Human Security System with Location Awareness

[1] *Sneha S,* [2] *Arun P,* [3] *Shaheen K P,* [4] *Stalige Mohan M,* [5] *Sreeji S*

[1]Sneha S, Student, Computer Science and Engineering, NCERC
[2]Arun P, Student, Computer Science and Engineering, NCERC
[3]Shaheen K P, Student, Computer Science and Engineering, NCERC
[4]Stalige Mohan M, Student, Computer Science and Engineering, NCERC
[5]Sreeji S, Assistant professor, Computer Science and Engineering, NCERC

Nehru College of Engineering and Research Centre (NCERC) ,Thrissur ,India

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Abstract - Ensuring personal safety has become a critical concern as incidents of harassment, abuse, and health emergencies continue to rise. Studies show that both men and women face physical and psychological threats, yet many incidents go unreported due to fear, lack of immediate assistance, or inadequate security mechanisms. To address these challenges, this research proposes an Android-based Human Security System with real-time emergency response and location awareness. The system integrates multiple security features:

Panic Button – Instantly sends alert messages and places an emergency call to pre-configured contacts.

Location Awareness System – Uses GPS tracking to monitor and share the user's real-time location.

Machine Learning-based Recommendation System – Employs collaborative filtering algorithms to provide safety insights based on historical user reviews and risk assessments.

By leveraging mobile technology, GPS, and machine learning, this system offers a proactive, data-driven approach to security. The combination of real-time location tracking, emergency alerts, and AI-powered recommendations enhances user safety while enabling swift responses in distress situations. This research explores the system's architecture, functionality, and efficiency, evaluating its advantages over existing emergency response applications.

Keywords: Machine Learning, Panic Button, Alert Message, Emergency Response, Location Tracking, Recommendation System, Collaborative Filtering, Personal Security.

1.INTRODUCTION

1.1 Background

In modern society, personal safety is a significant concern, especially in urban areas with high crime rates. Studies indicate that both men and women frequently experience harassment, abuse, and emergency health situations. However, many of these incidents go unreported due to fear, lack of evidence, or the absence of immediate help. While some safety applications exist, they lack a multi-layered approach that integrates location tracking, real-time alerts, and emergency assistance.

1.2 Objectives

The primary objective of this research is to develop an Android-based security system that provides:

1. **A Panic Button** – Instantly alerts emergency contacts and authorities.
2. **Location Awareness System** – Tracks user location in real time.
3. **Situation Capturing** – Helps gather evidence for law enforcement.
4. **A Recommendation System** – Uses **collaborative filtering** to assess safe and unsafe locations.

1.3 Motivation

Many security applications either fail to function without the internet, lack tracking features, or require manual intervention in emergencies. The proposed system aims to overcome these limitations by integrating multiple security measures into one mobile platform, ensuring reliability, efficiency, and accessibility.

2. LITERATURE SURVEY

To develop an effective security system, we analyzed existing research in human tracking, emergency alert systems, and mobile-based security applications. Previous studies highlight several challenges and advancements in personal security technology. The findings indicate that existing methods, while effective to some extent, face limitations such as poor visibility, connectivity issues, and lack of integrated features. The following sections provide an overview of relevant research in the field.

2.1 People Counting and Human Detection:

People counting and human detection play a crucial role in security surveillance and public safety applications. Accurately detecting individuals in crowded or complex environments is a

challenge due to factors such as poor visibility, low image resolution, and background obstructions. Traditional methods rely on motion detection and object tracking[1]; however, they struggle to differentiate between individuals in dense areas. Recent research suggests leveraging machine learning techniques to improve accuracy by employing pattern recognition, feature extraction, and predictive analysis. These advancements help enhance crowd management, crime prevention, and real-time monitoring, making them highly relevant for personal security applications.

2.2 Unified Tracking and Recognition:

Traditional tracking methods often fail in complex environments, particularly in crowded places where multiple moving objects interfere with detection algorithms. Many conventional systems rely on low-level image processing techniques that struggle with issues such as rapid movement, lighting variations, and overlapping objects. A promising approach involves combining lowlevel

tracking with high-level object recognition to enhance accuracy and adaptability. By integrating deep learning[2] and feature-based classification, modern tracking systems can differentiate between objects, recognize patterns, and adapt to environmental changes. This hybrid approach significantly improves tracking reliability and is essential for applications that require real-time surveillance and security monitoring.

