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"People Counting, Capturing Image Using YOLO Deep Learning Algorithm"

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Abstract: Targeting the current Covid 19 pandemic situation, this paper identifies the need of crowd management. It is a comprehensive real-time people counting system that utilizes the advanced YOLOv8 object detection algorithm. The proposed system aims to accurately track individuals within a video stream and provide precise counts of people entering and exiting specific areas of interest. The system combines state-of-the-art computer vision techniques, leveraging the robust object detection capabilities of YOLOv8, along with efficient tracking mechanisms and region-based analysis. The system demonstrates exceptional accuracy and robustness in people-counting tasks through extensive experimental evaluations conducted across various scenarios. The results highlight the system's effectiveness in crowd management, occupancy analysis, and surveillance applications.

Keywords: People counting, Real- Time System, YOLOv8 Algorithm, Computer Vision, Object Detection.

INTRODUCTION

The booming event industry has faced its biggest disruption due to the challenges of Covid 19, causing many events to be cancelled, postponed, relocated, and transformed into virtual events. However, the demand of crowd management does not reduce as it is still significant to prevent virus spreads by controlling the crowd density in a specific environment. In this case, object detection is the ideal solution for crowd management in public areas like malls, shops, restaurants, parks, subway station, and more. Unlike the complicated and traditional manual crowd management which requires planning, risk assessment, and communication, object detection is far more efficient and effective without involving any human or manual operations.

This paper proposes a real-time human detection and counting system specifically for public places with entrance like shopping malls. It helps to detect individual human objects within the camera coverage area to estimate the crowd size. Technically, a surveillance camera will be installed at the entrance and send real-time video footage to the system installed in a server. The system should then perform human detections on the video received and keep track of the number of human objects who have entered and left the environment. In addition, this system implements image processing technique and lightweight deep learning algorithms for object detection, classification, and tracking which requires less computational power. The main contribution of the work is to allow human detection and counting in almost real time for concurrent crowd management in real-life environment. This is achieved by converting the information into TensorFlow format which is also known as graph visualizations for faster processing using the more powerful graphical processing unit (GPU) as target machine.

I.LITERATURE SURVEY

The research papers that were examined aimed to investigate the effectiveness of various methods for human detection and crowd counting. These included the use of density-based classifiers, which analyze the density of people in a given area to determine the presence of a crowd, as well as Histogram of Oriented Gradients (HOG), which identifies the shape and orientation of individuals based on the distribution of gradients in an image. Additionally, the You Only Look Once (YOLO) model was also studied, which is a real-time object detection system that processes images in a single pass. The papers analyzed to provide valuable insights into the strengths and weaknesses of these techniques, and how they can be optimized to improve their performance in real-world scenarios.

1. Other importance of human detection and counting Human detection and counting with computer vision not only can solve crowd management problems but also help to study people behavior in a specific environment or scenario. In Velastin et al. (2020), the same approach is used to perform passenger traffic management for reducing delays in public transport systems (Mokayed et al., 2022). Especially in railway system where traveling at optimized and highest speed at their own track, passenger transit time is the only critical factor affecting the system's effectiveness and efficiency. For example, detecting and counting how many passengers can enter or exit the train in each transit. The challenge is related not only to human detection but also to other object detection like plate numbers, vehicles, and other objects that add value to the field of the intelligent transportation system (Velastin et al., 2020). Thus, an intelligent model is developed to determine the best dwell time, suitable physical conditions such as door width, gap between the train and platform, allocation of train interior, and train and platform floor material while ensuring passengers can be boarded and exited easily, quickly, and safely. Human detection and counting with computer vision not only can solve crowd management problems but also help to study people behavior in a specific environment or scenario. In Velastin et al. (2020), the same approach is used to perform passenger traffic management for reducing delays in public transport systems (Mokayed et al., 2022). Especially in railway system where traveling at optimized and highest speed at their own track, passenger transit time is the only critical factor affecting the system's effectiveness and efficiency. For example, detecting and counting how many passengers can enter or exit the train in each transit. The challenge is related not only to human detection but also to other object detection like plate numbers, vehicles, and other objects that add value to the field of the intelligent transportation system (Velastin et al., 2020). Thus, an intelligent model is developed to determine the best dwell time, suitable physical conditions such as door width, gap between the train and platform, allocation of train interior, and train and platform floor material while ensuring passengers can be boarded and exited easily, quickly, and safely.

