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"PERSONAL PROTECTIVE EQUIPMENT DETECTION"

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Abstract : This research focuses on the instance segmentation of soft aspects on individuals, such clothing and personal protective equipment, in a risky industry. We propose to pre-train a mask segmentation network utilizing soft biometric item classes from the Open Images V5 and DeepFashion2 datasets in order to recognize and segment personal protective equipment in the workplace. The preliminary results of our proposed model achieve a mean average precision with modest optimization, which results in extremely effective segmentation of welding masks, high visibility vests, construction helmets, and ear protection in the workplace. The results of this research can be applied to improve workplace safety in high-risk industries by providing a way to ensure that personal protective equipment (PPE) is used appropriately while protecting employee privacy.

IndexTerms **- Computer Vision, Yolo, Personal Protective Equipment, Data Pre-processing, Safety Equipment, Object Recognition.**

I. INTRODUCTION

Nowadays, real-time object recognition is used to automate a wide range of tasks in industrial settings. Ensuring that personal protective equipment (PPE) is properly used in hazardous locations is a critical task that can significantly improve worker safety.

In this case, PPE use is usually assessed in real time by a surveillance system that watches the security camera feed. To raise awareness and vigilance, an automated visual or audio alert is triggered when an employee fails to wear the appropriate personal protective equipment (PPE). Most of the solutions that have been implemented so far rely on cloud-based systems; images from the sites are periodically moved to the cloud for analysis. due to its network bandwidth and centralized architecture, which enable the video feeds to be sent over a stable internet connection. It is essential to apply health and safety rules to all individuals. In Indonesia, business is one of the most important factors.

The application of PPE is arranged according to occupational health and safety. These are safety instruments that need to be worn by employees, and each workplace has different standards for them. Companies have standards that limit what workers are permitted to wear. Personal protective equipment whenever they work in a specific field. Companies with a certification in health and safety ought to have standards that prioritize health and safety.

II. LITERATURE REVIEW

Coronavirus disease 2019 (COVID-19) is a new type of disease SARS- SARS- CoV-2 and resembles the SARS virus which has now become a pandemic. The level of transmission caused by droplets raises the need for personal protective equipment that can prevent spread. The great need causes the ratio of supply and demand to become unbalanced. This study aims to develop a personal protective product in the form of a face shield with a good product acceptance rate and an effective manufacturing process. This study uses a 3D printer with the Fused Deposit Material (FDM) system as a means of manufacturing products. First, a product modification process is carried out which is then tested with several parameters. The parameters of the product acceptance level used are fit, space, comfort, and weight. Each parameter is measured using a visual analog scale. The results of product testing were obtained that the fit and weight parameters were in the very good category and the space and comfort parameters were in the good category. The production time required to manufacture a product is 31 minutes and 31 grams of filament.

Computational project CCEIA was developed (Calculation of Short circuit and Incident Energy of Arc Flash), in agreement with the procedures of norm NFPA 70E-2015. These calculations represent the platform for obtaining the certificate of securing and safe industry by the international norms. The developed algorithm provides for each node of the system.

Most beneficiary vending machines are PPE Vending machine that dispenses personal protective equipment such as glasses, gloves, PPE kits, etc. This is highly essential for Industrial sites, Hospitals, and construction sites. During the COVID-19 pandemic period, the role of personal protective equipment is very crucial because it avoids contact, droplets, or airborne. Many hospitals and medical agencies reported and believed that existing systems lack features like contactless access and inventory management of PPE items viz. face masks, hand gloves, clothing suits, respirators, shields, helmets, sanitizers, etc. In this paper, an Internet of Thing-based smart personalized protective equipment vending machine is developed. The RFID technology is used to scan the authorized

user and dispense desired items with contactless and keep live tracking of inventory. The live inventory data is transferred to a remote system using the Webhook software platform.

