Mapping Women's Safety through Location-Based Reviews

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***Abstract* - This paper presents a conceptual framework for addressing women's safety concerns during travel and exploration through the development of an intuitive web-based platform. The proposed platform aims to empower users by providing a means to report unsafe locations with multimedia evidence, engage with stakeholders, and access real-time safety indices. Through a systematic classification of location-based data, areas are categorized based on permanent and temporary factors, enabling informed decision-making and risk assessment. Key features outlined in the proposed platform include user registration, review submission, administrator management, report generation, event visualization, safety coordinator oversight, and identification of safety improvements. While the platform itself is in the conceptual stage, this paper lays the groundwork for its development, emphasizing collaborative efforts and robust security measures to foster safer communities.**

Keywords *- Safety-index, location-based data, security, crowdsourcing.*

1. INTRODUCTION

This section includes the introductory part of our work. In today's digitally interconnected world, where exploration and travel are increasingly facilitated by online platforms, ensuring safety and reliability in unfamiliar environments is paramount, particularly for women. The advent of location-based reviews and safety indices offers promising avenues for addressing the unique safety concerns and exploration needs faced by women in diverse settings. From selecting restaurants to planning travel itineraries, individuals often turn to online reviews to inform their choices. However, while the abundance of user-generated content offers valuable insights, it also presents challenges, particularly concerning the reliability and relevance of information.

Women's safety during travel and exploration remains a critical concern globally. Whether navigating through bustling city streets or exploring remote destinations, women often encounter challenges related to personal safety, access to reliable information, and navigating unfamiliar environments. In response to these challenges, digital platforms have emerged as invaluable tools for accessing real-time information and insights about locations, services, and safety conditions.

The motivation for research arises from a collective recognition of the need to address significant gaps or challenges within a specific field or area of study [1]. Our research initiative is driven by a shared recognition of the prevalent safety challenges encountered by women during their journeys, whether locally or globally. Each team member's personal encounters with these challenges have underscored the urgent need for proactive interventions to address them. These experiences have ignited within us a collective determination to effect tangible change in the domain of women's safety.

As we engaged in discussions and reflections prompted by our individual experiences, it became increasingly evident that a substantial gap exists between awareness and actionable solutions. It became apparent that mere acknowledgment of the problem was insufficient – concerted efforts were necessary to empower women with the tools and resources needed to navigate unfamiliar environments confidently and securely. Thus, our research aims to bridge this gap by developing a comprehensive platform that provides women with accessible avenues to access vital safety information and cultivate supportive networks fostering mutual assistance and solidarity. Through collaborative innovation, we aspire to contribute substantively to the discourse surrounding women's safety and empowerment, catalyzing positive change and enabling women to explore and engage with the world around them free from fear and constraint. In the domain of safety analysis, achieving precise and dynamic assessments of safety indices for different locations remain a significant challenge.

While past studies have explored methods as utilizing street images to predict area safety, these approaches often fall short in providing fine granularity and accurate predictions. Furthermore, these methods typically lack the real-time responsiveness necessary for timely safety evaluations [4]. With access to diverse location-based data, there is potential to analyse the complex relationships between various factors and safety outcomes more accurately. By examining variables such as demographics, infrastructure, and crime statistics, researchers can develop more refined models [2] for predicting safety indices at specific locations.

Addressing safety concerns, particularly for women, requires an effective means of reporting and collaborating. The absence of a digital platform for reporting unsafe locations and sharing visual evidence poses a significant obstacle. This project aims to create an interactive web platform that enables users to report unsafe spots,

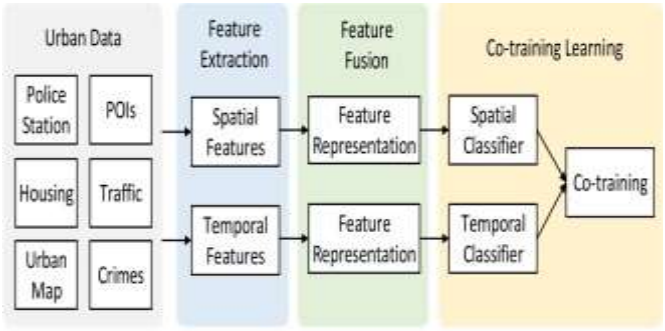

Fig. 1.1 Featural Classification of Location Data

share images and caption reviews, and engage with relevant stakeholders, fostering safer communities through collective action.

