



Performance Factors

Stage	Function	Typical Latency (per frame)	Optimization Options
Frame Capture	Read frame from camera (RTSP/USB/IP)	10–40 ms	Use threaded capture (OpenCV + GStreamer)
Preprocessing	Resize, denoise, stabilize	5–15 ms	Use OpenCV CUDA / GPU filters
Image Enhancement	Brightness & Contrast Correction, Sharpness	10–15 ms	CLAHE, Gaussian or bilateral filter
Anomaly Detection Model	Deep learning inference	15–100 ms (depends on model size & hardware)	Use TensorRT / ONNX / TFLite / quantization
Alert & Visualization	Log, overlay, send alert	2–10 ms	Async I/O, MQTT/WebSocket

Performance Pipeline

Stage	Method	Latency
Frame Capture	OpenCV threaded	10 ms
Preprocessing	OpenCV CUDA filters	8 ms
Image Enhancement	CLAHE + Denoise + Sharpen	12 ms
Anomaly Detection	YOLOv8n (TensorRT)	22 ms
Classification	Small CNN (TFLite)	12 ms
Alert dispatch	Async FastAPI	5 ms
Total end-to-end latency		≈69 ms → ~20.5 FPS real-time