

Peer to Peer Ridesharing using Blockchain Technology

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Abstract

This study aims to bolster security and trust in ridesharing by leveraging blockchain technology. Employing blockchain, smart contracts, and simulations, the research focuses on facilitating transparent and secure transactions within the ridesharing ecosystem. The findings reveal a substantial enhancement in carpooling security and transparency, marking a transformative milestone for shared mobility. Through the integration of blockchain, this research pioneers novel approaches, ensuring the integrity of transactions and fostering trust between rideshare participants. The study's novelty lies in its introduction of unprecedented blockchain applications, reshaping the landscape of shared mobility. By establishing a secure foundation through blockchain and smart contracts, the research contributes to the evolution of ridesharing, emphasizing the potential for heightened security and trust in the increasingly interconnected world of shared transportation.

Keywords: Smart- Contracts, Blockchain, Web, Peer-to-Peer, Decentralized, Carpooling, Ethereum (EVM).

1. Introduction

The urban landscape pulsates with an ever-increasing demand for mobility. Ridesharing platforms have emerged as a dynamic response, promising convenience, shared costs, and environmental benefits. Yet, these platforms, often built on centralized models operate in an opaque cloud of high fees, data privacy concerns, and single points of failure. This research paper delves into a bold reimagining of this landscape, proposing a decentralized, peer-to-peer (P2P) ridesharing platform powered by blockchain technology and also the payment and data management processes, paving the way for enhanced transparency, reliability, and resilience in the evolving landscape of ride-sharing applications. Traditionally, centralized ridesharing giants orchestrate the dance between riders and drivers, acting as gatekeepers of data and facilitators of transactions. This model, while fostering convenience, comes at a cost. Opaque pricing structures, hefty service fees, and a lack of furthermore, these systems are inherently vulnerable to server failures and data breaches,

exposing the fragility of a single point of control. Our research envisions a future where these limitations are transcended. We propose a P2P ride-sharing platform built on the unshakable foundation of blockchain technology. This distributed ledger ensures unalterable recording of transactions and data, fostering a trustless network where intermediaries become an archaic relic. Smart contracts, self-executing agreements baked into the blockchain, automate ride bookings, payments, and dispute resolution, eliminating the need for centralized control and its associated fees. Adapted from Transparency becomes the guiding star in this is decentralized universe. Users retain ownership of their data, empowering them to choose how much they share and with whom. This paradigm shift not only bolsters privacy but also fosters accountability. Ride histories and user reputations become etched onto the blockchain, creating a community where trust flourishes based on verifiable information. Figure 1 shows the Centralized Ridesharing System

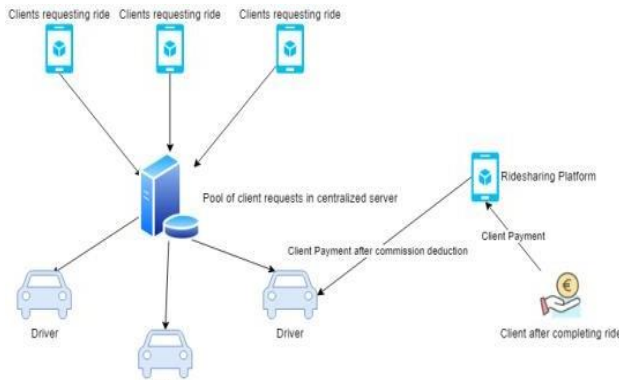


Figure 1 Centralized Ridesharing Method

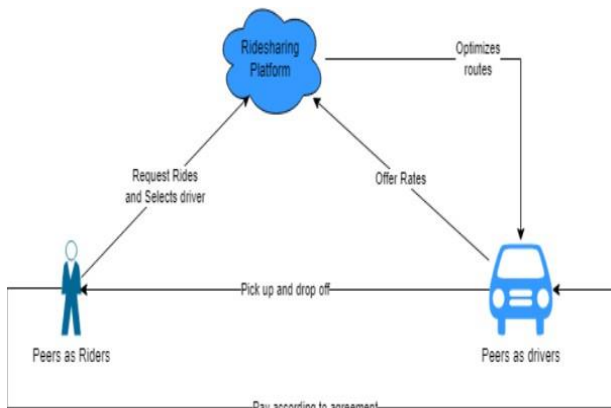


Figure 2 Peer-to-Peer Ridesharing Model

Figure 2 shows the Decentralized Ridesharing System Adapted from This research is more than just a technical exploration. It's a glimpse into a future where ridesharing empowers. We pave the way for a platform that is democratic, data-driven, and user-centric, where riders and drivers connect directly, sharing the road and its benefits with greater transparency and trust. Join us as we unlock the potential of blockchain to democratize mobility and redefine the very essence of ridesharing.

