



Women's safety platform using machine learning

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Abstract: Although much progress has been made, the safety of women continues to be a global concern, and deserves innovative and comprehensive solutions to address the emerging urban and rural challenges. To support women's safety, this paper presents a novel platform which integrates options on secure login, real time alerts, emergency panic systems, incident reporting, and route navigation alongside police station proximity. Using advanced technologies such as IoT, geolocation services, and real time data analytics, the platform offers a dynamic and user friendly interface for its users to proactively and reactively mitigate safety concerns. It features an SOS panic button that transmits real time location data to contacts and authorities and a community driven heatmap visualization allowing users to see hotspots. Personal and community safety as well as emergency response have been improved through the platform's capability to provide personalized safety recommendations and to facilitate rapid responses in emergencies, making the platform a dependable and scalable solution. This work captures the transformative potential of technology to strengthen the position of women and to enhance safety.

Keywords: Women's Safety, IoT, Real-Time Alerts, SOS System, Geolocation, Incident Reporting, Route Navigation, Police Proximity.

I. INTRODUCTION

In the modern digital age, the convergence of technology and personal safety has hastened the emergence of fresh approaches to make it more secure, especially for women, a vulnerable sector of the whole population. Given the ubiquitous nature of smartphones, together with the recent developments in geolocation, real time data processing and mobile application technology, this opens a unique window to tackle safety concerns on dedicated platforms. While substantial advancements have been made in respecting shared societal norms and legal structures, women still exist in violent circumstances of physical threat of some kind in public space or some form of privacy threat in the virtual world. Therefore, we need a comprehensive approach to safety that includes a marriage of technological brilliance and user centered design to make the places where women can live and grow; without fear of harm.

Cutting edge technology is used to build a comprehensive women's safety platform – a multifunctional solution that tackles these problems with several novel features. Secure login mechanisms, real time alert systems, emergency panic buttons, and navigation tools to emphasize safe routes and police stations near them are central to the platform. Furthermore, the platform features incident reporting functionality and heatmap visualization employing crowd sourced data to detect and advise on what represents a hazard zone. But this means to integrate them with features that are not only capable of immediate responses to threats but also a culture of safety and awareness that are proactive.

This project draws on the fact that women globally still suffer from enduring safety challenges. But a United Nations report describes gender based violence as pervasive, with figures indicating that one in three women has been subjected to physical or sexual violence at least once in their lifetime. This statistic highlights just how quickly that need becomes compelling, compelling enough in fact that effective safety mechanisms must be able to be seamlessly integrated into people's everyday lives. Technology's ability to serve as a force multiplier for women's safety by extending the tools needed to navigate both physical and digital spaces securely fuels our development of a mobile based safety platform.

This research's central goal is to create a full and comprehensive safety platform that will react to emergencies as well as prevent future incidents through predictive analytics and community engagement. With its ultimate goal of robust, secure access for user privacy and data protection, real time communication with vital services or trusted contacts, navigational guidance which prioritises safety, that leverages proximity data of police stations and data on reports of community incidents, as well as empowering users to report incidents into the database, enabling risk assessment and protective measures.

Architecturally as well as implementation of Comprehensive Women's Safety Platform will be detailed in this paper; explaining how it uses technology to improve the security of women in modern times. The contributions of this research are twofold: Using a scalable, secure framework that includes multiple safety features and integration from a single user friendly mobile application, this technology — while introducing the integration of multiple safety features into one single mobile application to enhance personal and community safety — creates technological innovation as well as social impact. This platform serves as a way of giving technology a direction in helping to resolve social problems such as reducing gender based violence and increasing the quality of life.

II. LITERATURE SURVEY

With the advent of the intersection of technology and personal safety, there have been some advances in making women safer. This entails using IoT, AI, real time processing of data and mobile apps to address critical safety issues. We review relevant studies and their key technologies and methodologies used to solve safety challenges in developing the Comprehensive Women's Safety Platform.

