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Fake Drug Detection Using Blockchain Technology

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Abstract: For a few decades, it is a getting challenging to keeptrack and monitor of non-counterfeit drugs in health care. Due to Lack a trust system and safe and secure monitoring, unauthorizerscan make fake drugs easily. Because fake drugs has a harmful effect on the human health and has deadly results. Fake medicines are analyzed as a great challenge for the medical industry worldwide. As mentioned by statistics, due to these counterfeit drugs yearly business loss of around $200 billion is described by US pharmaceutical organizations. These fake medicines may not assist the patients to get well from health disorder but can have many other harmful ramifications. According to the World HealthOrganization (WHO) survey, in undeveloped nations each 10th medicine consumed by the patients is fake and has bad quality. To find the fake drugs, we are proposing a drug traceability system by using blockchain technology. Our system helps in detecting substandard and fake drugs from manufacturer to end user. Blockchain helps to make the system more reliable and transparent. Blockchain based system helps in detecting the fake drugs and ensures the transparency and security of e-health data. This paper aims to ensure transaction security, medicine quality, and data security by using blockchain technology.
Index Term: Blockchain, Counterfeit Drugs Detection, Ethereum, Smart Contracts, Supply chain

I. INTRODUCTION

Fake medicines or fake drugs are called as "one which is designedly and fraudulently mislabeled with respect to identityand source" These are principally the pharmaceutical medicines which may have wrong constituents or either have correct constituents but in wrong volume. Medicine counterfeiting is being linked as a serious trouble to the druggiesencyclopedically. The utilization of these fraudulent products might have serious impacts ranging from minor deterioration in health to veritably severe impacts similar as death of the case. As per the the script the number of conditions and cases are continuously adding and so is the expenditure of these fake medicines. One large issue in dealing with the fake medicines is the storehouse of health records substantially medicine records and deals throughout the force chain. thus, in the healthcare industry the conservation of health records earnings utmost significance. The transfer of health data across different associations faces two major issues- the integrity issue and the privacy of data. In case of blockchain there's no central point offailure as the data is distributed and is stored in blocks. Blockchain technology helps in overcome the security problem in healthcare. Features which make blockchain dependable for use in tackle fake medicines are-

1) Peer- to- Peer Transmission
2) Distributed Database
3) Computational sense
4) transparency with counterfeit drug
5) Irreversibility of Records

Medicines move across a distribution chain that involves several actors. These generally include, but are not limited to, a manufacturer, a wholesaler, and a retailer. A nonsupervisory body, similar as the FDA (Food and Drug Administration), maytest the quality of a batch of medicine product before or while it's distributed down the supply chain. These actors enter into direct contract-grounded connections with each other For case, a retailer may enter a contract with a certain wholesaler to buy stocks of a certain medicine product regularly and another contract with another wholesaler to buy stocks of a different medicine product regularly.

A. Motivation

The thing of this design is to find whether a given drug is fake or original using blockchain technology. Some of thereasons for justification are as follows

1) Blockchain grounded medicine traceability result offers a participated, trusted, permissioned and decentralized platform for storehouse and dispatches among different pharmaceutical supply chain stakeholders
2) Evidently that can execute crucial conditions and features that include security, isolation, availability, transparency, and expandable.

3) It provides a visionary proposal to track, detect, and survive fake medicines in pharmaceutical supply chains.
4) Demonstrate the benefits of Blockchain Technology practicalnew way in the public sector, as well as to the society.
5) To increase supply chain visibility.

B. Problem Definition

Healthcare supply chain is a composite network of severalindependent realities that cover raw material dealer,manufacturer, seller, pharmacist, clinic and cases. Tracking inventories through this network is non-trivial due to several factors including lack of information, centralized control and competing behavior among stakeholders. We're proposing a blockchain- grounded result for the pharmaceutical supply chain that provides security, traceability, invariability, and availability of data history for pharmaceutical medicines. We are designing a smart contract able of operate various transactions among pharmaceutical supply chain stakeholders.

