

Safest Route Analysis System with SOS Alert

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Abstract:

Women safety has become a critical concern in modern urban environments due to increasing crime rates, poor infrastructure in certain areas, and lack of awareness among individuals while traveling. Traditional navigation systems primarily focus on shortest distance or fastest route without considering safety parameters. This creates a major gap in ensuring secure travel, especially for women during late hours or in unfamiliar locations.

The proposed system introduces a safety-first approach by integrating geospatial heatmaps with route analysis. The system identifies unsafe zones using intensity-based mapping and evaluates routes based on proximity to these zones. By doing so, it provides users with multiple route options categorized into safest, moderate, and risky paths.

This allows users to make informed decisions based on their comfort and safety level. In addition to navigation, the system incorporates an SOS alert mechanism that enables users to send emergency notifications along with their real-time location. This enhances the reliability of the system and ensures immediate assistance during critical situations. The integration of visualization, analytics, and emergency support makes this system a comprehensive solution for women safety.

Keywords — Women Safety, Heatmap, Route Optimization, Risk Analysis, SOS Alert, Smart Navigation Systems

I. INTRODUCTION

Women safety has become a critical concern in modern urban environments due to increasing crime rates, poor infrastructure in certain areas, and lack of awareness among individuals while traveling.

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II. LITERATURE SURVEY

Several existing studies focus on crime data

visualization and smart city applications. Crime mapping tools use historical data to identify hotspots but lack real-time route guidance. Navigation applications like Google Maps and Mapbox provide efficient routing but do not incorporate safety metrics into their algorithms. Research in smart mobility emphasizes the importance of integrating safety into navigation systems. However, most solutions either focus on visualization or analysis separately. Some applications provide SOS features, but they are not integrated with route planning. Therefore, there is a need for a unified system that combines visualization, route optimization, and emergency response in a single

III. RESEARCH GAP

Several existing studies focus on crime data visualization and smart city applications. Crime mapping tools use historical data to identify hotspots but lack real-time route guidance. Navigation applications like Google Maps and Mapbox provide

efficient routing but do not incorporate safety metrics into their algorithms. Research in smart mobility emphasizes the importance of integrating safety into navigation systems. However, most solutions either focus on visualization or analysis separately. Some applications provide SOS features, but they are not integrated with route planning. Therefore, there is a need for a unified system that combines visualization, route optimization, and emergency response in a single platform.

This project addresses that gap effectively

Proposed System

Women safety has become a critical concern in modern urban environments due to increasing crime rates, poor infrastructure in certain areas, and lack of awareness among individuals while traveling. Traditional navigation systems primarily focus on shortest distance or fastest route without considering safety parameters. This creates a major gap in ensuring secure travel, especially for women during late hours or in unfamiliar locations. The proposed system introduces a safety-first approach by integrating geospatial heatmaps with route analysis. The system identifies unsafe zones using intensity-based mapping and evaluates routes based on proximity to these zones. By doing so, it provides users with multiple route options categorized into safest, moderate, and risky paths. This allows users to make informed decisions based on their comfort and safety level.

System Architecture

The methodology of the proposed system involves multiple stages including data generation, heatmap creation, route extraction, and risk analysis. Synthetic data is generated to simulate crime intensity across different regions. Each data point is assigned a risk value, which is used to create a heatmap using geospatial libraries. Routes between source and destination are obtained using routing APIs. Each route consists of multiple coordinate points. The system calculates the distance between route points

and nearby heatmap points. A weighted risk score is computed based on proximity, where closer unsafe zones contribute higher risk. The final risk score is normalized to ensure fairness across routes of different lengths. Based on the score, routes are categorized into safest, moderate, and risky. This methodology ensures accurate and meaningful route comparison for users.

Methodology

The methodology of the proposed system involves multiple stages including data generation, heatmap creation, route extraction, and risk analysis. Synthetic data is generated to simulate crime intensity across different regions. Each data point is assigned a risk value, which is used to create a heatmap using geospatial libraries.

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System Implementation

The system is implemented using modern web technologies including HTML, CSS, and JavaScript. Leaflet.js is used for map visualization and heatmap rendering. OpenStreetMap APIs provide geocoding and routing functionalities. The user interface is designed to be interactive and intuitive, allowing users to easily input locations and view route comparisons. The SOS system uses browser geolocation APIs to fetch real-time coordinates.

These coordinates are used to generate a Google Maps link, which is sent to stored emergency contacts. LocalStorage is used to manage contact information, ensuring quick access without requiring backend infrastructure.

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Algorithm and Model Design

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Application and Use Cases

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Result and Analysis

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Deployment

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Advantages

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CONCLUSIONS

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