Implementing Blockchain Technology in Logistics

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Abstract: The logistics industry is the backbone of all businesses across the globe. While companies have started experimenting with enterprise software and systems based on technology, businesses have started seeing the advantages that blockchain brings in logistics. It can prevent frauds, eliminate inaccuracies, increase data security and transparency, improve efficiency, and reduce expenditure. In order to protect the information of the consignment occurred, it has adopted the " key cryptography " method. Each transaction has two different keys, private key which is the exclusive property of each active user used to unlock the deal and the other public key like any information or value. These two keys allow to encrypt and decrypt the transaction. When the transaction between the two parties is initiated a smart deal is established. After the transaction is completed a block is generated. A block is an object which encompasses the hash key, data and hash key of the previous block. Data consist of the information of consignment with respect to timestamp and it will be distributed on the decentralized network. The hash key for the current block is generated using the timestamp and data. After that, transactions are collected in an updated version of the ledger, called block. This newly generated block is added to the existing blockchain.

IndexTerms - **Blockchain, Decentralized system, Distributed ledger.**

I. INTRODUCTION

As digital technology reshapes the transportation industry, Blockchain has become one of the top priorities for most organizations[6]. Blockchain is a decentralized distributed technology designed specifically to transform business operations. Blockchain has been widely adopted by the financial industry and has slowly entered other sectors, including the supply chain and healthcare. Lately, the film industry has begun exploring the benefits of implementing the technology.

At its core, Blockchain is a shared digital ledger encompassing a list of connected blocks stored on a decentralized distributed network that is secured through cryptography[6]. Each block contains encrypted information and hashed pointers to a previous block, making it difficult to retroactively alter without modifying the entire chain and the replicas within the peer network. New blocks are validated by peers on the network, providing credibility and preventing malicious activity and policy violations.

Cryptography and membership functions provide easy data sharing between parties without privacy breaches and tampering of records. All confirmed transactions are timestamped to provide full record provenance.

The transaction between the consigner and the consignee facilitates the generation of keys for each of them which will be unique providing security. For the accurate records, the timestamp will also be generated keeping the consigner and the consignee updated with every date and time of their conversation and order placements

II. LITERATURE REVIEW

The project is based on fleet shipment which uses the blockchain technology to provide the services enabling more security, establishing trusted transportation between two agreed parties.

1. Existing System

The traditional cargo shipping system is completely manual and hence, tedious and much time-consuming. There is a high chance of losing and delivering the items to wrong recipients due to misplacement of a single paper. So, a computerized and online management system is an ultimate solution to such problems in Cargo-related systems.

For updating any kind of data we need a human resource for each task. Data analyzing and data rectification are not possible and data loss is a big issue. Report generation on specific criteria is not possible.

2. Disadvantage of Existing System

The existing system is not totally automated. Though the computer system is computerized to a particular extent, it has to do a lot of manual work. From the client side, the entire work is achieved manually and they manage all their billing and services manually. It involves managing a huge number of data each having separate data items. All the work is done at a very large volume, so we have the possibility of losing the data. To look for a particular problem the entire system is searched, so the process becomes more time-consuming.

3. Overview

The blockchain is an undeniably ingenious invention – the brainchild of a person or group of people known by the pseudonym, Satoshi Nakamoto. But since then, it has evolved into something greater, and the main question every single person is asking is: What is Blockchain?

By allowing digital information to be distributed but not copied, blockchain technology created the backbone of a new type of internet. Originally devised for the digital currency, Bitcoin, (Buy Bitcoin) the tech community is now finding other potential uses for the technology.

Using cryptography to keep exchanges secure, blockchain provides a decentralized database, or "digital ledger", of transactions that everyone on the network can see. This network is essentially a chain of computers that must all approve an exchange before it can be verified and recorded.

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All of that would happen electronically, eliminating paper-based documentation and errors from multiple parties entering the same data into different databases. But it would also create a scenario in which the trust in the data is verified by the structure of the system itself, not by individual parties.

III. PROPOSED WORK

1. Problem Definition:

To overcome the difficulties of an offline system, which requires a lot of human intervention and a lot of time and money, "Cargo Shipping using Blockchain" is implemented. Cargo Shipping System Using Blockchain is a web-based application designed to computerize the various operations in cargo agencies. It aims at managing and implementing activities and plans for a cargo company. The generated application reduces the manual work and provides fast, comfortable, reliable and effective service. The software can record data in the database, display billing details, inquire modules.

