An Integrated ANN Framework for Women's Personal Security and Emergency Assistance

Gundumogula Pujitha Ramya Sri[1], M.Anusha[2]
[1]MCA Student , Dept of MCA , Ellenki College of Engineering and Technology , Hyderabad
[2]Assistant Professor , Dept of MCA , Ellenki College of Engineering and Technology , Hyderabad

***Abstract*—** Ensuring women's safety has become a major societal concern due to the increasing number of crimes reported across different regions. Although several digital safety solutions are available, many of them provide only isolated services such as emergency alerts or location tracking, limiting their effectiveness during critical situations. This paper presents an integrated women's safety framework that combines crime prediction, emergency response, location-based navigation, and safety visualization within a single intelligent platform. The proposed system employs an Artificial Neural Network (ANN) trained on a publicly available women crime dataset to estimate the expected number of crime incidents across different states based on historical records. Data preprocessing techniques, including cleaning, normalization, and feature preparation, are applied to improve prediction quality before model training. In addition to predictive analytics, the framework incorporates a panic alert mechanism that instantly delivers emergency notifications containing the user's location to registered contacts, enabling rapid assistance during emergencies. A route navigation module assists users in identifying nearby police stations, while a heatmap visualization highlights crime-prone regions to improve situational awareness and support safer travel decisions. The system also provides secure user authentication and incident reporting functionalities to enhance usability and encourage timely reporting of safety-related events. Experimental evaluation demonstrates that the proposed ANN model effectively captures crime patterns and generates reliable predictions while seamlessly integrating multiple safety services into a unified application. By combining machine learning with real-time emergency support and location-aware services, the proposed framework offers a practical, scalable, and user-centric solution for improving women's personal safety and assisting informed decision-making in everyday travel.

***Keywords*—** Women's safety, Artificial Neural Network (ANN), crime prediction, machine learning, emergency panic alert, location-based navigation, heatmap visualization, crime analytics, public safety, police station routing, geospatial analysis, incident reporting, predictive analytics, location-aware services, intelligent safety system.

I.INTRODUCTION

Women's safety has become an increasingly important social concern as incidents of harassment, assault, kidnapping, and other crimes continue to rise in many parts of the world. Despite improvements in communication technologies and public safety infrastructure, women often face difficulties in obtaining immediate assistance during emergency situations. Delays in reporting incidents, lack of awareness about nearby support services, and limited access to real-time safety information can significantly increase personal risk. These challenges highlight the need for intelligent technological solutions that not only respond to emergencies but also assist users in making informed decisions before dangerous situations occur **[13]**.

The rapid growth of mobile computing, location-based services, and artificial intelligence has created new opportunities for developing smart personal safety applications. Modern safety systems are no longer limited to emergency communication; instead, they integrate predictive analytics, geographic information systems, and intelligent decision-support mechanisms to provide comprehensive protection. Machine learning techniques have shown considerable promise in analyzing historical crime records, identifying hidden trends, and forecasting crime patterns that can help individuals avoid unsafe areas. Such predictive capabilities allow users to make safer travel decisions while enabling authorities to gain better insights into regional crime distribution **[1]**.

Several existing women safety applications provide features such as GPS tracking, emergency messaging, panic buttons, and location tracking. Although these functionalities are valuable during emergencies, many available systems operate independently and do not combine crime prediction, route planning, and geographical safety analysis within a unified platform. Furthermore, the absence of data-driven crime forecasting limits their ability to provide preventive guidance. Integrating predictive models with real-time safety services can significantly improve the effectiveness of personal security applications by supporting both proactive and reactive safety measures **[8]**.

This work presents an intelligent women's safety framework that combines machine learning with location-aware emergency services to enhance personal security. The proposed system utilizes an Artificial Neural Network (ANN) trained on historical women crime data to estimate the expected number of crime incidents across different states. Prior to model development, the dataset undergoes preprocessing procedures, including data cleaning, normalization, and feature preparation, to improve prediction performance. Along with crime prediction, the application incorporates secure user authentication, emergency panic alerts through email notifications, police station route navigation, incident reporting, and heatmap visualization to provide users with comprehensive safety support through a single platform **[14]**.

