because a user may not be able to reach or operate the interface during an actual incident.

That said, everything in the system still happens after activation. Identifying an abnormal situation before the user manually triggers anything would require a separate risk-assessment layer that this architecture does not include.

F. SAHA Women Safety Application

The online/offline duality is again central to SAHA, proposed by Shastrakar et al. [6], though here it is achieved by pairing a mobile application with a portable hardware device built around GSM/GPS, voice detection, and safe-zone definitions.

For situations where interacting with a smartphone itself is difficult, having a dedicated hardware component is a genuine advantage. That same hardware dependency, though, adds cost, complexity, and maintenance overhead that a purely software-based system would not carry.

G. SecureHer

What sets SecureHer, developed by Shastri et al. [7], apart from many of the other systems reviewed here is its inclusion of an AI-based safety chatbot alongside the more conventional one-tap SOS, live GPS tracking, audio evidence recording, and encrypted communication.

Together, these features reflect a broader shift toward integrated platforms rather than single-function SOS tools, with the chatbot in particular hinting at how intelligent guidance could be offered during an emergency.

Conversational assistance is not, however, the same thing as automated detection—reliable triggering, risk assessment, and evidence handling still have to be handled separately, and the chatbot does not substitute for them.

H. Spark Women

Salve et al. [8] proposed Spark Women as a mobile safety application for real-time emergency assistance. The work is included in this review as an example of mobile emergency assistance. The publisher confirms the paper and its March 2026 publication details.

Its inclusion in the literature review reinforces the continuing focus on mobile-based emergency support. However, the available source material does not provide sufficient technical details about the system to make a detailed algorithm-level comparison. Therefore, stronger claims should be avoided until the original paper is examined in full.

I. Women Safety Assistant

Red-zone mapping is the defining idea behind the Women Safety Assistant proposed by Rastogi et al. [9]: crime-prone areas are pre-identified, and the system warns users as they enter or approach one, on top of the more standard one-tap SOS, GPS location sharing, and emergency-contact features.

Connecting emergency response with preventive awareness in this way is a useful contribution, but it is also inherently limited to predefined risk zones—behaviour that is unusual for a specific user, or danger that arises outside those mapped areas, falls outside what the warning system can detect.

J. Smart Women Safety Application

The application developed by Shinde et al. [10] is reactive by design: GPS, Google Maps, cloud storage, trusted contacts, and emergency alerts are combined into a straightforward architecture built around responding to an alert once it is raised, rather than anticipating one.

That simplicity is arguably a strength for practical deployment, since fewer moving parts generally means fewer points of failure. It does mean, though, that the system stops short of the predictive behaviour analysis this review identifies as a broader research need.

K. AI-Based Women Safety and Alert System

Location information, voice commands, and intelligent alert processing come together in the AI-based system investigated by Ara and Rajeshwari [11], marking a step toward AI-supported communication that does not rely solely on the user manually setting off an alert.

Even so, alert-oriented AI of this kind is not the same as continuous risk prediction or anomaly detection—the system responds intelligently once triggered, but integrating it with an upstream contextual risk-assessment layer remains an open task.

L. RescueNow

RescueNow, developed by Pawar et al. [12], brings together real-time SOS, GPS tracking, silent audio-video recording, multiple emergency triggers, and machine-learning-based prediction of crime-prone areas within a single AI-integrated application.

Of all the systems reviewed here, this one comes closest to combining predictive functionality with evidence collection and communication in one place, which makes it particularly relevant to the present review—it shows that these capabilities have already been explored, if only partially integrated.

The remaining challenge, then, is less about adding further features and more about making these components work reliably together: controlling false alarms, protecting sensitive information, and keeping response times acceptable.

M. W-SAFE Android Application

Future extensions involving AI-based threat detection and predictive alerts are explicitly flagged by Kouser et al. [13] as next steps for W-SAFE, their Android application built around an SOS panic button, live GPS tracking, emergency helplines, and educational safety content.

Positioned this way, the work illustrates a broader progression from basic emergency assistance toward more intelligent safety applications—though it is worth noting that,

in the reported system itself, predictive AI remains a stated future direction rather than something actually implemented.

V. COMPARATIVE ANALYSIS

TABLE I
 COMPARISON OF REVIEWED WOMEN SAFETY SYSTEMS

Ref.	Yr	Main Approach	Emergency Trigger	GPS/Location	AI/ML	Evidence	Main Limitation
[1]	2026	AI, Random Forest, CNN	Voice SOS	Yes	Yes	Limited	Historical-data dependency
[2]	2026	Contextual risk assessment	Context-based	Yes	Yes	Not central	Limited integration
[3]	2026	Offline SMS / community safety	Button, shake	Yes	Limited	Not central	Mainly communication-focused
[4]	2026	AI tools / recommendation	Depends on tool	—	Yes	—	Review rather than deployed system
[5]	2026	Android emergency response	Button, shake, voice	Yes	Limited	Multimedia	Mainly reactive
[6]	2026	Hardware + mobile safety	Voice/SOS	Yes	Limited	—	Additional hardware required
[7]	2026	Integrated digital safety	One-tap SOS	Yes	AI assistant	Audio	Prediction not central
[8]	2026	Mobile emergency assistance	SOS	Yes	Not clearly detailed	—	Limited technical detail in supplied review
[9]	2026	Location-based safety	One-tap SOS	Yes	Location analysis	—	Dependence on predefined risk areas
[10]	2026	Android/GPS safety	SOS	Yes	No major ML component	—	Mainly reactive
[11]	2026	AI alert system	Voice/SOS	Yes	Yes	—	Limited predictive/anomaly focus
[12]	2025	Predictive SOS/evidence	Voice, shake, button	Yes	Yes	Audio/video	Further intelligent decision-making needed
[13]	2025	Android emergency support	Panic button	Yes	Future scope	—	AI/predictive functions not central

The comparison indicates that **GPS/location sharing is the most common capability**, while predictive AI, behaviour learning, anomaly detection, automatic evidence collection, and multi-stage decision-making occur less consistently. This supports the research gap identified in this review.

