Real-Time Cigarette Detection In Video Streams Using YOLO And RTSP Integration

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Abstract -To facilitate seamless IP camera surveillance in public and commercial contexts, this project presents a real-time cigarette identification system for video streams using YOLOv5 combined with RTSP. To effectively detect smoking behaviour, we trained the model on a custom dataset by utilizing YOLOv5's speed and accuracy. The system handles difficult situations like changing lighting and occlusions while processing video frames, applying object detection, and tracking smoking incidents. This scalable system addresses lifestyle-related health hazards and promotes safer settings by supporting applications in public space management, security, and health monitoring.

Key Terms— IP, YOLO, RTSP Integration.

I. INTRODUCTION

Enforcing smoking bans in public spaces is critical for public health and safety, particularly in areas where passive smoke affects vulnerable groups, including children and individuals with respiratory issues.

Despite regulations, smoking in restricted areas remains a common issue, largely due to the limitations of traditional surveillance systems, which depend on human monitoring to identify prohibited behavior. Manual methods are both resource-intensive and prone to human error, often resulting in delayed or missed detections.

This project aims to bridge these gaps by developing an automated, real-time cigarette detection system that leverages AI and video streaming technologies.

With the use of RTSP (Real-Time Streaming Protocol) for video feeds and YOLO (You Only Look Once), a deep learning model renowned for its speed and accuracy, this solution will allow for continuous monitoring and immediate notifications, enabling prompt responses to instances of smoking in prohibited places.

II. SCOPE OF THE PROJECT

This project's scope includes everything from data preparation and model training to system integration and performance optimization in order to construct a real-time cigarette detection system. To make sure the model can effectively generalize to a range of real-world situations, we will gather and annotate a broad dataset of cigarette photos.

A YOLOv5 object detection model will be developed, trained, and fine-tuned on this dataset to achieve high accuracy. Integration with RTSP will enable the system to process live video streams from IP cameras, ensuring continuous surveillance. The system will overlay detection results on video feeds, and an automated alert mechanism will be designed to notify authorities in real time.

Additionally, performance testing and optimization will ensure the system is scalable and efficient across different hardware platforms, including high-end servers and edge devices. The project does not extend to smoke detection or post-event analysis but will focus on real-time cigarette identification.

III. EXISTING SYSTEM

For the project Real-Time Cigarette Detection in Video Streams Using YOLO and RTSP Integration, several existing techniques have been developed over time, each utilizing a range of strategies from traditional image processing to sophisticated deep learning models.

Earlier systems relied heavily on traditional image processing techniques to detect smoking behaviour. Traditional methods typically involve image processing steps like edge detection, colour segmentation, and morphological operations to locate objects.

After separating the object from its backdrop using techniques like thresholding or background subtraction, feature extraction techniques (like Histogram of Oriented

Gradients, or HOG) are frequently employed to capture the distinctive qualities of the object.

Following feature extraction, these features can be classified using machine learning models such as Support Vector Machines (SVM) or k-Nearest Neighbours (KNN).

Limitations of Existing System:

However, detecting cigarettes using these methods is particularly challenging because cigarettes are often small, partially occluded, or held at various angles, making them hard to distinguish from the background or other objects.

IV. LITERATURE SURVEY

Patel et al. (2022) [1] focused on optimizing the YOLO model for deployment on edge devices, which is crucial for the scalability of our cigarette detection system. Patel and Patel explored various techniques, including model pruning and quantization, to enhance the model's speed without compromising accuracy. Their findings are particularly relevant for ensuring that our system can run efficiently in resource-constrained environments while maintaining high detection performance.

Chen et al. (2021) [2] presented a hybrid method for cigarette detection in this study that combines deep learning and conventional image processing approaches. The authors gave examples of how preprocessing techniques like edge detection and background subtraction can improve deep learning models' accuracy. Their research emphasizes the importance of preprocessing in improving the effectiveness of YOLO, guiding the methodology for integrating YOLO with RTSP in our project for improved real-time detection.

Liu et al. (2020) [3] focused on developing a CNN-based framework specifically for cigarette detection in images. The authors discussed various challenges associated with detecting small and partially occluded objects in cluttered environments. They highlighted the necessity of a comprehensive dataset and robust data augmentation techniques to improve the model's generalization capabilities. This research is particularly relevant as it informs the dataset creation and training strategies for the YOLO model in our project.

Gupta et al. (2019) [5] examined the integration of deep learning models with RTSP to facilitate real-time video analysis. Their work detailed the technical aspects of using OpenCV and GStreamer for efficient video streaming and processing. The authors illustrated that integrating these technologies could lead to significant improvements in the responsiveness of surveillance systems, aligning with our project goals of developing an efficient cigarette detection system utilizing live video feeds.

