



International Journal of Innovative Research in Science Engineering and Technology (IJIRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)



Impact Factor: 8.699

Volume 15, Issue 3, March 2026

Campus Shield: Artificial Intelligence-Based Women Safety Application with Emergency Response Features

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ABSTRACT: CAMPUSSHEID is an AI-based women's safety web application designed to provide real-time emergency response, location tracking, and intelligent threat detection. The system integrates Flask-based backend services, secure authentication, real-time communication, AI-powered CCTV surveillance using YOLOv8, and Indian map APIs to ensure user safety. The application is developed as a localhost-deployable academic project using free and open-source technologies.

I. INTRODUCTION

Safety of women in campuses and public places has become a major concern in today's society. Increasing cases of harassment, stalking, and physical attacks show the need for fast and reliable emergency support systems. Traditional safety methods like calling someone or visiting a police station often take time and may not work in critical situations. With the growth of smartphones and Artificial Intelligence (AI), it is now possible to create smart applications that provide quick help, live monitoring, and real-time communication during emergencies. CampusShield is an AI-based women's safety application designed to provide immediate assistance using modern technologies such as GPS tracking, real-time video streaming, and YOLOv8 threat detection. The system consists of two main panels: Admin Panel and User Panel.

The user panel provides features like one-tap SOS, location sharing, loud siren, emergency contacts, video recording, heat maps for safe and unsafe areas, and an AI self-defense chatbot. These features help users quickly alert authorities and contacts during dangerous situations. The admin panel monitors all activities and ensures a fast response. It displays active users, offline users, SOS alerts, CCTV live feeds, and detected threats using YOLOv8. The system also supports Google Maps integration for real-time tracking and a community chat feature for communication. CampusShield aims to create a smart, reliable, and user-friendly safety platform that reduces response time and improves protection for women inside campus environments.

A. Project Background

Women's safety on campuses and in public spaces is a growing concern. Traditional safety measures, such as helplines and manual reporting, often result in delayed responses and limited real-time support. Advances in mobile technology and AI enable solutions that provide immediate assistance and preventive safety measures. CampusShield combines AI-powered threat detection, real-time alerts, and self-defence guidance in a single platform. The app allows users to quickly notify authorities and trusted contacts while receiving actionable safety instructions. The Admin Panel supports live monitoring, rapid alert management, and secure incident tracking, improving overall campus security. CampusShield aims to create a safer, more responsive environment where women feel protected both on and off campus.

B. Motivation

The main motivation for developing CampusShield is to empower women with technology that enhances personal safety and confidence. Access to real-time alerts, AI-driven safety guidance, and emergency communication helps women respond effectively during critical situations. Safety knowledge and preparedness enable women to feel secure while commuting, studying, or working. In today's world, where women play multiple roles—as students, professionals, caregivers, and leaders—it is crucial that they have reliable systems to protect themselves. Empowering

women with technology-driven safety solutions contributes to safer campuses, stronger communities, and a more secure environment for all.

C. Statement of Problem

Despite significant advancements in safety technologies, women in distress often face delayed emergency responses due to the lack of fast, direct, and integrated communication channels with emergency services and authorities. Existing safety solutions are scattered across different platforms, making it difficult to alert trusted contacts or administrators immediately when danger arises. There is no unified system that combines real-time tracking, instant alerts, and intelligent assistance to ensure immediate response during unsafe situations. In critical moments, women may not have the time or presence of mind to make calls or send messages. Most current applications fail to provide a One-Tap SOS feature that instantly shares the user's live location, alert notifications, and video or audio evidence with authorities and emergency contacts.

Additionally, these apps often lack AI-driven self-defence tips, automated detection of unsafe areas, and real-time CCTV-based threat recognition, which limits their effectiveness in preventing or responding to incidents. Therefore, there is a crucial need for an AI-based women's safety system that ensures fast, reliable, and intelligent emergency response. The proposed solution, CampusShield, aims to bridge this gap by integrating features such as One-Tap SOS with live GPS sharing, an AI self-defence chatbot, emergency contact alerts, loud siren alarms, video recording, and YOLOv8-powered CCTV threat detection. This unified, IoT-enabled, and AI-driven platform ensures that help is dispatched instantly, users are continuously monitored, and women feel safer and more empowered in any environment.