2.3 Android-Based Emergency Alert Systems:

Emergency alert systems, particularly SOS applications, have gained popularity as a means of providing quick emergency assistance. These applications allow users to send distress signals, notify emergency contacts, and share location data in critical situations. However,most existing SOS apps lack integrated features such as evidence collection, automatic call tracking, and continuous location awareness. Additionally, their dependence on internet connectivity limits their effectiveness in remote areas or low-network conditions. To overcome these challenges, modern security applications must incorporate offline functionality, multi-channel alerting mechanisms[3], and cloud-based data storage for improved reliability and accessibility.

2.4 Mobile-Based Tracking Using GPS & GSM:

GPS-based tracking systems provide accurate real-time location detection, making them a crucial component of personal security applications. However, urban environments often interfere with GPS signals, resulting in delays or inaccuracies in location tracking. To address this issue, researchers propose combining GPS with GSM[4] (Global System for Mobile Communications) to enhance tracking reliability. GSM-based tracking allows for location approximation even in low-signal conditions, making it a valuable backup solution when GPS alone is insufficient. By leveraging both GPS and GSM technologies, security applications can ensure continuous and accurate tracking, regardless of environmental limitations.

2.5 Improving the Performance of Video Tracking Using SVM:

Object tracking is essential in video surveillance, autonomous driving, and analytics, enabling systems to identify and follow objects across frames. Support Vector Machines[5] (SVMs) enhance tracking accuracy by effectively classifying objects in high-dimensional spaces, while the Kalman Filter predicts object movement, reducing noise and improving real-time tracking.However, challenges remain in complex environments with occlusions, rapid movements, and overlapping objects. Additionally, multi-object tracking requires high computational power, and SVM training depends on large labeled datasets, making it resource-intensive. Addressing these challenges requires adaptive algorithms and efficient data processing techniques to enhance tracking reliability.

4.PROBLEM STATEMENT

Security concerns for both men and women are increasing, with many cases of harassment, abuse, and
health emergencies going unreported. Immediate assistance is crucial in such situations. This project
proposes an Android-based security application integrating:

Panic Button – Sends instant alert messages and emergency calls to preset contacts.

Location Awareness System – Tracks and shares real-time GPS location for quick assistance.

Machine Learning-based Recommendation System –
Uses collaborative filtering to provide safety ratings for locations. Additionally, the system enhances the Emergency SOS feature by enabling instant connection, silent alerts, and automated location sharing, ensuring swift emergency responses without requiring users to unlock their phones. This approach bridges the gap in existing security applications, offering a comprehensive and proactive personal safety solution.

5.REQUIREMENT ANALYSIS

5.1 Software Requirements: The proposed system requires Windows 10 as the operating system, with MySQL Database and PHP for backend development. The frontend is designed for Android, utilizing Android Studio as the primary development environment. Additionally, the system requires Java Runtime Environment (JRE 1.7+) and SDK Tools for efficient application development and deployment.

5.2 Hardware Requirements: To support real-time security and surveillance, the system relies on high resolution cameras for accurate object detection and tracking. Powerful processing units, including GPUs or AI accelerators, are essential for running real-time video analytics efficiently. A reliable cloud-based storage system ensures secure data management and seamless retrieval for forensic analysis. A high-bandwidth,low-latency network infrastructure is crucial for uninterrupted data transmission, maintaining system responsiveness. The system also leverages cloud computing resources for scalable processing power and adaptability to dynamic workloads. To enhance reliability, redundancy and backup mechanisms, including failover systems and backup storage solutions, are implemented to prevent data loss and ensure continuous operation even in case of failures.

