Advanced Parking System

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Abstract. The project entitled ADVANCED PARKING SYSTEM utilizes JavaScript and Python to reduce traffic congestion stemming from parking unavailability. The system identifies and displays the nearest vacant parking slot relative to a user's location. Efficient usage of parking real estate is achieved by continually tracking open spaces and allocating bookings. The core on-site module monitors parking occupancy through signals reflecting the availability status of individual spaces in real-time. This data feeds into a mobile application that allows drivers to check availability and reserve open slots. Together, the automated signaling of vacancies and user-friendly booking interface aim to create a reliable, rapid, and secure parking management ecosystem. By directing drivers to empty spaces, congestion arising from hunting for slots is greatly mitigated.

1 Introduction

Each passing day witnesses a surge in the fleet of personal vehicles navigating our roads, inevitably resulting in a growing challenge of finding parking spaces, particularly during peak hours. This phenomenon not only consumes drivers' valuable time but also contributes to unnecessary fuel consumption and exacerbates traffic congestion. Moreover, the rise in vehicular emissions negatively impacts the environment. Consequently, reservation-based smart parking systems have become a necessity.

This Smart Parking Application aims to aid drivers in finding and reserving the most suitable parking area. Users can view various parking options and select their preferred location. If the desired parking slot is vacant, drivers can book the spot for a specific time, with the option to extend or cancel the reservation. The infrastructure employs available open spaces for parking, ensuring both convenience and security. Overall, this application tackles parking availability and traffic problems through an innovative solution.

The technical backbone involves using image processing to identify occupied versus unoccupied parking slots. Specifically, Python scripts analyze camera images of parking spots to determine vehicle presence.

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We propose an Android application that allows drivers to book slots after verifying availability through the computer vision algorithm described above. This can significantly reduce the time spent hunting for a spot by allowing reservations.

2 Literature Review

2.1 Research on Automatic Parking Systems Based on Parking Scene Recognition

This paper develops a smart parking system app enabling drivers to reserve vacant slots detected via computer vision. Cameras placed in parking facilities feed footage to image processing algorithms that identify unoccupied spaces. Drivers use the mobile application to book these vacant spots and access navigation to the reserved parking location. Our system uniquely employs scalable machine vision technology for parking monitoring and availability updates. This parking occupancy oversight bypasses a need for manual sensing or human oversight. The automated vision-based analysis is easily adapted across diverse parking configurations.[4]

2.2 Smart parking system with image processing facility

This Smart Parking System obtains real-time parking availability information through image processing algorithms. Cameras installed in parking facilities capture footage that is analyzed to identify vacant spaces. The system processes this visual data and allocates bookings for open slots. A prototype employs a rack-pinion mechanism to automatically lift and position vehicles in the reserved spot when drivers arrive. This robotic parking assist functionality, enabled through computer vision updates, constitutes an automated end-to-end smart parking solution.[3]

2.3 Automatic Parking Management System and Parking Fee Collection Based on Number Plate Recognition

An AI-Powered Parking Optimization Network Leveraging Vehicle Fingerprinting for Automated Access and Billing The goal is to create a parking system that enhances convenience and security while automatically handling fees without requiring magnetic cards. The system uses image processing and optical character recognition to identify vehicles by their license plates. This enables automatic parking guidance to available spaces as well as billing the corresponding vehicle owner. The entire parking process and access control runs via a pre-programmed controller for minimal human involvement.[5]

2.4 Automated car parking system commanded by android application

The Automated Car Parking System, controlled by an Android application, manages the number of vehicles parked in a facility through automated parking and exit processes. Sensors identify available slots, enabling optimized use of the parking space based on real-time occupancy. Entry and exit are controlled through an Android app. Users command the automated parking or retrieval of their vehicle via this mobile interface. Once commanded, the system automatically maneuvers the car to open parking spots or back to the exit gate through robotic machinery.[1]

3 Implementation of The System

The parking area is live streamed using cameras connected to the system. The video feed is processed as a sequence of images. To efficiently analyze parking occupancy, the system first converts the RGB images into grayscale. This removes unnecessary white space and speeds up processing. Next, the parking area is divided into standard slot sizes based on space boundaries. To accurately identify vehicles, the grayscale image of each parking slot is converted into an inverted binary image. This turns occupied spaces black and open slots white. This inverted binary representation allows efficient computer vision analysis to distinguish between vacant and occupied parking spots in the video stream. Overall, the image processing pipeline enables reliable real-time detection through the camera imagery to support the parking booking system.