As the implementation of software in cargo agencies reduces the number of workers and paper works, it ultimately minimizes the overall expenditure of the company. Moreover, it helps the company in its promotion through web technology.

2. Proposed System:

The proposed cargo shipping system application performs multi-task effectively in the management of cargo companies.

Modules:

1. User :
   - i. Registration page of a consignee and consigner.
   - ii. Login page of a consignee and consigner.
   - iii. Request for the deal.
2. Blockchain :
   - i. Adding a hash key for the block.
   - ii. Adding data to the block.
   - iii. Adding timestamp.
   - iv. Adding the previous block hash key.
   - v. Confirmation of deal.
   - vi. Generating Block.
   - vii. Encrypting the block.

3. Key Generation :
   - i. MD5 for key generation.
   - ii. SHA-1 for the hash key.

The process of the transaction is as follows:

Step 1: Cargo Shipping using Blockchain includes registration of both, the consigner as well as the consignee. Each time they have to log in to access their account. The consignee sends a request to make a deal.

Step 2: On the request, the system assigns cryptographic keys to the consigner and the consignee which is unique for each transaction.

Step 3: The keys are matched and a block is created which contains the encrypted information about the transaction.

Step 4: This block is then added to a chain of blocks in which each previous block is pointed by hashed pointers. Also, each block contains a timestamp.

Step 5: On establishing a connection by exchanging the requests and giving confirmation by the consigner the transaction gets completed.

IV. IMPLEMENTATION DETAILS

The key will be generated using MD5 which will be a public key. This key will be exchanged between both the parties and transaction related communication will begin.
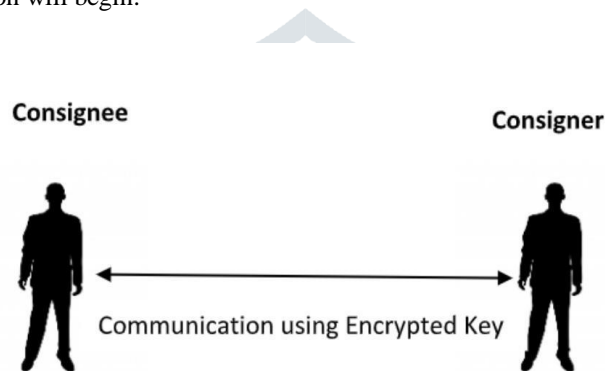
Consignee   **Consigner**

Communication using Encrypted Key

Fig: Communication Using Encrypted Key

The receiver will confirm the receival of the key and both the parties will have their data with the timestamp stored logically inside an object. After the completion of the transaction a block will be generated which will consist of the following:
- Previous hash key of the block
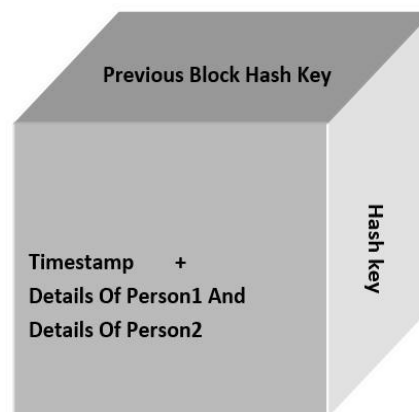- Hash key of current block
- Data (with timestamp)

Previous Block Hash Key

Hash key

**Timestamp   +
Details Of Person1 And
Details Of Person2**

Fig: Block Detail

As seen in the above figure the block will be having data of both the parties, timestamp, previous block hash key and the hash of the current block.

This newly generated block will be added to the previous block of the existing blockchain. The timestamp of both these blocks will be different as well as the hash key.
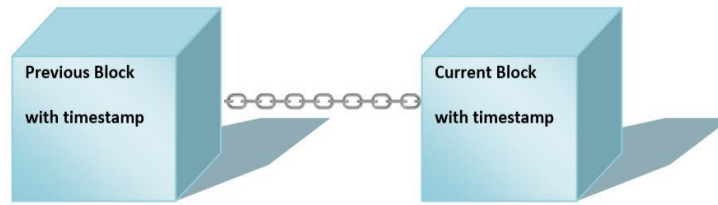

