International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 07 Issue: 01 | January - 2023 Impact Factor: 7.185 ISSN: 2582-3930

MedBust: Blockchain in Pharmaceutical Supply Chain

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Abstract: Counterfeit drugs are a major and growing concern globally, particularly during pandemics. One of the reasons for this is the inefficiency of the supply chain system in the pharmaceutical industry, which can make it difficult to trace the ownership of drugs from manufacturer to wholesaler, distributor, and pharmacist before it reaches the customer. In this study, we have evaluated different proposed blockchain-based supply chain management systems. The system that uses Hyperledger Fabric ensures data sharing, storage, transparency, and traceability in every stage of the supply chain. Meanwhile, the Ethereum architecture makes use of smart contracts to manage the communication between sender and receiver. The primary aim of the research is to improve the safety of pharmaceutical products and streamline supply chain operations with the most effective architecture.

In addition to the benefits of transparency and traceability that blockchain technology can provide, it can also help to improve the overall efficiency and security of the supply chain. For example, by using smart contracts, automated processes can be put in place for the transfer of ownership and payment for drugs, reducing the need for manual intervention and reducing the risk of errors or fraud. Additionally, by creating a tamper-proof record of all transactions, blockchain technology can provide an auditable trail of the movement of drugs through the supply chain, which can be helpful for regulatory compliance and quality assurance.

Furthermore, blockchain technology can also support the implementation of new business models in the pharmaceutical industry such as digitalized provenance records and tokenization of drugs to provide more transparency, security, and trust for the customer.

It's worth noting that implementing blockchain technology in the pharmaceutical supply chain will require collaboration and cooperation between stakeholders in the industry, including manufacturers, wholesalers, distributors, and regulators. With the right approach and collaboration, blockchain technology has the potential to revolutionize the way that the pharmaceutical industry operates, making the supply chain more efficient, secure, and reliable, while also helping to reduce the risk of counterfeit drugs and protect public health.

Keywords – Blockchain, ethereum, decentralization,supply chain in pharmacy.

1. INTRODUCTION

Counterfeit drugs are a major concern, as they can have serious negative effects on human health and can be difficult to detect. Lack of transparency in the current system also makes it difficult for customers to know the true value of products and for authorities to investigate tampering or unethical practices in the supply chain.

Blockchain technology offers a potential solution to these challenges by providing a distributed, transparent, and immutable record of transactions. By using smart contracts and an event request-response mechanism, blockchain can enable the transfer of products between authenticated entities in the supply chain, while recording all transactions on the blockchain. This can help to increase transparency, trust, and accountability in the supply chain and improve the traceability of drugs.

Supply Chain Management (SCM) is an important aspect of ensuring efficient coordination among various entities in the supply chain. In recent years, there has been increasing interest in using blockchain technology to improve SCM, particularly in the pharmaceutical industry.

One of the main advantages of using blockchain in SCM is decentralization, which means that the data is not controlled by a single central authority but is instead distributed among all participants in the network. This can help to increase security and robustness by reducing the risk of data tampering or unauthorized access.

Blockchain also offers transparency, as all participants in the network have access to the same data. This can help to increase trust and confidence in the supply chain, as customers can see the complete history of a product's movement from manufacturing to delivery.

In addition, blockchain technology allows for real-time tracking of products, which can be particularly useful in the pharmaceutical industry where speed and coordination are critical. By creating a permanent and tamper-proof record of all transactions, blockchain can help to track assets from manufacturing to delivery and reduce the risk of theft or loss.

Overall, the use of blockchain in SCM has the potential to improve efficiency, transparency, and security in the supply chain, which can ultimately help to improve patient safety and reduce the risk of counterfeiting in the pharmaceutical industry.

