



# SMART AUTOMATED ANTI-VIOLENCE INTERVENTION

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**Abstract:** Hearing about the violent activities that occur on a daily basis around the world is quite overwhelming. Personal safety and social stability are seriously threatened by the violent activities. A variety of methods have been tried to curb the violent activities which includes installing of surveillance systems. It will be of great significance if the surveillance systems can automatically detect violent activities and give warning or alert signals. The whole system can be implemented with a sequence of procedures. Firstly, the system has to identify the presence of human beings in a video frame. Then, the frames which are predicted to contain violent activities has to be extracted. The irrelevant frames are to be dropped at this stage. Finally, the trained model detects violent behavior and these frames are separately saved as images. The enhanced images along with other necessary details such as time and location are sent as an alert to the concerned authority. The proposed method is a deep learning based automatic detection approach that uses Convolutional Neural Network to detect violence present in a video. An alert message is given to the concerned authorities using telegram application.

**Index Terms** – Convolutional Neural Network, Machine Learning, Python.

## I. INTRODUCTION

In recent years, the alarming increase in incidents of violence whether in schools, workplaces, or public spaces has underscored the urgent need for effective, real-time intervention systems. Traditional surveillance and security methods often fall short in preventing aggressive behaviors before they escalate into harmful acts. As a result, the integration of intelligent technologies in violence prevention has become a pressing priority. With the rise of smart systems and artificial intelligence there is a growing opportunity to leverage these tools for social good, particularly in the domain of public safety. This paper explores the development of a Smart Automated Anti-violence Intervention system, which uses a combination of computer vision, machine learning and automated alerts to detect and respond to potentially violent behaviors. The goal is not just to monitor but to actively intervene through timely notifications and support mechanisms, thereby creating safer environments. This approach emphasizes a shift from reactive to proactive safety strategies. By analyzing human posture, gestures, and behavior patterns through camera feeds, the proposed system aims to recognize signs of aggression and distress at an early stage. The system is designed to operate seamlessly in various settings educational institutions, corporate offices, public spaces serving as an ever-vigilant assistant that can alert authorities and even offer de-escalation support.

Ultimately, this project envisions a safer environment, especially for vulnerable groups by replacing passive monitoring with active, intelligent systems. By bridging the gap between violence detection and intervention, the proposed model moves us closer to a future where help arrives not minutes later but in the moments that matter most. The objective is to demonstrate how smart technology can be responsibly and effectively used to reduce violence and promote community well-being.

## II. LITERATURE SURVEY

[1] This systematic review investigates the complex relationship between technology and intimate partner violence (IPV). It reveals that while tools like smartphones and social media can be misused by abusers for stalking, control, and harassment, they also offer innovative solutions that can empower victims. The authors highlight various technological interventions, such as safety apps and online support services, that provide essential resources and information. By emphasizing the dual role of technology, this study underscores the importance of responsible tech development, advocating for solutions that maximize benefits for survivors while minimizing risks.

[2] Focusing specifically on immigrant women who experience IPV, this study explores a targeted technology-based intervention designed to enhance their safety and mental health outcomes. The intervention incorporates culturally sensitive practices and aims to empower participants by providing them with tailored resources and support. Results from the study indicate significant improvements in participants' mental health, self-esteem, and feelings of safety. This research showcases how technology can serve as a critical tool in supporting marginalized groups, highlighting the need for continued innovation in this area to meet the unique needs of diverse populations facing violence.

[3] In examining the effectiveness of ICT-based interventions for IPV, this review synthesizes existing research to evaluate various digital tools aimed at reducing violence. The findings suggest that when these interventions are designed with the needs of users in mind, they can lead to substantial improvements in safety, mental health, and overall well-being for victims. The authors stress the importance of further research to refine these technologies, ensuring they are accessible and effective for various demographic groups. This study serves as a call to action for researchers and practitioners to collaborate on developing more inclusive digital solutions that address the unique challenges faced by IPV survivors.