Wang et al. (2019) [6] provided a comprehensive overview of performance metrics relevant to real-time object detection systems. They discussed the importance of metrics such as precision, recall, and frames per second (FPS) for evaluating system performance. This work serves as a guideline for assessing the effectiveness of our proposed cigarette detection system and ensuring that it meets the requirements for real-time applications.

Hassan, et al. (2018) [7] applied the YOLO model to detect suspicious activities in public areas, demonstrating its effectiveness in a surveillance context. The authors conducted experiments that highlighted the model's capability to detect various objects with high precision and minimal latency. Their results indicate that YOLO can effectively be integrated into real-time monitoring systems to enhance security measures, which is directly relevant to the proposed cigarette detection project.

V. PROPOSED SYSTEM

The project "Real-Time Cigarette Detection in Video Streams Using YOLO and RTSP Integration" has an approach that is designed to efficiently and accurately detect smoking activity in live surveillance footage. To manage continuous video data from monitoring cameras, it combines Real-Time Streaming Protocol with the potent YOLOv5 object identification model.

Real-time video streams are first recorded from RTSP-capable cameras positioned in observation locations. At regular intervals, these video streams are divided into individual frames. After that, each frame undergoes preprocessing to conform to the input requirements of the YOLOv5 model, which includes scaling, normalization, and color space conversion.

Overall, by utilizing cutting-edge computer vision and artificial intelligence, our method supports improved adherence to anti-smoking laws by identifying smoking behavior in dynamic contexts quickly, scalable, and accurately.
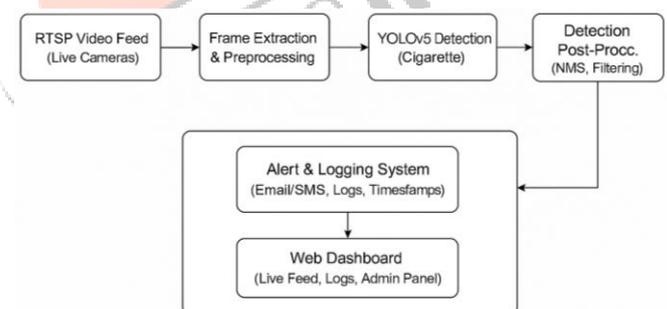

Figure 1: Proposed System

VI. SYSTEM ARCHITECTURE

The system architecture for this research combines deep learning-based object detection with live video stream processing to perform real-time cigarette detection with excellent accuracy and efficiency. The first step in the system is the capture RTSP video feeds from security cameras placed in public or restricted areas.

To balance performance and detection responsiveness, individual video frames are sampled at predetermined intervals from these constantly captured streams before being sent to the frame extraction module. Following extraction, every frame is sent to the preprocessing

unit for color correction, scaling, and normalizing in order to conform to the input format needed by the detection model.

A YOLOv5 object detection module, which has been pre-trained and optimized on a dataset of annotated cigarette images, receives the processed frames after processing. Each frame is processed using YOLOv5, which produces bounding boxes, class labels, and confidence scores for items that are detected.

The system uses Non-Maximum Suppression, which removes redundant detections and guarantees that only the most accurate bounding boxes are kept, to improve the output and lower false positives. The alarm generation module is triggered upon successful detection of a cigarette. This module notifies the appropriate authorities by email or SMS of the detection details, including the timestamp, camera ID, and frame.

A web-based dashboard is another component of the system that allows for real-time monitoring. Administrators can effectively manage and assess occurrences thanks to the dashboard's presentation of live video feeds, detection logs, and system alarms.

The complete system may be set up on edge devices like the Raspberry Pi or Jetson Nano for localized, low-latency processing, or on cloud infrastructure for centralized surveillance. This architecture offers a workable way to enforce public smoking bans through intelligent surveillance since it guarantees end-to-end real-time detection, reliable processing of live video feeds, efficient alerting, and easy-to-use monitoring.
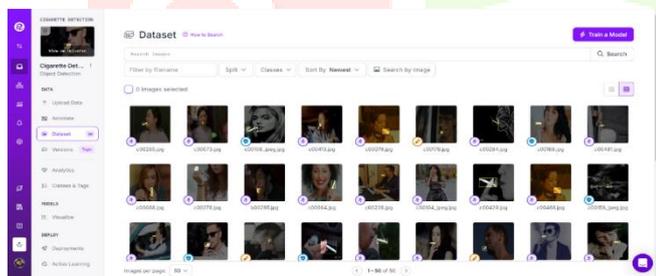
VII. RESULT AND ANALYSIS

