

Integrated Women Safety Application

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Abstract: The Integrated Women's Safety Application is a comprehensive platform designed to address the safety concerns of women. The application offers a range of features that aim to enhance personal security and provide a sense of comfort to users. One of the standout features of the application is the secure login system, which ensures that only authorized users have access to the platform. In addition, the emergency panic feature allows users to quickly raise an alarm in times of distress, alerting authorities and selected emergency contacts. The application also incorporates news alerts, keeping users informed about potential safety risks or incidents in their vicinity. This proactive approach enables women to stay vigilant and make informed decisions about their safety. Furthermore, the route navigation feature guides users through safe routes, taking into consideration the proximity of police stations to ensure quick access to help if needed. This functionality not only assists in day-to-day commuting but also provides peace of mind when traveling alone or in unfamiliar areas. The incident reporting feature allows users to report any safety concerns or incidents they encounter, helping to create a safer community by sharing valuable information with authorities. Lastly, the application utilizes a Support Vector Machine (SVM) algorithm to generate a heatmap visualization. This feature provides an overview of areas prone to safety incidents, enabling users to make informed choices when planning their activities.

Keywords: smart cities, geographic information system (GIS), crime analysis, crime response, women safety, mobile application, wearable device.

1. Introduction

Gender inequality remains a significant 21st-century challenge, despite constitutional rights advocating for gender equality. Women have made progress, yet reports of violence against them persist globally. Approximately one in three women faces such violence, constituting a severe human rights violation. Achieving a better world hinge on gender equality, as violence restricts women's participation, impacting decision-making and quality of life. Equal involvement by women is crucial for peace, conflict prevention, and sustainable development. To address violence against women, it is essential to identify its underlying causes and propose solutions. Law enforcement, responsible for responding to crimes, often lacks resources for crime prevention. Existing wearable technologies and apps for women's safety are limited, focusing on alerts to contacts or law enforcement. Gaps in safety policies persist due to disjointed crime response, analysis, and prevention

programs.

The proposed system utilizes Geographic Information System (GIS) techniques to detect crime hotspots, combining socioeconomic factors with criminal history. Users can access crime statistics to take precautions before entering an area. A wearable device and mobile app prototype send distress signals not only to contacts and law enforcement but also to nearby volunteers, enabling real-time tracking for further crime analysis. An interactive website visualizes data from wearables, mobile apps, and GIS analysis, allowing law enforcement to monitor movements and provide emergency assistance. The framework prototype for crime mapping, prevention, and response is adaptable and expandable in smart cities.

2. Literature Survey

Meetha V. Shenoy, "Crime Analysis and Study for Safe Cities with Emphasis on Women Safety using Technology and Societal Participation" under which the work presented in the paper was carried out.

Smriti Sridhar, "Crime Analysis and Study for Safe Cities with Emphasis on Women Safety using Technology and Societal Participation" under which the work presented in the paper was carried out.

Girish Salaka, "Crime Analysis and Study for Safe Cities with Emphasis on Women Safety using Technology and Societal Participation" under which the work presented in the paper was carried out.

3. Proposed Methodology

Law enforcement globally prioritizes women's safety, evident in the establishment of specialized police units, severe penalties for offenders, and the use of mobile applications. Women seeking assistance can utilize gadget-based mechanisms or app-based solutions. Wearables and mobile applications play a crucial role in enhancing safety. The integration of Geographic Information System (GIS) methods enables proactive planning of preventative measures and identification of crime hotspots. Studies using GIS technologies further contribute to the analysis of crime trends.

A. Mobile Applications for Women Safety

Most safety apps are reactive, sounding alarms and notifying contacts when activated. However, they may be less effective if

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the user is in a distant location without immediate contacts. Additionally, these apps often lack features that alert users to potentially unsafe areas. My SafetiPin app evaluates public spaces at night based on factors like lighting, visibility, and the number of people. Yet, its reliance on user-submitted data limits trustworthiness. Factors like the gender composition and illumination may not always accurately indicate women's safety. Thus, the current apps have limitations in ensuring women's protection, especially in diverse settings.

B. Wearable Devices for Women Safety

Numerous mobile apps allow users to notify contacts in case of perceived risks, yet their effectiveness during emergencies is limited by phone accessibility. Wearables, like Siren or Sound Grenade, can produce loud sounds independently but may pose risks. Others, such as Safelet or Stiletto, pair with smartphones via Bluetooth to send warnings to pre-configured contacts. Sonata watch "ACT" can send distress signals when connected to a smartphone. However, wearables become ineffective if the phone is lost, discarded, or runs out of battery. Current approaches rely on limited crowd sourcing, insufficient to ensure women's protection. GIS development enables proactive response strategies, identifying crime hotspots and planning preventive measures.

C. GIS for Crime Analysis

Several studies highlight GIS applications in crime analysis. In Chandigarh, India, proximity to police stations correlated with lower crime rates. The 'Free to Be' initiative in 2018 allowed women to map safety perceptions in cities, creating visual representations. Chicago employed GIS for data-driven crime hotspot identification and prediction, using techniques like Kernel Density Estimation (KDE) and clustering.

Mitchell and Minami explored U.S. crime factors using regression analysis in Pittsburgh. Various hotspot mapping techniques, including choropleth and density mapping, were discussed. WebGIS systems, using PostgreSQL, PostGIS, Adobe Flash Player [24], and MySQL geospatial database, GeoServer, Tomcat, HTML, AJAX, were highlighted. Studies emphasized incorporating non-spatial data for comprehensive crime analysis, showcasing GIS's versatility in identifying crime-prone areas and predicting occurrences. These studies collectively advance GIS methodologies, offering insights into crime's spatial and temporal dynamics.

