

# **CONSTRUCTION SITE SAFETY** **MONITORING**

## **ABSTRACT:**

The threat to worker safety and health is high in jobs such as construction. There is a need to monitor the workers and check if they are wearing the right and the needed amount of Personal Protective Equipment (PPE) kit in the construction site as safety measures.

Workers can be monitored using CCTV videos. But it would be a tedious task to manually check the workers of their safety in the construction site. Hence there is a need for an automation system that would detect the workers and identify if they have the right PPE kit on them. The pose of the workers and the construction site equipment they are near to will also be analysed in order to mark them as safe or not.

## **LITERATURE SURVEY:**

**a.** “Automated Hardhat Detection for Construction Safety Applications”- Bahaa Eddine Mneymneh et.al, Creative Construction Conference 2017, CCC 2017, 19-22 June 2017

- A hard hat detection system using HOG-based cascade object detector.

**b.** “Hard hat wearing detection based on head keypoint localization” - Bartosz Wójcik, et.al, arXiv.org, Cornell University, 2021.

- Hard hat detection using head keypoint localization. Proposed a conjunction of novel deep learning methods with humanly-interpretable rule-based systems. The authors have used Mask RCNN.

**c.** “Applications of Computer Vision in Monitoring the Unsafe Behavior of Construction Workers: Current Status and Challenges”- Wen Yao Liu, et.al, MDPI, 2021.

- Study performed on computer vision techniques to identify workers and their unsafe behaviours in construction site. Authors have used YOLOv3.

## **OBJECTIVES AND OUTCOMES**

- To identify the workers

To identify and classify the individual PPE kit components that include hard hat, vest, gloves and mask.

- To identify the construction equipment on site
- Represent the persons near the construction equipment without the full ppe kit in red and mark as unsafe.
- To recognize the pose of the workers and create tags of their pose.

## **STEPS**

### **1. Pre-Processing**

- Label the dataset using (Cvat, Labelme)

### **2. Person and PPE Kit Detection**

- Use the COCO dataset model and perform transfer learning to identify the person, and PPE kit. (CHV, Pictor PPE, Roboflow hardhat)
- Use YOLO v4 / v5 / R as the detection model.
- Use head point localization and pose estimation to identify the joints and in turn help in detecting if the PPE kit is worn correctly.
- The kit objects will have to be classified into different colours, eg. Blue hardhat would represent the supervisor, Red hardhat represents the general worker, etc. (using OpenCV identify the object colour)
- Represent the missing items as tags. (eg. NO hat, NO vest, etc.)

### **4. Construction Site Equipment Detection**

- Train the object detection model to identify the construction site equipment.

5. Represent the persons near a construction equipment without full kit as unsafe.

## 6. Pose Estimation

- Identify and classify the pose of persons on site (media pipe or open pose).

## REFERENCES

- Bahaa Eddine Mneymneh, Mohamad Abbas, Hiam Khoury, Automated Hardhat Detection for Construction Safety Applications, Procedia Engineering, Volume 196, 2017, Pages 895-902, ISSN 1877-7058, <https://doi.org/10.1016/j.proeng.2017.08.022>.
- Wójcik, Bartosz, Mateusz Źarski, Kamil Książek, Jarosław Adam Mischczak, and Mirosław Jan Skibniewski. "Hard hat wearing detection based on head keypoint localization." arXiv preprint arXiv:2106.10944 (2021).
- Liu, Wenyao, Qingfeng Meng, Zhen Li, and Xin Hu. 2021. "Applications of Computer Vision in Monitoring the Unsafe Behavior of Construction Workers: Current Status and Challenges" Buildings 11, no. 9: 409. <https://doi.org/10.3390/buildings11090409>
- Nipun D. Nath, Amir H. Behzadan, Stephanie G. Paal, Deep learning for site safety: Real-time detection of personal protective equipment, Automation in Construction, Volume 112, 2020, 103085, ISSN 0926-5805, <https://doi.org/10.1016/j.autcon.2020.103085>.