D. Aims and Objectives

The main aim of the project is to develop a secure, AI-powered women's safety mobile application—CampusShield—that functions as an intelligent emergency response system, capable of providing real-time alerts, live location tracking, AI-driven self-defence guidance, and video-based threat detection to ensure faster response and improved safety for women in distress.

- 1. To implement secure user authentication and accessibility:** The application will provide a secure login and registration system, ensuring only verified users can access the platform. The interface will be simple and user-friendly to cater to all age groups. Validation can be measured by successful login/authentication rates and user feedback on interface usability.
- 2. To develop a One-Tap SOS system for quick emergency communication:** Users can send instant alerts to authorities, trusted contacts, and administrators with live GPS location, audio, and video evidence. The system's effectiveness will be measured by alert delivery time under 5 seconds and successful location transmission. This will utilize GPS tracking, push notifications (Firebase Cloud Messaging), and video streaming.
- 3. To integrate an AI-powered self-defence chatbot:** The chatbot will provide real-time self-defence tips, preventive safety guidance, and step-by-step instructions during emergencies. Its performance can be validated by response accuracy, response time under 2 seconds, and user feedback. Technologies include Dialogflow, Rasa, or transformer-based models.
- 4. To implement AI-powered surveillance and threat detection:** CCTV feeds integrated with YOLOv8 object detection will monitor for suspicious activities and alert admins in real-time. The effectiveness can be measured by threat detection accuracy above 90% and notification latency under 3 seconds.
- 5. To provide real-time tracking and monitoring via the admin panel:** Admins will monitor user locations, categorise users by safety levels (critical, less safe, normal), manage emergency alerts, and document incidents in real-time. Validation includes accurate location updates within 5–10 meters and successful incident logging. Technologies include Google Maps API / OpenStreetMap, Firestore real-time database.
- 6. To enable video recording and evidence sharing:** The system will allow users to record videos during emergencies, which are automatically sent to the admin panel and securely stored for later reference. Validation is

through successful video upload and download within 10 seconds.

7. **To generate heatmaps and location analytics:** The app will display dangerous and safe areas using real-time user location data to assist both users and admins in identifying high-risk zones. Validation includes accurate visualisation of hotspots and a responsive map interface. Technologies include GeoJSON, Firebase Firestore, and mapping libraries.

E. Organization of the Report

This report first explores existing women safety applications, AI-based emergency systems, and related works in the Review of Literature. Following this, the System Analysis and Design chapter details the project's functional and non-functional requirements, system architecture, data flow, and design of various components, including the user panel, admin panel, and AI chatbot modules. The Methodology and Implementation section then describes the software tools, AI models, database integration, and step-by-step workflow for implementing features such as One-Tap SOS, live tracking, video recording, AI self-defence guidance, and threat detection. After implementation, the Results and Evaluation chapter presents the system's real-time performance, emergency response effectiveness, chatbot accuracy, and provides a walkthrough of the user interface. Finally, the report concludes with a summary of the project's outcomes and discusses potential future enhancements such as wearable device integration, voice-activated SOS, and advanced AI-driven threat detection.

II. REVIEW OF LITERATURE

A. Related Work

1. SURAKSHA: Women Safety Application

The SURAKSHA app provides features like SOS alerts, siren, and live location sharing to emergency contacts. It uses GPS technology to send the user's location during dangerous situations. The app also includes gesture-based activation such as shaking the phone. However, it mainly focuses on basic alert and tracking functions only. It is less effective than CampusShield because it does not include AI features, chatbot support, or smart monitoring.
<https://www.ijnrd.org/papers/IJNRD2305663.pdf>

2. Android App for Women Safety

This application allows users to send messages and location using a HELP button. It continuously shares GPS location with registered contacts. Users can store emergency contacts and predefined messages. The system depends on manual activation during emergencies. It is less effective than CampusShield because it lacks AI automation, real-time monitoring, and advanced features.
<https://ijsrcseit.com/paper/CSEIT1217368.pdf>

