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Blockchain-Based Decentralized Cab Aggregator

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Abstract: ***A Blockchain-based decentralized cab aggregator system that aims to revolutionize the traditional ride-hailing industry. The system leverages the transparency and security features of blockchain technology to create a thrustless environment where riders and drivers can connect without the need for intermediaries. The decentralized platform also eliminates the problem of surge pricing and ensures that drivers are paid fairly. In addition, the use of smart contracts ensures that all parties fulfil their obligations, thereby reducing the risk of fraud and disputes. The project promises to create a more equitable and efficient cab aggregation system that benefits all stakeholders involved.***
Keywords: Decentralized, Aggregator, Consensus, Proof of Work, Peer-to-Peer.

I. INTRODUCTION

Online Vehicle Booking Services provide their users to hire a vehicle and help them to reach their destination. Nowadays these services are available in all cities, towns and some villages. These services help the users from wasting their time looking for a taxi or auto hire to reach their destination. One can directly select their source and destination and the registered driver who accepts the drop can take the customer to their destination. Not only customers but also vehicle drivers benefit from these services. Drivers need no wait for the customers or have to ask every person on their way whether they require a drop or not. Though drivers and customers benefit from the service there are no third-party commissions, which is making money from driver and customer deals. That is nothing but the centralized owner of the application. They charge a certain percentage from every deal that happens using the website. Applications developed using blockchain are immutable, more secure, traceable, and free from a centralized authority which makes money from our data and transactions.

II. WHAT IS BLOCKCHAIN

Blockchain is a public, enduring ledger that may be used to track resources, record transactions, and create trust. Any asset (physical or intangible) may be tracked and exchanged on a blockchain network, with the major benefit being a reduction in risk and a large reduction in costs for all parties.

Data is the foundation of every industry and discipline. Most firms rely primarily on the exchange of information; the sooner this occurs, the better.

Blockchain is ideal for data transportation because it can deliver timely, shareable, and entirely transparent information that will be stored on an irreversible ledger that can be accessed only by those who are permitted to do so. A blockchain network can be employed in the tracking of orders, expenditure, financial records, manufacture and so on. The most important feature of blockchain is that all users share a single view of the truth, so each member can see all the particulars of a transaction from the very beginning, giving members greater confidence while also increasing efficiency and giving rise to a plethora of applications blockchain can be used for. To further reduce transaction time, a set of rules known as the smart contract is stored on the blockchain and executed automatically. It is used to define conditions for transfer, include terms for different bonds and so on

III.EXISTED SYSTEM

Currently, cab service aggregators are using a centralized methodology to carry out their day-to-day operations. The policies, rules and regulations, terms and conditions that both the user and the driver must follow vary from company to company. Central authority has all the control of the data belonging to the users due to which, there is no anonymity and the data of the user is compromised. Central authority has complete control over the commission rates; hence a few board members have completed say on the commission that is charged without any intervention of providers of the cab service.

This has led to pricing issues such as surging. Furthermore, the booking of cabs requires mediators or third-party businesses to carry out the payment process. With more parties involved, this proves to be problematic with the creation of a lack of transparency. These disadvantages have led to an extensive study of the blockchain technology and subsequently several proposals of architecture built atop the blockchain.

IV. BLOCKCHAIN BASED INTELLIGENT TRANSPORT SYSTEMS

Decentralization helps to transfer decision making to the end users rather than a single central authority. Our project aims at democratizing the cab service sector. Rather than having a central authority, the decisions are taken by people, leading to a much fairer trade. This eliminates the lack of transparency and leads to fair pricing. Apart from this, there is no central authority that has control over the data of users and hence importance is given to anonymity of the users leading to a more secure and sustainable model.

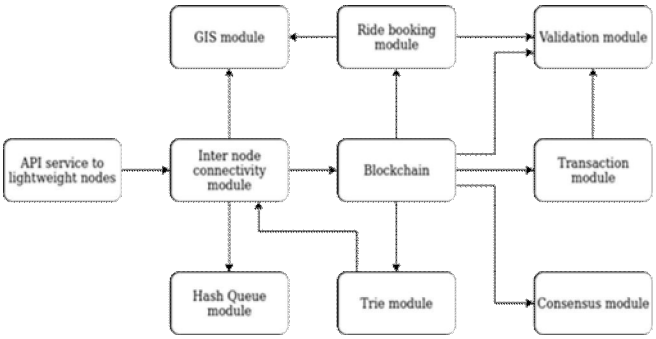

Fig. 1 Carried out Architecture

A. *Book ride Module*

Book ride module comprises the APIs and interfaces which facilitate the booking of rides which are submitted to any node on the blockchain.

