# SafeZone AI: Smart surveillance for urban and rural safety

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# Introduction

In today's world, safety in public spaces—from busy city streets to quiet village markets—is more important than ever. Although CCTV cameras are widely used, they depend heavily on continuous human monitoring, which is tiring, error-prone, and often results in missed accidents, crimes, or emergencies.

SafeZone AI addresses these challenges by using advanced artificial intelligence to automatically analyze video and audio in real time.

# Problem Statement

- Most CCTV systems rely on human supervision, making them time-consuming, error-prone, and ineffective at detecting critical events like accidents, crimes, fires, or animal intrusions in real time.

- Existing AI surveillance solutions are mostly urban-focused and typically detect only a single type of anomaly, limiting their effectiveness in diverse real-world scenarios.

- Current systems often lack combined video-audio analysis, real-time automated alerts, and require costly hardware, making them unsuitable for scalable deployment in rural areas.

# Objective

- To use AI to analyze CCTV video and audio in real time and detect unusual activities like accidents, weapons, fires, screams, large crowds, or wild animals.

- To send instant alerts with GPS location via SMS, email, or alarms to help authorities respond quickly and ensure public safety.

# Related Theory

- Computer Vision & Object Detection (YOLOv8):
  Enables the system to analyze live video, detect multiple objects like people, weapons, fire, animals, and accidents in real time with high accuracy using CNN-based YOLOv8.

- Audio Classification:
  Uses microphones to identify unusual sounds like screams, gunshots, and crashes by converting audio into spectrograms and applying machine learning.

- Anomaly Detection:
  Recognizes abnormal behaviors or sounds (e.g., sudden crowds or unusual movements) to detect threats beyond predefined objects.

- Automation & Alert System:
  Automatically sends real-time alerts with GPS location to security personnel or authorities via SMS, email, or alarms for rapid response without human monitoring.

# Methodology

For SafeZone AI, we chose the Iterative Model because it lets us improve the system in small, repeatable steps. We begin with basic data collection and model training, then test it with real video and audio.

As we test, we find and fix issues, adding features like alerts, dashboards, and specific event detection one at a time. This helps us build a more accurate and reliable system with each cycle.
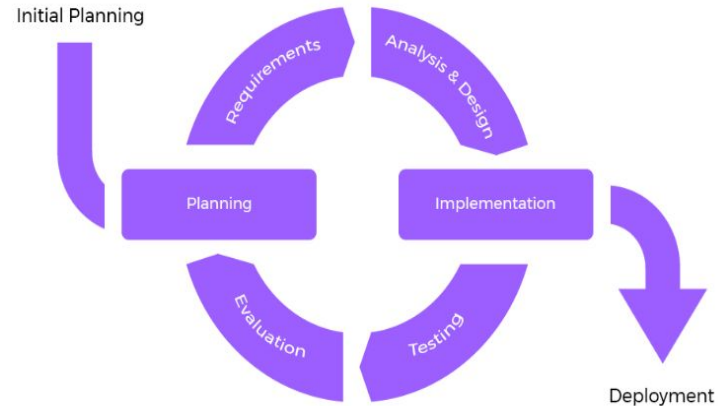
# **Requirement Analysis**

**Functional Requirements:**

- Real-time object detection (YOLOv8)

- Real-time sound detection (e.g., screams, crashes)

- Live CCTV monitoring dashboard

- Automatic alert generation (SMS, email, alarms)

- GPS-based event location mapping

- Event logging (date, time, type, location)

- User login and access control

# Requirement Analysis

**Non-Functional Requirements:**

- High reliability and low latency
- Scalable for multiple CCTV feeds
- User-friendly dashboard interface
- Secure access with credentials
- Easy to maintain and update