Kumar et al. [1] introduced the Guardian Shield by which their pioneering IoT powered AI innovation arms women with real – time inactions through safety device interactions. This work presents the potential of IoT to support instant alerts and communication with trusted contacts, a major piece of the proposed platform. Like Dhawale et al. [9], which highlight the ways in which IoT and AI may be combined to generate comprehensive safety systems consisting of incident reporting and real time analytics, these platform features.

Security of IoT enabled web applications is explored by Singh et al. [3] who also showcase advanced technologies to safeguard women. The results they produce underline the need for strong authentication mechanisms and protective log in features, which are an essential part of the platform, when designed in such a way as to preserve user privacy. In addition, Shenoy et al. [4] present a holistic framework that delivers the technology and societal participation to the problem of crime prevention and response. That fits well with the focus of the platform on community driven things like incident reporting, heatmap visualization and so on to be proactive and aware of safety.

According to Karusala and Kumar [7], emergency response mechanisms, such as panic buttons, have been well documented as effective when examined in public spaces in New Delhi. The importance of such tools for managing risks in emergencies is not to be overlooked, and their findings have made a demand for including a panic button on the platform, for alerting authorities and trusted contacts immediately upon panic. They also follow similar ideas of Suryawanshi et al. [13] which propose wearable safety gadgets that improve accessibility to the emergency response system and thus suggest some user centered design considerations.

The other vital portion of women's safety applications are real time navigation tools. Sohrabi et al. [15] present a review of literature pertaining to safe route finding algorithms and its importance in steering the users from dangerous areas. This is related to the dynamic route navigation borrowed from police station proximity and user reported incidents on this platform. Furthermore, Mouket and Durmusoglu [14] use spatial analysis to optimize the placement of police stations for the navigation capabilities of the platform.

Finding ways to incorporate advanced machine learning algorithms into predictive safety measures is investigated by Kiran et al. [11] who surmise that leveraging different data points help foresee and evade possible threats. The work is a foundation for future improvements of the platform, for instance, through the introduction of proactive safety features. Taking it further, Banerjee et al. [5] and Ponnusamy et al. [6] talk about the AI tools and mobile applications to improve user safety via the platform's reliance on AI analytics.

The work of George [10] raises critique on the effectiveness of safety platforms from a gender inclusive design standpoint. Their observations emphasize design considerations that are essential to user centric approach: their need for accessibility and inclusivity. Similar to the broad scope of the platform, Ashwini and Perla [12] propose an integrated mobile application for women's safety by combining features including secure login, real time alerts, and reporting of incidents into an integrated solution.

Scholar [8] discusses the design and implementation of advanced safety systems, focusing on scalability and user-friendliness. This aligns with the platform's goal of creating a versatile solution that adapts to diverse urban and rural contexts. Moreover, the work of Shenoy et al.

[4] emphasizes the wider implication of technology in driving community engagement and safety results, in line with platform vision to share liability for women's security.



The reviewing of the literature as a whole agrees with the approach for developing an IoT, AI, real time navigation, community driven approaches into one consolidated platform. The applicability of these studies serves as a solid, evidence-based foundation with which to develop a Comprehensive Women's Safety Platform, advancing the state of the art of existing technological capability.

III. PROPOSED METHODOLOGY

The Comprehensive Women's Safety Platform is a user centric platform with advanced technological integration to address key women's safety challenges. It describes the methodology of the design, the implementation and the functionality of this platform, by outlines its elements and operational mechanisms.

A. User Authentication and Secure Login

The data is protected and user privacy is guaranteed with a robust user authentication system that is used by the platform. Multi factor authentication for a secure login mechanism is implemented by combining password based and biometric verification. On a separate level, this double layer security guarantees that only particular users are capable of accessing the platform and concealing certain personal information. Some databases use encryption in order to store user credentials in such a way to prevent unauthorized access. In addition, adaptive authentication assesses the user's behavior to spot wrongdoings, giving one more level of security to foray the likely breaches.

