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WOMEN SAFETY ANALYTICS: A FRAMEWORK FOR PROTECTING WOMEN FROM THREATS

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Abstract:

Across the globe, women's safety is a major problem. Concerns over hazards in online environments, emotional injury, and physical threats are still on the rise. In addition to harassment and other forms of exploitation on digital platforms, gender-based violence has escalated. Such patterns necessitate proactive measures to protect women. In any setting, every woman should feel secure and safe. The Women's Safety App is a dependable online resource. In an emergency, it provides prompt assistance. Users can send alerts to trustworthy contacts with only one tap. They can also call for an ambulance or speak with the local authorities. When time is of the essence, this arrangement provides immediate assistance. Real-time location updates are provided by the app. Friends and family are always informed of the user's location. The app has a number of built-in functions. One has to do with an intelligent SOS system. It has settings for automatic triggering and a panic button. GPS and network signals are used for real-time tracking. Notifications are sent using geofencing as necessary. Network priority allows emergency calls to connect quickly. Multiple contacts receive pre-programmed distress messages. Sharing a location is simple. Coordination of ambulances happens quickly. The national emergency services are directly linked. The software assists in preventing hazards before they arise, in addition to issuing alarms. Women can discreetly exit unpleasant circumstances with the use of a false call feature. The app's ultimate goal is to promote a generally safer and more attentive workplace. Women can go about their daily lives with more confidence and calm.

Keywords: Women's Safety, Emergency App, Real-Time Tracking, SOS Detection, Microphone Access.

INTRODUCTION

With a rise in incidents of gender-based violence, harassment, and threats in both public and private settings, women's safety continues to be a major concern on a global scale. Utilizing current technology, such as machine learning, data analysis, and real-time tracking, offers creative ways to address these issues. In order to maximize women's safety in a variety of settings, this project suggests an intelligent safety monitoring and analytics solution. The system gathers, processes, and analyzes location and context data in order to predict danger zones, identify potential hazards, and enable prompt responses. This system seeks to provide a secure environment for women by integrating features like AI-based risk forecasting, emergency messaging, and real-time alert production. Through a data-driven, integrative approach that is available on mobile and web platform.

Not only do they pose a threat directly, but they may also be part of long-term intimidation patterns, movement restriction, and reduced social interaction. Women turn to short-term protection measures, alter their daily routines,

or leave particular situations all of which demonstrate how the system does not provide so much as the most basic sense of security. Traditional solutions that do not address delayed response, underreporting, and stigmatization are, for instance, calling the police or waiting for a call during an emergency. Such failure justifies the necessity for innovative, proactive, and low-cost protection measures to suit the demands of the current times.

A. Background

- Cultural and Societal Relevance:

Women have suffered security-related problems since the dawn of history on the basis of social culture, institutionalized discrimination, and societal structure. In virtually all societies, mobility constraints, limited access to justice, and low rates of criminal reporting have ensured that insecurity and fear became a cultural phenomenon. Not only is women's safety an issue of personal security, but it also falls under human rights and social development. The right to safety allows women to make a positive contribution to education, work, and social life, and to contribute positively to economic growth and social integration [1].

- Response to Women's Safety:

Historically, the measures of security for women involved neighbourhood watch, self-security measures, and protective law. The measures have been universally re active in nature rather than preventive. Implementation of women-focused measures of security such as women-only transport systems and support hotlines herald the evolution towards a more complete approach. The measures are non-scalable and predictive in nature like technology solutions [2].

- Technological Advancements and Innovation:

Emergence of new technology in geospatial analytics, IoT, and AI has transformed the manner in which we address safety concerns. From wearable technology to protective gear, to phone panic buttons and location applications, technology has moved in to close the gap between alarm detection and response. It is now possible for machine learning algorithms to analyse behavior patterns, environmental data, and real-time user responses to detect anomalies and raise alarms ahead of time. All these technologies are making prevention of harm and assistance to vulnerable individuals more intelligent, quicker, and more efficient [5].