Our aim is to develop a web-based platform, prioritizing women's safety. The platform will enable users to report insecure locations with multimedia evidence and engage with stakeholders. By merging public input and administrative responsiveness, the goal is to contribute to secure community environments through collaborative efforts.

To address the challenges face by women, we make following contribution through our work:

1. Develop an intuitive web-based platform facilitating user submissions for reporting unsafe locations, enhancing community engagement in safety initiatives.
2. Implement interactive mapping functionalities to visually depict unsafe areas, empowering users to discern and navigate potential hazards effectively.
3. Establish a robust and secure framework enabling governmental entities to access and assess user-generated data, fostering data-driven decision-making processes in public safety management.
4. Foster collaboration with user commentary and issue prioritization features to address critical safety concerns collectively.

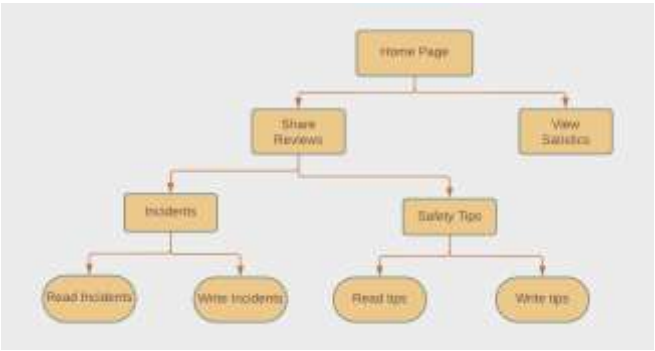

Fig. 1.2 Flow Diagram

Presenting users with a streamlined interface offering two primary options: "Share Reviews" and "View Statistics," the platform serves as a sophisticated hub for community engagement and data-driven insights, as shown in Fig. 1.2. Within the "Share Reviews" section, users are encouraged to contribute incident reports and dispense safety tips, fostering collaborative knowledge exchange. Simultaneously, the "View Statistics" segment furnishes users with comprehensive insights derived from aggregated data, enabling a nuanced understanding of prevailing safety trends. Through active participation and informed discourse, the platform endeavours to cultivate a dynamic online community committed to promoting safety awareness and facilitating data-driven decision-making processes.

This paper focuses on the collection and classification of location-based data, employing two categories: permanent factors and temporary factors. As shown in Fig. 1.1 Featural classification of location data [2].

Permanent factors encompass infrastructure, Lighting, Presence of Public Transportation, Proximity to Safe Spaces, Quality of Public Restrooms, etc while temporary factors include traffic, the presence of suspicious individuals, Crowd Density, Social Events and Festivals, Weather Conditions, etc. Through this classification process, areas are categorized as risky, dangerous, safe, or moderate. This information is then mapped, pinpointing the respective locations on maps. Our study specifically centres on Shegaon city in Buldhana, Maharashtra, as our primary area of investigation.

2. LITERATURE REVIEW

This section includes the literature survey for our work.

Our motivation arises from understanding the concerns women face when traveling to unknown areas, compelling us to prioritize their safety and well-being. We initiated the study of research papers to glean insights that could guide us in realizing our idea and working towards creating solutions to address the safety concerns faced by women during travel.

We embarked on a study of crowdsourcing to gain a comprehensive understanding of its mechanisms and functionality, through the review papers [1].

As we delved deeper into the study of crowdsourcing, we recognized the intertwined relationship between crowdsourced data and location-based information. Exploring the nuances of location-based data allowed us to grasp its significance in leveraging collective intelligence for various applications and decision-making processes. We did it from our second reference paper [2]. Thus, the information for us was easily gathered from such references.