B. *Ride selection Module*

The cab driver can query a list of rides from the node in the blockchain. Among the rides requested in the list, the driver can proceed to select any of the bids in the list and accept the ride.

C. *Transaction Module Ride*

This module helps in sending tokens from one wallet to another after undergoing a request verification to check whether the request is valid or not. If found to be valid, then the transaction is flooded across all the nodes in the blockchain.

D. *GIS Module*

The GIS module is used to automate geoprocessing tasks. It helps in retrieving the nearest ride request by minimizing the time spent in searching on a localized area, this is done with the help of bucketizing portion of the globe and when a query is executed on the blockchain, the location is converted to the nearest landmark that represents all the request within the given block of area.

E. *Inter node connectivity Module*

This module maintains the consensus between the nodes. The state of all the nodes that are connected to the network must have the same state i.e. information stored on the blockchain and the trie module.

F. *Validation Module*

Validation module helps in validating requests submitted to the blockchain using signature verification of ECC which uses elliptic curves to generate key pairs and sign data. If the generated value matches the expected value, the signature is considered valid and authentic. Otherwise, the signature is considered invalid

G. *Trie Module*

The trie module is a software module that implements the trie data structure for inserting new keys, searching for the keys and deleting the keys and helps to hold information regarding the transactions inputs (received), transaction outputs (spend), rides booked and rides provided.

H. Hash Queue Module

The hash queue module is used in order to suppress the possibility of message rebroadcast by storing the hash of the message and checking if it exists in the queue. If it does then the message is not broadcasted.

V. RELATED WORK

Rohit Panchal et al. [1] they proposed an idea on blockchain which can be extended to Car Hailing applications to make a decentralized application to overcome the issues with the current Car Hailing Industry and take a step toward Web 3.0. They discussed a Decentralized Car Hailing System and the benefits it serves over the traditional and current Car Hailing Industry

Shuchih Ernest Chang et al. [2]

This paper primarily contributes to extant literature by not only proposing a layered system architecture adapting blockchain and smart contracts into the desired ridesharing service but also demonstrating the design and implementation details, covering the development tools, the deployment environment and the deployed smart contracts.

Hema Pallevada et al. [3] proposed Blockchain based Decentralized Vehicle Booking Service where they aimed to overcome the major pitfalls of online vehicle booking services being in the hands of centralized authorities. Their decentralized platform avoids a third-party getting profits from the transactions. The third-party truthfulness was the major issue of decentralized platforms that was overcome by uploading driver's documents to blockchain and allowing users to view the documents using their hash value.

Somanath Tripathy et al. [4] proposed A Decentralized Cab Consortium over Blockchains where they proposed an alternate model by constructing a decentralized cab consortium where the car owners and the renters can directly interact and share the car based on certain predefined agreements. They utilized the concept of smart contracts on top of a blockchain platform to realize such a system that provides a secured, tamper-proof, fair, and transparent interface for car sharing.

Riddhi Gupta et al. [5] They proposed an idea that vehicle sharing can be revolutionized by implementing blockchain technologies. Blockchain is a decentralized record where all the information is stored on systems everywhere which can be retrieved and traced freely. There is a mechanism that allows peer to peer transactions and brings the need for third parties to a absolute minimum. The system is no longer trust-based but simply based on concrete proof that exists which is built into the ledger.

Myeonghyun Kim et al. [6] The design of a decentralized car-sharing scheme is vital for solving the centralized problem. This study designed a decentralized car-sharing scheme using blockchain. Specifically, blockchain technology was used to provide a decentralization car sharing service and ensure data integrity. The participant entities of the proposed system can be authenticated anonymously.

Naipeng Dong et al. [7] proposed a decentralized booking system that uses the blockchain as the intermediary between hoteliers and travelers. The system enjoys the trustworthiness of blockchain, improves efficiency and reduces the cost of the traditional booking agencies. The design of the system has been formally modelled using the CSP# language and verified using the model checker Process Analysis Toolkit.