2. Literature Review

Beyond the global adoption of cryptocurrencies, blockchain has seen widespread acceptance since the 2008 release of the Bitcoin whitepaper. Its adaptability has been useful in many different kinds of fields, among them data sharing, supply-chain management, financial technologies, healthcare, and the Internet of Things (IoT). Notably, blockchain has reshaped the sharing economy with platforms like Filicinin has revolutionized the management of digital assets, including music. The

technology's potential is further underscored by its ability to establish a secure, dependable, and decentralized autonomous Intelligent Transportation System (ITS) environment. This advancement holds the promise of optimizing the utilization of existing ITS infrastructure and resources, especially benefiting from the integration of crowdsourcing technology .Sarvesh Wadi, Mrunal Shidore proposed the carpooling android application. The research paper identifies critical obstacles in the realm of carpooling, addressing concerns related to security, privacy and delved into the potential solutions offered by blockchain technology to mitigate these challenges. The authors showed blockchain-driven framework for carpooling. Veeranki Surya, Mukesh Hanumanth Kumar proposed a blockchain-based solution for peer-to-peer ride-sharing that addresses the challenges of traditional ride-sharing platforms, such as high fees and lack of transparency. The system would allow riders and drivers to connect directly, reducing costs and improving trust. Chauhan and Saini introduced an innovative carpooling system that harnesses blockchain technology. This system is grounded in a blockchain-based platform, ensuring the delivery of secure and transparent ride-sharing services. They advocated for a payment system driven by smart contracts, contributing to the automation and efficiency of the payment process. Bharath MU et al. [3] proposed system that incorporates a decentralized ride-matching mechanism for efficiently pairing riders with drivers. Additionally, a smart contract-based payment system has been implemented to automate the payment process. To further bolster the security and reliability of the system, the authors have put forth the concept of a reputation system. Lee et al. introduced a system designed to provide ride-sharing services through the utilization of a blockchain-based platform. Additionally, the authors put forth a payment gateway using smart contracts for the automation of fair charges. Furthermore, a robust system was proposed to encourage positive behavior within the carpooling system. Miah et al. introduced a platform that employs a blockchain infrastructure to deliver

carpooling services. Additionally, the authors suggested the implementation for the automation of payment processes. Novel system was proposed to encourage positive behavior within the carpooling platform. Zhang and Yang A novel carpooling system leverages decentralized technologies to provide secure and privacy-conscious ride-sharing. The system incorporates a decentralized ride-matching mechanism designed to match riders and drivers while ensuring the preservation of their privacy. The authors further suggested the implementation of a smart contract-based payment system to automate the payment process

3. Methodology

3.1 Software Used

Web and blockchain development are the two software components which together make up the system that is recommended. The list of apps, libraries, dependencies, and APIs utilized to build the system that was suggested is offered below.

3.2 Tools Used

3.2.1 Visual Studio Code (VS Code)

Acts as a versatile integrated development environment (IDE). It is a lightweight and extensible platform for coding.

3.2.2 Google Maps/Directions API

To visually present ride routes and locations within the web app, the application integrates with Google Maps API, incorporating a map fragment directly into the user interface. Additionally, Google Directions API is used to extract and display accurate directions between any two points on the map, ensuring clear and convenient navigation guidance for users.

3.2.3 Node V20.10.0

Node V20.10.0 is a JavaScript runtime environment used for Javascript and Solidity development.

3.2.4 HTML/CSS/Javascript

HTML is used for structuring the content, CSS for styling and layout, and JavaScript for interactive and dynamic functionalities.

3.2.5 Remix IDE

Remix IDE is a powerful web-based integrated development environment for Ethereum smart contract development.

