

SMART PARKING SYSTEM USING ARTIFICIAL INTELLIGENCE AND YOLO FOR REAL-TIME VEHICLE DETECTION WITH SLOT RESERVATION FEATURE

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Keywords:

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Introduction:

The increasing number of vehicles in urban areas has created significant challenges in managing parking space effectively. Traditional parking methods depend heavily on manual processes, which tend to be slow, inefficient, and prone to mistakes. These methods cannot meet the changing needs of modern cities, where drivers often spend a lot of time searching for available parking. This problem causes inconvenience and adds to traffic congestion in cities, leading to wasted fuel and increased pollution. Therefore, there is a rising demand for automated smart parking systems to address these urban traffic issues. To solve these problems this project proposes an AI based smart Parking system that uses computer vision to monitor parking space availability in real time. By analysing camera feeds, the system can accurately identify which slots are taken and which are open without needing additional hardware like sensors. A website provides its real time updates, allows them to reserve parking slots, and assists with navigation. The system also features a 15 minutes reservation option enabling users to temporarily hold a parking slot before they arrive ensuring availability without a long-term blocking of spaces. This smart solution enhances parking efficiency, reduces congestion, and offers a flexible answer for various urban areas.

Objectives:

1. To develop an AI-powered system that identifies available parking spaces in real time.
2. To reduce human intervention, save time, and optimize space utilization.

3. To provide users with a seamless and intelligent parking experience via a website or in-vehicle system.

Methodology:

1. The proposed Smart Parking System is designed to monitor and manage parking spaces efficiently using Artificial Intelligence and computer vision techniques. The methodology begins with capturing real-time video footage of the parking area through installed surveillance cameras. These live camera feeds are processed continuously to detect vehicles entering, exiting, or occupying parking slots. The YOLO (You Only Look Once) object detection model is used as the core AI component to identify vehicles accurately in different environmental conditions. Once the video frames are captured, they are preprocessed and passed to the trained YOLO model, which detects the presence of vehicles and determines the status of each parking slot as either occupied or vacant. The system also incorporates Optical Character Recognition (OCR) to recognize vehicle number plates for identification and record-keeping purposes. The detected information, including slot occupancy, vehicle entry time, and exit details, is stored and managed using a MySQL database.
2. A web-based application is developed using appropriate frontend technologies to provide a user-friendly interface for both administrators and users. The system updates parking slot availability in real time, allowing users to view the current status of parking spaces and make reservations. A temporary reservation feature is implemented, enabling users to hold a parking slot for 15 minutes before arrival, after which the slot is automatically released if not occupied. The administrator module provides full control over parking management, including monitoring slot usage, verifying vehicle entry and exit, and confirming payment status. The integration of AI detection, database management, and web interface ensures smooth communication between system components. Overall, this methodology enables automated parking monitoring, reduces manual effort, improves parking efficiency, and supports real-time decision-making in open parking environments.

Result and Conclusion:

1. The Smart Parking System was successfully implemented, enabling real-time monitoring and management of parking spaces. With the integration of YOLO v11, the system accurately detects vehicles, identifies available parking slots, and captures license plates. The use of a MySQL database ensures efficient storage and management of parking data, allowing slot occupancy updates to be reflected accurately on the platform. The web-based interface allows users to easily check parking availability, view detection results, and make 15-minute reservations in a simple and user-friendly manner. The project demonstrates

reliable detection performance, smooth communication with the database, and a seamless user experience, providing an effective solution for managing open parking areas.

2. In conclusion, the Smart Parking System provides an efficient method for monitoring and managing parking spaces in open environments using the YOLO v11 algorithm and MySQL database integration. The system offers an intuitive web interface that enables users to view available parking slots and make short-term reservations based on their needs. The integration with the MySQL database ensures that the real-time status of parking slots is accurately maintained and displayed, providing users with up-to-date and reliable information.

Future Scope:

The future scope of this project includes:

1. Development of a mobile application to provide easier access and improved user convenience.
2. Integration of navigation support to guide users to the nearest available parking slot using real-time location services.
3. Implementation of in-app payment features to enable secure and seamless digital transactions for parking services.