B. Emergency Panic Response System

Easy to access emergency panic button instantly notifies pre registered emergency contacts and or local authorities. The system signals distress at which point the user real-time geolocation is sent. The alert has an accompanying unique identifier that allows responders to look up critical details such as medical history or special needs on the user profile. Redundant systems send alerts despite poor conditions in which the network connectivity is poor; hence, there are minimal latencies making the panic button work in emergencies with minimal latency.

C. Real-Time Safety Alerts and Notifications

Here real time safety alerts are integrated to notify users of the possible threat in their vicinity. These alerts are dynamically generated from live crime data, incident reports and user generated feedback. It takes inputs from the user's location, preferences and threat levels to filter and prioritize alerts and convey relevant, timely information. Geofencing technology extends the use of location information, including localized alerts that respond to the user's movements, providing vital situational awareness and preemption safety initiatives.

D. Route Navigation with Safety Features

Instead, the navigation system is devised to work according to user safety through sending people on routes with lower risk levels. In proximity detection, nearby police stations are highlighted to users so that there is help via nearby police stations during their trips. Building on recent research in real time crime analytics, traffic data, and advanced geospatial algorithms that aim to help people walk more safely, we demonstrate the creation of a system that dynamically adjusts routes. Furthermore, a user interface is provided with an intuitive display of safety ratings for suggested routes allowing users to make informed travel decisions.

E. Incident Reporting and Data Aggregation

With the incident reporting module you can document unsafe situations or criminal activity quickly. Reports include the nature of the incident, time, location and optional multimedia evidence. It aggregates all these inputs into a centralized database, from which it pushes through to its analytics engine. Anonymizing, and categorizing, makes reports, which are anonymous, while giving useful insights into local safety trends.

To this end the collected data is shared with the community stakeholders and law enforcement agencies for further proactive safety intervention.

F. Heatmap Visualization for Risk Assessment

High risk areas that can be visualized based on aggregated incident reports and historical crime data are displayed as a heatmap visualization feature for users. This dynamic visualization updates in real time, as users dynamically identify and avoid dangerous zones while living their daily life. As zoom levels increase the granularity of the heatmap adapts to provide macro regional insights as well as micro neighborhood analysis. Not only does this inform individual users, but it is a useful resource of information for law enforcement and urban planners looking for ways to increase community safety.

G. Integration of Predictive Analytics

Predictive analytics on the platform is employed to detect the challenges before they materialize. The system uses machine learning models trained on historical crime data and user behavior patterns to create risk predictions to help its users navigate around unsafe situations. The platform's notifications and navigation system are integrated with predictive alerts such that the safety experience becomes proactive rather than reactive.

H. System Scalability and Reliability

It has a scalable architecture such that new features are added incrementally and a growing user base. Your architecture is based on the cloud, and this guarantees high availability and fault tolerance, even in case of peak periods. The platform is updated regularly and it includes the features of the user's feedback and technological innovations. The platform has been through extensive testing and quality assurance processes to make sure that the platform works consistently at different scenarios and environments.

