IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 6, March 2026
Impact Factor: 8.2

SafeGuard : A Safe Route Recommendation System

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Abstract: *The proposed system aims to provide users with the safest possible route from the source to the destination by analyzing potential risks and vulnerabilities along different paths. The system collects and processes real-time data such as crime reports, traffic conditions, and user-reported incidents to evaluate the safety level of available routes. Based on this analysis, it recommends the most secure route while avoiding high-risk areas. If new threats or incidents are detected during navigation, the system dynamically reassesses the situation and reroutes the user to ensure safe travel. Additionally, the system visualizes incident data through live heatmaps to help users make informed travel decisions. In recent years, ensuring personal safety during travel has become an important concern, especially in urban environments where crime incidents, traffic congestion, and unexpected emergencies can occur frequently. Traditional navigation systems mainly focus on identifying the shortest or fastest routes without considering safety-related factors. This limitation may expose users to unsafe areas or potential risks while traveling. To address this issue, the proposed system, SafeGuard, introduces an intelligent safety-aware navigation approach that prioritizes user security while recommending travel routes.*

The SafeGuard system gathers and analyzes real-time data from multiple sources, including crime reports, traffic conditions, and user-reported incidents. By processing this information, the system evaluates the risk levels associated with different routes between the source and destination. Based on the analyzed data, the system suggests the safest possible route rather than simply the shortest path. In addition, the system continuously monitors real-time updates, allowing it to dynamically reroute users if new threats or incidents occur during the journey..

Keywords: Safe route, Google Maps, Crime-rate, Hot-spot, Recommendation

I. INTRODUCTION

In the contemporary world, personal safety has become a major concern, especially for individuals who travel alone such as women, children, and elderly people. While commuting through city streets, traveling late at night, or driving through unfamiliar or remote locations, people may face various risks including crime, road accidents, and other unexpected emergencies. With the rapid growth of urban populations and increasing mobility, ensuring safe travel has become more challenging. Traditional navigation systems mainly focus on providing the shortest or fastest route to a destination; however, they often ignore safety-related factors such as crime-prone areas, traffic incidents, or unsafe environments. As a result, users may unknowingly travel through locations that may pose potential threats to their safety.

With the advancement of mobile technology, smart devices, and real-time data analysis, it is now possible to develop intelligent systems that can enhance personal security during travel. By integrating information from crime reports, traffic conditions, and crowd-sourced incident reports, such systems can analyze potential risks along different routes and guide users through safer paths. Providing safety-aware navigation can significantly reduce the chances of encountering dangerous situations while traveling.

SafeGuard is an Android-based application designed to address these safety challenges by offering a comprehensive and intelligent safety solution. The system collects and analyzes real-time data from multiple sources, including crime

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records, traffic updates, and user-reported incidents. Based on this information, the application evaluates the safety level of different routes and recommends the most secure path between the source and destination. In addition to route suggestions, the system provides features such as live incident heatmaps, emergency assistance, and real-time alerts to help users stay informed about potential risks in their surroundings.

By combining smart navigation, real-time data analysis, and user participation, SafeGuard aims to create a safer travel environment for individuals. The application not only helps users avoid high-risk areas but also enables them to report incidents and contribute to community safety. Through this approach, the system supports proactive safety management and promotes secure mobility in modern urban environments.

II. RELATED WORK

In recent years, the rapid growth of urban populations and increased mobility have raised significant concerns regarding personal safety during travel. Conventional navigation systems mainly focus on identifying the shortest or fastest route between two locations. However, these systems often neglect safety-related factors such as crime rates, accident-prone areas, and real-time incidents. As a result, travelers may unknowingly pass through high-risk zones that could threaten their safety. Researchers have therefore explored intelligent navigation systems that incorporate safety considerations into route planning.Several studies have proposed methods for integrating crime data and risk analysis into navigation systems. A study titled *User Specific Safe Route Recommendation System* presents a model that recommends safer travel routes by analyzing crime statistics and user preferences. The system evaluates different paths and assigns risk values to road segments, enabling users to select routes that minimize exposure to potential crime incidents.

