REAL TIME OBJECT DETECTION USING YOLO

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ABSTRACT

Object detection is a crucial field in computer vision that aims to identify and locate multiple objects within an image or video and real time detection using camera. Traditional methods for object detection involve human designed features and complex algorithms, which can be both time-consuming and which leads to error. This project introduces an object detection system utilizing the YOLOv8 (You Only Look Once) model, a deep learning architecture known for its speed and accuracy. By integrating a web-based interface with user authentication and camera access, this ensures secure and user-friendly operation. The server-based deployment enables efficient real-time object detection without depending on high-end local hardware. This project enhances automation in object recognition tasks, improving both performance and scalability.

1.INTRODUCTION

Object detection is a difficult computer vision task that involves detecting and locating objects within images or video frames or and through the camera access. It is widely used in applications such as smart surveillance, autonomous driving, and monitoring. Traditional methods often require complex algorithms for feature extraction and manual monitoring, making them inefficient in dynamic environments. Furthermore, these methods will face problems with detecting small, overlapping, or fastlymoving objects, reducing their efficiency.

Recent improvements in deep learning, particularly the development of CNN(convolutional neural networks) models, haveimproved object detection accuracy and performance. YOLOv8, an algorithm object detection model, offers exceptional speed and precision by analyzing entire frames in a single forward pass through camera. This project integrates YOLOv8 with a server-based structure and integrating with the frontend authentication to enhance processing capabilities and enable real-time detection. The system's design includea

Doi:10.48047/ijiee.2025.15.5.56

secure user authentication mechanism, ensuring only authorized users can access the object detection features. This solution aims to improve detection speed, reduce false positives, and offer a more platform for various real-world applications[1-34].

2.PROBLEM STATEMENT

Traditional object detection systems face multiple problems, including slow performance, difficulty in detecting small or overlapping objects, and not efficient to environmental changes such as lighting variations or background. Additionally, existing systems often require extensive manual configuration, making deployment inefficient for real-time applications.

Moreover, the lack of secure access control in traditional systems poses a risk, as unregistered users can manipulate or misuse the system which leads to Inconsistency . This project aims to address these challenges by developing a secure, server-based object detection system that employs advanced CNN techniques through YOLOv8. The system improves detection accuracy, minimizes false positives, and ensures fast, automated identification of objects in real time camera detection.

3.LITERATURE SURVEY

Researchers[1] have explored various object detection techniques to improve accuracy and efficiency. One study highlights the effectiveness of CNNs in object detection by employing a region-based convolutional network (R-CNN) for feature extraction, achieving notable improvements in detection precision. However, this approach faced limitations in real-time performance due to its complex architecture and computational demands.

Another study[2] focused on improving object detection speed by utilizing the YOLO model, which processes entire images in a single pass. While this method demonstrated faster detection capabilities, early YOLO versions struggled with detecting smaller objects accurately. Researchers later enhanced the YOLO architecture by introducing anchor boxes and improved loss functions, significantly boosting performance in real-world scenarios.

Further research[3] explored the use of the YOLOv8 model, which integrates improved feature pyramids and deeper convolutional layers to enhance multi-scale object detection. This study achieved remarkable accuracy while maintaining real-time performance, making

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YOLOv8 an ideal candidate for fast-paced applications such as surveillance, robotics, and automated inspection.

Additional studies[4] experimented with hybrid models that combine CNNs with machine learning classifiers to improve detection robustness. For example, a model integrating CNN with Support Vector Machines (SVM) demonstrated improved precision for detecting objects under challenging conditions like low lighting or noisy backgrounds. Despite its success, this hybrid approach required extensive parameter tuning, limiting its scalability for real-time use.

These studies collectively emphasize the growing importance of CNN-based models, particularly YOLOv8, in enhancing object detection accuracy and performance. The combination of real-time processing and improved detection precision makes YOLOv8 an ideal choice for the system.

4.EXISTING SYSTEM

Conventional object detection systems often depend on traditional image processing methods, such as background subtraction and contour detection. This is effective in controlled environments, the approaches are struggling to maintain accuracy in dynamic scenes with changing object sizes, speeds, and environmental conditions like background and the lighting.

Deep learning models like earlier YOLO versions and R-CNN architectures have increased detection accuracy but remain computationally intensive, requiring powerful hardware to operate efficiently. Additionally, these systems often lack proper user authentication features, posing a problem of unauthorized access and manipulation.

5.PROPOSED SYSTEM

To overcome these limitations, this project introduces a server-based object detection system that uses the YOLOv8 model for improved accuracy and performance. This system integrates advanced CNN-based feature extraction to ensure precise detection of small, overlapping, and fast-moving objects. By operating on a dedicated server, the system processes video streams efficiently without requiring high-end hardware on the client side.

