Real-Time Person Detection and Alert System Using YOLOv8

1. Objective

The goal of this project is to develop a **real-time person detection and alert system** using the YOLOv8 object detection model. The system detects people via a webcam feed and triggers an **audio alert** and **email notification** upon detection.

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2. Tools and Technologies

- **Python** – Programming language used for development
- **OpenCV** – Real-time computer vision and video processing
- **Ultralytics YOLOv8** – Pre-trained object detection model
- **gTTS (Google Text-to-Speech)** – Converts text to speech for audio alerts
- **pygame** – Plays audio files for the alert system
- **smtplib** – Sends email alerts using SMTP protocol
- **Multithreading and Queue (optional)** – Can be used for non-blocking alerts and efficiency

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3. System Architecture

3.1. Input

- Real-time video feed captured using `cv2.VideoCapture(0)` (webcam).

3.2. Processing

- The `YOLOv8n.pt` model detects objects in each frame.
- Detected objects are filtered for `class_id == 0`, which corresponds to a **person**.
- Bounding boxes and labels are drawn for detected persons.

3.3. Output & Alerts

- **Audio Alert**:
    - `buzzer.mp3` is played using `pygame`.
    - A voice alert is generated via `gTTS` saying “Person detected”.
- **Email Alert**:
    - An email is sent to a specified recipient informing them that a person has been detected.

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4. Key Functions

Function Name	Purpose
`play_alarm()`	Plays a buzzer sound when a person is detected
`say_person_detected()`	Converts text-to-speech and plays voice alert
`send_email()`	Sends an alert email using SMTP protocol

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5. Email Configuration

- **Sender Email**: `your_email@gmail.com`
- **Password**: Application-specific password for Gmail (for secure access)
- **Recipient Email**: `recipient_email@example.com`

Note: It is recommended to use environment variables or a `.env` file to store sensitive data like email credentials.

6. Flowchart

Start

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Initialize Webcam and YOLOv8

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Capture Frame from Webcam

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Detect Objects using YOLOv8

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Is Person Detected?

↓ ↘

Yes No

↓ ↓

Draw Bounding Box

Play Buzzer & Voice Alert

Send Email Notification

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Wait for 30 seconds (cooldown)

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Continue Loop

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Press 'q' to Exit

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Release Camera and Close Windows

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7. Enhancements & Suggestions

- **Multithreading**: Use threads to run audio and email functions concurrently to prevent UI lag.
- **Database Logging**: Log detections in a database for future review and analysis.
- **GUI Integration**: Use Tkinter or PyQt for user-friendly interface.
- **Cloud Storage**: Upload snapshot/image to cloud (e.g., Firebase or AWS S3) and include link in email.
- **SMS Alerts**: Integrate with Twilio API for real-time SMS alerts.

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8. Conclusion

This system effectively demonstrates a practical application of object detection using **YOLOv8** integrated with real-time alert mechanisms. It can be deployed for **home security, restricted area monitoring, and surveillance systems**. With further improvements like cloud integration and GUI support, it can evolve into a complete commercial product.

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