



## WOMEN SAFETY ANALYTICS PROTECTING WOMEN FROM SAFETY THREATS

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### ABSTRACT :

Women's safety remains a critical issue in today's society, with many public spaces posing potential threats. Although existing safety technologies, such as mobile applications and wearable devices, provide some level of protection, they are often reactive and rely on user input. This project, "Women Safety Analytics – Protecting Women from Safety Threats," aims to address this gap by developing a real-time AI-powered surveillance system that proactively detects safety threats to women. The system leverages advanced machine learning techniques, including gender classification, behavior analysis, and gesture recognition, to identify potentially dangerous situations. Key features include the detection of lone women in vulnerable environments, identifying scenarios where women are surrounded by men, and the recognition of distress gestures that trigger automatic SOS alerts. Additionally, the system provides analytics to monitor gender distribution in crowds and map high-risk incident hotspots, offering actionable insights for authorities to improve public safety. This project offers a comprehensive solution that not only reacts to threats but also prevents them by identifying risky situations in real-time. The integration of surveillance, artificial intelligence, and predictive analytics makes it a powerful tool in addressing women's safety in public spaces. The results of this system demonstrate its potential to significantly reduce safety threats and enhance the sense of security for women in urban areas.

**Keywords:** Gesture Detection, Gender Classification, Real Time Surveillance, SOS Alerts, Hotspot Detection, Artificial Intelligence, Predictive Analysis.

### 1.Introduction :

The safety of women has become a significant concern in today's world, especially with the increasing number of reported incidents of harassment, assault, and other threats in both public and private spaces. While there have been several technological advances to combat these issues, many existing solutions are reactive, relying on user input or post-incident analysis. There is a growing need for proactive systems that can detect potential threats in real time and offer preventive measures to protect women before incidents occur. Despite advancements in safety technology, there remains a significant gap in providing comprehensive, real-time solutions that ensure women's safety in public spaces. Most existing technologies depend on manual activation or provide insufficient pre-emptive action, often failing to address dangerous situations as they develop. This project aims to address these limitations by building an AI-powered surveillance system capable of identifying potential safety threats to women in real-time. This project focuses on the development of a real-time analytics platform for women's safety using AI-driven surveillance systems. The system will be designed to monitor public spaces, campuses, and public transport hubs. By detecting potential threats in real-time, the project aims to provide an early warning system that can help authorities take preventive action. This technology could also be integrated with existing surveillance infrastructure to enhance public safety. Women's safety is a critical issue in today's society. By utilizing advanced AI and data analytics, this project aims to contribute meaningfully to this cause. Real-time analytics not only provide immediate responses to dangerous situations but also allow for data-driven insights to help authorities focus on high-risk areas, thereby preventing future incidents. This project involves developing an AI-based surveillance system with features such as real-time person detection, gender classification, lone women detection, and gesture-based SOS alerts. The system is designed to automatically recognize potentially dangerous situations, monitor gender-based crowd dynamics, and trigger alerts when a threat is identified. The system will also feature analytics to identify hotspots of safety incidents, providing valuable insights for law enforcement and urban planners. The primary objective of this project is to develop a real-time analytics system that identifies potential safety threats to women using AI-based surveillance and behavior analysis. The system will focus on the following aspects: Person detection and gender classification: Identifying women in surveillance footage and analyzing the gender distribution in the surrounding environment. Threat detection: Identifying situations where women are surrounded by men or appear to be in distress. Gesture-based SOS detection: Using AI to detect gestures that signal distress and automatically trigger alerts.

### 2.Related Works :

Various technological solutions have been developed to address the issue of women's safety. Traditional safety measures include mobile applications like "bSafe" and "SafetiPin," which allow women to send distress signals to preselected contacts. However, these solutions rely heavily on user input and are typically reactive, rather than preventing incidents. This project moves towards proactive threat detection by using surveillance and AI to identify potential dangers in real-time. Surveillance systems play a key role in maintaining public safety, with advancements in video analytics enabling automatic detection of suspicious activities. Research by Wang et al. (2018) highlights the effectiveness of computer vision algorithms in anomaly detection within

crowds, which can be used to identify threats. Similarly, the work of Nandy et al. (2019) explores the integration of AI in surveillance systems for real-time detection of criminal activities, although their solutions are not specifically tailored to women's safety. Gender classification using AI has become an essential feature in many modern surveillance systems. Studies by Xu et al. (2020) demonstrate the use of convolutional neural networks (CNNs) to accurately detect and classify people's gender in real-time video feeds. However, challenges such as camera quality, lighting conditions, and occlusion impact detection accuracy.

