

PEER TO PEER CARPOOLING APPLICATION

USING BLOCKCHAIN TECHNOLOGY

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RESEARCH PAPER

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ABSTRACT

The auto-sharing marketplace is constantly growing and lately it has come to be even more famous than vehicle possession. But, conventional automobile-sharing system is based on a centralized database server that may frequently lead to hacker assaults or password leaks. Furthermore, in a classic car-sharing system, the owners of the cars can misuse clients' records. As seen nowadays from quite a few use cases, the satisfactory approach to these problems is to use blockchain technology. Blockchain is a decentralized, immutable, public ledger that gives the clients with security that is impossible to tamper. The proposed solution aims to create and implement a peer-to-peer car-pooling application based on blockchain technology and smart contracts. The Solidity programming language is used to implement smart contracts. Solidity works on the Ethereum blockchain. The main novelty of this research paper is the launch of a peer-to-peer carpooling application without a central authority, reflecting reduced fees and greater transparency in this system. It covers the business-to-business (B2B) and business-to-customer (B2C) use cases.

INTRODUCTION

Currently, cab services are using a centralized methodology to carry out their daily operations. The guidelines, policies and regulations, and terms and conditions that both the user and the driver have to observe range from company to company. Moreover, the booking of cabs calls for mediators or third-party businesses to carry out the payment process. The involvement of extra parties causes problems like a lack of transparency. These problems have caused an in-depth study of blockchain technology and

how the car-pooling structure can be built atop the blockchain. The principal objective of this paper is to shed light on how a carpooling application can be implemented using a decentralized blockchain. In this paper, we have also discussed the benefits and the shortcomings of this methodology.

INTRODUCTION TO BLOCKCHAIN

Blockchain is an immutable public ledger for keeping a track of resources, recording transactions, and building trust. Any asset (tangible or intangible) can be tracked and traded on a blockchain network, with the main benefit being the decreased risk as well as the reduction in cost for all parties involved. Every sector and business work on data and operate better if the transfer of data and information is higher. Blockchain is perfect for the transfer of data because it can offer prompt and completely transparent information to be saved on an incontrovertible ledger from where it can be retrieved only by authorized people. A blockchain network can be employed for the tracking of orders, expenditures, financial statistics, manufacture, and so forth. The most essential characteristic of blockchain is that each user shares a single view of the truth so every member can see all the particulars of a transaction from the very beginning, giving members extra confidence along with increasing performance and giving upward thrust to all the applications blockchain can be used for. To reduce the transaction time further, a set of rules known as the smart contract is stored on the blockchain and executed automatically. It is used to define the terms and conditions for any transaction occurring on the network.

CURRENT SCENARIO OF CARPOOLING SERVICES

Carpooling services provide facilities like arranging transportation on a brief note through mobile applications and websites. To make the ride extra less expensive and environmentally friendly, the system groups customers going in the same direction or to the same destination and then split the cab fare. The carpooling industry is booming, with customers ready to pay on-demand for comfort and a reduced fee. However, there are several disadvantages to this traditional carpooling system.

- **Inadequate Transparency:** the prevailing centralized system is controlled by huge companies with numerous levels of personnel that stay unknown to both drivers and riders. Due to the intervention of numerous parties, both riders and drivers do not get any explanation for the abrupt price spikes and changes in policies. Furthermore, the database of all transactions and bookings is managed through the organization itself, keeping it unavailable to the public, therefore unauthorized any self-verification the riders or drivers may prefer
- **Trust-based Centralization:** As mentioned before, the company is the sole owner and manager of the entire database of information about the users and drivers. Credibility and responsibility arising from the trust the users put in the company. This also means that there is a single point of failure due to the centralized nature of the system i.e. a single dishonest employee or a single malicious attack

can lead to the collapse of the entire system.

- **Lack of Data Safety and Privacy:** The companies' database consists of sensitive information of all users including current locations, phone numbers, and home addresses. Even if companies make large investments in user authentication and information safety, instances of data pirates and false identities hacking into the database are not unusual.
- **Employee Exploitation by the companies:** Several carpooling companies are currently facing numerous lawsuits due to their exploitative labor practices. Because the whole system is centralized, labor laws are framed entirely and only by corporate executives without any consideration for the actual employees.
- **Price issues because of Intermediaries:** The booking of cabs calls for third-party organizations to perform the payment process, vehicle tracking, etc. Every mediator involved will take a considerable fee per transaction which will result in an increase in the cab fare and will also lower the drivers' salaries.

