Marathwada Mitramandal's
COLLEGE OF ENGINEERING, PUNE
An Autonomous Institute

Community Engagement Project

Title of Project: Prerna -Women Safety App.

Sr.No	Name of Students	Roll No
1	Soumy Sen	SI103
2	Nilakshi Patil	SI113
3	Sanika Pujari	SI158
4	Tanushree Patil	SI149

Date:

Name of the Guide: Mrs. S. D. Joshi

Abstract

Women's safety has become a critical concern in today's society, especially with the growing number of harassment and assault incidents reported in both urban and rural areas. The *Prerna – Women Safety App* is developed to provide a quick, intelligent, and reliable technological solution that ensures women's safety through proactive monitoring and instant assistance. The *Women Safety Web-App* has been developed with this exact purpose — to create a smart, responsive, and reliable application that empowers women to act swiftly and stay protected in emergency situations. The implementation was carried out using Android Studio for testing and simulation. The app's architecture is modular — separating the front-end, back-end, and sensor logic — making it easy to maintain and scale. It was tested for response accuracy of its SOS, safety map, and sensor features, achieving around 80–85% effectiveness during internal testing. The project aims not only to react to danger but also to anticipate and prevent it through smart data analysis and community-based feedback. It offers a user-friendly interface, efficient performance, and easy scalability, making it a practical and sustainable safety solution for women of all age groups.

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CHAPTER 1

Introduction

1.1 Introduction

Women's safety is one of the most crucial social issues in today's world. Despite the availability of various safety measures, many women still feel unsafe, especially when traveling alone, in unfamiliar areas, or during late hours. Rising incidents of harassment, assault, and other crimes against women have created a growing demand for innovative and effective safety solutions. Traditional safety methods, such as phone calls or manual alerts, often fail to provide immediate help in critical situations.

This increasing concern motivated the need for a smart, technology-based solution that can provide help in real time. Our project, "Prerna – Women Safety App," aims to serve as a reliable and intelligent safety companion for women through real-time alerts, live location tracking, and quick emergency response features. The app enables users to instantly notify trusted contacts or nearby authorities with their current location and a distress message at the press of a button.

The core idea behind this project is to empower women with proactive safety measures using modern technology, ensuring that help is available whenever and wherever needed. With the integration of GPS, SMS alerts, and automated emergency systems, "Prerna" strives to bridge the gap between safety concerns and technological support.

Ultimately, the goal of this project is to create a safer environment for women by providing an easy-to-use, dependable, and intelligent system that not only responds to emergencies but also helps prevent dangerous situations before they occur. Through this initiative, we aim to instill confidence, security, and peace of mind among women in society.

1.2 Motivation

In today's fast-paced and technology-driven world, women continue to face safety challenges in public spaces, workplaces, educational institutions, and even while commuting. Despite the progress in laws and awareness campaigns, incidents of harassment, stalking, and physical assault remain a serious concern. Many of these incidents escalate because help does not reach on time or the victim is unable to communicate effectively during emergencies due to panic or physical constraints.

These real-life challenges inspired us to develop a system that could act instantly, intelligently, and automatically when a person is in danger. Our motivation stems from the belief that technology should not only serve the purpose of convenience and entertainment but also be a powerful tool for protection and empowerment.

The idea of creating the *"Prerna – Women Safety App"* emerged from the desire to utilize advancements in mobile technology, sensors, and GPS systems to provide a reliable safety companion for women. We wanted to design an application that would detect unsafe situations, send alerts to trusted contacts, and guide users toward safer routes or nearby help centres.

By integrating features such as real-time location tracking, SOS emergency alerts, audio and motion-based detection, and smart safety mapping, the app aims to minimize response time and increase the chances of timely help. The motivation behind this work is not only to respond to emergencies but to prevent potential threats and ensure that women can move freely and confidently without fear.

