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COMPREHENSIVE ANALYSIS OF INTELLIGENT TECHNOLOGICAL FRAMEWORKS ENHANCING WOMEN'S SAFETY AND SECURITY APPLICATIONS

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ABSTRACT

Social beliefs on women's rights and historical trends of gender-based violence have had a big impact on how women's safety and security apps have developed. Women all

Keywords: Women, Security, Technology, Safety, AI, IOT, Monitoring, Protection, Innovation

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1. INTRODUCTION

1) Overview

around the world have endured centuries of discrimination and abuse and their vulnerabilities in both public and private settings are well acknowledged. In the contemporary era, women are no longer regarded as a marginalized group. They hold equal authority, rights and opportunities alongside men making significant contributions across various fields thereby fostering global progress. Despite these advancements, gender- based challenges persist, particularly in developing and underdeveloped regions. In an ever-changing technology context, ongoing research and development efforts are required to produce inclusive safety apps that take into consideration the varied experiences of all women, guaranteeing that these tools are reliable and successful in boosting their safety and security. One of the most pressing concerns is the persistent threat of physical harassment which hinders women's empowerment and societal participation. This study conducts an extensive review of existing frameworks and technological innovations in the

domain of women's safety. A comparative evaluation of multiple security-oriented technologies including the Internet of Things (IoT), Embedded Systems, Artificial Intelligence (AI), Machine Learning (ML), Augmented Reality (AR) and mobile-based applications has been undertaken to assess their effectiveness in ensuring women's safety. The global market for women's safety software is anticipated to grow at a compound annual growth rate (CAGR) of 5.6% between 2024 and 2032. With over 700 million internet users and 600 million smartphone users, there is a substantial base for digital solutions aimed at enhancing women's safety, The effectiveness and limits of current women's security apps and new technologies are carefully evaluated in this study using a structured qualitative method. The findings highlight potential research gaps and propose critical directions for future advancements aiming to aid researchers in developing a holistic security solution that ensures a safer environment for women on a global scale.

Although women have made significant strides in various sectors, concerns regarding their personal security remain prevalent worldwide. This paper explores the implementation of advanced technological solutions aimed at enhancing women's protection through intelligent safety frameworks [1]. A variety of wearable safety tools have been introduced offering immediate assistance in emergency situations. However, the critical question remains do these systems together form a comprehensive security framework? Any design flaw in an existing model which was originally developed for a specific use case may lead to inefficiencies in other scenarios, ultimately preventing the establishment of a fully functional protective mechanism. The concepts of threat mitigation and preventive security measures must be integrated seamlessly to create an effective personal safety solution. This paper encourages researchers to work towards designing a multi-functional security system that enables women to safeguard themselves in real-world environments. Due to the nation's quick digital change, the women's safety software industry in India is expanding significantly.

The core objective of any women's protection technology is to develop wearable electronic devices that can be interconnected with smart sensors and automated response mechanisms through cloud-based communication networks. The demand for such innovations arises from growing security concerns in public spaces particularly in high-traffic areas. Most existing portable security gadgets are designed to transmit key details such as geolocation tracking and user movements to authorized personnel through wireless data transfer protocols including mobile messaging services, radio frequency communication and short-range connectivity modules [2-3]. Current models lack the ability to continuously monitor an unfolding situation leaving a crucial gap in ensuring immediate intervention. To enhance the efficiency and usability of these systems, it is essential to integrate cutting-edge advancements in fields such as cyber-physical systems like Internet of Things (IoT), embedded computing technologies and immersive digital interfaces like Augmented Reality (AR) to create a next-generation security ecosystem.[4]