Fig: Addition of new block

Fig: Addition of new block into the blockchain

Thus the newly generated block has been added to the blockchain with all the other existing blocks. Editing in any block is possible but new the block will be generated and this will be again added to the chain but now with a different hash key. Therefore every block will continue to exist. Removing or deleting any block in the chain is not possible. The alternative is, therefore, to do the editing in the required block.
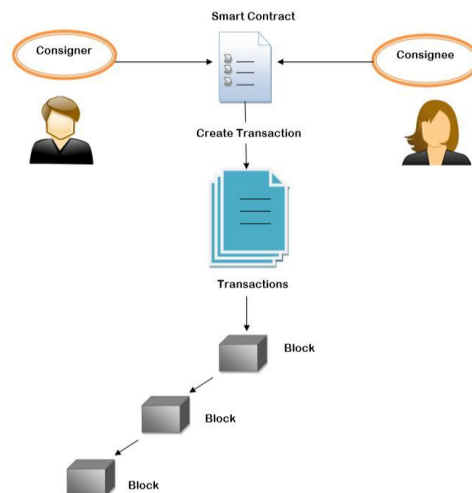
V. RESULT

Fig: Blockchain

The consigner or consignee any of them can initiate the transaction by generating a key that is a public key and this key is broadcasted over the network. The particular consignee interested in making a transaction recognizes this key. At this point, a deal gets established between the two of them. The consignee can now demand goods as per its requirement and communicate with the consigner. The other parties over the network will not know about the communication details taking place between these two parties but rather they will only be aware that the transaction is taking place. After the transaction gets completed which is when the consignee receives its ordered goods, a block gets created. This block holds all the transactional data.

VI. CONCLUSION

The blockchain generates transparency by providing a decentralized public ledger of ownership that monitors and registers the goods movements throughout the supply chain, from origin to end-customer. Turning physical items or documentation into smart property respectively smart contracts enables direct validation of an item originality and authenticity. Actors within the network have a copy of the ledger enabling them to gain information concerning any transaction. Additionally, the technology can be used for tracking and monitoring assets, communication and information sharing, and executing long-term and conditioned contracts.

In the perspective of a supplier or manufacturer, the blockchain can be used as a competitive advantage by providing the customer with information about their products, manufacturing process and labour and sustainability policies. Recognizing that customers have over the years become more aware of where products come from, environmental impacts and footprints of production and emissions from transportation suppliers could inform customers about their stance of policy concerning these factors to gain more business. If the expansion of blockchain continues customers could disregard all suppliers that are not active on the blockchain and suspect that they are hiding something concerning production, labour conditions and quality of goods or services.

VII. FUTURE SCOPE

The application of blockchain technology in the transport and logistics industry is expected to have far-reaching implications, with some logistics experts considering blockchain to offer 'enormous potential', to "transform the supply chain and disrupt the way we produce, market, purchase and consume our goods" and to be a "much-needed platform for economic renewal" .

a. **Big Data Analytics:** Blockchain could be well combined with big data. Here we roughly categorized the combination into two types: data management and data analytics. As for data management, blockchain could be used to store important data as it is distributed and secure. Blockchain could also ensure the data is original. For example, if blockchain is used to store patients health information, the information could not tamper and it is hard to steal that private information. When it comes to data analytics, transactions on blockchain could be used for big data analytics. For example, user trading patterns might be extracted. Users can predict their potential partners' trading behaviours with the analysis.

b. **Using The Internet Of Things (IoT) And AI To Increase Efficiency:** Blockchain, with the help of innovations in IoT, can be particularly useful for capacity monitoring. Cargo Volume often defines the cost of shipping freight. By using IoT sensors in trucks and other shipping vehicles, shippers and transportation companies can detect the amount of space taken up in a shipment and determine cost accordingly, transmitting all of this information to the blockchain. Keeping in mind the fact that global shipments often undergo numerous checkpoints and are handled by a variety of companies along the way, having this type of data on a secure, accurate record becomes a huge advantage for shippers.

c. **Using The Internet Of Things For Vehicle To Vehicle Communication (IOT):** Here's yet another way that blockchain technology and the Internet of Things can combine to improve efficiency in the trucking industry: Some companies are already implementing Vehicle to Vehicle (V2V) Communications, which essentially allow for multiple freight vehicles to form a platoon and communicate, improving fuel efficiency and safety. Storing and validating the data created by the use of V2V Communications on the blockchain can help transportation companies across the world streamline their operations.

d. **Effective Tracking Of Fleet Or Vehicle Performance History:** The importance of tracking isn't limited to delivery performance. It's also applicable to the performance of individual vehicles within a fleet. When a large company or a small business wants to purchase a second-hand delivery vehicle, the blockchain can help to authenticate information on the past performance of the vehicle and its maintenance history. If the records of all used parts and vehicles were to be placed on a secure, immutable ledger, there would be a much more standardized and reliable way to determine pricing and other factors inherent in purchasing.

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