2. Challenges and difficulties in human detection and counting In a comparative research paper (Raghavachari et al., 2015), the main difficulties in vision-based human object detection and counting applications are its accuracy in different scenarios and conditions. Different camera orientations will obtain distinctive angles of the human objects which require a different type of implementation to perform the detection and counting. Moreover, the accuracy of detection commonly changes with different people density as crowd size can be increased or decreased throughout the day. Occlusion happens when human objects are too concentrated with overlaying, causing difficulty to distinctly detect each object separately. In addition, lighting or weather conditions might also decrease the quality of images sent for detection such as blurred caused by the camera glare. Therefore, different types of algorithms or techniques should overcome these four common issues to be compatible and suitable for various experimental environments. Another concern in real-time human detection and counting is the high computational efficiency to execute multiple image frames at one time.

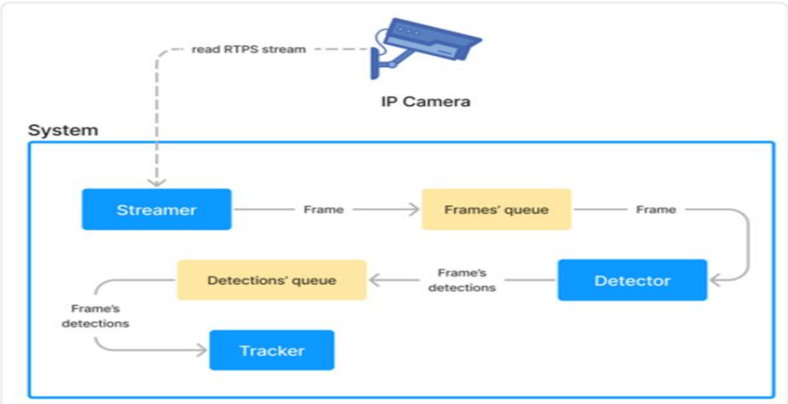
3. Computer vision-based approaches Jalled and Voronkov (2016) perform human body and vehicle detections using image processing to perform background subtraction and obtain the foreground mask using corresponding shape commonly shared shapes with other objects. Therefore, the face detected from human object is sent to the Haar classifier to further determine the human object using a series of sequential classifiers where the object must pass all the classifiers to obtain a true result. Based on the conducted experiment, Haar classifier only works for face detection while the performance drops on vehicle detection due to its characteristics. The tracking on face or human object is performed using simple constant facial features like color which does not change when the object rotates or moves. However, these limited tracking features can suffer through light and camera issues. This paper has also shown the importance of training classifier with quality data to outperform advanced methods. Although head detection is fast, its limited and commonly shared features with other objects could cause high false pos

II.PROPOSED SYSTEM

Overall system architecture : The proposed system has three primary counting features such as to count the number of people who have left, entered, and are present in the shopping malls. To achieve these, only the people crossing the intrusion line needs to be counted by determining whether it is an up to down direction or the opposite For visualization, detected human objects are drawn with a bounding box and a unique identification number for sequence indication. A secondary warning feature is also implemented to alert user when crowd size has exceeded the pre-set threshold. Special Proposed system threshold configuration tab features like setting the shopping mall's crowd threshold, parallel video recording for future search and playback, selection of normal detection or faster detection module for speed, and accuracy trade-off are included.

Human object detection and classification : The first element is to perform object detection and only returns human objects for tracking by filtering using object classification. To achieve real-time capability, YOLOv8 is selected which is a deep learning convolutional neural network algorithm that performs both detection and classification in a single stage. The YOLOv8 model used is trained on the advance and famous COCO dataset with the target's weight and height set to 416 This configuration has a respectable accuracy and performance with 55.3 mean average performance and 35 frame per second (FPS) compared to other fast detection algorithms claimed by the model's official website.

Human object tracking : Tracking is another important element for all the human counting features using the intrusion line to judge the object movement from a particular direction. In general, object tracking is the process to assign a unique identification to the detected human object and perform constant tracking when it moves throughout the frames until the object is disappeared. Detection cannot be solely run in every frame as it cannot connect the same object being detected in the previous frame especially when handling multiple objects. Further more, when an object exits the detection and reappears, it cannot be determined that whether it is the same object that appeared in previous frames or a completely new.



III. System Architecture

The system architecture for a people counting and image capture project using the YOLO (You Only Look Once) algorithm involves several components working together. Below is a high-level description of the system architecture: 1.User Interface: Description: Develop a user interface for system configuration, monitoring, and reporting. This interface could be a web-based dashboard or a standalone application.