[4] This systematic review delves into the impact of mobile technology on mental health outcomes, revealing its potential to significantly enhance psychological support for individuals, including those affected by trauma from IPV. The study analyses a range of mobile health applications and highlights their ability to provide users with immediate access to resources, coping strategies, and support networks. The authors argue that integrating mental health resources directly into these applications can further improve user engagement and effectiveness, particularly for individuals who may face barriers to accessing traditional mental health services. This research underscores the transformative potential of mobile technology in supporting mental health and well-being among vulnerable populations.

[5] Focusing on the creation and evaluation of a mobile app designed for IPV prevention, this research highlights the significance of a user-centered design approach. By involving survivors in the development process, the app effectively meets their specific needs and preferences. Evaluation results demonstrate that the app not only provides crucial resources but also empowers users by facilitating discreet help-seeking behavior. This study illustrates the potential of technology to enhance the safety and well-being of individuals experiencing IPV, emphasizing the importance of tailoring digital tools to effectively serve the intended audience. The findings encourage further development of similar interventions that prioritize user input and engagement.

[6] This literature review examines the multifaceted role of technology in addressing domestic violence, focusing on various innovative approaches and their implications for intervention strategies. The authors highlight the need for creating digital resources that are inclusive and accessible to diverse populations, especially those who may not have traditional avenues for support. They discuss existing gaps in technology offerings and advocate for the development of comprehensive digital solutions that address the specific needs of different communities. By emphasizing community engagement in the design and

implementation of these technologies, this study underscores the importance of collaboration between tech developers and social service providers in creating effective interventions.

[7] Providing an overview of the use of smart technologies in preventing domestic violence, this paper discusses how innovations like wearable devices can enhance safety for victims. The authors explore the various functionalities these technologies offer, such as emergency alerts and location tracking, which can provide real-time support in critical situations. However, they also raise significant ethical concerns regarding privacy and data security, stressing the need to ensure that these tools are used responsibly and safely. The study highlights the importance of developing guidelines and best practices for the deployment of smart technologies in domestic violence interventions, aiming to protect users while providing them with essential support.

[8] This review addresses the dual impact of technology on domestic violence, focusing on how it can serve as both a tool for abusers and a resource for empowerment for victims. The authors analyze cases where technology has been used for surveillance and manipulation by abusers, alongside examples of how innovative solutions can provide support and resources for victims. They advocate for a balanced approach that recognizes these complexities, emphasizing the need for awareness and education around technology's role in IPV. By fostering an understanding of both the risks and benefits, this study encourages the development of targeted interventions that leverage technology to empower victims while safeguarding their privacy and security.

[9] Conducting a scoping review of mobile applications designed to address IPV, this study categorizes these tools based on their functionalities and target populations. The findings reveal a growing trend in app development focused on IPV prevention and support, but they also emphasize the necessity of rigorous evaluations to ensure these apps are effective and safe for users. The authors highlight that while many apps offer valuable features, such as crisis resources and safety planning tools, there is a need for more comprehensive research to validate their impact on user outcomes. This study advocates for greater collaboration between developers, researchers, and community organizations to create robust, evidence-based applications that effectively meet the needs of survivors.

[10] This comprehensive review explores the significant role that technology can play in preventing domestic violence, emphasizing various interventions and their effectiveness. The authors argue that technology should not be seen as a standalone solution but rather as a critical component that can be integrated with traditional support services. By combining digital tools with face-to-face support, they propose a more holistic approach to addressing IPV. The study highlights successful case studies and best practices that can inform future interventions, advocating for innovative solutions that enhance community safety and support for victims.

[11] Focusing on digital interventions for violence prevention, this review categorizes a variety of platforms and assesses their effectiveness in addressing IPV. The authors argue that while digital tools have great potential to reach wide audiences, their success largely depends on community engagement and accessibility. They emphasize the importance of tailoring these resources to fit the unique needs of different populations, particularly those that may face barriers to accessing traditional forms of support. By advocating for inclusive approaches to intervention design, this study highlights the necessity of incorporating feedback from users to ensure that digital solutions are effective and meaningful.