Rateb Jabbar et al. [8] In the paper they published aimed to develop a Blockchain-based IoT system in order to establish secure communication and create an entirely decentralized cloud computing platform. Moreover, the authors qualitatively tested the performance and resilience of the proposed system against common security attacks.

Computational tests showed that the proposed solution solved the main challenges of Vehicle-to-X (V2X) communications such as security, centralization, and lack of privacy. In addition, it guaranteed an easy data exchange between different actors of intelligent transportation systems.

El Faqir et al. [9] They introduce the concept of DAO and review the main software platforms that offer DAO creation as a service, which simplifies the use of DAOs to non-blockchain experts; namely: Aragon, DAO stack, DAO haus and Colony. These platforms will be compared by showing their key features. Finally, we will review the available visualization tools for DAOs, and we will introduce our open-source tool to plot DAOs activity, DAO Analyzer.

Shuai Wang et al. [10] Presented a systematic introduction of DAO, including its concept and characteristics, research framework, typical implementations, challenges, and future trends. Novel reference model for DAO which employs a five-layer architecture is proposed. The focus of this article is to make a detailed introduction of DAO and provide helpful guidance and reference for its future research efforts and industrial application. The inter-node connectivity module enables communication and data exchange between different nodes in this platform by acting as a bridge between the nodes. This module handles the interconnectivity between nodes that includes the functionality of broadcasting of messages for other nodes to process requests like ride booking and processing transactions.

VI. STEPS INVOLVED AND ALGORITHMS

A. At Driver's Side

Step 1: Check whether the user is registered as driver or not.
Step 2: If not, ask him/her to register as driver by uploading his/her identity proof such as license in blockchain.
Step 3: Display all available drops to the driver
Step 4: If driver accepts a drop update the details in blockchain and don't allow him/her to take that drop until the current drop is completed.
Step 5: Get OTP from customer and enter OTP, price in the input fields given

B. At Customer's Side

Step 1: Check whether the user is registered as customer or not.
Step 2: If not, ask him/her to register as customer by giving his mobile number.
Step 3: Take the source and destination if the customer needs a drop.
Step 4: Display the OTP of the drop and display the status of the drop (accepted driver id, link of the driver's identity etc.) continuously

ALGORITHMS

Algorithm 1 Car Booking Request

```
0: procedure Car Booking Reqest
1: if renter sends a booking request with x ether then
2:     CarId = FairCarAllocation(BookingRequest)
3:     AddRequestToQueue(CarId,RenterId)
4: else
5:     decline the transaction
6: end if
```

Algorithm 2 Fair Car Allocation

```
0: procedure FairCarAllocation
1: MinRequest = INT_MAX
2: CarId = NULL
3: for Each Car do
4:     if Attributes of Car match Request Attributes then
5:         CarId = CarWithMinRequest
6:     end if
7: end for
8: if CarId==NULL then
9:    decline transaction
10. end if
```

Algorithm 3: Add Request To Queue

```
0: procedure AddReqestToQueue(CarId,RenterId)
1: RenterScore = CalculatePriority(RenterId,Request Fee);
2: PriorityQueue[CarId].add(RenterScore,RenterId);
```

Algorithm 4 Calculate Priority

```
0: procedure CalculatePriority(RenterId,RequestFee)
1: return UserScore[RenterId] + RequestFee;
```

Algorithm 5 Accept request

0: **procedure** Accept request
1: renter = PriorityQueue[CarId].TopElement()
2:PriorityQueue[CarId].Clear()
3: **if** owner accepts the request, send y ether and encrypted booking details **then**
4: **if** owner rejects the request **then**
5: transfer y+b to renter and x-b to owner.{penalize owner}
6: **else if** renter withdraw the request **then**
7: transfer x+b to owner,y-b to renter.{penalize renter}
8: **else**
9: mark car as booked
10: **end if**
11: **else**
12: transfer x ether back to renter
13: **end if**

Algorithm 6 End Car Rental

0: **procedure** End car rental
1: **if** end timeă=decided time & end place=decided place then
2: transfer x+a ether to owner and y-a to renter
3: **else**
4: call function Extra Time
5: **end if**