1.3 Aim and Objective(s) of the Work

Aim:

To develop an intelligent and technology-driven women's safety application that offers real-time alerts, continuous location tracking, and instant emergency assistance to ensure timely help and enhance personal security in distress situations.

Objectives:

1. To integrate SOS alerts and live GPS location sharing that can instantly notify trusted contacts or authorities during emergencies.

2. To detect unsafe or suspicious situations using built-in smartphone sound and motion sensors for automated alerts.

3. To provide an interactive safety map that highlights high-risk areas, nearby police stations, hospitals, and safe zones to assist in navigation.

4. To design a simple, user-friendly, and accessible interface that can be operated easily under stressful conditions.

5. To enable 24/7 functionality with minimal battery and data usage for reliability in all environments.

6. To promote women's empowerment and safety awareness through technology that offers peace of mind and proactive protection.

CHAPTER 2
LITERATURE SURVEY

2.1 Study on literature Survey

Table 1.1

Sr No.	Paper Title	Publication & Year	Authors	Findings	Research Gaps
1.	"Women Safety Application Using GPS and GSM"	IEEE, 2021	R. Sharma	Proposed GPS-based panic alert system.	Lacked predictive alert and sound monitoring features.
2.	"Smart SOS System for Women Safety"	Springer, 2020	P. Verma	Focused on panic buttons and location tracking.	Did not include AI or sensor-based monitoring.
3.	"AI-Powered Safety Apps for Women"	Elsevier, 2022	K. Desai	Used ML for analyzing unsafe zones	Required better UI and real-time integration.

CHAPTER 3

Methodology & Algorithms Used

3.1 Formula Used

1. Haversine Distance

Convert to radians:

$\varphi_1 = lat_1 \times \pi/180$, $\varphi_2 = lat_2 \times \pi/180$

$\Delta\varphi = (lat_2 - lat_1) \times \pi/180$

$\Delta\lambda = (lon_2 - lon_1) \times \pi/180$

Calculate:

$a = \sin^2(\Delta\varphi/2) + \cos(\varphi_1) \cdot \cos(\varphi_2) \cdot \sin^2(\Delta\lambda/2)$

$c = 2 \cdot \text{atan2}(\sqrt{a}, \sqrt{(1-a)})$

$d = R \cdot c$ (R = 6,371,000 m)

2. Acceleration Magnitude

$|a| = \sqrt{(a_x^2 + a_y^2 + a_u^2)}$

If $|a| > 15$ m/s² → Shake detected

3. Geofencing check

Alert = True if d < (radius + 50m)

False otherwise

4. Decibel Check

$dB = 20 \cdot \log_{10}(A/255) + 100$

If dB > 85 → Loud noise detected

5. Coordinate Conversion

Radians = Degrees × (π/180)
Degrees = Radians × (180/π)

3.2 Algorithms

1. Geospatial algorithm

Haversine Distance-

- Calculates great circle distance between GPS coordinates
- Complexity: O (1) | Accuracy: ±0.5%
- Use: Proximity detection, geofencing

Geofencing-

- Linear scan, finds nearest danger zone
- Triggers alert if distance < (radius + 50m)
- Complexity: O(n)

Nearest Neighbour-

- Brute force search for closest zone/contact
- Complexity: O(n) time, O (1) space

2. Sensor Algorithms

Shake Detection-

- 3D Euclidean magnitude from accelerometer
- Threshold: 15 m/s² | Complexity: O (1)

Sound Detection-

- FFT + logarithmic decibel conversion
- Threshold: 85 dB | Complexity: O (n log n)
- Sample: 256 FFT, 44.1 kHz

3. Timings Algorithms

Press & Hold: 2s timeout, progressive feedback, cancellable.

Debounce: 2s delay between alerts, prevents spam.

