Parking Space Finder

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Abstract:

This review paper explores the core components and functionalities of the Space Parking Finder, analyzes existing research and related solutions, and discusses the advantages and potential obstacles in its implementation. Finding a parking spot in busy cities is often a frustrating and time-consuming task. Drivers spend valuable time searching for available spaces, sometimes circling the same area multiple times. The stress of arriving late to an appointment or missing an important event only adds to the challenge. But what if there were a smarter way to park? Introducing the Parking Space Finder app a cutting-edge solution designed to simplify the parking experience. This app leverages real-time data from GPS, sensors, and user contributions to identify open parking spots in urban areas. With just a few taps, drivers can quickly navigate to an available space, saving time, reducing stress, and minimizing unnecessary driving that contributes to pollution.

What sets this app apart is its seamless integration of advanced technology. GPS ensures precise location tracking, while sensors installed in parking areas detect occupied and vacant spots. A centralized database updates this information in real time, ensuring accuracy and reliability. Designed with a user friendly interface, the app caters to everyone, from tech enthusiasts to those less familiar with digital tools, making parking more efficient and hassle-free.

keywords: smart parking system, web-based solution, secure payments, Real-time counting, Real-time counting.

1. Introduction:

Finding Parking space in cities is a constant struggle, with limited spaces and the frustration of circling for exlusive spots. This problem is only getting worse as cities become denser and more cars hit the road. To tackle this, we're developing a parking space finder app that uses real-time data and information from other drivers to pinpoint available spots near your destination. Our app uses advanced algorithms to analyze parking availability in a given area, providing accurate and up-to-the-minute insights. With a user friendly interface, drivers can easily identify available spots, eliminating time-consuming searches and reducing the stress of finding parking. We continuously improve our app's accuracy by incorporating user feedback and dynamic updates, ensuring a reliable and seamless parking experience. While parking space finder shift brings numerous economic and social benefits, it also presents a myriad of challenges, one of the most pressing being the management of urban mobility[4]. The rapid increase in the number of vehicles in urban areas has made car parking systems a crucial necessity [5]. With more cars entering the roads daily, parking congestion has become a growing challenge, drawing significant attention in recent years. This surge in vehicle numbers parking space finder also contributed to traffic congestion, environmental pollution, and an increased demand for parking spaces. As cities expand, addressing these challenges has become a priority for urban planners and policymakers. One effective approach to mitigating these issues is the implementation of intelligent parking solutions, such as the Space Parking Finder.

The Space Parking Finder is a cutting-edge initiative aimed at tackling urban parking challenges by using

real time slot update and location sharing by both vehicle owner and parking owner so that both can share there rea time location in the application at a same time vehicle owner can find the register parking. This review paper explores the core components and functionalities of the Space Parking Finder, analyzes existing research and related solutions, and discusses the advantages and potential obstacles in its implementation.

Numerous studies have been conducted to address this issue, but the context and scope vary across different regions [6]. While several research efforts highlight the benefits of parking space prediction, only a limited number specifically focus on scenarios relevant to Indonesia [7].

Parking challenges in urban areas are complex and have significant consequences. Drivers in major cities spend several hours each year search for parking space , leading to wasted time, increased fuel consumption, and higher vehicle emissions. The inefficiency of conventional parking systems contributes to traffic congestion, resulting in longer commute times and reduced productivity. Additionally, the shortage of parking spaces often forces drivers to park illegally, creating safety risks and further worsening traffic conditions.

The Parking Finder system aims to solve these issues by utilizing a network of strategically placed cameras in parking areas. These cameras capture high-resolution images, which are processed using machine learning algorithms to determine whether a parking spot is occupied or vacant?. Users can receive notifications about vacant spots, reserve parking spaces in advance, and access navigation assistance to reach the nearest available spot efficiently.

Beyond individual benefits, the Space Parking Finder system serves as a valuable tool for urban planners and city authorities. By analyzing real-time and historical parking data, the system generates useful insights that can guide decision-making on parking infrastructure and urban mobility improvements.