Algorithm 7 Extra Time

0: **procedure** ExtraTime
1: **if** end timeă=decided time & end place=decided place then
2: transfer x+a ether to owner and y-a to renter
3: **else if**
4: **then**
a <- a+ extra time*k
5: **else if** renter runs away with the car **then**
6: inform insurance
7: **end if**

VII. APPLICATIONS

1) *Tourist transportation*: When visiting a new city or country, tourists often need transportation services to explore local attractions and landmarks. A blockchain-based decentralized cab aggregator platform can provide a secure and convenient transportation option for tourists. By leveraging blockchain technology, the platform can offer transparent pricing, secure transactions, and thrustless transactions, giving tourists peace of mind that their funds are secure. The platform can also offer customized tour packages, providing tourists with personalized experiences based on their interests. Additionally, the platform can offer language translation services and provide access to local guides, making it easier for tourists to communicate with drivers and explore the local culture
2) *Medical transportation*: Medical transportation services are often required by patients who need to visit hospitals or clinics for regular check-ups or treatments. A blockchain-based decentralized cab aggregator platform can provide a secure and reliable transportation option for patients with medical needs. By leveraging blockchain technology, the platform can offer transparent pricing, secure transactions, and thrustless transactions, giving patients peace of mind that their funds are secure. The platform can also offer specialized medical transportation services, such as wheelchair-accessible vehicles or non-emergency medical transportation, making it easier for patients to get the care they need. The platform can also enable patients to securely share their medical information with drivers to ensure a safe and comfortable ride.

3) *International travel*: When traveling to a new country, it can be challenging to navigate the local transportation systems. A blockchain-based decentralized cab aggregator platform can provide a secure and reliable transportation option for travellers. By leveraging blockchain technology, the platform can offer transparent pricing, secure transactions, and thrustless transactions, giving travellers peace of mind that their funds are secure. The platform can also enable language translation services, making it easier for travellers to communicate with drivers in different languages.

VIII. MERITS AND DEMIRITS OF BLOCKCHAIN BASED SYSTEM

A. *Merits of the Blockchain-Based Decentralized Cab Aggregator*

1) *Security:* Blockchain technology provides enhanced security and privacy features, making the cab aggregator platform more secure and reliable. The decentralized nature of the platform reduces the risk of hacking and cyber-attacks.
2) *Transparency:* The blockchain-based platform provides a transparent and immutable record of all transactions, which enhances the transparency of the platform. This ensures that all transactions are accounted for and cannot be manipulated.
3) *No Middlemen:* No middlemen: A decentralized cab aggregator eliminates the need for intermediaries, such as third-party booking agents or payment processors. This reduces the overall cost of the service and makes it more affordable for users.
4) *Decentralization:* A decentralized cab aggregator is not controlled by any single entity, making it more resilient and resistant to censorship. This also gives more power to the users as they have more control over the platform.
5) *Efficient:* The use of blockchain technology in a cab aggregator platform can improve the overall efficiency of the platform by reducing the time and cost required for transactions.

A. *Demerits of the Blockchain-Based Decentralized Cab Aggregator*

1) *Complexity:* Developing a blockchain-based decentralized cab aggregator platform requires a high level of technical expertise, making it difficult for non-technical users to understand and use.
2) *Scalability:* The blockchain technology used in the platform may not be scalable enough to handle a large number of transactions, leading to slow transaction times and high fees.
3) *Adoption:* The adoption of a new technology can be slow and may require significant marketing efforts to encourage users to switch to the new platform.
4) *Regulations:* The regulatory landscape surrounding blockchain-based cab aggregator platforms is still evolving and can be uncertain, leading to potential legal challenges.
5) Limited features: Blockchain technology may not be able to support all the features that traditional centralized cab aggregator platforms offer, leading to limitations in functionality.

IX. FUTURE WORK

Work can be improved by incorporating a bidding process to accept the drop rather than the driver picking the drop first come first serve. Drivers can bid on a drop, and the client can choose the best offer from the various offers. When the drop is complete, this model may be extended further by integrating automatic token or ether transfers from the customer's account to the driver's account. The position of the drop accepted driver may also be notified to the client in order to track the time it takes the driver to reach the consumer

X. CONCLUSION

Concluding, we built an entire platform from the ground up where users can book rides and send transactions over the blockchain. The future scope and enchantment of our project would be to improve security, scalability by incorporating appropriate data structures, and also adding features provided by Ola and Uber, to make the users' (commuters' and drivers') experience better and easier. We also intend to make this project open source so that other developers can build on top of the blockchain, for example, for cab aggregation.

