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Online Vehicle Parking Reservation System

Chamanthula Jagadeesh
PG scholar, Department of MCA, DNR College, Bhimavaram, Andhra Pradesh.
V.Sarala
(Assistant Professor), Master of Computer Applications, DNR college, Bhimavaram, Andhra Pradesh.

Abstract: The urban population growth rapidness has produced an increase of vehicles which resulted in considerable parking challenges. Our current parking practices generate various issues because they prove inefficient in managing available spaces. The research introduces an online vehicle parking reservation system based on image processing which optimizes parking space detection and distribution and parking management enforcement. Image processing runs in real time to detect empty parking spots which enables user reservation thus reducing search duration while enhancing parking administration. Proposed method uses Django framework and python software as backend and frontend as html, CSS is used. Proposed method provides efficient solution for automated vehicle parking.

Keywords: Online Vehicle Parking Reservation System, Smart Parking, Real-Time Booking, Traffic Congestion Reduction, Urban Mobility Enhancement.

I. INTROCUTION

In contemporary urban settings, the surge in vehicle ownership has intensified parking challenges, leading to traffic congestion, increased fuel consumption, and environmental degradation. Traditional parking methods, which often involve manual searches for vacant spots, are inefficient and time-consuming, exacerbating these issues. To address these challenges, the development of an intelligent parking reservation system that leverages real-time image processing and automation has become imperative. This study aims to develop an intelligent parking reservation system that optimizes parking space allocation, reduces congestion, and enhances user convenience through real-time image processing and automation.

Objectives

Below are the objectives of proposed system,

a) Design an automated parking system capable of detecting vacant spaces.
b) Provide real-time parking status updates to users.
c) Minimize parking search time and improve urban traffic conditions.
d) Integrate a user-friendly web interface for seamless booking and slot management.
e) Enhance security by monitoring and recording parking activities.

The rise of urban development has made parking spot search a persistent issue for all commuters. Human-based parking efforts present inefficiency problems because they depend on manual searches. Live updates about vacant parking locations are possible through the proposed system which employs image processing technology for real-time identification of empty spaces. This system combines automated detection and reservation capabilities to provide users with superior convenience and space optimization benefits while lowering traffic congestion rates.

The continuous increase of vehicles throughout cities creates a pressing problem to locate available parking spots in modern urban areas. Urban efficiency and environmental health face significant deterioration because traffic congestion, excessive fuel usage and enhanced pollution levels result from this situation. Image Processing technologies enable the development of a Smart Parking System which represents a valuable solution for resolving current parking problems. The Smart Parking System implements image processing systems which effectively detect and control parking slots through sophisticated image analytics methods.

The system captures current images of parking areas through strategically installed cameras. Processing algorithms perform advanced

operations on obtained images which enables the system to detect parking spaces, track vehicles and check space occupancy. The system improves parking management efficiency as well as the experience of users due to its implementation approach.

A Smart Parking System needs to detect both empty parking spots and spaces with vehicles in them as one of its fundamental elements. The analysis of caught images runs through image processing algorithms which include edge detection and background subtraction and machine learning-based classification. These algorithms determine between vehicles at rest and unoccupied parking areas to deliver current parking availability reports. A central system receives this data through communication channels to deliver it to users via mobile applications and electronic displays for directing them to available parking spots. Machine learning integration with the system boosts its accuracy levels as well as its reliability performance.

The software trains along big image collections of parking lots to enhance its capacity to identify vehicle types and unify performance under changing lighting situations and weather conditions. The system requires this kind of adaptability to deliver consistent high performance across multiple environments. Through license plate recognition and other similar features the Smart Parking System extends its capabilities to give users security and automated functionalities. License plate identification functions enable the system to administer parking durations as well as execute regulatory enforcement and process automatic payments. The system streamlines parking operations and presents a necessity for human operator involvement.