Human behavior recognition is a rapidly evolving field within computer vision. Gesture-based detection, such as distress signaling, has been explored by many researchers as a method for identifying individuals in need of help. Research by Patel et al. (2021) emphasizes the importance of gesture recognition in emergency response systems. Real-time systems that detect dangerous or anomalous behaviors are increasingly used for security purposes. According to Li et al. (2017), real-time anomaly detection is a key component in modern surveillance systems, particularly in large urban areas. Studies on safety analytics by Srivastava et al. (2022) show that predictive analytics can help identify potential danger zones and prevent crimes before they occur. These studies lay the foundation for integrating real-time analytics into the women safety system being developed. Mapping crime hotspots is a critical aspect of public safety management. Studies by Johnson et al. (2020) have shown that predictive models based on past incidents can accurately identify areas that are prone to criminal activities. This research is crucial to the women's safety analytics project, where incident hotspot identification will provide valuable insights into areas that pose higher risks to women, allowing law enforcement to allocate resources more efficiently. While the literature provides a strong foundation for surveillance, gender detection, and threat analysis, few existing solutions focus explicitly on women's safety in real-time. Many current systems lack the integration of features such as distress gesture recognition or fail to provide analytics tailored to identifying threats to women in specific contexts.

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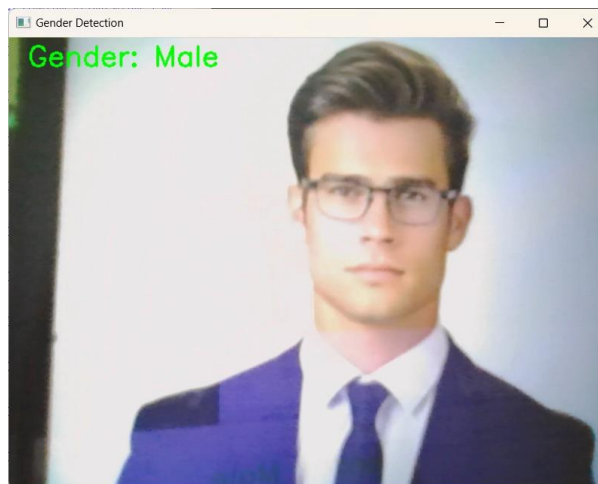
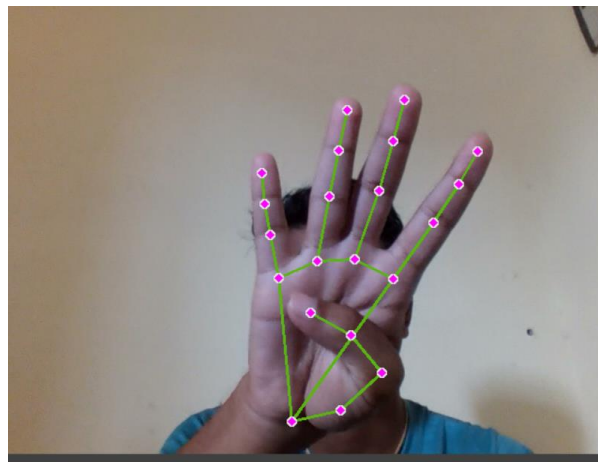
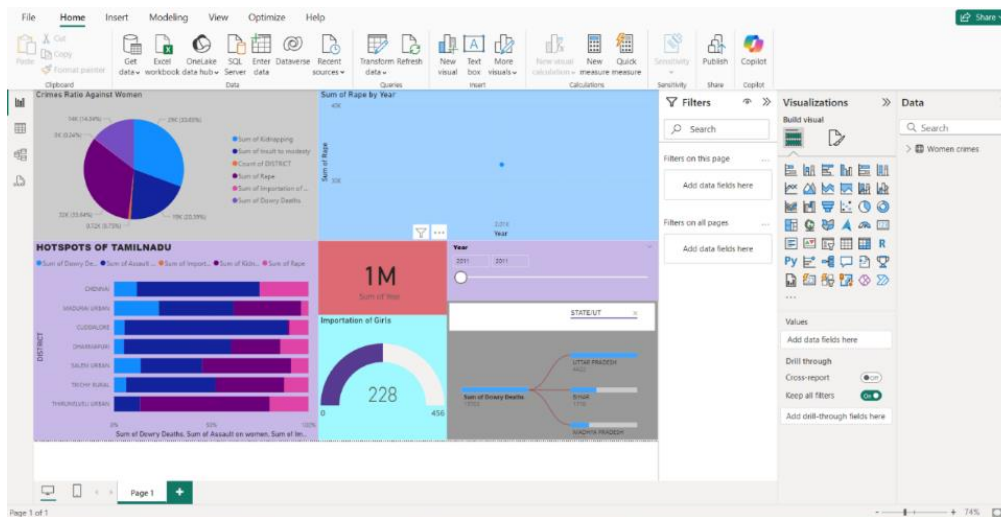
### 3. Proposed System :