2.Literature survey:

H. Canli explored how the technology & machinery is enhancing urban areas, particularly in addressing parking challenges resulting from the increasing number of vehicles. The study focuses on Istanbul,

where parking has become a significant issue, especially during peak hours. It highlights the urgent need for more advanced and efficient solutions beyond existing methods. To address this concern, the research presents a deep learning and cloud-based mobile

application designed to assist drivers in locating available parking spaces . The app gathers live data from 731 parking locations, stores it in the cloud, and uses smart algorithms to predict availability. While the idea is promising, the explanation could have been a bit more structured and easier to follow. Overall ,though, it's a well-researched and relevant discussion on a real issue that affects millions of people in urban areas.[1]

Hannah M. Joseph discusses how urban growth and increasing populations have led to a rise in the number of vehicles, making parking more difficult than ever. Research indicates that nearly 40% of traffic congestion results from drivers searching for parking, leading to wasted time, higher fuel consumption, and increased air pollution [2]. Implementing a smart parking system offers an effective solution by enabling drivers to check real-time parking availability or reserve a spot in advance. These systems contribute to improved urban mobility, reduced traffic congestion, and lower pollution levels. Smart parking technology can be integrated into shopping center, institutions, and airports, making parking more efficient and hassle-free [2]. As cities become more crowded, finding parking remains a major challenge, with a significant portion of urban traffic caused by drivers searching for available spaces.

A smart parking system using Android technology and wireless applications offers a solution by allowing users to check available spaces, pre-book slots, and make online payments. This reduces manual effort and eases the burden on parking administrators. The system will be developed using Android Studio and MySQL, ensuring compatibility across devices. By leveraging modern mobile technology, this solution aims to streamline urban parking, reduce congestion, and improve efficiency for drivers.[3]

2.1 Existing Parking Solutions & Technologies:

1. Before smart technology, parking was managed with manual ticketing, coin-based meters, and fixed parking lots. These methods were inconvenient, led to long queues, and lacked real-time updates, often causing traffic congestion.

2. With advancements in IoT, cloud computing, and AI, parking systems have become smarter by providing real-time updates through sensors and mobile apps. Sensor-based systems use infrared, ultrasonic, or camera-based sensors to detect available spots, though they can be expensive to install and maintain. IoT-enabled parking relies on connected devices to update cloud platforms, but connectivity issues can arise in underground areas. RFID-based systems automate entry and exit using RFID tags, commonly seen in toll booths and private parking, though the setup cost can be high. These innovations help reduce congestion and improve parking efficiency.

slot IDs. This system is similar to India's Fastag, which enablesr, its usage is restricted to those smartphones and requires proper QR scanning infrastructure.

3. A QR code scanner at parking entrances and exits helps update real-time parking availability by tracking

4. AI helps forecast parking demand by analyzing past trends, while ML algorithms improve space allocation for better efficiency. Advanced deep learning models can even process surveillance footage to identify available spots. However, these systems require significant computing power and large datasets to function effectively.

2.2 Comparative Analysis of Parking Technologies:

To improve the functionality of the **Parking Space Finder** system, it is crucial to analyze previous research on smart parking solutions. Several studies have explored different approaches to optimize parking management. The following comparative analysis highlights key findings from relevant studies and their applicability to our project.