Similarly, research on crime-avoiding routing navigation introduced a method that integrates crime risk into traditional path-finding algorithms. In this approach, city roads are represented as a network graph where each road segment is assigned a risk weight based on crime type and frequency. The routing algorithm then identifies a path that balances both travel efficiency and safety considerations. Another significant contribution in this area is the concept of safe urban navigation using crime data. Researchers developed a risk model for urban street networks by analyzing historical crime records from cities such as Chicago and Philadelphia. Their approach calculates the probability of crime occurrence on specific road segments and uses this information to generate safer navigation routes rather than only the shortest ones. More recent studies have explored machine learning techniques for predicting unsafe locations and recommending safer routes. For example, the *Safe Route Advisor System using Machine Learning* uses clustering algorithms such as K-means to identify crime-prone areas and categorize locations based on risk levels. By identifying high-risk zones, the system can guide users through safer alternatives.

In addition, some modern navigation systems combine multiple data sources such as crime reports, traffic information, and crowd-sourced incident data to enhance travel safety. The *SafeRoute – A Comprehensive Travel Solution* framework proposes an intelligent routing system that integrates historical crime data, environmental conditions, and real-time user feedback to generate safe travel recommendations. Despite these advancements, many existing solutions still face limitations such as limited real-time data integration, lack of user-generated incident reporting, or insufficient visualization tools for identifying high-risk areas. To address these limitations, the proposed SafeGuard system aims to integrate real-time crime reports, traffic conditions, and user-reported incidents while providing features such as safe route suggestions, emergency assistance, and live incident heatmaps. By combining these capabilities, the system intends to provide a more comprehensive and user-centric approach to travel safety. A. Utamima et al, in [3] describes the fact that the Google map shows the shortest distance route and doesn't cover the safety level. They suggested an application which will recommend for the safest route for users from source to destination. It has shown the cast study for Surabaya dataset, a city in Indonesia. Machine-learning algorithms are used to generate the risk score of a particular route based upon average risk score of nearby clusters/regions. S. Soni et al, in [4] taken the crime dataset from NYC Open Data to

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determine the average risk score of clusters/regions. They suggest that better results can be achieved by increasing the factors of safety level. The aim to make a better prediction algorithm that can identify crimes while travelling on a particular route.

A hybrid approach for finding safe routes using semantic processing and classification Bayes algorithms was proposed in [5] by F. Mata et al. They found the optimal path by not only considering the shortest distance but also keep mark on other factors such as security level. Authors considered the need for an application to recommend the safest road to be passed by the users while crossing through a particular area. In [10] they examines about a set of methodologies which when applied to the traffic signal, will help in defeating the issue of traffic blockage related issues. It works in the accompanying three angles: Development of an assortment of street crossing, and proposes complex changes of the street crossing traffic light frameworks. The control arrangement that isn't just ready to maintain a strategic distance from the traffic clog scattering yet additionally to stay away from new traffic blockages being occurred. It assesses the adequacy of our control procedures for taking care of the issue of traffic clog in three sorts of traffic stream circumstances by utilizing VISSIM. In [8], talked about a top to bottom execution of savvy road light framework for shrewd city with electronic administration framework. Specifically, the proposed design contains road lights in gatherings, which associated with online administration framework to give interface to approved client. They characterized a calculation to find solicitation to answer transmission between the used system and the other way around alongside changing between the set shading temperatures alongside also darkening usefulness if essential. Thus roadlight is then constrained by a focal server known as road light server in which control flagging experience is done by organizer initially at that point every switch as per their ID.

III. OBJECTIVE OF SYSTEM

The objective is to identify patterns in the language of individuals with depression by comparing their vocabulary to that of users.

- **Safe Route Recommendation** – To provide users with the safest route from source to destination by analyzing real-time data such as crime rates, traffic conditions, and crowd density while avoiding high-risk areas.
- **Emergency SOS Alerts** – To allow users to send instant emergency alerts to trusted contacts along with their real-time location and distress message during emergencies.
- **Live Location Sharing** – To enable continuous sharing of the user's real-time location with trusted contacts for safety monitoring during travel.
- **Real-Time Incident Detection** – To collect and analyze real-time incident reports such as crimes, accidents, and user-reported threats.
- **Community Safety Reporting** – To allow users to report incidents and safety issues to improve the system's safety database.
- **Smart Route Re-Routing** – To dynamically update and suggest alternative safe routes if a new threat or incident is detected during the journey.

IV. PROPOSED SYSTEM

The proposed system, **SafeGuard**, is an Android-based safety navigation application designed to enhance the personal security of users during travel. Unlike traditional navigation systems that mainly focus on the shortest or fastest route, the SafeGuard system prioritizes safety by analyzing real-time data and identifying potential risks along different routes. The application integrates multiple data sources such as crime reports, traffic conditions, and user-reported incidents to evaluate the safety level of different areas.