3. Women Safety App Project (2024)

This app provides features like a panic button, GPS tracking, and safe route suggestions. It allows users to share their location with emergency contacts easily. The system includes some basic AI-based safety alerts. However, the AI implementation is limited and not highly advanced. It is less effective than CampusShield because it lacks YOLO-based detection, chatbot integration, and real-time monitoring system.
<https://doi.org/10.22214/ijraset.2024.58829>

4. Smart Phone Based Women Safety Application

This paper presents a mobile app that alerts users about unsafe areas using GPS and a safety map. It relies on crowdsourced and admin-verified data to mark danger zones. The system mainly provides alerts when users enter a 3 km risky area. It also allows users to report unsafe locations and view them on a map. However, it is less effective than CampusShield because it only focuses on location-based alerts and lacks real-time threat detection, AI-based analysis, and active monitoring features used in your project.
<https://www.google.com/search?q=Smart+Phone+Based+Women+Safety+Application+with+Location+Tracking+and+Emergency+Response+IJRTI2505183>

5. Nirbhaya – The Women Safety App

This paper introduces a multi-feature safety app with SOS alerts, real-time tracking, panic button, and chatbot support. It also includes features like nearby safe locations, mental health support, and emergency communication. The system

uses APIs for accurate tracking and integrates multiple modules for safety. It aims to provide a complete safety solution for women. Still, it is less effective than CampusShield because it mainly depends on user activation (panic/shake) and does not provide continuous automated surveillance or AI-based suspicious activity detection like your system. https://ijirt.org/publishedpaper/IJIRT176672_PAPER.pdf

B. Limitations of the existing system

1. **No AI-Powered Assistance:** Most existing women safety apps do not provide real-time self-defence guidance, AI chatbot support, or video-based alerts. Users are limited to traditional calls or messages during emergencies.
2. **Weak Admin Monitoring:** Admin panels, if available, often lack real-time tracking of SOS alerts. Notifications are not instant, and the absence of alarm sounds delays response and situational awareness.
3. **Poor Location Tracking:** Many applications rely on basic GPS, which can be inaccurate indoors or in areas with weak signals. There is often no “last known location” tracking if the internet is lost, reducing the effectiveness of emergency response.
4. **No Two-Way Communication:** Most apps allow sending SOS messages but do not support real-time guidance or responses from administrators, limiting the ability to assist victims during critical moments.
5. **Dependence on Internet Connectivity:** Some systems fail when the internet connection is poor and lack backup features like SMS-based alerts, reducing reliability in remote or low-signal areas.
6. **Lack of Integration:** Features are scattered across multiple platforms—for example, one app for emergency calls, another for chat, and another for location tracking. There is no unified system combining AI chatbot, calling, admin tracking, and incident logging into a single platform.

III. SYSTEM ANALYSIS AND DESIGN

This chapter presents the detailed architectural framework for the CampusShield: AI-based Women Safety Application. It begins by translating the project’s aim and objectives into a structured plan, specifying the complete set of functional and non-functional requirements for both the user and admin panels. The chapter also outlines the required software, hardware, and AI components, including React Native/Expo for mobile development, Firebase for authentication and real-time database, YOLOv8 for threat detection, GPS modules for live tracking, and cloud storage for video and alert data. Following this, a technical and feasibility study validates the use of an AI-driven, IoT-enabled approach for real-time emergency response, one-tap SOS alerts, live location tracking, and intelligent self-defence guidance. The chapter further details the system’s design using Data Flow Diagrams (DFDs) to illustrate the flow of information between users, admin panels, and cloud services, a UML class diagram specifying the structure of software components, and a multi-layer system architecture diagram showing the integration of mobile app, AI models, database, and notification modules.

C. Requirements

C.1 Functional Requirements

1. **User Registration and Authentication:** The app allows women users to register and log in securely before accessing safety features.
2. **Emergency Call and Contact Management:** Users can directly call emergency numbers like police, ambulance, or custom contacts through the app.
3. **AI Chatbot for Self-Defence Guidance:** An AI-powered chatbot provides self-defence tips, instructions, and related videos when the user asks questions.
4. **Admin Communication Panel:** Users can send SOS messages or unsafe location details to the admin; the admin receives an alert notification with sound.
5. **Real-Time Location Tracking:** The admin can view the user’s last known location during an emergency to assist in a quick response.
6. **Incident Logging and Multi-Language Support:** The system stores incident details (date, time, type) for records and supports multiple languages, such as Marathi and Hindi.