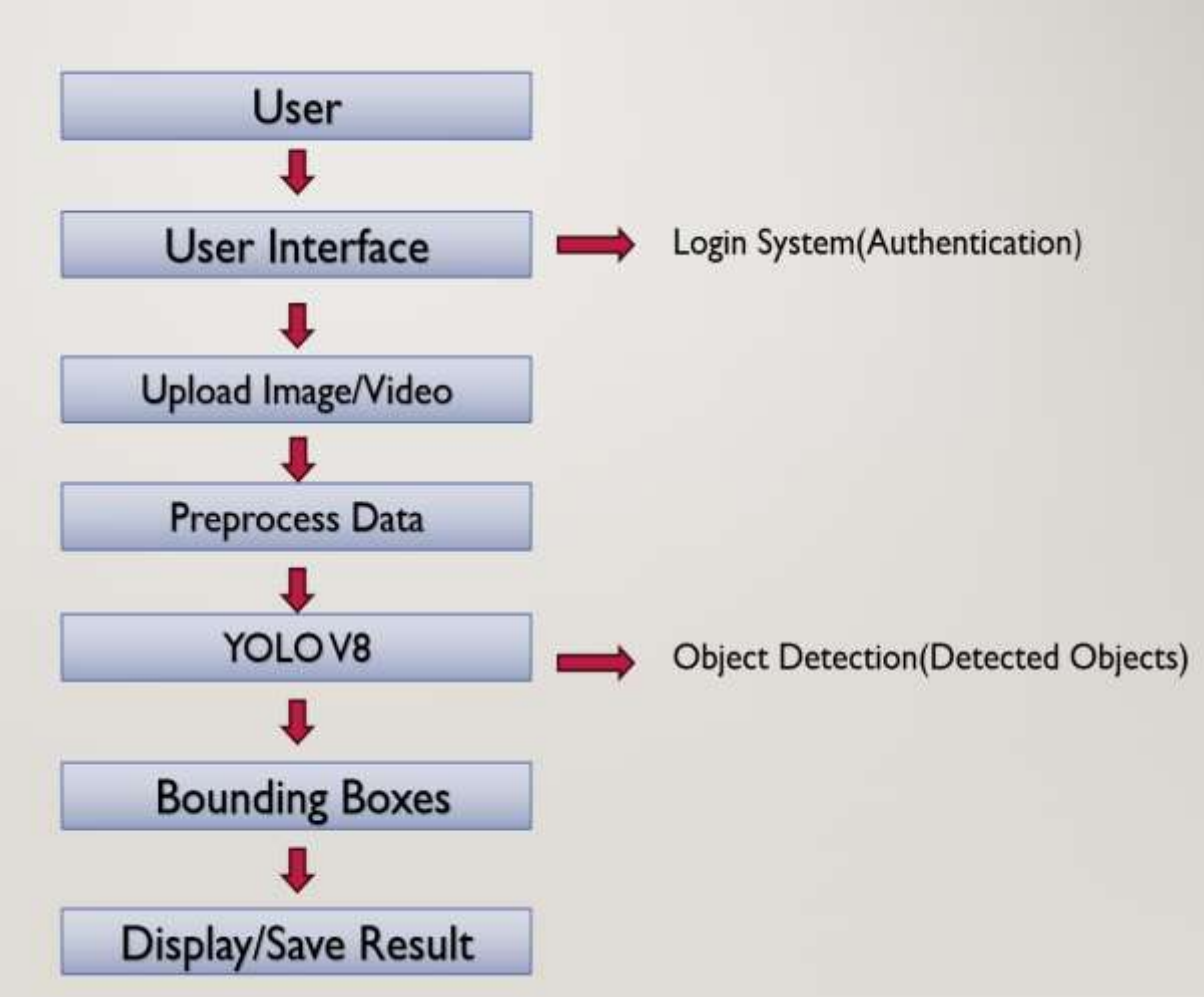
A secure user authentication system has been integrated to restrict access, ensuring only registered users can utilize the object detection platform. Users can log in, upload video feeds, and initiate object detection with ease. The system’s architecture allows seamless scalability, supporting multiple concurrent users without compromising performance.

Doi:10.48047/ijiee.2025.15.5.56

By incorporating improved feature extraction, enhanced dataset generalization, and server-based processing, this system provides a robust, secure, and efficient solution for real-time object detection applications.

6.METHODOLOGY

The object detection system follows a structured workflow designed for efficiency and accuracy:



1. **User Login:**Users must authenticate themselves with valid credentials to access the platform, ensuring secure access.
2. **Camera Access :**After logging in, users can activate their device camera feeds for detection.

