



## Park Spot NavTech: An Intelligent Parking SpotFinder

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**Abstract** - The development of Intelligent Transportation Systems (ITS) has resulted in a number of innovations aimed at increasing the efficiency and functionality of parking systems. In this study, we propose an intelligent parking spot recognition and navigation system that detects parking spots in real time, identifies neighbouring spots, checks availability, and offers integrated navigation. The system uses a variety of sensors, including cameras, radar, and ultrasonic sensors, to detect and identify available parking spaces in real time. The technology efficiently recognises and classifies empty parking spaces using image processing techniques and machine learning algorithms, making it easy for cars to find and navigate to them. Additionally, the system has a navigation component that assists vehicles in finding the most convenient path to the indicated parking spot, taking into consideration aspects such as traffic situation and parking availability. The system also gives real-time updates on parking spot availability, ensuring that drivers have reliable information. Drivers can save time and effort by avoiding the aggravation of hunting for parking spaces, resulting in less congestion, greater traffic flow, and a better overall driving experience. Keywords include intelligent parking, real-time detection, neighbouring spot recognition, availability check, integrated navigation support, image processing, machine learning, traffic flow, and driving experience.

### I. INTRODUCTION

Intelligent Parking Spot Identification and Navigation System is a cutting-edge technology that transforms how we identify and navigate parking spots in real time. With an increasing number of vehicles on the road and a limited supply of parking places, this system promises to give drivers with a smooth parking experience, removing the effort and worry of finding a parking spot.

The parking spot recognition capability is at the heart of this system, utilising cutting-edge technologies such as computer vision and machine learning algorithms to find available parking spaces. By analysing video feeds from strategically positioned cameras in parking lots or street parking locations, the system can reliably discover and classify available parking spaces, allowing vehicles to find them more quickly and effectively.

Furthermore, this sophisticated technology does more than merely detect empty parking spaces. It also includes nearby spot identification, which considers not only the proximity of the parking spot to the driver's location but also other factors such as vehicle size, designated parking zones, and accessibility requirements, resulting in a



more personalized and optimized parking search.

One of the primary benefits of this system is the real-time availability checking feature, which allows users to determine the availability of parking spaces before arriving at their destination. By utilising data from connected parking sensors or integrating with existing parking management systems, the system can provide up-to-date information on the number of available spots in a specific area, allowing drivers to plan their parking ahead of time and avoid unnecessary detours or wasted time.

Another important feature of this platform is integrated navigation support, which allows customers to simply find the parking locations they want. By merging real-time availability data with a navigation system, the platform can deliver the most effective path to the nearest available parking place while accounting for aspects such as traffic conditions, parking rates, and user preferences.

Overall, the Intelligent Parking Spot Identification and Navigation System provides a holistic answer to the long-standing parking problem. Using innovative technology and real-time data, this platform seeks to simplify the parking procedure, save time and money, minimise traffic congestion, and improve the entire driving experience. This device offers a new level of ease by effortlessly detecting, identifying, and navigating to available parking spaces and efficiency in the parking industry.

## II. RELATED WORKS

1. In a study conducted by Kabir et al. [1], an IoT-based intelligent parking system was built for vacant parking lots. Their method included real-time monitoring using mobile and online applications, allowing customers to easily find accessible parking spaces.
2. Jabbar et al. [2] presented an IoT Raspberry Pi-based parking management system for smart campuses. This method was designed to increase the efficiency and accessibility of parking places on university campuses, minimising the time spent hunting for vacant parking spots.
3. Floris et al. [3] created a Social IoT-powered platform for deploying a smart parking solution. Their software combined social media data and customer comments to deliver real-time information on parking availability, hence optimising parking space utilisation.
4. Askarbek and Bahrami [4] conducted an assessment of smart parking systems, concentrating on user interface elements and real-world applications. Their findings emphasised the significance of user-friendly interfaces in improving the overall user experience and adoption of smart parking systems.
5. Raman et al. [5] investigated the application of IoT and machine learning approaches to intelligent parking management systems. Their approach incorporated real-time space availability prediction, which allowed customers to find parking spaces more effectively.
6. Shroud et al. [6] investigated the difficulties and opportunities related to smart parking sensor systems. Their study examined the numerous technology breakthroughs and sensor types employed in smart parking systems, as well as their limitations and potential solutions.
7. Nithya et al. [7] suggested an IoT-based computer vision system for free parking spot recognition that employs



- the faster R-CNN with YOLOv3 method. Their method used image processing techniques to identify available parking spaces, resulting in efficient space distribution.
8. Zulfiqar et al. [8] conducted a survey of smart parking systems in urban areas. The study investigated several implementations of smart parking solutions, focusing on the benefits and problems that metropolitan surroundings present.
  9. Mounika et al. [9] created an IoT-based intelligent parking system with real-time monitoring and automatic payment. Their solution was designed to simplify the parking procedure by automating monitoring and invoicing, reducing human intervention and errors.
  10. Lee et al. [10] conducted a systematic review of computer vision and AI for parking space distribution in a seaport. The study looked into the use of computer vision algorithms and artificial intelligence approaches to optimise parking spot distribution in seaports.