During our exploration of location-based data, we uncovered a pivotal insight: data can be categorized into two distinct categories, namely permanent and temporary factors. This classification system provided us with a structured framework to analyse and understand the dynamic nature of location-based information [2].

In our pursuit of mapping unsafe locations, we delved into safety index calculations [5]. This exploration equipped us with a systematic approach to assess and quantify safety levels, allowing for the identification and visualization of unsafe locations on maps based on safety indices [2].

For mapping unsafe locations, we utilized Google Maps and its corresponding requirements. This platform provided us with the necessary tools and infrastructure to accurately pinpoint and visualize unsafe areas, enabling effective safety mapping initiatives [3].

Therefore, in our endeavour to collect location-based data and women's safety information, we employed various methods and platforms, including Google Maps, to gather pertinent data and insights [6][4].

Thus, to implement our idea of ensuring women's safety, we integrated the collection of location-based data [2], engaged crowdsourcing initiatives [1], and developed a conceptual framework as a web platform [4]. This platform not only empowers women to review locations and access location-based reviews but also serves as a collaborative space where users can share insights and contribute to community-driven safety measures, fostering a

safer environment for them to navigate and empowering them with information to make informed decisions about their surroundings.

3. RESEARCH APPROACH

In this section, the research approach for our work is included. To analyze effectively with the Sparse Auto-Encoder (SAE), it is crucial to fuse diverse factors from various sources into a single dataset. This dataset is then processed by the SAE, which autonomously learns intricate patterns and insights, enhancing accuracy and efficiency in classification tasks and data analysis across domains like machine learning.

The Sparse Auto-Encoder (SAE) is a neural network architecture that autonomously learns high-level feature representations from input features in an unsupervised manner [2]. Research indicates that using SAE for feature representations, rather than the original features, often enhances performance in tasks like image and object recognition. This improvement is attributed to transforming original features into a new data space, establishing stronger relationships with different classes.

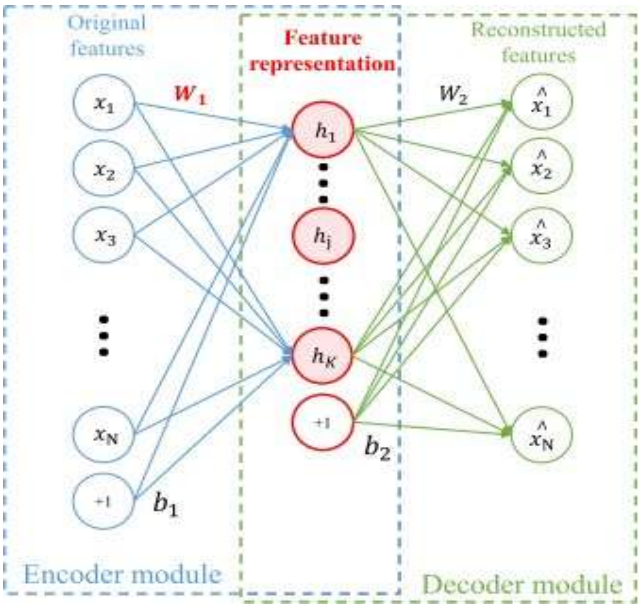

Fig. 3.1 Structure of SAE model

This model is addressed from the paper [2] that included the working and all parameters required by the model. The structure of SAE consists of two primary modules: the encoder module and the decoder module. In the encoder module, the input vector ([x_1, x_2, ..., x_n]) represents the original features to be amalgamated. This input vector is then transformed into a vector ([h_1, h_2, ..., h_k]) within the middle layer (depicted as red nodes) using a parameter matrix W1, which serves as the feature representation of the input original features [2]. To learn the parameters within the matrix W1, a decoder module is incorporated to reconstruct the original features from the feature representation using another parameter matrix W2. The SAE model is trained as a whole to optimize the two parameter matrices W1 and W2 by minimizing the error between the original features and their reconstructed counterparts [2].

