

Application of Blockchain in the Sharing Economy: Use Case of Ride-Sharing Platform

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Abstract. Applications based on the business model of the sharing economy, which rely on traditional technologies, have trouble ensuring information traceability, transparency, and trust between their participants. Blockchain technology and smart contracts can help in overcoming these problems and improve efficiency. In this paper, the benefits that this technology can provide in support of sharing economy applications are presented. It also addresses which existing problems and challenges it can solve. The paper includes a use case of blockchain technology using the example of a ride-sharing platform. Although the participants and transactions in the described model are simplified, they are an excellent demonstration of how these technologies can improve the efficiency of the described system.

Keywords. sharing economy, blockchain, ride-sharing

1 Introduction

One of the most remarkable trends in recent years has been the emergence of the sharing economy, which used to be often referred to as collaborative consumption or P2P (peer-to-peer) sharing. This socio-economic pattern emphasizes the efficacy of sharing, renting, or swapping items among society members brought about by digital networks. The whole definition of the sharing economy consists of different areas, such as travel, accommodation, and financial services.

The challenges in shared economy applications are establishing a system of trust and increasing transparency among all participants. These can be the main issues for such systems that are based on traditional technologies. Therefore, an alternative to the traditional way of implementing such applications should be presented. Blockchain technology has the potential to offer a solution and help overcome these challenges.

The authors of this paper propose the use of blockchain technology as an innovative solution for establishing verification and increasing transparency among all participants in shared economy applications. A proposal for such a system, based on blockchain technology, is described in the case of a ride-sharing platform.

The rest of the paper is divided into 5 sections. **Section 2** describes the basic concepts of blockchain technology. **In part 3** of the paper, it is explained how blockchain technology can make the sharing economy more efficient and what challenges it can address. Then, **in part 4**, a simplified use case is presented using the example of a ride-sharing platform. **Section 5** presents the conclusions, while **part 6** lists the references used for writing the paper.

2 Fundamentals of Blockchain Technology

Blockchain technology, conceived as a raw support for bitcoins, is a new paradigm of empowering various fields, and also concept of sharing economy (Frenken, 2019). Underneath all the buzzwords and jargon, Blockchain is an immutable, decentralized, and publicly distributed ledger that records computer transactions in a peer-to-peer network. Its main features include decentralization, integrity/immutability, publicity, and cryptography.

Using a dispersed network of nodes to store transaction data, blockchain technology functions on the premise of a decentralized ledger. Redundancy and traceability are introduced throughout, and traceability is introduced by replicating the structure that cannot be modified with transactions linked into blocks and connected through cryptography. The decentralized structure of a blockchain provides a peer-to-peer means of transaction, thereby avoiding the danger of any single point of failure. Consensus mechanisms such as Proof of Work (PoW) and Proof of Stake (PoS) are used to reach a general agreement among the network users to tell if a transaction is legal and the chronological order of blocks (Javaid, 2022). Proof-of-Stake (PoS) validators are selected based on the cryptocurrency they own, significantly decreasing the energy used and making the system more scalable.

On the other hand, in PoW, any investor needs to solve complicated problems to approve transactions and create new blocks. The Blockchain's intelligent contracts digitize the transaction process based on rules to improve trust and efficiency that removes intermediaries in peer-to-peer transactions (Lazareva, 2021). They allow automated payments, escrow services, and decentralized autonomous organizations (DAOs) to be used within the shared Economy. This assists with the reduction of costs and simplification of processes.

The first application of blockchain technology was the cryptocurrency Bitcoin. It has been globally accepted and represents an immutable system of e-payments. Following the successful development of the Bitcoin cryptocurrency and its support system, it became clear that blockchain technology has a much broader application. Through the use of smart contracts, it is possible to surpass simple transactions of buying and selling currencies. They represent a program that is recorded on the blockchain network and executed when predefined conditions are met (Swan, 2015). This new way of conducting transactions can be applied in many spheres of human organization and replace traditional technologies.

The following part of the paper describes the challenges of the shared economy that blockchain technology can respond to and help overcome.

3 Shared economy and blockchain: challenges and solutions

The emergence of social networks, the development of information technologies in general, and the integration with IoT devices have led to a broader application of the sharing economy. Additionally, blockchain technology is an innovation that can support such a business model without the misuse of platform providers. This is because, by its technical characteristics, this technology perfectly combines with the idea of the sharing economy. It is based on a peer-to-peer architecture, lacks a central institution that can control and manipulate the system, and once data is recorded, it is persistent and cannot be changed or deleted (Tschuchnig & et., 2023).