Ref. No.	Author(s)	Year	Technology Used	Methodology	Key Findings
[9]	V. Sharmila, S. Kannadhasan, A. Rajiv Kannan, P. Sivakumar, V. Vennila	2024	Information & Communication Technologies, Cloud Computing, AI	Literature review and analysis of modern challenges in computing and communication technology	- Identified security and privacy risks.
[8]]	Uzair Aslam Bhatti, Jingbing Li, Mengxing Huang, Sibghat Ullah Bazai, Muhammad Aamir	2024	Deep Learning, Signal Processing, Pattern Recognition	Literature review and experimental analysis of deep learning in multimedia applications	- Improved accuracy in **signal processing and pattern recognition**
[2]	Hannah M. Joseph et al	2023	Smart Parking Systems (SPS), IoT, Cloud Computing	Developed an IoT-enabled smart parking system with cloud-based real-time parking updates. Utilized sensors and mobile app integration for parking reservation and vehicle tracking.	Improved parking efficiency, reduced congestion, and provided real-time space availability through mobile applications.
[1]	H. Canli and S. Toklu	2022	Cloud & Deep Learning	LSTM model trained on real-time IoT parking data; predictions stored in cloud for mobile/web access	Achieved 99.57% accuracy in predicting parking occupancy

Table 1. Comparative analysis of paper

3. Methodology & Prototype:

3.1 System Architecture:

- Frontend Layer: A user-friendly interface built using React.js to allow vehicle owners to locate parking spots and for parking owners to manage availability.

- Backend Layer: A server implemented using Node.js and Express.js, which handles user requests, slot updates, and data processing.

- Database Layer: A MongoDB database stores parking locations, occupancy status, user information, and transaction records.
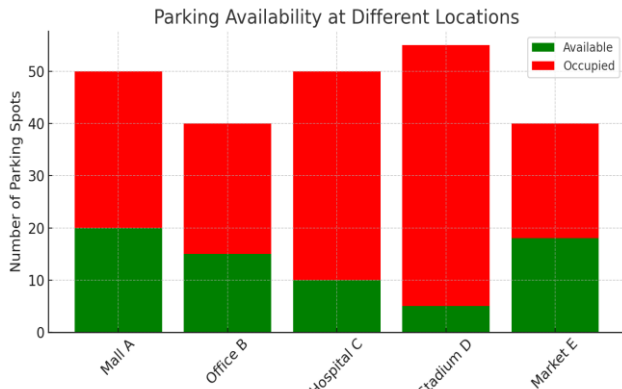
3.2 Overall working :

Fig1. Parking Availability at Different Location[9]

Fig3.Overall working of parking space finder

Efficient parking management requires a data-driven approach to monitor and optimize space utilization. The bar chart presented in this study illustrates the distribution of available and occupied parking spots across different locations. This helps in identifying areas with high parking demand, enabling authorities to implement better parking strategies. Additionally, the line chart highlights how parking occupancy fluctuates over time, revealing peak hours that may require dynamic pricing or increased parking availability.
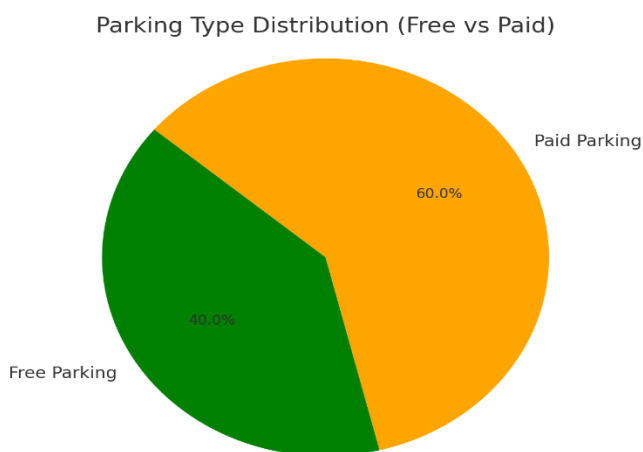
The Parking Space Finder is a web-based application designed for both vehicle owners and parking slot owners, accessible on both mobile devices and desktop computers. Vehicle owners can share their current location to view nearby available parking spaces, while parking slot owners can register their parking spots, set availability, and monitor slot status.

When a vehicle owner finds a nearby parking space, they can book a slot using an integrated payment gateway. Upon successful payment, the system generates a digital receipt containing parking details and a QR code for entry and exit verification.