II. LITERATURE SURVEY

In this paper, the author has discussed about the differentapproach for preventing fake drug based using blockchaintechnology.[1] The author of this paper discusses the differentchallenges and opportunities in applying blockchain technologyto healthcare in the future.[2] Sudeep Tanwar [1] has proposedin this paper regarding the Automating COVID- 19 vaccineforward supply chain. Author discussed blockchain-baseddecentralized system with integration of interplanetary filesystem for storing records along with blockchain-based decentralized system.[3] In this paper, the author has discussed about the drug supply system that incorporates blockchain along with the tracking process. In addition, the paper lacks complete decentralization and transparency of the system.[4] In the paper, the author discusses the G-Coin named druglifecycle, covering every stage of drug development from manufacturing to post-marketing. However, simulation dataused in paper is not relevant for blockchain.[5] This paperdiscusses how Hyperledger is used to track and verify theauthenticity of drugs throughout the supply chain. There is noinformation in the paper about Smart Contracts, access lists, orprototypes. In addition, no tests have been conducted.[6] In thispaper, the author has introduced the problem in pharmaceutical supply of Saudi Arabia. A Saudi Arabian pharmaceutical supply chain problem is presented in this paper. There has beenno discussion of the actual implementation of the system. [7] In this paper, the author has discussed about the trackingsolution having decentralized and distributed track and tracesystem has been presented together with RFID and Barcodes. There is no practical implementation provided by the author. [8].

III. SYSTEM DESIGN

Fig1. represents the architecture of drug traceability system using blockchain. A typical drug traceability system is complicated and typically centralized. It has lack of transparency across network of supply chain, that allow to modify data to central authority without notifying other stakeholders. Blockchain technology helps to overcome these issues. Blockchain technology is revolutionizing how people transact and interact online. This technology enables peer-to- peer transactions without the need for a central authority to verify them. This opens up a range of opportunities for parties to transact directly with each other, without the need for a middleman to prove the legitimacy of the transaction. This canbe particularly useful for tasks such as making payments, managing contracts, and exchanging data. In our system each stakeholder such has supplier, manufacturer, NAFDAC, distributer, pharmacists and patient have authority to be part ofthe network. Supplier provides the material to the manufacturer,at this occasion a block gets created with details of supplier. Further, Manufacturer makes the drugs and second block next to previous gets attached in chain of blocks with data. After manufacturer next block of record is added by NAFDAC (NAFDAC) National Agency of Food and Drug Administration and Control is a health ministry. Its purpose is to regulate and control the manufacture, importation, exportation,advertisement, distribution, sale, and use of drugs, medical equipment, packaged water, food, chemicals, and cosmetics through regulation and control of the entire process. Theyverifies the manufactured drugs. Manufacturer package thedrugs into a lot and sends it to the distributer who can transfer the lots to the pharmacies. At each step new block of record gets added into a blockchain with related data. Hence traceability ofeach drug can be trace from manufacturer to the patient. For storing data IPFS file system is used. Each stakeholder in the network have a separate copy of each blockchain record, henceno one can update or change the records and transparency is maintained throughout the supply chain. Smart contract is used here to automate all contracts in supply chain to maintain trust.So that end patient can receive safe and non-counterfeit drugs.

A. Working

Firstly, we have set up a blockchain network, which is done using existing blockchain platform known as Ethereum. The blockchain network is designed to allow multiple parties including drug manufacturers, distributers, pharmacist, and regulators to access and update the ledger. Each drug has a unique identifier or serial number that is recorded on the blockchain ledger.

This identifier is used to track the drug throughout the supply chain from manufacturing to distribution to the end user. Each time drug changes hands the transaction gets recorded on blockchain. This provides transparent and auditable record of the drug's moment. In the supply chain, smart contracts are used to automate certain aspects, such as verifying the authenticity of the drug or ensuring compliance with regulations. Finally, a user interface has been created to allow users to access the blockchain network and view drug traceability information. Through this web application user can scan the barcode from drug and can ensure if drug is safe andverified.