2.Cameras and Data Sources: Description: Cameras are the primary data sources for capturing video feeds. These could be fixed cameras in specific locations, surveillance cameras, or other sources providing real-time video streams. Considerations: Camera placement, field of view, and resolution are crucial for accurate people detection.

3.YOLO Model: Description: The YOLO algorithm is responsible for real-time object detection, including identifying and counting people in each frame of the video feed. Configuration: Use the chosen YOLO version (e.YOLOv8) and configure it for real-time object detection. Integration: Integrate the YOLO model into the system, either by using a pre-trained model or training a custom model on your dataset.

4. People Counting Module: Description: A module dedicated to counting the number of people detected by the YOLO model in each frame. Implementation: Develop an algorithm to track people across frames, maintaining count accuracy. Thresholding: Set thresholds to trigger actions based on the count (e.g., capturing images when a specific count is reached).

5. Image Capture Module: Description: When certain conditions are met (e.g., reaching a people count threshold), the system captures images for further analysis or storage. Implementation: Define the logic for capturing images, including frequency, resolution, and storage location. Integration: Connect the image capture module to the people counting module.

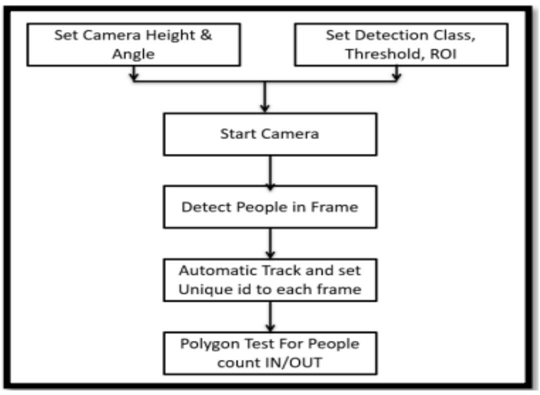
6. Database/Storage: Description: Store relevant information, including people counts, timestamps, and captured images, in a database or storage system. Implementation: Choose a database solution suitable for storing large amounts of data efficiently.

7.Security and Access Control: Description: Implement security measures to protect the system from unauthorized access. Access Levels: Define different access levels for users based on roles (e.g., administrators, operators).

8. System Integration and APIs: Description: Ensure seamless integration with other systems and external applications through well-defined APIs. Interoperability: Allow for easy integration with third-party applications or services.

9. Deployment Environment: Description: Choose the deployment environment, considering factors like on-premises servers or cloud services. Scalability: Ensure the chosen environment can handle the expected load and scaling requirements.

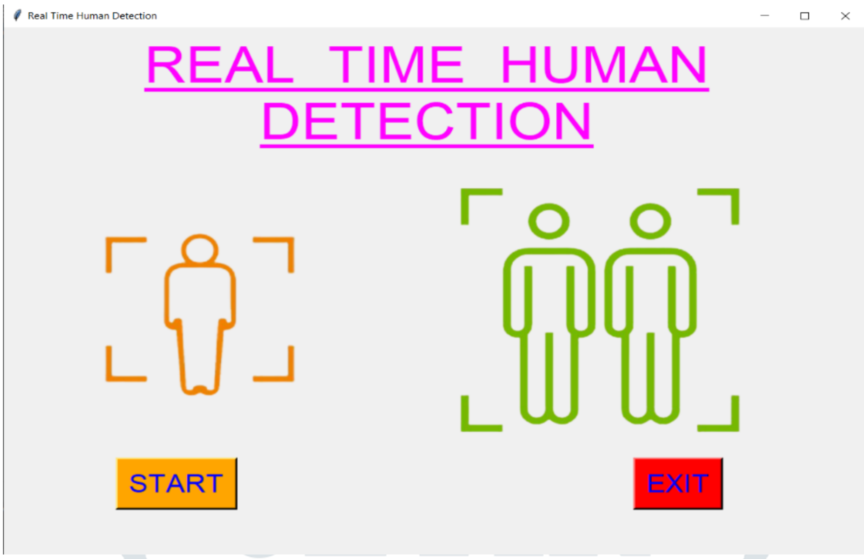
10.Logging and Monitoring: Description: Implement logging and monitoring to track system performance, errors, and user activities. Tools: Use logging frameworks and monitoring tools for real-time insights