When a user enters the source and destination locations, the system analyzes available routes and calculates a safety score for each path based on factors such as crime rate, accident records, and crowd density. Using this analysis, the

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system recommends the safest route that avoids high-risk zones while still ensuring efficient travel. If any new incident or risk is detected during the journey, the system dynamically updates the route and suggests safer alternatives.

The SafeGuard application also includes an **Emergency SOS feature** that allows users to send immediate alerts to their trusted contacts during emergencies. When activated, the system automatically sends the user's real-time location along with a distress message to selected contacts, enabling quick assistance.

Another important feature of the proposed system is **Live Location Sharing**, which allows trusted contacts to track the user's location in real time. This provides continuous monitoring of the user's safety, especially during late-night travel or journeys through unfamiliar areas.

Additionally, the system presents **incident heatmaps** that visually highlight areas with a high number of reported crimes or safety incidents. These heatmaps help users understand risk levels in different locations and make safer travel decisions. The application also encourages **community participation** by allowing users to report incidents such as suspicious activities, accidents, or unsafe environments. These reports are stored in the system database and contribute to improving the accuracy of safety analysis.

SYSTEM ARCHITECTURE

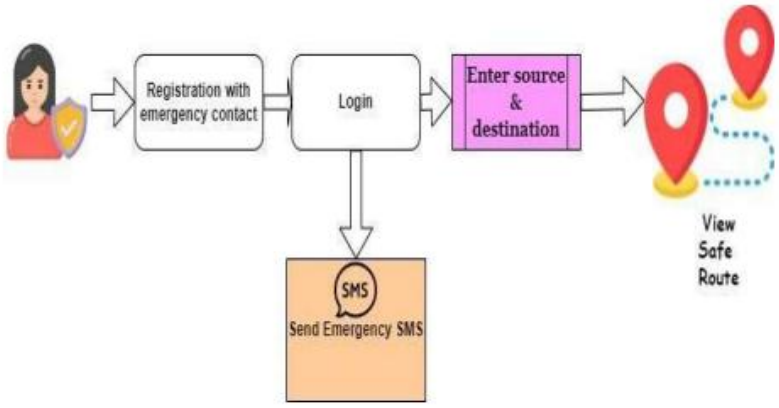

Fig 1. System Architecture

In the present accelerated and dynamic lifestyle, individual security while traveling is a critical concern, especially among women, children, seniors, and individual tourists. The mounting crime rates, lack of accessibility to real-time safety information, and failure to notify emergency contacts in cases of emergencies heighten the concern. Current navigation systems widely used, including Google Maps, plan routes according to time and distance but not according to safety elements of a trip.

V. CONCLUSION

The *SafeGuard – Safe Route Recommendation System* provides a powerful and innovative solution to the growing concern of personal safety during travel. By integrating modern technologies and real-time data analysis, the system addresses the limitations of traditional navigation applications that mainly focus on distance and travel time rather than safety. The proposed system emphasizes user security by analyzing various factors such as crime reports, traffic conditions, and user-reported incidents to identify potential risks along different travel routes.

Through features such as real-time safe route recommendations, dynamic crime zone mapping, and reliable emergency SOS alerts, the SafeGuard system enables users to make informed decisions and respond effectively to possible threats. The integration of live location sharing further enhances user safety by allowing trusted contacts to monitor the traveler's location during the journey. Additionally, the use of incident heatmaps helps users easily identify high-risk areas and avoid unsafe regions.

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By combining intelligent route planning, community-based incident reporting, and emergency communication mechanisms, the system promotes a safer travel environment for individuals, especially women, children, and elderly users. The SafeGuard system not only improves personal safety but also encourages collective awareness and participation in maintaining safer communities. Overall, this system demonstrates how technology can be effectively utilized to enhance travel safety and provide users with greater confidence and peace of mind during their journeys.

VI. ACKNOWLEDGMENT

We express our heartfelt gratitude to our esteemed mentors and professors, especially **Prof**. **Anirudh A. Kolpyakwar**, for their invaluable guidance in our academic and project endeavours. We also extend our thanks to the Engineering Department and its staff for their continuous support. Our sincere thanks go to Principal of Sandip University, for his support and permission to complete this project. We appreciate the assistance of our department's support staff, and we're grateful to our parents, friends, and all those who supported us throughout this project.

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