

SafetyEye

Ai-Powered Workplace Occupancy & Safety Monitor

Team 8

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ABSTRACT

- **Purpose:**

Develop an AI-based system that uses video surveillance feeds to monitor workplace occupancy levels and detect safety compliance violations in real-time.

- **Scope:**

The platform helps office and industrial space managers improve space utilization and ensure employees follow safety protocols such as wearing helmets, vests, and other PPE.

- **Key Innovation:**

Automated detection using YOLOv8 deep learning model trained specifically on construction site safety datasets.

INTRODUCTION

Problem Context:

- Workplace safety violations are a leading cause of industrial accidents
- Manual safety monitoring is time-consuming and error-prone
- Traditional surveillance systems lack intelligent analysis capabilities
- Need for automated, real-time safety compliance monitoring

Why AI-Powered Solution?

- 24/7 automated monitoring without human fatigue
- Instant violation detection and alerting
- Consistent application of safety standards
- Data-driven insights for safety management

Method	Advantages	Limitations
Manual Inspection	Direct human oversight	Time-intensive, inconsistent
Basic CCTV	Continuous recording	No automated analysis
Rule-based Systems	Simple logic	Limited adaptability
Generic AI Models	Broad detection	Poor domain-specific accuracy

EXISTING APPROACHES

Research Gap:

Lack of specialized AI models trained specifically for construction site PPE detection with real-time processing capabilities.

PROBLEM STATEMENT

Challenge:

Current workplace safety monitoring relies heavily on manual processes that are inconsistent, delayed, and cannot provide comprehensive coverage of large industrial sites.

Specific Issues:

- Missing helmet detection in real-time
- Lack of automated vest compliance monitoring
- No instant alerting for safety violations
- Insufficient data for safety trend analysis

Solution Requirement:

An intelligent system that can automatically identify safety compliance violations and generate immediate alerts with visual evidence.

OBJECTIVES

Primary Goals:

1. Identify safety compliance violations such as missing helmets and vests
2. Generate real-time visualizations and alerts to improve safety
3. Present results via a live dashboard along with E-mail alerts
4. Provide data analytics for safety trend monitoring

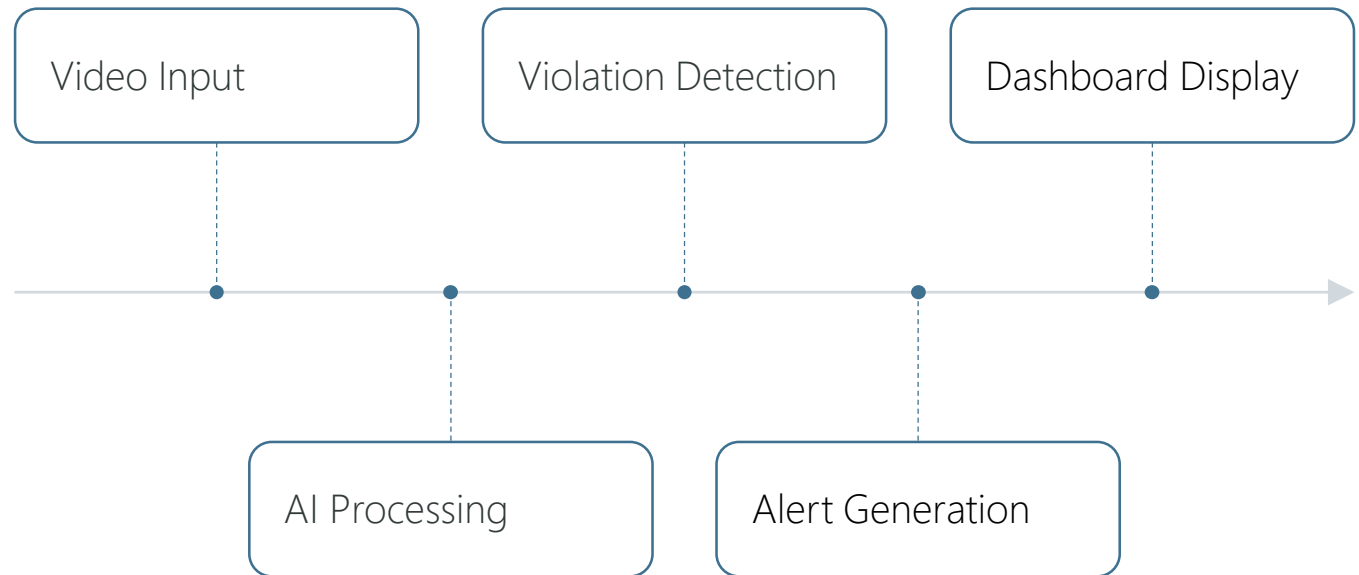
Success Metrics:

