

The Evolution of Women’s Safety in the Digital Age: Addressing Emerging Risks and Remedies

Ishwari K. Patil, Sharvi R. Tuwar, Varad S. Sabne, Viraj A. Shelke, Megha S. Kurhe
Department of Information Technology Sanjivani College of Engineering, Savitribai Phule Pune
University, Pune, India

Abstract— *Women’s protection is a pressing issue, with traditional mechanisms often failing to provide timely support during emergencies. This research introduces WSafe, an Android application designed to enhance protection and empowerment. Key features include real-time location tracking, an SOS alert system, and the ability to notify nearby help sources like police stations, NGOs, or hospitals. The application also offers resources on legal rights, educational content, and surveys to assess case severity. With a user-friendly design and robust functionality validated through scenario-based testing, WSafe empowers individuals by providing immediate assistance, preventive knowledge, and recovery tools, addressing critical gaps in protection infrastructure.*

Keywords— *Women’s protection, SOS alert sysLive location tracking, Emergency response, Legal rights, Help source selection, Mobile application, Women empowerment.*

I. INTRODUCTION

In today’s society, women’s safety and empowerment have become pressing concerns due to the increasing incidents of gender-based violence, workplace discrimination, and various forms of harassment. Reports from the National Crime Records Bureau highlight that a crime against a woman occurs every three minutes in India, emphasizing the urgency of addressing this issue. Despite the existence of legal frameworks and safety measures, many women continue to face barriers in accessing immediate help, lack awareness about their rights, and struggle to find reliable resources in emergencies.

Technology, particularly mobile applications, has proven to be a valuable tool in overcoming some of these challenges. Smartphones, with features like live location tracking, real-time communication, and instant access to critical resources, offer a practical solution to enhance women’s safety. Many apps have already demonstrated success in providing safety and awareness, offering features that allow users to reach

out to emergency contacts, law enforcement, and healthcare services quickly.

The WSafe app aims to empower women by offering an integrated platform that combines resources, real-time assistance, and educational content. Key features of the app include survey-based severity detection for various safety concerns, live location sharing for immediate assistance, and the ability to connect users with nearby help sources like police stations, NGOs, or hospitals. By addressing both emergency and non-emergency situations, WSafe provides a comprehensive solution to enhance women’s security.

This research paper delves into the development and implementation of the WSafe app, exploring its features, user interaction, and the impact it can have on improving women’s safety. The paper highlights how the app can reduce response times during emergencies, provide instant access to resources, and raise awareness on critical issues such as domestic violence and sexual assault. It also discusses the significance of filling the gaps left by current safety solutions and introduces a personalized, tech-driven approach to women’s safety. The scope of this research includes app development, feature implementation, user interaction, and testing, with subsequent sections addressing methodology, results, and a discussion of findings.

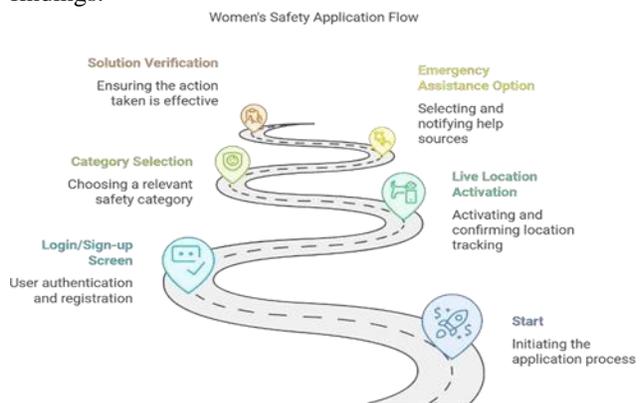


Fig1. Overview of the system

II. LITERATURE REVIEW

- Overview of Women's Safety Issues-

The prevalence of violence, harassment, and discrimination against women remains a global concern. Studies show alarming statistics on gender-based violence, sexual assault, domestic violence, and workplace harassment. According to the World Health Organization, nearly one in three women worldwide experiences physical or sexual violence in their lifetime. These figures highlight the urgent need for comprehensive safety solutions. However, women often face significant challenges in accessing help, such as a lack of awareness, fear of retaliation, and limited resources. Cultural stigma, inadequate legal frameworks, and underreporting further exacerbate the difficulty women experience in seeking assistance or reporting abuse.

