IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940



International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 8.471 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 15, Issue 11, November 2026

DOI: 10.17148/IJARCCE.2026.1511141

SENTINEL AI FOR WOMEN SAFETY: A SURVEY ON ARTIFICIAL INTELLIGENCE-BASED THREAT DETECTION AND EMERGENCY RESPONSE

Akshitha M N[1], Ananya Gangadhar Haldipur[2], Bindu B L[3], Dr. Lavanya N. L[4]

Students, Department of Computer Science and Engineering, East West College of Engineering, Bengaluru, India[1-3]

Head of the Department, Department of Computer Science and Engineering, East West College of Engineering, Bengaluru, India[4]

Abstract: Women's safety in public, semi-public, and isolated environments remains an important application area for intelligent monitoring and emergency-response technologies. Conventional safety mechanisms frequently depend on manual surveillance or on the victim initiating an emergency request after a threat has already developed. Recent progress in artificial intelligence (AI), machine learning, deep learning, computer vision, Internet of Things (IoT), global positioning system (GPS), and intelligent communication technologies has enabled more automated approaches to threat recognition and assistance. This paper presents a survey of AI- and IoT-based approaches for women-safety applications and examines five representative studies covering violence detection in surveillance videos, women-focused video anomaly detection, crime prediction, IoT-based safety devices, and GPS/communication-enabled emergency systems. The reviewed approaches are compared in terms of methodology, technologies, datasets or platforms, benefits, and limitations. The survey identifies recurring challenges including limited and diverse datasets, false alarms, real-time processing requirements, environmental variability, privacy concerns, communication reliability, and the difficulty of integrating detection with response. Based on these observations, Sentinel AI is presented as a conceptual integrated framework that combines threat detection, contextual analysis, location awareness, and automated emergency notification. The proposed direction is intended to reduce dependence on victim-initiated actions while maintaining attention to privacy, reliability, and practical deployment constraints.

Keywords: Artificial Intelligence, Women Safety, Violence Detection, Video Anomaly Detection, Computer Vision, Internet of Things, GPS, Emergency Response

I. INTRODUCTION

Women's safety is a significant societal and technological concern, particularly in public spaces, isolated locations, transportation environments, and areas monitored by surveillance cameras. Existing safety mechanisms commonly include surveillance, mobile applications, wearable devices, emergency buttons, GPS tracking, and communication-based alert systems. Although these mechanisms can provide useful assistance, many of them depend on manual observation or require the user to recognize a threat and initiate an emergency action.

Artificial intelligence and related technologies provide opportunities to make safety systems more proactive. Computer vision can be used to analyze surveillance video, while deep learning models can identify violent or suspicious activities. Video anomaly detection can help identify events that differ from normal activity, and crime-prediction approaches can support risk assessment. IoT devices can collect sensor information and communicate emergency conditions, while GPS can provide location information for response. These technologies can therefore support a transition from purely user-initiated safety mechanisms toward systems that can detect potentially dangerous situations automatically [1]–[10].

However, an effective women-safety system cannot depend on a single detection technique. Violence may occur under different lighting conditions, camera angles, crowd densities, and environmental conditions. A system that detects only one type of action may miss other threatening situations. Similarly, detecting a possible threat is not sufficient if the system cannot communicate an emergency alert, determine the relevant location, or operate reliably in real time.

 This work is licensed under a Creative Commons Attribution 4.0 International License

IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940



International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 8.471 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 15, Issue 11, November 2026

DOI: 10.17148/IJARCCE.2026.1511141

This survey examines recent research related to AI-based violence detection, video anomaly detection, crime prediction, IoT safety devices, and GPS/GSM-based emergency systems. The objective is to identify common capabilities and limitations and to formulate the research gap that motivates Sentinel AI. Sentinel AI is treated in this paper as a conceptual integrated framework rather than as an experimentally validated product.

II. LITERATURE SURVEY

A. SUSAN: A Deep Learning-Based Architecture for Violence Detection

Andrade et al. proposed SUSAN, a deep learning-based architecture for detecting violence against women in surveillance videos [1]. The work focuses on the use of video analysis and deep learning to identify violent situations. The study demonstrates the relevance of automated visual analysis for women-safety applications because surveillance footage can be processed without requiring a person to continuously observe every camera feed.

