


# Blockchain-Based Traceability of Counterfeited Drugs

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## ABSTRACT

In the healthcare industry, providing a vital backbone for services is critical. The supply chain is a complex network that crosses organizational and geographical borders. In the healthcare business, counterfeit pills are one of the primary reasons for the harmful impact on human health and financial loss. Thus, pharmaceutical supply chains and end-to-end tracking systems are the recent research in healthcare. In this paper, the authors propose blockchain-based traceability of counterfeited drugs (BBTCD) that implements tracking of counterfeited drugs using smart contracts on the Ethereum blockchain. They offer a solution to fully decentralize the tracking by storing BBTCD on IPFS (inter planetary file system) to provide transparency and cost-effectiveness.

## KEYWORDS

Blockchain, Counterfeit, Decentralised, Ethereum, Supply Chain

## INTRODUCTION

The suppliers of raw materials, manufacturers, retailers, hospitals, distributors, clinics, and patients are contained as an agent in the healthcare supply chain. The necessity of data, centralized organizations and the competition in the market between the partners and other factors are responsible for the difficulty in supply throughout the process. It is complex due to COVID-19 (Chambliss et al., 2012) and the challenge of countering fake drugs as they can quickly soak the healthcare sector.

Some healthcare drugs are produced and illegally designed to increase financially in the market, which affects human health while they seem genuine (Chambliss et al., 2012). Medicines with no proper ingredients, inaccurate amounts of API, repackaging of expired drugs, a lower degree of rank, and poisonous substances are examples of medications that lead to harmful side effects like organ failures and even death.

In India, CDSCO (Central Drugs Standard Control Organization) is an administrative office assigned to recognize the materials for producing drugs through a loyal API provider. The re-packer gets a bundle of the drugs from the manufacturer. A few parts of the item are sent to merchants. Others

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depend on switching the medications built on item requests or secondary suppliers (if the number of items is exceptionally vast) who will change the items to the stores. In the end, patients usually medicate on doctor's prescribed medicine allotted by stores. The whole process does not need a third party because of the supply chain (Musamih et al., 2021).

Demand for drugs has increased quickly in recent years and has been widely exported to the market on profit margins (Musamih et al., 2021). Poor healthcare facilities, public and private sector corruption, and restricted access to effective medicinal products are the critical causes of counterfeit and second-rate drugs. For this reason, we need dominant and constant monitoring of healthcare items in the supply chain market (Maruchek et al., 2011).

Several governments worldwide help to improve the demand for tracking and tracing counterfeited drugs. The traceability of drugs has turned out to be an essential part of the healthcare supply chain that authenticates tracking and tracing of healthcare products in the supply chain (Conti et al., 2018).

In the healthcare industry, counterfeit drugs are a significant problem that concerns patients who consume drugs. The information gathering of drugs is resolved by open-source intelligence (OSINT) based solutions (Rai et al., 2021), and the medical prescription and Report Analyzer (MPRA) proposed model helps patients to analyze the data and prescribed medicines by providing handwritten text data from images (Kumar Rai et al., 2021).

Hospitals and pharmacies are knowledgeable about the complications in analyzing the materials used in drugs; this is a significant cause in the healthcare sector for patient illness. The PcPbEHR system designed an algorithm for a healthcare information system that maintains the security and privacy of patient data (Rai, 1 C.E.), and electronic healthcare records (EHR) help to maintain the safety of patient information with the support of chained hashing (Rai, 2022).

In this paper, we propose blockchain-based traceability of counterfeited drugs (BBTCD) that implements tracking of counterfeited drugs using smart contracts on the Ethereum blockchain. We propose a solution to fully decentralize the tracking in healthcare by storing BBTCD on IPFS (Inter Planetary File System) to provide transparency and cost-effectiveness.

## BACKGROUND

We have tried to showcase all the research work done before to place our piece against the problem statement.

Ellis Soliman et al. (2019) defines their application using an inimitable smart contract which merges with the Ethereum blockchain through Newcastle university and establishes a centralized management platform (Solaiman et al., 2021). Benedikt Notheisen et al. (2016) give three schemes of recent research: First, they present the irreversibility of transactions to decrease the risk of transaction failure. Second, they introduce an independent transaction database with more security for registration and transactions. Third, they provide reliability, transparency, and records of every market's asset (Notheisen et al., 2017). Nakka Murali Krishna et al. (2020) introduce a supply chain system that uses a distributed public ledger for secure transmission and tracking (Krishna & Kumar, 2020). National Urban Security Technology Laboratory (2016) gives data on 20 assets and inventory systems. Commercial merchants provide a solution, product, and technology from the market but cannot cover all retail merchants (FDA, 2014).

Mr Daryl Woodfield, DAF (2019) studies blockchain in more detail, specifically how the DOD supply chain influences DOD assets in cyber security. Their descriptive study states that to prevent counterfeit products, they need to analyze related work done through blockchain in the healthcare sector and then conclude what best algorithms are designed for the DOD supply chain for DOD assets in cyber security (Woodfield, 2019). Arnab Banerjee et al. (2019) propose a solution for tracking and tracing to upgrade the performance of tasks for the recall and return of products. They simplify the penetration process, gathering and obtaining information through a transversely multifaceted supply chain through a centralized system (Banerjee & Venkatesh, 2019). Victor Zakhary et al. offer

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