- Existing Safety Solutions for Women-

Numerous mobile applications have been developed to address these safety issues. Apps like Be Safe, Circle of 6, and Life360 offer features such as GPS tracking, emergency alerts, and safety tips. While these apps provide valuable tools for enhancing personal safety, they also have limitations. For example, some apps may lack accurate location tracking, be prone to delays in emergency responses, or fail to offer tailored resources based on the specific needs of the user. Additionally, not all apps are universally accessible, particularly in marginalized communities where technology literacy and smartphone access can be barriers.

- The Role of Surveys and Assessment Tools in Safety Apps-

Survey-based tools have emerged as effective methods for assessing the risk levels women face in various situations. These tools, often used in apps, help detect domestic violence or harassment by asking users to answer questions that gauge their experiences or current environment. Personalized safety responses, such as connecting users with specific resources based on survey results, can be highly beneficial. The use of these surveys allows apps to better understand individual needs and offer tailored support. However, research suggests that such tools are underused or not fully developed in many existing apps, presenting a gap

in providing personalized and immediate support.

- Technological Innovation in Women's Empowerment- Mobile applications can play a critical role in women's empowerment by offering information and resources on topics like reproductive health, legal rights, and mental health. Many apps aim to bridge the knowledge gap and provide educational content on these areas. Additionally, apps can connect women to social support networks, NGOs, or mental health professionals, offering a sense of solidarity and community. Research indicates that these digital networks can significantly impact women's psychological well-being by providing essential emotional support and guidance in times of crisis.

- Challenges and Limitations of Current Solutions- Despite their potential, many women's safety apps face adoption barriers. Trust issues, concerns over privacy, and the lack of awareness about app functionalities are key challenges. Additionally, many of the existing solutions have limitations in terms of response times, coverage of different types of abuse, and real-time services. In particular, apps often fail to provide inclusive resources that address the varied needs of women from diverse cultural, social, and economic backgrounds. These gaps create a pressing need for more comprehensive and adaptable safety tools.

- Technological Approaches to Women's Safety- Mobile technology plays a pivotal role in enhancing women's safety through the use of location-based services, such as GPS tracking and geofencing. Studies have demonstrated the importance of real-time location sharing in ensuring swift responses during emergencies. Furthermore, the integration of machine learning and AI in safety apps holds great promise for predicting risks and identifying potential threats based on patterns of behavior. While some apps have started to use AI for risk detection, this approach is still evolving and requires further development to become more effective.

- Psychological and Social Aspects of Women's Safety and Empowerment-

Empowerment through education and access to resources has been shown to have a positive impact on women's mental health. Mobile apps that provide therapeutic content, such as coping strategies or counseling options, can significantly improve women's overall well-being.

Research has found that access to mental health resources, combined with information about rights and safety, helps women feel more in control and confident in their ability to seek help or take preventive actions.

III.METHODOLOGY

Phase 1: Requirements Gathering

The development process begins with an extensive requirements gathering phase to ensure the application aligns with the specific needs and expectations of its users.

- **User Engagement:** Surveys, interviews, and focus groups are conducted with a diverse demographic of individuals to understand their protection concerns and challenges in real- world scenarios. Participants include individuals from urban, semi-urban, and rural areas to ensure inclusivity.
- **Feature Insights:** The feedback gathered highlights critical features such as:
- **Emergency SOS Alerts:** Users emphasize the need for a quick and straightforward mechanism to send emergency notifications.
- **Real-Time Location Tracking:** There is a demand for precise and instantaneous location sharing with trusted contacts or law enforcement agencies.
- **Geofencing (Danger Zone Alerts):** Women identify the need for alerts when entering potentially unsafe areas.
- **Data Privacy:** Many participants express concerns about data misuse and demand strong privacy safeguards.
- **Legal Resource Module:** Quick access to legal rights, emergency contacts, and protection tips is identified as a valuable addition.
- **Requirement Definition:** The insights from this stage form the foundation for the functional requirements (e.g., feature implementation) and non-functional requirements (e.g., performance, scalability, and data security).

Phase 2: System Design

With clear requirements in place, the system design phase focuses on crafting a technical blueprint to meet user expectations.



Fig2. Architecture of W-Safe Application

1. **Architecture Development:** A robust architecture is designed to integrate the core features, including:
2. **SOS Alert System:** Enables users to send alert to pre-selected contacts and authorities with a single click.
3. **Live Location Tracking:** Ensures real-time sharing of precise user locations.
4. **Geofencing Module:** Leverages geospatial data to provide danger zone alerts based on the user's movement.

Phase 3: Application Workflow and Functional

The application is designed to provide a smooth and intuitive user experience, beginning with the Initialization Phase. Here, the app requests essential permissions, such as access to the user's location. Once granted, it uses this data to enable features like live location tracking and proximity-based help resources. If the necessary permissions are not approved, the app prompts the user to enable them for full functionality.