Upon completion of the training process, the parameter matrix W1 is generated, enabling the derivation of the feature representation from the given original features. This mechanism enhances the capacity of the model to capture meaningful patterns and relationships within the data, leading to improved performance in subsequent classification tasks.

Our analysis and research approach for our system and idea are characterized by a systematic framework that prioritizes thorough investigation, meticulous data collection, and rigorous analysis procedures. We integrate interdisciplinary perspectives, stakeholder input, and ethical considerations to inform the development and refinement of our ideas. Through iterative processes of data collection and analysis, we strive to derive meaningful insights and actionable recommendations that drive innovation and positive change.

As seen in the Fig. 3.2 has three actors and seven use cases. Here in the conceptual prototype, actors included are User, Administrator, Safety Coordinator. The services allocated to these actors include, write review, read review, manage reviews, generate reports, visualize map events, inspect reports, and identify improvements. Users are prompted to register by providing key details such as username, email, and password, thus enabling access to platform features like review writing and favourite saving. Through written reviews, users share experiences, access insights from peers, and make informed decisions based on ratings and comments.

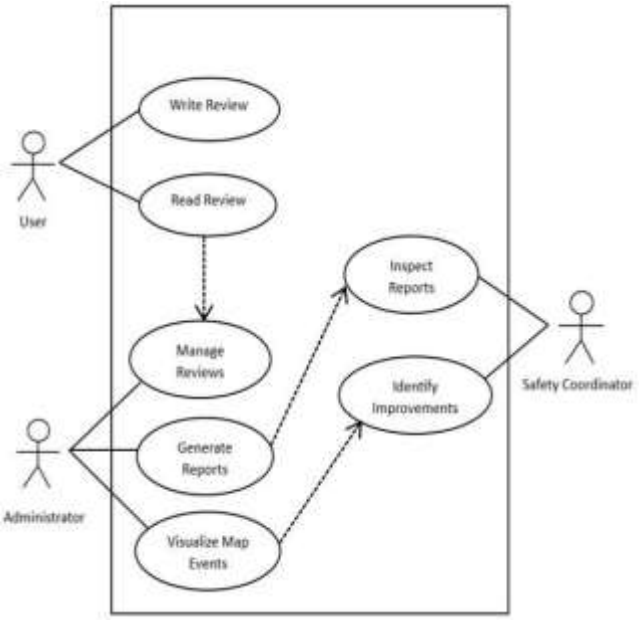

Fig 3.2 Use Case Diagram

Administrators oversee user reviews, handling creation, verification, and suspension as necessary, and generate comprehensive reports to glean insights into user activity and platform performance. Utilizing data visualization tools, administrators analyse trends and patterns, facilitating proactive measures and resource allocation. Safety Coordinators undertake the critical task of reviewing locations, evaluating safety based on user feedback, and identifying opportunities for improvement, including infrastructure upgrades and community engagement initiatives.

Here the actor user has two cases explained below. Write Review: Users have the ability to share their experiences, feedback, and opinions by composing and submitting reviews for locations, services, or products they have encountered. They can provide ratings, descriptions, and additional comments to contribute valuable insights to the community.

Read Reviews: Users can browse through a collection of reviews left by other users regarding various locations, services, or products. They can access detailed insights, ratings, and comments to make informed decisions about their interactions with different entities.

Here actor Administrator has three cases explained below. Manage Accounts: Administrators have the responsibility to oversee user reviews within the system. This includes tasks such as user reviews creation, verification, suspension, or deletion as necessary. They ensure that user data is accurate, secure, and compliant with platform policies.

Generate Reports: Administrators can generate comprehensive reports based on user activity, review trends, and system performance metrics. These reports provide valuable insights into user engagement, popular locations, trending topics, and overall platform health, aiding in decision-making and strategic planning.

Visualize Events: Through data visualization tools, administrators can analyze and visualize events, trends, or patterns within the system. Visual representations such as graphs, charts, or heatmaps help identify outliers, anomalies, or emerging trends, facilitating proactive measures and resource allocation.