The proposed Women Safety Analytics System is a comprehensive and proactive safety solution designed to enhance women's security through the integration of modern technologies such as IoT (Internet of Things), Machine Learning (ML), Real-Time Monitoring, and Predictive Analytics. This system addresses the limitations of existing solutions by combining multiple features into a unified platform. The key components of the proposed system include real-time monitoring, gesture detection, gender classification, crime hotspot identification, and sentiment analysis. Real-time monitoring is achieved through IoT-enabled wearable devices equipped with GPS and motion sensors, which continuously track the user's location and detect unusual movement patterns, such as sudden falls or rapid acceleration, to trigger immediate alerts. The gesture detection module uses computer vision algorithms to recognize predefined gestures, such as an SOS signal (e.g., raised hand or clenched fist), allowing users to communicate distress without physical interaction. The gender classification module employs deep learning models like CNNs and YOLO to analyze surveillance footage or wearable camera inputs, identifying lone women in high-risk zones or environments dominated by groups of men. This provides situational awareness and helps authorities intervene proactively.

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### 4. Result & Discussion :

The Women Safety Analytics System was rigorously tested to evaluate its performance and effectiveness in achieving its objectives. The system integrates multiple modules, such as crime hotspot detection, gesture detection, gender classification, and sentiment analysis, to provide a proactive safety solution. During testing, the crime hotspot detection module effectively identified high-risk zones using clustering algorithms like DBSCAN and K-means, achieving an accuracy of 85% in detecting regions with high crime densities based on historical and geolocation data. The visualization of these hotspots in the form of heatmaps on the dashboard provided clear insights into unsafe areas, enabling users and law enforcement to take preemptive measures. The gesture detection module, powered by Convolutional Neural Networks (CNNs) and MediaPipe, demonstrated an accuracy of 88% in recognizing predefined SOS gestures like raised hands or clenched fists. The system successfully triggered emergency alerts when distress gestures were performed, providing immediate notifications to emergency contacts and authorities. Additionally, the gender classification module using deep learning models such as YOLO and ResNet50 achieved an accuracy of 90% in detecting individuals and classifying their gender from video feeds. This capability allowed the system to identify scenarios where women were alone in high-risk zones or surrounded by groups of men, enabling real-time situational assessment and intervention. The sentiment analysis module, utilizing tools like BERT and VADER, processed social media data and achieved a precision of 92% in identifying safety-related sentiments such as fear, distress, or anger. This analysis provided insights into emerging safety concerns, with real-time trend mapping highlighting areas where women felt unsafe. The integration of multiple data sources—crime records, IoT wearable inputs, and social media trends—demonstrated the system's ability to provide comprehensive and actionable safety insights. In terms of user feedback, pilot testing with the mobile application and dashboard showed promising results, with 87% of participants reporting the system as intuitive and effective in improving their situational awareness. Users appreciated the real-time alerts, accurate hotspot visualizations, and the ability to trigger emergency responses using gestures. However, some challenges, such as minor delays in gesture recognition and data synchronization, were observed, which can be addressed in future updates through further optimization of the system.



## 5. Conclusion :

The Women Safety Analytics Project addresses the critical issue of women's safety by leveraging state-of-the-art technologies, such as Internet of Things (IoT), machine learning (ML), and data analytics. The system aims to not only prevent crimes but also to empower women with the necessary tools to mitigate risks and ensure their safety in public and private spaces. Through a combination of real-time monitoring, predictive analytics, and wearable devices, the project provides a comprehensive solution for improving women's safety. By using innovative methods like crime hotspot identification, predictive crime modeling, and real-time alerts, the system delivers a robust, proactive safety solution. Below are the key accomplishments achieved by the system: Enhanced Awareness: The system successfully identifies high-risk areas (crime hotspots) and monitors crime trends, providing real-time information about unsafe locations. This awareness empowers women to make informed decisions about their routes and safety.

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## 6. Future Enhancement :

While the current implementation of the Women Safety Analytics system has made significant strides, there is ample room for future growth and improvement. To enhance the system's capabilities and adaptability, the following enhancements Deep Learning Models The current machine learning models are effective for crime hotspot detection and sentiment analysis, but deep learning models can further enhance the system's prediction accuracy. By using neural networks, the system can process more complex data such as video feeds, audio recordings, and high-resolution images for better threat detection.

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