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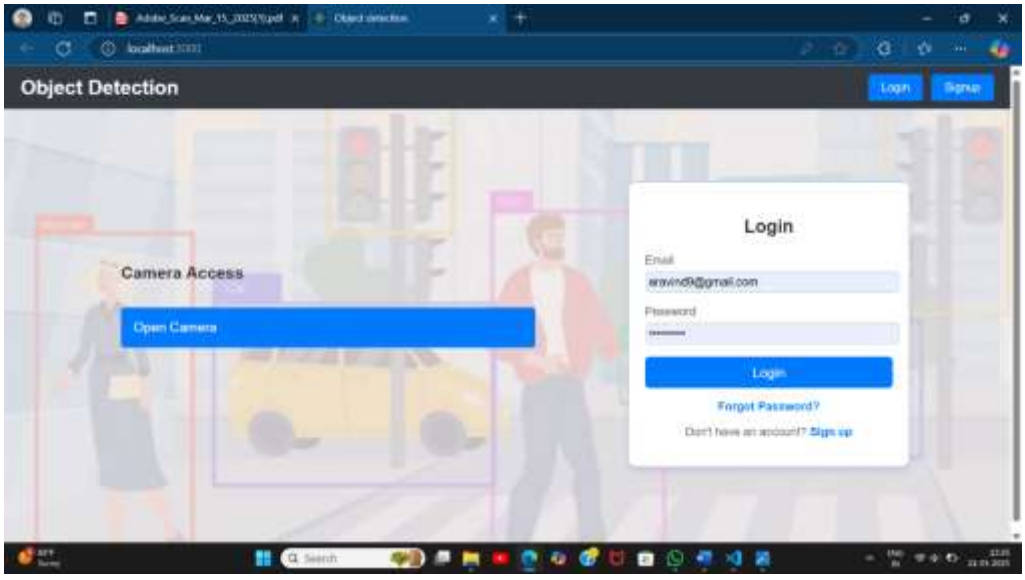
3. **Preprocessing:**after that it enhances the camera feed by adjusting brightness, contrast, and resolution to improve detection accuracy.
4. **Feature Extraction:** The YOLOv8 model analyzescamera frames, extracting key object features for accurate detection.
5. **Object Detection & Classification:** The model detects objects, assigns labels, that includes labelling and outlines their positions within the frame.
6. **Result Display:** The detected objects are highlighted directly within the rectangular boxes on the camera feed, ensuring real-time visualization for the user.

By integrating secure login access with efficient image processing and CNN-based detection, the system offers a fast, accurate, and user-friendly solution for real-time object identification.



8.ADVANTAGES

1. High Accuracy and Speed: The YOLOv8 model ensures precise detection with faster processing for real-time applications.

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2. Efficient Resource Management: The server-based architecture reduces the computational load on client devices.

3. Enhanced Security: User authentication ensures only registered users can access the system.

4. Adaptability: The system effectively handles varying conditions and identifies small or overlapping objects.

9.LIMITATIONS

1.Accuracy Challenges: Detection performance may decrease in poor lighting, low-resolution streams, or rapidly changing object positions.

2. Network Dependency: The system requires stable server connectivity, which may cause delays in low-network environments.

3. False Positives: Despite YOLOv8's improved accuracy, complex scenes may still trigger incorrect detections, requiring further model tuning.

4.Hardware Dependence: The system's performance may vary based on the server's processing power and hardware capabilities.

10.FUTUREWORK

Future enhancements for this system include improving object detection precision by integrating additional deep learning techniques such as Transformer models or improved data augmentation strategies. Implementing multi-object tracking capabilities will further enhance its usability in dynamic environments such as traffic surveillance or monitoring.

Additionally, integrating a comprehensive database to store the registered user details enhancing the user interface for better visualization are planned improvements. Increasing dataset diversity and refining model parameters will ensure the system's adaptability to various real-world conditions.

11.CONCLUSION

This project presents a secure, server-based object detection system utilizing the YOLOv8 model for real-time object identification. By combining CNN-based feature extraction, secure login functionality, and scalable server processing, the system offers a robust solution for

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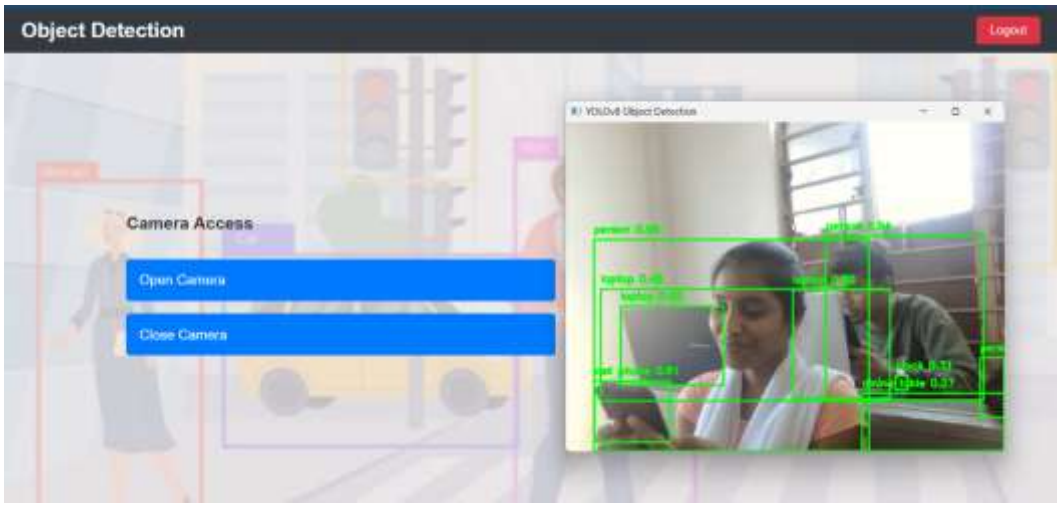
diverse object detection applications. With future enhancements, this system has the potential to become a valuable tool for industries requiring fast and reliable visual analysis.



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