[12] Investigating the use of mobile technology to support survivors of IPV, this pilot study provides compelling evidence that these tools can enhance coping strategies and promote empowerment among users. The findings highlight how mobile interventions can offer essential resources, such as crisis support and community connections, which are crucial for individuals navigating the challenges of IPV. The authors emphasize the importance of accessibility and user-friendly design in maximizing the impact of these technologies, suggesting that further development in this area can significantly improve support for survivors. This study underscores the transformative potential of mobile technology in the broader context of violence prevention.

[13] This examination of smart technologies in domestic violence interventions reveals their potential for providing real-time support and enhancing victim safety. The authors discuss various applications of these technologies, including emergency response systems and location tracking, which can be life-saving in critical situations. However, they also address challenges related to user adoption, such as trust in technology and concerns about privacy. By highlighting the importance of building user confidence and ensuring ethical standards, this study aims to maximize the effectiveness of smart technologies while safeguarding user rights. The authors advocate for continued research to refine these tools and ensure they meet the needs of survivors effectively.

[14] Offering an overview of current research on technology-based interventions for violence prevention, this paper highlights successful case studies that demonstrate the effectiveness of digital solutions. The authors stress the importance of customizing interventions to fit specific community needs, recognizing that a one-size-fits-all approach is often insufficient. By focusing on tailoring strategies to resonate with diverse populations, this study encourages collaboration between researchers, practitioners, and community organizations to enhance the impact of technology in preventing IPV. The authors call for ongoing evaluation and adaptation of these interventions to ensure they remain relevant and effective in addressing the evolving landscape of domestic violence.

[15] Reviewing telehealth interventions for domestic violence, this systematic review highlights how telehealth can provide effective counselling and support for survivors, particularly in remote areas where access to traditional services is limited. The findings suggest that telehealth offers unique advantages, such as increased accessibility and the ability to reach individuals who may be hesitant to seek help in person. The authors advocate for integrating telehealth into broader violence prevention strategies, emphasizing the need for training and resources to ensure these services are effectively delivered. This study points to the potential of telehealth as a crucial component of a comprehensive approach to supporting IPV survivors and enhancing their access to vital services.

### III. METHODOLOGY

The methodology encompasses a systematic approach to identify, evaluate, and synthesize relevant research, ensuring a rigorous and unbiased review.

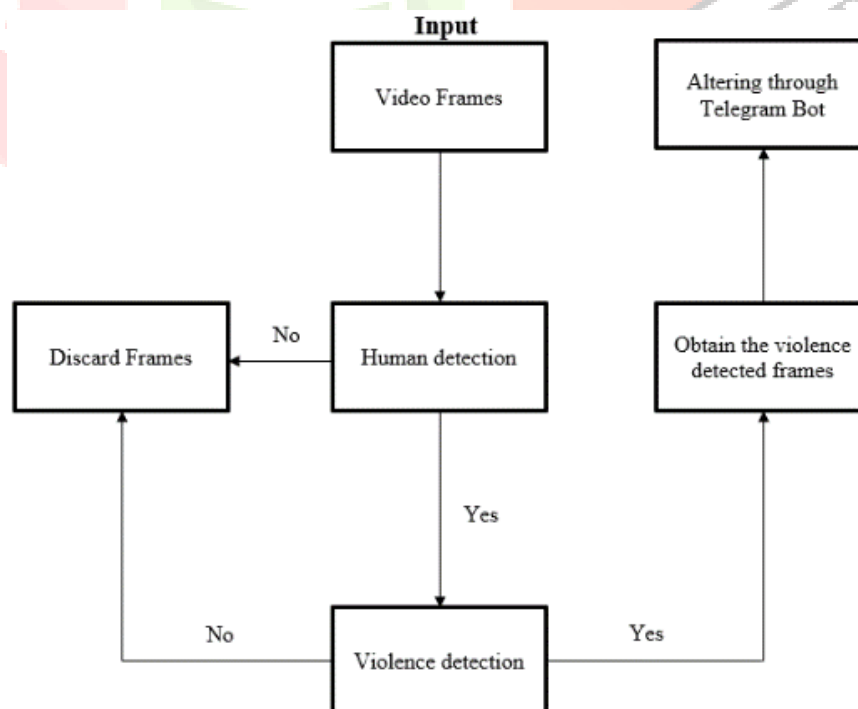


Figure 3.1: Block diagram of violence detection and alert system

To create a smart system that automatically stops violence, we need to gather lots of information. This includes things like crime reports, videos from security cameras, and even data about past violent incidents.