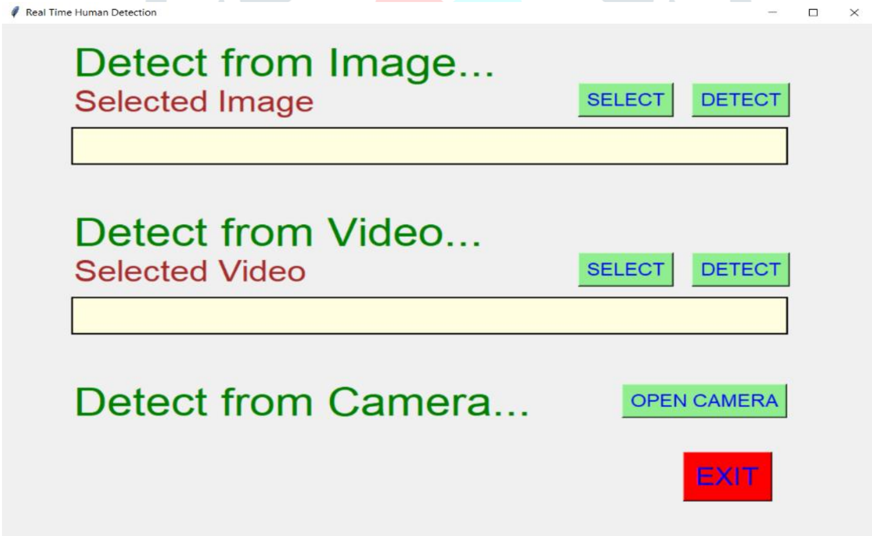


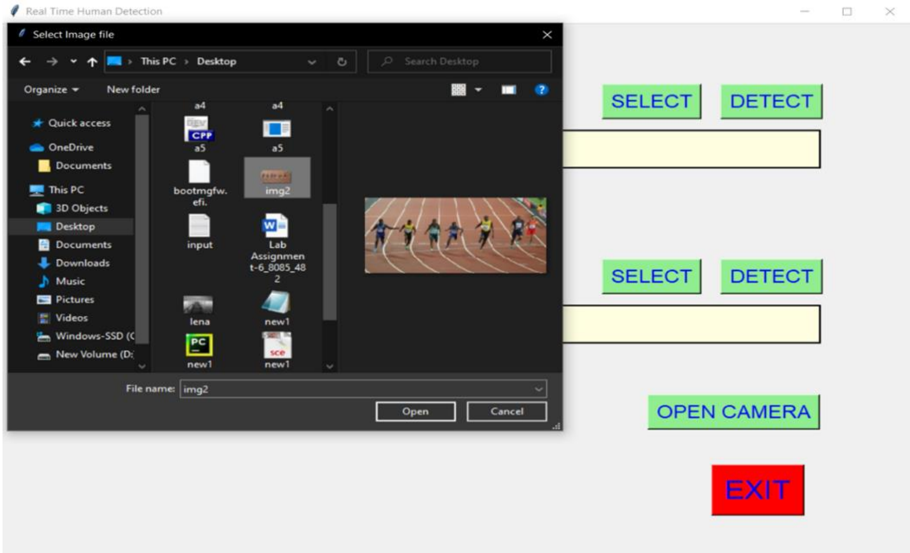
System Architecture

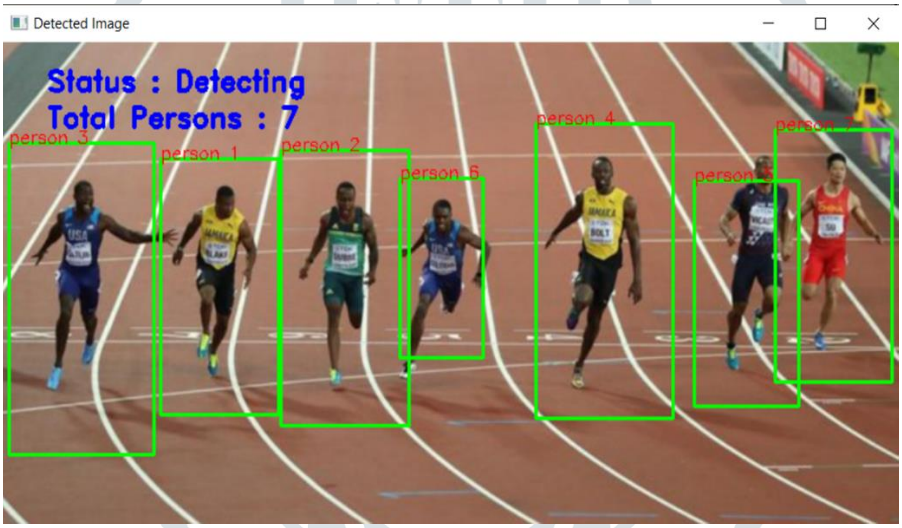
IV. Actual Implementation of The System

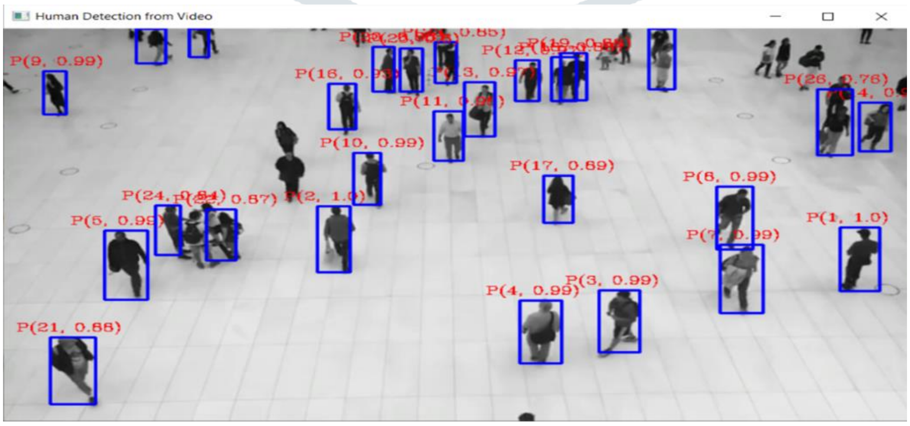
1. GUI Output (final Result / look of system)





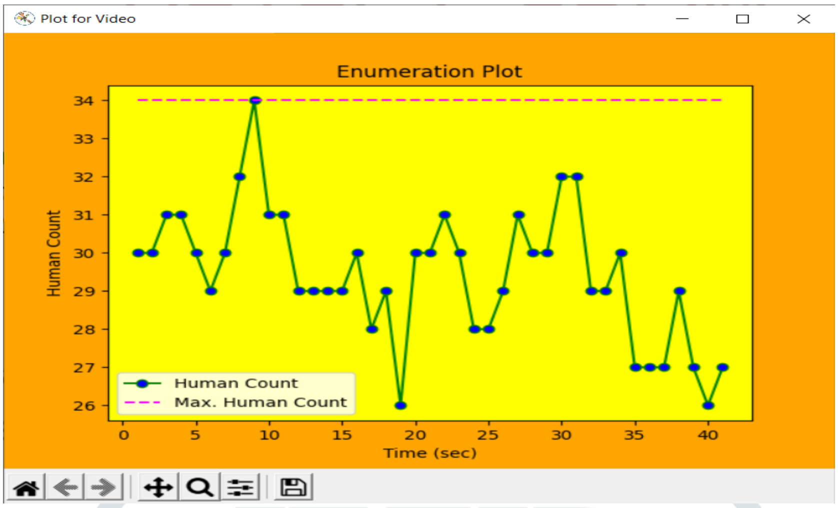

Real Time Human Detection
