# HELMET DETECTION USING DEEP LEARNING MODELS

## 1. INTRODUCTION

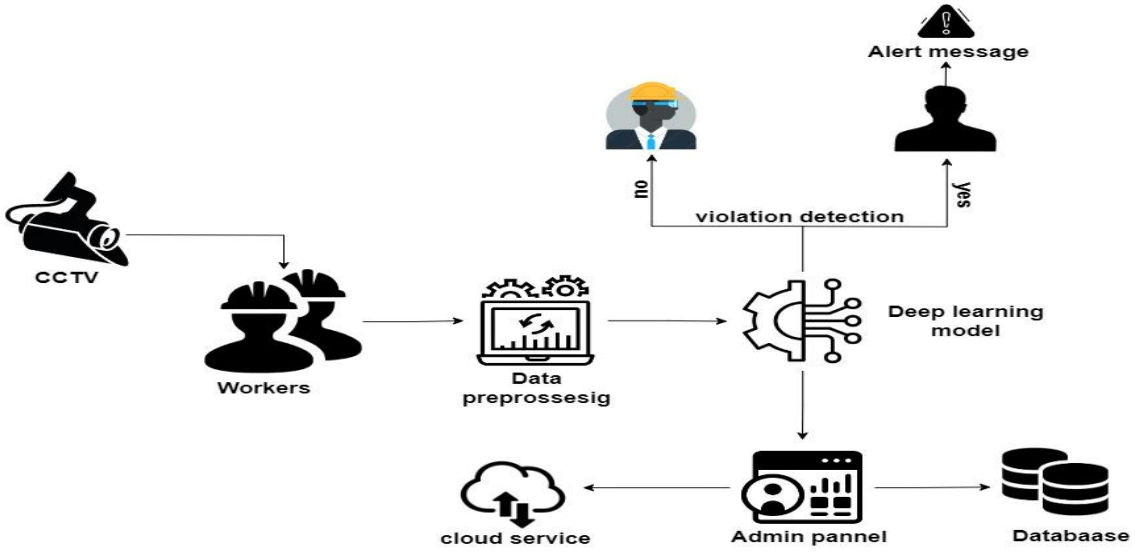
In safety management at the construction site, it is essential to supervise the safety protective equipment wearing condition of the construction workers. Safety helmets can bear and disperse the hit of **falling objects and alleviate the damage of workers** falling from heights. Construction workers tend to ignore safety helmets because of weak safety awareness. At the construction site, workers that wear safety helmets improperly are much more likely to be injured.Helmet detection with deep learning enhances workplace and public safety,ensuring compliance with safety regulations and reducing the **risk of accident and injuries**.The Helmet detection using deep learning in construction sites is a cutting-edge application of computer vision technology that significantly enhances safety measures in the construction industry. The primary objective is to **automate the identification of individuals who are not wearing required safety helmets** within the construction site environment. This innovative approach utilizes deep learning models, particularly Convolutional Neural Networks (CNNs), which have demonstrated remarkable capabilities in image recognition tasks.Construction sites are inherently risky places, and head injuries pose a substantial threat to workers and visitors. Helmet detection systems equipped with deep learning algorithms offer a proactive solution. By analyzing video feeds or images in real-time, these systems can identify instances of non-compliance with helmet-wearing protocols. This introduction outlines the essential components of helmet detection in construction: **data collection, model training, deployment, and continuous improvement.** Such technology not only mitigates the risk of accidents but also assists in **safety auditing, visitor control, and remote monitoring**. Ultimately, it promotes a safer work environment, ensuring that safety regulations are diligently followed. As construction companies increasingly prioritize worker safety, helmet detection using deep learning emerges as a crucial tool in safeguarding lives and preventing avoidable injuries on construction sites. In the construction industry, ensuring the safety of workers is paramount. One critical aspect of worker safety is the proper use of safety helmets. Accidents resulting from failure to wear helmets can lead to severe injuries or fatalities. While video monitoring systems are widely used on construction sites, there is a need for an automated solution to detect and alert workers in real-time when they are not wearing safety helmets. Existing solutions for helmet detection primarily focus on traffic surveillance and may not be suitable for the complex and dynamic environments encountered on construction sites. The presented method offers an alternative solution to detect the safety helmets and improve the safety management of the construction workers at the construction site.The experiment results demonstrate that the method can be used to detect the safety helmets worn by the construction workers at the construction site.

