A blockchain-based hub that helps to identify counterfeit products in the Indian drug supply chain.

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Abstract - *In this project, we'll describe a blockchain technology-based prototype that will be utilized in the supply chain. There are presently many fraud activities and corruptions happening within the Drug supply chain at present, because the drug sometimes doesn't reach the other sections of the society, and sometimes the society gets a fake drug. This project focuses on developing a blockchain prototype that is used to record all the supply chain states. The project features a rest service that gives interaction with blockchain and its smart contract. The project features a private blockchain which is Hyperledger blockchain, which provides all the concepts of blockchain.*

Key Words: drug supply chain, hyperledger block chain, sha 1, node JS, etc.

1.INTRODUCTION

One in five drugs sold in India is counterfeit, per the Associated Chambers of Commerce and Industry of India (Assocham). Worldwide, 35% of all fake drugs originate in India, per the business organization, during a special report which has been submitted to the Indian federal .

WHO estimates that "1 in 10 medical products circulating in low- and middle-income countries is either substandard or falsified." that has pills, vaccines and diagnostic kits

1.1 Blockchain

The blockchain has the entire capability to deal with and tune the supply chain procedure very efficiently. Blockchain is immutable, less prone to breakdown, has zero scams and distributed, while traditional databases are vulnerable to data tampering and data leakage and there is a possibility of loss due to centered storage.

The proposed system stores drug supply chain details in the blockchain ledger and lets the customer and distributors verify them. The manufacturer has permission to insert and the distributor to update.

1.2 Private vs Public Blockchain

Private blockchain has some sort of authorization, thus only selected members have access to the network. While in public blockchain anyone can participate and perform read and various other operations on the ledger.

In a public blockchain, anyone can request a transaction. So, when there are too many requests on the network, the network relatively slows down with the transaction speed. It can take tons of your time to even process a transaction then. While in private only some members have access hence it's speed is high.

Hyperledger fabric is a private blockchain while others like Ethereum, EOS, etc. are public.

Ethereum takes about 30 seconds to complete a transaction, while Bitcoin takes up to 3 minutes, while private blockchains like Hyperledger perform up to 1 lakh transactions in one second.

2. Literature Survey

The reference paper implementing a blockchain from scratch: why, how, and what we learned, explains how blockchain is made, how data is stored, what are the drawbacks while developing it from scratch. One of the drawback is time and another is native development.

The reference paper Hyperledger Fabric Blockchain: Chaincode Performance Analysis, compares various chain code languages and provides the performance analysis of each of these chain codes.

The reference paper A Privacy-Preserving Healthcare Framework Using Hyperledger Fabric provides an example of using Hyperledger for an application, i.e. converting a problem statement into actual implementation.

3. Proposed System

The System involves four actors : Government, manufacturer, distributors and other members(i.e. customers and pharmaceutical shops). Manufacturer has the insert and update permission of medicine data. Distributor has update permission. All other remaining have read permission.

The drug supply involves all these actors and according to the permission they act accordingly. The current owner's of the medicine switch accordingly.

Chart -1: Drug Supply Chain

This concept can be used to store data in the blockchain. Since the above diagram has states, blockchain data also have

states, hence using the same concept we can map it. The data structure of the medicine will be as follows :-

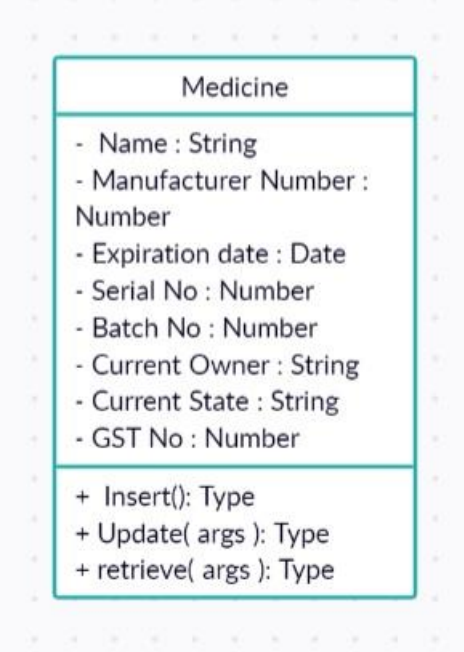

Fig -1: Data Structure

The attribute Current owner is the member to which the medicine package currently belongs. The attribute Current State is the state in which the package is, for e.x. in transport state i.e. the package is being transported, received i.e. the package has been received, etc.

The operations operating on the data are insert, update and retrieve. Hence, the smart contract should include these operations and the data structure stated above should also be included in it.

Since we are using Hyperledger fabric, we need to define the blockchain network structure. Since this is a prototype, the blockchain network currently includes two organizations, organization one belongs to the government and it is only kept for reading purposes, organization two belongs to manufacturer and distributors and it contains update and insert operations. Each organization contains 2 peers, One committing peer and one endorsing peer. Endorsing peer receives the transactions and passes them to all other peers in the organization while committing peer verifies the endorsements. Each peer has the ledger and the smart contract is installed on endorsing peers. The network also includes one orderer and 2 CA each belonging to one organization.

In Node JS, we have used Hyperledger JS SDK to contact the network.

Since the Hyperledger blockchain is a private blockchain there is a need for authorization, the authorization is been handled in the Node JS server. The Node JS server is a rest server with the operations of smart contract as rest service. The Insert and update should be authorized hence the authorization is taken through JWT, which is provided by the Node JS network handled by the Government when the manufacturer gets registered, the private keys of these manufacturers are kept at the server-side, which are received by the server when the government register's the manufacturer in the network. These private keys are used to interact with the blockchain network. The manufacturers are registered at CA of 2nd organization.

The Read request is carried out using the keys of the government and is open to all. For a write, request return's the hash that is used for retrieval and updation in the blockchain. This hash should be printed as a QR code on the medicine's packet.

The hash of the write request is made from Mfg. Lic. No., Expiration date, serial no., batch no. and GST no. and the algorithm used is SHA-1.

4. CONCLUSION

This system successfully helps in identifying counterfeit products in the drug supply chain. It also provides all the features of the blockchain.

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