B. Scope

The project will create a converged safety analytics platform utilizing new technologies to solve the complex problems of women's safety. The platform's ultimate vision is to deliver end-to-end management of safety, ranging from real-time identification of threats and predictive analytics to incident reporting and follow-up messaging after the incident has happened. This is as compared to more traditional safety standards that respond after the threat has already been present. This is proactive. It takes advantage of the synergy between real-time environmental data and sensor data from mobile sources. Overall, the system's strength is that it can collect, process, and analyze multiple data streams in a manner that gives immediate understanding and predictive warning. It will correlate data from different sources, such as end-user reports of events, open-source government crime reports, police data bases, and IoT sensors like smart cameras, GPS, and personal safety wearables. The feeds will be streamed continually into a machine learning-based centralized analytics platform that will query trends between crime events, user behavior, location-based threats, and time-of-day usage. Besides, the platform will utilize weather and lighting APIs data to evaluate outside risk factors. Ease of use and user-centric design as well as the fact that it will be easy for even less computer-literate people or those with irregular internet access to use are also factors in as much as it's an inherent part of the way the platform functions. The solution will also be able to function effectively in low-bandwidth systems, which is highly relevant for the rural or disadvantaged communities. The platform will also include speech prompts, visual alerts, and a few of the local languages so that the users can make it more readable at different literacy levels and languages. This would be done to make sure that women from all socioeconomic levels, wherever they are located, and whatever their educational level, could access the technology. In addition, the site will provide a community safety dashboard so visualization of trends in incidents can be promoted for communal awareness and participation [7].

C. Objectives

- Real-Time Threat Detection :

The primary purpose of this system is to provide real-time threat detection through several sources of information including cellular phone sensors, GPS locations, time context, and criminal history databases. Ongoing monitoring of the user environment and activity enables the system to detect anomalies—like unexpected accelerations, noise, or unusual routes that are damaging. By integrating this real-time data with other data such as crime maps and environmental sensors (e.g., lack of illumination, low pedestrian level), the platform can provide real-time warnings and alerts to the user. This aspect enables users to know what is happening and take preventive measures before a threat occurs.

- Emergency Response Integration

The primary focus of this website is to provide a quick and instant emergency response system that provides instant help in the case of an emergency. There will be an exclusive SOS button, gesture initiation (i.e., shake-to-alert), and even voice initiation to initiate emergency alert. The instant an alarm is triggered, the system will immediately notify the user's emergency contacts, nearby trusted users, nearby police, or emergency numbers with real-time location, context information, and possibly audio/video recordings (if users allow it). This is also time saved in emergency response and guaranteed that the victim is never alone in an emergency scenario, hence the possibility of receiving timely and safe help.

- User-Centric Interface Design

Being aware of the heterogeneity of its women users, the system will have an easy and clear interface which is designed for women specifically in areas, languages, and literacy. The web site will be multilingual, user icon-based navigation with low literacy requirements, and voice support for features to enable safety tools to be accessible to all. Easy-to-use interface is equally important to facilitating adoption as it is with usability; hence, the interface will be simplicity-driven, responsive to get around, and frugal with data consumption. Moreover, the personalized aspects of suggested safe routes, instant-access emergency functions, and resource pages will be integrated into the design to support usability and care for user trust.

LITERATURE REVIEW

Technical innovations like mobile apps, Internet of Things, artificial intelligence, and machine learning have been put to use in the area of women's safety as a major research topic in an attempt to avert threats and offer real-time security. There have been various studies that have helped in the integration of innovative physical and cyber security solutions for women.

The focus is on mobile-based safety apps in recent studies. Kalshetty et al. [6] and Sakthivelan et al. [1 concentrate on analytics-based solutions through real-time surveillance for risk detection and elimination. Likewise, Kalaiyarasan et al. [2] introduce Jhansi, a cutting-edge women's safety app with contemporary security options for emergency notifications. Whereas Vats et al. [4] created W-SAFE, a 24x7 software that is able to provide protection on a 24x7 basis, Bhadre et al. [3] came up with Raksha placing focus on simple-to-use emergency response capabilities. In addition, IoT and machine learning integration has received interest. While Pau and Kalaiselvi [16] developed IoT-based ML models for experimental safety testing, Shankar et al. [5] created an app through ML automatically detecting and mitigating hazard. Such strategies were utilized by Nasare [18] and Anisha et al. [15] to research hazards using AI and ML techniques, such as social media-based analysis for real-world applications.