6.PROPOSED SYSTEM

Our proposed system consists of five main parts which are governed by admin and user:
1) Emergency Alarm Module
2) GPS Module
3) Location Awareness Module
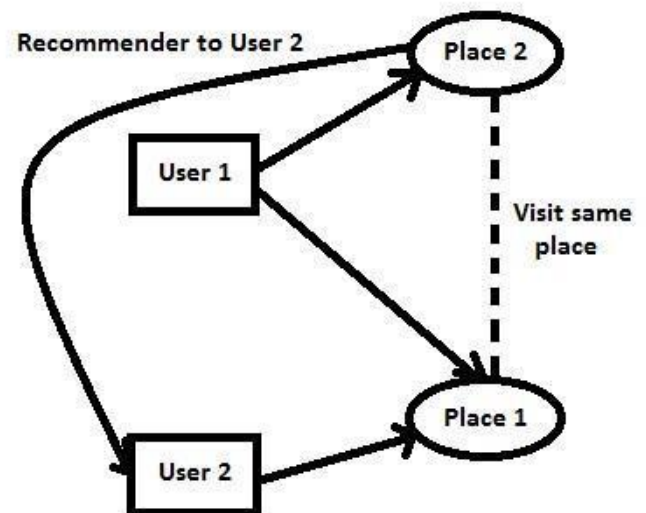4) Call Tracking Module
5) Situation
Tracking Module. The user must install the android application on the smart phone. The user has to register and login in to the system. There are multiple features collaborated together to ensure the complete security of the person. During the time of registration, a prompt window opened on the screen; to which allow the user to set some chosen contact numbers as Emergency Contact Number.
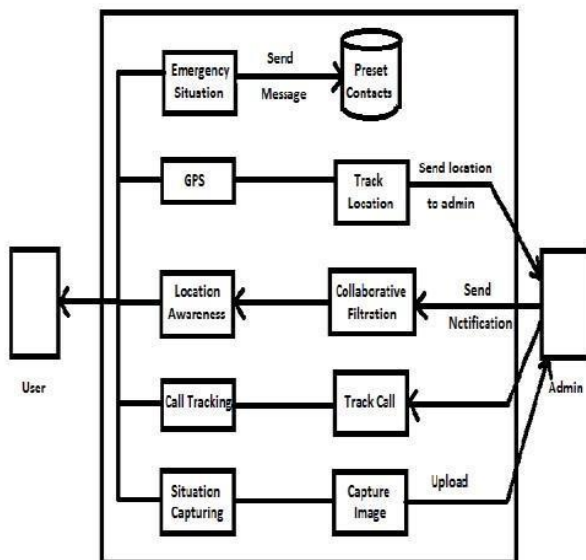
A. Emergency Alarm Module: In case of any physical/sexual violence on distress, the user need to open the application and has to press the Emergency Alarm Module (designed in the form of Panic Button) which will send messages to preset contacts followed by a call.

B. GPS Module: The GPS Module is essential for tracking the user's real-time location by determining longitude and latitude coordinates. It utilizes the Haversine Formula to calculate distances accurately,enabling precise location sharing during emergencies.

C. Location Awareness Module: The Location Awareness Module (LAM) utilizes collaborative filtering, a machine learning technique, to provide personalized safety recommendations. It analyzes user data and feedback to suggest safe or high-risk locations based on similarities with other users. This module includes user rating estimation and feature extraction, ensuring data-driven decision-making for travel and location safety.

D. Call Tracking Module: The Call Tracking Module serves as an evidence collection tool, where the admin acts as the primary authority. Once activated, the system tracks calls from the user's device, logging essential details from the beginning to the end of the conversation. This feature helps in documenting critical evidence during emergency situations.

E. Situation Capturing Module: The Situation Capturing Module allows users to utilize their smartphone cameras (both front and back) to record and upload images or videos of incidents such as accidents, crimes, or suspicious activities. These recordings can then be reviewed by the admin and, if necessary, reported to law enforcement or relevant authorities for further action.

6.1 METHODOLOGY

SYSTEM WORKFLOW

1. Distress Activation – The user can trigger any application functionality in an emergency.

2. Emergency Alarm Activation – Pressing the panic button activates the Emergency Alarm Module An alert message is sent to pre-set emergency contacts.

3.GPS Tracking – The GPS Module tracks the user's real-time location for safety. The admin continuously monitors the user's latitude and longitude positions.

4. Location Awareness – The Location Awareness Module provides safety recommendations through collaborative filtering.

5. Situation Capturing – The Situation Capturing Module records videos and audio of incidents such as accidents or crimes,Users upload captured media to the app, which the admin collects for further action.

6. Emergency Assistance – The admin and emergency contacts receive alerts and can take immediate action
to assist the user.
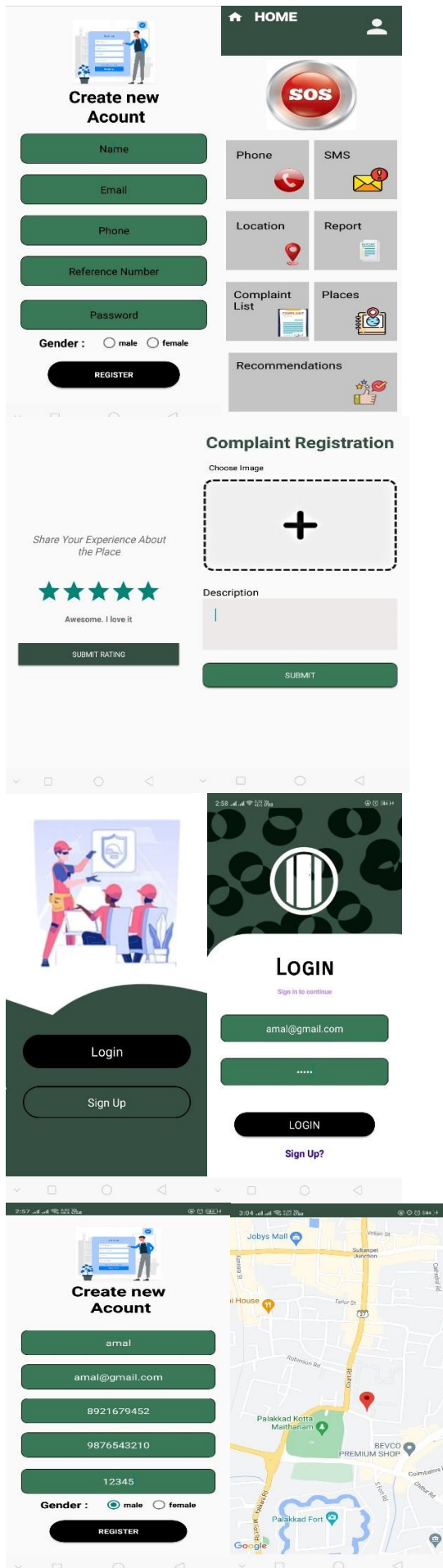
6.2 ADVANTAGES AND APPLICATION