3.2.6 Solidity v0.8.0

Solidity is primarily used for writing smart contracts, self-executing contracts with the terms of the agreement written directly into code. These contracts run on the Ethereum Virtual Machine (EVM) and can be deployed on the Ethereum blockchain. drawers for both ride requests and ride approvals. Drivers send information about their current location through a new blockchain transaction. Subsequently, the rider receives the driver's data and accepts the request, which is then recorded on the blockchain. Consequently, the developed Web application is designed to communicate with the workflow. Figure 3 shows the Workflow Diagram for the P2P ridesharing Platform.

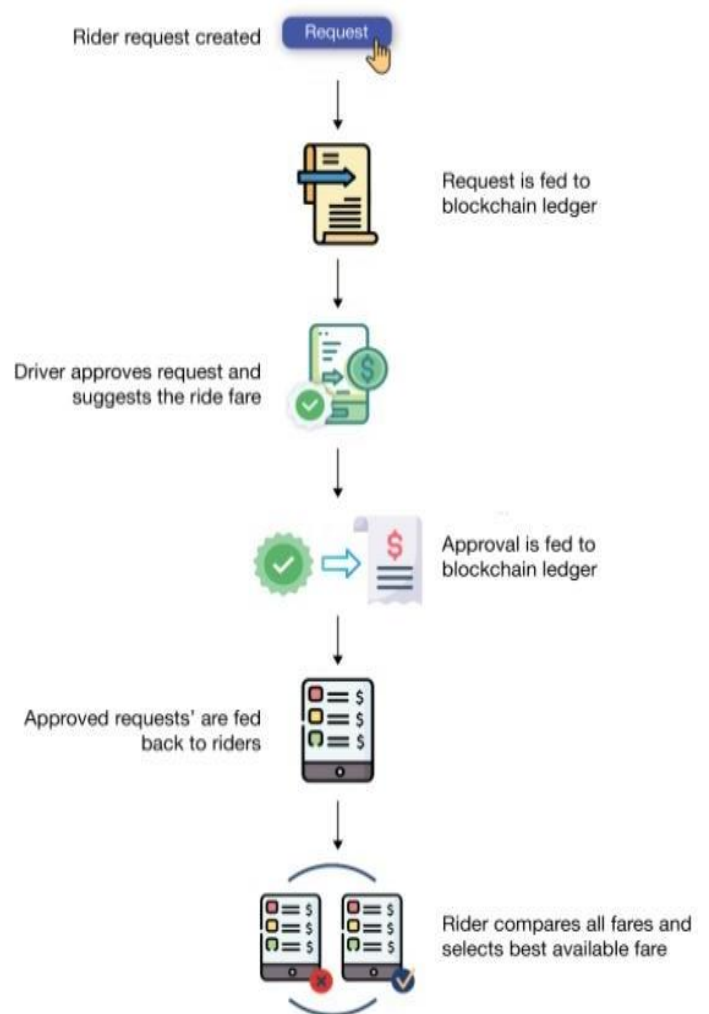


Figure 3 Workflow Diagram

3.3 Proposed Method

A straightforward user interface accompanies the deployment of a Login and Registration service, while the backend employs a Metamask authentication service to store and validate the user's login credentials. A map fragment has been incorporated into the map activity to execute fundamental map functionalities, including enabling user location, utilizing location markers, adjusting map types, and more. The application's frontend is constructed using the ReactJS frontend UI library. It encompasses elements such as login/registration interfaces, a search bar, and drawers for both ride requests and ride approvals. Drivers send information about current location through a new blockchain transaction. Subsequently, the rider receives the driver's data and accepts the request, which is then recorded on the blockchain. Consequently, the developed Web application is designed to communicate with the blockchain through The above image illustrates the home page of a P2P ridesharing web application. It includes three main components. Figure 4 shows the P2P Ride Sharing Process (2023) Coin telegraph. with the blockchain This system is grounded in a blockchain-based platform, ensuring the delivery of secure and transparent ride-sharing services. They advocated for a payment system driven by smart contracts. Figure 5 shows the navigation.