A Smart Parking System that implements Image Processing methods creates substantial effects for urban planning together with environmental sustainability practices. Implementing better parking infrastructure management enables cities to cut down their need for additional parking spaces thereby creating essential urban real estate. The system decreases traffic congestion and idle periods of cars which results in lower greenhouse gas emissions together with enhanced air quality. The Smart Parking System employing Image Processing technology represents a modern solution to solve increasing parking difficulties within cities. This system uses advanced technologies of image processing and machine learning to provide a sustainable user-friendly solution with efficiency as its core feature. Smart urban development depends heavily on implementing innovative technologies which will shape the creation of smarter cities with higher quality living standards.

II. LITERATURE SURVEY

The research examines how expanding cities and increasing vehicle ownership affects parking system administration. The proposed system builds an online framework combining web technology with mobile apps which provides users real-time access to locate empty spaces and pay for them instantly through digital channels. The pricing structure within the system functions dynamically to modify rates according to present demand levels which optimizes operational resource allocation and brings maximum profits to operators. This system delivers three main advantages: it saves driver search time for parking spaces and decreases their stress levels and results in greater parking occupation rates for operators. The paper demonstrates that adopting this technology for urban planning allows better development of sustainable urban spaces. [1]

The authors present a smart reservation solution that addresses the parking issues created by electric vehicle (EV) advancement because EV drivers face difficulties locating charging station-equipped spots. The system evaluates EV user preferences together with parking slot availability and EV state-of-charge and user parking lot usage records. The Decision support system implements Analytical Hierarchy Process (AHP) as a part of multicriteria decision-making techniques to achieve optimal slot ranking and allocation. Simulation findings indicate that the system effectively controls parking slot availability throughout heavy traffic periods while proving that user preferences form crucial decisions for slot reservations.[2]

The paper develops the Online Vehicle Parking Reservation System (OVPRS) which grants users spot reservations and parking status visibility across different locations. The system

development utilized HTML, CSS, JavaScript, PHP and XAMPP for its database management architecture. The system framework allows users to book available parking spaces with the purpose of decreasing time expenditures in parking spot searches. The system followed error testing procedures which revealed successful capabilities for parking reservations. [3]

A smart parking system operating through short message services (SMS) functions as the main solution to minimize commercial area parking spot search duration according to this research paper. The micro-Remote Terminal Unit functions as a device processor which delivers reservation details by means of a password and lot number in response to SMS messages. The system runs on a Peripheral Interface Controller (PIC) which manages empty parking space storage and delivers passwords together with access control functions in the parking area. A functional prototype exhibited the system's capability to handle parking reservation while providing entry access as well as getting rid of parking spot search difficulties. [4]

A web-based system has been developed to show parking spot availability in real-time because vehicle ownership together with traffic congestion has increased. Users can book protected parking spaces from any time or place through the PHP and MySQL developed system while obtaining time and labor savings. The application supports electronic subscriptions together with electronic payment methods. Owners and managers of parking facilities achieve better parking space booking and subscription management through this system which improves traffic flow and lessens parking spot search difficulties. [5]

An investigative study explores the creation of an Online Parking Reservation (OPR) system which seeks to address parking problems in city environments. Real-time data combined with mobile technology enables users through the system to find empty parking places beforehand for reserving while making payments to save both searching time and fuel costs. The pilot experiment yielded results which showed users found parking 25% faster while creating 15% less road congestion around parking areas. Research findings demonstrated that the dynamic price system had the ability to boost municipal revenue through a 20% annual increase. The research paper presents a breakdown of the system development process alongside its execution results and difficulties and recommendations for improvement. [6]

The research develops a real-time parking reservation service that decreases total user travel expenses in metropolitan areas. By developing a mixed-integer programming model the authors establish effective methods for slot parking distribution and driver planning scheduling. The model provides improved driver parking activities while promoting slot usage above existing scheduling-free reservation systems. An analysis using simulations of parking activities focused on commuters and visitors in central business district areas helps practical parking management organizations develop practical guidelines. [7]

III. PROPOSED METHOD

The designed Online Vehicle Parking Reservation System provides administrators and users with simplified parking administration through an organized process. Through this system administrators gain the capacity to add parking slots and monitor the space utilization together with optional price changes. Users enjoy a smooth process which leads them from account creation and authentication to their chosen parking resource selection followed by payment handling inside a user-oriented interface.