The effectiveness of the proposed framework is evaluated by analyzing the prediction capability of the neural network and the practical integration of its safety modules. The crime prediction component assists users in understanding regional crime trends, while the navigation module identifies nearby police stations to facilitate quick access to assistance. The panic alert mechanism enables immediate communication with registered emergency contacts by transmitting the user's current location, and the heatmap visualization provides a graphical representation of crime intensity across different regions. By integrating predictive analytics, emergency communication, and geospatial services into one application, the proposed system offers a scalable, user-friendly, and intelligent solution for improving women's safety and supporting timely emergency response **[2].**

II.RELATED WORK

M. Chatterjee and S. Roy (2021) presented **"AI-based Personal Safety Applications for Women: A Review"** [1]. The authors reviewed the evolution of intelligent safety applications developed to enhance women's security through artificial intelligence. Their study examined features such as emergency alert mechanisms, location tracking, and automated assistance that are commonly integrated into modern safety applications. The review concluded that AI technologies can improve the responsiveness and effectiveness of personal safety systems by providing timely support during emergency situations. Their work also emphasized the need for combining multiple safety services within a unified platform.

A. Jain and P. Verma (2020) introduced **"Women Safety Device Using IoT and Machine Learning"** [2]. The proposed system combined Internet of Things (IoT) technology with machine learning techniques to develop an intelligent safety solution capable of monitoring user activities and generating emergency notifications. The research demonstrated that integrating sensor-based monitoring with predictive analytics enables faster emergency response while improving the overall reliability of personal safety applications. The study highlighted the importance of real-time communication for protecting vulnerable users.

C. McMillan and A. Vasan (2021) presented **"The Impact of Machine Learning Algorithms on Crime Prediction and Safety Assurance"** [6]. Their research investigated the application of machine learning models for analyzing historical crime information to estimate future crime occurrences. The authors showed that predictive models can identify hidden crime patterns and support better safety planning for both citizens and public authorities. The study concluded that machine learning provides valuable decision-support capabilities for developing intelligent public safety systems.

S. Basu and P. Roy (2021) proposed **"Deep Learning Techniques for Anomaly Detection in Women Safety Applications"** [12]. The research explored the use of deep learning methods to recognize abnormal situations that may indicate threats to personal safety. By learning complex behavioural patterns from historical data, the proposed approach demonstrated improved detection performance compared with conventional analytical methods. The authors suggested that deep learning can significantly strengthen proactive safety monitoring in modern mobile applications.

N. Rani and P. Bedi (2022) presented **"Smart City-Based Surveillance Using Artificial Intelligence for Women Safety"** [14]. The study focused on employing artificial intelligence within smart city environments to improve women's security through intelligent surveillance and automated monitoring. The proposed framework utilized real-time information to detect suspicious activities and support rapid emergency response. The authors concluded that integrating AI-driven surveillance with urban safety infrastructure can enhance public security and provide safer environments for women.

III.DATASET DETAILS

The proposed intelligent women's safety system is developed using the **Women Crime Dataset**, which contains historical records of crimes reported against women across different states and union territories. The dataset is obtained from a publicly available Kaggle repository and serves as the primary source for training the Artificial Neural Network (ANN)