The main contribution relevant to Sentinel AI is the use of deep learning for violence detection. However, violence recognition alone does not provide a complete emergency-response mechanism. A practical safety architecture also requires contextual interpretation, location information, and a reliable alert pathway. These additional functions form part of the broader integration considered by Sentinel AI.

B. Women-Focused Multi-Modal Video Anomaly Detection

Sangeeta et al. examined whether video anomaly detection models can be enhanced using a women-focused multi-modal dataset [2]. The study addresses the importance of suitable and diverse data for detecting safety-related anomalies. A multi-modal perspective can provide information beyond a single visual signal and may support recognition of different forms of suspicious activity.

The study highlights an important challenge for women-safety systems: the quality and diversity of training data directly influence the ability of an AI model to generalize across environments. Sentinel AI therefore considers contextual and multi-source information as an important direction rather than depending exclusively on one visual feature or one type of event.

C. Crime Prediction Against Women in Surveillance Videos

Dhuri and Patil reviewed deep learning models for crime prediction against women using surveillance videos [3]. The review indicates that AI-based video analysis can be extended beyond the recognition of an already occurring violent action toward identifying patterns associated with possible criminal activity.

For Sentinel AI, this distinction is important because safety assistance can benefit from earlier recognition of suspicious conditions. At the same time, predictive systems must be treated carefully because an inferred risk is not equivalent to a confirmed crime. Any practical deployment would therefore require appropriate thresholds, contextual information, human oversight where necessary, and evaluation of false-positive and false-negative behavior.

D. IoT-Based Smart Women Safety Device with Multi-Face Detection and Emergency Alert

Maganti et al. presented an IoT-based smart women-safety device incorporating multi-face detection and an emergency alert mechanism [4]. The work represents a device-oriented approach in which sensing, processing, and communication are combined to support emergency assistance.

The approach is relevant to Sentinel AI because it demonstrates how IoT hardware can complement AI-based detection. A distributed system can use device-level information together with camera-based analysis. However, the effectiveness of such a system depends on sensor reliability, connectivity, power availability, and the ability to coordinate the device with an appropriate emergency-response mechanism.

E. Women's Safety with Smart IoT

Tidake et al. discussed a smart IoT approach for women's safety [5]. IoT-based systems can connect sensing and communication components to support rapid alert generation. Such approaches are useful for situations in which a wearable or connected device can provide information about the user and communicate an emergency condition.

The limitation of a device-only approach is that a user may not always be able to activate the device during an emergency. This motivates combining device-generated signals with automated video and contextual detection. Sentinel AI is designed conceptually around this complementary approach.

 This work is licensed under a Creative Commons Attribution 4.0 International License



International Journal of Advanced Research in Computer and Communication Engineering
Impact Factor 8.471 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 15, Issue 11, November 2026
DOI: 10.17148/IJARCCE.2026.1511141

F. Literature Survey Summary

The reviewed studies show that women-safety research has developed along several related directions. Deep learning is used for violence detection and video anomaly detection [1]–[3], while IoT and communication technologies support emergency alert generation [4], [5]. Broader video-anomaly research further identifies issues such as dataset limitations, anomaly definition, environmental variation, computational requirements, and the difficulty of obtaining reliable real-world training data [11]–[17]. Suspicious-action recognition also provides a related research direction for identifying potentially unsafe activities in surveillance environments [18]. GPS/GSM and connected wearable approaches extend the system from detection toward location-aware emergency communication [19], [20]. A systematic review of assault-detection technologies also summarizes the available approaches and challenges [21]. These findings support the need for an integrated architecture rather than a collection of independent safety functions.

III. COMPARATIVE ANALYSIS

The selected studies differ in their primary objectives and technological emphasis. Some focus mainly on visual detection, whereas others concentrate on IoT devices, location tracking, or emergency communication. Table I summarizes the major characteristics relevant to Sentinel AI.