This would increase the business's self-sufficiency without raising prices or commissions for users and drivers, respectively. We are also looking forward to implementing a franchise model where our platform could be used by other business owners to run their own cab services.

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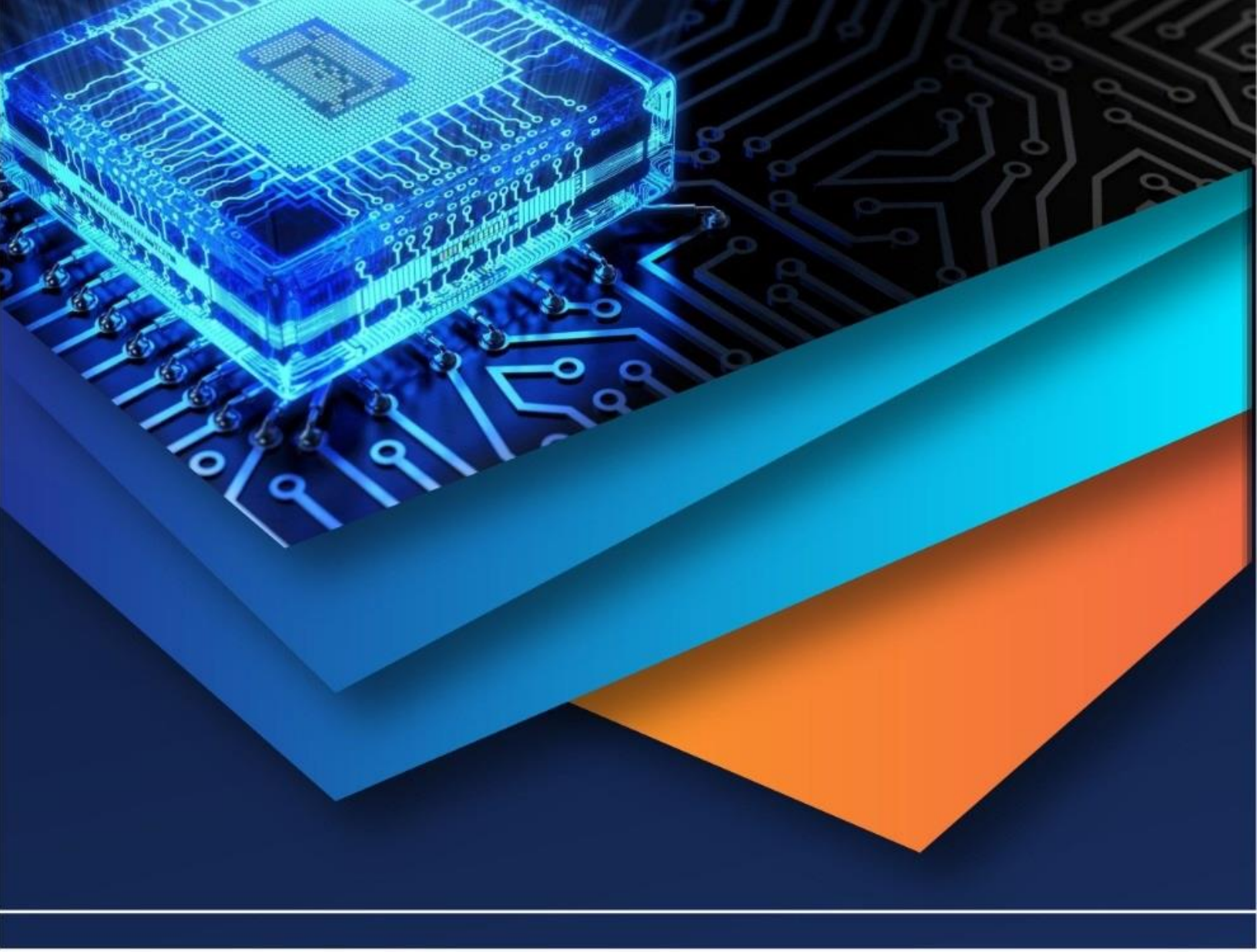

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