model used in crime prediction. It includes state-wise crime statistics collected over multiple years, allowing the model to learn regional crime patterns and estimate the expected number of crime incidents for a selected location. The dataset consists of structured numerical information representing various categories of crimes, geographical regions, and corresponding annual crime frequencies. Prior to model development, the collected data undergoes several preprocessing operations to improve its quality and suitability for machine learning. Missing or inconsistent records are removed, categorical information such as state names is transformed into numerical representations, and the numerical attributes are normalized to ensure consistent feature scaling during training. These preprocessing steps reduce data inconsistencies and enable the neural network to learn meaningful relationships among the available features while improving prediction accuracy and model convergence. The processed dataset is subsequently used to train an Artificial Neural Network capable of identifying hidden correlations within historical crime records. During the learning phase, the network automatically adjusts its parameters to model complex relationships between geographical regions and crime occurrences without requiring manually engineered rules. Once training is completed, the model predicts the expected number of crimes for a user-selected state, providing valuable information that supports awareness and safer travel planning. In addition to crime prediction, the developed application integrates the trained ANN model with several safety-oriented modules, including secure user registration, emergency panic alerts, police station route navigation, and crime heatmap visualization. The prediction results generated from the dataset are combined with location-based services to provide users with both preventive guidance and immediate assistance during emergency situations. The heatmap module visually represents crime intensity across different regions using the historical dataset, enabling users to identify comparatively safer and high-risk areas. The dataset also supports the overall operation of the integrated safety platform by supplying historical crime information for predictive analysis while user-specific information, including registration details and emergency contact data, is maintained separately within the application database. During system execution, the ANN prediction model works together with emergency notification, navigation, and visualization modules to provide a comprehensive and intelligent women's safety solution. The combination of historical crime analytics, neural network-based prediction, geospatial visualization, and real-time emergency support establishes a scalable framework for enhancing personal safety and improving situational awareness.

IV.PROPOSED METHODOLOGY

The proposed framework introduces an intelligent women's safety application that integrates Artificial Neural Network (ANN)-based crime prediction with location-aware emergency services to enhance personal security. The primary objective of the system is to provide preventive guidance as well as immediate assistance during emergency situations through a unified platform. The application combines historical crime analysis, emergency communication, police station navigation, incident reporting, and geographical crime visualization to support informed decision-making and improve user safety. A secure web-based interface is developed to facilitate user registration, authentication, crime prediction, route guidance, panic alert generation, and safety monitoring within a single application.

The proposed methodology begins with user registration, where individuals create an account by providing their personal information along with a valid email address that will be used for emergency communication. After successful authentication, users gain access to the various safety modules integrated into the application. The historical women crime dataset is first preprocessed by eliminating inconsistent records, transforming categorical attributes into numerical representations, and normalizing feature values to improve the quality of the training data. The processed dataset is then used to train an Artificial Neural Network capable of learning complex crime patterns from historical records and estimating the expected number of crime incidents for a selected state.

Following model training, the application enables users to predict crime levels by selecting a particular state from the interface. The trained ANN analyzes the learned crime patterns and generates an estimated crime count, providing users with valuable insights regarding regional safety conditions. In addition to predictive analysis, the framework incorporates a route navigation module that identifies nearby police stations based on the user's current location, allowing quick access to law enforcement services during emergencies. A heatmap visualization module graphically represents crime intensity across different geographical regions, enabling users to identify comparatively safer and high-risk locations before planning their travel.

To provide immediate support during dangerous situations, the application integrates a panic alert mechanism that allows users to instantly transmit an emergency email containing their current location to a pre-registered contact. This feature minimizes response time by enabling family members or trusted individuals to receive accurate location information without delay. The system also provides an incident reporting facility through which users can report safety-related events, contributing to

improved awareness and timely intervention by the concerned authorities.

The proposed framework combines machine learning-based crime prediction with real-time location services, emergency notification, and geospatial visualization to deliver a comprehensive women's safety solution. By integrating predictive analytics with proactive and reactive safety mechanisms, the developed system enhances situational awareness, supports informed travel decisions, and enables rapid emergency communication. The unified architecture provides a scalable, efficient, and user-friendly platform capable of improving personal security while leveraging artificial intelligence to assist women in responding effectively to potential safety threats.