TABLE I COMPARATIVE ANALYSIS OF AI-BASED WOMEN SAFETY SYSTEMS

Study	Primary Focus	Key Technology	Data / Platform	Major Benefit	Limitation / Challenge
[1]	Violence detection	Deep learning, computer vision	Surveillance video	Automated violence recognition	Detection scope and real-time deployment
[2]	Women-focused anomaly detection	Multi-modal video anomaly detection	Women-safety video data	Better representation of safety-related anomalies	Dataset diversity and model generalization
[3]	Crime prediction	Deep learning, surveillance analysis	Surveillance video / reviewed models	Potentially earlier risk identification	Prediction uncertainty and false alarms
[4]	Smart safety device	IoT, face detection, alerts	Connected device platform	Combines detection with emergency alerting	Connectivity, device reliability
[5]	Smart IoT safety	IoT sensing and communication	Connected safety devices	Rapid emergency communication	User dependence and system integration

IV. RESEARCH GAP

The literature indicates that existing women-safety solutions often concentrate on a specific stage of the safety process. Video-based studies focus on violence, anomaly, or crime-related detection [1]–[3], whereas IoT-based studies emphasize sensing and emergency communication [4], [5], [19], [20]. These approaches demonstrate the value of their respective technologies but do not necessarily provide a unified architecture covering detection, contextual understanding, location awareness, and automated response.

A second gap is the dependence on limited or specialized datasets. Video anomaly detection research has repeatedly identified data availability, class imbalance, variation in environments, and the definition of normal versus abnormal behavior as important challenges [11]–[17]. A model trained in one environment may not perform similarly under different camera viewpoints, illumination, crowd conditions, or cultural and behavioral contexts.

A third gap concerns the transition from detection to action. Detecting a suspicious event is only one component of a safety system. A useful end-to-end framework should determine whether the event is sufficiently credible, obtain relevant contextual and location information, and communicate an alert through an appropriate channel. This integration also introduces practical issues such as communication failure, privacy, false alarms, computational latency, and user trust.

 This work is licensed under a Creative Commons Attribution 4.0 International License

DOI: 10.17148/IJARCCE.2026.1511141

Based on these observations, Sentinel AI is proposed as a conceptual framework for integrating AI-based threat detection, contextual analysis, location awareness, and automated emergency notification. The framework is intended to connect the strengths of computer vision and IoT rather than replacing one with the other. Because the present paper is a survey and conceptual proposal, no experimental accuracy, response-time, or deployment performance is claimed.

V. FUTURE SCOPE

Future work can develop Sentinel AI into a tested prototype using representative surveillance and sensor data. A multi-modal architecture could combine video, device signals, location information, and contextual variables. Such integration may help distinguish ordinary activities from potentially threatening situations and reduce dependence on a single sensor.

Another direction is the development of more diverse and ethically collected datasets. Data should represent different environments, camera positions, lighting conditions, crowd densities, and relevant safety events. Privacy-preserving techniques can be considered so that useful safety information is extracted without unnecessarily retaining personally identifiable video or location information.

Real-time processing is another important research direction. Lightweight models, edge computing, and efficient communication can reduce latency between detection and alert generation. The system can also incorporate confidence thresholds and multi-stage verification to reduce unnecessary emergency alerts while maintaining sensitivity to genuine threats.

Location-aware response can be extended using GPS and communication technologies. Depending on the deployment context, the system could transmit an alert containing an event classification, approximate location, timestamp, and other relevant contextual information to an authorized emergency contact or response service. Such functionality should be designed with authentication, access control, and privacy safeguards.

Finally, future evaluation should consider more than classification accuracy. Important measures include false-positive rate, false-negative rate, detection latency, alert-delivery reliability, energy consumption for wearable or edge devices, robustness under changing environments, and privacy risk. User-centered evaluation is also important because safety technologies must be understandable and usable during stressful situations.

VI. CONCLUSION

This paper surveyed recent AI-, computer-vision-, and IoT-based approaches for women's safety, with emphasis on violence detection, video anomaly detection, crime prediction, connected safety devices, GPS, and emergency communication. The reviewed literature demonstrates that individual technologies can support important parts of a safety system, but it also reveals challenges involving data diversity, false alarms, real-time processing, environmental variability, privacy, reliability, and integration.