The algorithm processes each inverted binary parking slot image to determine occupancy. It counts the number of white pixels to obtain a threshold value representing the emptiness of the space. If the white pixel count exceeds a benchmark threshold, then the slot is considered vacant and available for parking. Conversely, if a vehicle is present in the slot, it will show up as black pixels. This pulls the white pixel count below the threshold, correctly signaling the system that the space is occupied. In effect, by comparing the white pixel tally against a calibrated benchmark, the system can reliably discern between unoccupied and occupied parking spaces from the inverted binary images. This allows accurate real-time detection of vacancies to support the parking reservation functionality and guide drivers to open slots. The thresholding approach provides robustness by avoiding misclassifications if some pixels are incorrectly black or white. The following figure 1 explains about block diagram

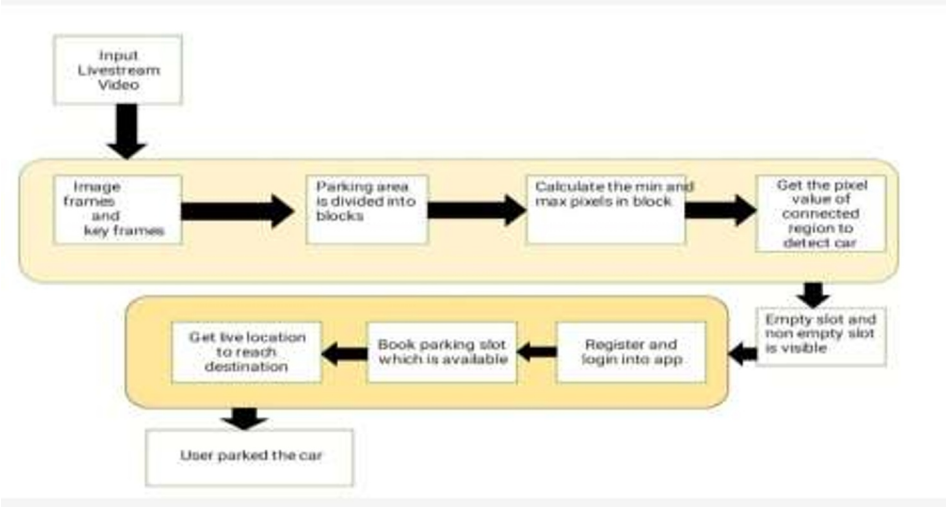

Fig. 1 Block diagram

4 Visualization and Analysis

4.1 Image showing experimental output.

The following figure 2 shows the detecting empty slots**.**

Fig. 2. Detecting empty slots

The following figure 3 shows the updating of the slots**.**

Fig. 3. Updating the slots

4.2 Output

The following figure.4 shows the main page of the mobile parking application. It provides users with various features to manage and improve their parking experience.

Fig. 4. Index page of application

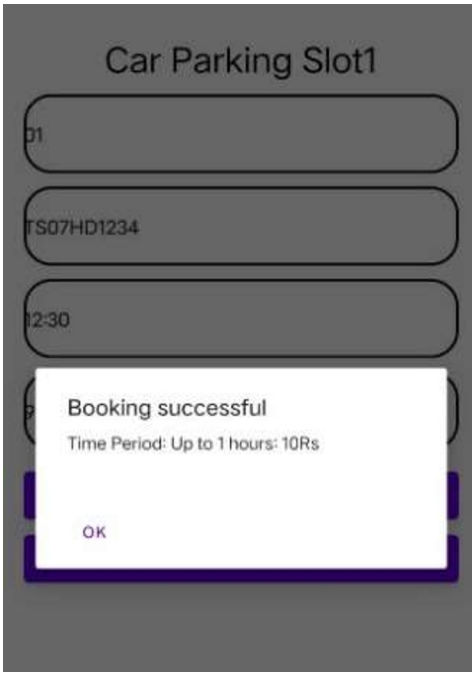

Fig. 5. Booking successful message

The following figure 6 shows the reservation page streamlines the parking booking process by letting users select the exact parking duration needed, while showing appropriate available time slots across various location options. The calendar and reservation summary enable easy booking confirmation