To implement this system, several key modules have been developed:

1. **Admin Login**: Enables administrators to access the system using predefined credentials.
2. **Add Parking Area**: Allows administrators to define new parking areas and specify the number of slots available.
3. **Modify Parking Area**: Provides the capability to update existing parking areas, including adjusting the number of slots and associated costs.
4. **View Users**: Displays a list of registered users within the system.
5. **View Occupancy**: Shows the current status of parking slots, indicating which are occupied and which are available.

6. **User Sign Up and Login**: Enables new users to create accounts and existing users to access the system.
7. **Book Slot**: Allows users to view available parking areas, select a desired slot, and confirm their booking.
8. **Release Slot**: Facilitates users in vacating their parking spot, upon which the system calculates the parking duration and charges.
9. **View History**: Provides users with a record of their past parking activities.

Through image processing methods the system improves its operational features. The parking lot cameras record current images which get processed through advanced methods including edge detection along with deep learning-based object detection models. The classification of each parking slot as occupied or vacant happens using a trained CNN which enhances its learning capacity through algorithms based on machine learning. The technology implementation method fits into existing research descriptions about using image processing methods and artificial intelligence for smart parking development.

Mobile and web application integration enables users to access present parking information and reserve spaces ahead of time while receiving guide assistance for their chosen parking area. The system uses automated space allocation and benefits from license plate recognition (LPR) and vehicle entry and exit timing recording to improve security while also allowing automated billing based on parking times. Using these modules with image processing techniques enables the system to deliver an all-encompassing solution for present parking management problems which enhances efficiency and security along with user satisfaction for administrators and users.

IV. RESULT ANALYSIS

Proposed application is running on local host. Proposed local host link is obtained in below page when we run Django server.

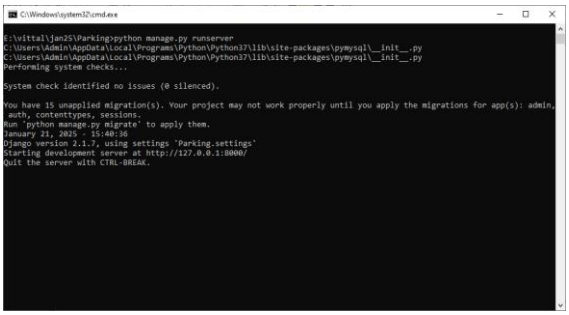

Fig. Local Host URL access of application

In above screen python server started and now open browser and enter URL as http://127.0.0.1:8000/index.html and then press enter key to get below page.