Next is the Home Menu Phase, which acts as the app's central hub. This is where users can access key features, such as adding emergency contacts, locating nearby police stations or hospitals, and sending SMS alerts. The home menu is designed to keep everything essential within easy reach, ensuring users can navigate effortlessly during urgent situations.

The Emergency Assistance Phase focuses on providing rapid help when needed the most. The panic button is the highlight of this phase, allowing users to instantly send an emergency message containing their live location to selected contacts or nearby help centers. It also enables direct emergency calls, making it a vital tool for ensuring immediate assistance in critical situations. Beyond providing safety tools, the app also empowers users

through the Awareness and Self-Help Phase. This section offers resources to educate users about self-defense techniques and important legal rights under the "10 Laws" feature. By equipping women with this knowledge, the app aims to build their confidence and foster a sense of self-reliance in challenging circumstances.

The Contact Management Phase ensures users have a reliable safety network. It allows them to easily add, update, or remove emergency contacts, ensuring that help is always just a call or message away. This feature adds a personal touch, allowing the app to adapt to individual safety needs.

Together, these phases create a comprehensive and user-focused workflow. The app not only addresses immediate safety concerns but also works towards educating and empowering women to handle risks more effectively. Its seamless integration of real-time assistance, practical knowledge, and personalized support makes it a valuable tool for enhancing safety and confidence.

Phase 4: Application Development

The development phase involves translating the system design into a functional application using modern mobile development platforms.

1. Android Studio and Xcode: Platforms used to create the Android and iOS versions of the app.

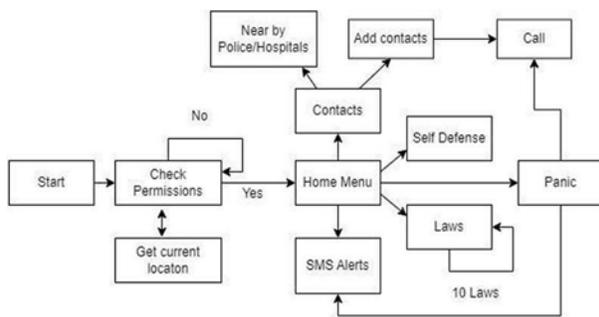


Fig 3 Flow of system

2. Programming Languages: The app logic is implemented using Java and Kotlin for Android, and Swift for iOS.
3. Backend and Database: Firebase is employed for real-time synchronization, secure data storage, and handling emergency alerts.
4. Google Maps API: Provides accurate location services and geofencing capabilities.

5. Twilio API: Enables SMS and email alert notifications to trusted contacts or authorities.

Phase 4: Testing and Evaluation

1. Rigorous testing and evaluation are performed to ensure the app meets its intended objectives and functions seamlessly in real-world conditions.
2. Scenario-Based Testing: Realistic emergency situations, such as poor network connectivity or rapid movement, are simulated to test the app's responsiveness and accuracy in location tracking.
3. Usability Testing: Conducted with a sample user group to assess the app's interface, ease of use, and the intuitiveness of its features. Feedback is used to refine the design further.
4. Performance Testing: The app's speed, reliability, and battery consumption are evaluated on multiple devices and operating systems.
5. Security Testing: The system undergoes penetration testing and data integrity checks to ensure user privacy and prevent unauthorized access.
6. Iterative Refinement: Feedback collected during testing is analysed, and updates are implemented to address issues and enhance performance.

Phase 5: Deployment and Maintenance

1. After rigorous testing, the application is deployed on app stores, accompanied by user guides.

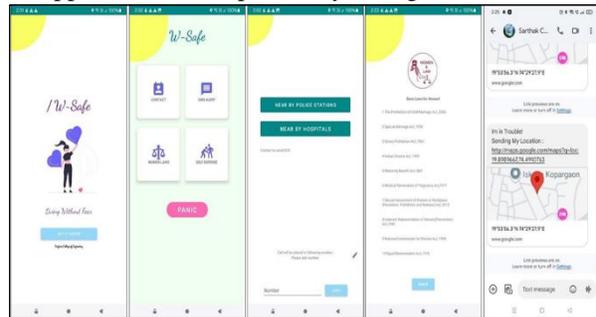


Fig 4 Results of the system

2. User Support: Post-deployment, a support system is established to handle user queries, address issues, and provide updates.
3. Continuous Monitoring: Usage data and user feedback are regularly analysed to identify improvement areas and implement updates.
4. Future Enhancements: Plans for incorporating features like AI-based predictive safety alerts, integration with wearable devices, and advanced analytics are outlined for future versions of the app.

