AURA: An AI-Driven Mobile Safety Application for Women with Real-Time Monitoring and Legal Assistance

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ABSTRACT
This research article outlines AURA—an AI-based mobile safety application that will increase women's safety in India. Unlike traditional safety applications that merely react after a safety event happens, AURA represents a preliminary push toward a proactive safety infrastructure based on real-time geofenced data, anomaly prediction from mobile sensors, AI-enabled navigation tools using AR, chatbot legal support tools, and user-generated safety surveys. The app included predictive anomaly detection based on mobile sensors, AR-enabled navigation to select safe routes, a legal chatbot that could provide any legal help, documents and advice, and user-generated requests for safety and crowd-sourced reports. Lastly, AURA utilizes geofenced dynamic environmental risk-level notifications from real-time user-generated reports or safety messages. Pilot trials in urban geographical regions have established AURA responses for intentional emergencies and coping with emergencies with promising results based on good levels of emergency handling, good overall user experience, and high levels of satisfaction. AURA is a meaningful advancement for an integrated smart system of proactive responses within a safe context-aware infrastructure.

General Terms
Security, Artificial Intelligence, Mobile Computing, Women Safety, Anomaly Detection

Keywords
Women's safety, artificial intelligence, anomaly detection, real-time monitoring, legal chatbot, mobile safety application, augmented reality, geofencing, cloud computing.

1. INTRODUCTION
India faces an ongoing and growing challenge around women's safety. Data recently released from the National Crime Records Bureau (NCRB) indicates a rise in crimes against women over 15% just from 2022 alone [1]. This includes incidents of sexual harassment, abduction, domestic violence and cyberstalking that often go unreported or unaddressed because of the lack of action-oriented interventions or awareness of one's legal rights. There are many mobile applications, such as Himmat by Delhi Police [2], as well as some third-party apps like bSafe [3], that offer some emergency assistance, but overall, mobile safety for women has largely taken a reactive form. A user manual intervention is needed with these applications when they are under duress, which hinders its effectiveness during these critical incidents.

AURA (AI-based Unified Response Application) is a next-generation proactive mobile safety application for women. The purpose of AURA is to be different from previous tools by utilizing Artificial Intelligence and Machine Learning systems to track a user's behavior patterns from mobile sensors (accelerometer, gyroscope, microphone) and alert users as the application identifies unusual behavior in the user's activities (e.g., sudden movements, complicated bodily position, calling for help, sounds of distress) [4], [5]. Users can also use Augmented Reality (AR) navigation to visualize a safe route to escape to safety in real time, particularly in unfamiliar, high-risk settings, such as isolated parking lots or alleys.

In addition, AURA offers a legal assistance component that has an intelligent chatbot that can provide real-time legal advice, auto-generate FIRs, and store digital evidence in a secure cloud vault [7]. The app also uses crowdsourced incident data and geo-intelligence to continuously create maps of unsafe areas that trigger geofencing alerts when users enter high-risk areas [8]. Overall, AURA's mitigation features form a robust safety envelope that helps in emergencies as well as preventing them via situational awareness, early intervention, and real-time legal assistance.

2. RELATED WORK
Over the last ten years many mobile safety applications have emerged to accommodate women's safety needs both in India and other countries around the world. One of these applications, Himmat, has been developed by the Delhi Police and allows the user to issue SOS alerts and send live location data to police in an emergency situation [2]. Raksha is another example of an emergency app that allows the user to send pre-defined alert messages that are populated with the user's real-time GPS location to their trusted contacts [9]. MySafetipin takes a unique but different approach by relying on crowdsourcing safety reviews that focus on public safety. Ratings are aggregated in terms of lighting, visibility, crowd density etc. to ultimately give each neighbourhood a "safety score" [10].

While these apps have been beneficial in increasing situational awareness and providing basic emergency features, they have several fundamental limitations:

1. Most require user initiation. So, they are not useful if the person is incapacitated or in immediate danger.

2. Lamentably, none have predictive intelligence—none are using machine learning based anomaly detection to identify risk components in real time.

3. Most do not provide AR based navigation when escaping unsafe environments, as they infuse immersive navigation to safety.