2. LITERATURE SURVEY

Table 1 LIST OF EXISTING LITERATURES

Author	Title	Key Findings	Research Gap	Future Scope	Technology Used
Islam, M.R., et al. (2024)	*Machine Learning-Driven IoT Device for Women's Safety: A Real- Time Sexual Harassment Prevention System*	Created a wearable Internet of Things gadget that uses force-sensitive resistors to identify instances of harassment using an AdaBoost classifier, it achieved 99.3% accuracy.	Centered on detecting physical harassment for more thorough monitoring.	Integrate audio-visual data for comprehensive monitoring.	IoT, Machine Learning (AdaBoost Classifier), Wearable Sensors, Cloud Computing
Srividhya, R., et al. (2022)	*Smart Device for Women Safety Using Machine Learning-Based Logistic Regression Algorithm*	Presented a wearable gadget that uses physiological cues to identify discomfort and uses a logistic regression technique to monitor in real	Limited to physiological data	Incorporate environmental sensors for improved accuracy.	Wearable Technology, Machine Learning (Logistic Regression), Physiological Sensors

		time.			
Uzma Omer, et al. (2023)	*The Role of IoT in Woman's Safety: A Systematic Literature Review*	Discussed IoT-based gadgets that improve women's safety emphasizing functions like emergency notifications and GPS tracking.	Found a deficiency in device compatibility and defined protocols,	Unified frameworks are required.	IoT, GPS, GSM, Wearable Technology
Nikita Salke, et al. (2023)	*A Comprehensive Survey on IoT-Based Smart Safety Devices for Women*	Discussed several modules like GPS and GSM while surveying current IoT gadgets and apps made for women's protection.	Identified issues with device usability	Need for interfaces that are easy to use.	IoT, GPS, GSM, Wearable Devices
Shetye, S., et al. (2023)	*A Deep-Learning Approach to Early Identification of Suggested Sexual Harassment from Videos*	Created a deep learning algorithm that uses visual characteristics like unwanted touching and facial expressions to detect sexual harassment in videos.	Dataset limited to movie scenes	For wider application, incorporate data from the actual world.	Deep Learning, Computer Vision, Video Analysis
Zytko, D., & Aljasim, H. (2022)	*Designing AI for Online- to-Offline Safety Risks with Young Women: The Context of Social Matching*	Investigated how AI may be used to solve safety concerns in social matching systems using young women in the design process to identify and reduce possible dangers.	Concentrated on online interactions	Analyze offline situations and larger populations.	Artificial Intelligence, Participatory Design, Social Matching Systems
Stanney, K.M., et al. (2025)	*Virtual Reality in Industry: Spotlight on Women*	Highlighted how women have contributed to VR applications in a variety of sectors highlighting how VR is changing conventional procedures.	Lacked specific focus on safety applications	Explore VR's potential in personal security.	Virtual Reality, Industry Applications, Gender Diversity
Pedram, S., et al. (2022)	*Influence of Age and Industry Experience on Learning Experiences and Outcomes in Virtual Reality Mines Rescue Training*	Age and experience have an impact on learning results according to research on VR-based training for mine rescue operations.	Mining Specific	Modify virtual reality instruction for women's safety education.	Virtual Reality, Training Simulations, Occupational Safety
Woodburn, et al. (2022)	*Herd Routes: A Preventative IoT-Based System for Improving Female Pedestrian Safety on City Streets*	Suggested a system that uses distributed ledgers for security and trust making busier walking routes possible	The study offers a proof-of-concept	Evaluate user uptake and large-scale deployment.	IoT, Distributed Ledgers, Mobile Application

		through social incentives			
Ghodake, et al. (2021)	*Design and Implementation of Women Safety System Based on IoT Technology*	Incorporated GPS and GSM modules into a wearable gadget to transmit position information and real-time notifications in case of an emergency.	The study concentrates on hardware implementation	Incorporating machine learning for predictive safety measures	IoT, GPS, GSM, Wearable Technology

3. METHODOLOGY

A multifaceted study strategy that looks at both theoretical developments and real-world applications is needed to ensure women's safety in contemporary society. Supported by a thorough literature review and case study assessments, this study takes an organized way to examining current mobile applications created for women's protection. This study employs a systematic qualitative research methodology that combines market analysis, literature review and case study evaluation. A thorough analysis of the features, efficacy and potential areas for development of the security apps that are now accessible was carried out in order to obtain a better understanding of the existing environment. In order to comprehend user experiences and real-world applications, case studies were also examined.