To address the identified gap, Sentinel AI is presented as a conceptual integrated framework that brings together threat detection, contextual analysis, location awareness, and automated emergency notification. The framework does not claim experimental validation in this survey. Instead, it provides a direction for future implementation and evaluation of an end-to-end intelligent women-safety system. Future research should validate the framework using diverse datasets and real-world or controlled environments while measuring both technical performance and practical safety requirements.

DECLARATIONS

Funding: The authors received no funding for this work.

Conflict of Interest: The authors declare no conflict of interest.

Data Availability: This survey does not introduce a new experimental dataset. Dataset details discussed in the reviewed studies are available in the cited literature.

Author Contributions: Akshitha M N, Ananya G H and Bindu B L jointly carried out the literature review, analysed the selected studies, and prepared the comparative analysis and the Sentinel AI framework. Dr. Lavanya N. L. supervised the work and reviewed the manuscript. All authors read and approved the final manuscript.

 This work is licensed under a Creative Commons Attribution 4.0 International License



International Journal of Advanced Research in Computer and Communication Engineering
Impact Factor 8.471 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 15, Issue 11, November 2026
DOI: 10.17148/IJARCCE.2026.1511141

ACKNOWLEDGMENT

The authors thank the Department of Computer Science and Engineering, East West College of Engineering, Bengaluru, for academic support and guidance in preparing this survey.

REFERENCES

[1] J. P. F. Andrade, T. Si, A. P. Cavalcanti, A. C. A. Nascimento, and P. B. C. Miranda, "SUSAN: A deep learning-based architecture for violence detection against women in surveillance videos," Expert Systems with Applications, vol. 280, Art. no. 127337, 2025, doi: 10.1016/j.eswa.2025.127337.

[2] S. Sangeeta, M. S. Prajwal, D. P. Dogra, K. V. Thakare, H. Jung, I.-J. Kim, and H. Choi, "An Analysis Focused on Women's Safety: Can VAD Models Be Enhanced by a Multi-Modal Dataset," arXiv preprint arXiv:2605.25806, 2026, doi: 10.48550/arXiv.2605.25806.

[3] K. G. Dhuri and S. Patil, "Crime prediction against women in surveillance videos using deep learning models: A review," Computers & Electrical Engineering, vol. 128, Art. no. 110651, 2025, doi: 10.1016/j.compeleceng.2025.110651.

[4] A. Maganti, L. G. Katam, G. Gudimetla, S. Kona, and K. Mamidi, "IoT-Based Smart Women Safety Device with Multi-Face Detection and Emergency Alert System," 2026, doi: 10.2139/ssrn.6474079.

[5] V. S. Tidake, V. S. Temkar, A. B. Sathe, and S. P. Vidhate, "Women's Safety with Smart IoT," International Journal on Science and Technology, vol. 16, no. 2, 2025, doi: 10.71097/IJSAT.v16.i2.5772.

[6] S. R. Abhiraj, A. Nizar, A. Vijay, S. Rahna, and G. S. Anju, "IoT based unified approach for women safety alert using GSM," in Proc. 2021 3rd International Conference on Intelligent Communication Technologies and Virtual Mobile Networks (ICICV), 2021, doi: 10.1109/ICICV50876.2021.9388415.

[7] K. Sangeetha, R. L. Devi, A. Ananya, S. M. M. Suvetha, and R. V. Visshnu Priya, "Women Safety System using IoT," in Proc. 2022 International Conference on Applied Artificial Intelligence and Computing (ICAAIC), Salem, India, 2022, pp. 1477–1480, doi: 10.1109/ICAAIC53929.2022.9792929.

[8] M. M. Bangar, S. Bhadane, M. Bhamare, O. Jore, and S. S. Shinde, "Women Safety Device Using IoT," International Journal of Advanced Research in Computer and Communication Engineering, vol. 13, no. 4, 2024, doi: 10.17148/IJARCCE.2024.134111.

[9] S. Bombothula, B. S. Sunkari, S. Vaddeboina, K. Kranthi Kumar, and P. Shanthi, "Women Safety Android Application," International Journal for Research in Applied Science & Engineering Technology, vol. 10, no. 6, pp. 3930–3932, 2022, doi: 10.22214/ijraset.2022.44136.