A great place to find this kind of data is Kaggle, which has a huge collection. For example, they have a set of videos labelled as either violent or non-violent, which can teach computers to recognize dangerous behavior. With this data, we can use powerful machine learning tools like neural networks to build a system that can recognize violence in real-time, predict when violence might happen and trigger interventions. This system could make our communities much safer by helping us prevent and respond to violence more effectively.

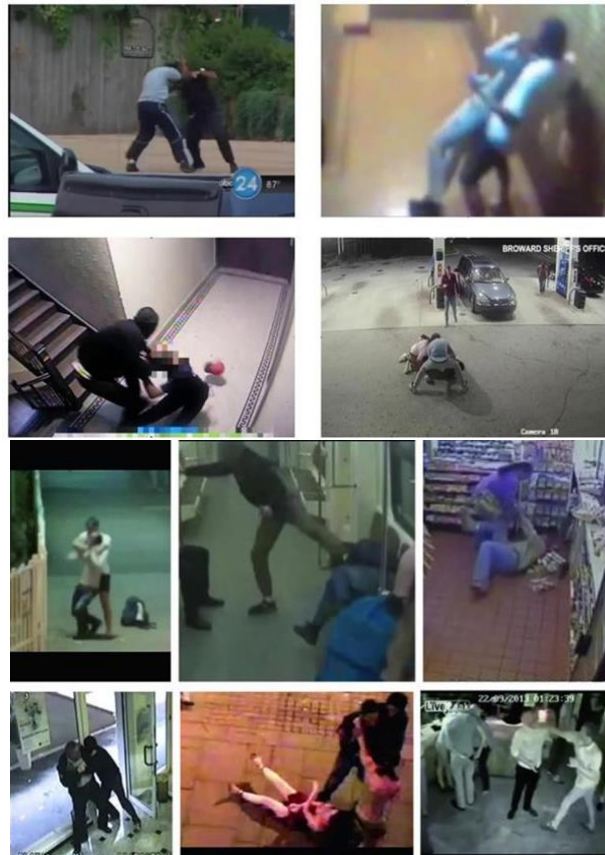


Figure 3.2: Example of violence dataset

### 3.1 Data Pre-processing

Data pre-processing is a vital step in preparing raw data for analysis or machine learning models by transforming it into a clean, consistent, and usable format. The process begins with data cleaning, which involves handling missing values through techniques like imputation or deletion, removing duplicates, and addressing inconsistencies. Data integration combines data from multiple sources, ensuring uniformity in format and structure. Data transformation standardizes the dataset, often through normalization or scaling, to ensure that all features contribute equally to the analysis. Categorical data is encoded into numerical formats using methods like one-hot encoding or label encoding. Outliers are identified and addressed to minimize their impact on model performance.

Finally, feature selection or extraction is performed to reduce dimensionality, improve efficiency, and eliminate irrelevant or redundant variables. Throughout the process, careful attention is given to preserving data integrity, ensuring it accurately represents the problem space while optimizing it for analysis or model training.

### 3.2 Gray scale conversion

Gray-scale conversion is a process used in image processing to transform a colored image into a single-channel image where each pixel represents varying intensities of gray. This conversion simplifies the image data while retaining essential structural information, making it particularly useful for applications like edge detection, pattern recognition, and computational efficiency in machine learning. The process involves calculating a weighted sum of the red, green, and blue (RGB) channels, using coefficients (e.g., 0.299 for red, 0.587 for green, and 0.114 for blue) to reflect human perception, as the human eye is more sensitive to green. The resulting gray-scale image has pixel values ranging from 0 (black) to 255 (white) in an 8-bit representation. By reducing the complexity of the image without losing critical information, gray-scale

conversion is a fundamental step in pre-processing for many vision based algorithms and applications. Why gray scale conversion?

