Project Design Phase-I
Proposed Solution Template

Date	19 September 2022
Team ID	PNT2022TMIDxxxxxx
Project Name	ConstructGuard_YOLO-Based Saftey Gear Survilance
Maximum Marks	2 Marks

Proposed Solution Template:

Project team shall fill the following information in proposed solution template.

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	The construction industry has high accident and fatality rates owing to time and cost pressures as well as hazardous working environments caused by heavy construction equipment and temporary structures. Thus, safety management at construction sites is essential, and extensive investments are made in management and technology to reduce accidents. This study aims to improve the accuracy of object recognition and classification that is the foundation of the automatic detection of safety risk factors at construction sites
2.	Idea / Solution description	using YOLO v5, which has been acknowledged in several studies for its high performance, and the recently released YOLO v8. Images were collected through web crawling and labeled into three classes to form the dataset. Based on this dataset, accuracy was improved by changing epochs, optimizers, and hyperparameter conditions. In each YOLO version, the highest accuracy is achieved by the extra-large model, with mAP50 test accuracies of 94.1% in v5 and 95.1% in v8. This study could be further expanded for application in various management tools at construction sites to improve the work process, quality control, and progress management in addition to safety management through the collection of more image data and automation for accuracy improvement.
3.	Novelty / Uniqueness	The two-stage method, which was proposed earlier than the one-stage method, performs location identification using a CNN to identify candidate bounding boxes and then applies another CNN to identify the object in each bounding box. This method has evolved

		into R-CNN, Fast R-CNN, Faster R-CNN, and Mask R-CNN, with improvements in detection speed and accuracy
4.	Social Impact / Customer Satisfaction	Productivity gains - Preventing injuries and incidents avoids production delays and costs associated with investigating and managing occurrences. Workers can focus on being productive. Proof of safety culture - Deploying advanced safety tech like YOLOv8 shows construction firms take safety seriously and invest in protecting workers. This could improve public perception. Continuous improvement - The data collected by YOLOv8 could be analyzed over time to identify systemic risks, pinpoint training needs, and continuously improve safety practices. Customer assurance - Construction customers would take comfort knowing their projects utilize the latest tech to keep workers safe and sites compliant. This builds trust and satisfaction.
5.	Business Model (Revenue Model)	Hardware sales - Sell camera and sensor hardware bundled with the YOLOv8 software to construction firms to install on their sites. Could charge an upfront cost for the hardware and a licensing fee for the software. Software as a service (SaaS) - Offer YOLOv8 powered safety monitoring as a subscription service. Construction companies pay a recurring fee to access the software, dashboard, and analytics. Scaling to serve multiple customers can increase revenue. Safety compliance service - Provide YOLOv8 safety monitoring as a complete service. This includes installing cameras, sensors, running the AI, and providing compliance reporting. Can charge a monthly fee scaled to the size of the construction site. Data analytics service - Offer advanced analytics and reporting services on top of the basic YOLOv8 monitoring. This provides deeper insights into safety risks, trends, etc. Can charge premium fees for analytics and advisory services.
6.	Scalability of the Solution	AI acceleration - Use AI acceleration chips like GPUs and TPUs to speed up YOLOv8 inferencing and increase the number of video feeds that can be processed concurrently. Distributed cameras - Have distributed camera networks with edge inferencing to scale to multiple large construction sites rather than single centralized systems. Load balancing - Use load balancing and auto-scaling techniques to distribute inferencing across servers. Adds servers dynamically to handle increased demand.

		Compression techniques - Use video and image compression like MJPEG to reduce bandwidth usage and scale to more camera feeds. Alert escalation - Use rules and escalation workflows to only alert human operators for the most critical safety events detected by YOLOv8. Avoids alert fatigue. Worker safety buttons - Equip workers with safety buttons to request help which feeds data into the system. Scales safety without needing cameras everywhere. Standardized models - Leverage transfer learning to create standardized YOLOv8 models that can scale across clients and construction sites more quickly.