Figure 2: Data Collection

Figure 2 illustrates the Data Collection and Preparation stage. We will compile an extensive and varied dataset by obtaining photos from public databases that show people smoking and personally recording video footage from security cameras in different settings.
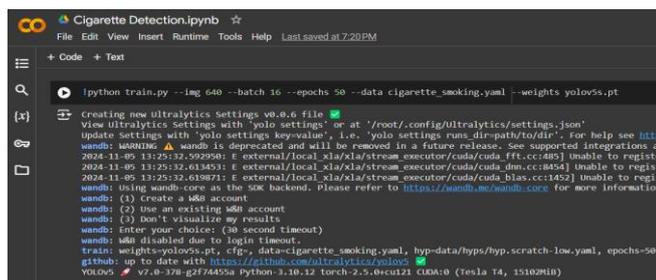

Figure 3: Training the algorithm

The YOLOv5 training algorithm is shown in Figure 3. With the help of Google Colab and GPU acceleration, it is trained effectively on a custom dataset. The trained model can be used to identify objects in images or video streams, making it a versatile tool for a variety of computer vision applications.
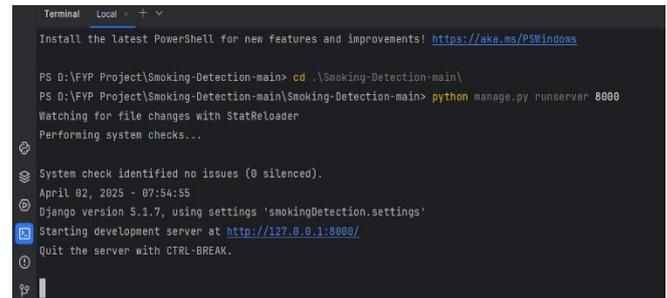

Figure 4: User Runs Django Server for Smoking Detection

The Django development server is being set up and operated in Figure 4's PowerShell terminal session. The user navigates to the project directory and runs the command, which launches the Django development server on port 8000.
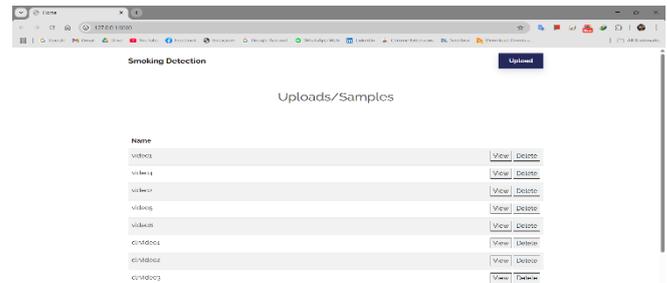

Figure 5: Smoking Detection System: Video Management Interface

Figure 5 shows a web interface for a Smoking Detection System, listing uploaded video samples (e.g., `video1`, `ctrvideo2`) with view and delete options for each file. This suggests a dashboard for managing and analyzing video data, likely used to detect smoking behavior in the uploaded footage.

Figure 6: Real-Time Smoking Detection System Performance Metrics

Figure 6 displays a real-time smoking detection system analyzing video footage at 10 frames per second (FPS). It has identified a cigarette with 86% confidence (score: 0.86), demonstrating the AI model's capability to detect smoking-related objects in live or recorded video streams with measurable accuracy.

VIII. CONCLUSION

In summary, the project "Real-Time Cigarette Detection in Video Streams Using YOLO and RTSP Integration" aims to tackle the challenge of monitoring smoking in public spaces through innovative technology. Utilizing the YOLO framework, the project focuses on achieving efficient and accurate cigarette detection in real-time video streams, a crucial aspect for effective surveillance and compliance with public health regulations.

By integrating RTSP (Real-Time Streaming Protocol), the system ensures seamless access to video feeds from various sources, enabling continuous monitoring of designated areas. The use of advanced computer vision techniques not only enhances detection accuracy but also allows for rapid processing of video data, making it suitable for dynamic environments where smoking policies need strict enforcement.

Throughout the project, various methodologies are employed, including the training of the YOLO model on specific datasets tailored to cigarette detection, ensuring the system can effectively identify smoking behavior in real-world conditions. It is expected that the outcomes will show the approach's viability and efficacy, opening the door for more study and advancement in this field. All things considered, this research not only marks a substantial advancement in the use of artificial intelligence for public health monitoring, but it also offers insightful information on the continuous initiatives to support smoke-free settings, which will ultimately result in healthier communities.

The successful implementation of this system could lead to broader applications, encouraging compliance with anti-smoking laws and enhancing the effectiveness of health regulations in public spaces.

IX. REFERENCES

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