VI. RESEARCH GAPS AND OPEN CHALLENGES

A. Dependence on Manual Activation

Several systems continue to depend on the user initiating an SOS. This creates a usability problem when the user is unable to access the smartphone.

Multi-trigger mechanisms such as voice and shake detection reduce this limitation, but they do not completely solve proactive emergency detection.

B. Limited Behaviour Learning

Most reviewed systems analyze the current location or predefined danger zones. Fewer systems attempt to understand what is normal for an individual user.

Personalized behaviour modelling could allow a system to identify unusual travel patterns, unexpected movement, or deviations from established routines.

C. False Positives and False Negatives

Automatic emergency detection must balance two competing risks. A false positive can unnecessarily contact emergency responders, while a false negative can result in a missed emergency.

This review specifically identifies reliable alert triggering without false alarms or missed emergencies as an important challenge.

D. Data Availability

AI-based risk assessment requires suitable data. This review identifies the lack of suitable real-time datasets as a limitation, with synthetic data generation considered a possible approach for model development.

This is an important limitation because synthetic data may not fully represent the complexity of real-world emergencies.

E. Connectivity and Background Operation

Emergency applications cannot always assume stable internet connectivity. Offline communication has therefore become an important research direction.

In addition, background operation on smartphones presents practical challenges. Android's battery-optimization settings are known to interfere with background listeners, often requiring the use of foreground services as a workaround.

F. Privacy and Security

Safety applications may process highly sensitive information, including location, audio, video, emergency contacts, and behavioural patterns. Consequently, future systems must consider secure storage, controlled access, encryption, user consent, and appropriate data-retention policies.

VII. PROPOSED RESEARCH DIRECTION

Based on the gaps identified in the literature, an integrated AI-based women safety platform is proposed, combining predictive risk assessment, multiple emergency triggers, location tracking, evidence collection, and automated emergency response.

The proposed system collects contextual information including GPS location, time, travel patterns, crowd level, and voice commands. The collected information is intended to undergo preprocessing involving cleaning, feature extraction, feature selection, and normalization. Random Forest, Decision Tree, and Isolation Forest are proposed for analysing the data and determining whether a situation is normal or requires attention.

If the system identifies a situation requiring attention, the proposed response includes emergency alerts, live location sharing, emergency-contact notifications, audio/video recording, and cloud evidence storage.

The planned technology stack consists of Flutter for the mobile application, Python/FastAPI for backend services, Firebase for cloud services, and Scikit-learn for machine-learning implementation.

Importantly, these capabilities should be described as proposed or under development, rather than as completed experimental results. The current progress report states that AI/ML features had not yet been integrated at the documented stage of development.

The implemented project foundation currently includes the application architecture, database collections, authentication, emergency-contact setup, and an initial SOS alert pipeline. The progress report records that a manual SOS can capture the user's location and initiate the alert process, while background triggers were still being developed.

Therefore, this direction should currently be presented as a proposed research direction and system under development, not as a completed AI system with validated performance.

VIII. FUTURE RESEARCH DIRECTIONS

Several areas can be explored in future work.

First, personalized behaviour modelling could be developed to establish a baseline for individual users. Instead of relying only on general crime-risk information, the system could compare current behaviour with previously observed patterns.

Second, anomaly detection could be investigated using unsupervised learning methods such as Isolation Forest. This may be useful when labelled emergency data are limited.

Third, multimodal emergency detection could combine voice, motion, location, time, and environmental information. Such fusion could reduce dependence on any single sensor.

Fourth, future studies should evaluate models using real-world or carefully designed simulated scenarios. Accuracy alone would not be sufficient for an emergency system; precision, recall, false-alarm rate, missed-event rate, and response latency should also be examined.

Finally, privacy-preserving approaches should be considered because continuous location and behavioural monitoring can create significant privacy risks.

IX. CONCLUSION

This review examined recent women safety and emergency response systems, focusing on mobile

applications, GPS-based services, AI-assisted risk assessment, voice activation, offline communication, evidence collection, and predictive safety.

The reviewed studies demonstrate clear progress from simple manual SOS applications toward systems that incorporate multiple emergency triggers, contextual information, machine learning, and cloud-supported communication. However, the capabilities remain distributed across different systems. Some applications focus on emergency communication, others on location-based risk, while others introduce prediction, evidence collection, or AI assistance.

The major research gap is therefore not simply the absence of individual safety features. Rather, there is a need for reliable integration of these capabilities into a system that can detect abnormal situations, assess risk, select an appropriate response, collect relevant evidence, and notify trusted contacts with minimal user interaction.

Future work is proposed in this direction, with an architecture that combines predictive risk assessment, multiple emergency triggers, location sharing, evidence collection, and automated emergency response. At the current development stage, the basic application and emergency pipeline have been established, while the AI/ML components and remaining modules are planned for further implementation and evaluation.

Future experimental evaluation will be necessary to determine whether the proposed approach can provide reliable predictions while controlling false alarms and protecting user privacy.

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