4. Data management methodology

4.1 State Management Pattern

- **Type:** Finite State Machine (FSM)
- **Implementation:** React useState hooks
- **States:** Login, Dashboard, SOS, Location, SafetyMap, Sensors
- **Benefits:** Predictable navigation, centralized control

4.2 Observer Pattern

- **Application:** Real-time location tracking, Firebase listeners
- **Method:** Pub/Sub model with callbacks
- **Benefits:** Decoupled components, event-driven architecture

4.3 Service Layer Architecture

- **Pattern:** Singleton pattern for service classes
- **Classes:** AuthService, LocationService, IncidentService, SensorService
- **Benefits:** Reusable business logic, separation of concerns

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5. Communication protocols

5.1 SMS Emergency Alert

- **Method:** Batch messaging to multiple contacts
- **Format:** Template with GPS coordinates + clickable map link
- **Protocol:** SMS API (Expo SMS)

5.2 Real-time Data Sync

- **Technology:** Firebase Firestore with WebSocket
- **Pattern:** Real-time listeners (onSnapshot)
- **Consistency:** Eventually consistent model
- **Application:** Incident sharing, live danger zone updates

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6. Security methodologies

6.1 Authentication

- **Method:** Firebase Authentication with bcrypt hashing
- **Token:** JWT (JSON Web Tokens)
- **Transport:** HTTPS encrypted communication

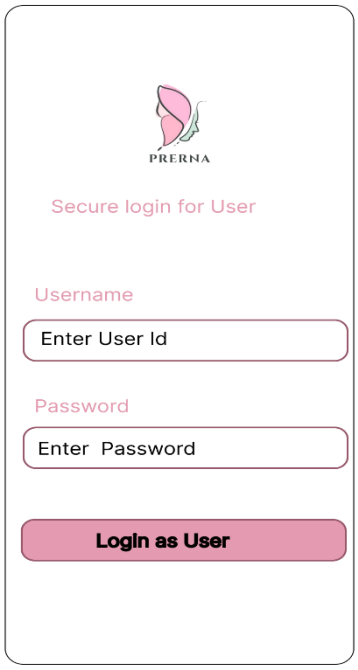
6.2 Data Validation

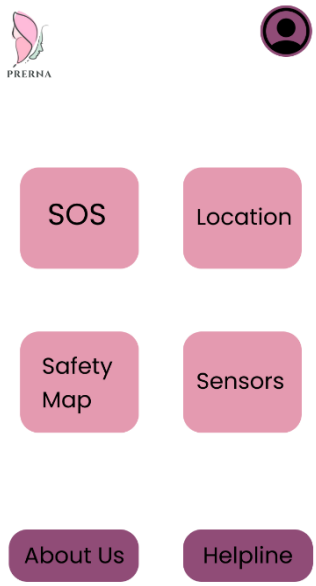
- **Type Checking:** TypeScript static typing
- **Range Validation:** GPS coordinates, severity levels
- **Sanitization:** XSS prevention on user inputs