The other studies emphasize emergency features and geolocation. Geolocation-enabled quick tracking application is demonstrated by Jefry et al. [12], whereas Android-based safety systems that are light and responsive are investigated by Sarma et al. [10] and Kataria et al. [11]. To minimize reaction time, Kumar [19] showcased one-click safety solution, while More et al. [14] have created Sakhi-The Saviour, a socially responsible app to facilitate quick distress calls. Gonde & Ghewari's review [17] and empowerment-oriented study by Dr. Prakanshi [8] a few instances of larger conceptual and review-based paradigms that cater to the scope of safety technology to empower women. Pragna & Poojary's [20] and similar past work formed the pillars for today's solutions by providing basic understanding of safety devices and applications.

Hence, the literature illustrates a clear transition from basic emergency alarm systems to smart Internet of Things solutions based on ML/AI that are capable of anticipating threats. Most focus on mobile applications, though more recent trends aim for preventive over reactive safety by inclining toward automation and predictive analytics.

The following Table 1 provides description of different techniques with its drawback for women's safety as,

Table 1. Comparative Review of Recent Studies and Technologies on Women's Safety Systems

Ref. No.	Publication Year	Abstract	Methodology Used	Limitations
[1]	Decmber-2024.	Emphasizes the analysis and improvement of women's safety by real-time monitoring, alarm messages, and threat alerts.	Data analytics, predictive modeling.	Dependent on constant internet availability, does not cater to all safety situations
[2]	April-2024	Discusses a sophisticated women's safety application for instant alert and response systems.	Android-based application development, GPS tracking.	Confined to users with smartphones, battery drainage risk.
[3]	May-2024	Launches Raksha, an application for mobile that can give emergency alerts as well as follow the location of the user.	App development with emergency alerts, location tracking.	Internet and GPS-dependent, can fail to work properly in rural settings.
[4]	April-2023	Analyzes the deployment of a women safety device to address emergencies and safety scenarios.	Device deployment, real-world testing with users.	May not be widely used, user resistance, and cost of the device.
[5]	May-2021	Innovates an Android application for women's safety with SOS feature.	Android application development, real-time alerting.	Limited features in locations without mobile phone network coverage..
[6]	July-2018	Describes different devices and applications to provide women's safety, including device functionalities and market issues	Review of different safety devices and applications.	Limited coverage by applications, high reliance on technology infrastructure
[7]	November-2023	Creates an app based on Android to provide women's security with emergency notices.	App development based on Android platform, real-time monitoring.	Not always successful where connectivity is weak in remote or low-network areas
[8]	April-2023	Concentrates on women's safety via an Android app that sends out distress calls and signals..	App development with real-time monitoring and alerts.	Could have problems with false alarms or technical malfunctions
[9]	May-2024	Explains the characteristics of the W-SAFE app for 24/7 monitoring of safety.	App development with incorporating safety alerts and location tracking.	Dependence on the network, can be challenged in particular places with poor service coverage.
[10]	January-2021	Introduces Sakhi app to assist women during social insecurity with real-time support.	Mobile app development incorporating emergency response.	Network coverage and device compatibility issues.
[11]	October-2023	Introduces a women's safety mobile application employing geolocation in helping women in emergencies.	App development based on geolocation, tracking location.	App development based on geolocation, tracking location.
[12]	November-2021	Examines women's safety in Indian cities employing machine learning to examine public tweets regarding safety concerns.	Machine learning-based analysis of public information from tweets.	Cannot be entirely accurate, dependent on social media information which may be biased.

[13]	March-2021	Treats a safety management system with IoT and machine learning to enhance women's safety.	Experimental analysis of IoT-based safety system.	Technical complexity in implementation, system complexity.
[14]	May-2024	Presents a danger-detecting safety app that autonomously sends alerts through machine learning..	App development and machine learning for danger detection.	Might not catch all forms of danger, dependent on machine learning algorithms.
[15]	December-2024.	Emphasizes data analytics for anticipating and avoiding safety dangers for women.	Data analytics, safety prediction models.	Subject to the quality of data, can be wrong positives.
[16]	January-2021	Reviews existing systems for women's safety and recommends changes.	Literature review and system analysis.	Does not have experimental data or implementation details.
[17]	February-2020	Emphasizes AI-based systems for improving women's security in public places.	Artificial intelligence, security system integration.	High in complexity, possible privacy issues.
[18]	June-2024	Creates a safety hub platform for women, providing real-time alerts and assistance.	Platform creation with real-time monitoring and alerts.	Reliance on mobile networks, restricted area of coverage.
[19]	April-2024	Analyzes women's safety and empowerment, suggesting solutions.	Qualitative analysis, case studies.	Broad findings, not technology-specific solutions..
[20]	October-2018	Launches a one-click women's safety app for distress situations, aimed for ease of use.	Mobile application development with simple interface.	Limited scope, does not provide extensive safety options.