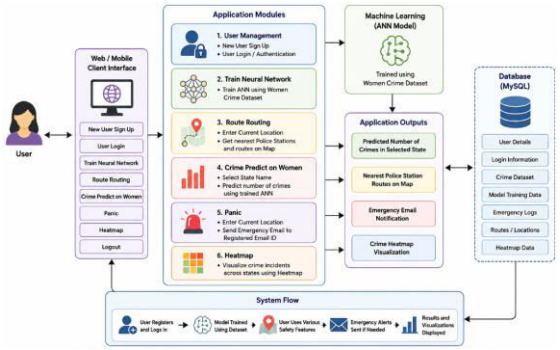

Figure 1: System Architecture of the Proposed ANN-Based Intelligent Women Safety System

Figure 1 illustrates the architecture of the proposed ANN-based intelligent women safety system. The process begins with user registration and secure login, where users provide personal details and an emergency email address. The Women Crime Dataset is preprocessed and used to train the Artificial Neural Network (ANN) for crime prediction. After training, users can select a state to predict the expected number of crime incidents based on historical data. The application also provides route navigation to nearby police stations, enabling users to identify the safest routes during emergencies. A panic module allows users to instantly send their current location to registered emergency contacts through email. Additionally, a heatmap module visualizes crime-prone regions to improve situational awareness. All user information, crime records, prediction results, emergency logs, and location details are securely maintained in the MySQL database, providing an integrated, reliable, and scalable women safety solution.

V.RESULT AND DISCUSSION

The proposed ANN-based intelligent women safety system was evaluated through the developed web application under various operational scenarios. The application successfully executed user registration, secure login, neural network training, crime prediction, police station route navigation, emergency alert generation, and crime heatmap visualization through a unified interface. During registration, users provided personal information along with a valid email address, which was securely stored for emergency communication. The Artificial Neural Network was trained using the preprocessed Women Crime Dataset, enabling the model to learn historical crime patterns and generate reliable crime predictions for different states. The crime prediction module accurately estimated the expected number of crime incidents based on the selected state, providing users with valuable information for safer travel planning. The route navigation module successfully identified nearby police stations and displayed accessible routes on the map, while the panic module instantly transmitted emergency emails containing the user's current location to registered contacts. Furthermore, the heatmap module effectively visualized crime intensity across different regions, improving situational awareness. All user details, prediction results, emergency logs, and location information were securely maintained in the MySQL database for efficient management. The experimental observations demonstrate that integrating Artificial Neural Network-based crime prediction with emergency communication, route navigation, and crime visualization provides a reliable, scalable, and user-friendly solution that enhances women's personal safety while supporting timely emergency response and informed decision-making

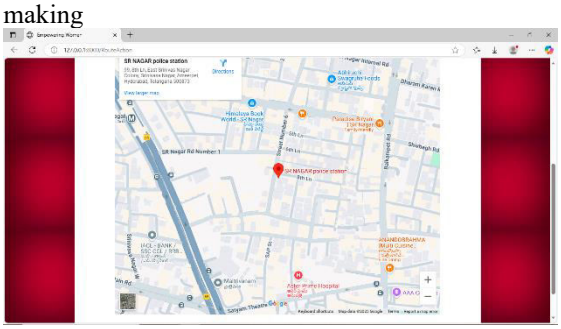

Figure 2: Route Routing Module – Nearest Police Station Navigation

The above figure illustrates the **Route Routing** module of the proposed ANN-based intelligent women safety system. This module assists users in locating the nearest police station based on their current location using an interactive map interface. After the user enters the current location, the application identifies nearby police stations and displays their positions using map markers, enabling quick access to law enforcement services during emergency situations. In the illustrated example, the system successfully locates the **NRI Nagar Police Station** and presents its exact geographical location along with the surrounding road network. The map also provides directional guidance, helping users identify the shortest and most convenient route to the police station. This functionality enhances situational awareness by allowing users to quickly

locate nearby emergency support facilities without manually searching for them. By integrating location-based services with the women safety application, the Route Routing module reduces response time during critical situations and improves user confidence while travelling. This feature plays a significant role in providing immediate assistance and strengthening the overall effectiveness of the proposed intelligent women safety framework.

