International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 15 Issue 03 , March - 2026

Parkshare - A Web Based System for Connecting Private Parking Space with Public Users

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Abstract: Urban areas are increasingly facing challenges with parking management due to the rapid growth of vehicles and the limited number of parking spaces. Traditional parking systems often create issues like inefficient space use, traffic congestion, and wasted time while searching for available parking. To tackle these problems, this paper introduces ParkShare, a Smart Parking Space Sharing Platform that helps users find, book, and manage parking spaces through a web-based application. The system lets parking space owners register and list their available spots. Drivers can then search, view locations on an interactive map, and reserve spaces in advance. The platform includes features like real-time availability updates, booking management, and separate user roles for drivers and parking space owners. Additionally, the system has smart modules that offer parking recommendations and flexible pricing strategies to make better use of space. Modern web technologies support the implementation, featuring a scalable backend and a lightweight database for effective data management. Experimental results show that this platform cuts down the time needed to find parking spaces, improves space utilization, and makes things easier for both drivers and space owners. Overall, the system enhances urban mobility by providing a practical and user-friendly solution for sharing parking spaces.

Keywords- Smart Parking System, Parking Space Sharing, Location-Based Search, Dynamic Pricing Strategy, Flask Framework, Urban Traffic Management, Parking Recommendation System

1. INTRODUCTION

The rapid growth of cities and the rise in vehicle numbers have created significant challenges in managing parking. As populations increase and more people own cars, finding available parking spots has become a frustrating task for drivers. In many urban areas, a lot of traffic jams result from cars looking for parking, leading to higher fuel use, more pollution, and less efficient transportation. So, effective parking management systems are vital for improving city mobility and making better use of available parking resources.

Traditional parking systems mainly rely on manual processes or fixed parking setups, like public lots and street spaces. These systems often do not provide real-time information about available parking, forcing drivers to search for vacant spots on their own. Additionally, many private parking areas stay empty for long periods because there isn't a proper platform for owners to share their spaces. This results in wasted parking resources while drivers struggle to find spots.

Thanks to digital technologies, online platforms, and location services, new solutions have emerged to tackle parking management problems. Smart parking solutions use modern technology to offer real-time information about parking spaces and facilitate efficient booking and management. By combining digital platforms with location services and easy-to-use interfaces, smart parking systems can greatly cut down the time and effort needed to find parking.

In recent years, various studies and commercial applications have looked into smart parking solutions using technologies like the Internet of Things (IoT), cloud computing, and mobile apps. These systems aim to track parking availability, provide navigation help, and enhance overall parking efficiency. However, many current systems require costly sensors or are limited to certain parking facilities. A more flexible and scalable approach is needed to let individuals and organizations share their parking spaces with drivers looking for spots.

To address these issues, this project proposes ParkShare: a smart parking space sharing platform that makes it easy to find, book, and manage parking spaces through a web-based application. Parking space owners can register and list their available spots, while drivers can search for nearby options, see details through an interactive interface, and reserve spaces

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ahead of time. By connecting drivers and parking space owners through a digital platform, the system encourages better use of existing parking resources.

The platform is built using modern web technologies, featuring a Flask-based backend and a lightweight database to manage user accounts, parking space details, and booking information. It also includes smart modules that offer parking suggestions and dynamic pricing strategies to improve space use and convenience for users. Role-based features ensure that drivers and parking space owners have access to the right tools within the system.

By providing a simple and effective parking sharing solution, the ParkShare platform helps reduce the time spent looking for parking, eases traffic congestion, and improves the overall parking experience for users in cities. The rest of this project report will discuss related work, system architecture, implementation approach, and the evaluation of the proposed smart parking system.

