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Methodologies and Models Justification in Smart Surveillance System with Behavioral Analytics

➔ **Introduction**

Modern surveillance systems go beyond simple video monitoring, incorporating AI to analyze behaviors, patterns, and space utilization. In commercial settings like retail stores, office buildings, or public spaces, understanding human activity can greatly enhance operational efficiency, security, and customer experience.

➔ **Methodologies**

● **Object Detection and Tracking:**

• Methodology: The system employs a custom-trained YOLOv8s model for object detection. YOLOv8s (You Only Look Once) is a state-of-the-art object detection model known for its speed and accuracy. Additionally, object tracking techniques are utilized to assign IDs to individuals and track their movements across frames.

• Justification: Object detection and tracking are essential for identifying and monitoring individuals within surveillance footage. YOLOv8s provides real-time detection capabilities, making it suitable for analyzing live video feeds.

● **Desk Region Detection:**

• Methodology: The system defines specific regions within the camera frames as desks. These desk regions are used to determine if individuals are occupying desks or not.

• Justification: By defining desk regions, the system can differentiate between individuals standing in other areas and those seated at desks. This information is crucial for understanding desk utilization patterns.

● **Concurrency with Threads:**

• Methodology: The system utilizes threads to manage multiple cameras concurrently. Each camera is handled in a separate thread, allowing for parallel processing and improved efficiency.

• Justification: Concurrency with threads optimizes system performance by enabling simultaneous processing of camera feeds. This approach reduces processing time and enhances real-time monitoring capabilities.

- **Database Storage:**

- Methodology: Data collected by the system, including occupancy times and desk statuses, is stored in a database file.

- Justification: Database storage facilitates data management and analysis. Storing collected data in a structured format allows for easy retrieval and enables post-processing tasks such as generating reports and conducting further analysis.

- **Models Used**

- **YOLOv8s Object Detection Model:**

- Description: YOLOv8s is a deep learning-based object detection model trained on a custom dataset to detect people within surveillance footage.

- Justification: YOLOv8s is chosen for its real-time detection capabilities and high accuracy. By training the model on a custom dataset, it can effectively identify individuals within camera frames, enabling behavioral analysis.