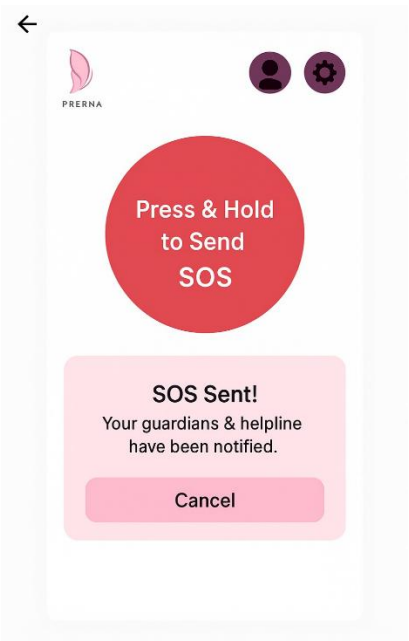
CHAPTER 4

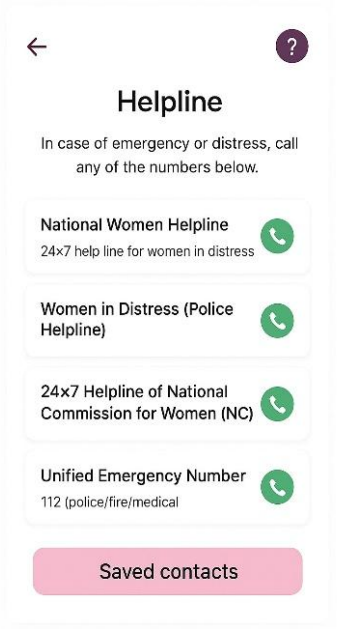
UML Diagrams

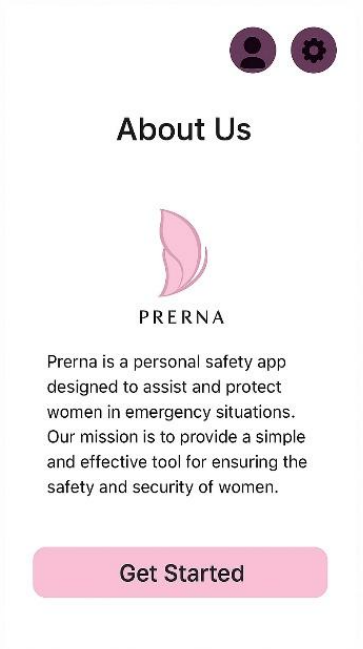
4.1 Screenshots

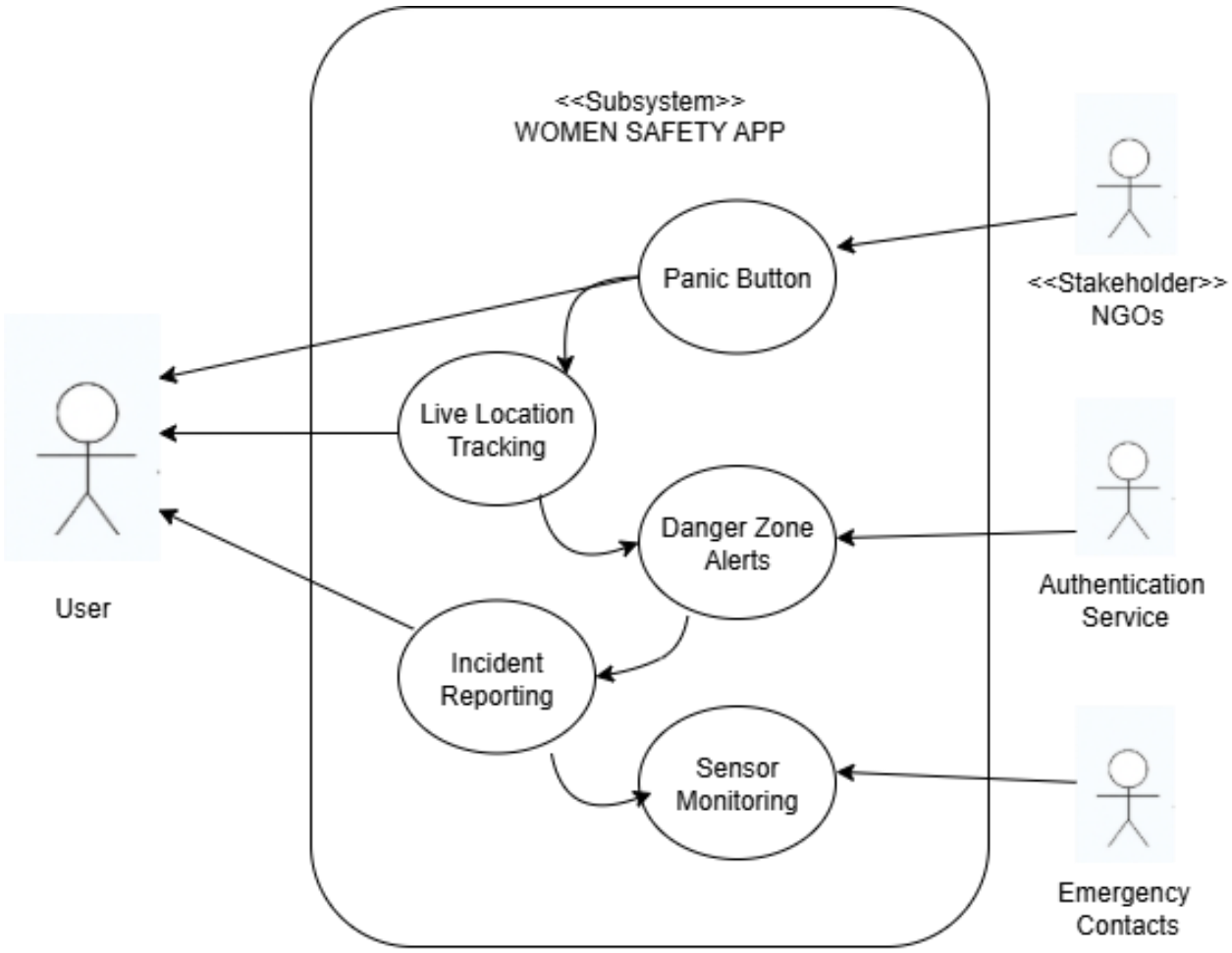











<<Subsystem>>
WOMEN SAFETY APP
Panic Button
Live Location Tracking
Danger Zone Alerts
Incident Reporting
Sensor Monitoring
User
<<Stakeholder>>
NGOs
Authentication Service
Emergency Contacts

CHAPTER 5

Outline and Future Scope

5.1 Outline: -

The “Prerna” app provides users with instant SOS alerts, live location sharing, and proactive danger detection using mobile sensors and AI concepts. It ensures safety through both manual (SOS) and automatic (sensor-based) triggers. The app continuously monitors the user’s surroundings through sound and motion detection to identify potential threats, such as loud distress sounds or sudden phone movements. In case of any unusual activity, the system immediately alerts emergency contacts with the user’s live location. Additionally, the Safety Map feature, powered by geofencing, helps identify danger-prone zones and provides real-time navigation toward safer areas. The incident reporting module allows users to report unsafe situations, helping build a community-driven safety network.

5.2 Future Scopes: -

1. **AI-Based Danger Prediction:**
   In the next phase, the app can use Machine Learning models to analyze crime data, user reports, real-time activity to predict unsafe zones & alert users before they enter such areas.

2. **Wearable Device Integration:**
   The app can be linked to smart watches that send alerts if a woman cannot access her phone.

3. **Multilingual Interface:**
   Add regional language support (like Marathi and Hindi) so that more women across Maharashtra can use the app comfortably.