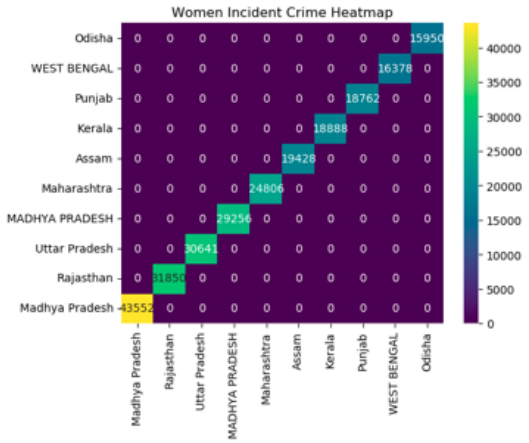

Figure 3: Women Incident Crime Heatmap

The above figure illustrates the **Women Incident Crime Heatmap** generated by the proposed ANN-based intelligent women safety system. The heatmap provides a visual representation of the number of crime incidents reported against women across different states using historical crime data. Each row and column correspond to individual states, while the color intensity indicates the relative magnitude of reported crime cases. Darker shades represent lower crime frequencies, whereas brighter colors indicate states with comparatively higher numbers of reported incidents. The numerical values displayed within the heatmap represent the total predicted or recorded crime cases for each state, enabling users to compare crime levels across different regions. This graphical visualization allows users to quickly identify high-risk and comparatively safer areas without analyzing large volumes of numerical data. The heatmap also supports authorities and policymakers in understanding regional crime patterns, facilitating informed decision-making for safety planning and resource allocation. By integrating crime visualization with machine learning-based prediction, the proposed system enhances situational awareness and helps users make safer travel decisions while contributing to improved women's personal security.

Figure 4: Crime Prediction Using Artificial Neural Network (ANN)

The above figure illustrates the **Crime Prediction** module of the proposed ANN-based intelligent women safety system. This module utilizes the trained Artificial Neural Network (ANN) model to estimate the expected number of crime incidents against women for a selected state based on historical crime records. In the illustrated example, the user selects **Andhra Pradesh**, and the trained model predicts **871** crime incidents. The predicted result is displayed immediately through the application interface, providing users with valuable information about the safety conditions of the selected region. The ANN model analyzes historical crime patterns learned during the training phase to generate reliable predictions that support informed decision-making. By presenting estimated crime statistics before travel, the application enables users to assess potential risks and choose safer locations whenever possible. This prediction capability also assists public authorities in understanding regional crime trends and planning preventive safety measures. The integration of machine learning-based crime prediction with the overall women safety application enhances situational awareness, promotes proactive safety planning, and contributes to improving women's personal security through intelligent data-driven decision support.

DISCUSSION

The proposed intelligent women safety framework integrates Artificial Neural Network (ANN)-based crime prediction with emergency communication, location-aware navigation, and crime visualization to provide a comprehensive personal safety solution. The system utilizes a preprocessed Women Crime Dataset to train the ANN model, enabling it to learn historical crime patterns and estimate the expected number of crime incidents for different states. A web-based application incorporates secure user registration, login authentication, crime prediction, police station route navigation, panic alert generation, and heatmap visualization within a unified platform. The route navigation module assists users in locating nearby police stations, while the panic module immediately sends emergency emails containing the user's current location to registered emergency contacts. The heatmap module graphically represents crime-prone regions,

allowing users to identify safer areas and make informed travel decisions.

Experimental evaluation demonstrates that the proposed framework effectively predicts regional crime trends while seamlessly integrating multiple safety services into a single application. The combination of ANN-based predictive analytics with real-time emergency alerts, interactive route guidance, and geographical crime visualization enhances situational awareness and supports rapid response during critical situations. Furthermore, user information, prediction results, emergency notifications, and application records are securely maintained in a MySQL database, ensuring efficient data management and reliable system operation. The proposed framework therefore provides a scalable, practical, and intelligent solution for improving women's personal safety through predictive analysis, location-based assistance, and timely emergency communication.

