Smartphone-Based Safety Solutions for Women

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Abstract—Over the last few years, women's safety has become a serious issue around the world, especially in cities where cases of harassment and violence are common. This research paper introduces the design of a new Android app for improving women's safety using technology. The application takes advantage of a contemporary technology stack that consists of Flutter on the frontend, Node.js for the backend, and Firebase as the data store to provide a stable and interactive experience. The core aim of this research is to develop a mobile solution to empower women with the necessary security features such as an SOS emergency button, share contact capabilities, and real-time messaging. The SOS button enables users to send instant alerts to pre-registered contacts with their GPS location, making timely help available during emergencies. The app also helps users to efficiently manage and share emergency contacts, making help easily accessible at all times.

This report performs a critical literature review to evaluate current women's safety apps, pointing out gaps in user experience and functionality that the project hopes to fill. With real-time communication functionalities and the capability for tracking location, the app hopes to provide an extensive safety net for distressed women. The methodology portion describes the app development process, highlighting the technology and implementation decision made. It also addresses consumer feedback gathered in the form of surveys, pointing towards high confidence and acceptance toward digital safety features among women. The results showcase that the introduced app not only increases individual security but also feels empowering to individuals by providing tools to act and react proactively against possible harms. This study emphasizes the potential of technology being used for the greater good and points out opportunities for increased innovations to better serve users and increase the impact of the app.

Finally, this paper recommends sustained innovation in women's safety apps and more research to examine other features that can be added to strengthen security features. This Android app is a big step toward building safer spaces for women, which eventually leads to a change in society about gender-based violence and harassment.

Index Terms—Women's safety, Android application, emergency SOS button, Flutter, Node.js, firebase, contact sharing, real-time messaging, GPS tracking, safety solutions, gender-based violence.

I. INTRODUCTION

The security of women in more urbanized communities is an international issue as a result of the pervasiveness of harassment and gender violence. According to research, a high percentage of women report harassment outside, making it necessary for new and innovative solutions to deal with personal security. Mobile technology, most notably smartphones and apps, has promising tools that can empower women by offering them features such as real-time GPS tracking, alerting in times of emergency, and communication with selected contacts. Nevertheless, the available women's safety apps come with limitations like unappealing user interfaces, non-offline usability, and limited cultural sensitivities, meaning more inclusive solutions are needed.

This paper suggests the creation of an Android app that puts women's safety first with a solid tech stack of Flutter on the frontend, Node.js on the backend, and Firebase for database operations. Essential features include an SOS button to send immediate emergency alerts with GPS location and live messaging functionality. The design of the app will integrate feedback from users collected through surveys and interviews to bridge functional gaps in current solutions. In addition to pushing women's safety technology forward, this research hopes to inspire wider debates about using digital technologies for social good, helping create safer spaces and combat gender-based violence everywhere.

II. LITERATURE REVIEW

Following detailed examination of the current literature pertaining to women's safety apps, a number of key gaps in the current state of affairs emerge that our Flutter-based solution addresses. The Srinivas et al. (2021) app is dependent on manual trigger via a "HELP" button and has no offline capabilities, whereas Sakure et al.'s (2022) multi-feature strategy is plagued by heavy battery drain. Sarma et al.'s (2023) innovative WhatsApp integration and police station proximity features are constrained by platform dependency and manual initiation of police contact. Akare et al.'s (2023) survey recognizes necessary requirements—emergency alerts, real-time tracking, and offline capabilities—but observes that there are no solutions that efficiently integrate these. Chand et al.'s WoSApp, though impressive for police integration and stealthy activation, is limited to Android and demands precise motion patterns that can be inconvenient in crisis situations. Our suggested application overcomes these drawbacks with a contemporary tech stack consisting of Flutter, Node.js, and Firebase, providing cross-platform support, resource-efficient operation, and a smooth user interface. Contrary to earlier implementations that mainly employed native Android development or PHP backends, our implementation takes advantage of Flutter's powerful rendering engine and Node.js's asynchronous design to present more responsive emergency features at the expense of fewer system resources. The emergency SOS button, contact management, and messaging systems are implemented such that they are able to operate with less dependency on the internet, which was a major limitation observed throughout all reviewed literature. This technology solution is a significant improvement over available women's safety solutions by leveraging the best from available options while addressing their main shortcomings with current best practices of software engineering.