1. Real-time detection with <1 second latency
2. High accuracy PPE detection (>82% precision)
3. Automated alert generation within seconds
4. Comprehensive compliance reporting

PROPOSED SYSTEM OVERVIEW

Core Components:

- Data Prep Module - Load & process YOLO-formatted images
- Model Training Module - Train YOLOv8 for PPE detection
- Detection Module - Real-time PPE violation spotting
- Alert Module - Send notifications for missing gear
- Dashboard Module - Live view + compliance statistics



Workflow

DATASET

Data Characteristics:

- YOLO-formatted annotations present in diverse construction site scenarios
- Multiple classes: Hardhat, Mask, NO-Hardhat, NO-Mask, NO-Safety Vest, Person, Safety Cone, Safety Vest, machinery, vehicle.
- Various lighting and angle conditions

Model Architecture:

YOLOv8 (You Only Look Once version v8)

Training Strategy:

- Data augmentation for robustness
- Hyperparameter tuning for accuracy optimization
- Validation using mAP, precision, and recall metrics

REQUIREMENTS

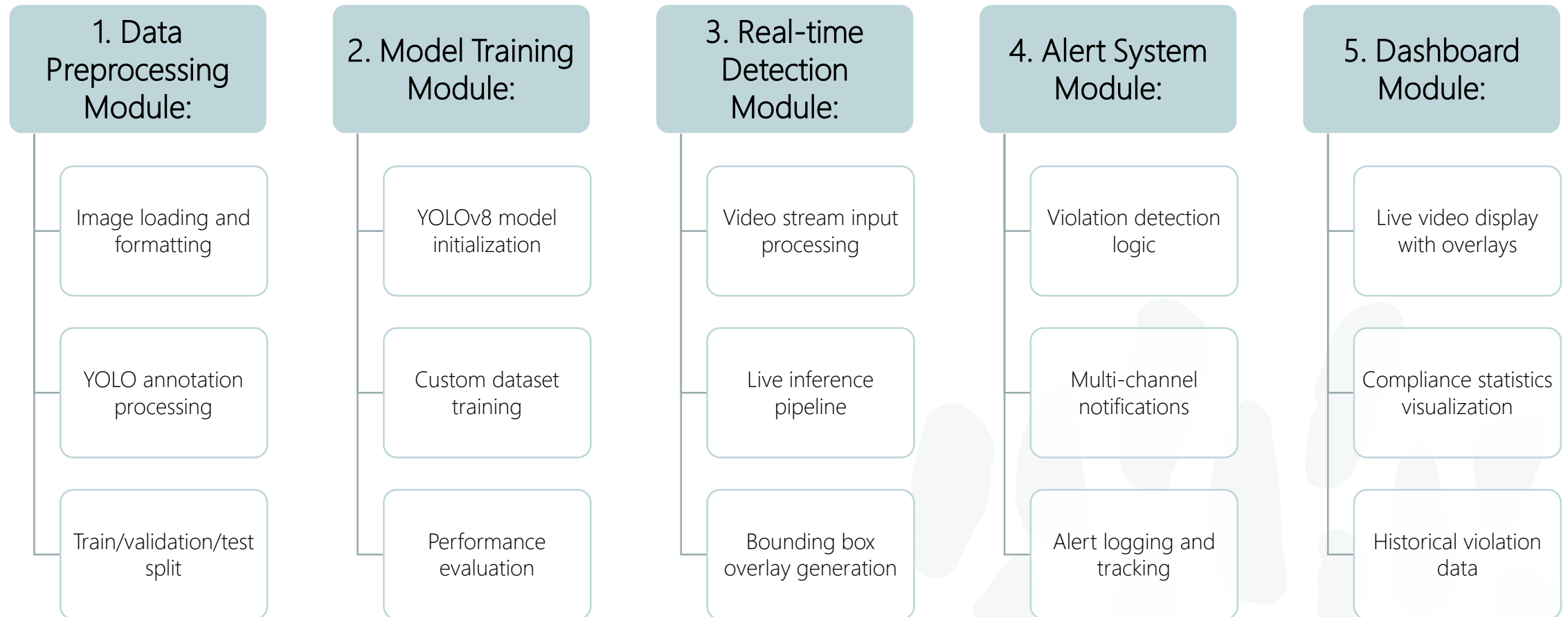
Requirements:

- Processing speed: <1 second per frame
- Accuracy: >81% detection precision
- Scalability: Multiple camera feed support
- Reliability: 24/7 operation capability