Thorough literature evaluation that includes an analysis and assessment of 10 research publications. The results are methodically compiled in Section II Table 1 to highlight significant technological developments, approaches and achievements in the field of women's security systems. The basis for future developments in security technology is laid by the identification of research gaps and new trends made possible by this comparative study. This methodology's organized approach guarantees that theoretical research and empirical data are integrated in a balanced manner. The findings of this study are included in Results and Discussion section which critically evaluates five key security technologies for their potential and influence on improving women's safety solutions.

Types of Mobile Applications for Women Safety

The advancement of mobile technology has led to the development of numerous personal safety applications aimed at enhancing women's security in various situations [5]. These applications utilize features such as GPS-based tracking, real-time alerts, emergency distress signals and self-defense resources to provide immediate assistance when needed. Below are different categories of women's security applications each serving a specific purpose.

1) Instant Emergency Alert Apps

These applications enable women to send distress signals immediately to trusted contacts, law enforcement or emergency responders. Equipped with essential features such as GPS tracking, panic buttons and automatic emergency dialing they ensure quick assistance during critical situations.

Table 2 EMERGENCY ALERT-BASED WOMEN'S SAFETY APPLICATIONS

Applications	Total Installs	User Ratings	Supported Platforms
bSafe	Over 1M	4.3	Android, iOS
Life360	Over 50M	4.5	

2) Safety Connection Apps

These apps work by creating a network of trusted individuals allowing users to share their safety status and send emergency alerts when needed. Women can stay connected with their family and friends ensuring immediate response in unsafe situations.

Table 3 TRUSTED NETWORK APPS FOR REAL-TIME SAFETY SHARING

Applications	Total Installs	User Ratings	Supported Platforms
SafeTrek	Over 1M	4.3	

Life360	Over 50M	4.5	Android, iOS

3) Live Location Monitoring Apps

With these applications, women can share their real- time location with trusted individuals helping them stay monitored and secure [6]. Advanced versions also include geofencing technology which triggers alerts when the user enters or leaves a defined area.

Table 5 LIVE GPS TRACKING APPLICATIONS FOR WOMEN'S SECURITY

Applications	Total Installs	User Ratings	Supported Platforms
Find My Device	Over 1M	4.5	Android
Find My iPhone	Over 500M	4.6	iOS

4) Simulated Emergency Call & Message Apps

These applications allow users to generate fake phone calls or text messages creating the impression of an urgent situation. This feature is useful when a woman feels uncomfortable or unsafe providing a way to exit the situation.

Table 5 SIMULATED CALLS AND MESSAGES FOR EMERGENCY SITUATIONS

Applications	Total Installs	User Ratings	Supported Platforms
PanicGuard	Over 100K	4.0	Android, iOS
iFake Text	Over 1M	4.2	

5) Self-Defense Learning Apps

These mobile applications provide training modules, tutorials and instructional guides on various self-defense techniques [6]. By equipping women with physical defense skills, these apps empower them to react effectively in threatening situations.

Table 6 SELF-DEFENSE TRAINING AND AWARENESS APPLICATIONS

Applications	Total Installs	User Ratings	Supported Platforms
MyDefense	Over 50K	4.5	Android, iOS
Krav Maga	Over 100K	4.7	

6) Emergency Assistance & Resource Apps

These apps serve as comprehensive safety guides offering helpline numbers, counseling services and self- defense workshop information. They provide vital resources for women seeking support or security assistance. [7]

Table 7 SAFETY ASSISTANCE AND RESOURCE BASED APPLICATIONS

Applications	Total Installs	User Ratings	Supported Platforms
American Red Cross	Over 10M	4.7	Android, iOS
Krav Maga	Over 50M	4.5	

These apps serve as comprehensive safety guides offering helpline numbers counseling services and self- defense workshop information. They provide vital resources for women seeking support or security assistance.

Table 8 PERSONAL SECURITY ALARM SYSTEMS IN MOBILE APPS

Applications	Total Installs	User Ratings	Supported Platforms
Noonlight	Over 5M	4.4	Android, iOS
Krav Maga	Over 50M	4.5	

These devices utilize embedded microcontroller technology enabling real-time monitoring and response without requiring a smartphone. Additionally, cloud connectivity enhances their effectiveness by providing seamless access to security networks. Augmented reality (AR) based security systems are another exciting development that enables improved monitoring and prompt defenses against any attacks. Similar to this, wearable technology powered by AI and ML uses predictive algorithms that evaluate data in milliseconds and occasionally even start defensive measures before an attack takes place [9]. In order to provide complete real-time protection for women these AI-based security models include four essential functionalities: detection, processing, communication and reaction.