One of the main challenges of shared economy applications is **Trust and Security**. The mutual trust problem is one of the biggest problems a shared economy deals with, as here, people do not know each other at all and are strangers in many cases. Users will face many worries about the safety of their personal data, financial accounts, and selected merchants. These are the main problems that traditional transactions' recorded ledgers face. The ledgers use intermediaries to ensure the transactions' accountability and security.

Blockchain technology is here to solve this problem by offering a distributed ledger for transparent and secure transactions without intermediaries, further improving trustfulness and minimizing security issues during transactions (Mehrwald & et., 2019).

Another challenge of this model that also attracts a lot of attention from blockchain enthusiasts is the **cost of service providers**. Intermediation costs, such as high platform and transaction fees and high processing fees, are a few problems the shared economy faces today. This results in consumers paying higher costs, reduced service provider profits, and, consequently, overshadowing the advantages of the shared Economy. Intermediaries who facilitate these transactions tend to increase their expenses. Blockchain technology providing a direct peer-to-peer transaction can reduce these by clearing off the intermediaries (Standing, 2018). Intelligent contracts can cut down on this intermediary middleman task, saving time. Likewise, acceleration in the transactions processed at meager costs compared to regular bank transactions reduces the cost of using the shared economy.

Below is a table that illustrates the main challenges of shared economy applications implemented using traditional technologies (Geng, 2022), as well as possible solutions using blockchain technologies:

Table 1. Challenges in shared economy applications that blockchain can provide solution to

Challenges	Solution with Blockchain Technology
Centralized Control and Vulnerability	Decentralization: Eliminates single points of failure, distributing operations across a peer-to-peer network.
Data Security and Privacy Concerns	Enhanced Security: Utilizes encryption and consensus algorithms to secure data against unauthorized access.
High Transaction Costs	Reduced Costs: Minimizes intermediaries and administrative expenses, lowering transaction fees.
Fraud and Manipulation	Transparency and Immutability: Records are public and cannot be altered, reducing fraud and ensuring integrity.
Lack of Trust Among Parties	Trustless System: Enables transactions without needing trust between parties, using smart contracts for automatic execution upon agreed conditions.
Inefficient Dispute Resolution	Smart Contracts: Automates enforcement and execution of agreements, providing clear dispute resolution mechanisms.
Platform Dependency	Interoperability: Allows for cross-platform interactions and reduces dependency on a single platform's policies and fees.

The decentralized blockchain technology allows society to create its own identity and reputation system that helps promote safety and standards of professional behavior in the shared Economy. The users can leverage cryptography to establish the proof of authority plus the ability to manage it with no ownership of any centralized identity service provider. Edge computing technology is made very secure and private, offering users more authority to control their data. Because the reputation systems on the Blockchain are publicly available, the users openly put each other on the scale and evaluate the articles of cooperation. Unchangeable reputational records are incentives promoting trust because they enable service users to assess the trustworthiness and competence of service providers before the transaction (Mehrwald & et., 2019).

Like a green book, Blockchain ensures the traceability of transactions in the peer (shared Economy), and each transaction cannot be modified and can only be connected to prior ones. A permanent, inviolable, and accountable chain of records manifests transparency and trust, and as a result, fraud and disputes decrease. It facilitates participants to check the data reality of disputable data, ultimately leading to a speedy settlement of disagreements.

4 System proposal of ride-sharing platform

Blockchain technology can put forth a paradigm shift in ridesharing platforms through the ability to establish trust, security, and efficiency in peer-to-peer transactions. The decentralized identity and reputation systems enable passengers to validate the identity and reputation of drivers before heeding rides, making safety issues (Soroková, 2020). The transaction records are transparent and immutable, which provides for safe recording and elimination of tampering and, therefore, preclude the absence of disagreements in pricing and payments. Intelligent, automated contracts aim to smooth payment processing and automatically pay the listed rates the system allows. Removing intermediary costs benefits the drivers and will enable them to earn fair prices while the passengers have cheaper fares.

Below are the entities and activities involved in applying blockchain technology for the mentioned use-case described. Following that, a process diagram is provided.