PROPOSED METHODOLOGY

The suggested Women Safety Analytics offers a smooth means of protecting women from possible harm in a single converged digital platform. The flow for a user registering and entering into the system, which is secure log-in. After verification, the user can make use of system services such as emergency services. In distress, the SOS is activated, which sends instant notifications to registered emergency contacts and broadcasts the geolocation of the user in real time. In addition to the safety features, the system also offers route analytics that suggest the safest route by processing environmental and background data.

The step by step process includes:

1. System Flow

The system starts with the User Management features where users can register for the first time, and registered users can securely log in. Change password and forgot password functionality maintains secure accounts and retrieves them in case of requirement. Upon verification, the user then moves towards the Application Dashboard, which is the core area where all safety functionalities are added.

From the dashboard, the user can directly access multiple features:

- Emergency Response features like SOS alarms, shake activations, emergency dialing of police/ambulance, and live sharing of locations.
- Preventive Features like simulation of fake calls to divert possible assailants.
- Evidence Collection functionalities like automatic voice recording in case of an emergency.
- Awareness functionalities like tips on safety and self-defense classes.

The process concludes with the stop point, marking the end of the flow once the chosen feature is executed.

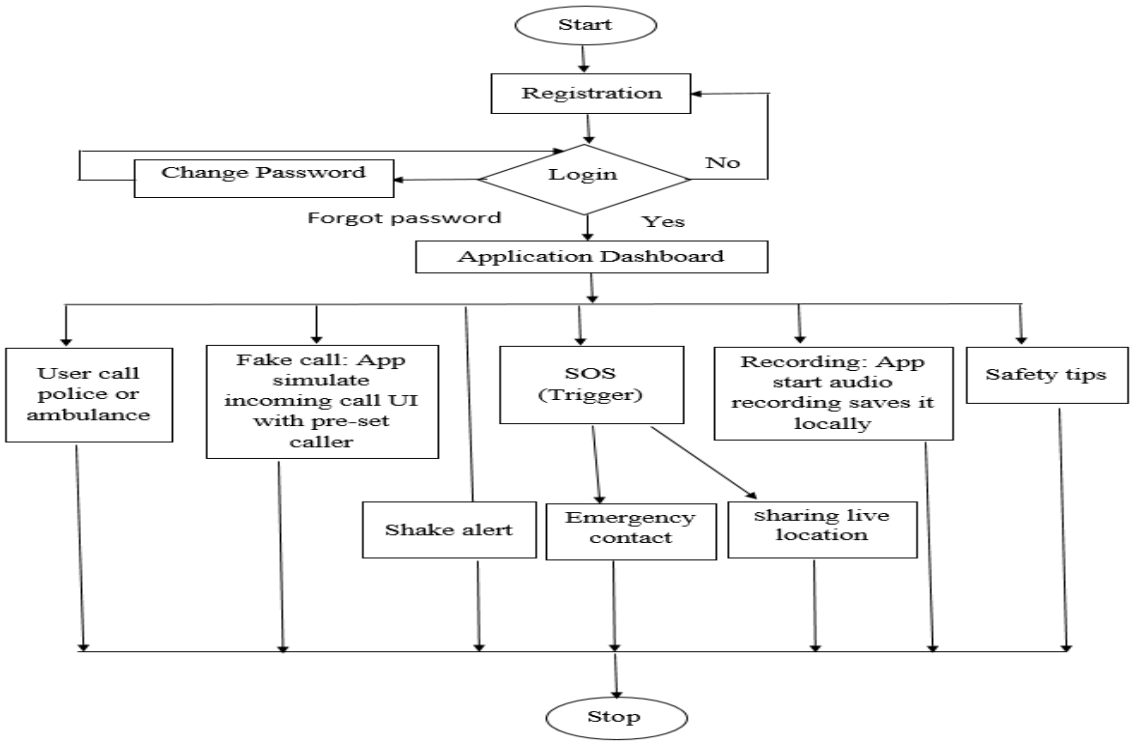

Figure 1. Proposed Methodology for Women Safety Analytics

2. Module-Wise

a. User Management Module: Manages registration, login, password recovery and reset, to authenticate the users before they access the system. Offers a secure point of entry and manages security features with stored contact emergencies.

b. Emergency Response Module: The central module, offering SOS alerting, shake-to-emergency, police/ambulance direct dialing, and live GPS sharing of location with contacts for emergencies. Offers quick assistance in critical emergencies.

c. Preventive Tools Module: Focuses on threat avoidance through the rehearsal of a mock call with the hope of discouraging danger and safety tips that teach women caution and safe working strategies.

d. Vidence Collection Module: Enables audio recording in times of emergency to present live evidence. The audio recordings are subsequently utilized by the police during investigations and during court presentation.

e. Awareness Module: Provides safety advice, legislations, and advisory advice to empower the women in response to unforeseen events.

3. Integration of Modules

All the modules interconnect nicely in the application dashboard. The User Management module offers validated-only access, and the Emergency Response module monitors critical safety situations in real-time. The Preventive Tools and Awareness modules deploy layers of prevention and preparedness, and the Evidence Collection module documents evidence of incidents. All these modules collectively build an integrated and complete system for women's safety.

