SMART SURVEILLANCE USING VIDEO ANALYTICS

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ABSTRACT - The Smart Surveillance Using Video Analytics project is an AI-based web application developed to improve public safety by automatically detecting weapons (guns and knives) and fire from live or recorded video. The system uses Artificial Intelligence (AI), Computer Vision, and the YOLO deep learning model for fast and accurate object detection. It is built using the Flask framework, with SQLite/MySQL for storing user information and detection logs. OpenCV is used for video capture and image processing, while HTML, Tailwind CSS, and JavaScript create a simple and responsive user interface. The system provides real-time monitoring, instant alerts, secure user login, video upload, and detection history. It reduces the need for continuous human monitoring and helps authorities respond quickly to emergencies. The modular design also supports future enhancements such as facial recognition, smoke detection, crowd monitoring, and cloud storage, making it a reliable and cost-effective solution for modern surveillance systems

KEYWORDS: Artificial Intelligence (AI), Computer Vision, Deep Learning, Smart Surveillance, Video Analytics, Weapon Detection, Fire Detection, YOLO, Real-Time Object Detection, OpenCV, Flask, Image Processing, Security Monitoring, Threat Detection, Automated Alert System.

INTRODUCTION

Smart surveillance systems are designed to improve security by automatically monitoring public and private spaces. With advancements in Artificial Intelligence (AI), Computer Vision, and Deep Learning, real-time detection of weapons and fire has become faster and more accurate. This

project combines intelligent video analytics with AI-based object detection to identify guns, knives, and fire from live or recorded video streams. The proposed system enhances public safety by generating instant alerts whenever a potential threat is detected, reducing the need for continuous manual monitoring. It also provides secure user authentication, detection history, and real-time surveillance through a simple web interface. By improving threat detection and emergency response, the system offers a reliable, scalable, and cost-effective solution for security in public places, educational institutions, industries, hospitals, transportation hubs, and commercial organizations.

LITERATURE SURVEY

Smart surveillance systems have gained significant attention in recent years due to rapid advancements in Artificial Intelligence (AI), Computer Vision, and Deep Learning technologies. A smart surveillance system is designed to automatically monitor live or recorded video streams and identify potential security threats without continuous human supervision. The core concept of smart surveillance is to use intelligent video analytics for real-time detection of weapons such as guns and knives, as well as fire, enabling faster and more accurate threat identification. By combining AI-powered object detection with modern web technologies, the system improves public safety, enhances surveillance efficiency, reduces manual monitoring, and supports quick emergency response. Such systems are widely applicable in public places, educational institutions, hospitals, industries, transportation hubs, and commercial organizations, providing a reliable, scalable, and cost-effective solution for modern security management.

RELATED WORK

Several researchers have contributed to the development of smart surveillance systems to improve public safety, security, and automated threat detection. Early surveillance systems mainly relied on CCTV cameras and continuous human monitoring, making them time-consuming, labor-intensive, and prone to human error. These traditional systems provided only video recording and required security personnel to identify suspicious activities manually. With the advancement of Artificial Intelligence (AI), Computer Vision, and Deep Learning, modern surveillance systems can automatically detect threats such as weapons (guns and knives) and fire in real time. AI-based object detection models, such as YOLO, have significantly improved the speed and accuracy of threat identification. These

intelligent surveillance systems reduce manual effort, provide instant alerts, and enhance emergency response, making them more reliable, efficient, and suitable for modern security applications.

EXISTING SYSTEM

The existing surveillance systems mainly depend on CCTV cameras and continuous human monitoring to identify security threats. Security personnel must constantly observe live video feeds, making the process time-consuming, labor-intensive, and prone to human error. Traditional systems only record videos and do not automatically detect dangerous situations such as weapons or fire. As a result, critical incidents may go unnoticed or be detected too late, delaying emergency response. These systems also lack intelligent threat analysis, real-time alerts, and automated monitoring capabilities. Additionally, reviewing recorded footage after an incident is inefficient and requires significant effort. Overall, the existing surveillance systems lack advanced AI-based detection, intelligent automation, and instant threat notification, reducing their effectiveness in ensuring public safety and security.

PROPOSED SYSTEM

The proposed system implements an AI-based smart surveillance system for the real-time detection of weapons (guns and knives) and fire using video analytics. It continuously monitors live or recorded video streams through surveillance cameras and automatically identifies potential threats using the YOLO deep learning model. Whenever a weapon or fire is detected, the system immediately generates an alert, enabling a faster emergency response. The application is developed using the Flask framework, with OpenCV for video processing and SQLite/MySQL for securely storing user information and detection logs. The system also provides secure user authentication, live monitoring, video upload, and detection history through a simple web interface. By reducing the need for continuous manual monitoring and providing intelligent threat detection, the proposed system improves surveillance efficiency, enhances public safety, and offers a reliable, scalable, and cost-effective solution for modern security applications.