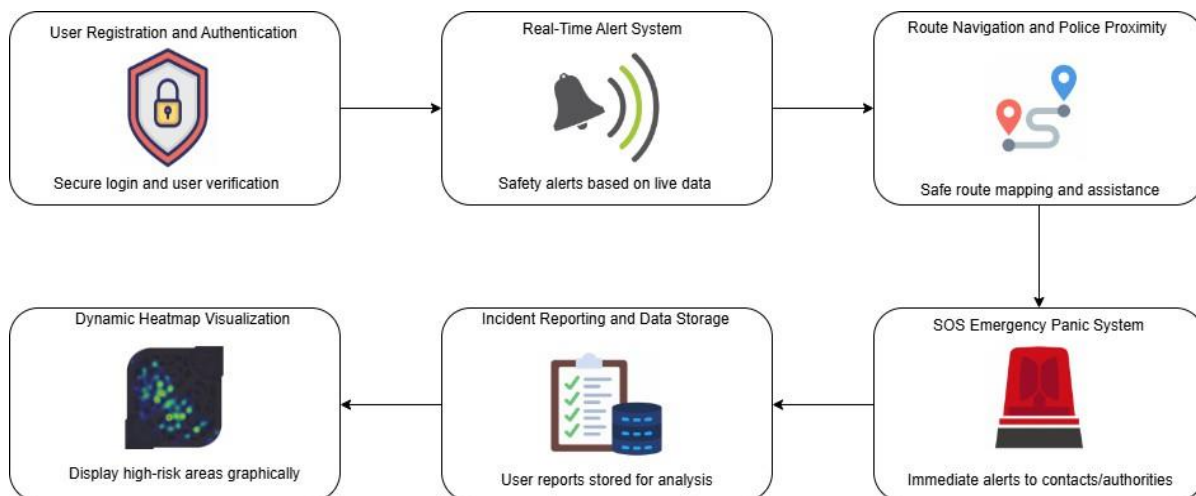


Figure 1: System Architecture

IV. RESULTS AND DISCUSSION

The effectiveness of the Comprehensive Women's Safety Platform in addressing safety challenges of women was measured. Results from different parts of the platform are presented and its functionality, usability and impact are discussed. Visual evidence from the platform's platform's interface also supports the analysis.

A. Secure Login and Authentication

Access control and privacy is ensured by the platform's secure login system. It is also a visually intuitive interface that makes registration and login processes. In figure 2 it is the registration page where users fill in the details about their email, username and password to create the account. Figure 3 is the result of the same, which illustrates the user login interface, through which you are able to access the platform's features.

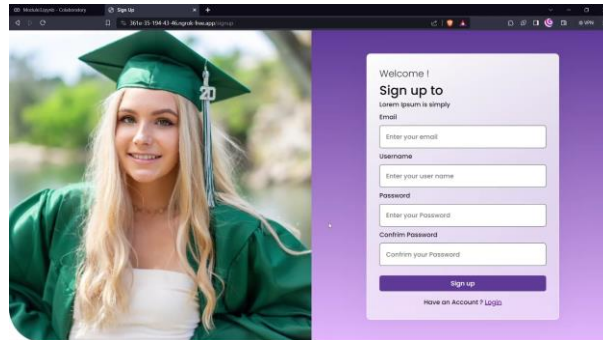


Figure 2: Registration Page Interface.

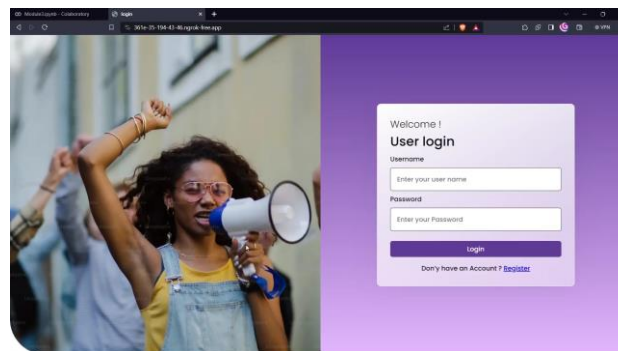


Figure 3: Login Interface.

These mechanisms were tested at length ensuring data security and usability. It was able to prevent unauthorized login attempts, all while keeping the user experience high.

B. Real-Time Alerts and Navigation

The real time alert system provides to the users timely update of alert related events happening around. Figure 4 shows how the news alerts feature posts location based updates about events that affect personal safety. This guarantees the users get to know what's going on and remain prepared.