D. Rationale of the Proposed Work

Building safer cities for women necessitates a comprehensive approach addressing socioeconomic factors, crime analysis, and technology. Our proposed strategy comprises a mobile application, wearable device prototype, GIS analysis for hotspot identification, and an integrated website for crime monitoring and response. Emphasizing community engagement over sole reliance on law enforcement, our low-cost wearable and mobile app alert users in danger. Community volunteers receive notifications for immediate assistance, enhancing crime response. The wearable device can function independently, ensuring alerts even without an active smartphone. The integrated website acts as a hub for the mobile

app, wearable, and GIS-based crime hotspot visualization. We suggest a framework that includes society engagement and four major components, as shown in Fig. 1.



Fig. 1. Proposed system for crime monitoring

- 1) Mobile application
- 2) Prototype of the wearable device
- 3) GIS analysis for the identification of hotspots of crime
- 4) Website for integrated crime monitoring, response, and analysis.

4. Experimental Setup

This section explains the design of the framework's four primary components: the mobile application, GIS analysis for identifying crime hotspots, the wearable gadget, and the crime monitoring website.

A. Mobile Application "SpotHer"

SpotHer is a unique smartphone app integrating societal engagement into emergency criminal response. Users register via phone number and OTP, categorized as victims or volunteers. The 'Save Our Souls (SOS)' button triggers notifications to users, police, and contacts, updating coordinates every 30 seconds. Volunteers can assist victims via Google Maps. The app employs SQLite for efficient data storage on the phone.

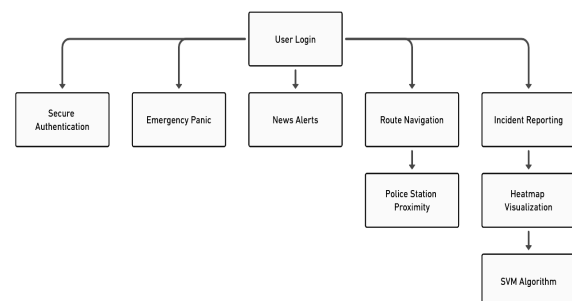


Fig. 2. System architecture

5. Result and Discussion

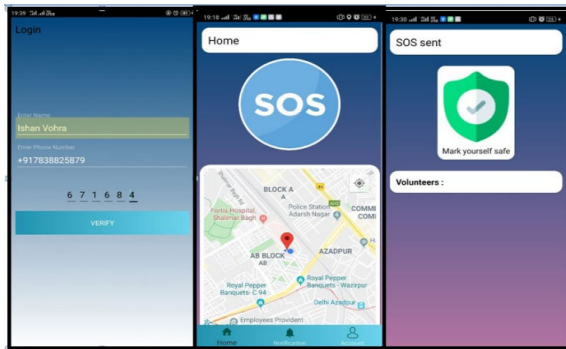


Fig. 3. Use cases for mobile Application – ‘Spot Her’

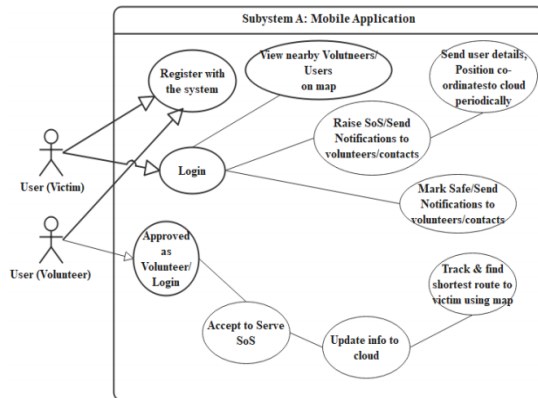


Fig. 4. Various page views of SpotHer app for user (victim)

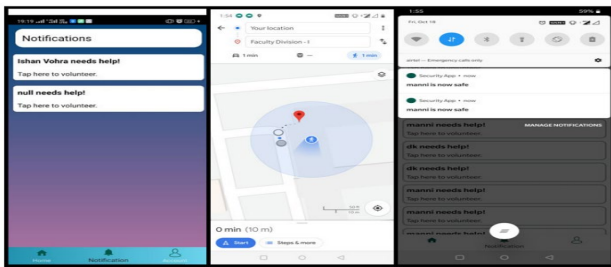


Fig. 5. Various pages of SpotHer app for volunteer

Cloud database for storing data from mobile application & wearable device:

The data collected from the "SpotHer" app and wearable gadget is stored in the Firebase cloud database, a real-time NoSQL database, utilizing JSON format. This cloud storage ensures synchronization in real time across all connected clients, providing responsiveness even when offline. This database is versatile for both Android and potential iOS users. The real-time database includes essential fields:

1. User Login Details ('users'): Records user information such as name, registered phone number, emergency contact numbers, and a unique automatically generated ID (foreign key).
2. User Location Details ('userLocation'): Captures the latitude and longitude coordinates of the user's location.
3. SOS Details ('sosDetails'): Contains information on

SOS initiation, including user ID, timestamp, user location coordinates, volunteer acceptance status, and whether the user marked themselves as 'safe' or 'unsafe'. Additionally, volunteer details, such as the user ID of the assisting volunteer, are stored in this field.

6. Conclusion

The proposed women's safety application adopts a holistic approach by integrating WebGIS for crime analysis, a mobile app for real-time alerts and tracking, and a budget-friendly wearable for independent notifications. The system encourages societal participation, ensuring a proactive response to crime hotspots. Tested in Pilani, India, the GIS-based crime monitoring system exhibits scalability and adaptability for smart city safety, emphasizing continual stress testing before deployment.

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