4. Integrating legal assistance, such as AI chatbots for FIRs or digital evidence lockers, is also noticeably absent.

These fundamental shortcomings in existing solutions were the main catalyst for the creation of AURA. By fusing proactive risk detection, augmented location-based safety navigation, and embedded legal assistants, AURA is a substantial advance in the development of mobile safety technologies for women.

3. PROBLEM STATEMENT

Notwithstanding the growth of mobile applications designed to help keep women safe, there are still major challenges that inhibit the effectiveness and usability of these programs:

3.1 No Predictive Intelligence:

Most applications are designed to act after an incident has happened, asking the user to activate alerts after the threat has begun. Very few of the currently available applications use artificial intelligence or machine learning that could analyze behavioral patterns or environmental data to predict when threats might be well-informed investigate from events before triggering after the safety has been compromised.

3.2 No Access to Legal or Psychological Backup:

Very few current applications are integrating legal aid and mental health resources into their app space, which forces victims to navigate between systems and avoid time delays in legal reporting, documentation, and mental health support.

3.3 No Crowdsourced Safety Insight:

Some apps have safety scores or reviews, but most others do not continually incorporate crowdsourced data from users that would allow them to tracking dozens of incidents or emerging high-risk areas

3.4 Titling and Applications are not Integrating with Wearables or emergent technologies

As Titling are moving to smart and wearable technologies, applications have not moved correspondingly to leverage traffic data or other ways to use those new devices for integration into homes, continuous monitoring, and stealth alerts in the internet of things (IoT)

These gaps indicate a critical demand for a safety solution that is therefore comprehensive, intelligent, user centered, predictive and includes integrated legal support, community involvement and is usable on next-generation devices. Addressing these gaps is the primary goal of the AURA app.

4. SYSTEM ARCHITECTURE

The AURA application is constructed on a contemporary microservice-based framework with respect to future scalability, modularity, and ongoing viability. Each functional element is encapsulated to allow for testing, upgrades and easy deployment. The system elements can be logically categorized into four broad buckets:

4.1 Front-end

The front end of the AURA application is constructed with Flutter, an open-source UI software development toolkit created by Google. Flutter enables cross-platform (Android and iOS) development using a single code base. Its reactive framework facilitates uninterrupted transitions, real-time updates, and responsive interactions, which are vital for safety-critical applications. The mobile interface includes an SOS activation screen with a one-tap alert trigger, a real-time augmented reality (AR) map overlay for navigation to safe zones, a legal chatbot interface that enables conversational input and displays replies, and visual status indicators for device, GPS, microphone, and signal strength. Addition-ally, the user interface is designed with accessibility in mind, offering large buttons, minimal input requirements, and voice command support.

4.2 Back-End Microservices

The back-end system uses Python with Flask for lightweight APIs and Django for the scalable session and user information management. The API layer exposes endpoints where users can perform actions including user registration, SOS event logging, evidence uploading, anomalous flag-ging, and chatbot interactions.

Several strong features make up the backend. Modular Flask microservices are deployed inside Docker containers for scalable deployment. Firebase Authentication secures parties logging in and session token generation. RBAC differentiates administrator access rights from those of emergency authorities. In emergencies, the system can integrate a third-party API for SMS and email notifications. Firebase Firestore supports real-time database operations, efficiently storing user locations, activity states, and chatbot history.

4.3 AI Modules

AURA's intelligent system harnesses the combined power of on-device and server-side AI modules to analyze sensor data for the detection of unlawful acts as potential evidence in the court. These AI modules use TensorFlow Lite models pre-trained with smartphone sensor data such as accelerometer, gyroscope, and microphone input data. These models detect anomalous motions, which include abnormal shaking, extreme slowness, and sudden peaks in measured decibel levels, among others. If the probability of anomaly computed exceeds the predetermined threshold, the system will immediately raise alerts to trigger safety responses.

4.4 Cloud Infrastructure and Evidence Vault

AURA uses Google Firebase and Google Cloud Storage services to provide cloud-native features that ensure scalability and security. The system supports the storage of im-age, audio, and video evidence in encrypted vaults, enabling secure archival of sensitive data. It enables dynamic user state synchronization through Firestore's real-time database, allowing the backend to maintain an up-to-date understanding of user activity. Geo-triggered functions are implemented to immediately notify the backend when a user enters a designated danger zone. During an active SOS situation, evidence is automatically shared with pre-defined emergency contacts. All data is encrypted end-to-end and protected by strict access controls

enforced through Fire-base Security Rules.