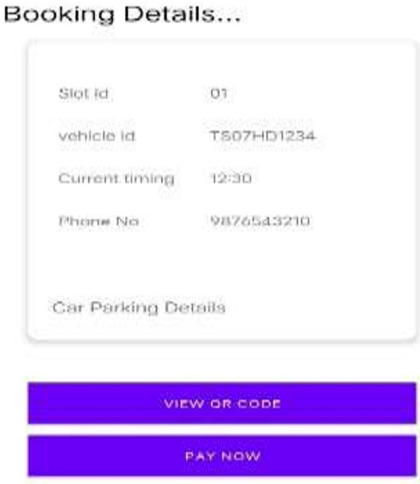

Fig.6 Booking details of user

The following figure. 7 shows the location of the slots**.**

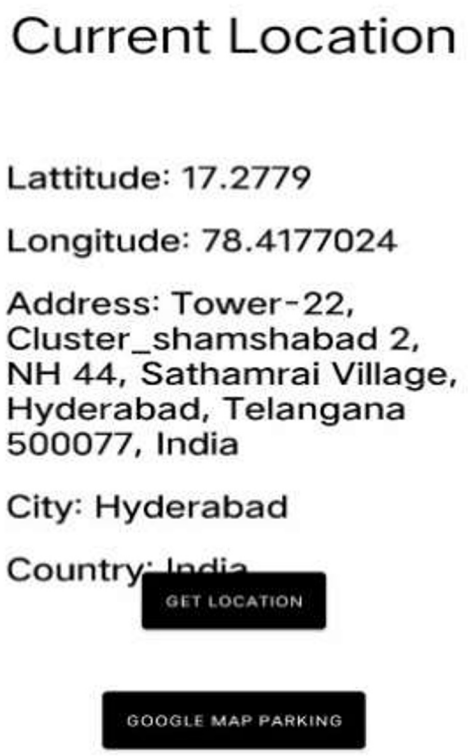

Fig.7 Location of the slot

5 Result

This innovative mobile app implements advanced technology to simplify finding and paying for parking. Using computer vision, the app maps parking areas and identifies open spaces in real-time. Users can visualize available spots right in the app and get directed to vacant spaces to reduce search time. Integrated CCTV reflects real-time occupancy information. If a spot is empty, users can reserve and pay for a particular time slot digitally through the app. The app allows users to locate their vehicle, find convenient parking, reserve, and pay for spots, and avoid unnecessary circling and cash payments, all through an intuitive mobile interface. The app's intelligent features and automation make parking a frictionless experience.

6 Conclusion

Accordingly, our team proposed and implemented a mobile application solution enabling drivers to digitally pre-book parking access slots ahead of time for booking available slots. A key advantage is avoiding expensive hardware sensors through use of computer vision. Users can visually identify and reserve vacant parking spaces through live camera feeds in the application. The mobile app provides multiple features beyond just parking bookings to improve convenience. This includes current location tracking to aid navigation, booking history and statistics, and time-bound reservations to fit usage needs. Here are some of the

points which also include:

- latest computer vision models for automated scene comprehension, the platform aims to provide drivers with live inventory of available parking supply.
- This grants motorists the ability to pre-book spots minimizing fruitless hunting and congestion-causing queues near full facilities.
- It also allows the user to do the digital payment.
- So hereby, we conclude that with the implementation of the proposed system will time savings stemming from remote visibility and pre-booking, traffic reduction perks from eliminating cruising patterns.

7 Future Scope

There is scope for enhancements to build on the core parking booking and vision-based vacancy detection functionality. One potential upgrade is integrating high-performance CCTV cameras for real-time parking lot visibility through the application. Users could visually verify the latest parking availability rather than relying on statistical occupancy data. Additionally, navigation and guidance features could be added to not just book slots but also assist drivers in reaching the allotted space. Turn-by-turn prompts can ensure users reach reserved parking in the minimum time.

This smart parking application empowers drivers with parking availability information and booking capabilities unlike traditional first-come-first-serve facilities. Large scale adoption stands to benefit users even in unfamiliar areas. The user-friendly app enhances convenience. By allowing drivers to reserve vacant spaces ahead of arrival, this Advanced Parking System aims to reduce on-site congestion and search times that degrade quality of life. The Android application provides visibility and limited time bookings for available parking spaces including seamless online payments. While the current system is a prototype, it demonstrates the capabilities of an automated smart parking solution. In the future, the project can be enhanced to leverage more powerful image recognition and targeting capabilities for mainstream real-time deployment at scale. The core innovations around camera-based sensing and mobile reservations lay the foundations for potential real-world implementation. It includes:

- Combining the camera parking live visual in app to use more friendly.
- Overcome the problem of multi-color road detecting parking slot.
- Using high performance camera in different weather conditions in different areas
- Car entry live monitoring in app.

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