INTRODUCTION TO PEER-TO-PEER CARPOOLING

A peer-to-peer carpooling service allows drivers (peers) to provide on-demand transportation services to the customer (peers) using their private vehicles. Peer-to-peer network services deal with a variety of hosts, for example, private cars and public vehicles. These differing actions affect agreements as well as transportation options.

Aside from being environmentally friendly due to the reduction in the number of vehicles and quantity of fuel required.

IMPLEMENTING P2P CARPOOLING USING BLOCKCHAIN

Softwares used:

- Visual Studio Code: IDE by Microsoft
- Nodejs: It provides runtime environment for Js and Solidity
- Ganache: Ganache is used to emulate Ethereum based blockchain which can interact with our smart contracts.
- Truffle: It is a development environment based on Ethereum Virtual Machine which helps in building, debugging, testing and deployment of smart contracts
- Solidity: Solidity is language for implementing smart contracts.

Methodology:

Using carpooling application one can:

- Share carpooling offers and use offers shared by others
- Add and use different services, e.g.: ID check, insurance etc.

Services can be registered and authorized as safe to be utilized by drivers and passengers without any third-party help.

Architectural model:

This approach contains two smart contracts:

1. Carpooling Factory: Offers and services are registered here and marked as safe to be used)
2. Carpooling:

- a. Manages carpooling services
- b. Manages all services linked to one carpool

Deploying and using the Smart contracts:

1. Edit and test the contracts using npm (ganache-time-traveler)
2. Run tests using Ganache
3. Deploy it on a blockchain using truffle or remix

MERITS OF BLOCKCHAIN BASED SYSTEM

1. The consensus-based system guarantees that no fraud, fake or misbehaving driver or user can make any contracts or transactions with others.
2. A permanent and secure blockchain record is created for every transaction without any involvement of any third party, thereby ensuring privacy and reducing cost.
3. If the system is under attack, the framework will display the block which has been altered and the blockchain after the altered block will become invalid. This guarantees safety, and security and reduces the time to re-validate statistics.

DEMERITS OF BLOCKCHAIN BASED SYSTEM

1. Lack of actual physical security screenings that include fingerprinting and identification checks along with lack of background checks on drivers.
2. The size of Blockchain data is quite large which might make maintaining security and privacy consistently a challenge.

3. It is not possible to make any corrections or necessary adjustments without creating a new block as the blockchain is immutable.

4. Lack of anonymity i.e., no user can remove or hide any details or traces.

CONCLUSION

Existing carpooling services, although popular, have room for improvement in pricing models, customer safety, lack of transparency in transactions, and information safety. Systems working on Blockchain can help clear up all of these issues and provide more inventive functionalities with higher ease of use and control. Riders can connect directly with drivers through the decentralized blockchain's network, thereby decreasing the extra costs, since there are no intermediaries. Moreover, it gives users with a smartphone and modern vehicles greater market prospects. Users can analyze how a carpooling service function thanks to blockchain's transparency feature. Smart contracts encourage stakeholders to use blockchain-based peer-to-peer leasing of vehicles for any two parties involved based on certain pre-decided conditions. As a result, it gives suitable pricing consistently and the system gains credibility and transparency. Furthermore, regulations created make sure that drivers do not have any unlawful conduct by producing a ranking of drivers for riders.

FUTURE SCOPE

Blockchain technology has the potential to revolutionize the way existing carpooling services work. Ethereum-based crypto-equity can resolve the issues that corporations in carpooling industry are going through such as labor exploitation, i.e., exploitative relationships with employees due to which

numerous court cases are filed against their labor practices. With decentralization, labor laws could be framed in consideration of the concerns of the drivers.

Another issue faced by these corporations is the demand for transparency by users regarding transactions, data handling, etc. The principles of bitcoin and cryptocurrency will revolutionize the whole industry with a foolproof layer of credibility, responsibility, and reliability.

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