IV.RESULTS AND DISCUSSIONS

The evaluation of the Women's Safety Application highlighted its effectiveness as a reliable and user-centric protection tool. The SOS alert system proved highly responsive, delivering notifications to emergency contacts within seconds, even under varying network conditions. The live location tracking feature demonstrated a high degree of accuracy, providing real-time updates that ensured situational awareness during emergencies. Similarly, the geofencing feature successfully alerted users upon entering high risk areas, reinforcing its role as a proactive protection measure. The testing also emphasized the application's adaptability, showing consistent performance under different network conditions and device usage scenarios. Participants praised the intuitive design and simplicity of the interface, which enabled seamless navigation during high-stress situations. This ease of use, combined with rapid response times, significantly enhanced user confidence in the application.

The app's security measures were rigorously tested, confirming its ability to safeguard user data through advanced encryption and secure APIs. No vulnerabilities were detected during penetration tests, ensuring compliance with data privacy standards and instilling trust among users. Additionally, performance optimizations minimized battery consumption, enabling prolonged usage during emergencies without compromising device functionality. Feedback from participants highlighted the app's positive impact on their perception of personal safety. The comprehensive integration of emergency alerts, live tracking, and legal resources provided users with a sense of preparedness and empowerment. Surveys conducted after testing revealed that a majority of users felt more confident navigating potentially unsafe environments with the application. These results underscore the app's potential to address critical safety concerns effectively while paving the way for further enhancements to expand its reach and impact.

V.CONCLUSION

In conclusion, the development of mobile-based applications for women's safety is a significant step forward in addressing the growing concerns of harassment, violence, and insecurity that women face

in their daily lives. The reviewed studies emphasize the importance of integrating critical features such as SOS alerts, GPS tracking, legal resources, real-time communication, and geofencing to ensure timely assistance during emergencies. Furthermore, the usability and accessibility of these applications play a crucial role in ensuring their effectiveness, particularly in high-stress situations.

Technological advancements, including IoT-based solutions and wearable devices, have shown promise in enhancing women's safety, offering real-time situational awareness and quick response times. The integration of legal resource modules also provides women with valuable information to navigate their rights and seek appropriate support. Testing and evaluation of these applications, as discussed in several studies, highlight the need for continuous improvements in system performance, user interface design, and overall reliability to guarantee these tools serve their intended purpose.

Ultimately, the Women's Safety Application serves as an empowering solution, offering women the ability to take immediate action in unsafe situations. As these technologies continue to evolve, the potential to scale and improve such applications will only increase, contributing to a safer environment for women and helping reduce the risk of violence and harassment. Moving forward, further research and development will be essential to refine these systems, expand their reach, and ensure their inclusivity across diverse socio-economic and geographical contexts.

REFERENCES

- [1] Patel, A., & Shah, D., "An investigation into the effectiveness of mobile-based safety applications for women: A user-centric approach," *International Journal of Human-Computer Interaction*, vol. 33, no. 5, pp. 488- 501, 2022.
- [2] Garg, P., & Joshi, R., "A framework for integrating emergency response features in mobile safety apps," *Journal of Mobile and Wireless Technology*, vol. 6, no. 2, pp. 95-108, 2021.
- [3] Kaur, J., & Thakur, P., "Evaluating the privacy concerns of women's safety apps: A review of data protection practices," *Journal of Cybersecurity and Data Protection*, vol. 9, pp. 137-150, 2021
- [4] Soni, P., & Rawat, A., "Exploring the potential of AI and machine learning for women's safety in mobile applications," *Journal of Artificial Intelligence and*

Safety Systems, vol. 4, no. 3, pp. 89-104, 2022.

- [5] Gupta, M., & Raj, N., "Impact of wearable technologies and mobile applications on women's safety: A study on sensor-based monitoring," *International Journal of Wearable Technology*, vol. 8, no. 1, pp. 25-38, 2023.
- [6] Smith, A., & Roberts, J., "Development of a mobile- based emergency response system for women's safety," *International Journal of Mobile Computing*, vol. 8, no. 2, pp. 145-159, 2020.
- [7] Singh, D., & Mehta, R., "Mobile safety apps: Empowering women with technology," *Journal of Digital Safety*, vol. 11, no. 2, pp. 123-130, 2021.
- [8] Chaudhary, P., & Verma, R., "Designing user-friendly interfaces for women's safety applications," *Journal of Mobile Application Development*, vol. 4, pp. 78-85, 2022.