Case Studies

1) Raksha: A Smart Safety Companion for Women

Raksha is a pioneering women's safety application designed to integrate intelligent security features that ensure real-time protection. One of its standout functionalities is the "Get Home Safe" system which utilizes continuous background location tracking. This feature proactively monitors a user's journey and triggers an alert if they do not reach their destination within a predefined timeframe. By acting as a digital safeguard, the app enhances users confidence and provides reassurance during travel. [14]

Additionally, Raksha is equipped with a comprehensive SOS alert mechanism that instantly shares the user's live location and critical details with emergency contacts ensuring swift assistance. Beyond emergency responses, the app also prioritizes user empowerment by offering a built-in helpline directory developed with Flutter's local storage capabilities [15]. This feature provides quick access to vital support numbers, allowing users to reach help efficiently when needed. Moreover, the app enhances security by allowing users to modify their PIN ensuring greater control and personalized safety.

Future versions of Raksha are expected to introduce voice-activated SOS triggers enabling hands-free emergency alerts. The app is also set to incorporate live video streaming during distress situations allowing real-time evidence capture for law enforcement [16]. Another planned innovation is the geo-fencing feature which enables users to define safe zones and receive alerts when entering or leaving these designated areas. These enhancements will significantly strengthen accessibility and situational awareness further improving women's safety.

2) SHEild: AI-Powered Safety Monitoring

SHEild is an innovative open-source initiative aimed at enhancing public safety by leveraging machine learning and computer vision to detect real-time instances of harassment and unsafe behavior. By analyzing live video feeds from CCTV cameras, SHEild can autonomously identify potential threats and generate instant reports for law enforcement intervention. The AI model powering this system has been trained on a diverse dataset to ensure high accuracy and reduce false positives.

A unique aspect of SHEild is its collaborative nature as it encourages participation from developers, data scientists and engineers worldwide. By fostering an open-source environment, contributors can enhance the algorithm's efficiency expand the dataset and introduce innovative features to refine detection accuracy. This initiative represents a crucial step in proactive safety monitoring, allowing authorities to intervene swiftly and deter potential threats before escalation. [17-18]

SHEild's impact extends beyond real-time threat detection as it also integrates predictive analytics to assess high-risk areas based on historical data enabling proactive law enforcement deployment [19]. The system's adaptive learning mechanism allows continuous improvement by refining detection patterns through user feedback and real- world testing. Additionally, SHEild prioritizes privacy protection by implementing anonymization techniques ensuring that personal identities are not compromised while monitoring public spaces. Its modular architecture enables seamless integration with existing surveillance infrastructure, reducing deployment costs and enhancing scalability. [20] To maximize accessibility, the platform offers customizable alert systems allowing authorities to receive notifications via multiple channels including mobile applications and smart dashboards. Beyond security, SHEild contributes to public awareness by generating safety heatmaps empowering citizens with knowledge about potentially unsafe areas. This initiative not only enhances urban safety but also fosters a community-driven approach to crime prevention through collaborative technology development.

3) Community-Driven Safety in Smart Cities

In the realm of smart city development, community engagement is playing an increasingly vital role in public safety enhancement. Many urban areas are implementing interactive platforms that encourage citizens to report safety concerns, share feedback and actively participate in local security programs. [21] The integration of mobile applications and social media has significantly improved communication between the public and law enforcement agencies fostering a collaborative approach to crime prevention.

Additionally, immersive training simulations powered by virtual and augmented reality (VR/AR) are gaining traction in emergency preparedness. These technologies enable first responders to simulate real-life crisis scenarios enhancing their ability to react effectively in high-pressure situations. Public awareness programs leveraging these tools are also empowering communities by equipping residents with essential safety knowledge and skills. [22]

4. RESULTS AND DISCUSSION

This section provides a thorough examination of the efficacy, drawbacks and possible uses of five major technologies investigated for improving women's security. To identify areas for development and technology gaps, a thorough comparison analysis was carried out. To give a comprehensive picture of the advantages and disadvantages of the security solutions available today the results were methodically collated. In order to improve women's safety measures, this review seeks to determine the best strategies while addressing the shortcomings of current solutions.

