JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue

JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)

An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Fake Medicine Identification Using Blockchain Technology

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Abstract:

The healthcare industry has faced challenges in accurately tracking the distribution of legitimate medications while ensuring that the proliferation of counterfeit drugs is minimized, thus safeguarding patient safety. Counterfeit drugs not only harm individuals' health but also lead to significant economic losses, with US-based pharmaceutical companies, for example, suffering annual financial setbacks of nearly $200 billion. Alarmingly, the World Health Organization has reported that in many developing nations, one in every ten medications consumed by patients is counterfeit and of substandard quality. To address this issue, we propose a solution that utilizes blockchain technology to track the production and distribution of pharmaceuticals. This paper seeks to enhance transaction security and reduce the risks to both medicine quality and data integrity through the adoption of blockchain technology.

I. INTRODUCTION:

Counterfeit medications represent a significant global challenge, particularly in low- and middle- income countries, where as much as 10% of medicines could be counterfeit. These fake drugs pose serious risks to patients by containing incorrect ingredients, incorrect dosages, or sometimes no active ingredients at all. Existing methods to detect and prevent counterfeit medicines, such as barcodes and centralized databases, often fall short, as they can be manipulated or lack the necessary transparency. [3] Blockchain technology presents a promising solution to this problem. As a secure, decentralized digital ledger, blockchain records transactions in an immutable manner. In the pharmaceutical industry, blockchain can track the entire lifecycle of a medication—from manufacturing to the end consumer—ensuring full transparency and preventing tampering. Each step, including production, shipping, and verification, can be securely documented and shared with all parties involved in the supply chain. [2]

II. RELATED WORK:

This section discusses the research and developments in fields closely related to healthcare and blockchain technologies. Additionally, this section is divided into two subsections: 1] Studies on Blockchain Technology. 2] Blockchain Applications in the Healthcare Sector [4]

III. METHODOLOGY:

The proposed D App system utilizes the MetaMask wallet for transaction processing, and the smart contract is deployed on the Rinkeby Test Network of the Ethereum blockchain. The D App is centered around three main actors: the Manufacturer, the Seller, and the Consumer. [4]

A. System Diagram :

Figure 1 shows the system architecture of the D App designed and developed. Every user of the D App needs to be logged in; that is, he or she must be authenticated first. This system of authentication has been achieved with the help of Firebase, which is a Google developed and provided dynamic mobile and web application development toolkit. Upon being authenticated successfully, the manufacturer can remove the restriction on the D App and add products of the manufacturer. The manufacturer is supplied with contract address of that company and all the details of that company and manufacturer's account are uploaded on the blockchain. After a product token has been made onto the blockchain, it is allocated a QR code for verification purposes. The sellers are allowed to purchase the said products from the manufacturer after they have registered themselves. The particular product ownership can also be traced through the QR code by the concerned parties.[5]

B. Manufacturer :

The activities of the manufacturers fall under the following categories: entering the company into the blockchain as well as naming the company and

establishing a minimum selling price for new sellers and retailers wishing to join the company. Only the Manufacturer can input goods into the system. A Manufacturer also prevents status of goods already in the system from being available for the intermediate parties and can also transfer a product's ownership after a buyer purchases the products and re-sells them.[5]

Adding and distributing products are the two main tasks which the manufacturer carries out in the system. In order to add a Product the following Algorithm is used.

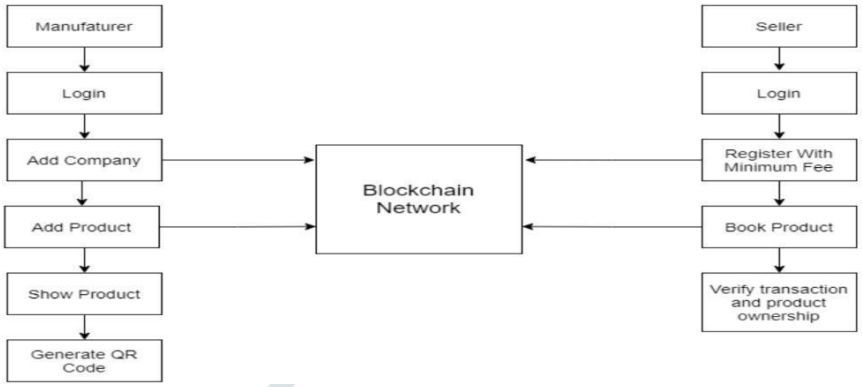

Fig. 1. System Diagram

C. Seller :

A seller can pay the minimum fee set by the manufacturer to register with the company. Once registered, the seller is able to buy products and track their distribution. When the manufacturer ships a product to the seller, its status changes from "Ready To Go" to "Shipped." [5]

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D. Consumer :

Consumers can scan the QR code attached to each product to verify its ownership transfer from manufacturer to seller. They can also confirm the current owner's name and check the distribution status. [4]

Fig. Consumer Module

E. Transactions Execution Procedure :

A blockchain-based system for identifying fake medicines ensures transparency and traceability throughout the supply chain. The process begins with the manufacturer registering the medicine on the blockchain, including details like the product ID, batch information, and certificates of authenticity. As the medicine moves through the supply chain, each participant (distributors, wholesalers, and retailers) records their transaction on the blockchain, capturing data such as transfer of ownership, timestamps, and verification details. Each record is immutable and cryptographically secured, creating an unchangeable history of the medicine's journey from production to sale.

Consumers and regulatory bodies can verify the authenticity of medicines by scanning a product's QR code or serial number, comparing it with the blockchain records. If discrepancies are found, the product can be flagged as potentially counterfeit.

The system also allows manufacturers to issue recalls, which are logged on the blockchain to notify all stakeholders. This decentralized and secure approach helps prevent fraud and counterfeiting, while ensuring regulatory compliance and enhancing consumer safety.

IV CONCLUSION:

Counterfeit drugs pose serious health risks, including fatalities, for users. A significant number of counterfeit medicines have been detected in markets, particularly in low- and middle-income countries, making the identification of such drugs a major challenge. With these threats in mind, this paper presents a blockchain-based solution for detecting counterfeit drugs. The proposed system also focuses on tracking the movement of pharmaceuticals from production to the patient. To implement the model, we utilized Hyperledger Fabric. In this system, the manufacturer uploads the details of a drug, which are then sent to the government for approval. Once approved, pharmacies can request the authorized drugs within the blockchain network. If a patient requires medication, a request is made within the network, and a medical professional approves or rejects the request. Since the entire system is built on a blockchain, it effectively prevents drug counterfeiting and provides a transparent way to track the journey of drugs from the manufacturer to the patient.

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