AMERICAN JOURNAL OF MANAGEMENT AND IOT MEDICAL COMPUTING
Peer Reviewed, Referred & Indexed Journal
E-ISSN: 3069-0110
Vol.5, No.2(1) (2026)
www.ajmimc.com

WOMEN SAFETY HOTSPOT ANALYSIS SYSTEM

[1]Mrs.S. GUNASREE, [2]S. DIVYA, [3]S. MANISHA, [4]M. KALYAN

[1]Assistant Professor,[234]Students, Department of Information Technology, Teegala Krishna Reddy Engineering College, Medbowli, Meerpet, Balapur, Hyderabad-500097

ABSTRACT

The increasing concerns regarding women's safety in public and private spaces have highlighted the urgent need for intelligent and real-time security solutions. This project proposes a Women Safety Hotspot Analysis System integrated with an SOS emergency alert mechanism to enhance personal security. The system enables users to send instant emergency alerts by pressing an SOS button, which transmits their live GPS location, time, and details to pre-registered emergency contacts, ensuring immediate assistance during critical situations. Additionally, the system incorporates a hotspot analysis module that collects and analyzes incident data to identify unsafe areas using clustering techniques. These high-risk zones are displayed on an interactive map, allowing users to make informed decisions and avoid dangerous locations. The application utilizes technologies such as GPS, Google Maps API, and cloud-based databases to provide real-time tracking and visualization of safety information. Unlike traditional systems that rely on manual communication, this system offers automated alerting and proactive safety awareness. It also supports community-based incident reporting, which enhances data accuracy and improves hotspot detection over time. The system is designed to be user-friendly, cost-effective, and scalable for deployment in various environments such as colleges, workplaces, and smart cities. Overall, this project demonstrates how integrating real-time emergency response with data-driven hotspot analysis can significantly improve women's safety and reduce response time in emergencies.

Keywords: Women Safety, SOS Alert, GPS Tracking, Hotspot Analysis, Emergency System, Crime Data, Real-Time Monitoring

I. INTRODUCTION

The rapid increase in crimes against women has created a strong demand for advanced technological solutions that ensure personal safety and quick emergency response [1]. Traditional safety methods such as phone calls or text messages are often unreliable during critical situations, especially when immediate action is required [2]. According to the project document, the absence of a real-time emergency alert system and lack of awareness about unsafe locations make it difficult for women to travel safely, particularly in isolated or unfamiliar areas [3]. Existing systems also suffer from inefficiencies such as delays in response time and lack of automatic location sharing [4]. Many safety applications require manual interaction, which may not be feasible during panic situations [5]. These limitations highlight the necessity for a smart system that combines real-time alerting with location-based risk analysis [6]. The integration of GPS tracking has significantly improved emergency response capabilities [7]. Mobile-based safety systems have also contributed to better accessibility and usability [8]. However, many existing solutions lack centralized data management [9]. This reduces their

effectiveness in providing accurate safety insights [10]. The need for intelligent systems that use real-time data processing is therefore increasing [11]. Technologies such as mapping APIs have enabled better visualization of safety information [12]. Data-driven approaches are becoming essential in modern safety applications [13]. These advancements provide opportunities to develop more reliable and efficient systems [14]. Overall, improving safety requires combining multiple technologies into a single platform [15].

To address these challenges, the proposed Women Safety Hotspot Analysis System introduces a comprehensive approach that combines reactive and proactive safety measures [16]. The system includes an SOS feature that allows users to instantly send alerts with live location, date, and time to emergency contacts, ensuring faster response during emergencies [17]. This feature reduces dependency on manual communication methods [18]. The hotspot analysis module identifies unsafe areas by analyzing collected incident data [19]. These high-risk zones are displayed on an interactive map, improving user awareness [20]. The system also supports community-based reporting, enabling users to contribute safety-related data [21]. This improves the accuracy and reliability of hotspot detection [22]. The architecture, as illustrated in the diagram on page 12 of the document, follows a layered approach involving frontend, backend, database, and analysis modules [23]. Technologies such as HTML, CSS, and JavaScript are used for frontend development [24]. Backend processing is handled using frameworks like Python and Node.js [25]. Databases such as MySQL are used for data storage [26]. Map integration is achieved using Google Maps API [27]. Clustering algorithms are used for hotspot detection [28]. The system is designed to be scalable and efficient [29]. Overall, it aims to reduce response time and improve safety awareness [30].