Authors propose a deep learning method to automatically detect personal protective equipment (PPE), such as helmets, surgical masks, reflective vests, boots, and so on, in images of people. Typical approaches for PPE detection based on deep learning are (i) to train an object detector for items such as those listed above or (ii) to train a person detector and a classifier that takes the bounding boxes predicted by the detector and discriminates between people wearing and people not wearing the corresponding PPE items. We propose a novel and accurate approach that uses three components: a person detector, a body pose estimator and a classifier. Our novelty consists in using the pose estimator only at training time, to improve the prediction performance of the classifier. We modify the neural architecture of the classifier by adding a spatial attention mechanism, which is trained using a supervision signal from the pose estimator. In this way, the classifier learns to focus on PPE items, using knowledge from the pose estimator with almost no computational overhead during inference.

This paper focuses on the instance segmentation of soft attributes on humans such as clothing and personal protective equipment at a hazardous workplace. We propose the use of soft biometric object classes from the Open Images V5 and DeepFashion2 datasets to pre-train a mask segmentation network to detect and segment personal protective equipment in the workplace. Preliminary results of our proposed model achieve a mean average precision, mAP50, of 61.7optimization, resulting in very good segmentation of construction helmets, high visibility vests, welding masks, and ear protection in the workplace. Applications of the results from this paper include improving workplace safety in hazardous industries by providing a tool to ensure proper personal protective equipment usage while maintaining worker anonymity.

The number of work accidents that happened in Indonesia has not decreased, at this moment. One of the causes of work accidents is human negligence in wearing personal protective equipment or what is called PPE. A system that can monitor the completeness of PPE worn by workers in an industrial environment automatically is needed. Computer vision technology one method known as convolutional neural network is used, this is a system to monitor directly and detect workers who do not wear PPE. The level of system precision is seen by comparing the real condition and the system condition red which is shown the people without PPE completely. The result of the system would be compared with the examiners. The result shows that this system can know and distinguish between workers who wear PPE in full and those who do not. With the number of dataset 14512 images, the accuracy of this system is 79.14precision of the detection resulted in 80a warning if there are workers who do not wear PPE completely and also could be implemented into several workplaces that have the requirements for the detection. This system contributes to decreasing work accidents and increasing the safety of the workers.

III. OPEN ISSUES

In order to reduce the risk of accidents, injuries, and exposure to hazardous materials, workers in industrial sites are required to wear specialized Personal Protective Equipment (PPE). This initiative aims to improve safety and regulatory compliance in these settings. Notwithstanding safety rules and recommendations, it is still a problem that workers are not wearing PPE, which puts them at serious risk and compromises workplace safety as a whole.

IV. PROPOSED SYSTEM

Personal Protective Equipment (PPE) detection uses technology like computer vision and AI to monitor and ensure people are wearing the necessary safety gear, such as masks, gloves, or helmets, in workplaces, healthcare settings, or public spaces. It involves capturing images or video, identifying PPE through object recognition, checking if it's worn correctly, and alerting when there's non-compliance. This technology enhances safety, especially during health crises like pandemics, and is crucial for maintaining regulatory compliance in various industries.

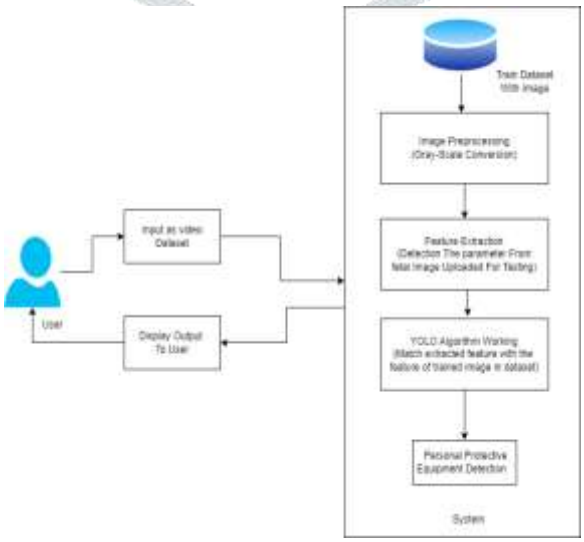

Figure 1. System Architecture

V. CONCLUSION

This work offers a real-time PPE detection method based on deep learning and video streaming analysis. Based on the edge computing idea, the system analyses images from a dangerous area in real-time using an embedded device to detect if workers are wearing protective gear, such in our example, a helmet, vest, and glove.

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