A Comparative Review for Human Safety Application

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Abstract. This paper presents a comprehensive review and enhancement proposal for personal safety applications, with a focus on addressing the pressing issue of violence against women and vulnerable groups. Drawing from seven key research studies, the paper evaluates existing mobile safety systems in terms of features, technological frameworks, and practical usability. It highlights a proposed model that consolidates essential safety functions such as real-time location sharing, voice-activated alerts, emergency contacts, route tracking, and educational outreach. The comparative analysis identifies gaps in current solutions and demonstrates how the proposed model overcomes these limitations through a multi-functional, user-centric mobile application built using the Flutter framework and Dart language. The result is a holistic platform aimed at strengthening user safety in both anticipated and unpredictable scenarios.

Keywords: Personal security, Emergency response, Real-time tracking, Mobile application, Flutter, Comparative analysis.

1 INTRODUCTION

In an era marked by increasing concerns over per- sonal safety, the demand for effective solutions to pro- tect individuals has never been greater. Emergencies can occur at any moment, often with little warning, making it essential for people to have access to timely assistance. Statistics reveal that quick access to emer- gency services can significantly reduce the severity of incidents, making it imperative to create tools that en- hance this accessibility. This project addresses this pressing need through the development of a compre- hensive application that empowers users with various safety features. By integrating voice activation, direct service access, and informative resources, the applica- tion aspires to provide a holistic safety solution that can be easily accessed during stressful situations.

2 LITERATURE SURVEY

Several research efforts have explored the appli- cation of mobile and embedded technologies for per- sonal safety. This section highlights key developments: Rodriguez et al. [1] categorize computer science solutions addressing violence against women into four segments: online detection, offline detection, emer- gency systems, and educational tools. Their review em- phasizes a gap in integrated solutions that combine de-

tection with response mechanisms.

Shenoy et al. [2] advocate for a socio-technical ap- proach that marries crime prevention with community participation. Their framework encourages holistic in- tegration of GIS crime mapping and societal involvement alongside technological development.

Da Silva Costa et al. [3] introduced the WHOT application, which uses facial expression analysis and psychological assessments to monitor women exposed to violence. While innovative in detection, WHOT lacks on-ground intervention tools such as emergency contact or navigation systems.

Vani et al. [4] proposed a GPS-enabled SMS alert system for women and children, enabling them to share their real-time location with authorities during emer- gencies. However, this solution is limited by manual activation and lacks educational and proactive compo- nents.

Dhana Lakshmi and Gayatri [5] presented a wear- able device integrated with a GSM module and buzzer, effective for quick response but lacking scalability and platform independence.

Bonde et al. [6] consolidated various techniques in their review, concluding that existing tools often fall short of providing comprehensive protection due to fragmented feature sets and lack of user engagement.

Zutshi et al. [7] developed the Spark Women app to reduce police response time through a discreet alert mechanism, yet it does not support education, route management, or automated recording for evidence collection.These studies collectively identify significant strides in safety tech but reveal that no single application addresses detection, response, and awareness si- multaneously.

3 PROPOSED SYSTEM

The proposed system is a mobile-based safety applica- tion designed primarily for women and children, leveraging advanced technologies to offer immediate assis- tance, proactive monitoring, and educational support. It serves as an all-in-one platform combining emergency features, real-time tracking, secure communication [8], and learning resourcesâan integration rarely seen in ex- isting models.

Drawing on shortcomings identified in prior re- search such as limited automation [4], lack of educa- tion features [9], and absence of route tracking [7], this system is built to:

- Minimize human interaction during emergencies (e.g., via voice-activated commands).
- Provide real-time location updates and route devi- ation alerts.
- Automatically record audio evidence discreetly during crisis moments.
- Educate users on safety protocols, mental health, and self-defense through interactive modules.

Furthermore, this system leverages Flutter for cross-platform development, Firebase for real- time cloud services, and integrates APIs for maps and voice recognition, ensuring smooth perfor- mance across devices and low latency in emergen- cies.

4 COMPARATIVE ANALYSIS OF EXISTING SYSTEMS

A comprehensive evaluation of existing women safety systems reveals the evolution of security solu- tions and highlights the innovations introduced in the proposed application. The table below summarizes key

features of various systems and contrasts them with our proposed model:

Comparative Analysis of Existing Systems

Feature	WHOT	Spark Women	GPS-SMS System	Proposed Model
Voice Activation	No	Yes	No	Yes
Location Sharing	Yes	Yes	No	Yes
Emergency Contacts	Yes	Yes	Yes	Yes
Facial Recognition	Yes	No	Yes	Yes
Educational Resources	No	Partial	Yes	Yes
Route Tracking	No	No	Yes	Yes
Nearby Safety Places	No	No	Yes	Yes
Custom Message	No	No	Yes	Yes
Single Tap SOS	No	No	Yes	Yes
Direct Help	No	No	Yes	Yes
All Types of Contacts	No	No	Yes	Yes

Figure 1: Existing System Vs Proposed System

4.1 WHOT (Women's Health Observer Tool)

WHOT stands out for its psychological assessment and use of facial recognition technology to aid in identifying signs of violence. However, it lacks emergency- response-oriented features such as voice activation, audio recording, and educational resources. WHOT is more preventive in nature, focusing on health profiling rather than real-time intervention [3].

4.2 Spark Women Application

This mobile-based solution focuses on emergency alert- ing and location tracking. Its standout feature is the voice activation trigger, allowing discreet alerts when in danger. However, it does not provide route guidance, educational content, or evidence-capturing mechanisms like audio recording [7].