1. **Reduced Complexity:** Grayscale images have a single color channel, representing intensity or brightness. This reduces the dimensionality of the data compared to color images (RGB, which have three channels), simplifying subsequent processing steps like feature extraction and classification.
2. **Computational Efficiency:** Processing grey scale images generally requires less computational power than processing color images.
3. **Focus on essential information:** Color information is not critical for detecting violence. Grayscale images can effectively capture the shapes, movements, and contrasts that are essential for identifying violent actions.
4. **Robustness to lighting variations:** Grayscale images can be less sensitive to variations in lighting conditions, which can be a significant challenge in real-world surveillance environments.
5. **Established Algorithms:** A wide range of image processing algorithms and techniques have been developed specifically for grayscale images, providing a foundation for building effective anti-violence systems.



Figure 3.2.1: Gray scale converted datasets

### 3.3 Convolutional Neural Network (CNN)

We developed a system using Convolutional Neural Networks (CNNs) to detect and respond to violent behaviors in real time. CNNs are a type of deep learning model that excel at processing visual data, making them perfect for analyzing live feeds from surveillance cameras. The main goal of our system is to automatically identify violent incidents, like physical altercations or aggressive behaviors, and trigger timely interventions to enhance security in public spaces, schools, and other sensitive areas. To train our CNN model, we utilized a large dataset that included both violent and non-violent scenarios captured from real-world video footage. Human annotators labelled these videos, marking violent events to provide context for the model's training. As the CNN learned to recognize key features—such as sudden movements and aggressive postures—it became more adept at identifying subtle signs of violence, like raised fists or erratic movements. One of the strengths of CNNs is their ability to handle variations in lighting, camera angles, and different individual appearances, ensuring reliable detection in diverse settings.

Training the CNN required substantial computational resources. We employed transfer learning, starting with a pre-trained model that had already processed a large image database. This approach sped up training and allowed us to fine-tune the model on our specific dataset. We also used data augmentation techniques like rotating and flipping images to enhance the dataset and improve the model's robustness. To

ensure optimal performance, we adjusted hyperparameters such as the learning rate and batch size and evaluated the model using precision, recall, and F1-score to minimize false positives and negatives. After training and evaluation, we integrated the CNN into a broader anti-violence intervention system that continuously analyses video feeds in real time. This system detects violent behavior, triggers immediate alerts, and can prompt automated responses, such as notifying security personnel or activating alarms. Its ability to perform real-time analysis is crucial in environments where quick intervention is necessary, helping to prevent situations from escalating.

Implementing this system came with challenges. One major hurdle was the complexity of human behavior, as not all aggressive actions are overt. To address this, we trained the CNN on a diverse dataset that included various violent and non-violent behaviors, allowing the system to differentiate between normal actions and aggression. We also had to consider privacy concerns related to video surveillance. Our design focuses solely on detecting violent actions, ensuring that personal data isn't unnecessarily captured. Despite these challenges, our system shows great promise in detecting violent actions and providing timely interventions. As we continue testing and refining the system, we envision future enhancements that may include additional sensors or data types, such as audio, to improve accuracy. Multi-modal data could offer a deeper understanding of violent events, as sounds like shouting or sudden impacts could provide further context for detecting aggression.

The potential of this system to reduce violence and increase safety is substantial. By automatically detecting and responding to violent incidents, it takes a proactive approach to preventing harm before it escalates. Looking ahead, we aim to incorporate more advanced CNN models that can handle complex scenarios and offer nuanced responses. As the system evolves, it will be an invaluable tool for enhancing public safety, helping to create environments where individuals feel secure and protected from violence.

### 3.4 Telegram connectivity

Integrating a telegram bot for sharing violence detected frames. Allow users to report violent incidents or suspicious activity directly to the bot, providing essential information such as location, description, and severity. Send real-time alerts to authorities, community leaders, or support groups when an incident is reported, ensuring prompt response and intervention.

