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CONSTRUCTION WORKERS SAFETY PRODUCTS DETECTION USING YOLOV7

Karthika V[1], Suba Abisha B[2], Surya kiruba P[3], Selci Radeesha J[4], L. Sajila[5]
[1,2,3,4]Student, [5]Assistant Professor,
Department of Information Technology,
Loyola Institute of Technology and Science, Nager coil, Tamilnadu, India.

Abstract : This project focuses on developing a system using YOLOv7 (You Only Look Once version 7) for the detection of safety products worn by construction workers. The system aims to enhance safety on construction sites by automatically identifying whether workers are wearing essential safety equipment, including hard hats, safety vests, gloves, and more. By leveraging computer vision and deep learning techniques, the project aims to provide an efficient and accurate solution to promote and enforce safety protocols in the construction industry

Index Terms - Safety equipment detection

Construction site safety, Object detection, Computer vision,YOLOv7,Helmet detection, Vest detection, Goggles detection, Gloves detection, Occupational safety, Real-time monitoring, Machine learning, Image processing, Artificial intelligence, Worker safety, Risk management, Safety compliance, Surveillance systems, Hazard detection, Wearable technology.

I. INTRODUCTION

The construction industry places a strong emphasis on worker safety, and ensuring that workers wear appropriate safety equipment is a crucial aspect of maintaining a safe work environment. In this project, we introduce a system that utilizes computer vision techniques to automatically detect safety products worn by construction workers in input images or videos.By leveraging the YOLOv7 (You Only Look Once version 7) object detection algorithm, our system can efficiently and accurately identify safety equipment such as hard hats, safety vests, gloves, and more. The system takes an input image or video and processes it using deep learning models trained on a labeled dataset of construction worker safety products.The goal of this system is to streamline safety inspections and minimize the reliance on manual monitoring, thereby increasing efficiency and reducing potential human errors. With automated detection capabilities, construction site managers can quickly identify workers who are not wearing the necessary safety equipment, allowing for immediate intervention and ensuring compliance with safety protocols.

II.PROPOSED SYSTEM:

The proposed system aims to develop a robust and efficient safety product detection system using YOLOv5 (You Only Look Once version 5) for construction sites. The system will utilize computer vision and deep learning techniques to automatically identify and detect safety products worn by construction workers. The system will take input images or videos captured at construction sites and process them using the trained YOLOv5 model. It will analyze the visual data to identify safety equipment such as helmet, mask, safety vest. The detection will be performed in real-time, allowing for quick and accurate identification of safety product usage

1) Input Module:

The input module stands at the forefront of workplace safety innovation. By harnessing the power of YOLO5, an advanced object detection model, this system monitors construction sites in real-time through webcam feeds, swiftly identifying workers and ensuring they're equipped with essential safety gear like helmets, vests, mask. In the event of any discrepancy or absence in safety gear, the system triggers immediate alerts, enabling supervisors to intervene promptly and uphold safety standards, thus mitigating the risk of accidents and injuries. This technology not only fosters a safer work environment but also streamlines monitoring processes, paving the way for proactive safety measures in construction sites

2) Preprocessing Module:

This project, incoming webcam footage undergoes several crucial steps to ensure accurate and efficient detection of safety gear. Initially, the raw video feed is captured and converted into frames, allowing for individual image analysis. These frames are then resized and normalized to a standard format suitable for input into the YOLO5 model. Additionally, techniques such as image enhancement and noise reduction may be applied to improve the quality of the input data, enhancing the model's ability to detect safety gear accurately amidst varying lighting conditions and environmental factors. Moreover, data augmentation techniques like random cropping, rotation, and flipping might be employed to diversify the training dataset, enhancing the model's robustness and generalization capabilities. Through meticulous preprocessing, the system ensures that the YOLO5 model receives high-quality input data, facilitating reliable real-time detection of safety gear on construction worker

3) Safety Product Detection Module:

In the Safety Product Detection module of the "Real-time Construction Worker Safety Gear Detection and Alert System using YOLO5" project, the YOLO5 object detection model is trained to accurately identify and classify essential safety gear worn by construction workers. This module focuses on detecting key safety products such as masks, vests, and helmets in real-time from webcam footage. Leveraging the YOLO5 architecture's efficiency and accuracy, the model analyzes each frame of the video feed to detect the presence and positioning of safety gear on construction workers. Through extensive training on annotated datasets containing diverse examples of safety gear in various orientations and environmental conditions, the model learns to recognize these items with high precision and recall. By effectively identifying safety gear in real-time, this module plays a critical role in ensuring that construction workers are adequately protected, while also enabling swift intervention in cases of missing or improperly worn safety equipment, thereby enhancing workplace safety protocols

4) Mail sharing Module:

The YOLO5 object detection model is trained to accurately identify and classify essential safety gear such as masks, vests, and helmets in real-time from webcam footage. This module utilizes the YOLO5 architecture's efficiency and precision to analyze each frame of the video feed, swiftly detecting the presence and correct positioning of safety equipment on construction workers. Upon detection of any discrepancies or absence in safety gear, an integrated Email Send module is triggered. This module promptly sends notifications to designated supervisors or safety officers, alerting them of the specific issue observed. These emails contain relevant details, such as the location and timestamp of the incident, enabling supervisors to take immediate action to rectify the situation and enforce safety protocols effectively. By seamlessly integrating safety gear detection with automated email alerts, this module ensures swift response and intervention, contributing to enhanced safety measures on construction site.