2. LITERATURE SURVEY

The rapid growth of urban populations and the increasing number of vehicles have created serious challenges for parking management in modern cities. Drivers often spend a lot of time looking for available parking spaces. This searching contributes to traffic congestion, fuel waste, and environmental pollution. Traditional parking systems rely on manual observation or fixed parking facilities, which require drivers to physically search for vacant spots. These limitations have led researchers to develop smart parking solutions that use modern digital technologies to improve parking efficiency and make it more convenient for users [1].

Several studies have looked into smart parking systems that offer real-time information about parking availability using sensor-based technologies. In these systems, sensors are placed in parking spaces to detect whether a spot is occupied or vacant. The data collected is sent to a central server, allowing drivers to check parking availability through mobile or web applications. Though sensor-based parking systems enhance accuracy and real- time monitoring, they often need significant investment in infrastructure and ongoing maintenance costs. This makes large-scale implementation challenging in many urban areas [2].

Recent research has also examined the use of Internet of Things (IoT) technologies for smarter parking management. IoT-enabled parking systems use interconnected devices, wireless communication, and cloud platforms to monitor parking spaces and guide drivers to available spots. These systems can automatically detect parking occupancy and provide navigation help to drivers. However, IoT-based solutions might encounter challenges like network reliability, high deployment costs, and scalability issues when used in large urban settings [3].

Along with sensor-based technology, other researchers have also proposed algorithms of parking reservation where drivers may essentially book parking space in advance via online channels or mobile apps. These systems allow the users to locate parking spaces around them, view their availability, and book their parking prior to their destination. Parking reservation systems can decrease the lack of predictability when finding a parking place and maximize the use of the available parking space. Nevertheless, most of the existing systems are more oriented towards parking locations owned by the government and do not access completely those parking areas owned privately and not used regularly [4].

The other significant field of study is on parking space sharing platforms, which is an area where individuals or organizations can rent their reserved parking space to drivers. This principle resembles the sharing economy model applicable to the service industry (e.g., ride- sharing and accommodation platforms). By enabling owners of parking spaces to advertise their free parking space and letting drivers reserve them beforehand, parking sharing platforms would enhance the use of parking spaces and minimise congestion in cities. In a number of studies, the possibilities of using such platforms to improve the mobility in the city and decrease the traffic issues connected with parking have been mentioned [5].

The latest changes also discuss the implementation of clever algorithms and recommendation systems to improve parking management systems. In these systems, the preferences of the users, their location, and the past booking history are collected to suggest appropriate parking spots to the driver. There are also researches that have proposed dynamic parking pricing mechanisms whereby the prices of parking will be changed depending on the demand, the location and availability. Smart parking applications can be more efficient and user-friendly with such smart features [6].

Although there is an improvement in the field of smart parking technologies and parking sharing platforms, there are various challenges that are still present. Numerous solutions available in the market are unfriendly and costly to maintain since they need a lot of hardware infrastructure or they are only applicable in small parking zones. Also, not all systems have systems that are user- friendly, provide real-time updates, or orchestrate the processes of booking with efficiency. It is required that it should be a flexible and scalable platform that will enable owners of the parking space as well as the drivers to communicate easily and at the same

International Journal of Engineering Research & Technology (IJERT)
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time ensure that the available parking space is efficiently used.

In response to such issues, the ParkShare Smart Parking Space Sharing System that has been proposed offers a web-based system within which the owners of parking spaces can create and acknowledge their parking space as well as drivers can view, search for and book parking space in real-time. The system encompasses the integration of location based services, smart recommendatory modules and dynamic pricing system to enhance the optimization of the use of parking space and ease to the user. The proposed system will help minimize the time wasted in search of parking spots by matching drivers to the parking spots available in a centralized digital environment, thereby increasing the efficiency of transportation in the city in general.

3. METHODOLOGY

The ParkShare Smart Parking Space Sharing System suggested is an effective system of finding, reserved, and managing parking places based on a web application. The system links the owners of parking spaces and the drivers into a centralized platform enabling real time discovery of parking space, reservation and management of parking spaces. The main aim of the system is to save time on the process of looking out parking space and enhance the use of the available parking facilities in the cities.

