World Journal of Advanced Engineering Technology and Sciences

eISSN: 2582-8266

Cross Ref DOI: 10.30574/wjaets

Journal homepage: https://wjaets.com/

(RESEARCH ARTICLE)

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Real-time crime detection system using yolo

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World Journal of Advanced Engineering Technology and Sciences, 2025, 15(02), 570-579

Publication history: Received on 26 March 2025; revised on 30 April 2025; accepted on 03 May 2025

Article DOI: https://doi.org/10.30574/wjaets.2025.15.2.0600

Abstract

In today's world, safety remains a critical concern, especially in public spaces like schools, offices, and streets. This project presents a smart AI-based surveillance system that uses computer vision to detect weapons in real time and respond immediately. Our system integrates a webcam with the YOLO(You Look Only Once) deep learning model to automatically identify weapons from live video feeds. Upon detection, it activates a buzzer, records video and audio, and sends an emergency email containing the user's live location to nearby authorities and predefined contacts. This immediate response helps in alerting both officials and nearby individuals, enabling faster and more accurate intervention. The goal is to shift from passive surveillance to proactive crime prevention, using intelligent technology to improve public safety and reduce the delay in emergency response.

Keywords: YOLO; Real-Time Detection; Deep Learning; Surveillance; Crime Prevention; Public Safety

1. Introduction

In today's rapidly changing world, the safety and security of individuals in public spaces such as schools, offices, and streets have become a major concern. With rising incidents of violence and weapon-related crimes, there is an urgent need for technologies that not only monitor surroundings but also respond instantly during emergencies. Traditional surveillance systems mostly record video footage and depend on human monitoring to identify threats, which often leads to delayed reactions and missed opportunities to prevent harm.

To address these limitations, this project proposes an intelligent, real-time crime detection system that utilizes deep learning and computer vision. The system is built using the YOLO (You Only Look Once) object detection model, known for its speed and accuracy in identifying objects from video frames. A standard webcam is connected to the system to continuously capture live footage, and the model analyzes each frame to detect the presence of dangerous weapons. Once a threat is identified, the system immediately triggers several actions: it sounds a buzzer to alert nearby individuals, starts recording both audio and video, and sends an emergency email with real-time location coordinates to nearby police stations, trusted contacts, and others who have the application.

This solution aims to reduce reliance on manual surveillance and enable quicker, more effective responses during emergencies. By combining artificial intelligence, location tracking, and communication services, the system provides a proactive approach to public safety. It represents a step toward creating safer environments through automation and real-time alert mechanisms.

The core functionality of the system relies on the YOLO (You Only Look Once) deep learning model, which is trained to detect weapons such as guns and knives from live video feeds. YOLO processes entire images in a single pass, making it highly efficient for real-time applications. The system is integrated with a webcam that constantly monitors the

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environment. As soon as a weapon is detected, multiple actions are triggered automatically to ensure quick response and evidence collection.

A buzzer sound is activated to alert people in the surrounding area. Simultaneously, the system starts recording video and audio for documentation and later investigation. An emergency alert email is sent to preconfigured contacts including police authorities and trusted individuals. The alert contains the live GPS location of the incident, making it easier for help to arrive quickly and accurately.

This project can be deployed in schools, offices, malls, or public places, where continuous manual monitoring is not feasible. It offers an automated, AI-powered safety solution to reduce the risk and impact of violent crimes.

1.1. Problem Statement

In recent years, the rise in criminal activities, especially involving weapons, has made safety a critical concern in public and private spaces.