2. Blockchain Theory

2.1 Need for Blockchain

Blockchain is used to meet the following requirements:

- Due to lack of transparency in the current system, it is extremely difficult for customers or buyers to know the value of the products.
- It is also very difficult to investigate the tampering within the supply chain when there is suspicion of illegal or unethical practices.
- Customers and buyers are currently unable to determine the true worth of goods due to a major lack of clarity in the current system.
- Blockchain provides a distributed hyperledger with no centralized authority over the system.
- Each transaction into the blockchain is immutable, which means there is no way sensitive data like Drug/Customer information can be tampered with.

2.2. Traceability

Blockchain can help to improve traceability in the supply chain by recording the movement of products from production to distribution. Manufacturers can see the journey of their products at any time, and the ownership of the drugs can be transferred simultaneously on the blockchain network as they change hands physically.

2.3. Increase Trust & Transparency

By enabling both producers and customers to track pharmaceutical products throughout the supply chain, blockchain can help to increase trust and transparency between parties. Manufacturers can see that their products are being received by the intended client, while customers can see that the products they are buying are genuine and have not been tampered with.

2.4. Immutability of data

The immutability of data on the blockchain means that records cannot be easily altered, which helps to ensure the security and integrity of the supply chain. This is particularly important in the pharmaceutical industry, where the authenticity and safety of drugs is critical.

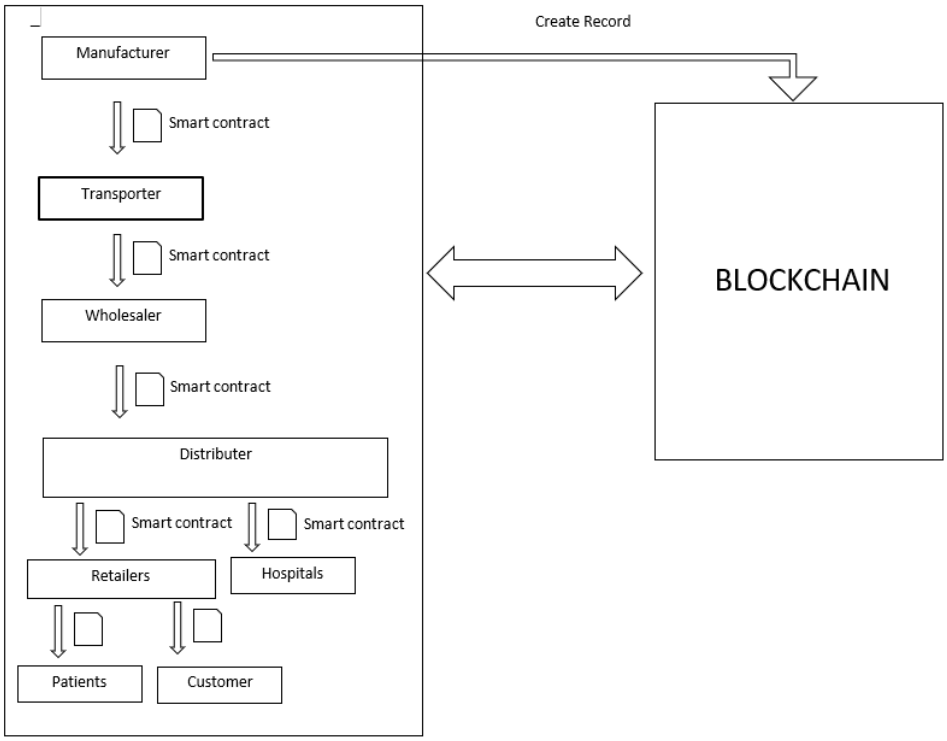
3. PROPOSED WORK

3.1. Problem and Proposal

In today's world, counterfeit medicines is a major concern because it can lead to health problems. Unfortunately, there is no current technology that allows us to get real-time updates on the quality of the pharmaceutical medicines/drugs that we use in our homes or other places like pharmacies & hospital. As a result, people may unknowingly consume these fake or tampered drugs and it may cause poisoning,blood pressure problems,disease progression and sometimes death. To address this issue, it is important to ensure that the medicines we use is properly tested whether it's consumable or not to prevent these types of health problems.