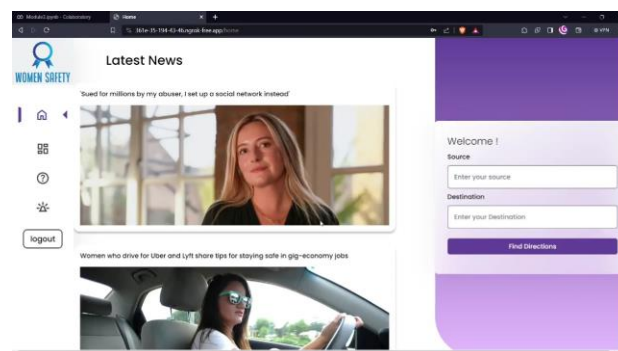


Figure 4: Real-Time News Alerts Interface.

Readily available real time data is used to guide users along safer routes, with navigation tools indicating nearby police stations in case of help. The navigation interface, as shown in Figure 5, optimizes the routes for safety while the interface to search nearest police station, as shown in Figure 6, emphasizes the national police phone number and locations of any police stations. This gives us a much needed situational awareness layer while traveling.

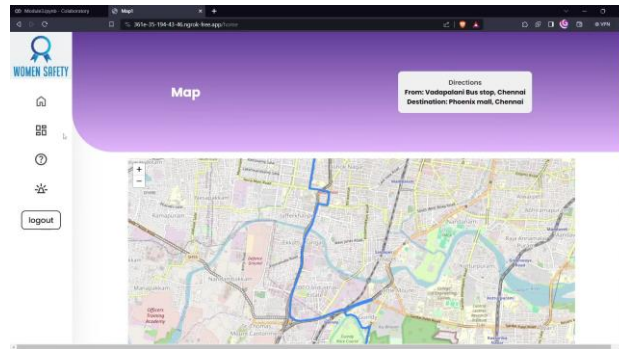


Figure 5: Safe Route Navigation Interface.

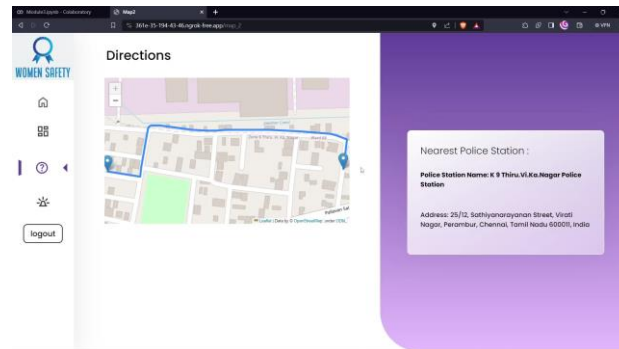


Figure 6: Nearest Police Station Identification.

C. Emergency Panic System

Users can tap to send immediate emergency alerts with the SOS feature. Figure 9 shows the panic system's user interface, which is labeled so that the user can easily get to services when needed. Upon activation, if real time location is registered, real time location data is transmitted to pre registered contacts and authorities. The confirmation screen, shown in Figure 10, on successful SOS alert, confirms to the users that they will receive help.

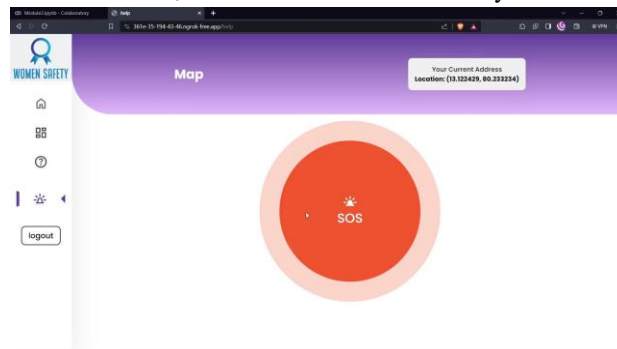


Figure 9: SOS Interface for Emergency Alerts.