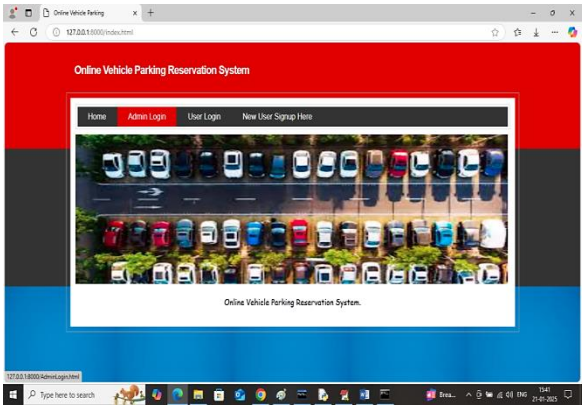

Fig. Admin Login

In above screen click on 'Admin Login' link to get below page

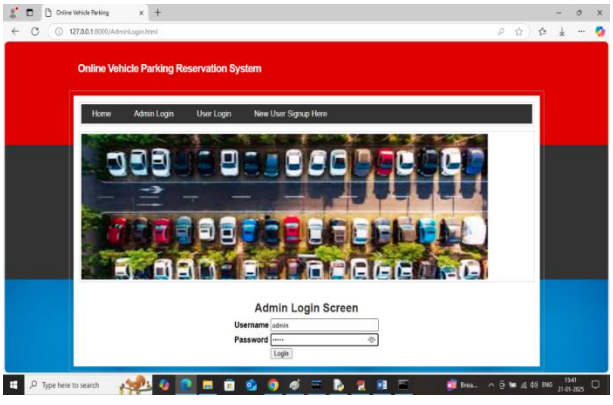

Fig. Admin Enters the Details

In above screen admin is login and after login will get below page

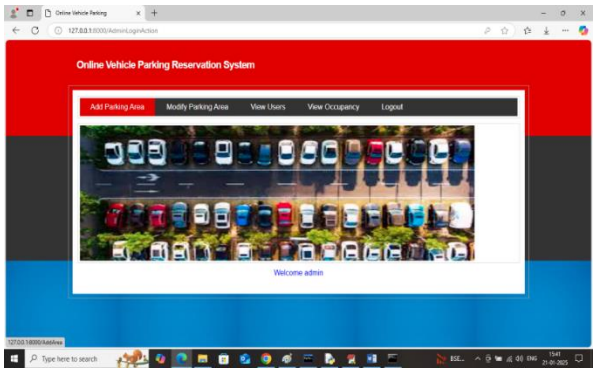

Fig. Add Parking Area

In above screen admin can click on 'Add Parking Area' link to get below page

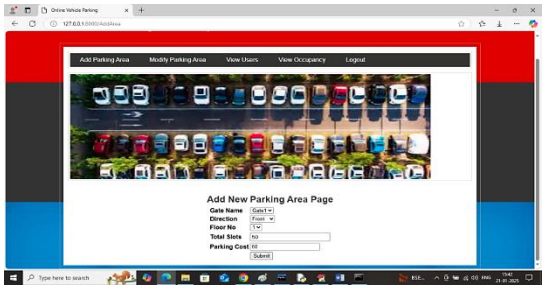

Fig. Adding Parking Area Details

In above screen admin is adding parking area from different location and then press button to get below page

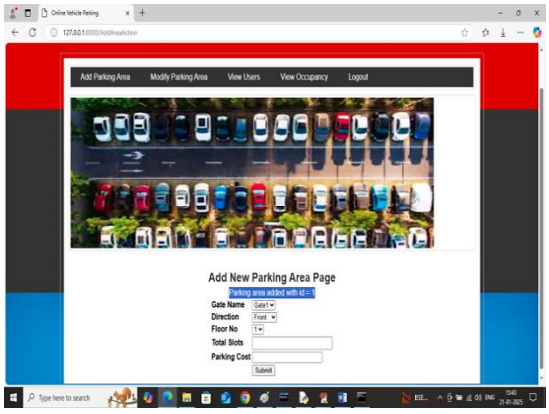

Fig. Parking Area Added with ID=1

In above screen parking details added with some ID and similarly you can add as many parking areas as you want and now click on 'Modify Parking Area' to get below page

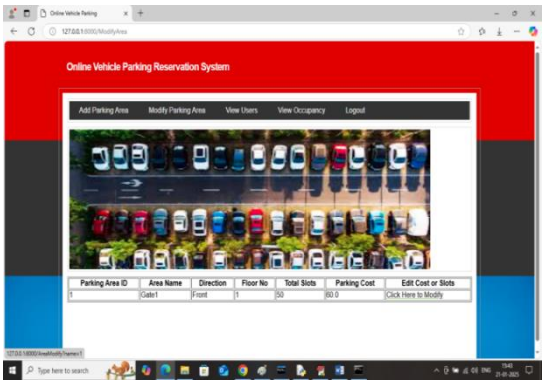

Fig. Modify Parking Area

In above screen admin can view all parking area and can click on 'Click Here to Modify' link to modify slots or cost