The proposed system has the following key components as the methodology:
The functions of the system include: (A) User Registration and Authentication, (B) Parking Space Listing and Management, (C) Parking Search and Location Services, (D) Parking Reservation and Booking Management, (E) Intelligent Pricing and Recommendation Module, and (F) System Workflow.

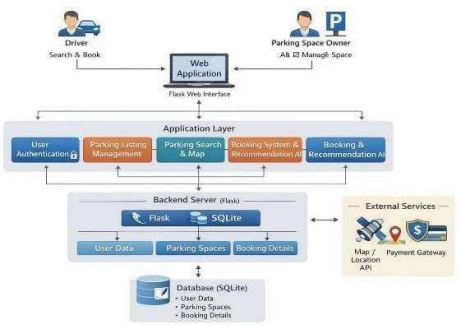
A. User Registration and Authentication

The system has a secure web-based interface, which enables the creation of accounts and access to system functionality based on the users of the system. The application will be developed with the help of the Flask web framework which will be used to handle interactions between users and a web-based interface. The key features of this module are:

- User Registration: Registration in the system can be done by new users who fillout the basic information of name, email address, password and role.
- Role Selection: There are two dominant roles in the system, and these are Driver and Parking Space Owner. Parking space search and reservation are carried out by drivers, and management of available parking spaces is done by the owners. Secure login authentication: This enables users to be recognized by their usernames and passwords.
- Secure login authentication: This allows users to be identified by their usernames and passwords. Before using the platform, users have to use a secure system to verify their credentials.
- Session Management: Once a successful user login is performed, the system uses user sessions to enable one to continually interact with the system tracking within the investigation system.

- **Secure File Storage:**
  Uploaded files are securely stored in a protected server directory to prevent unauthorized access.
- **Metadata Recording:**
  Important evidence information such as file name, upload timestamp, case ID, and uploader details are stored in the system database.

Fig. 1 – System Architecture.



B. Data Storage and Availability Verification

To maintain the accuracy and reliability of parking-related data, the parking management system stores data in a structured format for parking spaces. Every parking entry is uniquely identified and stored in a database to allow efficient data access and management.

The data handling process is as follows:

- Parking Data Entry:
  Parking data is entered into the parking management system when a parking space is created by a parking owner.

- Data Storage:
  Parking data is stored in a SQLite database along with parking owner data.

- Availability Verification:
  During parking space search by a user, parking availability is verified from a database.

- Data Consistency Check:
  Parking management ensures that only available parking spaces are displayed to users to avoid duplicate bookings or parking space conflicts.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 15 Issue 03 , March - 2026

C. Booking and Transaction Management

To effectively manage parking bookings, parking management system stores all parking-related activities in a structured database. Every parking booking is treated as a transaction and is stored accordingly.

Parking data is stored in a data structure containing the following data elements:

- Booking ID
- User Details
- Parking Space ID
- Booking Duration
- Time Stamp
- Booking Status

Each parking booking is linked to a parking space to maintain parking space availability.

D. Role-Based System Management

Role-Based Access Control is implemented in the system to allow only authorized users to perform certain actions.

There are two roles in the system:

Driver:
This role is responsible for search operations, viewing parking space information, and booking parking slots.

Parking Space Owner:
This role is responsible for adding, editing, and managing parking space listings and viewing bookings.

E. Booking History and Activity Tracking

It is vital to keep a record of user activities. The suggested system will keep a record of all activities carried out during booking.
The activities will include:

- Booking ID
- Parking Space ID
- Action performed (search, book, cancel)
- User performing the action
- Timestamp

These activities will be stored in the database and will be accessible to users via dashboards.

