**Patent Filing Document: Intelligent Surveillance and Suspect Identification System**

**1. Title of the Invention**

Intelligent and Selective Surveillance-Based Subject Identification and Notification System

**2. Field of the Invention**

The present invention relates to intelligent surveillance, facial recognition, and subject monitoring systems. It more specifically pertains to a unified platform that integrates CCTV video analysis, real-time subject identification using ONNX-based facial recognition, selective frame capture, and automated notification for organizations requiring identity verification, such as security agencies, enterprises, public safety infrastructures, and commercial environments.

**3. Background and Prior Art**

Numerous surveillance systems exist for tracking and identifying individuals in public or private spaces. Traditional systems continuously record video streams, consuming extensive storage and computational resources. Others offer facial recognition tools but lack comprehensive integration with real-time alerts, effective human detection, and management interfaces.

Relevant systems include:

* *Smart Surveillance Systems*: Video monitoring platforms for detecting individuals or objects.
* *Facial Recognition Engines*: Systems for comparing live camera images with databases.
* *Smart Cities Infrastructure*: Large-scale integrated surveillance and alerting platforms.

However, none of these existing solutions deliver:

* Intelligent frame capture triggered by human detection.
* Lightweight ONNX-based facial recognition embedded within a .NET environment.
* Centralized platform for managing subjects, locations, users, devices, and alert workflows.
* Real-time actionable notifications via multi-channel delivery.

**4. Summary of the Invention**

This invention introduces a multi-layered surveillance and subject identification platform that:

* Detects and extracts video frames only when human presence is detected to optimize storage.
* Matches faces from captured frames against a subject database using an ONNX-based facial recognition engine.
* Annotates and logs the matched frames with metadata.
* Sends instant notifications via SMS, voice call, or email based on configurable thresholds.
* Provides a robust administrative interface to manage users, subjects, devices, notifications, and match logs.

**5. Detailed Description of the Invention**

**5.1 System Architecture Overview**

* **Frontend**: Angular-based responsive web UI offering:
  + Subject Management
  + Device (CCTV) Management
  + Match Reporting
  + Notifications Dashboard
  + User and Role Management
* **Backend**: Python Flask REST API managing:
  + CRUD operations
  + Security and access roles
  + Notification dispatch logic
* **Database**: SQLite schema capturing:
  + Device metadata
  + Subject records
  + Match events
  + Notification logs
  + User and permission mappings
* **Frame Extraction Utility**:
  + Developed in Python
  + Subscribes to real-time CCTV streams
  + Uses motion and human detection (OpenCV + ML model) to save only relevant frames
* **Face Recognition and Matching Utility**:
  + Written in C# using .NET Core
  + Integrates ONNX runtime
  + Converts image frames to embeddings
  + Matches against stored subject embeddings
  + If match confidence > threshold:
    - Stores matched frame
    - Creates match log in database
    - Triggers notification workflow

**5.2 Functional Modules**

**A. Intelligent Frame Capture Engine**

* Detects humans using lightweight ML models.
* Prevents unnecessary storage by capturing only activity-based frames.

**B. Real-Time Face Matching via ONNX**

* Extracts face embeddings from suspect and frame images.
* Uses vector similarity (e.g., cosine distance) to confirm matches.
* Supports augmentation + averaging to improve match accuracy.

**C. Notification Dispatch System**

* Sends alerts through:
  + Email (SMTP)
  + SMS (via gateway APIs)
  + Voice Calls (via Twilio or similar)
* Automatically triggered on confirmed match events.

**D. Web-Based Admin Dashboard**

* Angular interface with modal-based forms.
* Uses ngx-datatable for data listing.
* Allows:
  + Creating and editing users
  + Managing subjects and devices
  + Viewing match logs and system activity

**E. Role-Based Access Control**

* Granular permission control
* Configurable roles (Admin, Operator, Viewer)

**6. Workflow Diagram**

**Subject Detection and Notification Flow:**

[Live CCTV Feed] → [Frame Extraction Utility]

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[Human Detection Logic]

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[Save Frame in Folder (if human)]

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[Face Matching Utility - ONNX/.NET]

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[Match Found?] → Yes → [Log Match]

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[Send Notification (SMS/Email/Voice)]

**7. Claims**

* **A method** for selectively capturing video frames from a live CCTV feed, comprising the steps of detecting human presence in the video stream and extracting only frames that contain such presence.
* **A facial recognition system**, implemented in a .NET environment, that uses ONNX models to generate embeddings from extracted CCTV frames and matches them against stored embeddings of known suspects.
* **A real-time alert mechanism** that automatically triggers multi-channel notifications—comprising at least one of SMS, email, or voice call—upon confirmation of a face match between a captured frame and a known suspect.
* **A centralized platform** integrating frame capture, facial recognition, and notification components, further comprising:
* a web-based administrative dashboard built with Angular,
* backend APIs implemented in Python Flask for managing entities,
* and a centralized database for storing data related to users, suspects, match logs, and device configurations.
* **The combination** of selective frame extraction, ONNX-based facial recognition, and automated real-time notifications, wherein said combination is applied within a law enforcement operational context, providing a novel and non-obvious approach to surveillance and suspect identification.

**8. Advantages of the Invention**

* Significantly reduces storage usage.
* Enables real-time response to identity matches.
* Designed for low-resource environments.
* Fully modular and extensible.
* Adaptable to non-police use cases such as commercial surveillance, employee access systems, and retail fraud detection.

**9. Future Enhancements and Differentiators**

* Mobile integration for real-time suspect alerts on field devices.
* Graph-based dashboards showing suspect movement over time.
* Edge deployment using NVIDIA Jetson or Raspberry Pi.
* AI-based anomaly detection to spot suspicious behavior trends.

**10. Conclusion**

This invention delivers a novel, technically refined surveillance and identity management system that intelligently captures video data, identifies subjects in real time, and facilitates immediate responses through integrated alerting. Its modularity and scalability make it applicable across industries, providing a competitive edge and unique technical positioning suitable for patent protection.

**Appendices**

* **Appendix A**: High-Level Architecture Diagram
* **Appendix B**: Sample Database Schema (SQLite Tables)
* **Appendix C**: Extract of ONNX Matching Code
* **Appendix D**: Notification Workflow Diagram
* **Appendix E**: Sample UI Screenshots (optional)