Here actor Safety Coordinator has two cases seen below. Review Locations: Safety coordinators play a crucial role in evaluating the safety and security of various locations based on user feedback, incident reports, and other relevant data sources. They analyze trends, patterns, and user sentiments to assess potential risks and vulnerabilities within reviewed locations.

Identify Improvements: Safety coordinators identify opportunities for enhancing safety and security measures within reviewed locations. This includes recommendations for infrastructure upgrades, security protocols, emergency response procedures, and community engagement initiatives aimed at mitigating risks and ensuring the well-being of users and visitors.

By implementing these expanded use cases, the platform facilitates user engagement, ensures efficient administration, and prioritizes safety and security, contributing to a positive and impactful user experience.

4. RESULTS

Safety index (SI) is a number used to communicate to the public how safe an area is currently. As the SI increases, crimes will occur with a decreasing possibility [2]. SI values are divided into ranges, and each range is assigned a descriptor and a colour code.

We calculate the safety index as follows [2]:

$$SI = (1 - R_C) * 100$$

where R_C is crime rate per 100,000 inhabitants and has been normalized. As shown in Fig. 3.2, the descriptor of

each SI level is viewed as the class to be inferred, i.e., C = {D, U, R, M, S} and the color is adopted in the following visualization figure [2].

In our exhaustive examination of women's safety concerns in Shegaon city, nestled in Buldhana district, we meticulously mapped pivotal locations to understand the dynamics impacting women's security. These mapped areas serve as crucial indicators, revealing potential vulnerabilities and areas where women may feel unsafe due to various factors such as inadequate lighting or higher instances of harassment. Our mission is to provide actionable insights and recommendations to enhance safety infrastructure and empower women to navigate public spaces with confidence and dignity. Through collaborative efforts with local authorities and community stakeholders, we aspire to create a city where women feel respected, secure, and free from the fear of harassment or violence, fostering an environment of inclusivity and empowerment for all residents.

Over the past seven months, our dedicated efforts have involved meticulously pinpointing locations of varying safety levels within Shegaon city, employing a color-coded system for clarity and ease of interpretation. Using red dots to signify unsafe areas, orange for risky zones, and green for safe spaces, we have visually represented the complex dynamics of safety across the cityscape.

Table 4.1. Color Code descriptor

SI	Values Level of Safety Concern	Colors
0-20	Dangerous (D)	Maroon
21-40	Unsafe (U)	Red
41-60	Risky (R)	Orange
61-80	Moderate (M)	Yellow
81-100	Safe (S)	Green

This comprehensive mapping endeavor serves as a vital tool in understanding the distribution and prevalence of safety concerns, empowering stakeholders with actionable insights to address existing challenges effectively. By visualizing unsafe, risky, and safe locations on the map, we have created a comprehensive overview of the safety landscape within Shegaon. This data-driven approach enables us to identify patterns, trends, and hotspots, facilitating informed decision-making and targeted interventions to enhance safety infrastructure and mitigate risks. Moreover, the visual representation of safety levels fosters community awareness and engagement, encouraging collaborative efforts to create safer environments for all residents.

Fig. 4.1 Safety Index Shegaon Map

The data collected city involves a comprehensive evaluation of both temporary and permanent factors influencing the classification of locations as safe, risky, or dangerous. Temporary factors, including time of day and seasonal variations, alongside permanent factors such as infrastructure quality and crime rates, are carefully analyzed.

This holistic approach provides a nuanced understanding of safety dynamics, enabling effective prioritization of interventions and resource allocation to enhance safety infrastructure and community well-being. By considering both short-term fluctuations and enduring aspects, we aim to create a safer environment where residents can thrive with confidence. Our assessment integrates community feedback, ensuring that safety classifications align with lived experiences and perceptions.

Through ongoing data analysis and stakeholder engagement, we strive to refine our understanding of safety concerns in Shegaon city and implement targeted solutions. By leveraging this data-driven approach, we seek to foster a resilient and inclusive community where safety is prioritized, empowering residents to lead fulfilling lives free from undue risk and uncertainty.