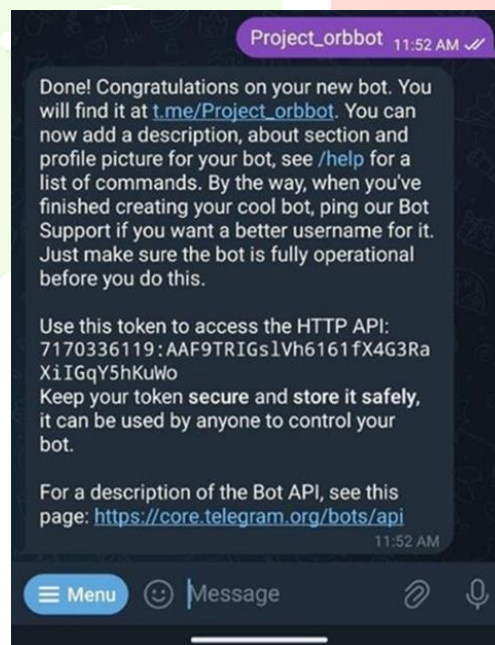


Figure 3.4.1: Telegram Bot



#### IV. RESULT AND ANALYSIS

The Python script executed in the Google Colab environment serves as a preliminary data preparation stage for a violence detection project using surveillance video footage. The process begins with mounting of Google Drive to facilitate access to relevant files. Subsequently, essential libraries including matplotlib.pyplot, drive and operating server are imported to enable tasks such as image visualization, file manipulation and video processing. The heart of the script lies in data preparation, where lists are initialized to store file paths for non-violent and violent videos from two different cameras. These lists are meticulously populated with file paths based on video categories and camera sources. A crucial aspect of the script is the definition of a function named extract frames. This function is designed to extract frames from video files, utilizing the cv2 library for video processing. It incorporates matplotlib.pyplot for the display of frames and includes a loop that continues until the 'q' key is pressed, allowing for user interaction.

The subsequent sections of the script invoke the extract frames function, first with the list of non-violent video paths (noncam1) and then with the list of violent video paths (voilcam2). This process results in the extraction and visual display of frames, offering an initial exploration and visual representation of both non-violent and violent scenarios captured by the surveillance cameras. The conversion of videos into a set of frames for violence detection represents a significant step in dataset preparation. With a dataset comprising 450 videos, generating around 700,000 frames provides a substantial volume of visual data for training and testing the violence detection model. This large dataset is valuable for capturing di-verse instances of violent and non-violent activities, contributing to the robustness and generalization capabilities of the model.

The considerable number of frames enables the model to learn intricate patterns and variations in motion, contributing to the model's effectiveness in violence detection. However, managing such a voluminous dataset requires careful consideration of storage, computational resources, and efficient data handling methods during the subsequent phases of the project. This dataset holds the potential to enhance the model.