Select Image file
SELECT
DETECT
SELECT
DETECT
OPEN CAMERA
EXIT
File name: img2
Open
Cancel


Detected Image
Status : Detecting
Total Persons : 7
person 3
person 1
person 2
person 6
person 4

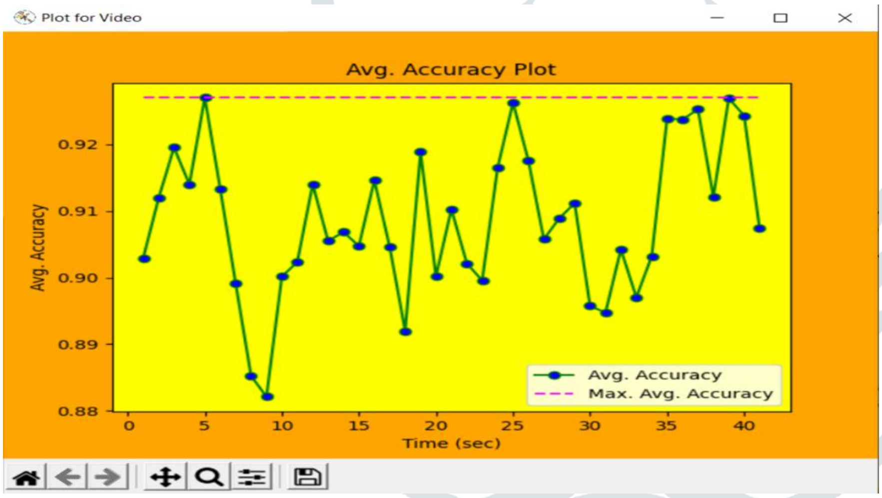

Human Detection from Video
P(9, 0.99)
P(10, 0.99)
P(17, 0.89)
P(6, 0.99)
P(1, 1.0)
P(5, 0.98)
P(21, 0.88)
P(3, 0.99)

