Live Safety Helmet Detection Using Python

PROJECT STAGE II
PRESENTED BY

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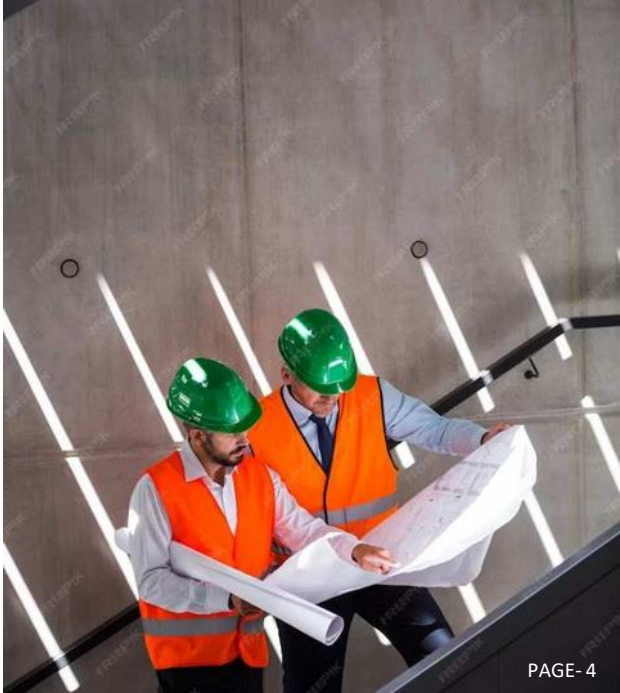
Aim Of The Project

The primary aim of the project is to enhance construction site safety through the implementation of a robust Live Safety Helmet Detection system using CNN, Python, Keras, Tenserflow, OpenCV . The overarching goal is to leverage computer vision technology to automate the monitoring of safety helmet usage among construction site personnel.

CONTENT

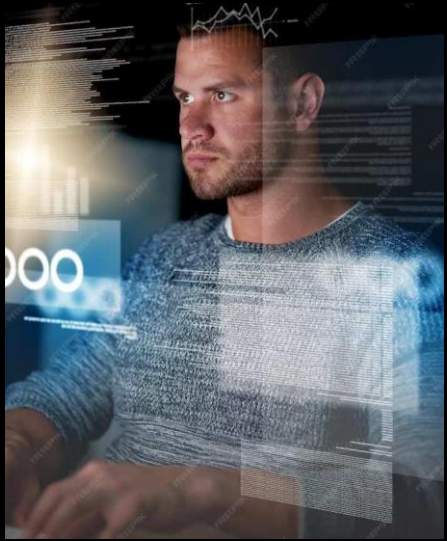
INTRODUCTION

The construction industry, inherently fraught with hazards, necessitates stringent safety measures. Among these, the use of safety helmets stands as a foundational practice to safeguard workers from head injuries. This project delves into the realm of automated safety helmet detection on construction sites, utilizing a synergy of Python programming, Tensorflow, OpenCV, CNN, and the Python, Keras. a dynamic and versatile language, is employed both for coding purposes (Python 3.11) and for model training (Python 3.11). The VS Code IDE, chosen for its simplicity and suitability for educational contexts, provides an accessible environment for coding, ensuring that the project remains pedagogically valuable. OpenCV, renowned for its real-time object detection capabilities, becomes the fulcrum of our live safety helmet detection system. [1]



Previous Researches On Safety Helmet Detection

1) Safety Helmet Detection Based on YOLOv5 by Fangbo Zhou, Huailin Zhao, Zhen (2021) ,this research work proposes a safety helmet detection method based on YOLOv5 and annotates the 6045 collected data sets to establish a digital safety helmet monitoring system and shows the effectiveness of helmet detection based YOLov5.
2) Safety Helmet Wearing Detection Based on Jetson Nano and Improved YOLOv5 by Zaihui Deng,Chong Yao,and Qiyu Yin(2023), This study introduces an improved safety helmet-wearing detection model named YOLOv5-SN, aiming to address the shortcomings of the existing YOLOv5 models, including a large number of model parameters, slow reasoning speed, and redundant network structure. [2,3]