II. LITERATURE SURVEY

Existing research on women safety systems primarily focuses on emergency response mechanisms such as SOS alerts and live location tracking [1]. Many applications provide features that allow users to send distress signals to emergency contacts [2]. These systems help in providing immediate assistance during dangerous situations [3]. According to the literature section of the document, several systems utilize GPS-based tracking to monitor user location [4]. Some solutions include voice activation features for emergency alerts [5]. Alarm systems are also used to attract attention during critical situations [6]. Real-time notifications improve communication efficiency [7]. However, most systems focus only on reactive safety measures [8]. They do not provide insights into unsafe locations [9]. This limits their ability to prevent incidents before they occur [10]. The absence of data analysis reduces system effectiveness [11]. Many applications lack visualization features for risk assessment [12]. Without proper analysis, users cannot identify high-risk areas [13]. This highlights the need for integrating analytics into safety systems [14]. Combining multiple features into one system can improve performance [15].

Recent advancements have introduced hotspot analysis techniques using data mining and clustering algorithms [16]. These methods help identify high-risk areas based on incident data [17]. According to the document, algorithms such as K-Means are used to group incident locations [18]. DBSCAN is used to detect dense regions more accurately [19]. These techniques improve the

accuracy of hotspot detection [20]. The identified hotspots are displayed on maps for better visualization [21]. This allows users to avoid unsafe areas [22]. However, many systems treat hotspot analysis and SOS alerts separately [23]. This reduces their overall effectiveness [24]. The proposed system integrates both functionalities into a single platform [25]. It provides real-time alerts along with hotspot visualization [26]. Community-based reporting improves data accuracy [27]. The system continuously updates safety data [28]. This ensures better reliability and performance [29]. Overall, the proposed system offers a more comprehensive solution [30].

III. PROPOSED SYSTEM

The proposed Women Safety Hotspot Analysis System is a web-based platform designed to improve personal security by integrating real-time emergency response with data-driven risk analysis. The system allows users to activate an SOS alert during emergencies, which instantly sends their live location, date, and time to pre-registered emergency contacts. This ensures quick response and immediate assistance in critical situations. Unlike traditional methods, the system automates the alert process, reducing dependency on manual communication. The SOS module is designed to be easily accessible, enabling users to trigger alerts with minimal effort. Additionally, the system supports multiple communication channels such as SMS and email, ensuring reliable delivery of alerts.

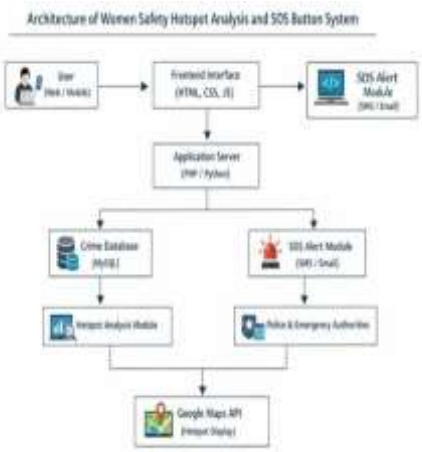


Fig.1 Architecture

Another key feature of the proposed system is the hotspot analysis module, which identifies unsafe areas based on collected incident data. Users can view these high-risk zones on an interactive map, helping them avoid dangerous locations. The system also includes a community-based reporting feature, allowing users to report incidents with details such as location and description. This data is stored in the database and analyzed using clustering algorithms to improve hotspot detection accuracy. As described in the architecture diagram (page 12), the system follows a layered structure with frontend, backend, database, and analysis modules working together efficiently . Overall, the proposed system provides a comprehensive safety solution by combining proactive awareness with reactive emergency support.