In addition to addressing current issues, the proposed project also focuses on the future by considering the potential involvement of multiple third-party organizations in the medical supply chain. To provide a secure platform for distribution, the project aims to utilize blockchain technology. By implementing blockchain, the project can eliminate corruption through its ability to maintain accurate records of every transaction. Blockchain offers several inherent properties that make it well-suited for this purpose, including fault tolerance, immutability, transparency, and full traceability of stored transactions and digital assets. These properties make blockchain an ideal choice for ensuring the integrity and security of the medical supply chain.

3.2. Architecture:



3.3. Role of Blockchain:

Blockchain is a new technology that is gradually emerging with the increasing popularity of digital currencies such as Bitcoin. It is essentially a distributed ledger database. Blockchain records transactions that have occurred by establishing a database maintained by all network nodes and the entire process is open, transparent, and irreversible. According to the participants, it can be divided into the public blockchain, consortium blockchain, and private blockchain, and the consortium blockchain and the private blockchain are collectively referred to as the permissioned blockchain. The public blockchain is completely decentralized in the real sense. At any time, any node will join or leave the decision to build a new block. In the permissioned blockchain, though, the decision to build a new block is made by certain trusted nodes. It has been applied to copyright management, identity authentication, and data storage services.

3.3. Role of Metamask:

MetaMask is a browser extension that allows users to interact with the Ethereum blockchain. It acts as a bridge between your web browser and the Ethereum network, allowing you to run Ethereum dApps (decentralized applications) and manage your Ethereum account(s) without the need to run a full Ethereum node.

With MetaMask, you can do the following:

- Create and manage Ethereum accounts
- Send and receive Ether (the native cryptocurrency of Ethereum)
- Interact with Ethereum dApps and smart contracts
- Sign and validate transactions on the Ethereum network

MetaMask is particularly useful for those who want to use Ethereum dApps but do not want to run a full Ethereum node on their computer. It provides a convenient and secure way to access the Ethereum network and use Ethereum-based applications without having to worry about the technical details of running an Ethereum node.

3.4. Role of Ganache

Ethereum-based applications. It is a free, open-source tool that runs on your computer and provides you with a personal, customizable Ethereum blockchain.
Ganache is designed to be easy to use and set up, making it an ideal tool for developers who are new to Ethereum development. It provides a user-friendly interface that allows developers to view and interact with the blockchain, as well as create and manage accounts and transactions.

Some of the key features of Ganache include:

- The ability to create and manage multiple Ethereum accounts
- The ability to deploy and test smart contracts
- A built-in block explorer for viewing and analyzing transactions on the blockchain
- The ability to customize the blockchain's settings, such as the block time and mining difficulty

Overall, Ganache is a useful tool for developers who want to test and develop Ethereum-based applications in a local environment before deploying them to the main Ethereum network.

4. Conclusion

The paper proposes a smart anti-counterfeit drug supply chain system based on blockchain technology and artificial intelligence. By using smart contracts and product registration and transferring, all product transferring records are permanently registered in the unchangeable ledger. The collaboration of smart contracts allows Tracking of the products. Consumers can also participate in the process of maintaining information flows. The proposed system has prominent decentralized characteristics, which significantly reduces the possibility of privately tampering with data. The Rasa chatbot handles improved customer service and transparency of drug details, order movements down the supply chain.

Furthermore, an event request-response process was created to verify the identity of all parties and the signature found in the event in order to decide if the event is authentic. All events can be recorded and stored in the blockchain as a log, which can be viewed in real-time. Finally, a decentralized application (DApp) was built based on the Truffle framework, deploy the smart contract, test the contract code through a local blockchain provided by Ganache, and implement a decentralized web app interaction interface based on the prototype. The system is characterized by data accessibility, tamper-proofing, and resistance to man-in-the-middle attacks.

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