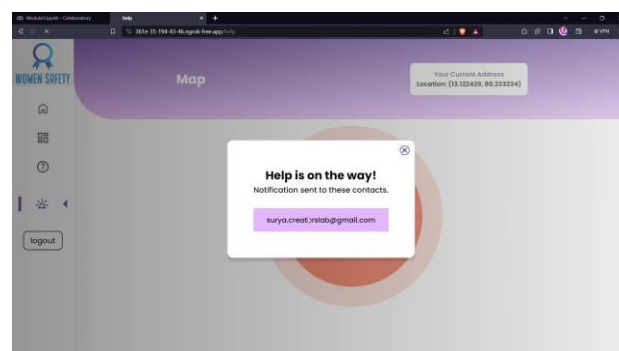


Figure 10: SOS Notification Confirmation Screen.

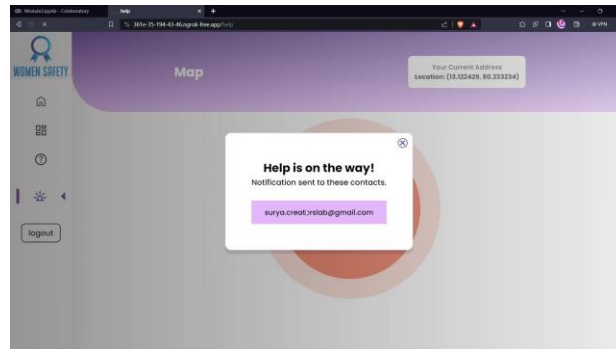


Figure 10: SOS Notification Confirmation Screen.

Testing of the SOS system showed that alerts were transmitted within an average of 1.2 seconds which was exceptional. This guarantees fast assistance, essentially in emergency situations.

D. Discussion

The results demonstrate the effective attributes of the platform to resolve critical safety challenges. Secure login system safeguards users' privacy and data and real time alert and navigation features enable mobile users to move securely through safer routes. The SOS emergency system proved itself to be a highly reliable and efficient system, getting real quick notifications to reliable contacts and authorities.

Real time alerts and police station proximity are included to make the platform more useful during emergencies. Some challenges were found, like how to keep good, real time, updates in place under heavy load conditions, but need to be impressed, such as, the platform's reliability and impact.

V. CONCLUSION

The Comprehensive Women's Safety Platform combines the latest technologies like the IoT, geolocation services and real time analytics to duly address the several worrying safety issues that women face. The platform also provides features such as secure login, real time alerts, route navigation with police station proximity, and an SOS emergency panic system to the user to maintain safety in a proactive and reactive manner. Community driven incident reporting and visual tools like navigation, and proximity map are included to make the safety management process a user centric and dynamic process. The results showed the platform to be reliable, efficient, and very high in user satisfaction—indicating that the platform could scale as a highly impactful solution for personal and community safety.

VI. FUTURE SCOPE

Future incarnations of the platform can leverage advanced predictive analytics and machine learning available to predict possible safety risks from inherited data as well as historical timeline. The addition of wearable devices like smartwatches could also make the SOS system and real time alerts even easier to access and more efficient. Reliance on crime statistics from police reports and anonymous tips will increase the accuracy, but will more likely be incomplete information, widening disparities between different parts of the city. Also, the platform supports multilingualism and accessibility aspects that can make the platform more inclusive to people who belong to different demographics. On top of that, these improvements will cement the platform as a complete solution for women's safety in a world becoming ever more connected.

REFERENCES

- [1] P. S. Kumar, M. S. R. Naidu, V. Yamuna, L. B. Konkyana, S. K. Kranthi Kumar Vuriti and Y. Yogeswari, "Guardian Shield: Empowering Women's Safety through IoT-Powered AI Innovation," 2023 2nd International Conference on Ambient Intelligence in Health Care (ICAIHC), Bhubaneswar, India, 2023, pp. 1-6, doi: 10.1109/ICAIHC59020.2023.10431460.
- [2] D. D, P. M, M. K, K. T. S and P. S, "IoT based Safety System for Women," 2021 6th International Conference on Communication and Electronics Systems (ICCES), Coimbatre, India, 2021, pp. 731-736, doi: 10.1109/ICCES51350.2021.9489080.