4. Overall Purpose:

This system provides pre-emptive women's safety analytics via registration, real-time location tracking, SOS alert, emergency communication, and safe route guidance. It minimizes response time, maximizes situational awareness, and increases personal protection in risky situations.

The below Table 2 shows from registration, log-in, and control of security to accessing emergency functions like SOS triggers, spoof calls, live location sharing, and recording, the table lists the functional elements of a women's safety app. It concludes with the stop module to provide a complete workflow from admission to closure, and preventive measures like safety tips. Together, these components offer an integrated strategy for women's security that integrates evidence gathering, prevention, and early reaction.

Table 2. Functional Components of Women Safety Application

Sr. No.	Block	Description	Purpose
1	Start	Entry point of the system. The app is initialized.	To begin the women safety process.
2	Registration	New users register by providing personal info and emergency contacts.	To enable personalized alerts and tracking.
3	Login	User enters credentials to access the dashboard.	To ensure secure access to safety features.
4	Change Password	Allows users to update their password.	To maintain account security.
5	Forgot Password	Helps users recover their account if credentials are lost.	To ensure users are not locked out in emergencies.
6	Application Dashboard	Central hub of all safety features.	To provide quick access to emergency and preventive tools.
7	User Call (Police or Ambulance)	Direct calling feature to emergency services.	To ensure immediate help in life-threatening situations.
8	Fake Call	Simulates an incoming call with a pre-set caller.	To distract or deter attackers.
9	SOS (Trigger)	Emergency activation feature. Sends alerts, location, and starts recording.	To initiate quick and effective safety responses.
10	Shake Alert	SOS can be triggered by shaking the device.	To silently trigger alerts when user cannot access phone normally.
11	Emergency Contact	Sends alerts to pre-set trusted contacts.	To notify family/friends instantly in case of danger.
12	Sharing Live Location	Sends real-time GPS coordinates to contacts.	To allow tracking and faster rescue.
13	Recording	Starts audio recording and saves it locally.	To collect evidence for legal or police use.
14	Safety Tips	provides for women to protect themselves in danger area.	To educate women on preventive measures.
15	Stop	End of the process. Returns to dashboard or closes app.	To complete the safety flow.

RESULT & DISCUSSIONS

The following Figure 2 illustrates the splash screen of the "StreeRaksha" software protecting women. The application, with a woman guarded by it, represents protection, security, and independence of women. Women Safety Analytics plans to incorporate real-time data, location tracking, sending alarm notification in case of emergencies, and predictive analysis for improving safety. Technologies like StreeRaksha are utilized via applications for identifying dangerous situations, alerting trusted contacts, and reaching authorities in an attempt to offer proactive protection and timely intervention in emergency situations.