- Increasing Threats and Public Safety Concerns: In today's world, crimes involving weapons are increasing at an alarming rate in both public and private areas. Places like schools, offices, shopping malls, and streets are becoming more vulnerable. People often feel unsafe, especially during odd hours or in less crowded places. This rising concern demands the use of advanced technology to improve security and reduce the risk of violent incidents before they occur.
- Limitations of Traditional Surveillance Systems: Most existing surveillance systems rely on CCTV cameras that only record video footage. These systems do not detect threats automatically and require continuous human monitoring, which is prone to human error or delay in response. In many cases, critical moments are missed, and action is taken too late. This manual process not only slows down the response but also increases the chances of serious damage or injury.
- Need for an Intelligent, Automated Solution: To solve these problems, there is a clear need for an automated system that can identify weapons in real-time and take immediate action. Using deep learning and computer vision, such a system can monitor video feeds continuously, detect threats instantly, and send alerts without human involvement. This smart, AI-based approach can help save lives by reducing response time and providing accurate, real-time information during emergencies.

To address safety challenges, our project introduces an intelligent, real-time system using YOLO that detects weapons through webcams. It offers a lightweight, cost-effective solution that triggers alerts instantly using standard hardware like webcams and microphones, enhancing public security without the need for complex or expensive infrastructure.

Objectives

This research aims to design and implement a real-time, AI-powered crime detection system capable of automatically identifying weapons using live video feeds. The system integrates deep learning with computer vision to create a smart, touchless safety response mechanism. The specific objectives of this project include:

- Detect weapons in real time using live webcam feeds and the YOLO deep learning model.
- Reduce human dependency by automating the surveillance and threat identification process.
- Trigger instant alerts through buzzer sounds and audio-visual recording upon weapon detection.
- Send emergency notifications via email with real-time GPS location to nearby authorities and pre-defined contacts.
- Improve response time during emergencies by providing timely alerts and evidence.
- Create a cost-effective and lightweight solution using commonly available hardware like webcams and microphones.
- Enhance safety in public places such as schools, offices, and crowded environments through proactive threat detection.
- Ensure easy integration and usability in existing security systems with minimal setup.

By achieving these objectives, the paper aims to enhance real-time crime detection by developing intelligent, accessible interfaces for improved public safety and response.

2. Literature review

2.1. Existing Methods

Existing models like traditional CCTV systems rely on manual monitoring and lack real-time threat detection. They only record video without automatic alerts, leading to delayed responses and limited effectiveness in preventing crimes or responding instantly during emergencies.

2.1.1. Traditional CCTV Surveillance:

Conventional surveillance systems involve the continuous recording of video footage through security cameras placed in key areas. These recordings are stored for later review, allowing authorities to examine incidents after they have occurred. However, these systems do not possess the capability to automatically detect threats or abnormal activities in real time. As a result, their effectiveness in preventing crimes is limited, since actions can only be taken after reviewing the recorded evidence.

2.1.2. Manual Monitoring

Many surveillance setups rely on security personnel to continuously watch live video feeds from multiple cameras. Their responsibility is to identify and respond to potential threats by observing any suspicious movements or activities. This method, however, heavily depends on human attention, which can be inconsistent over extended periods. Factors like fatigue, distraction, or oversight may lead to critical incidents going unnoticed, reducing the overall reliability of such systems.

2.1.3. Delayed Response Systems

In traditional monitoring environments, even if a threat is noticed, the process of raising an alert and initiating a response often involves delays. Security personnel must first confirm the situation before informing the appropriate authorities or taking further action. This delay can be critical in emergency scenarios where immediate intervention is necessary to prevent harm or damage.

2.1.4. Absence of Automated Alert Mechanisms

In A significant limitation in existing surveillance systems is the lack of built-in tools for automatic notifications. In most cases, there is no system in place to instantly alert nearby individuals, law enforcement, or family members when a dangerous situation arises. Without such mechanisms, valuable time may be lost before help arrives, increasing the potential risk during emergencies.

2.2. Proposed Method

The proposed model uses the YOLO deep learning algorithm to detect weapons in real-time. It automates alert systems with buzzer sounds, live recording, and emergency emails, improving security and response times.

2.2.1. Real-Time Weapon Detection and Automated Alerts

The system uses the YOLO deep learning model to instantly detect weapons through a live video feed, triggering an immediate buzzer alert to notify people nearby without human intervention.