IV. SYSTEM DESIGN

The system design of the Women Safety Hotspot Analysis System follows a client-server architecture that ensures efficient communication between different components. The frontend interface is developed using HTML, CSS, and JavaScript, providing users with features such as registration, login, hotspot map visualization, and SOS activation. The backend is implemented using technologies like Python (Flask) or Node.js, which

handle user requests, process data, and manage communication with the database. The database, implemented using MySQL or MongoDB, stores user details, emergency contacts, and incident reports securely , the system also integrates GPS and map APIs to fetch real-time user location and display it on an interactive map.

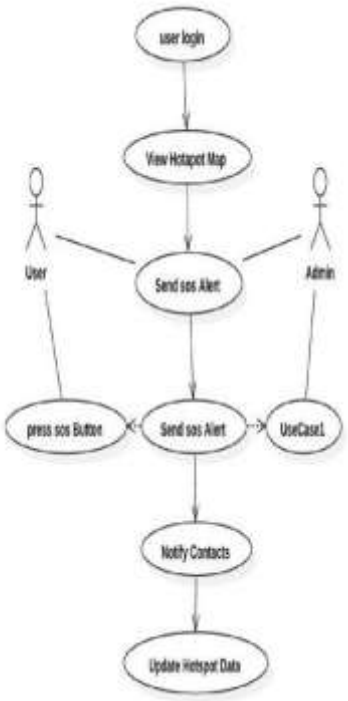


Fig.2 Use case diagram

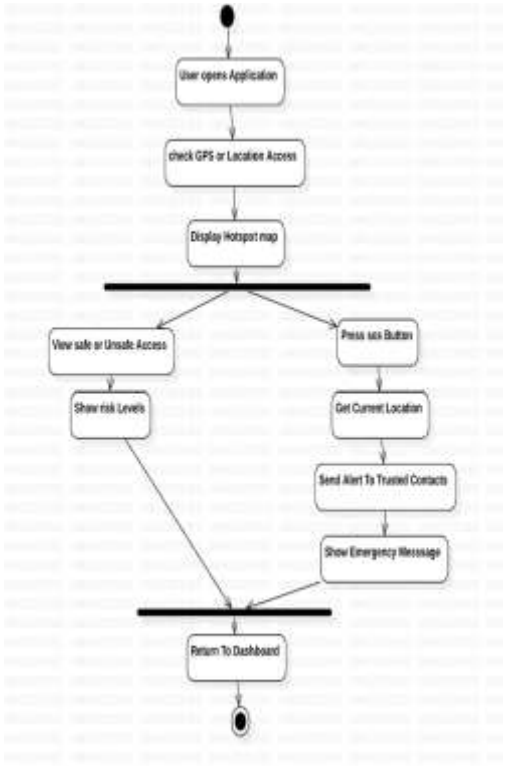


Fig.3 Activity diagram

The system consists of several modules, including user management, location tracking, hotspot analysis, SOS alert, and incident reporting. The hotspot analysis module uses clustering algorithms such as K-Means to identify high-risk areas, while the SOS module sends alerts to emergency contacts. The sequence diagram shows how the system processes SOS requests and delivers alerts efficiently. Additionally, the class diagram illustrates the relationships between system components such as User, Report, SOS Alert, and Database. The system is designed to be scalable, reliable, and user-friendly, ensuring smooth operation even with increasing data and users. Overall, the design provides a robust framework for implementing a real-time safety system.