C.2 Non-Functional requirements

1. **Performance:** The app should respond to user actions (like SOS trigger or chatbot queries) within 2–3 seconds to ensure a quick emergency response.

2. **Reliability:** The system must remain functional even during high user traffic or weak network conditions, with minimal downtime.
3. **Security:** All user data, location records must be encrypted to protect privacy and prevent unauthorized access.
4. **Usability:** The interface should be simple, clear, and easy to navigate for users of all age groups, including non-technical users.
5. **Scalability:** The system should support more users, locations, and new AI features without affecting performance.
6. **Availability:** The application should be accessible 24/7, especially during emergencies, with automatic recovery if the server fails.

C.3 Hardware and Software requirements Hardware

1. **Processor :** Intel i5 or higher (for development and admin dashboard)
2. **RAM :** Minimum 8 GB for smooth execution and testing
3. **Storage :** Minimum 500 GB HDD or 256 GB SSD
4. **Smartphone :** Android device with GPS, camera, and internet connection for user-side app
5. **Server :** Cloud-based or local server to host the database and backend
6. **Internet Connection :** Stable Wi-Fi or mobile data for real-time location and call features.

Software:

1. **Operating System :** Windows
2. **Programming language :** HTML, CSS, JavaScript
3. **Mobile App Framework :** Flask
4. **Database :** SQLite
5. **Backend Framework :** OpenCV YOLO8
6. **API Integration :** Google Maps, API
7. **IDE :** Visual Studio Code

D. Feasible Study

A feasibility study is the process of evaluating whether a proposed system or project is practical, achievable, and worth implementing. It examines technical capability, economic cost, operational factors, and potential risks to determine if the project can be successfully developed and maintained. For the CampusShield application, the feasibility study confirms that the system can be built using available technology within reasonable cost and resource limits.

D.1 Technical Feasibility

CampusShield is technically feasible using current low-cost smartphones, cloud services, and AI frameworks, achieving the project's real-time alert, tracking, and AI chatbot targets with manageable risks around network connectivity, battery usage, and data privacy that require mitigation plans.

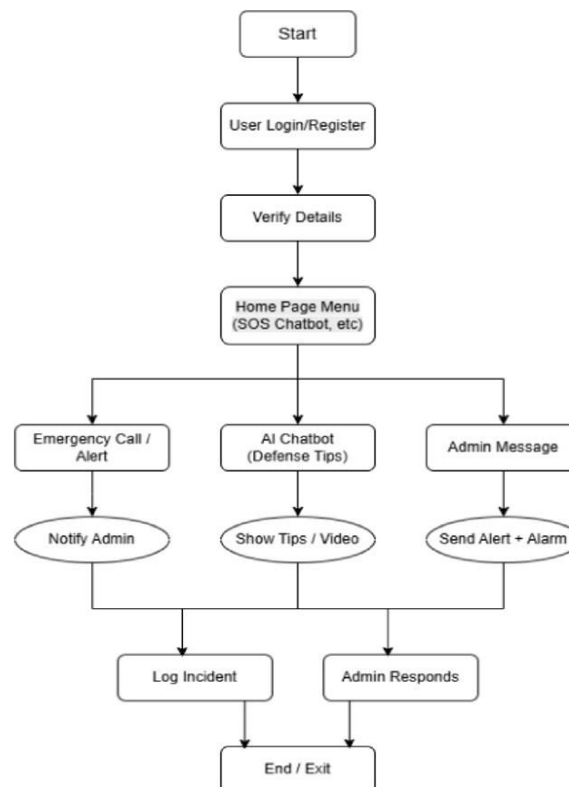
- **Architecture fit:** Standard Android smartphones with GPS, camera, and internet can handle real-time location tracking, push notifications, video streaming, and AI chatbot responses, meeting the system's latency and responsiveness goals.
- **Performance feasibility:** One-tap SOS alerts, live location updates, and video transmission can be delivered within seconds, while AI self-defence chatbots respond within 1–2 seconds using optimised APIs and lightweight ML models.
- **Power and thermal:** Periodic location updates, event-triggered video capture, and optimised AI inference ensure power-efficient operation without overheating smartphones.
- **Data and AI pipeline:** Collection, preprocessing, model training, deployment, and cloud synchronisation support on-device and cloud-based inference for the chatbot and YOLOv8 threat detection, with efficient memory and API usage.
- **System integration:** APIs like Firebase, Google Maps, and Twilio reduce integration risks and enable seamless interaction between the user panel, admin panel, and cloud services.
- **Maintainability and upgradation:** Modular design allows easy updates, wearable integration, voice-activated SOS, and advanced AI features for long-term sustainability.
- **Familiarity:** The development team's experience with mobile apps, cloud services, AI frameworks, and API integration ensures efficient prototyping and deployment.