GPS-SMS System

This is a device-based solution that leverages GPS modules and SMS alerts to notify emergency contacts. While practical in certain scenarios, it lacks modern user-interface design, voice activation, educational content, and real-time interaction with local services [4].

4.3 Proposed Application

The proposed system aims to bridge the limitations of earlier models by offering a holistic suite of features:

- Voice activation for hands-free alerts
- Real-time location sharing for rapid response
- Emergency contact dialing
- Route tracking to identify deviations from safe paths
- Audio recording during crises for evidence collec- tion

- Educational content to raise safety awareness and preparedness

4.4 Summary

This comparative analysis shows that while individ- ual systems focus on certain aspects of safety, none of them integrate all critical functionalities. The proposed model is designed to fill these gaps by combining real-time responsiveness with proactive educational tools, making it more versatile and user-centric for handling personal safety in diverse environments.

5 OBJECTIVES

The core objective of this research is to design and implement a technologically advanced, accessible, and holistic safety solution for women and vulnerable groups. Specific objectives include:

- To study existing women's safety systems and identify feature gaps and usability issues, as ob- served in Bonde et al.'s review [6] and Rodriguez et al.'s analysis [1].
- To understand ATM security and user verification which is based on CNN-based biometric authenti- cation systems that reduce spoofing and false pos- itives [8].
- To study detection of speed using machine learn- ing and OCR techniques for real-time monitoring and accident prevention [9].
- To design a responsive mobile application that pro- vides seamless emergency services without requir- ing significant user input, a critical advantage over earlier models such as GPS-SMS systems [4].

To integrate proactive safety mechanisms such as:

- Route deviation detection (as recommended in Shenoy et al.'s holistic framework [2]),
- Voice-activated SOS (inspired by Spark Women [7] but extended further), and
- Background audio logging (an innovative addition not present in any reviewed models).
- To empower users with knowledge, by including an educational section featuring self-defense tu- torials, mental health support, and safety laws- addressing the lack of such resources in tools like WHOT [3].
- To create a low-cost, scalable, and intuitive solu- tion accessible on both Android and iOS platforms using a single codebase.

6 SYSTEM ARCHITECTURE

The architecture of the proposed safety applica- tion is based on a modular and layered approach, de- signed for scalability, flexibility, and rapid response.

6.1 Client Layer (Frontend)

- Built Using Flutter (Dart) for cross-platform de- ployment.
- Responsive UI for quick access to core functions: SOS, Route Tracking, Education Hub.
- Speech-to-text library for voice activation trigger.
- Embedded audio recorder and camera access on user permission.

6.2 Middleware/Service Layer

- Voice Command Processing: Converts live speech input into text and matches predefined alert phrases (e.g., "Help me").
- Location Services: Integrates with Google Maps API to fetch real-time coordinates and track routes [7].

6.3 Deviation Monitor: Analyzes user movement and sends alert if route deviates from preset path.

6.4 Backend Layer

- Firebase Authentication: Secures user data and emergency contact access.
- Cloud Firestore/Realtime Database: Stores current location, route data, and alert history.
- Storage Bucket: Securely saves audio files and po- tential evidence [8].

6.5 Notification and Alert Engine

- Auto-generates SMS or WhatsApp messages to contacts with userâs location.
- Push notifications for route deviation or suspicious activity detection.
- Future enhancements could include AI-based threat prediction based on movement patterns [9].

6.6 Education Module

- Dynamic content on safety practices, helpline di- rectories, and case-based learning.
- Includes articles, short videos, and quizzes for user engagement.

7 RESULTS AND FUTURE SCOPE

Upon completion of the testing phase, the applica- tion demonstrated a high success rate in detecting voice commands and successfully contacting emergency ser- vices. User feedback was overwhelmingly positive, particularly regarding the ease of use and the stream- lined access to critical features.

The audio recording feature was recognized as par- ticularly valuable, providing users with a means to doc- ument emergencies for future reference. Additionally, the route management [9] functionality was praised for enhancing user confidence while traveling, especially in unfamiliar areas.

This application utilizes voice recognition technol- ogy to enhance human safety by detecting [8] specific emergency keywords, such as "help police help." Once the system identifies these triggers, it initiates an imme- diate response, such as alerting authorities or activating an emergency protocol. The voice recognition ensures rapid action without the need for physical interaction, providing a quick and discreet way to request help in critical situations. This technology can be integrated into personal devices, smart home systems, or security systems for constant vigilance. By automating the re- sponse to these emergency keywords, it aims to reduce response times and potentially save lives. Despite the successes, some challenges were identi- fied. For instance, variations in voice clarity and back- ground noise can affect the accuracy of the voice acti- vation feature. Future enhancements may include refin- ing the voice recognition algorithms to improve perfor- mance in various conditions, as well as considering the integration of additional safety features, such as auto- matic alerts based on unusual user behavior.

8 CONCLUSION

This research demonstrates that while numerous safety apps exist, most are fragmented in their feature offerings. A clear gap remains in unified, proactive, and user-friendly solutions that combine emergency response with real-time monitoring and education.

The proposed application bridges this gap by in- tegrating voice activation, live tracking, route intelli- gence, and audio evidence collection within a single system. Unlike systems like WHOT that focus solely on psychological health [3], or Spark Women that are lim- ited to alert mechanisms [7], this model offers a comprehensive safety ecosystem tailored to real-world us- age.

With ongoing testing and enhancement, this plat- form has the potential to become a gold standard for mobile safety systems, not only for women but for chil- dren, the elderly, and vulnerable communities. Fu- ture directions include integration with law enforce- ment databases, AI-based threat assessment [8], and wearable device pairing, ensuring continuous evolution toward complete societal safety.

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