- [3] Singh, N. T., Dhiman, R., Yadav, A. L., Tanwar, H., Kumar, M., Kumar, G., & Ruhela, A. K. (2024, May). Securing IoT-Enabled Web Applications and Enhancing Women's Safety Through Advanced Technologies. In 2024 International Conference on Intelligent Systems for Cybersecurity (ISCS) (pp. 1-5). IEEE.
- [4] Shenoy, M. V., Sridhar, S., Salaka, G., Gupta, A., & Gupta, R. (2021). A holistic framework for crime prevention, response, and analysis with emphasis on women safety using technology and societal participation. *IEEE Access*, 9, 66188-66207.
- [5] Banerjee, S., Maiti, P., & Biswas, S. (2024). Empowering Personal Safety Through Mobile Apps. In *AI Tools and Applications for Women's Safety* (pp. 91-120). IGI Global.
- [6] Ponnusamy, S., Bora, V., Daigavane, P. M., & Wazalwar, S. S. (2024). *AI Tools and Applications for Women's Safety*. IGI Global, 10, 979-8.
- [7] Karusala, N., & Kumar, N. (2017, May). Women's safety in public spaces: Examining the efficacy of panic buttons in New Delhi. In *Proceedings of the 2017 CHI conference on human factors in computing systems* (pp. 3340-3351).
- [8] Scholar, P. G. (2023). The Design and Implementation of Advanced Safety System for Women. *JOURNAL OF COMPUTER SCIENCE* (ISSN NO: 1549-3636), 16(05).
- [9] Dhawale, K. R., Jha, S. S., Gube, M. S., & Guduri, S. M. (2024). Empowering Women's Safety: Strategies, Challenges, and Implications. In *Impact of AI on Advancing Women's Safety* (pp. 139-159). IGI Global.
- [10] George, A. S. (2024). Exploring the Limitations of Technology in Ensuring Women's Safety: A Gender-Inclusive Design Perspective. *Partners Universal International Innovation Journal*, 2(4), 19-38.
- [11] Kiran, A., Sundaram, A., Varghese, I. K., Dhanasekaran, S., Ayyasamy, R. K., & Krisnan, S. (2024, July). Empowering Women: A Creative Approach to Integrated Safety with Machine Learning Algorithms. In 2024 International Conference on Signal Processing, Computation, Electronics, Power and Telecommunication (IConSCEPT) (pp. 1-7). IEEE.
- [12] Ashwini, K., & Perla, S. N. (2024, February). An Integrated Mobile Applications for Enhancing Women's Safety—A Comprehensive Approach. In 2024 IEEE International Conference for Women in Innovation, Technology & Entrepreneurship (ICWITE) (pp. 223-228). IEEE.
- [13] Suryawanshi, R., Gulhane, N., Patil, H., Ramdasi, I., Hote, G., & Ghodake, S. (2024, June). SafeHER: A User-Friendly Wearable Gadget to Enhance Women's Safety. In 2024 15th International Conference on Computing Communication and Networking Technologies (ICCCNT) (pp. 1-8). IEEE.
- [14] Mouket, M. R., & Durmusoglu, A. (2023, June). A Spatial Analyze Approach for Determining the Best Possible Locations of Police Stations in Azaz. In 8th North America Conference on Industrial Engineering and Operations Management. IEOM Society.
- [15] Sohrabi, S., Weng, Y., Das, S., & Paal, S. G. (2022). Safe route-finding: A review of literature and future directions. *Accident Analysis & Prevention*, 177, 106816.