**Project Title:** “Speed and Distance Estimation Using YOLO”

**Abstract (Total – 300 words):**

**Project Objectives:** The primary objective of this project is to develop an efficient real-time system for speed and distance estimation using the YOLO object detection model. The project aims to enhance accuracy and performance in applications such as traffic monitoring, autonomous driving, industrial automation, and sports analytics. By leveraging deep learning and computer vision, we seek to overcome limitations in traditional sensor-based approaches and improve real-time motion analysis.

**Methodology:** The proposed system utilizes the YOLO model for object detection, combined with motion tracking techniques to estimate speed and distance. The methodology includes:

1. Data collection and preprocessing, incorporating real-world video datasets.
2. Object detection using YOLO to identify and track objects in motion.
3. Motion analysis using frame-by-frame displacement calculations to estimate speed.
4. Enhancing distance estimation through depth-aware techniques or sensor fusion.
5. Optimization for real-time performance using model quantization and edge computing techniques.

**Key Findings:** The implementation of YOLO for speed and distance estimation demonstrates high accuracy in object tracking and motion detection. The model efficiently detects multiple objects in real time, making it suitable for diverse applications. Challenges such as occlusion, varying lighting conditions, and depth estimation limitations are addressed through data augmentation and sensor fusion techniques. The proposed system achieves improvements in tracking precision, computational efficiency, and adaptability across different environments.

**Stepwise Solution Approach:**

**Step 1:** Data collection and preprocessing, including labeled datasets with motion sequences.

**Step 2:** Implementing YOLO for object detection and tracking.

**Step 3:** Integrating motion analysis algorithms to estimate speed.

**Step 4:** Enhancing distance estimation through stereo vision or sensor fusion.

**Step 5:** Optimizing the system for real-time performance on edge devices.

**Step 6:** Testing and validation on real-world scenarios.

**Step 7:** Performance evaluation and improvement based on experimental results.

**Reference:** [1] Redmon, J., Divvala, S., Girshick, R., & Farhadi, A. (2016). "You Only Look Once: Unified, Real-Time Object Detection." Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition (CVPR).

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