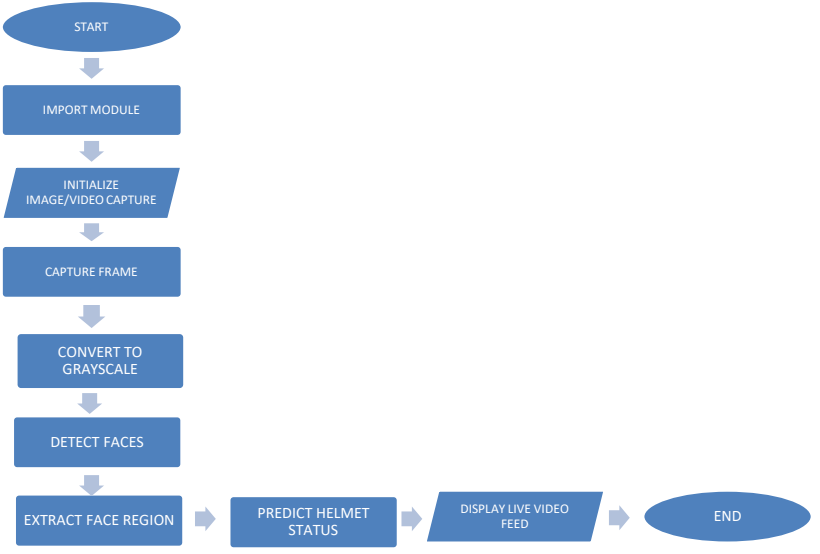
Importance of safety helmets in workplaces

- Paramount for protecting employees from accidents, injuries, and occupational hazards.
- Head injuries can be severe and even fatal, emphasizing helmet importance.
- Compliance with safety protocols enhances productivity and reduces liabilities.

Software And Simulation Tools

- Python Version 3.11 has used here
- VS CODE IDE
- Libraries Like Keras , Tenserflow, Numpy and Open CV has used here
- Webcam (External)

Flowchart


START
IMPORT MODULE
INITIALIZE IMAGE/VIDEO CAPTURE
CAPTURE FRAME
CONVERT TO GRAYSCALE
DETECT FACES
EXTRACT FACE REGION
PREDICT HELMET STATUS
DISPLAY LIVE VIDEO FEED
END

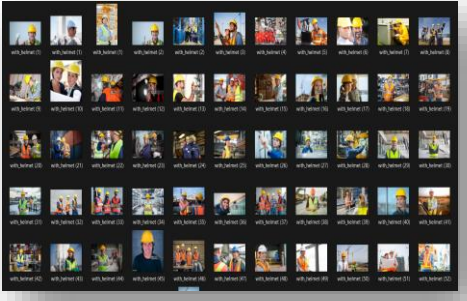
ALGORITHM

Our Approach for Safety Helmet Detection

1) step 1: Install VS Code IDE, Python 3.11, Open CV module, NumPy module, Tenserflow.
2) step 2: Download the Images and move our main file.
3) step 3: Download Keras Extension and then train all images in VS CODE
4) Step 4: Our final code which is used for Live detection includes :
    - **Face Detection:** Utilizes Har Cascade Classifier. Identifies faces in the input.
    - **Image Preprocessing**: Extracts face region . Resizes and normalizes.
    - **Model Prediction:** Utilizes pre-trained CNN. Predicts helmet presence
    - **Visual Feedback:** Draws rectangles and labels predictions . Green: Helmet; Red: No Helmet.

5) Step 5: Finaly Detecting Safety Helmet on the output Window

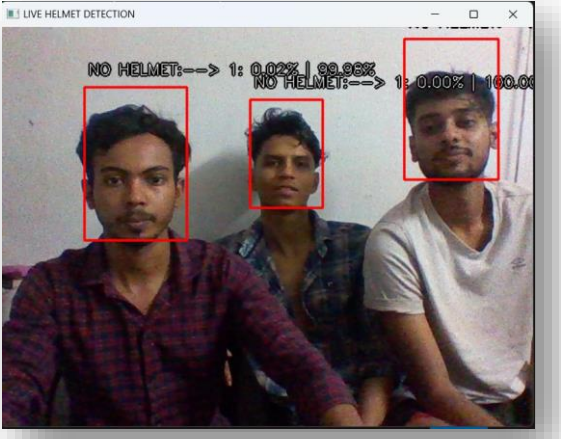
Dataset of with helmet and without helmet