# Tools and Technologies

Programming Language:
- Python

Machine Learning & Deep Learning:
- YOLOv8 (Ultralytics)
- TensorFlow / PyTorch

User Interface:
- HTML,CSS,JavaScript, React.js,Mapbox/leaflet.js

Data Labeling Tools:
- Roboflow / LabelImg
- Audacity / Audino

Database / Storage:
- SQLite / CSV files
- Google Drive / Local Storage

Alerting Tools:
- Twilio / SMTP Email
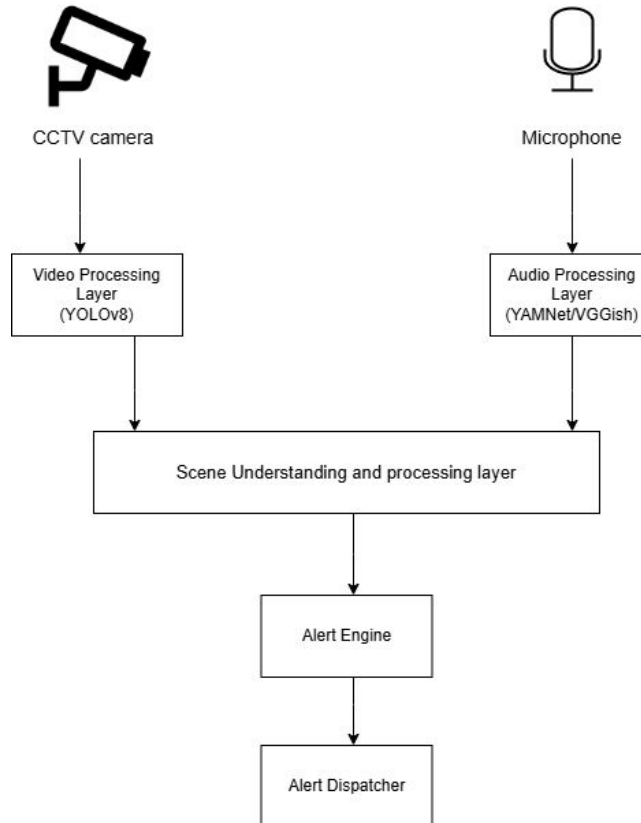- Notification Sound / Alarm Module
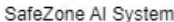
Visualization & Mapping:
- Folium / OpenStreetMap
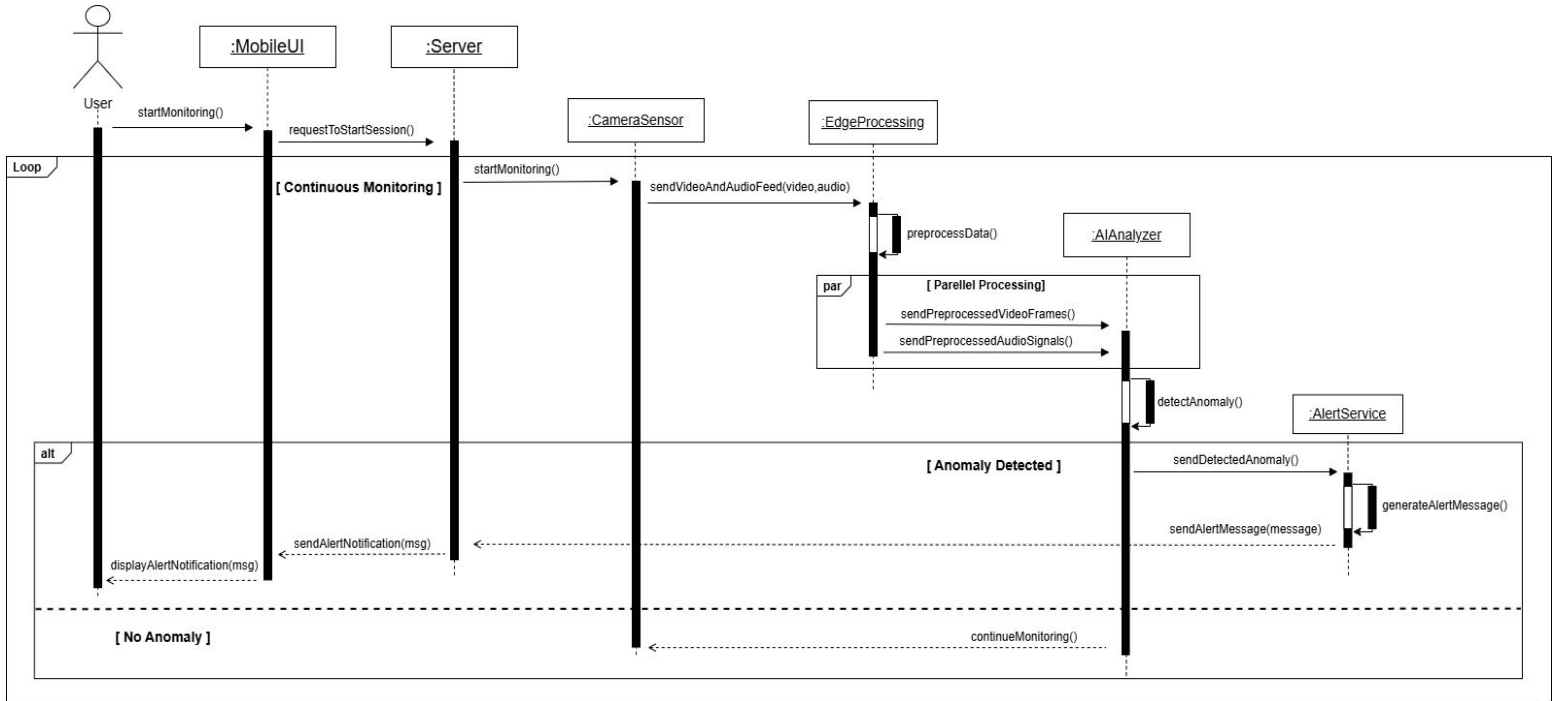- Matplotlib / Seaborn