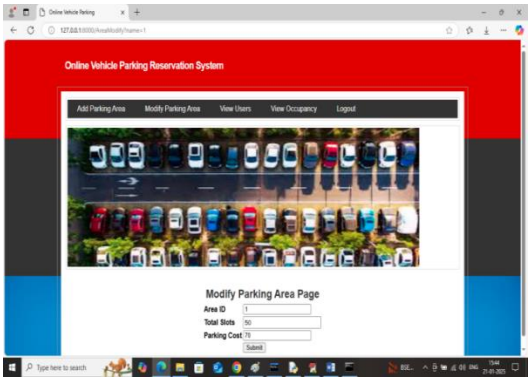

Fig. Modifying Parking Area

In above screen admin will add new slots or parking cost and then press button to get below page

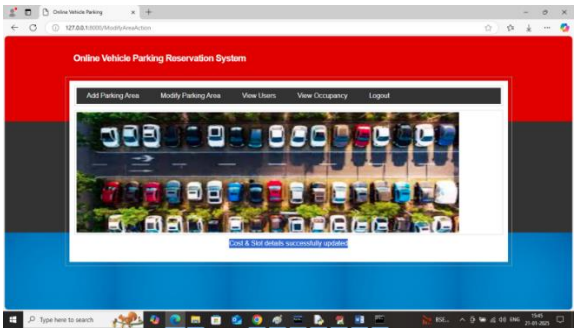

Fig. Cost and Slot Details are updated

In above screen parking details modified and now logout and sign up new user to perform booking

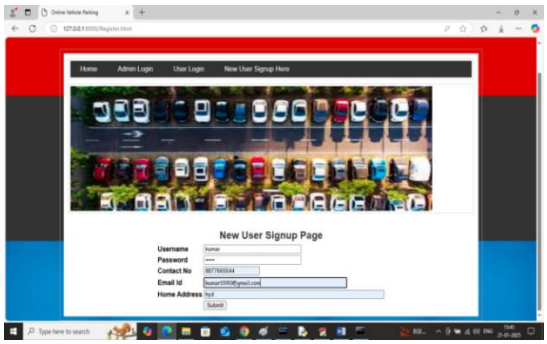

Fig. sign up new user to perform booking

In above screen user is entering sign up details and then press button to get below page

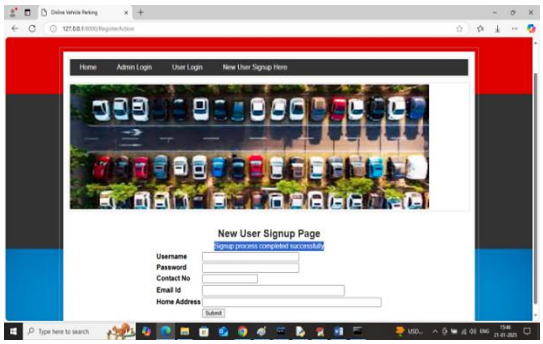

Fig. Signup Process Completed Successfully

In above screen user sign up task completed and now click on 'User Login' link to get below page

