Real-Time Object Detection Report

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# Task Title

Real-Time Detection of Object Missing and New Object Placement in Video

# Objective

To develop a real-time video analytics pipeline capable of detecting:

* When a previously visible object is missing from the video scene.
* When a new object is placed in the video scene.

The pipeline prioritizes detection accuracy and real-time performance (FPS).

# Hardware Configuration

* **Laptop:** Dell Inspiron
* **CPU:** Intel Core i3 11th Gen
* **GPU:** None (CPU-only system)
* **RAM:** 8 GB
* **Operating System:** Windows 10
* **Camera:** Integrated Laptop Webcam

# FPS Achieved (Real-Time Performance)

* **Average FPS:** 6–10 frames per second
* **Resolution:** 640480
* **Conditions:** Live webcam feed with default lighting

# Optimizations and Architectural Decisions

* Used **YOLOv8n** (nano model) from Ultralytics for optimal performance on CPU.
* Enabled **ByteTrack** to persist object IDs across frames for tracking.
* Resized input frames to 640480 for faster processing.
* Avoided saving video during test runs to prevent FPS drop.
* Tracked object IDs frame-by-frame:
  + New object = newly seen ID
  + Missing object = ID no longer present
* Displayed bounding boxes and labels using cv2.imshow().

# Dependencies Used (requirements.txt)

ultralytics==8.3.94  
opencv-python==4.8.0.76  
torch==2.2.2  
numpy==1.23.5

# Conclusion

The developed system successfully detects missing and newly placed objects in real time using YOLOv8 and ByteTrack. Despite being run on a CPU-only system, the model delivers usable FPS and reliable tracking. This system is modular and can be easily extended or containerized for production.