SYSTEM ARCHITECTURE

The architecture of the Smart Surveillance Using Video Analytics system consists of surveillance cameras, a video processing module, a YOLO-based detection module, a database, an alert generation module, and a web application. The surveillance camera captures live or recorded video and sends it to the video processing module, where OpenCV preprocesses each frame. The

processed frames are then passed to the YOLO deep learning model, which detects weapons (guns and knives) and fire in real time. When a threat is detected, the system generates an instant alert and records the detection details in the SQLite/MySQL database. The Flask-based web application provides secure user authentication, live monitoring, video upload, and detection history. This architecture enables fast, accurate, and automated threat detection, improving surveillance efficiency and ensuring quick emergency response in various public and private environments.

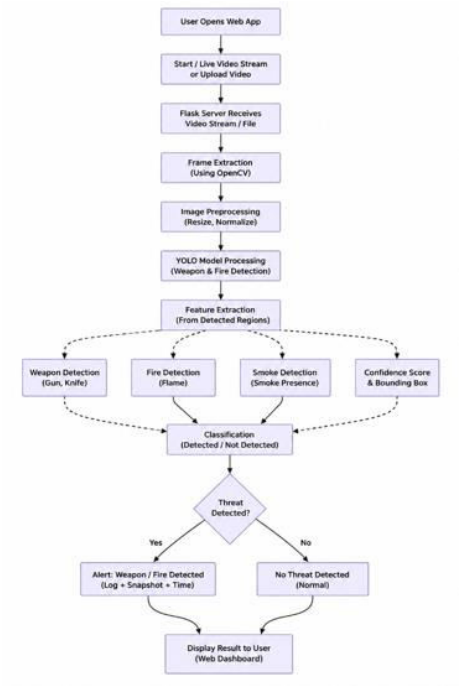

Fig 1: System Architecture

METHODOLOGY DESCRIPTION

The methodology of the Smart Surveillance Using Video Analytics system is designed to provide intelligent monitoring and automated threat detection using Artificial Intelligence (AI) and Computer Vision technologies. The system follows a structured approach that includes video acquisition, frame preprocessing, object detection, threat analysis, alert generation, and data storage. Live or recorded video is captured through surveillance cameras and processed using OpenCV. The processed frames are then analyzed by the YOLO deep learning model to detect weapons (guns and knives) and fire in real time. When a threat is identified, the system immediately generates an alert and stores the detection details in the SQLite/MySQL database. The Flask web application allows users to monitor live video, upload recordings, and view detection history, ensuring efficient, accurate, and reliable surveillance.

RESULT AND DISCUSSION

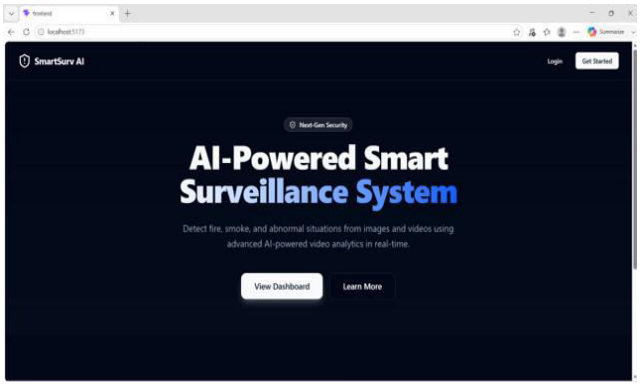

Fig 2: Home Page

The home page of the Smart Surveillance System serves as the primary interface for

users to access the application and its core features. It provides a user-friendly dashboard with options for login, navigation, and real-time AI-powered surveillance functions such as fire, smoke, and abnormal situation detection.

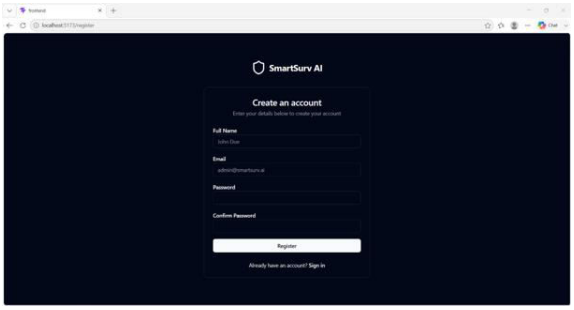

Fig 3: Register Page

The registration page allows new users to create an account by providing their full name, email address, and password. It ensures secure user authentication by validating the entered information before account creation. This page provides authorized users with secure access to the Smart Surveillance System and its monitoring features.

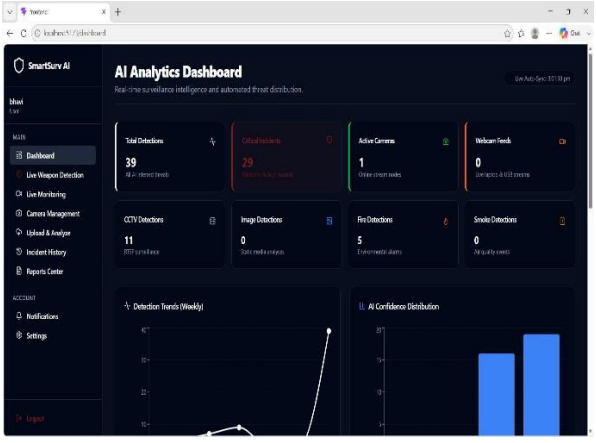

Fig 4: Dashboard Page

The Dashboard page provides a real-time overview of the surveillance system by displaying detection statistics, active cameras, and critical security incidents. It presents AI-generated analytics through charts and graphs, enabling users to monitor weapon, fire, and smoke detection efficiently. The dashboard helps security personnel analyze threats, track system performance, and make quick decisions for effective surveillance.