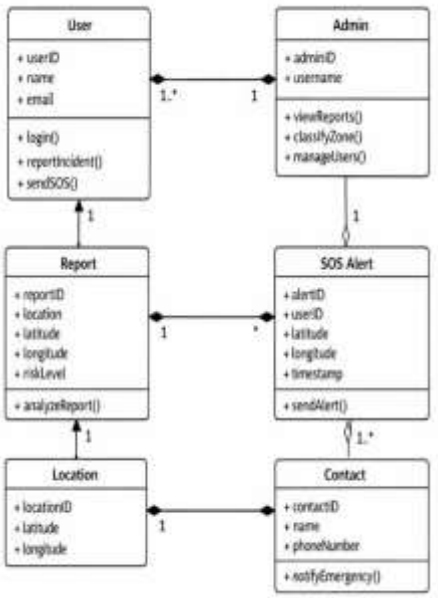


Fig.4 Class diagram

V. RESULTS & ANALYSIS

Test analysis is the process of examining software requirements and design documents to identify what needs to be tested and how to prioritize testing efforts. In the Women Safety Hotspot Analysis System project, this involves reviewing key functionalities such as user registration, incident reporting, hotspot mapping, and SOS alert mechanisms to determine potential risk areas and critical features that require thorough testing. During this phase, the testing team identifies test conditions, inputs, expected results, and dependencies between modules. For example, the SOS button must be analyzed for reliability and real-time accuracy, while hotspot mapping needs validation for correct visualization and risk-level representation. Test analysis also includes identifying error-prone areas such as incorrect GPS coordinates, missing user inputs, or delayed notifications, enabling the creation of focused and effective test cases. By performing comprehensive test analysis, the team ensures that all critical functionalities are covered, potential defects are anticipated, and testing resources are allocated efficiently.



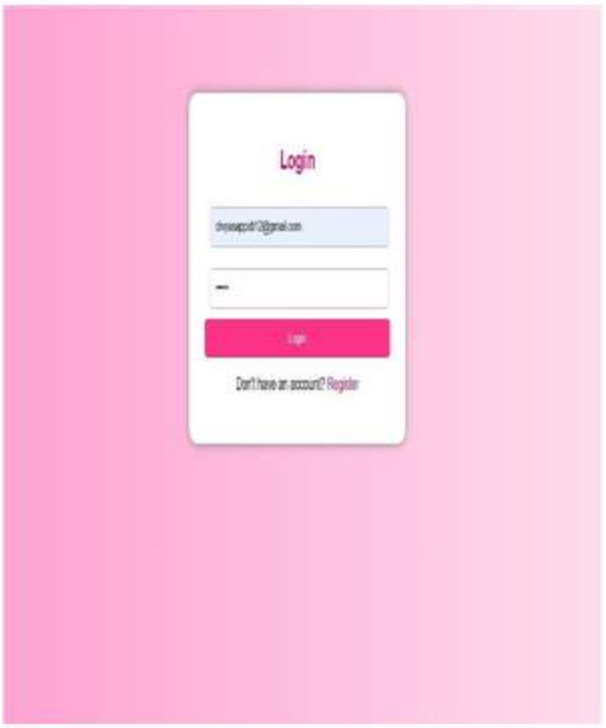


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VI. CONCLUSION

The Women Safety Hotspot Analysis System with SOS Button provides an effective and reliable solution to address the growing concerns of personal safety. By integrating real-time SOS alert functionality with hotspot analysis, the system ensures both immediate assistance and proactive safety awareness. The SOS feature allows users to quickly send emergency alerts along with their live location, enabling faster response from emergency contacts. At the same time, the hotspot analysis module helps users identify unsafe areas and avoid potential risks. According to the project conclusion , this combination of reactive and proactive measures makes the system more comprehensive than traditional safety solutions. The use of modern technologies such as GPS, Google Maps API, and clustering algorithms enhances the accuracy and efficiency of the system. Additionally, the inclusion of community-based reporting improves data reliability and helps in continuous system improvement. The system is designed to be cost-effective, scalable, and easy to use, making it suitable for various applications such as colleges, workplaces, and smart cities. Overall, the project demonstrates how technology can play a crucial role in improving women's safety, reducing response time during emergencies, and creating a safer environment for society.

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