AI-Driven Computer Vision System for Enhancing Personal Radiation Safety Interlock System

Abstract

Ensuring safety in high-risk environments such as radiation facilities and high-voltage systems is critical, particularly during maintenance and experimental operations. Traditional Personal Radiation Safety Interlock Systems (PRSIS) rely on hardware-based sensors and manual supervision, limiting real-time responsiveness and adaptability. This project proposes an AI-driven computer vision solution to enhance existing interlock systems using deep learning-based object detection models (YOLO) deployed on an edge computing platform (Jetson Nano).

The system enables real-time monitoring of both equipment and personnel to detect hazards and enforce safety compliance. It is integrated with an existing interlock system to automatically trigger safety actions such as alarms, access restrictions, or system shutdown upon detection of unsafe conditions.

Objectives:

• Deployment of already developed Water Droplet & Electrical Spark Detection System to identify hazards in high-voltage environments and prevent equipment damage.

• Development of a PPE Compliance Detection System to ensure personnel wear safety equipment such as helmets and Thermoluminescent Dosimeters (TLDs).

The solution emphasizes low-latency processing, reliability, and reduced human intervention. Technologies used include Python, YOLO-based deep learning models, Jetson Nano, and AI/ML techniques for training and optimization.

Deliverables

1. Deployment of the hazard detection system (Water Droplet & Electrical Spark)
2. Development of the PPE monitoring system.

Academic Project Requirements:

1) Required No. of student(s) for academic project: 2

2) Name of course with branch/discipline: B.E./B.Tech. Computer Engineering/IT/MCA

3) Academic Project duration:

(a) Total academic project duration: 8 Weeks
(b) Student's presence at IPR for academic project work: 2 Full working Days per week

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