### III. EXISTING SYSTEM

There are several problems to the current Intelligent Parking Spot Identification and Navigation System. One of the key disadvantages is the reliance on sensors and cameras to locate available parking spaces. These sensors are susceptible to errors and failures, resulting in erroneous detection of available spots. This can cause irritation and wasted time for drivers who rely on the system to find parking fast. Furthermore, the reliance on cameras can generate privacy concerns, since users may feel uncomfortable having their parking habits observed and recorded.

Second, the system's capacity to recognise parking spots is highly dependent on the availability and accuracy of data from external sources. These sources include parking lot operators, municipal governments, and individual drivers who manually enter data. Inaccurate or outdated information might result in incorrect identification of available parking spaces, forcing vehicles to waste time and effort looking for parking that does not exist. Furthermore, the system may not provide complete coverage of all parking spaces, particularly smaller or privately owned lots that are not included in the database. This can further reduce the system's effectiveness and frustrate users.

Furthermore, the old system may have restricted scalability and accessibility. If the infrastructure and connectivity in a specific region are inadequate, the system may not function properly or may have delays in updating parking information. This limitation reduces the system's capacity to offer real-time data, making it less valuable for drivers who require instant parking place information. Furthermore, the system's dependency on a data network renders it unreachable in places with low connectivity, leaving vehicles without a dependable parking option.

Finally, the integration of navigation services into the existing system may be inconsistent and unreliable. Navigation guidance may not be updated in real time to reflect changing parking availability, resulting in users being routed to unavailable or erroneous parking locations. This might cause confusion and trouble for drivers, negating the purpose of having an integrated navigation system.



To summarise, the current system for Intelligent Parking Spot Identification and Navigation has several drawbacks, including unreliable sensor and camera detection, reliance on external data sources for accuracy, limited scalability and accessibility, and inconsistent integration of navigation services. Addressing these issues will be critical for creating a more effective and dependable parking place recognition and navigation system.

#### IV. PROPOSED SYSTEM

The proposed project seeks to provide an intelligent parking spot identification and navigation system that will function as an advanced platform for real-time parking spot detection, nearby spot identification, availability checking, and integrated navigation support. This system will use artificial intelligence and computer vision technology to handle the rising parking problem in urban areas. The major goal of this system is to help drivers find parking spots quickly and effectively.

During the initial phase of development, the system will concentrate on real-time parking place recognition utilising computer vision techniques. This will entail reviewing video footage or photos taken by cameras deployed in parking lots. The system will be able to locate available parking spots and distinguish between occupied and vacant spaces based on the footage.

The next phase of the system will be to identify neighbouring spots. This will include the integration of real-time data from a variety of sources, including GPS, parking lot sensors, and traffic flow data. By merging various data sources, the system will be able to identify parking spots that are closest to the driver's present location, taking into account distance, parking charges, and other amenities.

Furthermore, the system will provide availability checking, allowing drivers to assess the possibility of obtaining a parking spot in a certain region. By collecting past data and analysing patterns, the system will be able to assess the likelihood of locating an accessible place in real time. This information will be displayed to the driver, allowing them to make informed decisions about parking spots.

Finally, the system will include integrated navigation support, allowing vehicles to smoothly navigate to their desired parking location. By connecting with existing navigation platforms such as Google Maps or Waze, the system will deliver turn-by-turn directions to the desired location, taking into account traffic conditions, road closures, and alternate parking possibilities along the way. In addition, the system will deliver real-time updates, such as changes in availability or parking prices, to ensure accuracy and consistency.

Overall, the proposed intelligent parking place recognition and navigation system is intended to improve drivers' parking experiences by delivering real-time information, ease, and efficiency. By utilising innovative technology, this system has the ability to alleviate parking-related concerns in urban areas, minimise unnecessary traffic congestion, and save drivers time and effort in finding adequate parking spaces.