With a focus on Shegaon's SSGMCE college area, we have zoomed in to ensure meticulous studies over this specific locality. By analyzing various factors including infrastructure, lighting, crime rates, and community feedback, we have marked locations within this area as safe, risky, or dangerous. This detailed assessment provides valuable insights into the safety dynamics around the college, enabling targeted interventions to enhance security measures and improve the overall well-being of students and the community. Our commitment to data-driven analysis and community engagement remains integral as we strive to create a safer and more conducive environment for all within the vicinity of SSGMCE college.

Fig. 4.2 Safety Index SSGMCE

Through a thorough review of community feedback and insights from the SSGMCE college area, several safety concerns for college students have come to light. Issues such as inadequate street lighting, the presence of suspicious individuals, unmonitored alcohol and smoking, and the lack of safe meeting places have been identified as contributing factors to the perceived lack of safety. These findings highlight the need for increased vigilance, improved infrastructure, and targeted interventions to mitigate risks and create a secure environment conducive to student well-being. By addressing these concerns collaboratively, stakeholders can work towards fostering a safer and more supportive college community, prioritizing the safety and success of SSGMCE students.

In response to these safety concerns, collaborative efforts between college authorities, local law enforcement, and community members are essential. Implementing measures such as improved street lighting, increased surveillance, and the establishment of designated safe meeting areas can significantly enhance the safety and security of students within the SSGMCE college vicinity. By fostering open communication channels and proactive initiatives, stakeholders can create a supportive environment where students feel empowered and protected, fostering a culture of safety for all.

Fig. 4.3 Safety Index Map

This map visualizes the safety index of specific parts of Shegaon. Using a color-coded system, it indicates areas deemed safe, risky, or dangerous based on factors like crime rates and infrastructure. This helps residents and policymakers identify safety concerns and prioritize initiatives to enhance security in Shegaon.

5. DISCUSSION

This section includes the discussion. In this paper, we introduce a conceptual framework for enhancing women's safety during travel and exploration through the development of an intuitive web-based platform [1][2][4]. Our platform aims to empower users by enabling them to report unsafe locations with multimedia evidence, engage with stakeholders, and access real-time safety indices. By systematically classifying location-based data into permanent and temporary factors, we facilitate informed decision-making and risk assessment. Key features of the proposed platform include user registration, review submission, administrator management, report generation, event visualization, safety coordinator oversight, and identification of safety improvements. While the platform is in the conceptual stage, this paper lays the groundwork for its development, emphasizing collaborative efforts and robust security measures to foster safer communities.

6. FUTURE WORK

This section includes the future work. In the web-based platform development for addressing women's safety concerns during travel, we will be integrating key features like user registration and profile management. These additions aim to streamline user interaction, facilitate reporting of unsafe locations, and empower users with control over their profiles. With the inclusion of registration and profile management, users can maintain their data securely while engaging with the platform's safety features. Moreover, collaboration among stakeholders is prioritized to effectively address safety concerns. Stakeholders will leverage user-generated data to prioritize improvements in unsafe areas, fostering community solidarity and creating safer environments.

Through these efforts, our platform seeks to empower users and drive meaningful change in safety dynamics. By integrating user registration and profile management alongside stakeholder collaboration, we aim to create a robust and user-centric platform that enhances safety and fosters community engagement. In collaboration with NGOs, our platform aims to offer swift assistance to women during emergencies, ensuring their safety and well-being are prioritized at all times.

7. CONCLUSION

In this paper, we present a structured analysis and research approach aimed at upholding professional standards and delivering impactful outcomes. Through thorough investigation, meticulous data collection [1], and rigorous analysis procedures [2], we integrate interdisciplinary perspectives, stakeholder input, and ethical considerations to inform the development of transformative solutions. Our focus is on enhancing safety, empowering communities, and fostering inclusive environments where individuals can thrive with confidence and dignity. We recognize the importance of rigorous methodologies and ethical considerations in addressing complex challenges, and our commitment to excellence guides us in creating solutions with a meaningful impact on society. Through collaborative efforts and dedication, we strive to contribute to a brighter and safer future for all.

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