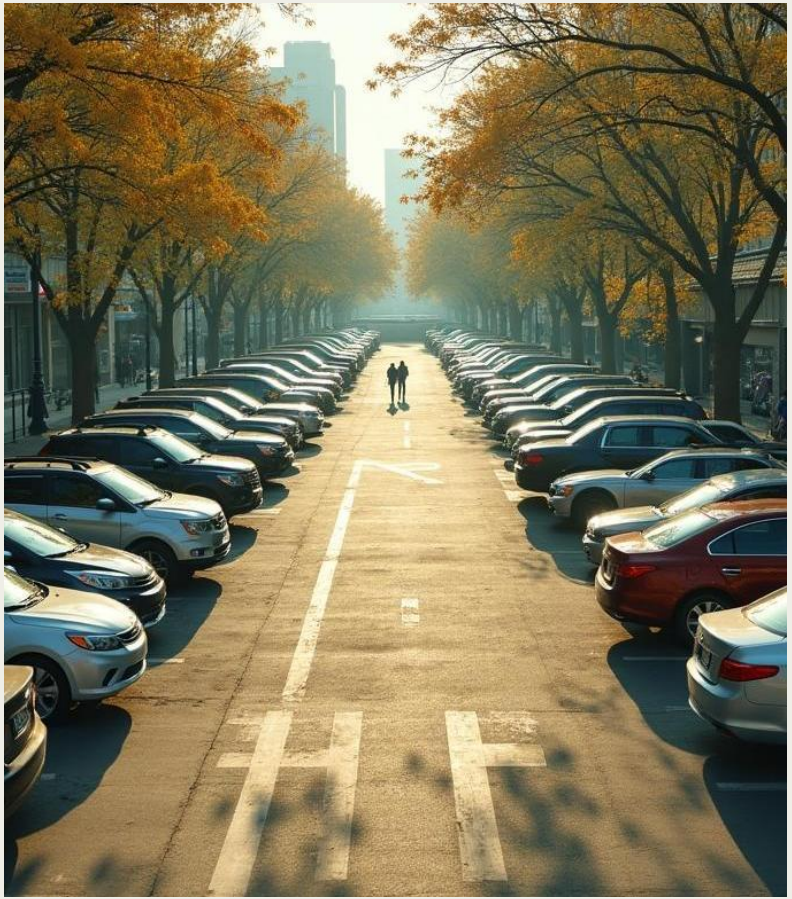
Intelligent Parking Management

Leveraging Computer Vision for Efficient Parking Space Utilization

Introduction

This presentation outlines and proposes a computer vision solution that enhances parking lot management.



01

Automation

Vision-based parking solutions

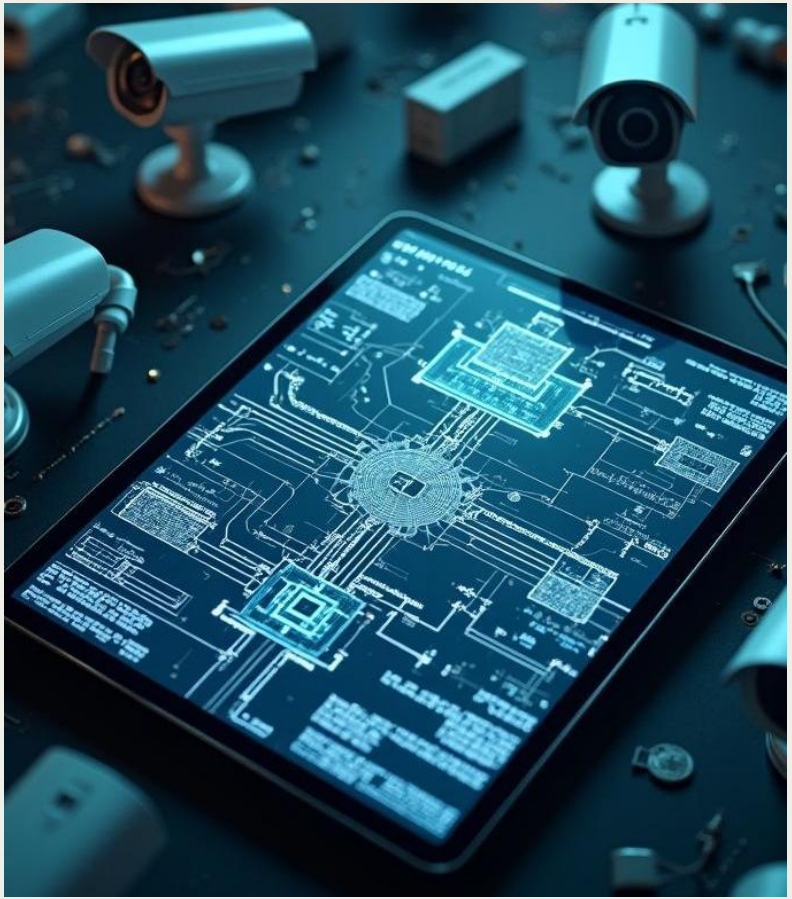
Vision-based parking solutions utilize computer vision technology to monitor and manage parking spaces efficiently. By employing static CCTV footage and advanced object detection algorithms, these systems provide real-time data on parking slot availability. This method eliminates the need for physical sensors, making the solution cost-effective and adaptable to various parking configurations. Users benefit from a graphical interface that visually indicates the status of parking slots, improving convenience and reducing search times.

