Foundation University Islamabad

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SCD

1. Background/Introduction of the System

The Smart CCTV System Using Face and Human Detection is an innovative surveillance solution that harnesses cutting-edge technology, including advanced facial recognition and human activity analysis, to transform traditional CCTV cameras into intelligent security tools. By identifying individuals, distinguishing suspicious behavior, and providing real-time alerts, this system enhances security in various settings while also protecting individual privacy. Its scalability, video analytics, and machine learning capabilities ensure adaptability to evolving security challenges, making it a crucial advancement in the field of video surveillance.

2. Problem Statement (Problem that software system will solve)

The Smart CCTV System Using Face and Human Detection addresses the critical shortcomings of traditional surveillance systems. Conventional CCTV cameras often generate vast amounts of unstructured footage, overwhelming security personnel and hindering their ability to respond effectively to security threats. Moreover, these systems lack the capability to intelligently identify individuals or distinguish between normal and suspicious activities. As a result, there is a pressing need for a comprehensive solution that can not only monitor and record but also analyze video data in real-time, providing actionable insights to enhance security and facilitate rapid responses to potential security breaches. This system aims to bridge these gaps by offering advanced facial and human detection, real-time alerts, and video analytics to revolutionize the way we approach surveillance and security.

3. Business Objectives and Preliminary Requirements (SRS Document)

Business Objectives

Enhanced Security: The primary objective is to significantly improve security in various sectors, including public spaces, transportation hubs, commercial establishments, and critical infrastructure. This system will help prevent security breaches, thefts, and unauthorized access by providing real-time alerts and intelligent threat detection.

Reduced Response Times: Decreasing response times to security incidents is a key goal. By promptly identifying and alerting security personnel to potential threats, the system aims to expedite decision-making and intervention, minimizing the impact of security breaches.

Customer Satisfaction: Customer satisfaction is vital for the long-term success of the system. Satisfied clients are more likely to renew contracts, recommend the system to others, and provide valuable feedback for continuous improvement, which can lead to sustained growth and market reputation.

Compliance with Privacy Regulations: Ensuring compliance with privacy regulations is essential to avoid legal and ethical complications. This objective demonstrates a commitment to respecting individual privacy rights while maintaining robust security measures, building trust with clients and stakeholders.

Preliminary Requirements

Face Detection: The system shall be able to detect faces of unknown individuals in the CCTV footage.

It should use the Viola-Jones algorithm for face detection.

Face Recognition: The system shall recognize the identity of detected faces using a trained classifier.

It should use a face recognition algorithm, leveraging training data.

Human Detection: The system shall detect the presence of humans in the CCTV footage.

It should use the HOG-SVM algorithm for human detection.

Duration Tracking: The system shall track the duration for which detected individuals or humans are present in the footage.

It should calculate the duration based on timestamps of initial and last detection.

Alarm Trigger: The system shall trigger an alarm if the detected duration exceeds a specified threshold.

Configurability: Users shall be able to configure parameters for face detection, human detection, and alarm thresholds.

The system should allow for the selection of different classifiers and detectors.

User Interface: The system shall provide a user-friendly interface for configuring and monitoring the detection process.

It should display detected faces, humans, and relevant timestamps.

Logging and Reporting: The system shall log detection events, including timestamps and identified individuals.

It should generate reports summarizing detection results.

Performance Optimization: The system shall optimize the processing speed of face and human detection to handle real-time CCTV footage.

Non-Functional Requirements

Accuracy: The face detection and recognition algorithms should have a high level of accuracy. The human detection algorithm should minimize false positives and negatives.

Speed: The system should perform real-time or near-real-time processing of CCTV footage. Face and human detection should be computationally efficient.

Scalability: The system should be scalable to accommodate a varying number of cameras and streams. It should handle increasing data loads without compromising performance.

Security: Access to the system and configuration settings should be secure and protected. Detected faces and human data should be stored securely, adhering to privacy regulations.

Usability: The user interface should be intuitive, making it easy for users to configure and monitor the system it should provide clear feedback on detection events.

Reliability: The system should be highly reliable, ensuring minimal downtime it should recover gracefully from errors or failures.

Portability: The system should be deployable on various platforms and operating systems it should support different camera models and formats.

Maintainability: The code base should be well-documented and maintainable. Updates and modifications should be easy to implement.

Compliance: The system should comply with data protection and privacy regulations it should adhere to any relevant industry standards for security and performance.

Integration: The system should allow integration with other security or monitoring systems it should provide APIs or interfaces for data exchange.

4. Current Situation and Opportunity Statement (Current Problems and Solution)

Problem:

The current surveillance system lacks efficient face and human detection capabilities, leading to false alarms and an inability to identify individuals. There is no duration tracking, making it challenging to assess the significance of detected events, and no real-time alerts for potential security threats or prolonged activity.

Solution:

To address these issues, we propose implementing advanced face detection using the Viola-Jones algorithm, integrating HOG-SVM for human detection, and incorporating duration tracking with user-configurable thresholds. Real-time alerts will be triggered for suspicious or prolonged activity, enhancing the system's security and monitoring capabilities.

5. Options and Recommendations (Potential and Recommended Solution to Problem)

Implement an advanced surveillance software solution that incorporates accurate face detection using the Viola-Jones algorithm, precise human detection with HOG-SVM, duration tracking, real-time alerts with user-configurable thresholds, an intuitive user interface, performance optimization, robust security measures, scalability for multiple cameras, and integration options, thus overcoming current limitations and enhancing security and monitoring capabilities.

6. Schedule Estimate (Estimated Completion time of Project)

The estimated completion time for the project will be determined during the project planning phase, taking into account factors such as project scope, complexity, available resources, and team size. A detailed project schedule will be established, outlining milestones and deadlines to ensure a well-managed and timely project delivery.

7. Potential Risks and Mitigation Plan (Uncertainty and Plan Bs)

Potential risks for the project include algorithm accuracy issues, hardware limitations, privacy concerns, integration challenges, and environmental factors affecting detection, project delays, regulatory changes, and resource availability. To mitigate these risks, we will conduct rigorous testing, implement data encryption and compliance measures, collaborate closely with stakeholders for integration, develop robust algorithms, and maintain clear communication while regularly assessing and adapting to changing conditions. Contingency plans will be in place to ensure the successful implementation of the surveillance system.

The Smart CCTV System Using Face and Human Detection is an innovative surveillance solution that harnesses cutting-edge technology, including advanced facial recognition and human activity analysis, to transform traditional CCTV cameras into intelligent security tools. By identifying individuals, distinguishing suspicious behavior, and providing real-time alerts, this system enhances security in various settings while also protecting individual privacy. Its scalability, video analytics, and machine learning capabilities ensure adaptability to evolving security challenges, making it a crucial advancement in the field of video surveillance.