1) Mobile Applications for Women's Safety

In today's world, personal safety has become a significant concern especially for women. The rise in smartphone usage has enabled the development of various mobile applications designed to enhance security. These apps leverage technologies such as GPS tracking, automated alerts and AI- driven monitoring to provide real-time assistance in emergencies. Many of these applications feature emergency calling, location sharing and distress signaling ensuring rapid response during critical situations.

Figure 1 Standard features in Women Safety Applications

However despite their benefits most of these applications require user intervention such as pressing a button or sending an alert which may not always be feasible in threatening circumstances. Some apps aim to overcome this limitation by incorporating motion sensors and background monitoring allowing automatic detection of unusual activity. This section explores notable safety applications their key features and how they function to enhance women's security.

Figure 2 Types of Women Safety Apps in Market

Table 9 COMPARISON OF EXISTINH WOMEN'S SAFETY MOBILE APPLICATIONS

Application Name	Primary Features	Functionality	Unique Aspects	Challenges
Abhaya App	Emergency alerts, GPS tracking, continuous SMS updates	Sends location-based messages to registered contacts and emergency numbers	Repeated location updates every few seconds for real-time tracking	Requires manual activation, making it difficult in sudden emergencies
Sekura	Fake calls, alarm activation, emergency messaging, unsafe location tagging	Provides users with multiple options to respond to unsafe situations	Allows marking of unsafe locations to create safer public spaces	User must activate features manually in distress situations
Eyewatch SOS	Audio and video recording, GPS tracking, multiple alert types	Captures surrounding sounds and visuals while sending alerts to selected contacts	Works without internet access ensuring safety in areas with poor connectivity	Dependent on smartphone compatibility and initial setup
MwithU	Continuous background monitoring, location tracking, emergency alerts	Sends automated alerts if a user does not respond within a set time	Operates in the background and requires minimal user intervention	Requires constant server connectivity which may drain battery life
Circle of 6	Enables users to designate six reliable contacts for prompt emergency notifications.	Offers pre- written notifications, location sharing and instant messaging.	Simple interface that requires little user input to provide quick help.	Preserving data security and guaranteeing message delivery in low-network locations.
Government-Mandated Emergency Features	Integrated emergency buttons, panic alerts	Uses built-in phone features for quick emergency activation	Available on all smartphones post 2017	Some users may not be aware of the feature or how to activate it

Each of these applications plays a crucial role in enhancing security by offering innovative solutions tailored to different scenarios. While some require manual input others function automatically ensuring assistance even in situations where the user cannot physically interact with the device. However challenges such as dependency on internet access, battery life and real-time responsiveness remain areas for future improvement. By integrating AI, IoT and real-time monitoring, future safety applications can provide even more effective and autonomous protection mechanisms ensuring women's safety in unpredictable environments.

2) Women's Safety Systems Driven by AI and Machine Learning

Artificial Intelligence (AI) and Machine Learning (ML) are revolutionizing safety measures including women's security applications. These technologies enable real-time tracking, predictive analytics and automated emergency responses to prevent potential threats. AI-powered security solutions utilize data-driven algorithms to assess risks provide safe route recommendations and initiate distress signals without manual intervention. [10]

Machine Learning-based applications can analyze previous security incidents, recognize patterns of unsafe locations and generate reports for users. By integrating GPS monitoring, audio-visual recording and automated alerts these systems enhance protection levels for women in public spaces. This section explores various AI-MLdriven security applications and their distinctive features.