1. **Users:** There are two main types of users - drivers and passengers.
2. **Registration and Authentication:** Users register on the platform and authenticate through the blockchain, ensuring security and transparency.
3. **Offering a Ride:** Drivers can offer rides, specifying details such as start point, end point, departure time, and price.
4. **Searching for Rides:** Passengers search for available rides based on their criteria.
5. **Booking a Ride:** Once a passenger finds a suitable ride, they can book it.
6. **Payment:** Payments are made using cryptocurrencies via the blockchain, ensuring security and reducing fraud risks.
7. **Rating:** After the ride is completed, both drivers and passengers can rate each other. This rating process is also conducted through the blockchain network for transparency and reliability.
8. **Smart Contract Execution:** Introducing smart contracts to automate payments, penalties, and rewards.
9. **Dynamic Pricing Model:** Implementing a dynamic pricing model based on demand and supply.
10. **Dispute Resolution:** Adding a process for dispute resolution through blockchain arbitration.
11. **Loyalty Rewards:** Integrating a loyalty rewards system for frequent users, managed via blockchain.
12. **Vehicle Tracking:** Incorporating real-time vehicle tracking during the ride.

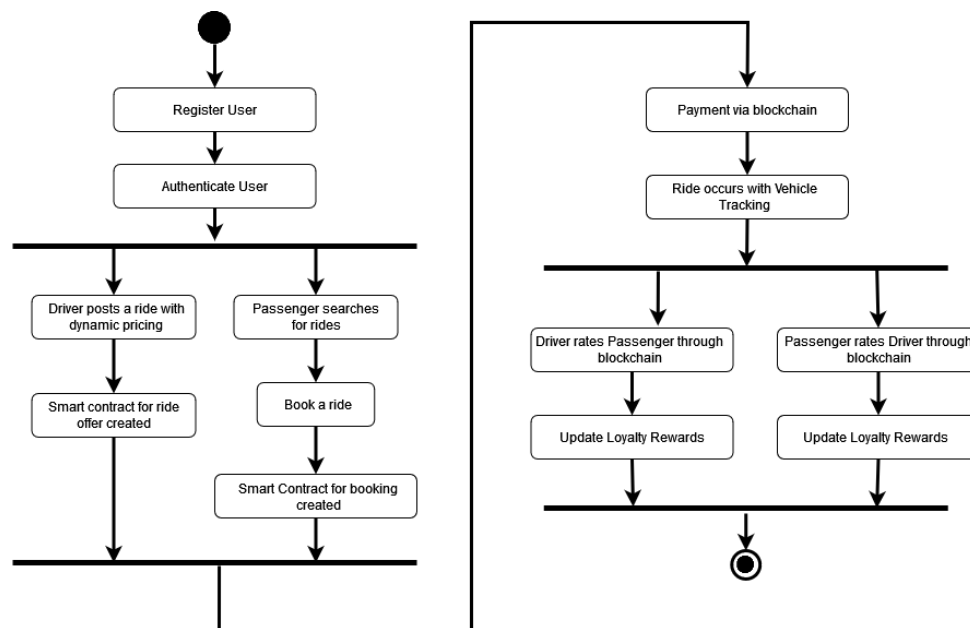


Figure 1 - Blockchain based Ride-sharing platform process diagram (Authors work)

5 Conclusion

The exploration of blockchain technology within the context of shared economy applications offers a solution to the issues of transparency, security, and trust among participants. By leveraging the inherent characteristics of blockchain, such as decentralization, immutability, and cryptographic security, this study illustrates the potential for a transformative shift in how transactions and interactions are conducted within these platforms. The deployment of blockchain can significantly mitigate the challenges associated with traditional systems, enabling a more transparent, secure, and trustworthy environment for all stakeholders (Fiorentino, 2021).

Such a system could contribute to a greater presence of the sharing economy in the real world. Users who are physically distant would be more willing to invest their resources because the reputation of participants is recorded on the blockchain system and easily verifiable.

The ride-sharing application is just one possible example, but it illustrates the benefits of such a system in a simple way. It gives all participants a chance to build up a much more secure, transparent, and ecosystem with minimized costs. The effect of this is to create an infinitely more efficient and user-friendly market for both riders and drivers. The multiplication of Blockchain's capacities leads to unlocking new opportunities, driving innovations, and creating new values for shared economy participants on different levels.

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