Figure 2. Splash Screen of Women Safety

Figure 3 illustrates the Registration Screen of the Women Safety app, where users can register securely for an account using obligatory information such as name, email address, phone number, and password. It is applied to offer personalized access to users and enable the application to authenticate the users, secure confidentiality, and link safety alarms with the right identity and contacts. Registration facility is a key feature of Women Safety Analytics as it offers the functionality of creating a secure user account to offer real-time assistance, emergency alerts, and location-based functionalities for safeguarding women from potential safety threats.

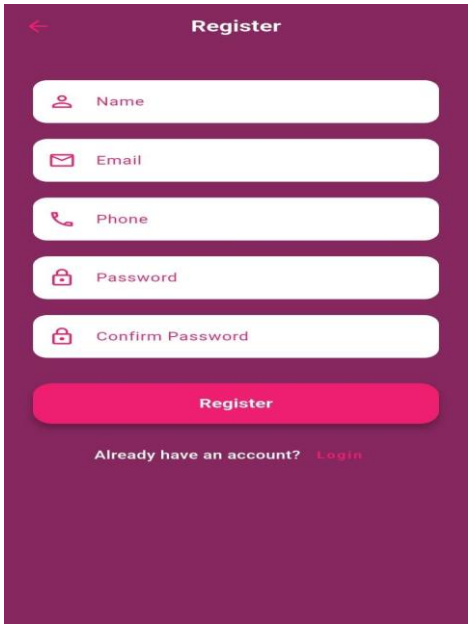

Figure 3. Registration Screen of Women Safety

Figure 4 depicts the Login Screen of Women Safety app, by which registered users can log in securely either by their email address or phone number. The process supports authentication and prevents anyone else from accessing

an account, thereby maintaining user data integrity and safety features. One type of quick login option is necessary for emergency-based apps where a matter of seconds can make a significant difference. Figure 5 indicates the Dashboard of the Women Safety app, which is the user's primary interface. The dashboard allows women to access the primary features like emergency SOS alerts, location monitoring, trusted contacts, and safety insights. The dashboard has an easy interface so that the users may instantly enable safety features at a moment's notice, hence playing a crucial role in securing women against harm.

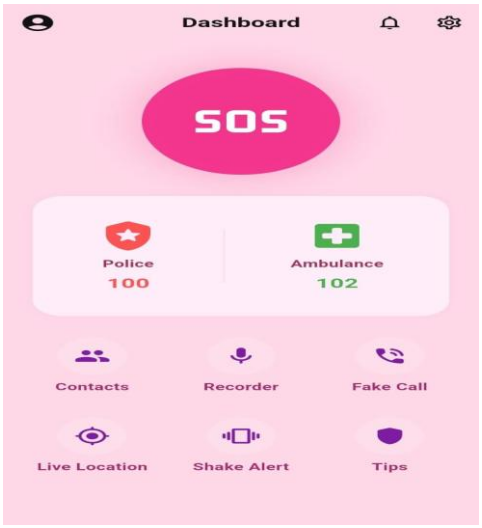

Figure 4. Login Screen of Women Safety **Figure 5.** Dashboard of Women Safety

In below Figure 6. The figure shows the profile page it has a username,Email Id.It also has the edit profile option where user can change their name,password if user forget their password in this field they can change it and they can signout/logout from this application. The below Figure 7 screen is designed to handle the user's Trusted Circle. It displays pre-defined emergency contacts with an option to call or message them instantly in times of danger. The Add New Contact feature at the end also helps the users in adding more trusted individuals for instant support in the event of an emergency.