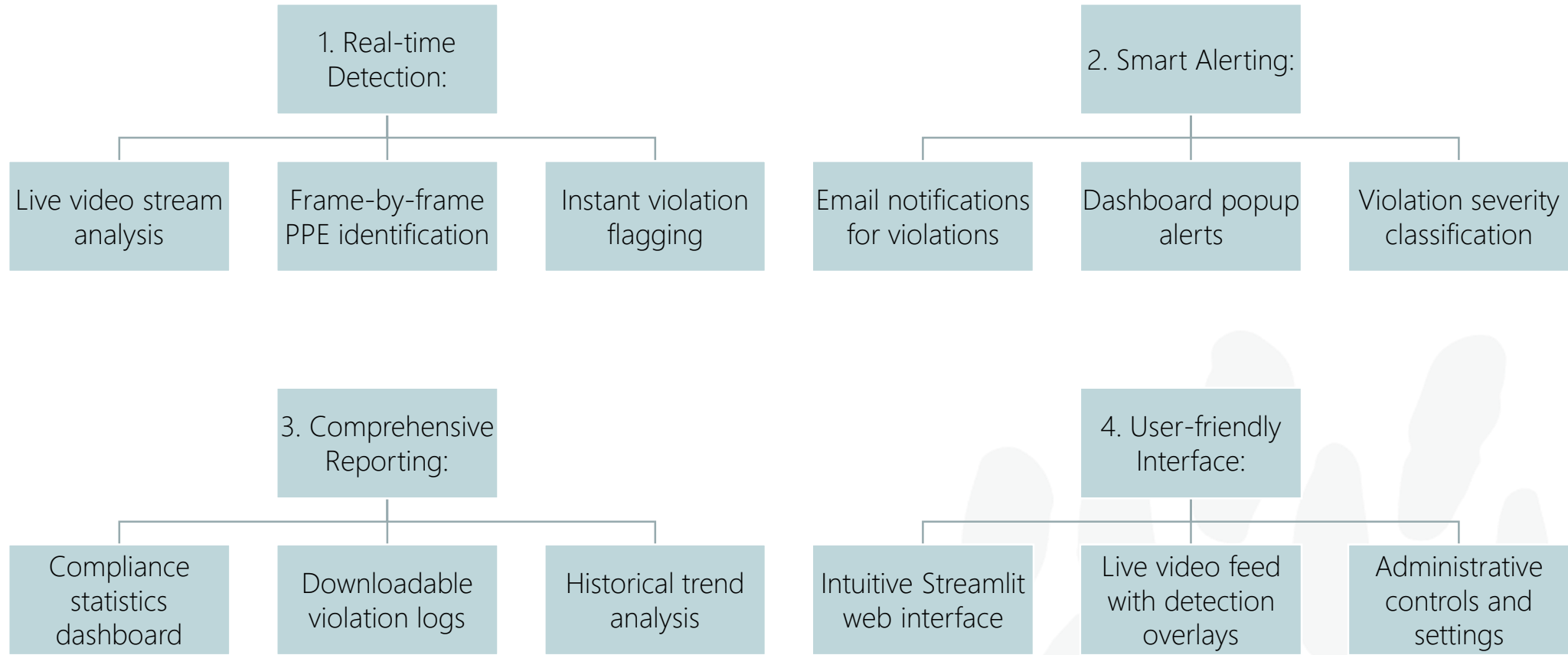
Technology Stack:

- AI Framework: YOLOv8, PyTorch
- Backend: Python, OpenCV
- Frontend: Streamlit
- Libraries: Ultralytics, Pandas, NumPy
- Training Platform: Kaggle
- Notifications: SMTP(email system)

SYSTEM MODULES



KEY FEATURES



Model Performance

- Epochs: 100
- Optimizer: SGD
- mAP@0.5: 81
- Precision: 90
- Recall: 74
- Deployment: CPU & GPU



PPE Detection Classes

Violation Rules:

- **Critical:**
Person detected without helmet
- **High:**
Person detected without safety vest
- **Medium:**
Person detected without face mask
- **Composite:**
Multiple PPE violations simultaneously

PPE Type	Detection Accuracy	Alert Priority
Hard Hat	High	Critical
Safety Vest	High	High
Face Mask	Medium	Medium
Person	High	Base Detection

INNOVATIVE SOLUTIONS

Achievements:

- Successfully Detects Missing PPE In Real-time
- Handles Various Lighting Conditions
- Works Across Different Camera Angles
- Minimal Processing Delay

Challenges & Solutions:

- Occlusion → Strategic Camera Placement
- Lighting → Model Robustness Training
- Speed → Optimized YOLOv8 Implementation

Commercial Applications:

Construction Sites - Manufacturing - Mining – Warehouses

Future Enhancements:

- Additional PPE Types (Boots, Gloves, Goggles)
- Mobile App Version
- Multi-site Monitoring

Market Impact:

- Reduced Workplace Accidents
- Cost Savings From Prevention

THANKYOU