

PureParking: A Decentralized, Secure Framework for Parking Space Sharing using Blockchain

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Abstract—The rapid urbanization and population growth in urban areas have led to a higher need for transportation services. With the rise in transportation numbers and frequent usage, it has become a major challenge for city residents to find available parking spots. Existing solutions primarily rely on large-scale public and private parking facilities. Nevertheless, these remedies fail to effectively handle the growing needs, leading to crowding, wasted time, and higher chances of traffic congestion. On the contrary, many private parking spaces go unutilized when their owners are absent. Hence, using smart apps to access private parking spots will minimize this issue. However, privacy concerns may arise when sharing private parking spots, particularly in centralized systems susceptible to data breaches, which may deter people from participating. In response, we proposed a framework for private parking space-sharing that aims to benefit both users and renters while alleviating traffic congestion and saving time. This system allows users to use a mobile app to ask for parking spaces, making it simple to reserve and reach the closest spot. Security is of utmost importance in public sharing systems, so we have implemented a blockchain model renowned for its strong security capabilities.

Index Terms—Blockchain, Consensus, Park sharing, Smart Parking, and Smart Contracts

I. INTRODUCTION

The rise of urbanization and improving living standards have led to a significant growth in urban car ownership. The rise in population and transportation has resulted in parking problems for those visiting urban areas. Locating a parking spot in urban areas has become a major challenge in recent times. Additionally, locating the available public parking spot takes time, resulting in wasted time and resources. In the past, numerous research projects have been carried out to make better use of both public and private parking spaces and to upgrade them with intelligent technology. These solutions aim to help users make parking reservations more affordably and enhance the use of current parking facilities. However, most current techniques concentrate on vast private and public areas, neglecting the unused private parking spots of residential people when the residents are away. In many of these regions, residents have established their own parking areas, some of which also include Electric Vehicle (EV) charging stations and car wash services. Some of the parking spots are typically free, while others are free at various times. Using these spaces not only decreases the amount of time drivers spend searching for parking but also minimizes traffic congestion, expenses, and

air pollution. The owners of the lot can also benefit by leasing the vacant lot briefly and making money. This system benefits both the leaser and drivers; leasers can utilize their unused parking space and earn money, while drivers can save time, resources, and money by parking in the nearest resident parking. Additionally, this framework minimizes traffic congestion and air pollution.

II. METHODOLOGY

The proposed system includes drivers searching for parking spots and parking lot owners wanting to lease out their unused space temporarily. The drivers seeking parking spaces and the parking lot owners willing to rent out their idle spots interact. The process includes two phases:

A. Registration Phase

In this step, the parking service provider generates a rental offer for parking that details the number of available parking spaces, the duration of availability, and the cost of the spaces.

B. Reservation Phase

Parking lot owners update the time spans during which their spots are available for rent. Drivers can then request an available spot and receive recommendations based on availability. The user's request is recorded in the blockchain as a transaction block, serving as the basis for recommending parking slots according to user preferences. Upon receiving recommendations, the user can either confirm the reservation of a parking slot or initiate a new request if the recommendations do not meet their needs. Upon confirmation of a recommended parking slot, the parking service provider acknowledges the user's selection. Once the parking reservation is completed and the user parks their car, the payment process begins, and relevant information is updated in the blockchain. Upon concluding the parking session, the payment is calculated based on the duration of the user's stay in the parking lot. Payment options include cash, card, or other online sources for the user's convenience. The subsequent section elaborates on the specifics of the blockchain module.