Table 10 COMPARISON OF APPLICATIONS FOR WOMEN'S SAFETY USING AI AND ML

Application Name	Key Features	Functionality	Unique Benefits	Limitations

AI-Powered Security Apps	Real-time route safety analysis, AI- based risk assessment	Uses past data to determine the safest travel routes	Suggests alternative paths based on risk levels in specific areas	Requires extensive data collection for accuracy
SAWDHAAN	Emergency activation via volume button, automatic data collection	Records surroundings and alerts emergency contacts	Hands-free activation ensures usability in critical situations	Requires prior setup and registration
FightBack	GPS tracking, social media alerts, emergency notifications	Sends real- time location updates to preselected contacts	Supports multiple communication channels including SMS, email and social platforms	Only available for registered users with active SIM and data
WoS App	Gesture-based emergency activation, direct police communication	Shake gesture sends distress signals with GPS location	Quick activation ensures response during sudden threats	Requires a stable internet connection for real-time updates
Raksha	Women's safety app for emergency assistance in real time.	Emergency contacts, real- time location sharing and instant notifications.	AI-powered notifications, prompt assistance and intelligent tracking.	User adoption, data security and network dependence.
Nirbhaya App	Continuous location tracking, emergency reporting, open-source adaptability	Updates emergency contacts at every location change	Open-source framework allows for custom modifications	Frequent location updates may cause battery drainage

These AI-ML-powered security solutions offer smart, automated and real-time safety mechanisms for women. While some require manual intervention, others rely on gesture-based or voice-activated triggers to minimize delays during emergencies.

3) Smart Embedded Solutions for Women's Safety

Embedded systems play a crucial role in modern safety solutions providing real-time monitoring, automated response mechanisms and emergency alerts. When integrated with wearable devices, biometric authentication and AI-driven detection, these systems enhance women's security in public and private spaces. [11-12]

This section explores innovative embedded security systems designed to provide instant protection, emergency assistance and location tracking during critical situations.

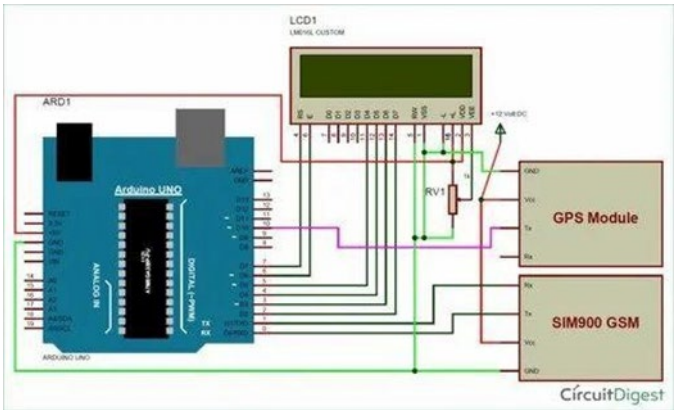

Figure 3 Mobile SMS-Based GPS Tracking Using Arduino and GSM Module

Table 11 A COMPARISON OF WOMEN'S EMBEDDED SAFETY TECHNOLOGIES

Technology	Core Features	Activation Mechanism	Advantages	Limitations
Wearable Embedded Device	Shock mechanism, distress signal, GPS tracking	Touch sensor & voice command	Immediate physical defense & emergency alert	Risk of accidental activation
Pulse-Triggered Security System	Heart rate monitoring, GPS-GSM integration	Detects abnormal pulse rate	Auto-alert to contacts without manual input	May trigger false alarms under stress
Biometric-Based Safety Watch	Fingerprint authentication, voice recording	User verification before activation	Reduces false alerts with fingerprint match	Requires pre-registered fingerprints
Kavalan SOS (Tamil Nadu)	Emergency alert app for quick police response	Provides the control room with real- time location-based SOS notifications.	Direct police integration to provide help more quickly	Dependency on the network and guaranteeing prompt response
Smart Emergency Alert System	Panic button, alarm, GPS- GSM tracking	Button press or forceful removal	Alerts surroundings and contacts instantly	Potential misuse and prank alerts

By incorporating AI-powered decision-making, biometric verification and real-time tracking these next generation embedded systems enhance security by providing instant protective actions, emergency alerts and location tracking. With further advancements, these safety solutions could integrate law enforcement databases enable live audio-video recording and function in low-network areas for maximum security and reliability.