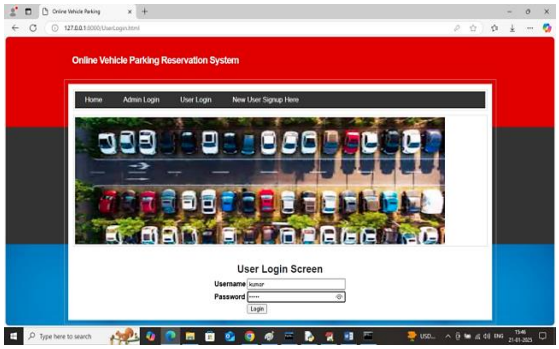

Fig. User Login Screen

In above screen user is login and after login will get below page

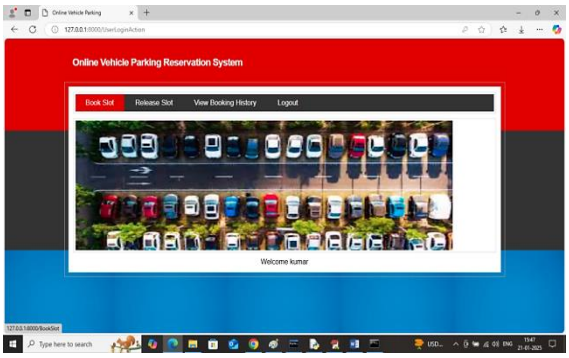

Fig. Welcome Page for User

In above screen user can click on 'Book Slot' link to get below page

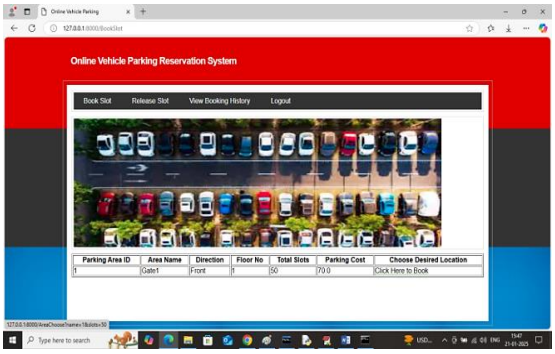

Fig. All Parking Areas Along with Directions

In above screen user can view all parking areas along with directions and can click on 'Click Here to Book' link to book desired area slot and get below page

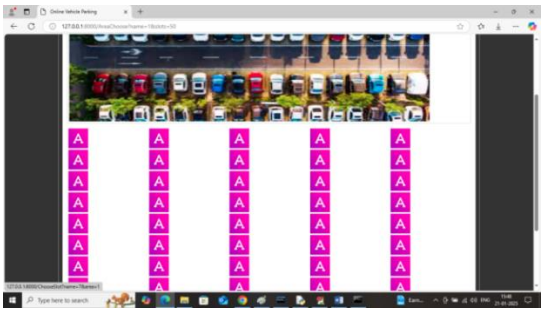

Fig. Parking Status (Pink and Parked Status)

In above screen all slots will be in pink colour and once booked any slot then it will get 'Parked' status and now select any slot to get below page

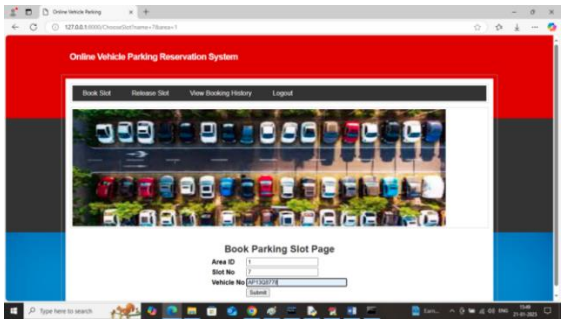

Fig. View Selected Parking Area

In above screen user can view selected parking area ID along with select slot and now enter vehicle No and then press button to confirm slot and get below page

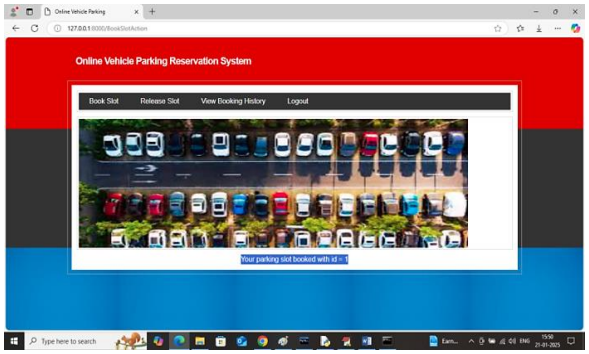

Fig. Parking slot with ID as 1 is booked

In above screen Parking slot with ID as 1 and now see the booking status in below screen

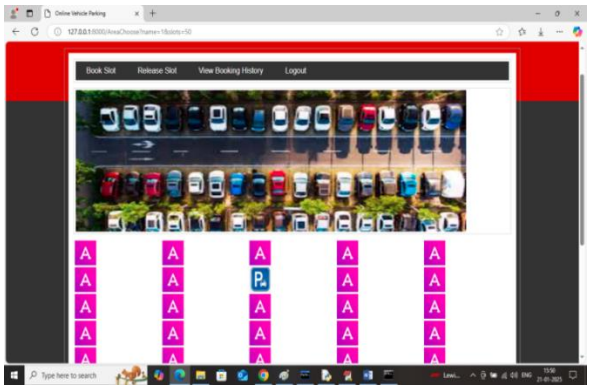

Fig. Booked Slot Changed to Parked Status

In above screen booked slot changed to parked status and now click on 'Release Slot' link to get below page