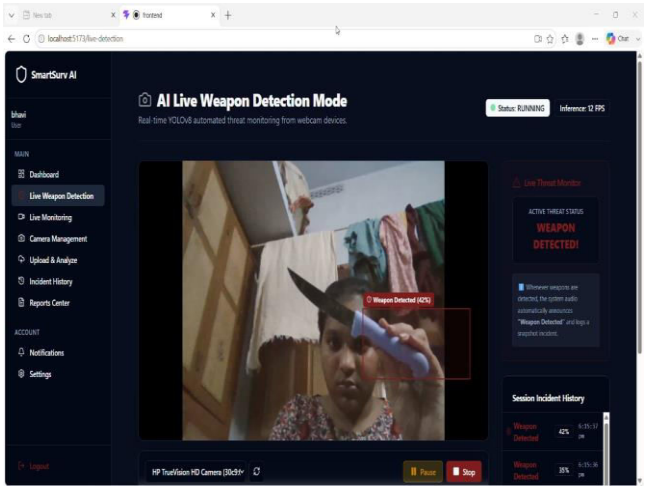

Fig 5: Weapon detection Page

The Live Weapon Detection page performs real-time monitoring using a webcam and the YOLOv8 deep learning model to detect weapons such as guns and knives. When a weapon is identified, the system highlights the object with a bounding box, displays the detection confidence, and generates an instant threat alert. It also records the detected incidents in the session history, enabling continuous surveillance and rapid response to potential security threats.

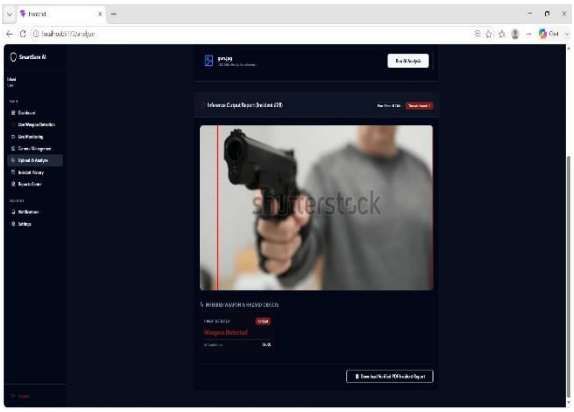

Fig 6: Upload & Image Page

The Upload and Analyze page enables users to upload images for AI-based weapon detection using the YOLOv8 model. After analysis, the system identifies weapons, displays the detection confidence and threat level, and highlights the detected object with a bounding box. It also generates a detailed incident report that can be downloaded for documentation and further investigation.

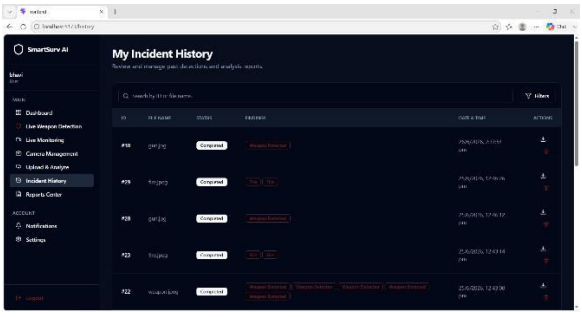

Fig 7: Incident History Page

The Incident History page maintains a complete record of previously detected incidents, including weapon and fire detections, along with their date, time, and status. It allows users to search, filter, view, download, or delete incident reports for efficient monitoring and record management. This feature helps security personnel review past events, analyze threats, and maintain surveillance documentation.

CONCLUSION

The AI-driven Smart Surveillance System using Video Analytics enhances public safety by automatically detecting weapons such as guns and knives in real-time video streams. Using advanced computer vision and deep learning techniques, the system identifies potential threats, generates instant alerts, and supports quick response from security personnel. By enabling continuous monitoring and reducing human error, the system provides a reliable, efficient, and intelligent surveillance solution for improving security in public and restricted areas.

FUTURE SCOPE

The proposed AI-driven Smart Surveillance System using Video Analytics can be further enhanced by integrating advanced deep learning models to improve the accuracy of weapon detection in complex environments. Future versions can support the detection of a wider range of suspicious activities, such as fights, intrusions, abandoned objects, and unusual human behavior. The system can be integrated with cloud storage and mobile applications for

remote monitoring and real-time alert notifications. Support for multiple surveillance cameras, edge computing, and IoT-based security devices can improve scalability and response time. Additionally, incorporating facial recognition, person tracking, and predictive threat analysis can make the system more intelligent, reliable, and effective for public safety and security.

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