4) IoT-Powered Safety Systems for Women

The Internet of Things (IoT) is transforming security by enabling real-time monitoring, automated alerts and rapid emergency responses [13]. By integrating wearable devices, mobile applications and AI-powered sensors, IoT-based safety systems enhance protection and prevent potential threats before they escalate.

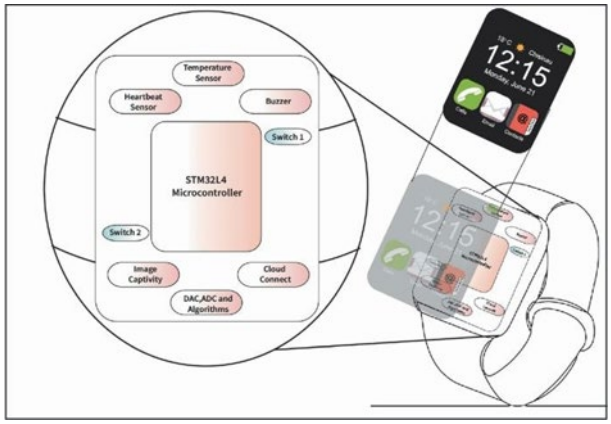

Figure 4 Designing Women's Safety Wearables with an Internet of Things-Based Framework

This section explores innovative IoT security devices designed to ensure women's safety through smart connectivity, instant alerts and automated defense mechanisms.

Table 12 AN ANALYSIS OF IOT-BASED WOMEN'S SAFETY SOLUTIONS IN COMPARISON

Technology	Core Functionality	Activation Method	Key Benefits	Challenges

Suraksha Safety App	Voice command, emergency switch, shock mechanism	Triggered via mobile interface	Instant alert, attacker deterrence	Requires internet connectivity
Amritha Safety System	Wearable emergency response device	Single- button activation	Discreet and user-friendly	Limited to registered contacts
Vithu Alert App	Emergency messaging and location tracking	Double- press power button	Quick distress signal to contacts	Needs pre-configured contacts
JIVI 2010 SOS Device	Auto-dial emergency calls	Long press of SOS button	Calls five predefined numbers sequentially	Only works with preset contacts
SHE (Smart Harnessing Equipment)	Electric shock defense, GPS tracking	Physical sensor detection	High- voltage shock for attacker deterrence	Requires regular maintenance

With AI-enhanced decision-making and real-time IoT connectivity, these security solutions ensure that women receive immediate help while preventing threats through proactive defense mechanisms. Future advancements may function in low-network areas to provide uninterrupted safety assurance.

5) Augmented Reality-Based Safety Solutions for Women

Augmented Reality (AR) seamlessly blends virtual information with real-world visuals, creating immersive and interactive experiences. As mobile devices become more advanced, AR-based applications are emerging as powerful tools to enhance security, provide real-time situational awareness and assist individuals in emergency situations.

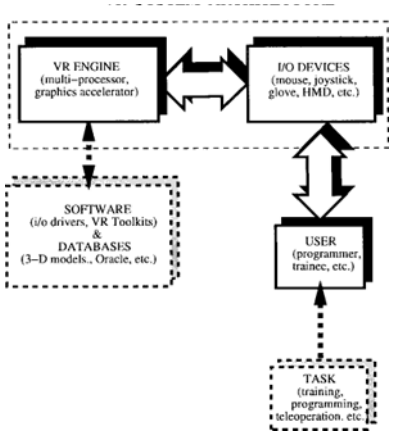

Figure 5 Generic VR System Architecture

This section explores AR-powered safety systems for women, focusing on how real-time data visualization, location awareness and intelligent alerts can enhance security in public spaces.

Table 13 COMPARING WOMEN'S SAFETY SOLUTIONS BASED ON AUGMENTED REALITY

Technology	Functionality	Activation Method	Key Features	Limitations

Safe Street App	Evaluates the safety level of public places	Camera-based AR scanning	Displays current area safety ratings derived from local data and user feedback.	Needs a steady internet connection and regular user involvement.
FEMME Safety System	Monitors surroundings for hidden threats	Wearable AR-integrated device	Tracks movements, finds possible threats and detects concealed cameras.	Requires continuous updates for accuracy
Women's AR Security App	Provide immediate security alerts and environmen based recommendations.	GPS and mobile camera	Location- based safety suggestions and SOS messaging	Limited efficacy in areas with poor connection or in remote areas
Wikitude AR Safety Integration	Overlays security insights on camera feed	Mobile camera and internet	Displays local crime reports and user reviews	Depends on content contributed by users which might be out-of-date or incomplete.