2.2.2. Live Evidence Recording and Emergency Notification

On detecting a threat, it automatically starts recording video and audio while simultaneously sending an emergency email with the user's live location and incident details to predefined contacts

2.2.3. Enhanced Safety with Minimal Human Supervision

Designed to reduce manual monitoring, the system ensures continuous surveillance and rapid response, making it ideal for public places like schools, offices, and crowded areas.

2.3. System Overview

The core of this system relies on real-time data captured through various input streams to ensure accurate and timely weapon detection.

2.3.1. Video Stream (YOLO Algorithm)

A webcam captures live video, which is processed frame-by-frame using the YOLO (You Only Look Once) algorithm to detect weapons in real time with high accuracy.

2.3.2. Audio Stream (PyAudio/Sounddevice)

A microphone records sound only when a weapon is detected. This audio, captured using pyAudio or sounddevice, helps provide supporting evidence alongside video footage.

2.3.3. Location Data (Geopy/Geocoder)

The system fetches live GPS coordinates using Geopy or Geocoder and includes them in emergency emails to help responders locate the incident quickly.

2.4. Core Components

- Video Capture Module: Continuously captures real-time video from a webcam to provide a live feed for monitoring and detection.
- Weapon Detection Module: Uses the YOLO deep learning model to analyze video frames and detect weapons instantly with high accuracy.
- Alert and Notification Module: Triggers a buzzer sound, records video and audio, and sends an emergency email with live location details when a weapon is detected.

3. Methodology

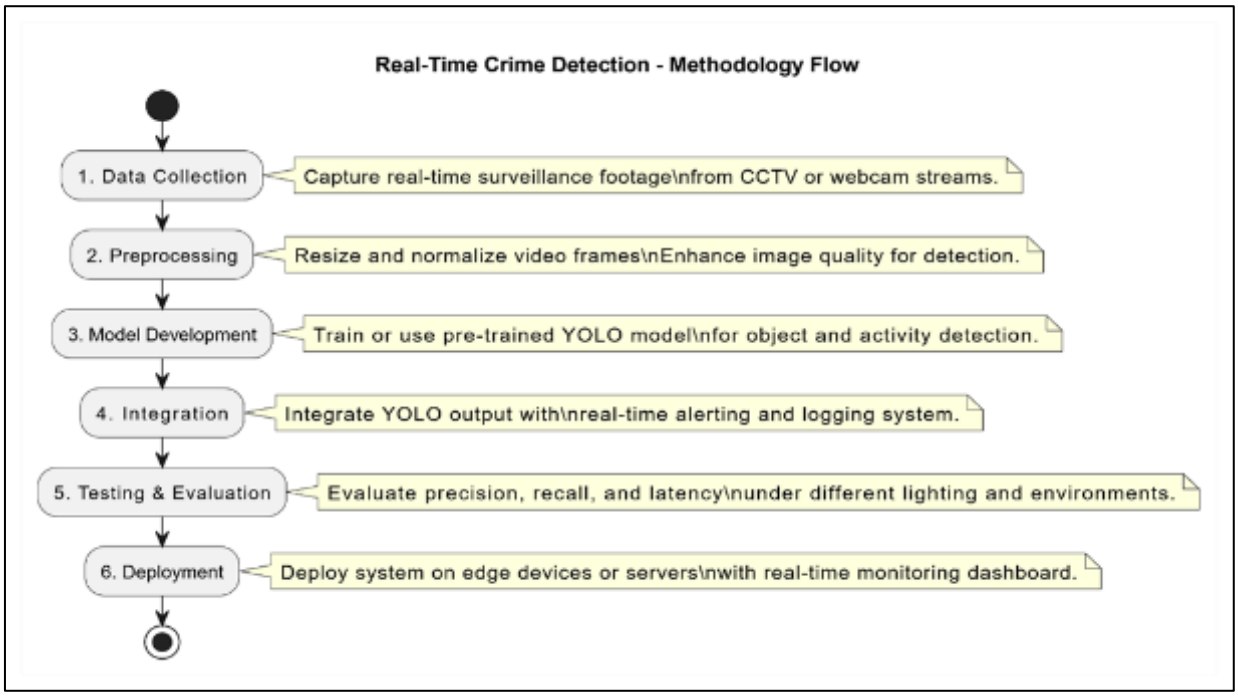

Figure 1 Methodology

The methodology of REAL-TIME CRIME DETECTION USING YOLO and DEEP LEARNING follows a systematic approach to enable real-time gesture and voice-based interaction:

- Input Acquisition
  - The system captures real-time video feeds through a webcam.
  - It functions continuously to monitor environments like schools, offices, or public spaces.
  - This feed serves as the primary data source for detecting potential threats such as weapons.
- Preprocessing
  - Captured video frames are resized, normalized, and enhanced to ensure uniformity.

  - Enhancements include contrast adjustment, noise reduction, and frame formatting.
  - This prepares the data for accurate and efficient processing by the YOLO model.
- Model Development
  - The system uses a YOLO-based object detection model (e.g., YOLOv3, v5, or v8) for weapon detection.
  - Either a pre-trained model or a custom-trained model on weapon datasets is used.
  - YOLO's speed and precision enable real-time detection with minimal latency.
- Integration
  - The trained model is integrated into a Python-based system that:
  - Plays a buzzer sound upon detection.
  - Records audio and video of the incident.
  - Sends an emergency email with the user's live location via GPS (using geopy/geocoder).
  - Integration bridges the model's output with real-time alert and response mechanisms.
- Testing & Evaluation
  - The system is tested under various environments and lighting conditions. Metrics such as precision, recall, and latency are evaluated to check detection performance and real-time responsiveness. This step ensures reliability before actual deployment.
- Deployment
  - The solution can be deployed on laptops or edge devices.
  - It includes a real-time dashboard for visualizing live feeds and detection status.
  - Once deployed, the system operates autonomously and efficiently, ensuring continuous surveillance.

This approach ensures a smooth, real-time, and touch-free user experience that can adapt to various environments and user needs.

3.1. System Architecture

The system architecture of our project consists of four main layers: Input, Processing, Decision & Alert, and Output. It begins with capturing live video through a webcam in the Input Layer. The Processing Layer extracts and preprocesses frames before using the YOLO model for real-time weapon detection. The Decision & Alert Layer classifies threats and triggers actions like alerts and data logging. Finally, the Output Layer handles emergency notifications via email/SMS, law enforcement alerts, and a monitoring dashboard.

3.1.1. System Components:

Input Layer

- Component: Live Video Stream
- This is where the system starts—by capturing continuous video from a webcam or surveillance camera.
- Acts as the raw data source for crime detection.

Processing Layer

- Frame Extractor:
  - Breaks down the live stream into individual frames for analysis.
- Preprocessing Module:
  - Enhances and prepares frames through operations like resizing, normalization, and contrast adjustment.
- YOLO Model (Object & Threat Detection):
  - The core of your system.
  - Performs real-time object detection (e.g., identifying weapons) with high speed and accuracy.

Decision & Alert Layer

- Threat Classifier:
  - Evaluates detection results to classify if an object is a threat, such as a weapon.
- Alert Generator:
  - If a threat is identified, it triggers responses like buzzers, video/audio recording, and emergency alerts.
- Database Logger:
  - Stores detection events in a database for later review, analysis, or reporting.

Output Layer

- Law Enforcement Notification:
  - Sends critical alerts to authorities in real-time.
- Dashboard UI:
  - Displays the current status and live detection feed.
- Email/SMS Alerts:
  - Sends emergency alerts with location and evidence to pre-set contacts via email or SMS.