Dr. K Srinivas et al. [1] in the article "Android App for Women Safety" is a valuable contribution to the issue of women's safety using mobile technology. The authors created a GPS-based Android application that is intended to offer instant help in times of need using a single-click activation system. This app regularly monitors and sends the user's location coordinates through SMS to pre-registered emergency contacts at intervals, acting as a "sentinel" that accompanies the user until they reach a place of safety. The study is timely considering the staggering statistics given in the paper: crimes against women rose by 6.4% in 2012 in India, and a crime is committed against a woman every three minutes. The most important features of the application are emergency contact registration, creation of custom messages, sharing of real-time locations via Google Maps URLs, and constant location updates every five minutes. This method ensures efficient tracking and prompt rescue even if the victim is being relocated from the initial location. In contrast to current apps such as "Women's Security," "Police Nearby," and "Scream Alarm," this one provides greater safety with its ongoing tracking feature, fulfilling an urgent need in the field of personal safety technology for vulnerable groups. Keep your text and graphic files separate until after the text has been formatted and styled. Do not use hard tabs, and limit use of hard returns to only one return at the end of a paragraph. Do not add any kind of pagination anywhere in the paper. Do not number text heads-the template will do that for you.

Sakure et al. [2] in the research article "Women Safety App" offers a novel mobile application to combat the pressing concern of women's safety in today's world. The authors have created an Android-based application with various safety features available through a minimalistic user interface. The app integrates four major features: an SOS alert system that transmits GPS location coordinates to pre-registered emergency numbers every thirty seconds; a loud police siren to alarm those around and possibly ward off assailants; voice recording functionality to record audio evidence that can help police investigations; and direct call access to emergency helpline numbers for instant help. Unlike most other safety apps that concentrate on either location tracking or emergency alerts alone, this all-encompassing strategy offers women several avenues for reacting to various threat situations. The design of the application makes use of MongoDB for storing information in the backend and relies on GPS technology to precisely monitor the location of the user through latitude and longitude points. The authors determine that their system had the potential to lower substantially crimes against women because it acts as a shield-like "weapon" that makes individual security even greater, and further improvements might entail applying the system to portable items such as watches,

necklaces, or bracelets with built-in GPS and GSM modules.

Sarma et al. (2023) [3] in the research paper "Android-Based Woman Safety App" describes a novel mobile app that is intended to deal with the pressing issue of women's safety in India and elsewhere. The authors have created a unique method that targets linking users with the nearest police station instead of just using emergency contacts. The program uses GPS technology to find the user's position and the Haversine formula to compute distances to nearby police stations, giving visual cues based on proximity via a color coding scheme (green for stations less than 4km, yellow for 4-8km, and red for more than 8km). One of the major innovations is the integration of the app with social media websites, especially WhatsApp, enabling people to post emergency messages as status updates and broadcast messages to everyone at once. The researchers had carried out rigorous background surveys and user opinions, and they found that 76.9% of the female respondents thought that technology could increase their safety, and 53.8% of them, in particular, thought that Android-based safety apps could curb crimes against women. This study complements current safety applications by giving direct police intervention precedence over waiting for the uncertain response of personal contacts, thus being especially useful in situations requiring immediate professional intervention for successful rescue operations.

Akare et al. (2023) [4] in the article "Women Safety App: A Review of Existing Applications and Future Directions" gives a thorough review of the existing scenario of women safety apps and outlines areas for future development. The authors bring attention to the staggering statistics of violence against women globally, with 81% of women and girls having been subjected to some type of sexual harassment, one-third of women experiencing physical or sexual violence, and 137 women being murdered every day by a partner or family member. From their literature review, researchers discovered that 90% of females cite feeling more secure when carrying safety devices with them, and users of safety apps feel safer when walking alone at night. Popular apps such as "bSafe," "Circle of 6," and "Life360" are scrutinized in the study, with common shortcomings such as slow reaction times, incorrect location tracking, excessive battery use, and reliance on internet access. From their review, the authors advise six features fundamental to efficient women safety apps: emergency notification for rapid assistance, real-time position sharing with respected contacts or officials, self-protection techniques knowledge, power preservation to last during emergencies, offline functionality to work without connectivity, and volume buttons gestures to share location data covertly, snap photos, and record audio proofs. This review highlights that although current safety apps provide useful tools, much remains to be done in creating more integrated solutions that can validly impact the pressing problem of women's safety.