5. PROBLEMS AND DIFFICULTIES IN THE DEVELOPMENT OF SECURITY SYSTEMS

1) **Rising Safety Concerns in Public Spaces**
   - With increasing urban populations and diverse social groups, crimes especially those targeting women, have seen a significant rise.
   - Women face heightened risks due to social inequalities, economic disparities and urban planning flaws that fail to prioritize safety.
   - The lack of opportunities for marginalized youth often leads to frustration contributing to criminal activities.
2) **The Psychological and Social Impact of Crime**
   - Women frequently experience restricted mobility and fear in urban settings which limits their access to education, employment and public spaces.
   - Beyond direct violence, the fear of crime itself significantly affects women's daily lives discouraging independent movement.
3) **Limitations in Existing Security Measures**
   - Most safety devices require manual activation which may not be possible during emergencies.
   - Connectivity issues in security devices can lead to delays or failures in emergency response making them unreliable in critical moments.
   - High battery consumption in smart security gadgets often limits their effectiveness during prolonged use.
4) **Societal and Structural Gaps in Women's Safety**
   - Governments and local authorities often lack comprehensive policies that address women's safety as an integrated issue rather than isolated incidents.
   - Many public services including law enforcement and emergency response units, lack gender-sensitive training reducing their effectiveness in handling such cases.

- Economic, cultural and societal biases make access to justice difficult especially for women from marginalized backgrounds.

5) Urban Infrastructure and Design Challenges

- Poorly lit streets, inadequate surveillance and unsafe public transportation make cities more vulnerable to crimes against women.
- Low-income areas, where poverty and unemployment are prevalent ften experience higher crime rates further endangering women's safety.

6) Need for Technological Advancements

- Existing security gadgets need improvements in AI- based threat detection, automated emergency alerts and internet-independent communication to ensure real-time assistance.
- Integration with 5G, IoT and advanced signal processing could help create smarter security systems with uninterrupted connectivity.
- Longer gadget operation without regular recharging particularly in emergency scenarios requires improved battery efficiency and energy-harvesting approaches.

6. FUTURE SCOPE

The future of women's safety is set to advance significantly with the integration of cutting-edge technology, societal initiatives and legal frameworks. AI- driven threat detection systems will play a crucial role in identifying potential dangers in real time while biometric authentication will enhance security by ensuring restricted access to safety applications and sensitive data. Smart wearables including clothing embedded with discreet alert mechanisms will empower individuals to seek help swiftly in emergencies. Additionally, data-driven urban planning can contribute to designing safer public spaces. However, beyond technology, societal transformation is equally vital implementing stricter cyber laws to combat digital harassment, corporate policies prioritizing employee security and digital literacy programs will strengthen overall protection. Collaborative policing strategies, utilizing data analytics and community involvement will foster trust and enable tailored law enforcement interventions. Moreover, increasing awareness and accessibility to safety resources including self-defense training and community workshops will enhance preparedness and resilience. The combined impact of these advancements will create a safer and more empowered environment for women bridging the gap between technological progress and practical safety solutions.

7. CONCLUSION

Ensuring women's safety is of utmost importance in today's world where they actively participate in all areas of life. However, the increasing threats against them necessitate the development of a robust and reliable security system that is easily accessible. A well-integrated security framework should empower women to handle dangerous situations effectively without endangering themselves. By leveraging modern advancements such as artificial intelligence, machine learning, IoT, embedded systems and mobile applications a comprehensive and foolproof security mechanism can be created. Additionally, future research should focus on addressing challenges related to internet connectivity through signal processing techniques and energy-efficient solutions. Implementing these innovations will enable seamless communication between individuals in distress and relevant authorities ensuring immediate assistance when needed.

CONFLICT OF INTERESTS

None.

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