## 2. OBJECTIVES

- The objective of implementing helmet detection using deep learning models in construction sites is to significantly enhance workplace safety by automating the identification and enforcement of safety helmet usage.
- The key objectives includes **Accident prevention, Real-time compliance monitoring, safety auditing, visitor control, remote monitoring, continuous improvement, overall safety enhancement.**
- Existing solutions for helmet detection primarily focus on traffic surveillance and may not be suitable for the complex and dynamic environments encountered on construction sites.
- Helmet detection using deep learning models contributes to improved **safety, reduced risks, cost savings, and enhanced operational** efficiency across various sectors and applications.

# 3. PROPOSED METHODLOGY

## 3.1 ARCHITECTURE

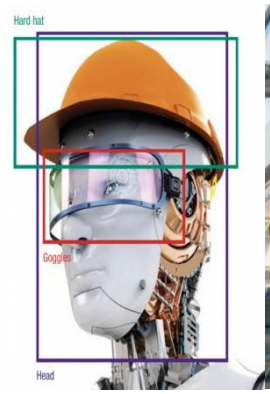



## 3.2 ARCHITECTURE PROCESS

- The **CCTV** camera will Camera capture video footage or images from construction sites. **Data preprocessing** enhances the quality of incoming images or frames.
- The deep learning model analyzes the preprocessed data for safety helmet detection.When a **violation is detected**, alerts are sent to relevant parties.
- **Authorized users** can monitor the system and access historical data through the user interface. **Data is stored and managed**, with privacy and compliance measures in place.
- In cases requiring low latency , edge computing devices assist with real-time inference. Cloud services can be integrated for additional functionality and scalability.

## 3.3 REAL-TIME PICTURES

the open-source TensorFlow framework is chosen to train the model per-trained SSD_mobilenet_v1_COCO model with the COCO datasets issued to learn the characteristics of the safety helmet in the built dateset to reduce the training time and save the computing resources.





### 3.4 ADVANTAGES

- Detecting and enforcing helmet usage reduces the risk of head injuries and accidents,safeguarding the well-being of construction workers and visitors.
- Provides the Real-time monitoring capabilities, allowing or immediate identification of safety violation and prompt corrective actions.
- Automates the monitoring process, freeing up human resource for other critical task and reducing the need for manual safety
- Extends safety benefits to visitors by ensuring they adhere to safety protocols, minimizing accident involving external parties.

## 4. WORK PLAN

### 4.1 Month 1: Project Planning Data Collection

Define project objectives and key stakeholders.Assemble the project team assign roles.Begin collecting a diverse **data set of construction site images or video frames**.

### 4.2 Month 2: Data Annotation and Model Development

Annotate collected data with helmet and head regions.Split the dataset into training, validation, and test sets.Commence **model development and training**. Choose a suitable deep learning architecture.

### 4.3 Month 3: Model Training and Evaluation

Continue **model training and optimization**.Monitor and adjust mode performance using validation data.Evaluate the trained model using performance metrics. Fine-tune the model for **improved accuracy** if necessary.

### 4.4 Month 4: Deployment, Testing, and Documentation

Configure the hardware and software infrastructure for on-site deployment. Conduct **testing and validation**. Ensure compatibility with on-site cameras.

### 4.5 Month 5: Training, Continuous Improvement, and Project Closure

Establish procedures for ongoing system monitoring, maintenance, and model retraining. Deliver a project closure report **summarizing achievements, challenges, and recommendations** for future enhancements.

## 5. BUDGET

| Product | Rating | Quantity | Amount |
|---|---|---|---|
| RAM | 16GB | 1 | 4650 |
| Camera | 84 MP resolution | 1 | 5250 |
| Hard disk | 256GB | 1 | 4985 |
| | | Total | 14885 |

## 6. OUTCOMES

- Helmet detection using deep learning models contributes to **improved safety, reduced risks, cost savings, and enhanced** operational efficiency across various sectors and applications.
- It aligns with the goal of **preventing accidents, protecting individuals, and ensuring compliance** with safety regulations.
- The presented method offers an **alternative solution to detect the safety helmets and improve the safety management** of the construction workers at the construction site.
- The experiment results demonstrate that the method can be used to **detect the safety helmets worn by the construction workers** at the construction site.


**Supervisor**
Ms.T.Suganya,
Assistant Professor/CSE,
SRM TRP Engineering College,
Irungalur-621105,
Tiruchirappalli,Tamilnadu.

**Team Members**
1.Nishanth. K (814720104030)
2.Pragadeesh. V (814720104033)
3.Vikash. B (814720104056)
4.Aishwarya. M (814720104301)