III. SYSTEM COMPONENTS

A. Parking Spot Owners and Drivers

Owners of parking spots and drivers are the main users of the PureParking system. Parking spot owners utilize the

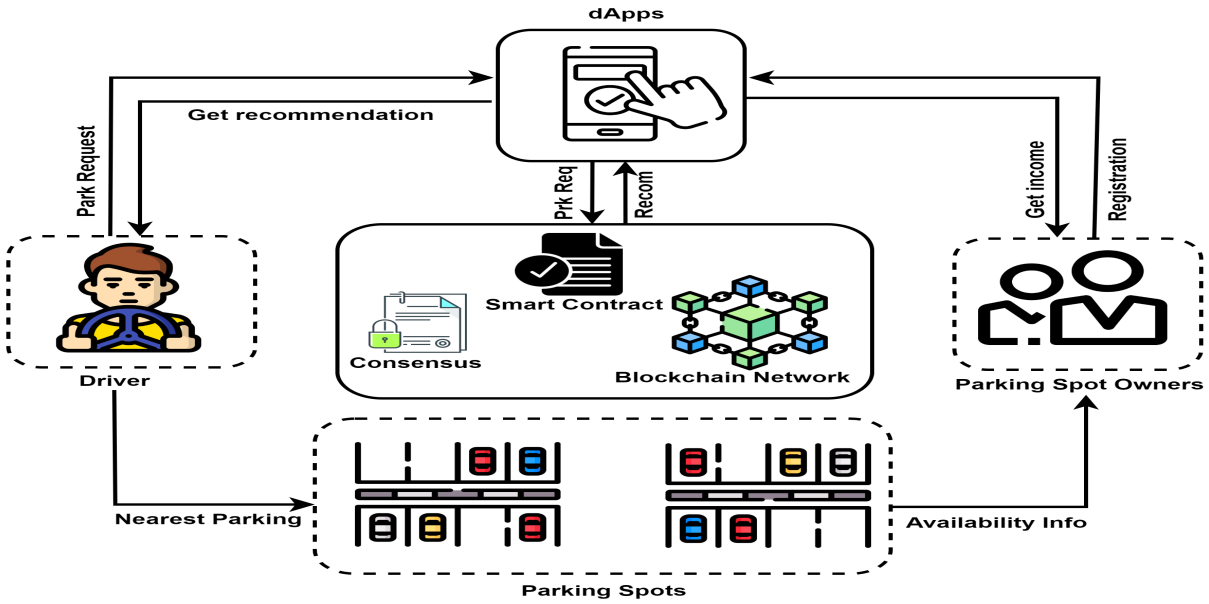


Fig. 1. Overview of the Proposed PureParking Framework

PureParking interface to list one or multiple of their vacant parking spots on the Blockchain. Drivers utilize PureParking to secure one of the parking spots that are currently open for a set period of time. When a driver reserves one of these parking spaces using the interface, the new reservation is included in the Blockchain.

B. Blockchain

PureParking employ Blockchain technology to securely store user data in a decentralized, privacy-preserving manner [1-3]. Ethereum is famous for its smart contracts and is a public Blockchain that welcomes any entity to become part of the network. On the other hand, Hyperledger is a private Blockchain that limits entry to designated users. The operations on every Blockchain are determined by smart contracts (known as "chaincode" for Hyperledger Fabric), which contain the application's business logic. When activities start on the front end, the back end converts them into information requests that can be sent to the relevant Blockchain. The ledger can be accessed by the Blockchain to retrieve or update data. Every transaction is verified by orderer nodes, as explained in a subsequent section.

C. User Interface

The user interface (UI) of PureParking serves as the gateway for users to interact with the parking space sharing platform. Through a user-friendly interface, drivers can effortlessly search for available parking spaces, view relevant details such as location and availability, and make reservations as per their preferences. The UI provides intuitive navigation and clear prompts, guiding users through the booking process seamlessly. Additionally, it offers features for parking lot owners to manage their listings, update availability, and track

reservations. The UI design prioritizes simplicity, functionality, and accessibility, ensuring a positive experience for both drivers and parking lot owners alike.

IV. CONCLUSION

This work introduces a blockchain-enabled secure parking system, enabling residents to share their unused parking spaces for both short-term and long-term periods, thereby earning financial benefits. By providing drivers with convenient parking options, this system saves time and resources while minimizing difficulties. The decentralized sharing system benefits both users and renters and aids in reducing traffic congestion and air pollution in urban areas.

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