D.2 Economic Feasibility

- **Low Development Cost:** The project primarily utilises open-source technologies such as React Native, Python, TensorFlow, and free APIs like Google Maps and Twilio trial accounts, keeping overall development expenses minimal.
- **Affordable Infrastructure:** Hosting on free or low-cost cloud platforms such as Firebase or AWS free tier ensures that server, database, and notification management are economically viable.
- **Maintenance Cost:** The modular and cloud-based architecture allows for easy updates, bug fixes, and feature enhancements, requiring minimal ongoing technical resources and reducing long-term maintenance costs.
- **Scalability without High Investment:** The system can be easily scaled to support additional users, new locations, or added features without significant infrastructure costs, ensuring sustainable growth for the CampusShield application.

E. Project Design

E.1 Flow chart

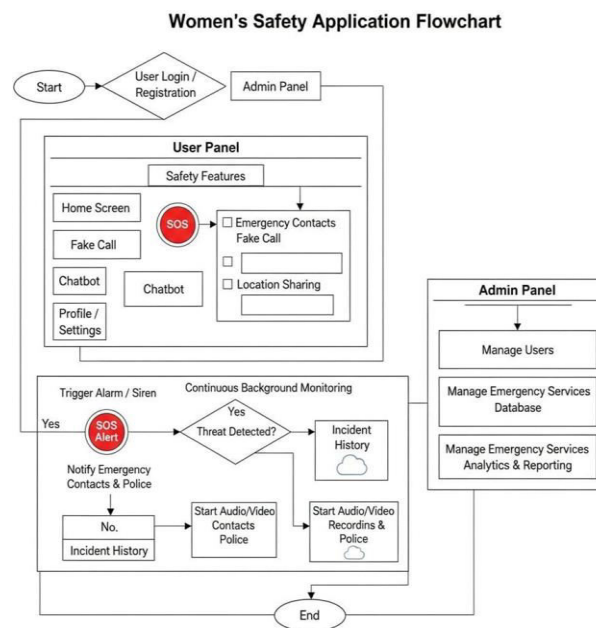


1. **Start:** The process begins when the user launches the CampusShield mobile application.
2. **User Login/Register :** The user either registers a new account by entering her details (name, phone number, emergency contacts) or logs in using existing credentials.
3. **Verify Details :** The system verifies the login information by matching it with the user database.
 - If valid, the user gains access to the main menu.
 - If invalid, an error message is displayed, and the user is asked to retry.
4. **Home Page Menu (SOS, Chatbot, etc):** After successful login, the main dashboard appears with different safety options such as:
 - Emergency Call/Alert
 - AI Chatbot (Defence Tips)
 - Admin Message
5. **Emergency Call / Alert :** When the user triggers an SOS or emergency call, the system immediately sends an alert and location details to the admin and emergency services.

6. **AI Chatbot (Defence Tips):** If the user selects the chatbot option, she can ask safety-related questions. The chatbot responds with self-defence tips or short training videos stored in the database.
7. **Admin Message:** If the user feels unsafe, she can send a text message to the admin containing her current location or address. The admin receives this as a notification with an alarm sound.
 - Notify Admin / Show Tips / Send Alert + Alarm:
 - For emergency calls, the admin gets a real-time SOS notification.
 - For chatbot requests, the user receives guidance or videos instantly.
 - For unsafe messages, an alarm notifies the admin of the danger.
8. **Log Incident:** The system records every SOS alert or emergency interaction with date, time, and user details in the database for future reference.
9. **Admin Responds:** The admin can reply to SOS messages, confirm the user's safety, or dispatch help if needed.
10. **End / Exit:** The process ends when the user closes the app or the admin marks the incident as resolved.