Fig 1. Drug Traceability System using Blockchain
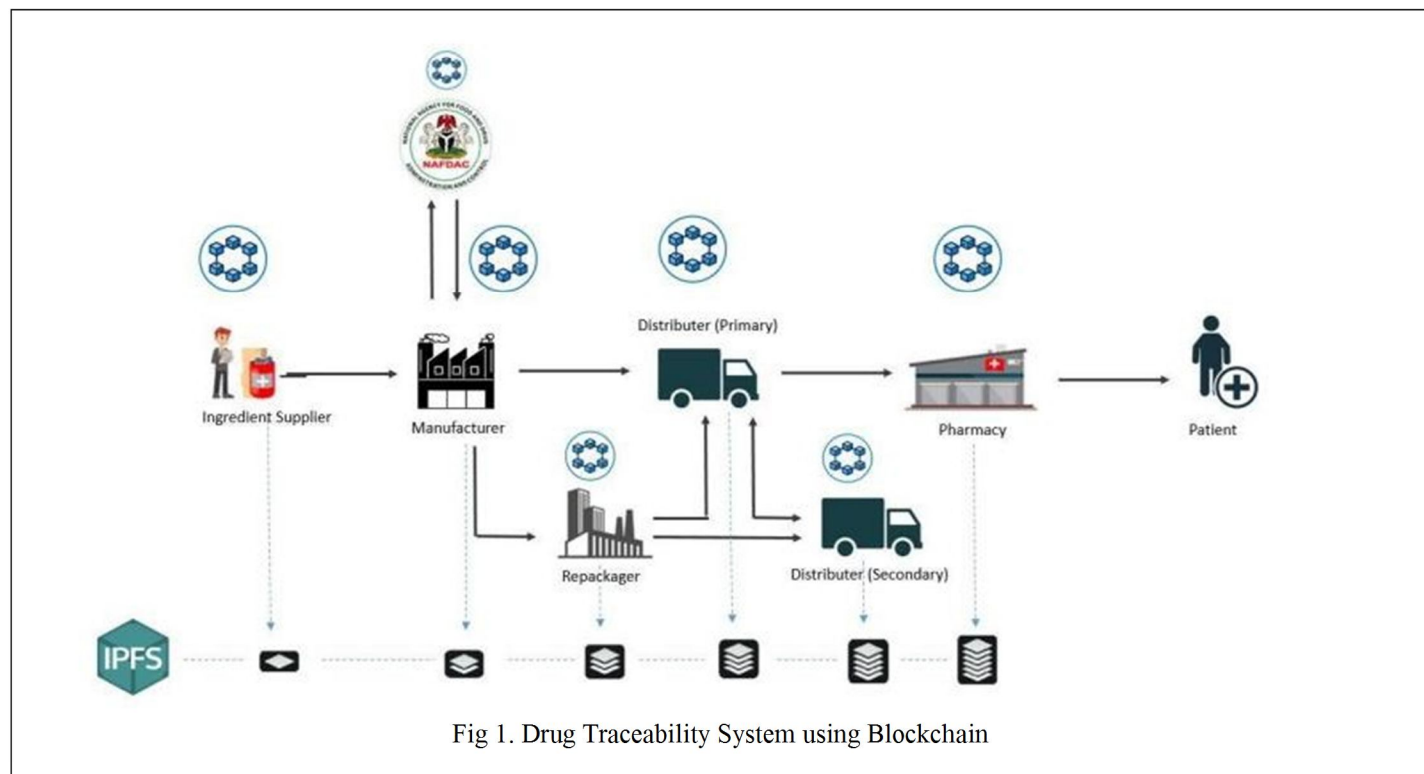
IV. TECHNOLOGIES

A. Ethereum

In order to deploy the supply chain, Ethereum Smart Contracts are used. As part of the decentralized storage server that allows participants to access the supply chain information,the smart contract is central to tracking the history of transactions and managing hashes. Modifiers provideauthorized participants with access to the functions of various stakeholders in the supply chain. Modifiers are basically ways to customize a function by adding new features or imposing restrictions. The smart contract also handles the transactions, such as selling drug Lots or boxes.

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B. Decentralized Storage System

With IPFS, supply chain transactions data can be securelystored off-chain to ensure data reliability, accessibility, and integrity. The unity of data is maintained by generating aindividual hash for every uploaded file on its server, and the separate hashes for the separate uploaded files are then stored on the blockchain and accessed through the smart contract, andany change that occurs to any of the uploaded file is reflected in the associated hash.