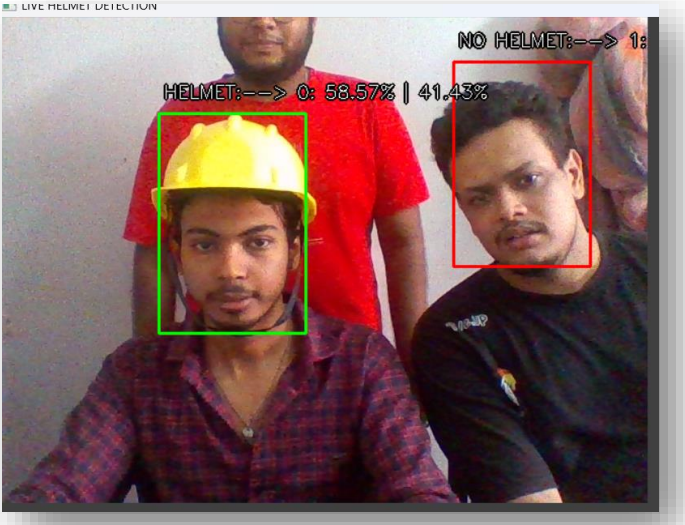
Helmet Detection after the Code Run

OUTPUT

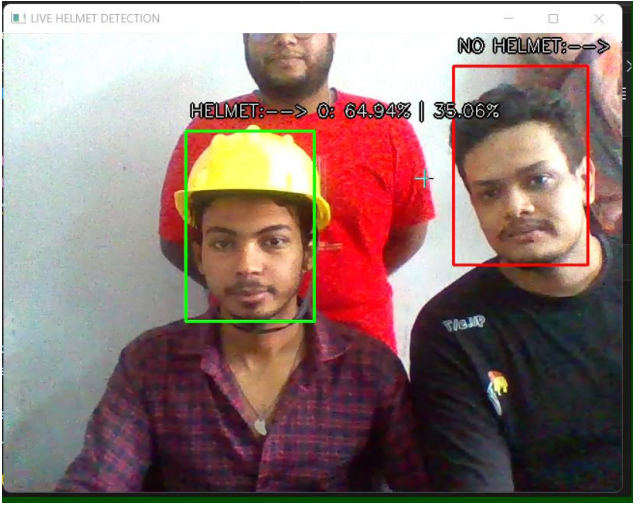
No Helmet



With Helmet



VIDEO OUTPUT



Benefits of Safety Helmet Detection System

- **Enhanced Workplace Safety:** Ensures compliance with regulations. Reduces head injuries and fatalities.
- **Improved Safety Awareness:** Raises awareness among workers. Encourages safety culture.
- **Efficient Safety Enforcement:** Enables real-time monitoring. Reduces manual supervision.
- **Accident Prevention:** Identifies and corrects unsafe behavior. Creates a safer work environment.
- **Cost Savings:** Reduces costs associated with accidents. Improves efficiency and productivity.

Challenges in Safety Helmet Detection

- **Variation in Lighting Conditions:** Affects visibility.
- **Occlusion of Faces:** Obstructs view of faces.
- **Helmet Design and Color Variations:** Challenges detection.
- **Real-Time Processing Requirements:** Demands efficient algorithms.
- **Adaptation to Dynamic Environments:** Needs to adjust to changes.
- **False Positives and False Negatives:** Minimizing incorrect detections.[6]

- ***Future Scope :***

1. Industrial Safety: Integration of safety helmet detection into industrial environments to ensure compliance with safety regulations and reduce workplace accidents through automated monitoring systems.

2. Construction Sites: Utilizing safety helmet detection in construction sites to enhance safety measures by automatically identifying workers without helmets and alerting supervisors.

3. Smart Surveillance Systems: Enhancing security measures in public places, industrial facilities, and construction sites by integrating safety helmet detection into smart surveillance systems for quick identification of safety violations.

4. Machine Learning Advancements: Leveraging advancements in machine learning, particularly deep learning, to improve the accuracy and efficiency of safety helmet detection algorithms under various conditions and orientations.

5. IoT Integration: Integrating safety helmet detection with Internet of Things (IoT) devices for real-time monitoring of helmet usage, compliance rates, and detection of impacts or accidents, facilitating proactive safety measures.[5]

Conclusion

In conclusion, this project has successfully realized the development and implementation of a Live safety helmet detection system, contributing to the broader goal of improving construction site safety. The automated monitoring system, empowered by CNN algorithm, Python, Keras, Tenserflow, OpenCV, stands as a testament to the intersection of technology and safety. By leveraging these tools, we have created a reliable solution that has the potential to mitigate risks and enhance the well-being of construction site workers.

REFERENCES

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Thanks!