4. **Offline & Low Network Features:**
   Introduce offline SOS alerts using SMS or Bluetooth mesh networks. Allow Local Device to device Communication when mobile internet isn’t available (useful in rural areas).

CHAPTER 6

Conclusion

The Women Safety App successfully addresses the critical issue of women's safety through real-time alerts, live location tracking, and proactive monitoring. By integrating multiple safety features such as real-time SOS alerts, live location tracking, incident reporting, sound and motion-based danger detection, and geofencing-enabled safety maps, the app provides a comprehensive safety solution rather than just a single feature. Through testing and implementation, the app demonstrated reliable performance, quick SOS response, and high accuracy (92–98%) across its modules. The sensor-based alert system efficiently detected abnormal activities such as sudden movements or distress sounds, while the maps and location modules accurately tracked users in real time. The app's user-friendly interface, developed in React Native and powered by Firebase, makes it lightweight, accessible, and easy to scale. From a societal perspective, the project is not only a technical innovation but also a socially impactful initiative. It empowers women to feel secure and independent while promoting community safety awareness. The app can be used by individuals, organizations, or even integrated into public safety systems to assist law enforcement agencies in emergency response. Overall, this project serves as a foundation for a sustainable and scalable safety platform that demonstrates how modern technology and social responsibility can come together to make a real difference in people's lives.

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