C. Smart Contract

A Smart Contract is a computer code that directly and spontaneously controls the transfer of digital means between the parties under certain conditions. Smart contracts are digitalcontracts that are stored on a blockchain. They typically run after meeting certain pre-established conditions. Additionally, they can automate a workflow by activating the next activity when certain conditions are met.
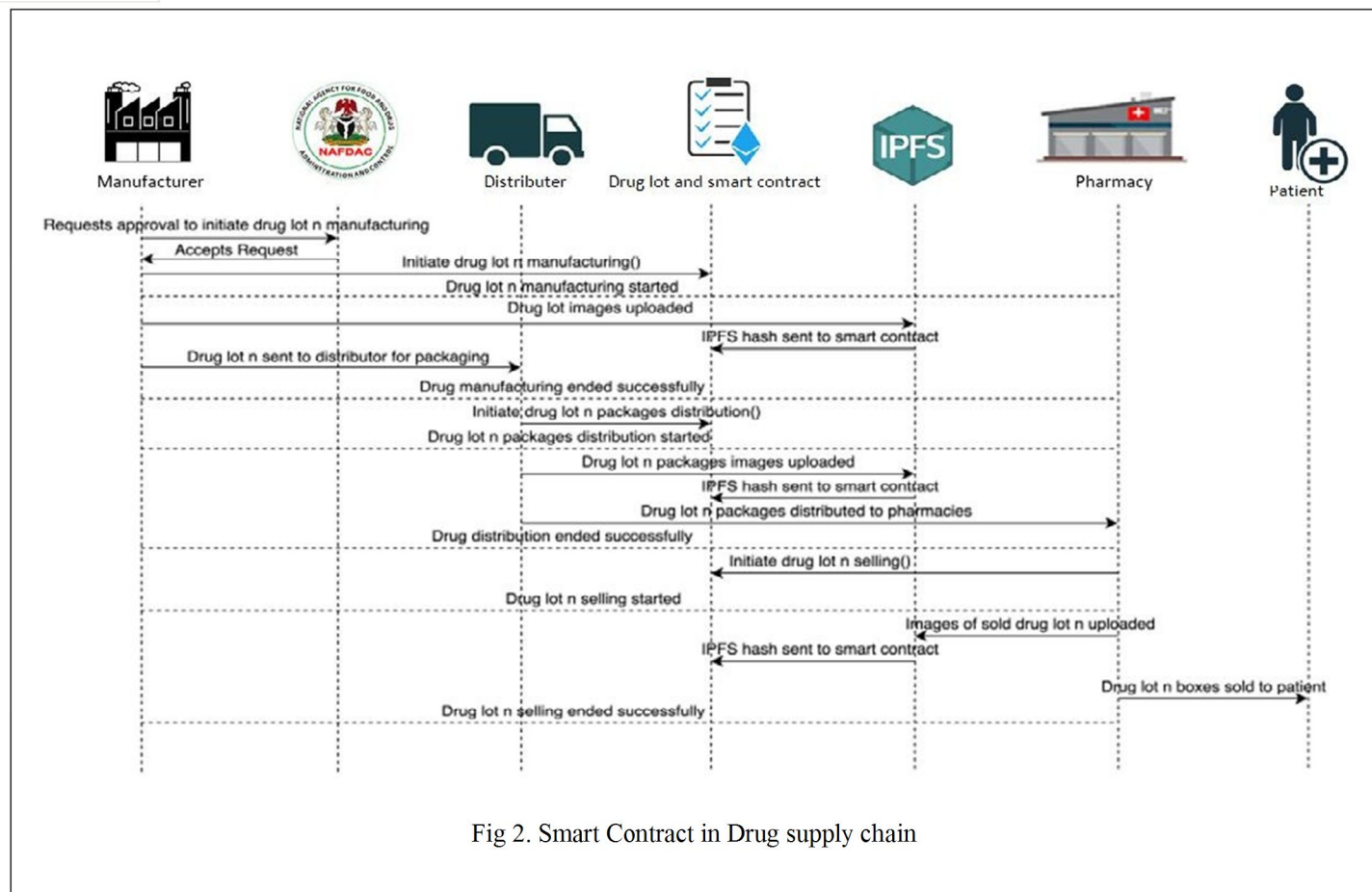
Fig 2. Smart Contract in Drug supply chain

V. CONCLUSION

The purpose of design this article is to highlight the significance of drug traceability, especially to protect against counterfeit drugs, within pharmaceutical supply chains. In order to track and trace drugs decentralized in the pharmaceutical supply chain, we have developed and evaluated a blockchain-based solution. particularly, our proposed solution utilizes cryptographic fundamentals underlying blockchain technology to achieve tamper-proof logs of events within the supply chain, and uses smart contracts within Ethereum blockchain to automate the recording of events so that all stakeholders can access them. besides, the conducted security analysis has shown that our proposed solution achieves protection against malicious attempts targeting integrity, availability and non- repudiation of transaction data, which are critical in complex multi-party settings such as pharmaceutical supply chains. In the future, we will pursue end to end transparency and verifiability of drug use using the proposed system and enhance the efficiency of pharmaceutical supply chains.

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