III Results and Discussion

Accident Prevention: Reduction in the likelihood of workplace accidents and injuries resulting from inadequate safety equipment usage, leading to improved worker safety and well-being.

Detecting safety equipment on construction sites is crucial for ensuring the well-being of workers and maintaining compliance with safety regulations. Here are some points to consider in a discussion about construction safety equipment detection:

1. Importance of Safety Equipment: Highlight the significance of safety equipment such as helmets, vests, goggles, and gloves in protecting workers from accidents and injuries on construction sites. Emphasize that detecting the presence and proper usage of safety gear is essential for minimizing risks.

2. Challenges in Manual Monitoring: Discuss the limitations of manual monitoring methods, which may be time-consuming, labor-intensive, and prone to human error. Point out that automating safety equipment detection using technology can improve efficiency and accuracy.

3. Role of Computer Vision: Explain how computer vision techniques, such as object detection algorithms like YOLOv7, can be applied to automatically identify and locate safety equipment in images or video footage from construction sites. Mention the advantages of real-time detection and scalability offered by computer vision systems.

4. Data Annotation and Model Training: Describe the process of collecting and annotating a dataset of construction site images or videos with labels for safety equipment. Discuss the importance of training machine learning models like YOLOv7 on

these annotated datasets to enable them to recognize safety gear effectively.

5. Integration with Site Infrastructure: Explore how safety equipment detection systems can be integrated with existing infrastructure on construction sites, such as CCTV cameras or IoT sensors. Discuss the potential for deploying these systems at scale to monitor multiple areas simultaneously.

6. Alerting and Intervention: Highlight the importance of implementing alerting mechanisms to notify site managers or supervisors in real-time when safety equipment is missing or improperly worn by workers. Discuss how timely intervention can help prevent accidents and ensure compliance with safety protocols.

7. Privacy and Ethical Considerations: Acknowledge the privacy concerns associated with monitoring workers using computer vision technology. Discuss the importance of implementing privacy-preserving measures and obtaining consent from workers to ensure ethical deployment of safety equipment detection systems.

8. Continuous Improvement: Emphasize the need for continuous evaluation and improvement of safety equipment detection systems through feedback loops and model retraining. Discuss how incorporating feedback from site personnel can help refine the system's performance over time.

IV Conclusion

In conclusion, the implementation of safety equipment detection using YOLOv7 offers a transformative solution to enhance construction site safety. By leveraging computer vision technology, it enables automated and real-time detection of safety gear such as helmets, vests, goggles, and gloves, thereby reducing reliance on manual monitoring methods and mitigating the risk of accidents and injuries.

YOLOv7's object detection capabilities provide a scalable and efficient means of identifying safety equipment across construction sites, facilitating proactive intervention and compliance enforcement. Integration with existing site infrastructure, such as CCTV cameras and IoT sensors, enables seamless deployment and monitoring at scale.

Moreover, the continuous improvement of detection accuracy through data annotation, model training, and feedback loops ensures that the system evolves to meet the evolving needs and challenges of construction site safety.

However, it's essential to address privacy and ethical considerations by implementing measures to protect workers' privacy and obtain their consent for monitoring. Additionally, ongoing evaluation and refinement of the system are crucial to maintaining its effectiveness and relevance in enhancing workplace safety.

Overall, the adoption of YOLOv7 for construction safety equipment detection represents a significant step forward in safeguarding the well-being of workers and promoting a culture of safety across construction site

REFERENCES

[1]. A. A. M. Fiaz, M. Usman, M. Awais, M. Tariq, and I. A. Bhatti, "Deep Learning-Based Safety Equipment Detection for Construction Workers," 2020 15th International Conference on Computer Science & Education (ICCSE), 2020, pp. 244-249. DOI: 10.1109/ICCSE49270.2020.9239004.

[2]. K. Ahmed, Z. Lu, and W. Yang, "Safety Helmet Detection in Construction Sites Using Deep Learning," Applied Sciences, vol. 9, no. 16, 2019, Article ID 3290. DOI: 10.3390/app9163290.

[3]. R. Chavan and R. Bhosale, "Safety Helmet Detection using Convolutional Neural Networks," 2020 International Conference on Smart Systems and Inventive Technology (ICSSIT), 2020, pp. 1308-1312. DOI: 10.1109/ICSSIT49285.2020.9201142.

[4]. L. Wei, L. Liang, C. Xu, and L. Zhen, "Construction Safety Helmet Detection and Recognition Based on Deep Learning," 2019 4th International Conference on Mechanical, Control and Computer Engineering (ICMCCE), 2019, pp. 478-482. DOI: 10.1109/ICMCCE47761.2019.00098.