4. Experimental Result

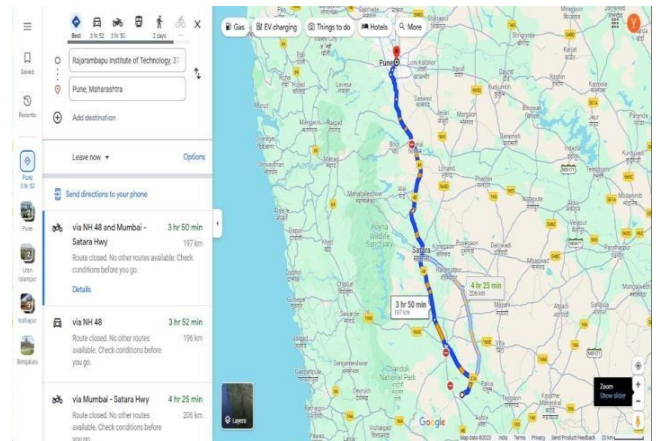


Figure 5 Navigation

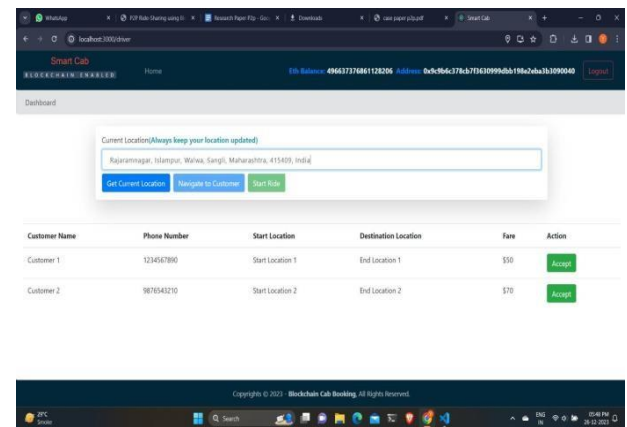


Figure 6 Driver Dashboard

Blockchain-based P2P ridesharing process

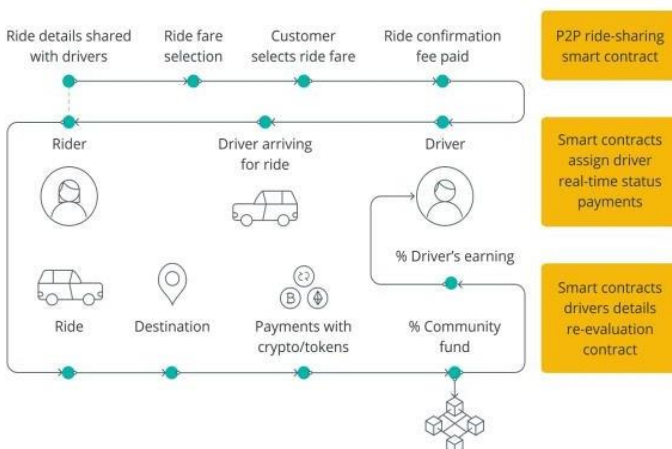


Figure 4 P2P Ride Sharing Process (2023) Coin Telegraph

The above image illustrates the driver dashboard. It includes a search bar for selecting the current location of the driver. It also includes requests from riders interested in sharing rides

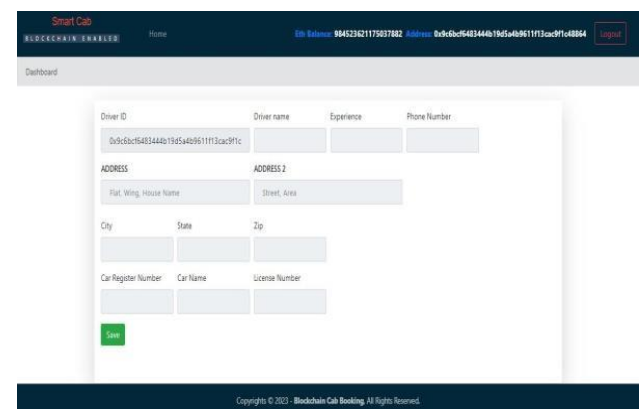


Figure 7 Book Ride

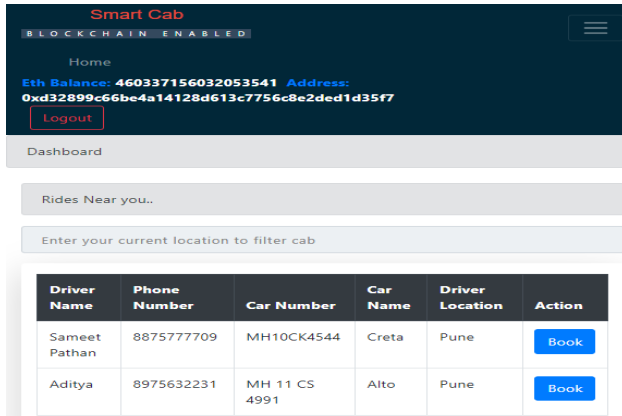


Figure 8 Add Driver

The above image displays the form to fill in the details of the driver during registration. Drivers send information about current location through a new blockchain transaction. Subsequently, the rider receives the driver's data and accepts the request, which is then recorded on the blockchain. Consequently, the developed Web application is designed to communicate with the blockchain. A map fragment has been incorporated into the map act.

