Home Surveillance Assistant

An AI-Powered Real-Time Monitoring System

Abstract

- The Home Surveillance Assistant is an AI-driven system designed for real-time monitoring of indoor environments.

- It integrates object detection, fall detection, fire and smoke detection, and a chatbot interface.

- The system stores metadata in MongoDB and sends alerts via email.

- Objective: Enhance home security and safety using intelligent automation.

Introduction

Surveillance systems are essential for security, especially in smart homes.

Traditional systems lack intelligence and adaptability.

Recent advancements in AI enable smarter, responsive systems.

This project leverages computer vision and deep learning for enhanced monitoring.

Existing Method

Conventional CCTV systems:

- Record footage continuously.

- Require manual monitoring.

- Do not offer object recognition or anomaly detection.

Limitations:

- No real-time alerts.

- Lack of automation.

- High dependency on human intervention.

Proposed Method

Object Detection using YOLOv8 to identify and label items.

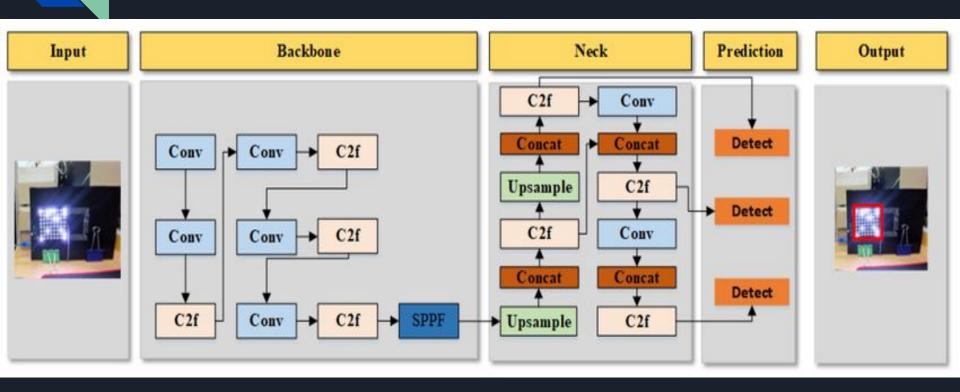**Fall Detection** by detecting whether is in fallen state or not.

Fire & Smoke Detection using YOLO.

Chatbot Interface for user interaction with voice input.

MongoDB to store object metadata with timestamps and coordinates.

Email Alerts for critical incidents.

YOLO Architecture

Object Detection Module

Model Used: YOLOv8 trained on custom dataset.

Detected Items: Laptop, bag, suitcase, human.

Functionality:

- Detects objects in real-time from the video feed.

- Stores label, coordinates, and timestamp in MongoDB.

- Updates if the object is moved or removed.

Accuracy: ~86% on test set.

Fall Detection Module

Approach: Trained a YOLO model for the detecting the state of human whether he is in fallen or falling.

Use Case: Elderly safety, accidental falls in households, when they are alone.

Detection Logic:

- When a sudden fallen state is detected, it triggers alert.

- Detects objects in real-time from the video feed.

Alert: Email notification on confirmed fall event.

Fall detection Flow chart

Fire & Smoke Detection Module

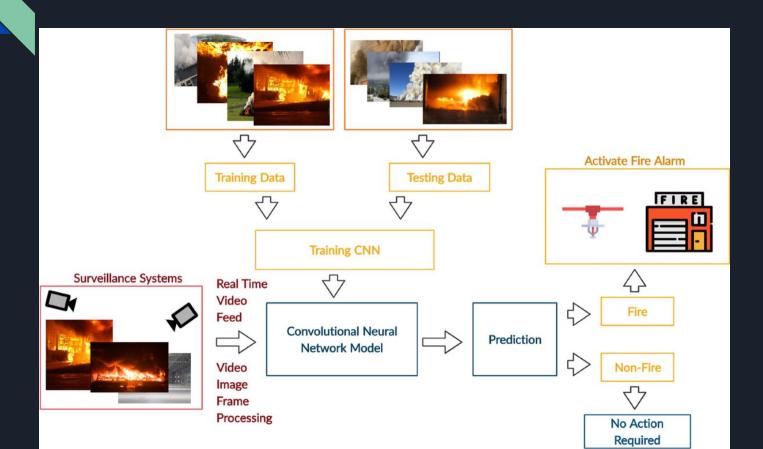**Technique:** YOLOv8 trained on fire/smoke datasets.

Features Detected: Color, motion, and shape of flame/smoke patterns.

Detection Response:

- Immediate alert through email.

- Stored image frame for evidence.

Accuracy: 88% in low-light and typical household settings.

Fire Detection Flow chart

Chatbot Interface

Built With: Flask + speech recognition module(voice input) + MongoDB.

Function:

- User can ask about object location (e.g., "Where is my laptop?").

- Voice converted to text, query processed using metadata.

- Returns last seen coordinates or status.

Benefit: Simple and hands-free interaction for locating items.

Initial Results

Object Detection Accuracy: ~86% (YOLOv8 on custom dataset)

Fall Detection: Detected within 1.2 seconds with ~87% accuracy.

Fire/Smoke Detection: Achieved 88% accuracy on test scenarios.

Chatbot: Successfully takes voice input and provides object location responses.

Future Scope

Integrate multi-camera setup for wider coverage.

Add human behavior analysis (e.g., aggression, abnormal movements).

Enable remote access via mobile app.

Incorporate edge computing to reduce server dependency.

Expand object tracking capabilities.

Conclusion

The Home Surveillance Assistant effectively improves home security through automation.

It combines multiple AI modules for holistic surveillance.

Offers real-time detection, alerts, and interaction.

Has strong potential for further enhancements and real-world deployment.

References

Bochkovskiy, A., et al. (2020). YOLOv4: Optimal Speed and Accuracy of Object Detection.

OpenCV for real-time video processing.

TensorFlow & PyTorch – Deep learning frameworks.

MongoDB documentation for NoSQL storage.

Roboflow on fire detection, fall detection.