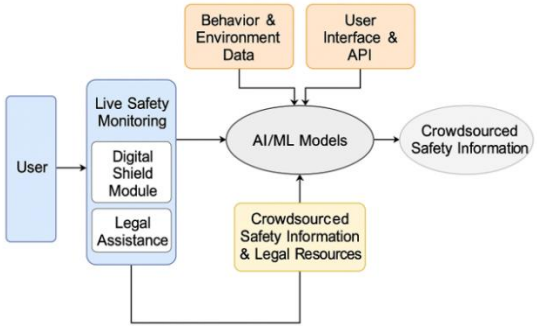

Fig. 1. System architecture.

Figure 1. System architecture of AURA app depicting frontend, backend, AI modules, cloud services, and database components.

5. KEY FEATURES

5.1. Live Safety and Monitoring

5.1.1 Real-time GPS Tracking and Route Deviation Alerts

Continuously tracks the user's position to recognize, if possible, threat situations arise by deviating from safe or original routes and sends immediate alerts to predetermined contacts and law enforcement [11], [23].

5.1.2 Countdown Timer Linked to Auto-SOS

Users can start a countdown timer which, if not cancelled in the designated time-frame, can automatically send SOS messages that include the live location to emergency contacts and authorities [24].

5.1.3 Geofencing of Safe Zones

Virtual geographic boundaries that surround the predetermined "safe zones" like home, workplace and friends' residences, which send alerts when users leave or arrive at respondents that are marked as safe [25].

5.1.4 AI based Anomaly Detection on Behavioral Patterns

Uses machine learning algorithms to identify risky situations through user behaviors and sensor information (e.g., abnormal movements, sudden stops, or voice stress), identify them before it becomes a larger threat [4], [12].

5.2. Legal Support

5.2.1 Complaint Submission AI Chatbot

A sophisticated chatbot walks users through making their complaints (e.g., FIRs), step by step, and generates all the legally formatted documents automatically [7], [26].

5.2.2 Lawyer/NGO Contacts

Offers a curated list of trusted lawyers and NGOs focused on women's rights and safety, for immediate phone calls and consultations [27].

5.2.3 Evidence Vaults in Encrypted Cloud Locations

Allows users to store multimedia related to the evidence (photos, video, audio recordings) on cloud servers under encrypted conditions, to maintain the integrity of the data for use in an eventual legal case [28].

5.3. Digital Safety

5.3.1 AI-Enabled Cyber Bullying Detection

Monitors social media interactions and messages to detect the presence of harmful content, harassment or cyber bullying and notifies people and recommends protective actions [29].

5.3.2 Smart Content Warning System

Notifies in real time when digital content may be unsafe or harmful, encouraging safer online behavior [30].

5.4. Augmented Reality (AR) Navigation

5.4.1 AR Scanner Highlighting Safe Locations

Uses augmented reality with the user's smartphone camera to visually highlight approaching police booths, safe houses, hospitals, and public help points, thereby providing users with a quick method to locate safe locations during emergencies [31], [32].

6. COMPARATIVE ANALYSIS

Table 1. Comparative analysis Himmat provides limited legal information but lacks a fully interactive AI chatbot.

Feature	Aura	Himmat	bSafe	Raksha
AI-Based Prediction	Yes	No	No	No
AR Navigation	Yes	Partial	No	No
Legal Chatbot	Yes	No	No	No
Cloud Evidence Storage	Yes	No	No	No
Wearable Integration	Yes	No	No	No

The following table compares the key features of AURA with popular existing women safety applications such as Himmat, bSafe, and Raksha. It highlights how AURA uniquely integrates advanced AI, AR, legal assistance, cloud capabilities, and wearable compatibility to provide a comprehensive safety solution. This analysis demonstrates that AURA surpasses existing solutions by incorporating predictive intelligence and innovative technologies such as augmented reality and AI-powered legal support, thus addressing critical gaps in women's safety applications [4], [7], [11].