2. Final Result of System

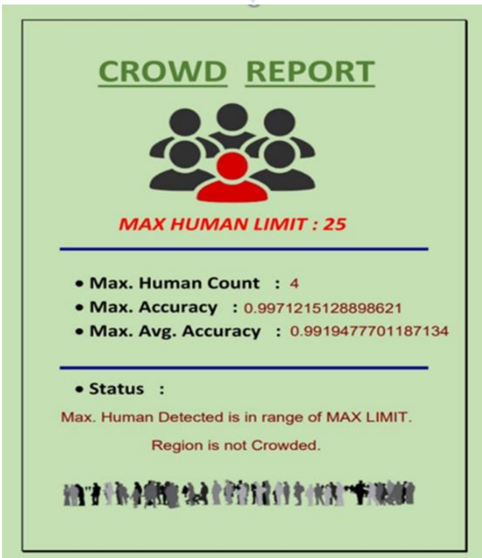
GRAPH PLOTTING



Avg. Accuracy plot



CROWD REPORT



V.CONCLUSION

In conclusion, the development of a smart AI system for generating electricity from waste materials holds great promise in addressing both our growing energy needs and the pressing issue of waste management. By harnessing the power of artificial intelligence to optimize the conversion of various waste materials into electricity, we can not only reduce the environmental impact of waste disposal but also contribute to a more sustainable and eco-friendly energy future. This innovative approach has the potential to revolutionize the way we generate power, making it more efficient, cost-effective, and environmentally friendly. As we continue to advance in AI and waste-to-energy technologies, the dream of a cleaner and more sustainable world, powered by waste, is becoming a reality.

VI.REFERENCE

1. Al-Zaydi, Z. N., Ndzi, D, & Sanders, D. A. (2016). Cascade method for image processing based people detection and counting. In Proceedings of 2016 international conference on image processing, production and computer science (pp. 30–36).
2. Bernama. (2021, February 26). RM10,000 fine for SOP violations beginning March 11.
3. Congrex. (2020, March 30). Disruption in the business events industry: rising to the challenges of Covid-19. Retrieved from congrex https://congrex.com/blog/disruption-business events-industry-challenges-covid-19/
4. M. Y. Zou, J. J. Yu, Y. Lv, B. Lu, W. Z. Chi and L. N. Sun, "A Novel Day-to-Night Obstacle Detection Method for Excavators based on Image Enhancement and" in IEEE Sensors Journal, pp. 1-11, 2023.
5. C. Liu, Y. Tao, J. Liang, K. Li and Y. Chen, "Object Detection Based on YOLO Network", *2018 IEEE 4th Information Technology and Mechatronics Engineering Conference (ITOEC)*, pp. 799-803, 2018.
6. Mikołaj Łysakowski et al., "Real-Time Onboard Object Detection for Augmented Reality: Enhancing Head-Mounted Display with YOLOv8" in arXiv preprint, 2023.
7. Dillon Reis et al., "Real-Time Flying Object Detection with YOLOv8" in arXiv preprint, 2023.
8. U. M. Prakash and V. G. Thamaraiselvi, "Detecting and tracking of multiple moving objects for intelligent video surveillance systems", *Second International Conference on Current Trends In Engineering and Technology - ICCTET 2014*, 2014.
9. I. Khutornoi et al., *Automatic Placement of Visual Sensors in a Smart Space to Ensure Required PPM Level in Specified Regions of Interest*, vol. 22, no. 20, Oct. 2022.
10. Fangbo Zhou, Huailin Zhao and Zhen Nie, "Safety helmet detection based on yolov5", *IEEE International conference on power electronics computer applications (ICPECA)*, pp. 6-11, 2021.
11. X. Wang, S. Wang and J. Ma, "An improved particle filter for target tracking in sensor systems", *Sensors*, vol. 7, no. 1, pp. 144-156, 2007.