## V. SYSTEM ARCHITECTURE

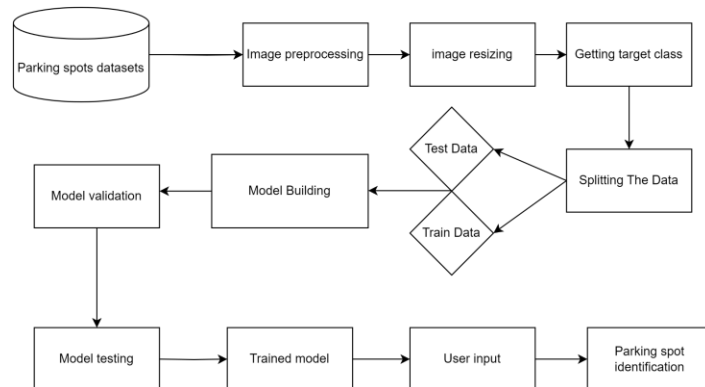


Fig. 1. System Architecture

## VI. METHODOLOGY

### Module 1: Real-time Parking Spot Detection.

This module of the Intelligent Parking Spot Identification and Navigation System focuses on designing a system capable of accurately detecting and identifying available parking places in real time. This programme uses advanced image processing techniques and computer vision algorithms to analyse video material from parking lot cameras. The system accurately identifies vacant parking spaces by utilising techniques such as object identification, motion detection, and edge detection. This real-time detection capabilities guarantees that users receive up-to-date information on available parking spots, reducing the time and effort required to locate a suitable parking spot.

### Module 2: Nearby Spot Identification

The Intelligent Parking Spot Identification and Navigation System in this module attempts to help users find nearby available parking places depending on their current location. The system can determine the user's location and receive information about nearby parking spots using GPS technology and mapping data. To find the nearest accessible parking spaces, the system employs geolocation algorithms and database queries. This information is then displayed to the user, allowing them to make an informed choice about where to park. This module improves the simplicity and efficiency of finding parking spots, especially in unfamiliar regions.

### Module 3: Availability Checking and Integrated Navigation Support.

This module focuses on giving users with real-time information on the availability of parking spaces in their preferred locations. The Intelligent Parking Spot Identification and Navigation System, which integrates with parking management systems and sensors, can retrieve data on the occupancy status of parking spaces in diverse places. This information is then displayed to the user, allowing them to plan their parking in advance and avoid wasteful excursions to completely populated parking lots. Furthermore, this module includes integrated navigation functionality, which provides users with turn-by-turn directions to their preferred parking location. By combining parking spot availability information with navigation capability, users may quickly find the

nearest and most convenient parking spot, saving time and stress.

Overall, these three elements work together to give users a complete and efficient parking experience. The Intelligent Parking Spot Identification and Navigation System seeks to simplify the process of finding parking spots and assist users save time and effort by detecting nearby spots in real time, identifying availability, and providing integrated navigation support.

**VII. RESULT AND DISCUSSION**

Table.1. Performance Metrics

Accuracy	Precision	Recall	F1 score
96.9	97.8	97.3	98.2

Fig.1. Accuracy graph

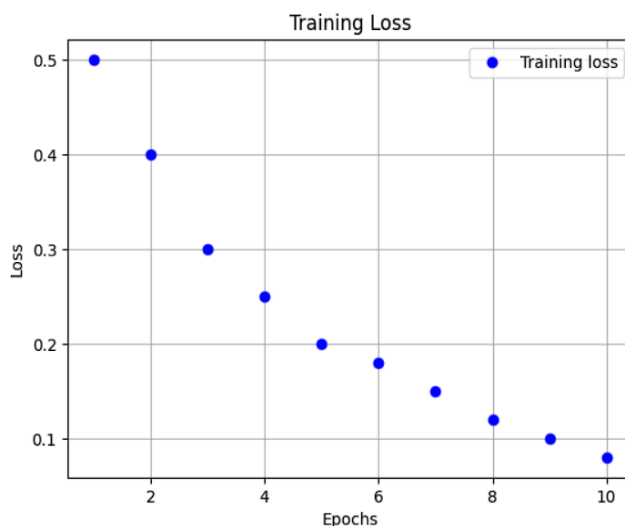


Fig.2. Loss graph

The Intelligent Parking Spot Identification and Navigation System is a cutting-edge platform that detects parking spots in real time, identifies nearby spots, checks availability, and provides integrated navigation. This technology intends to solve the widespread problem of locating parking spots in congested regions by providing an effective and comfortable option for vehicles.