Hardware(if applicable):
- CCTV Cameras / USB Webcam
- Microphone
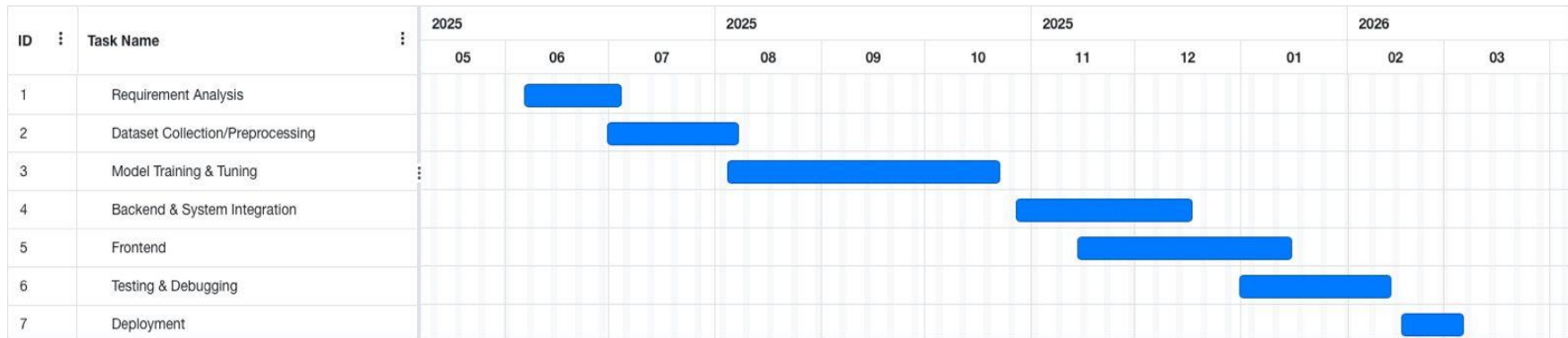- Raspberry Pi / Jetson Nano (optional)