IV. METHODOLOGY & IMPLEMENTATION

F. Block diagram of the project



G. Tool and Technology

1. Front-End Development

- Technology: HTML, CSS, JavaScript
- Framework: React Native / Flutter
- Purpose : To design a user-friendly mobile interface for registration, SOS alert, and chatbot features.

2. Back-End Development

- Technology: Python / Node.js
- Framework: Flask or [Express.js](https://expressjs.com/)
- Purpose: To handle server-side logic, database connectivity, and API integration for location tracking and admin communication.

3. Database

- Technology: Firebase Realtime Database
- Purpose: To store user details, emergency contacts, SOS logs, chatbot responses, and incident records.

4. AI and Chatbot Integration

- Technology: HTML, CSS, JavaScript
- Purpose: To implement the AI chatbot that provides defence tips and self-safety responses.

5. GPS and Location Tracking

- Technology: Google Maps API
- Purpose: To detect and share the user's live location with admins during emergencies.

6. IDE and Development Tools

- Tools: Visual Studio Code
- Purpose: For coding, testing, and deploying the mobile application.

7. Notification and Communication

- Technology: Firebase Cloud Messaging (FCM)
- Purpose: To send instant SMS or push notifications to registered emergency contacts or admin

H. Key Features Implemented

The applications core functionality is divided between the immediate, life-saving features on the User Panel and the centralized oversight provided by the Admin Panel.

1. User Panel Core Features

1. One tap SoS button with Location Sharing to the admin panel and emergency contacts
2. AI Self-defence chatbot that contains fighting skills, women training videos, and contact no of ambulance, police, and fire Briget
3. Emergency contact button, which can contact people
4. Siren /Loud Alarm, which should work and make noise
5. Video recording that will be sent directly to the admin and will be downloaded in the user panel, also
6. Heat maps showing the areas that are dangerous and the safe ones for the user based on their location, and also show the user in that location
7. Settings contain a black or white background and name, email ID , and phone no. Edit option also adding contact no.

2. Admin Panel Core Features

1. Total number of users using the app in a box, people who are offline in the second box, and the notification box
2. The notification box will go to the notification page, where the notification will come from the user. If the Sos button is tapped by the user, the video is sent by the user.
3. The User Emergency button will go to the page that will show the list of users in the critical area, the less safe area, normal area with their phone numbers.
3. CCTV access with YOLO8 technologies that detects threats and notify the admin. Add the technology to show a threat for this camera of laptop, which can be used through the admin panel
4. The community chat allows you to join in chat panel with other users who have logged in through the user panel.
5. The Google map location button shows another page where he can see the map with the user active, and below it, a button that can take the phone no. Also find the person with that no. On the map. The map should contain the names of places that can be zoomed in and out. Make it work using GPS.

V. CONCLUSIONS & REFERENCE A.CONCLUSIONS

The Women's Safety Application is designed to be more than just a panic button; it's a multi-layered, comprehensive safety ecosystem that blends immediate user autonomy with dedicated administrative oversight. The system's strength lies in its real-time coordination.

It seamlessly connects immediate user-triggered actions (via SOS and the local alarm) with automated backend processes, including high-accuracy GPS data fetching, mass contact alerts (via SMS), and real-time logging to the Firestore database. This integrated loop ensures that critical incident information reaches both personal contacts and centralised administrators simultaneously, enabling rapid and coordinated intervention. Furthermore, the integration of the AI Safety Chatbot (powered by the Gemini API) adds a crucial proactive element, providing users with grounded advice and guidance, thereby shifting the focus from mere reaction to active risk mitigation. On the backend, the Admin Panel acts as the vital human-in-the-loop, utilising real-time monitoring and documented response protocols to manage incidents effectively. Ultimately, by leveraging this robust and redundant technological architecture, the application shifts the paradigm of personal safety from passive caution to active, supported intervention, providing users with a definitive layer of confidence and protection.

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