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:** 640×480
- **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 640×480 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.