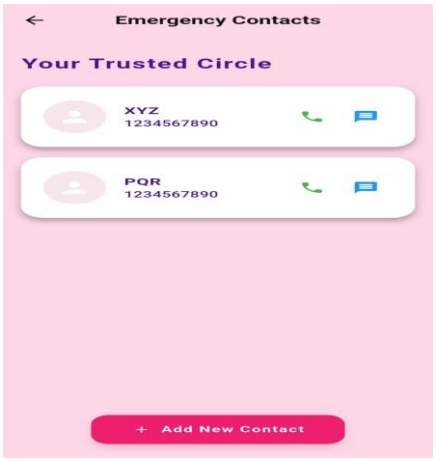

Figure 6. ProfileScreen of Women Safety App **Figure 7.** EmergencyContactScreen of Women Safety App

Figure 8 displays the Location Screen of the Women Safety app by which one can track his/her location in real time. It is an option by which timely sharing of accurate location to trustworthy contacts or security authorities during an emergency is facilitated so that there is prompt action and immediate rescue. Figure 9 is the Women Safety app Recorder Screen through which users are able to record as evidence in the form of video or audio in threatening situations. The recordings can serve as legal evidence and help the authorities to get crucial information to investigate. Combined, the recorder and location features enhance Women Safety Analytics by combining preventive actions with evidence-based assistance to ensure that safety threats are defended against better.

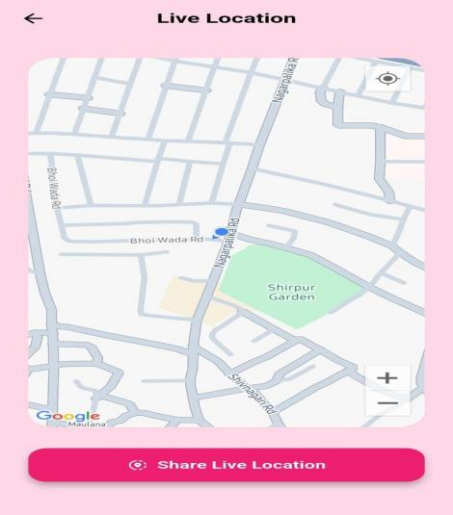

Figure 8. Location Screen of Women Safety **Figure 9.** Recorder Screen of Women Safety

Figure 10 is the Fake Call Screen of the Women Safety application, a feature that is set to present an incoming fake call. It is a distraction feature that can be utilized by women in order to exit unwanted or threatening situations since it will provide them with a good reason to do so that is to be called. Figure 11 is the Safety Tips Screen, which presents preventive guidance, awareness rules, and life-friendly advice to enhance personal safety in daily life. The guidance is an anticipatory aspect of Women Safety Analytics, alongside emergency response features by integrating knowledge-based protection interventions.

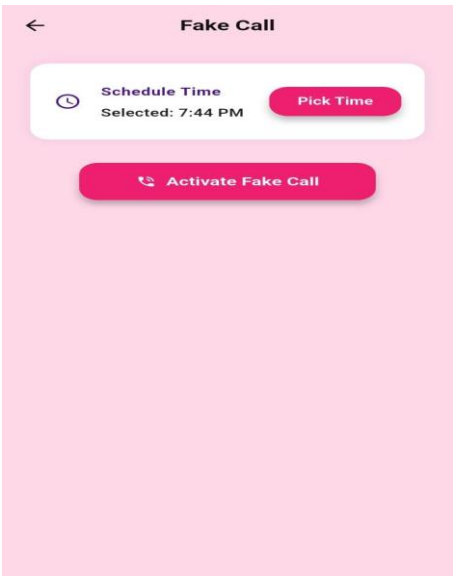

Figure 10. Fake Call Screen of Women Safety **Figure 11.** Safety Tips Screen of Women Safety

CONCLUSIONS

To improve women's safety and security in public areas, the Women Safety Analytics– Protecting Women from Safety Threats initiative offers a comprehensive, technologically advanced solution. The project meets the urgent demand for proactive and responsive personal safety solutions by combining real-time data analytics, risk zone detection, GPS-based position monitoring, and quick emergency warning systems into a single mobile application. While Firebase offers a strong backend architecture to handle real-time data, user authentication, and cloud-based

alert systems, Flutter is used for cross-platform frontend development to guarantee a consistent and responsive user experience. These technologies work together to give users secure communication, actionable insights, and quick access to assistance in times of need. The system is designed to be both dependable and to maintain user confidence through meticulous planning, risk assessment, user-centric design, and ethical data management procedures. In the end, this study shows how data-driven strategies and contemporary mobile technology may be successfully used to raise awareness, enhance public safety, and provide prompt intervention all of which significantly contribute to the creation of safer surroundings for women.

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