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"- Wenyao 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.

STEPS

1. Pre-Processing:
   - Label the image datasets (using CVAT) to perform transfer learning of the models.
2. Pose Estimation:
   - Identify the workers and their anchor points. (Open Pose)
   - Localize their body parts as Head, Body, Hands and Leg regions.
3. Binary Classifier:
   - Apply Efficient-Net classifier to each of the localized body part to check if the PPE kit is present or not.
4. Equipment Detection:
   - Detect the Construction equipment using Yolov4
5. Detecting Risk Factor:
   - Calculate the distance between the workers without PPE kit and the construction equipment.
   - If they are close by, display the worker as unsafe.

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 Żarski, Kamil Książek, Jarosław Adam Miszczak, 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.