02

Methodology

System Architecture Overview

The system architecture consists of an input stage that processes pre-recorded or live CCTV footage from the parking lot. This footage serves as the primary data source for the system, enabling it to analyze parking slot occupancy effectively. A processing pipeline performs various functions, including frame extraction, preprocessing of images, and the application of object detection algorithms to identify vehicles. The architecture is designed to work with static camera angles and fixed-slot layouts to ensure accurate occupancy detection.



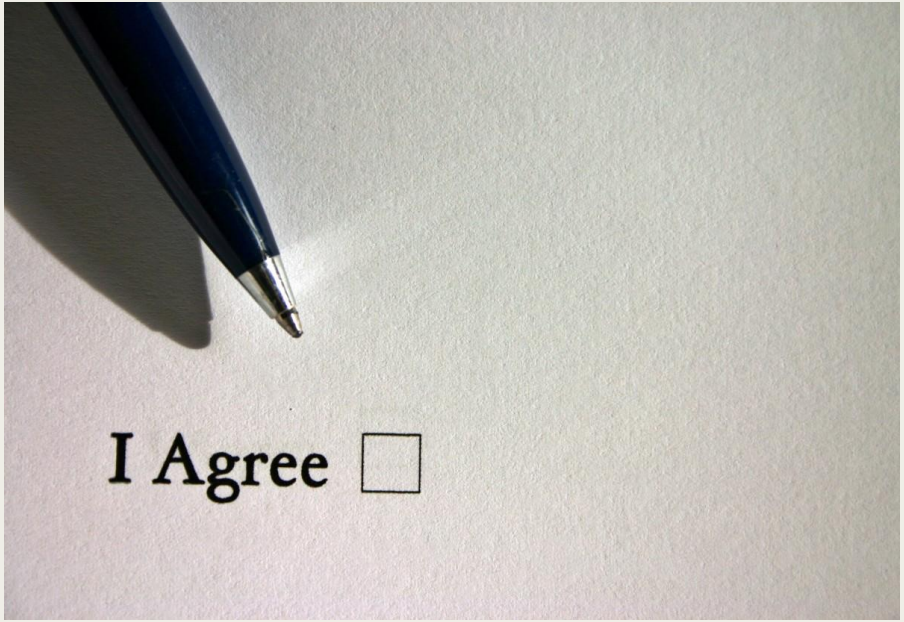
Processing Pipeline Steps

The processing pipeline involves several key steps. First, frame extraction captures images at regular intervals from the video feed. Next, preprocessing techniques such as resizing and contrast adjustment improve image quality for better detection accuracy. Subsequently, an object detection model, specifically YOLOv8, identifies vehicles in the footage. Following detection, segmentation models are used to create slot-wise masks that determine whether each parking slot is occupied or available based on vehicle locations. The final output is a visual representation of slot availability displayed in the user interface.

Tools and Technologies Used

This project employs several tools and technologies to develop the intelligent parking system. The programming language used is Python, known for its versatility and ease of integration with machine learning frameworks. The primary frameworks utilized include OpenCV for image processing, PyTorch, and TensorFlow for implementing machine learning models. The system's user interface is developed using Tkinter or PyQt, providing an intuitive experience for users. YOLOv8 serves as the foundation for fast and efficient vehicle detection, ensuring real-time performance. Furthermore, manually annotated parking slots are stored as coordinates to facilitate accurate occupancy calculations.

Conclusions



The proposed intelligent parking lot monitoring system significantly enhances parking space management through the implementation of computer vision technologies. By addressing the inefficiencies of traditional systems and leveraging real-time data, this solution improves user experience and optimizes parking space utilization. Future enhancements, such as license plate recognition and smart notifications, can further augment the system's capabilities, contributing to the overarching goal of smart city infrastructure development.