# System Block Diagram

# Use Case Diagram

# Sequence Diagram

# Gantt Chart

| ID | Task Name | 2025 | | | 2025 | | | 2025 | | | 2026 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | 01 | 02 | 03 |
| 1 | Requirement Analysis | | ▓ | | | | | | | | | |
| 2 | Dataset Collection/Preprocessing | | | ▓ | | | | | | | | |
| 3 | Model Training & Tuning | | | | ▓ | ▓ | | | | | | |
| 4 | Backend & System Integration | | | | | | | ▓ | | | | |
| 5 | Frontend | | | | | | | | ▓ | | | |
| 6 | Testing & Debugging | | | | | | | | | ▓ | | |
| 7 | Deployment | | | | | | | | | | ▓ | |

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# Expected Result

# Expected Result
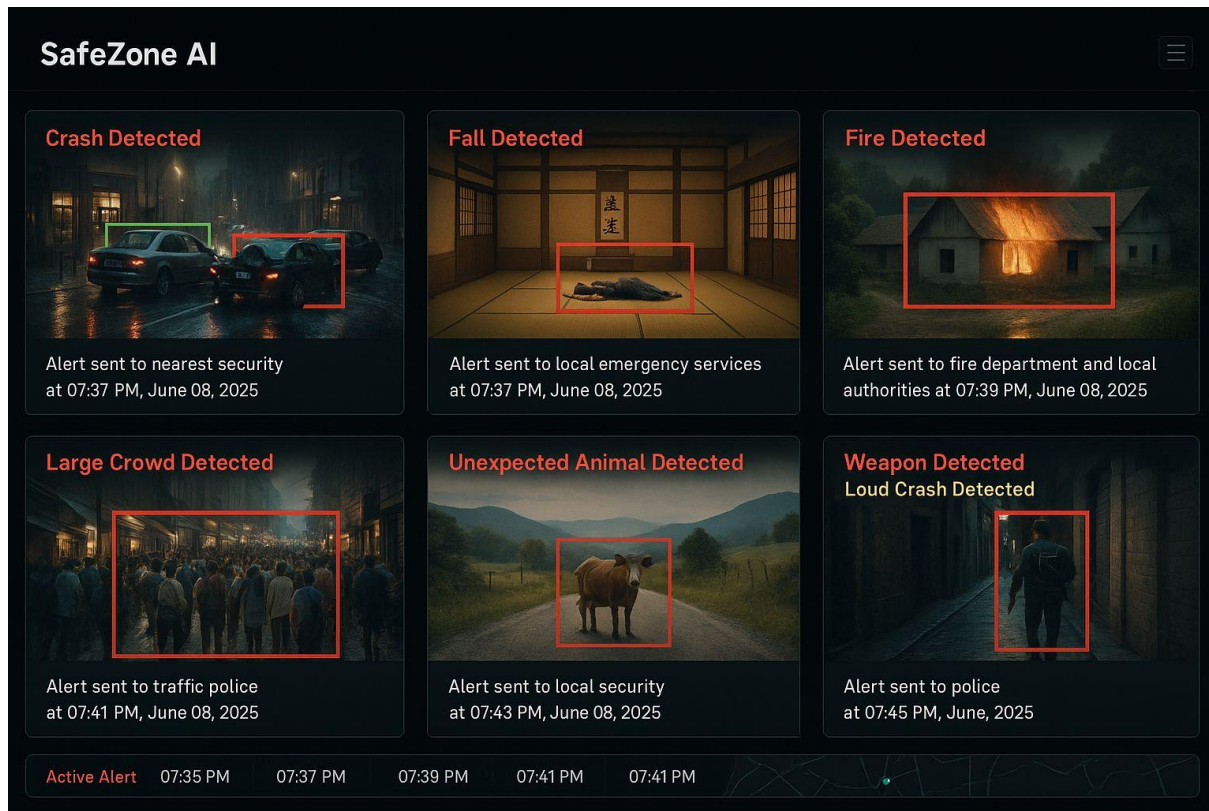
# References

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2. Sultani, W., Chen, C. and Shah, M. (2018). Real-World Anomaly Detection in Surveillance Videos. In Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition (CVPR).

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4. ESC-50 Dataset: Environmental Sound Classification Karol J. Piczak Proceedings of the International Conference on Machine Learning (ICML), 2015.

# References

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# Thank you.