F. System Workflow

The overall workflow for the proposed system, named Park Share, can be defined as follows:

1. The parking space owners will first register themselves with the system and then log in to the system.
2. The parking space owners will then add details regarding the parking space, such as location, price, and availability.
3. The drivers will then log in to the system, search for available parking space near them, and then select one parking space to book.
4. The system will then display all available parking space details from the database, and then after booking, it will update the parking space availability.
5. The parking space owners will then receive booking details, and the drivers will be able to view all booking history through the system's dashboard.
6. The system will then keep track of all bookings and update parking space availability in real time.

The overall workflow for this system will be efficient in utilizing parking space, will save time in searching for parking space, and will be convenient for all users, both drivers and parking space owners.

4. RESULT AND DISCUSSION

The proposed ParkShare Smart Parking Space Sharing System was successfully implemented and tested to evaluate the efficiency of a web-based parking management system. The system was implemented using the Flask framework, SQLite, HTML, CSS, and JavaScript.The experimental results show that the system efficiently enables users to search, book, and share parking space, reduces the time taken to park, and optimizes the utilization of available parking space.

A. Secure User Authentication

The system starts with a secure login mechanism, allowing users to access the system based on their roles. The login page provides users with a simple and secure authentication mechanism, requiring users to enter their credentials to access the system.

Once users have successfully authenticated, they will be redirected to their respective dashboards based on their roles, i.e., drivers and parking space owners.

The system also provides user registration, session management, and validation features to ensure secure access and prevent unauthorized access to the system.

B. Parking Space Listing and Management by Owners Upon successful login, parking space owners can list their parking spaces through the Owner Dashboard. The parking space owner can list their parking space, and a list of parking records will be displayed on the owner's dashboard. The parking records include parking ID, location, price, availability, and booking status.

Each parking space will be stored in the database. Parking

International Journal of Engineering Research & Technology (IJERT)
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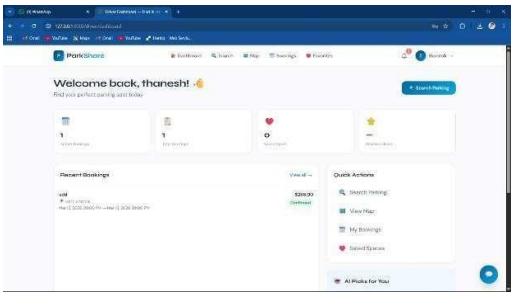
owners can update or delete their parking space listing anytime. The parking availability will be updated dynamically based on bookings.

Parking owners can view booking requests and efficiently manage their parking space through the owner's dashboard. The parking space owner can update parking availability in real time based on booking.

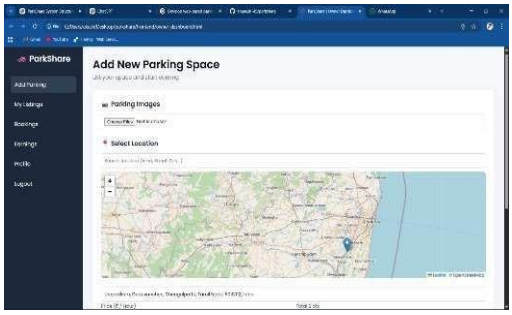
Fig. 2.user login page .



C. Parking Search and Booking by Drivers

Drivers can search for parking spaces through the search interface available in the Driver Dashboard. Users can enter their desired location in the search interface. Parking spaces will be displayed based on availability.

Fig. 3 –home page



Parking search will include parking location, parking price, parking availability, parking type, etc. Drivers can select a parking space and proceed with the booking process.

Upon successful booking, parking booking will be stored in the database. Parking availability will be updated in real time.