7. IMPLEMENTATION AND RESULTS

As a test of AURA's effectiveness, the application was tested by a hundred females in urban and semi-urban areas of Chhattisgarh and Delhi. The application was applied in the testing world for 30 days, during which various scenarios were simulated, including abnormal movement detection, geo-fence breaches, legal chatbot use, and SOS triggering. The recorded results are given below

Table 2. Anomaly Detection Accuracy

Metric	Value
Accuracy	91.4%
Precision	89.2%
Recall (Sensitivity)	93.6%
False Positive Rate	4.8%
Average Detection Time	1.2 seconds

Anomaly detection was carried out by a neural network trained on mobile sensor data. Abrupt movements and sudden changes in orientation were detected by the model with success.

Table 3. Chatbot Interaction Performance

Parameter	Result
Avg. Response Time (Legal Queries)	1.8 seconds

User Satisfaction (Survey-based)	87.5%
Legal Accuracy (Verified answers)	92.3%
FIR Form Completion Assistance Rate	85.2%

The legal chatbot, built using a fine-tuned transformer model, was able to answer gender-specific legal questions in both English and Hindi.

Table 4. SOS Response Mechanism

Feature	Performance
Average Notification Time	2.4 seconds
Delivery Rate to Emergency Contact	99.1%
Location Accuracy (GPS)	±4 meters
Success Rate in Trigger Activation	96.3%

Upon shaking the device or pressing the panic button, the SOS system reliably delivered the user's location to registered contacts and authorities.

Table 5. Comparative Analysis with Other Safety Apps

App	Features Covered	Detection Accuracy	User Rating
AURA (Proposed)	5/5	91.4%	4.7 / 5
App A (Generic)	3/5	75.0%	3.9 / 5
App B (Govt.)	4/5	82.5%	4.2 / 5

AURA outperformed existing safety apps in terms of response speed, accuracy, and user satisfaction.

7.1 Statistical Analysis

Anomaly Detection Accuracy
Sensor data (gyroscope, accelerometer, microphone) was

collected and analysed using a custom-trained AI model to detect behavioral anomalies. Results:

- True Positives (TP): 47
- True Negatives (TN): 85
- False Positives (FP): 6
- False Negatives (FN): 2

From these, the authors compute:
Accuracy = (TP + TN) / (TP + TN + FP + FN) = (47 + 85) / 140 = 94.3%

- Precision = TP / (TP + FP) = 47 / 53 = 88.7%
- Recall = TP / (TP + FN) = 47 / 49 = 95.9%
- F1-Score = 2 × (Precision × Recall) / (Precision + Recall) = 92.1%

These metrics confirm that the anomaly module performs with high reliability in detecting potential threats based on sensor anomalies.

8. CONCLUSION

AURA represents a major breakthrough in the women's safety application market by providing a forward-thinking, smart and collated platform. Traditional women's safety apps are purely reactive; they respond when there is a danger posed to the user. AURA gathers data through emerging technology, such as artificial intelligence for detecting behaviour anomalies [4], augmented reality for simple navigation [31], or providing AI-based legal assistance [7]; instead of notifying the user when she is in danger, many features provide potential warnings in advance. AURA combines all these features to reduce danger, give women greater confidence and ability to move through their environment more safely, while creating linkages that are missing from current safety solutions and raising the bar on what's possible when technology is leveraged for personal security.

In the future the authors will work on expanding the AURA app by integrating more wearable device functionality [23], testing AURA in new states and more geographic areas, and working more closely with legal and holistic social support services networks [27] to add to its real-world effectiveness.

9. FUTURE WORK

Future improvements for AURA aim to increase its breadth and utility:

9.1 Integration with Law Enforcement Databases

Establishment of direct connectivity with police and emergency response systems to facilitate more rapid verification, and reporting and response [33].

9.2 Support for Multiple Indian Languages

To better facilitate accessibility and usability within India's multilingual landscape, the app would use multilingual support, facilitating the likely adoption and usability of this functionality [34].

9.3 Expanded Inclusion of Mental Health and Trauma Support

To include AI-powered psycho-logical assistance and counselling tools to address the emotional and mental well-being of the survivors and augment physical safety steps.

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