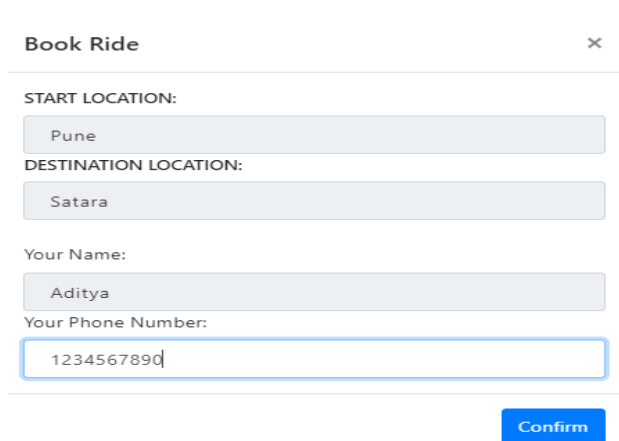


Figure 9 Add the Source to the Destination (Rider)

Figure 9 shows the image illustrates the driver dashboard. It includes a search bar for selecting the current location of the driver. It also includes requests from riders interested in sharing rides critical issues such as trust, transparency, and security. By decentralizing control and enhancing the immutability of transaction records, blockchain

minimizes the risks associated with fraudulent activities and fosters a more reliable and accountable ridesharing ecosystem.

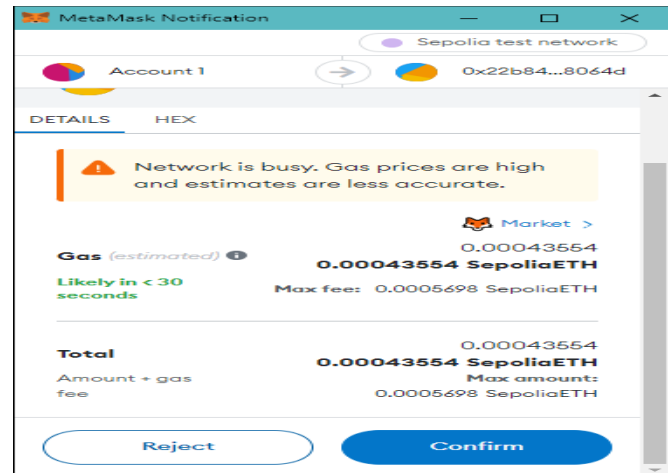


Figure 10 Transactions and Gas Fees

Figure 10 shows the Transactions and Gas Fees the it MetaMask transactions involve sending and receiving cryptocurrency on the Ethereum blockchain. Users initiate transactions through the MetaMask wallet extension, confirming actions via a secure interface. Gas fees, essential for transaction processing, compensate Ethereum miners.

Conclusions

The utilization of blockchain technology within carpooling applications holds the promise of transforming the dynamics of ride-sharing. The integration of blockchain technology in peer-to-peer ridesharing holds significant promise for addressing critical issues such as trust, transparency, and security. By decentralizing control and enhancing the immutability of transaction records, blockchain minimizes the risks associated with fraudulent activities and fosters a more reliable and accountable ridesharing ecosystem. The smart contract functionality embedded in blockchain facilitates automated, secure, and transparent transactions, streamlining the payment process and reducing the dependency on intermediaries. Additionally, the use of decentralized identity verification enhances user privacy while ensuring the credibility of participants. While challenges such as scalability and regulatory concerns remain, the potential benefits for both riders

and drivers, coupled with the evolving landscape of blockchain technology, underscore the need for further exploration and implementation of these innovative solutions in the peer-to-peer ridesharing industry. As the technology matures and regulatory frameworks adapt, blockchain's transformative impact on ridesharing is poised to revolutionize the way we engage in shared mobility.

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