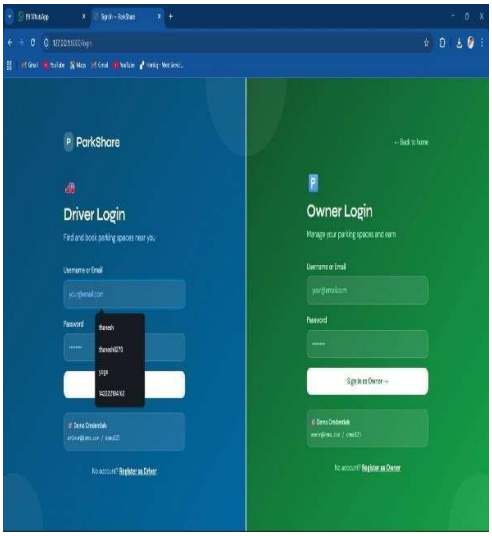
D. Booking Management and Data Handling

All data related to bookings is stored in the database. The data is efficiently managed. Each booking is stored in the database as:

- Booking ID
- Driver Information
- Parking Space ID
- Booking Duration
- Time Stamp
- Booking Status

No duplicate bookings are allowed. The system checks for availability before allowing bookings. Thus, data consistency and reliability are ensured in parking management.

Fig. 4– login page



E. System Performance and Efficiency

System performance was checked for different user interactions. It is observed that:

- System response to user requests such as login, search, and booking is efficient.
- Database operations are efficient due to SQLite database use.
- System can handle many users without a significant delay.

The user interface is a web-based interface, which provides smooth and efficient user experience.

F. Discussion

From the experimental results, it is clear that the ParkShare system can overcome the limitations of traditional parking systems. The system can reduce the time taken to find parking and can increase parking space utilization. The system can ensure that users can easily find parking spaces and book parking spaces through the use of location-based search and real-time booking. The use of role-based access control can increase system security and usability. The limitations of the current system can be improved in future enhancements. The system is currently limited to the web-based platform and does not have advanced features such as real-time traffic integration and mobile application support.

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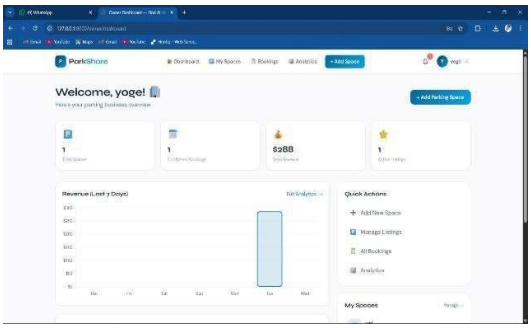
5. CONCLUSION

This project involved the development of ParkShare – Smart Parking Space Sharing System, a web-based application aiming to enhance the efficiency, ease of use, and management of parking spaces in a city. Conventional parking management involves a search for parking spaces, which is not efficient due to a lack of real-time information. This increases traffic congestion, fuel consumption, and waste of available parking space. These problems cause inconvenience to drivers and affect city transport management.

The proposed ParkShare System aims to resolve these problems by developing a centralized platform for parking space owners and drivers. It will enable parking space owners to list available parking spaces using a web-based interface. On the other hand, drivers will be able to search for parking spaces and book them in advance. The ParkShare System will efficiently manage parking data, parking space owners' data, and booking data in a structured manner.

The ParkShare System will be developed using a Flask framework for building a web-based application, SQLite database management, and frontend technologies such as HTML, CSS, and JavaScript for a user-friendly interface. Role- based access control will be implemented to enable parking space owners to manage parking space data and drivers to search for parking spaces. As the experimental evaluation reveals, the proposed system can efficiently minimize the time taken to park

Fig. 5 – Owner Dashboard



the vehicle and utilize the parking resources. The incorporation of the location-based searching and reservation facilities can increase the convenience of the users. The proposed system can efficiently manage the booking of parking spaces without any conflicts.

With the incorporation of various web-based tools, the proposed ParkShare system can efficiently address the parking management challenges. The proposed system can be implemented for parking management in urban areas, business centers, and even housing communities. The proposed system can efficiently manage the parking space sharing. The proposed project can contribute to the development of a smart parking management system.

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