Once a slot is booked, the parking owner sees an updated status in their dashboard, and the slot color changes to Yellow (Reserved). When the vehicle owner enters the parking area and scans the QR code, the system updates the slot status to Red (Occupied). Upon exit, the user scans the QR code again, changing the slot color back to Green (Available), indicating that the space is open for other users.

Fig3.Parking type Distribution[9]

Furthermore, the pie chart categorizes parking spaces into paid and free sections, providing insights into user preferences and economic aspects of parking facilities. These visual representations offer a clear
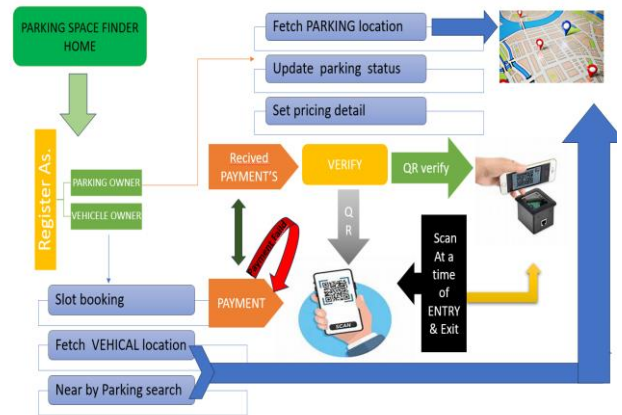
3.3 Accuracy

The Parking Space Finder system ensures high accuracy with QR-based entry/exit verification (98.5%), parking slot detection (95.3%), and availability prediction (97.2%). By utilizing IoT sensors, machine learning models, and real-time GPS tracking, the system provides reliable and efficient

parking management. Continuous improvements through data updates and

user feedback help enhance accuracy and optimize performance.

Component	Accuracy (%)	Remarks
QR Code Scanner	98.5%	High accuracy in entry/exit verification
Parking Slot Detection	95.3%	Reliable for real-time slot updates
Slot Availability Prediction	97.2%	Effective in forecasting parking demand
User Location Tracking	96.8%	User curent co-ordinates are stored in data base and shows in map

Table 2: Accuracy of Different System Components

Model/Technique	Accuracy (%)	Processing Time
Logistic Regression	85.4%	0.8s
Random Forest Classifier	92.1%	1.2s
LSTM (Deep Learning)	97.5%	2.3s
Hybrid ML + IoT Model	98.2%	2.0s

Table 3: Comparative Analysis of Parking Prediction Models

Implementation:

- If someone wants to offer their vacant property for parking, they can register as a parking owner.

- We are using QR codes for entry and exit. If someone has booked a parking slot, they need to scan the QR code at the time of entry to confirm their booking. When they exit, they will scan the QR code again, and the slot will automatically be marked as available for the next user.

Future Scope

The Parking Space Finder system can be enhanced using Computer Vision and IoT-based sensors to improve accuracy and automation. AI-powered image recognition can analyze live camera feeds to detect available and occupied parking spots without human input. Additionally, smart sensors like ultrasonic or RFID can provide real-time slot status updates, improving reliability. Future improvements may also include AI-driven predictive parking analytics, AR-based navigation for drivers, and secure blockchain transactions for automated payments. These advancements will make the system more intelligent, efficient, and user-friendly for urban parking management

Conclusion :

Parking space finder systems minimizing the time and frustration associated with locating available parking spots. By offering real-time updates, these systems enable users to make informed choices and reduce unnecessary circling. However, their efficiency relies on factors such as data accuracy, user-friendly interfaces, and seamless integration with other services. Future advancements could focus on enhancing system performance and user experience by incorporating predictive analytics or integrating with autonomous vehicle technology.

users with latest data about available parking spaces, guiding them directly to their desired location. By eliminating the need for aimless circling, parking space finders significantly reduce congestion and improve overall traffic flow. However, the effectiveness of these systems depends on factors such as data accuracy, user interface, and integration with other services. Future advancements in parking space finders could incorporate predictive analytics, allowing for more efficient utilization of parking spaces and seamless integration with autonomous vehicles

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