User Interface:

The User Interface (UI) of the Real-Time Crime Detection System is designed to be simple, intuitive, and effective for live monitoring. It displays the live video feed from the webcam along with real-time detection alerts when a weapon is identified. The UI may also show the detection status, timestamp, and threat classification result for each event. Additionally, it includes access to recorded audio/video files and a dashboard view for monitoring alerts and system health. This helps users (like security personnel) respond quickly and track past incidents efficiently.

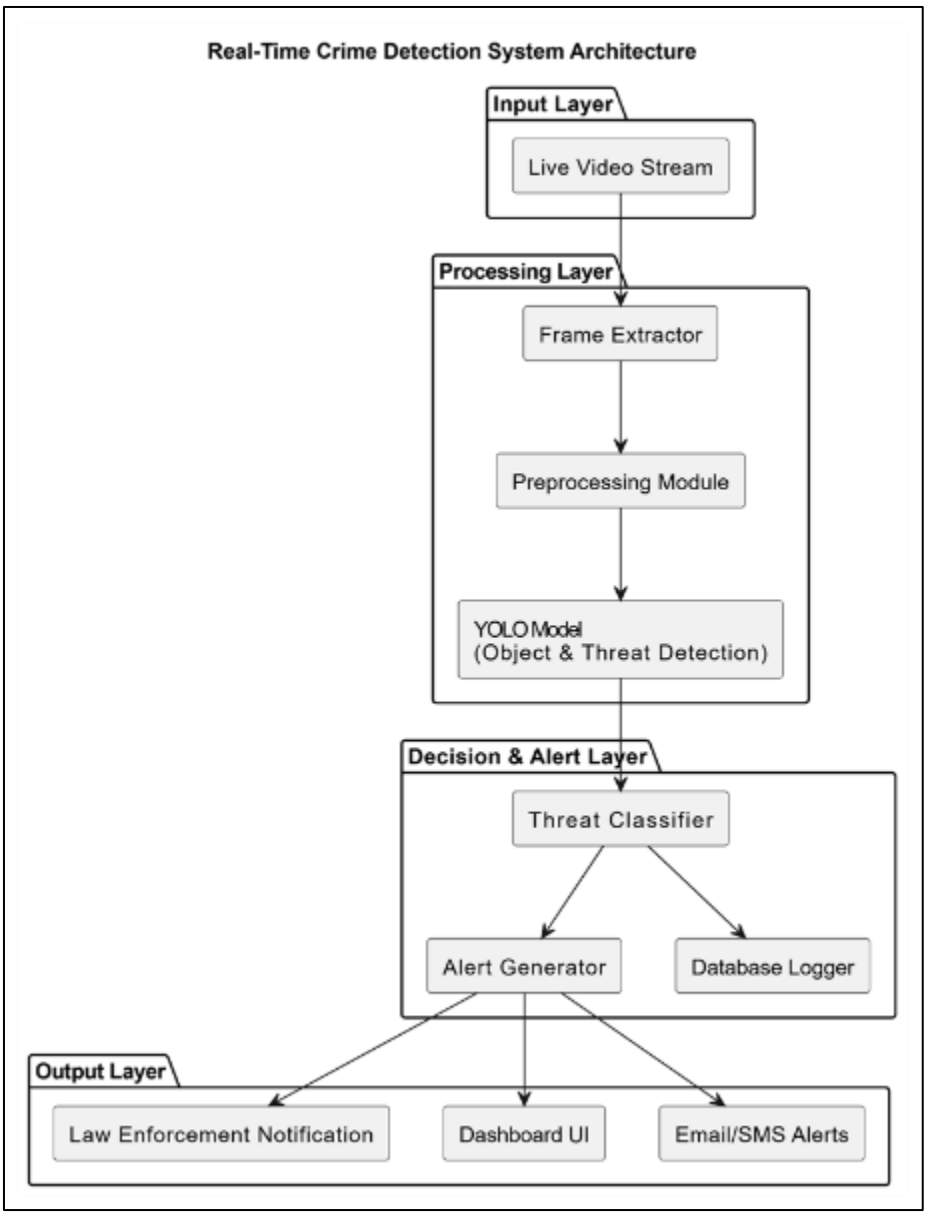

Figure 2 System Architecture

This layered design ensures that your system is modular, scalable, and real-time, enabling quick response to criminal activities with minimal human intervention.