A. Advantages of the Proposed System
· Fast Emergency Response – Alerts are sent immediately during distress situations.
· Emergency Contact Notification – Notifies pre-set emergency contacts when the user is in danger.
· Single Device Functionality – No need for additional safety devices; everything is integrated into a smartphone application.
· Personalized Safety Recommendations – Machine learning-based collaborative filtering reduces risks by providing recommendations from users with similar profiles.
· Automated Evidence Collection – Captures images, videos, and call logs, aiding in investigations.

B. Applications of the Proposed System
· Women's Safety – Ensures protection for working women and travelers.
· Child Safety – Parents can monitor and track their children's location.
· Crime Evidence Collection – Helps document incidents and criminal activities.
· Senior Citizens & Physically Challenged Users – Assists vulnerable individuals in emergencies.
· Offline Alert System

7. CONCLUSION AND FUTURE SCOPE

This research highlights the need for an integrated personal security system and proposes a multi-functional Android application that enhances user safety through real-time tracking, emergency alerts, and AI-driven recommendations. By consolidating panic alarms, GPS tracking, call monitoring, and evidence capturing, the system acts as an all-in-one security solution, offering users protection anytime, anywhere. For future improvements, the system can incorporate voice scream detection, customizable text alerts, social media integration, and emergency activation without unlocking the phone, further enhancing security and accessibility.

REFERENCES

[1]. Ya-Li Hou, Student Member, IEEE, and Grantham K. H. Pang, Senior Member, IEEE, "People Counting and Human Detection," IEEE.

[2]. Jialue Fan, Xiaohui Shen, Student Member, IEEE, and Ying Wu, Senior Member, IEEE, "A Unified Approach of Tracking and Recognition," IEEE.

[3]. D. Gogoi, "Android-Based Emergency Alert Button," International Journal of Innovative Technology and Exploring Engineering (IJITEE), vol. 2, no. 4, Mar. 2013.

[4]. Mayank Kumar Jarwal, Abhimanyu Barun, Arshpreet Singh, and Akanksha Srivastava, "2022 8th International Conference on Signal Processing and Communication (ICSC)," Year: 2022.

[5]. Ms. G. Anusha and Mrs. E. Golden Julie, "Improving the Performance of Video Tracking Using SVM," International Journal of Engineering Trends and Technology (IJETT), vol. 11, no. 3, pp. 133-139, May 2014.

[6]. T. Zhao and R. Nevatia, "Tracking Multiple Humans in Complex Situations," IEEE Transactions on Pattern Analysis and Machine Intelligence, vol. 26, no. 9, pp. 1208-1221, Sep. 2004.

[7]. S. Avidan, "Ensemble Tracking," IEEE Transactions on Pattern Analysis and Machine Intelligence, vol. 29, no. 2, pp. 261-271, Feb. 2007.

[8]. R. T. Collins, Y. Liu, and M. Leordeanu, "Robust Online Appearance Models for Visual Tracking," IEEE Transactions on Pattern Analysis and Machine Intelligence, vol. 27, no. 10, pp. 1631-1643, Oct. 2005.

[9]. F. Bobick and J. W. Davis, "The Recognition of Human Movement Using Temporal Templates," IEEE Transactions on Pattern Analysis and Machine Intelligence, vol. 23, no. 3, pp. 257-267, 2001.

[10]. S. Bhatti and J. Xu, "Survey of Target Tracking Protocols Using Wireless Sensor Networks," in Proceedings of the Wireless and Mobile Communications International Conference, vol. 0, pp. 110-115, 2009.