[10] P. B. Thummalakunta, T. Nemane, P. Naik, S. Palkar, and A. Poonawala, "Implementation of IoT-based real-time women's safety system," International Journal of Engineering Research & Technology, vol. 13, no. 1, 2024, doi: 10.17577/IJERTV13IS010014.

[11] H.-T. Duong, V.-T. Le, and V. T. Hoang, "Deep Learning-Based Anomaly Detection in Video Surveillance: A Survey," Sensors, vol. 23, no. 11, Art. no. 5024, 2023, doi: 10.3390/s23115024.

[12] Y. A. Samaila, P. Sebastian, N. S. S. Singh, A. N. Shuaibu, S. S. A. Ali, T. I. Amosa, G. E. Mustafa Abro, and I. Shuaibu, "Video anomaly detection: A systematic review of issues and prospects," Neurocomputing, vol. 591, Art. no. 127726, 2024, doi: 10.1016/j.neucom.2024.127726.

[13] S. A. Jebur, K. A. Hussein, H. K. Hoomod, L. Alzubaidi, and J. Santamaría, "Review on Deep Learning Approaches for Anomaly Event Detection in Video Surveillance," Electronics, vol. 12, no. 1, Art. no. 29, 2023, doi: 10.3390/electronics12010029.

[14] E. Şengönül, R. Samet, Q. Abu Al-Haija, A. Alqahtani, B. Alturki, and A. A. Alsulami, "An Analysis of Artificial Intelligence Techniques in Surveillance Video Anomaly Detection: A Comprehensive Survey," Applied Sciences, vol. 13, no. 8, Art. no. 4956, 2023, doi: 10.3390/app13084956.

[15] S. Anoopa and A. Salim, "Survey on anomaly detection in surveillance videos," Materials Today: Proceedings, vol. 58, Part 1, pp. 162–167, 2022, doi: 10.1016/j.matpr.2022.01.171.

[16] Berroukham, K. Housni, M. Lahraichi, and I. Boulfrifi, "Deep learning-based methods for anomaly detection in video surveillance: a review," Bulletin of Electrical Engineering and Informatics, vol. 12, no. 1, pp. 314–327, 2023, doi: 10.11591/eei.v12i1.3944.

[17] J. Ren, F. Xia, Y. Liu, and I. Lee, "Deep Video Anomaly Detection: Opportunities and Challenges," in Proc. 2021 IEEE International Conference on Data Mining Workshops (ICDMW), 2021, pp. 959–966, doi: 10.1109/ICDMW53433.2021.00125.

[18] S. Khanam, M. Sharif, X. Cheng, and S. Kadry, "Suspicious action recognition in surveillance based on handcrafted and deep learning methods: A survey of the state of the art," Computers & Electrical Engineering, vol. 120, Art. no. 109811, 2024.

 This work is licensed under a Creative Commons Attribution 4.0 International License



International Journal of Advanced Research in Computer and Communication Engineering
Impact Factor 8.471 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 15, Issue 11, November 2026
DOI: 10.17148/IJARCCE.2026.1511141

[19] N. P. Raj Kumar, E. Bhargav, G. V. Rao, B. V. Ramana, and B. Navya, “IoT Based Smart Wearable Device for Women Safety Using GPS And GSM,” International Journal of Information and Electronics Engineering, vol. 16, no. 2, pp. 312–318, 2026, doi: 10.48047/ryb91v19.

[20] S. Sudheer, M. Naveen, and P. Sinthuja, “An Emergency Alert and Monitoring System using Compact IoT-based real-time women and child safety,” in Proc. 2025 10th International Conference on Smart Structures and Systems (ICSSS), 2025, doi: 10.1109/ICSSS66939.2025.11346389.

[21] V. S. S. Bhuvaneswari and M. Thangamuthu, "Towards Intelligent Safety: A Systematic Review on Assault Detection and Technologies," Sensors, vol. 25, no. 13, Art. no. 3985, 2025, doi: 10.3390/s25133985.