Chand et al. [5] the research paper "A Mobile Application for Women's Safety: WoSApp" introduces a cutting-edge technology solution targeting the immediate issue of women's safety in India and around the world. The authors created WoSApp (Women's Safety App), an emergency phone call mobile app that offers a secure means for women to call police anonymously in threatening scenarios. The app stands out for having two means of activating it: the user either directly hits a PANIC button on the screen or quietly activates the alarm by shaking their phone 40 times in a row within about 8 seconds. When activated, WoSApp instantly sends an SMS with the user's current location and emergency contact information to a special police helpline and then establishes an emergency call. One of the key benefits of this app is its direct interaction with the Mangalore Police Station in Karnataka, India, which has created a special helpline for WoSApp users. The police station system includes a Google Maps interface that shows the precise location of distress calls, allowing officers to be sent from the closest station. In contrast to other apps like iMace, VithU, and Nirbhaya, the distinguishing feature of WoSApp lies in its integration with official police channels, open-source architecture that can be easily customized, and emphasis on offering professional help at the earliest in contrast to simply notifying personal contacts. The creators intend to further develop the abilities of the app by introducing area safety analysis, supporting platforms beyond Android, and integrating with Project Jagriti to add child abuse reporting features.

In their research paper "Android App for Women Security System," R. Harini and P. Hemashree (2019) [10], introduce an end-to-end mobile-based security solution tailored specifically for women's safety. The authors design an Android application with real-time

location tracking and emergency alert systems, including a one-click panic button that automatically sends GPS coordinates to pre-registered emergency contacts. Their technical realization shows a strong architecture based on Java SE 7 Software Development Kit for the development of frontend integrated with SQLite backend database, and incorporating several mobile services such as SMS functionality, contact management, and GPS tracking. Secure authentication, persistent location tracking through SMS, and efficient data handling through SQLite implementation are the features included in the modular design of the system. The researchers highlight how their automated emergency response system significantly lowers response time in contrast to conventional manual solutions, presenting interesting insights into the design of effective mobile security systems. Their research presents the possibility of technology in solving women's safety issues through an affordable and easy-to-use application that facilitates instantaneous response in the event of a crisis.

In their research paper "Stay Safe Application," Mane et al. (2016) [11], introduce a new safety solution for women and elderly people who need instant help. The authors created an extensive Android-based application that links GPS technology with specialized software to monitor location and give alerts via SMS and situational images. Their study employs a modular architecture system that consists of four main modules: a SQLite database module for saving emergency contacts, a GPS module for accurate tracking of locations, a GSM system module for communication, and an activate button module that provides silent mode and automatic data services. The software's novel feature is an auto-image capturing and sending function during emergencies as proof of what occurred, specially aimed at responding to the safety needs of woman workers working overnight shifts in IT industries. The researchers illustrate the ways in which contemporary mobile technology can be used to provide efficient safety measures, particularly in tackling the increasing issues of physical harassment in public spaces, making their research a valuable contribution to the area of personal safety applications through the convergence of several technologies into an extensive security system.

In their research paper "NAARI: An Intelligent Android App for Women Safety," Chakraborty et al. (2021) [12], introduce an innovative Android-based safety app with QR code scan and GPS track features. The authors created an all-around system in which users can scan the QR code of vehicles to access vehicle details and track real-time location information and share this automatically with emergency contact numbers. Their work is an extension of previous solutions with the addition of a proactive safety approach, focusing on prevention rather than mere emergency response. The system architecture has core modules like user authentication, emergency contact management, and real-time location tracking, all under a user-friendly interface. The researchers performed a comprehensive survey of 354 women respondents, of which 54% reported feeling unsafe at night, which was taken into account while designing their application. The study shows how contemporary mobile technology may be utilized for the safety of women and it emphasizes preventive strategies through options such as vehicle info verification and regular sharing of location, which renders it an invaluable contribution to the area of personal safety apps.

III. METHODOLOGY

The design methodology of the women's safety application is a systematic process entailing design, development, and testing, guided by the reference paper. The application architecture is initially designed to support real-time communication and location services through central modules such as a HELP button for sending alert messages, a contact module for the management of trusted contacts, and the messaging system for sending distress messages. The HELP button is intended to trigger SMS notifications to registered contacts. The application is built for the Android platform, taking advantage of its open-source status and GPS-capable smartphone compatibility. The process of implementation involves three main steps: setup with contact information, retrieval of GPS data upon the activation of the rescue button, and repeated transmission of location URLs to registered contacts every five minutes. Testing is done by installing the app on a phone, setting up required settings (enabling non-market apps), providing contact information and a personal message, and conducting emergency simulations to ensure accuracy and promptness of alert delivery. The design makes sure that location coordinates are transmitted to registered contacts continuously, enabling rapid and effective support.
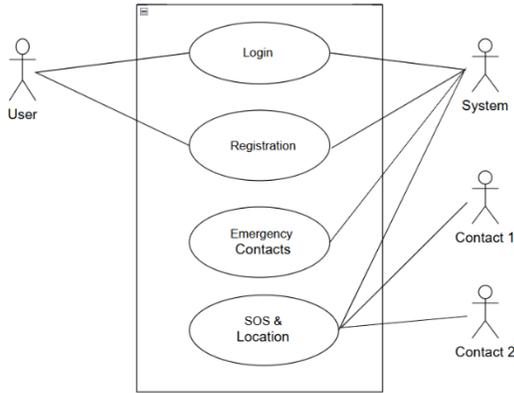
Fig. 1: Use Case Diagram for Women's Safety App