4. Results and Discussion

Figure 3 GUI Interface

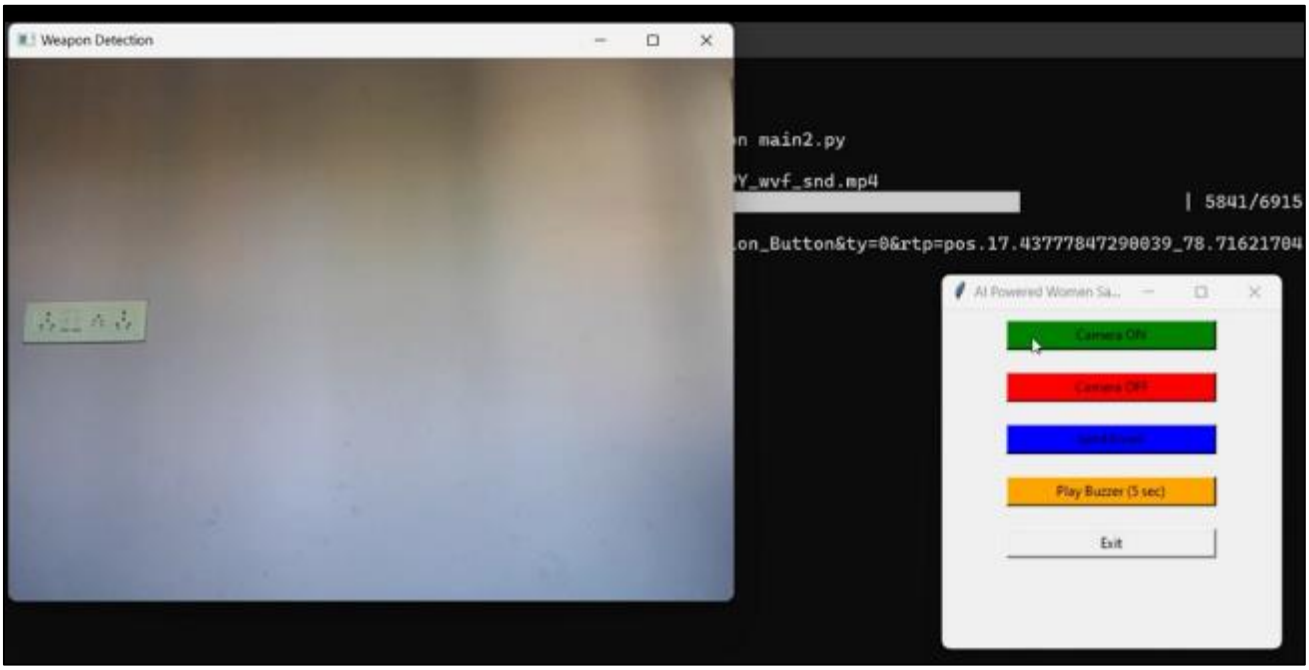

Figure 4 Activating Camera

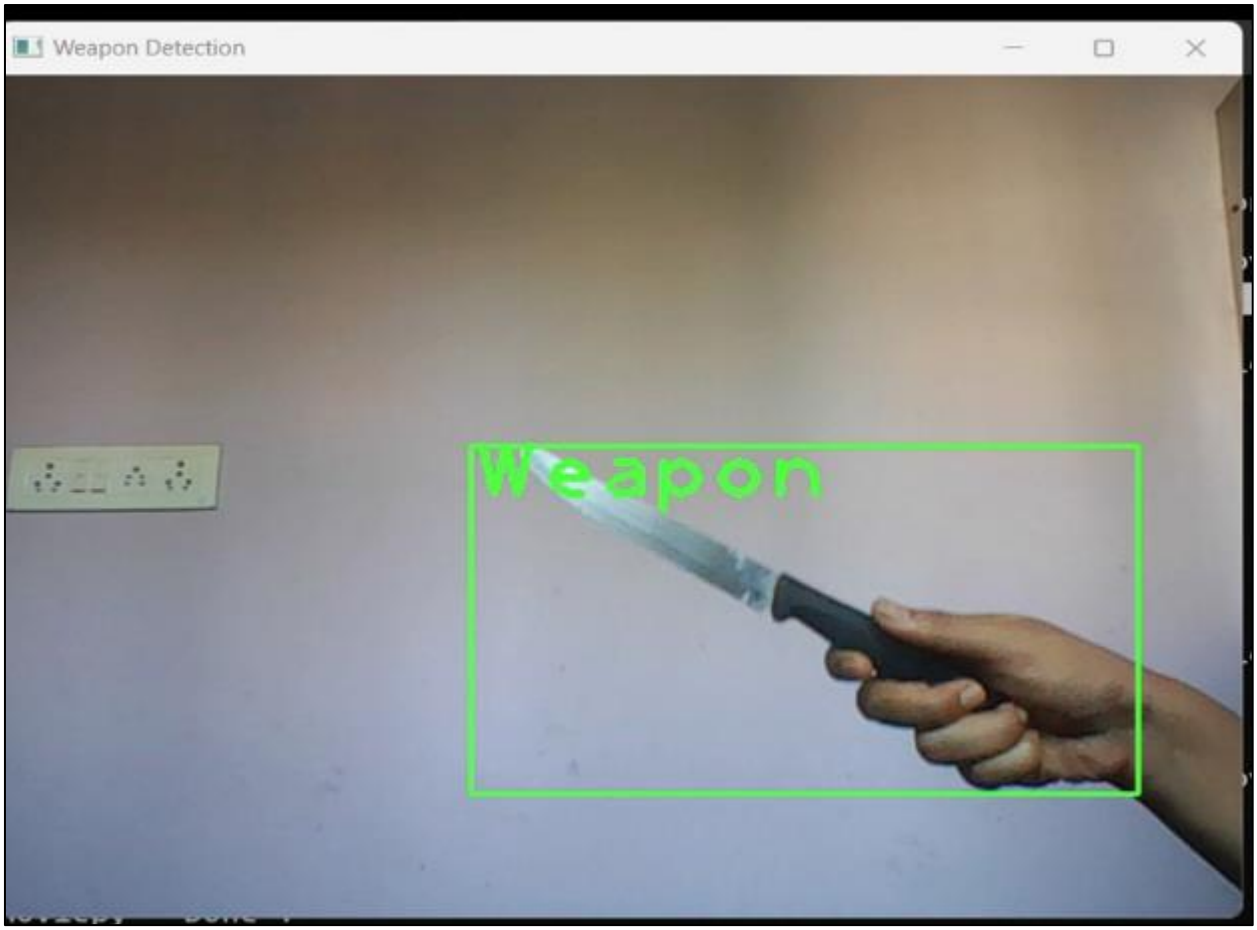

Figure 5 Weapon Detection

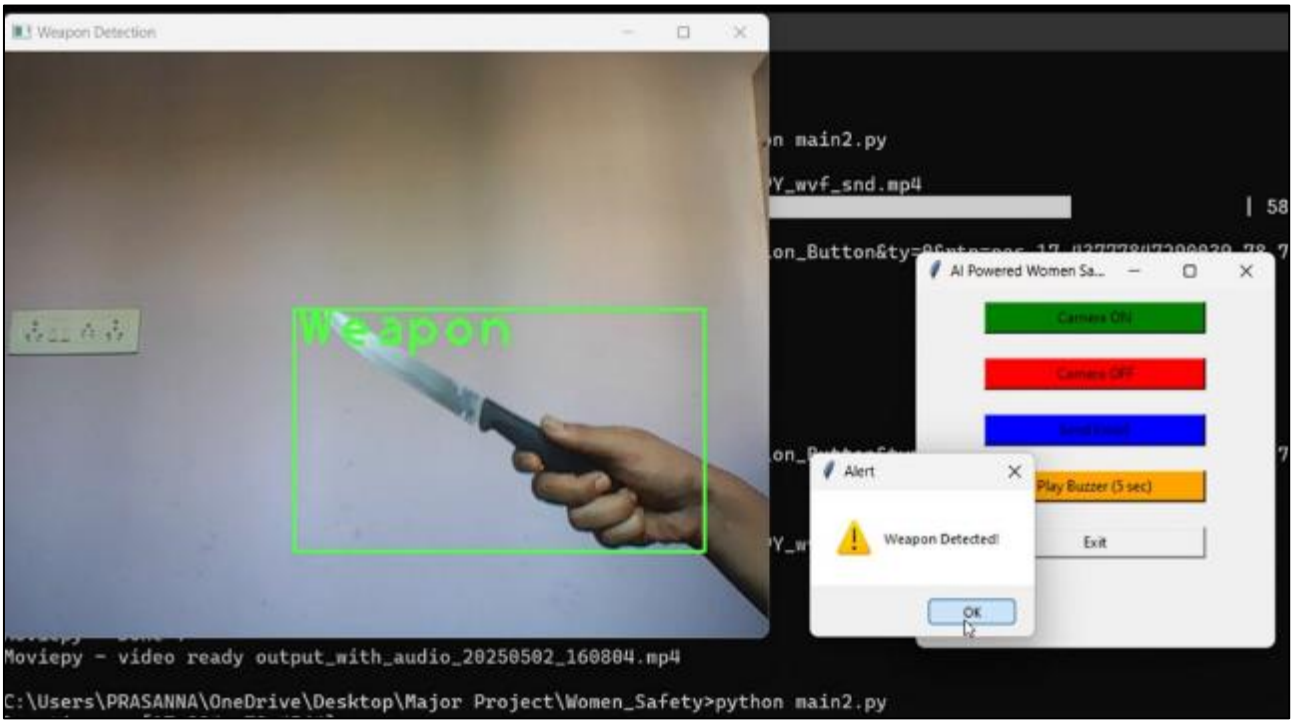

Figure 6 Weapon Detection and Altering

```
Microsoft Windows [Version 10.0.22631.5189]
(c) Microsoft Corporation. All rights reserved.

C:\Users\PRASANNA\OneDrive\Desktop\Major Project\Women_Safety>python main2.py
Moviepy - Building video output_with_audio_20250501_195642.mp4.
MoviePy - Writing audio in output_with_audio_20250501_195642TEMP_MPY_wvf_snd.mp4
MoviePy - Done.
Moviepy - Writing video output_with_audio_20250501_195642.mp4

Moviepy - Done !
Moviepy - video ready output_with_audio_20250501_195642.mp4
location==> [17.384, 78.4564]
https://www.bing.com/maps?mepi=127%7EDirections%7EUnknown%7EDirection_Button&ty=0&rtp=pos.17.43777847290039_78.716217041
01562__ACE+Engineering+College__e_%7E&mode=d&v=2&sV=1&cp=17.43779%7E78.716231&lvl=14.5
Email sent successfully.
```

Figure 7 Email Alert Generation triggered after Weapon Detection

Figure 8 Altering Email

5. Conclusion

The Real-Time Crime Detection System using YOLO offers an efficient and automated solution for public safety. By leveraging live video streaming and advanced object detection, it identifies weapons in real-time and triggers immediate alerts, including sound alarms, recordings, and emergency notifications with location details. This reduces dependency on manual monitoring and enhances rapid response during critical situations. The system is highly useful in sensitive environments like schools and offices, ensuring increased security and faster action against potential threats or crimes.

Compliance with ethical standards

Disclosure of conflict of interest

There is no conflict of interest.

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Author's short biography

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