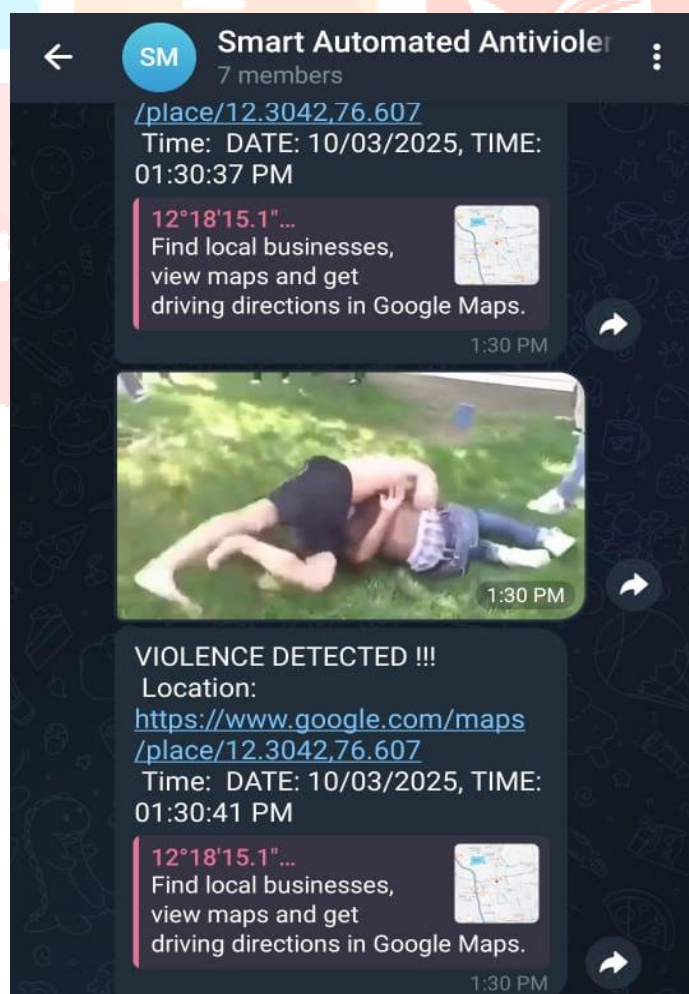


Figure 4.1: Violence detected alert



After implementing our system, we have the following results: In Figure 4.1, the characters seem to engage in a fight and thus an alert "Violence" is displayed. Additionally, we implemented the telegram bot that sends out alert upon detection of violence in deployed locations and alerts the concerned authorities. It sends the location and time along with a google map link to directly take to the pinpoint location.

## REFERENCES

- [1] Decker, M. R., et al. (2015). "Technology and Intimate Partner Violence: A Systematic Review." *Journal of Interpersonal Violence*.
- [2] Rivas, M. M., & García, L. M. (2020). "A Technology-Based Intervention to Improve Safety, Mental Health, and Empowerment Outcomes for Immigrant Women with Intimate Partner Violence." *Journal of Interpersonal Violence*.
- [3] García, M. M., & García, S. (2020). "Effectiveness of ICT-Based Intimate Partner Violence Interventions." *International Journal of Environmental Research and Public Health*.
- [4] Kuo, C., et al. (2017). "Using Mobile Technology to Improve Mental Health Outcomes: A Systematic Review." *Telemedicine and e-Health*.
- [5] Gagliano, C. E., & D'Amato, A. (2018). "A Mobile App for the Prevention of Intimate Partner Violence: User-centered Design and Evaluation." *Health Informatics Journal*.
- [6] Gibbons, M. M., et al. (2021). "The Role of Technology in Addressing Domestic Violence: A Review of the Literature." *Violence Against Women*.
- [7] Carbone, L., & Knafo, S. (2019). "Smart Technology and Domestic Violence: An Overview." *Journal of Family Violence*.
- [8] Klein, A. R. (2016). "The Impact of Technology on Domestic Violence: A Review." *Journal of Social Issues*.
- [9] Yoon, S. J., et al. (2018). "Mobile Apps for Intimate Partner Violence: A Scoping Review." *Journal of Medical Internet Research*.
- [10] Bonomi, A. E., et al. (2013). "The Role of Technology in the Prevention of Domestic Violence: A Review of the Literature." *Journal of Family Violence*.
- [11] Hossain, M., et al. (2018). "Digital Interventions for Violence Prevention: A Review." *Global Health Action*.
- [12] Chang, J. J., & Kwan, C. Y. (2020). "Using Mobile Technology to Support Survivors of Intimate Partner Violence: A Pilot Study." *Health Education Research*.
- [13] McGaw, K., & Hatzis, M. (2019). "The Use of Smart Technologies in Domestic Violence Interventions: A Review." *Social Work in Public Health*.
- [14] Shultz, C., et al. (2020). "Technology-Based Interventions for Violence Prevention: An Overview of Current Research." *Aggression and Violent Behaviour*.
- [15] Pritchard, A. J., & Zatzick, D. F. (2019). "Telehealth Interventions for Domestic Violence: A Systematic Review." *Psychological Trauma: Theory, Research, Practice, and Policy*.