VI.CONCLUSION

This work presents an Artificial Neural Network (ANN)-based intelligent women safety system that integrates crime prediction, emergency communication, location-aware navigation, and crime visualization within a unified platform to improve personal security. The proposed framework utilizes a preprocessed Women Crime Dataset to train the ANN model for predicting the expected number of crime incidents across different states based on historical records. In addition to predictive analysis, the developed web application provides secure user registration, authentication, police station route navigation, emergency panic alerts, and heatmap visualization to support both preventive awareness and immediate assistance during critical situations. Experimental observations indicate that the ANN model effectively identifies crime trends while the integrated safety modules operate reliably to deliver timely emergency support and location-based guidance. User information, prediction results, emergency notifications, and application records are securely maintained in the MySQL database, ensuring efficient data management and dependable system performance. The proposed framework offers a practical, scalable, and user-friendly solution for enhancing women's personal safety through intelligent decision support and rapid emergency response. Future work may focus on integrating real-time crime data streams, GPS-based live tracking, advanced deep learning models for improved prediction accuracy, multilingual voice assistance, wearable device connectivity, and cloud-based deployment to further strengthen the effectiveness and accessibility of the proposed safety system.

REFERENCES

[1] M. Chatterjee and S. Roy, "AI-based personal safety applications for women: A review," International Journal of Innovative Technology and Exploring Engineering (IJITEE), vol. 10, no. 5, pp. 101–105, 2021.

[2] A. Jain and P. Verma, "Women safety device using IoT and machine learning," Procedia Computer Science, vol. 167, pp. 2001–2008, 2020.

[3] K. Singh and A. Sharma, "Smart wearable for women safety using machine learning," International Journal of Engineering Research & Technology, vol. 9, no. 6, pp. 122–126, 2020.

[4] R. Gupta and R. Sinha, "A review of mobile applications for women safety," Journal of Mobile Computing, vol. 8, no. 2, pp. 55–61, 2019.

[5] World Health Organization, Violence Against Women: Prevalence Estimates, 2018. Geneva, Switzerland: WHO, 2021.

[6] C. McMillan and A. Vasan, "The impact of machine learning algorithms on crime prediction and safety assurance," IEEE Transactions on Computational Social Systems, vol. 8, no. 3, pp. 470–479, 2021.

[7] N. Sharma and S. Mehra, "An IoT and machine learning-enabled safety system for vulnerable groups," Journal of Safety Science and Technology, vol. 12, no. 1, pp. 80–85, 2021.

[8] P. Shinde and S. Patil, "Emergency alert system for women using GPS and GSM technologies," International Journal of Research in Engineering, Science and Management, vol. 3, no. 9, pp. 15–19, 2020.

[9] UNESCO, Empowering Girls and Women Through Digital Skills. Paris, France: UNESCO Publishing, 2020.

[10] R. Kumar and S. Raj, "Designing a cloud-based emergency response system for women's safety," International Journal of Cloud Computing and Services Science, vol. 8, no. 2, pp. 99–105, 2019.

[11] A. Ahmed and I. Hussain, "Machine learning-based crime detection and prediction: A literature review," International Journal of Advanced Computer Science and Applications, vol. 11, no. 2, pp. 417–423, 2020.

[12] S. Basu and P. Roy, "Deep learning techniques for anomaly detection in women safety applications," Journal of Applied Security Research, vol. 16, no. 3, pp. 342–359, 2021.

[13] United Nations, The Global Status Report on Preventing Violence Against Women. New York, NY, USA: UN Women, 2019.

[14] N. Rani and P. Bedi, "Smart city-based surveillance using artificial intelligence for women safety," Procedia Computer Science, vol. 184, pp. 789–794, 2022.

[15] M. Patel and M. Thakkar, "Real-time tracking and monitoring system for women using Android applications," International Journal of Recent Technology and Engineering, vol. 8, no. 3, pp. 112–115, 2019.