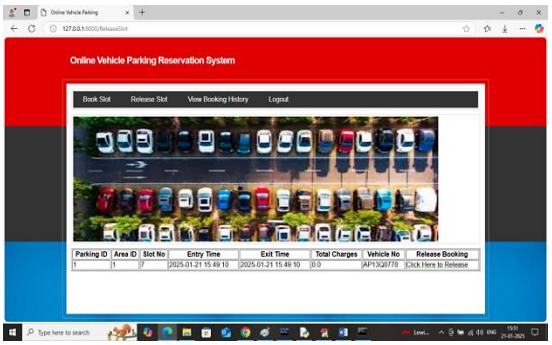

Fig. Release Slot

In above screen user can view list of booked slots and can click on 'Click Here to Release' link to get below page

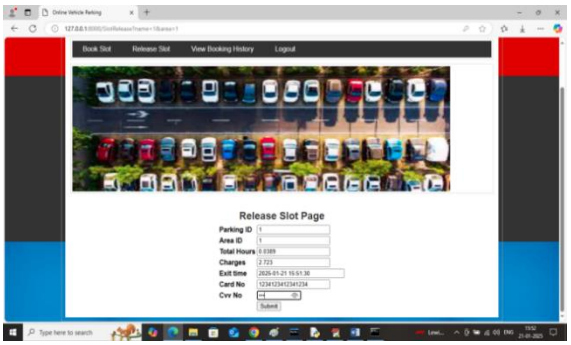

Fig. Release Slot Page

In above screen based on entry and exit time system will calculate parking charges and then user will enter dummy card details to make payment and then slot will get released

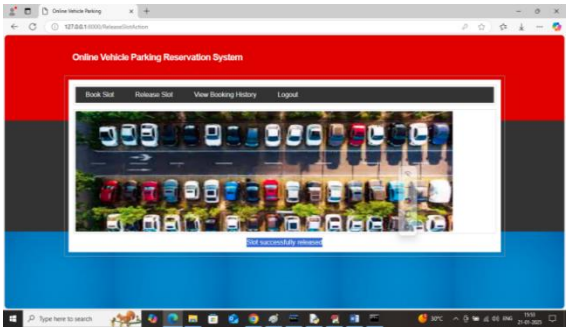

Fig. Slot Successfully Released Page

In above screen slot successfully released and similarly you can book any number of parking's. Now click on 'View Parking History' link to get below page

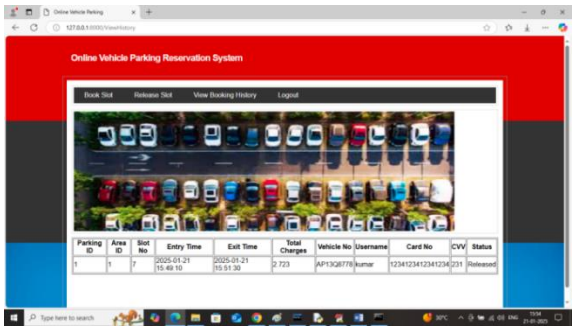

Fig. View Parking History

In above screen user can view all his past booking slots along with status and payments details.

Similarly by using above screens we can run project to make N number of bookings.

V. CONCLUSION

The proposed system based on online reservations through image processing technology delivers a new approach to solve parking issues in cities. The automated parking space detection system improves operational efficiency and reduces traffic congestion to deliver better service to users. The system can be improved through AI predictive analytics that predict demand and through integrating IoT technology for improved parking automation capabilities. Proposed parking slot booking for vehicle helps to make intelligent decisions and to get effective solution. Proposed method is more user friendly than state of art techniques.

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