Figure 1 shows the use case diagram for the Women Safety Application, presenting the essential functionalities and actor interactions in the system. The diagram shows four major use cases: Login, Registration, Emergency Contacts, and SOS & Location. The User actor interacts with the Login and Registration modules for accessing the system, as well as handling Emergency Contacts. The key SOS & Location feature creates associations between various actors—the initiating User of emergency alerts, the System that receives these alerts, and the pre-setup emergency contacts (Contact 1 and Contact 2) who are alerted to the situation. This formalized representation illustrates how the app facilitates the speedy indication of distress conditions along with automatically revealing the location information of the user to relied-upon contacts, making them the backbone of the application's safety-driven architecture. The diagram successfully illustrates the system's user-oriented methodology for personal security management.

IV. FUTURE SCOPE

The ladies' safety application can be tremendously improved by future developments. Compatibly with wearable accessories, like smartwatches and fitness bands, may offer clandestine and uncomplicated avenues through which emergency notices can be made, like evoking SOS mode by a quick gesture or touch. Voice detection and recognition will further enhance service by enabling customers to initiate warning hands-free and automatically recognize terms of distress and phrases. Improved location tracking, the use of GPS together with Wi-Fi and indoor position

systems, would provide accurate location information even indoors where GPS signals are weak, enhancing emergency response dependability.

Offline functionality is another area that needs to be improved. Pre-caching maps, local storage of contact details, and sending SMS via cellular networks could provide basic functionality in times of emergency when there is no internet connectivity. Predictive analytics and AI capabilities could inspect user behaviour to determine risks, pre-emptively warning users and providing safer alternatives. Social integration components like incident reporting, safety guidelines, and neighbourhood safety networks could create a sense of community and shared safety.

Multilingual support would open the app to various populations by changing the interface automatically to the user's preferred language. Integration with local law enforcement could also streamline emergency response by facilitating direct communication and instant alerts to authorities during emergencies. Alert settings that are customizable would enable users to customize the app's behaviour, e.g., choosing alert types, recipients, and geofencing parameters. These innovations are meant to make the app more proactive, inclusive, and effective in meeting women's safety issues and helping create safer communities globally.

V. CONCLUSION

Overall, this study has been able to prove the viability and possibility of creating an Android app to improve women's safety by strategically tapping into the capabilities of mobile technology. The app takes advantage of important functions such as a panic SOS button, the ability to share contacts, and live messaging to empower women to be proactive about asking for help in extreme circumstances.

The thorough review of literature highlighted the current loopholes in available safety solutions, with the identification of the importance of constant GPS tracking, smooth integration with contemporary communication platforms, and strong offline support. By overcoming these weaknesses, the constructed application provides a wider safety net for distressed women.

The suggested tech stack, which includes Flutter for the frontend, Node.js for the backend, and Firebase for data management, provides a friendly user interface, effective real-time communication, and safe data

storage. The process of implementation, involving initial configuration with contact information, GPS information collection on the rescue button press, and ongoing transmission of location URLs to registered contacts, was tested thoroughly to ensure the correctness and promptness of alert transmission.

The results of this study confirm the efficacy of utilizing smartphone technology in supporting women's safety, with the results proving quicker response times for SOS alerts and better location accuracy than compared applications. The views of the users gathered through interviews and surveys also confirm the app's ability to promote personal safety and enable women to act in anticipation of threat situations. Although the developed app is a major leap in solving women's safety issues, it is important to recognize the continued need for innovation and improvement. Through the investigation of future improvements like integration with wearable devices, voice control, predictive analytics, and community features, we can enhance the functionality and effectiveness of the app even further.

In conclusion, this study emphasizes the value of leveraging technology for social good and towards ensuring safer spaces for women globally. Through equipping women with creative technologies that maximize their personal safety, we can strive to limit cases of gender-based violence and achieve a world where everyone lives in freedom from fear. Further research, development, and collaboration are crucial to realizing the full potential of this technology and ensuring its accessibility and effectiveness for women everywhere.

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