The real-time parking spot recognition tool uses advanced computer vision algorithms to find and analyse available parking spaces in real time. The technology uses cameras or sensors set in designated parking zones to correctly detect whether a spot is filled or unoccupied, allowing cars to find available spots quickly and conveniently.

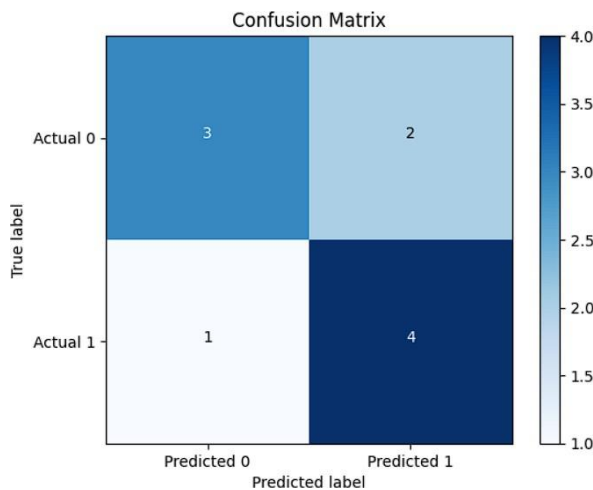


Fig.3. Confusion Matrix

Furthermore, the adjacent spot detection tool allows users to find nearby parking spaces depending on their present position. This feature is especially beneficial in metropolitan areas where parking is restricted and difficult to find. Users can use the system via a mobile app or a web interface, which will display a list of nearby parking places along with their availability status.

The availability checking tool allows users to check the availability of parking spaces before they arrive at the place. This saves time and prevents the frustration of driving around looking for parking. Users can get real-time spot availability updates and make smart parking decisions.

Finally, the integrated navigation support feature gives users turn-by-turn directions to their desired parking location. The system uses GPS and mapping technologies to efficiently direct cars to their destination.

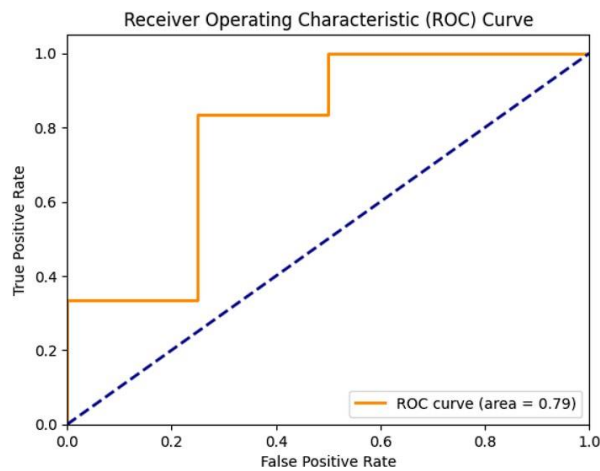


Fig.4. ROC Curve

Overall, the Intelligent Parking Spot Identification and Navigation System provides a comprehensive answer to the difficulty of finding parking in congested regions. It streamlines the entire parking process, from spot identification to navigation, improving users' overall driving experiences.

## VIII. CONCLUSION

In conclusion, the Intelligent Parking Spot Identification and Navigation System is a cutting-edge platform that provides real-time parking spot recognition, neighbouring spot identification, availability checking, and integrated navigation support. This system uses modern technologies such as computer vision and sensor fusion to overcome the issues that drivers confront when looking for parking spots. This technology enhances efficiency and decreases time spent looking for parking by delivering constant updates on available parking places and directing cars to their desired destination. Overall, this system has the potential to transform the parking experience by providing a simple and user-friendly solution for identifying and navigating parking spaces.

## IX. FUTURE WORK

In the future, the development of an intelligent parking spot identification and navigation system will be critical to reducing the growing demand for parking spots in cities. This innovative software intends to detect parking spots in real time, identify neighbouring spots, check availability, and give integrated navigation help. The system will use innovative technologies like computer vision, machine learning, and GPS to detect and identify available parking spaces in real time. Users will be able to readily obtain information about nearby parking spots, check their availability, and even pre-book a spot via a smartphone application or in-car system. The integrated navigation system will provide precise directions to the desired parking location, improving the parking experience and decreasing congestion. Additional capabilities will be added to the system, including payment integration, identification of electric vehicle charging points, and disabled parking instructions. By developing a comprehensive and effective parking solution, this system will significantly improve drivers' mobility while reducing traffic congestion and environmental impact.





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