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# Fake Drug Identification Using Blockchain Technology

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**ABSTRACT:** At present, In Pharmacology one of the most serious problems is Counterfeit Drugs. Counterfeit drugs tend to have fake company logos and brands, have a reputation for being lower quality and may contain toxic substances. Counterfeit drugs are fakes or unauthorized replicas of the real drug. The Health Research Funding Organization reported that in developed countries, nearly 10-30% of the drugs are fake. Counterfeiting has become one of world's largest and fast growing criminal businesses. The consumption of these fraudulent products might have serious results ranging from minor deterioration in health to very severe impacts such as death of the patient. One of the reasons for drugs counterfeiting is the imperfect supply chain system in pharmaceutical Industry. To overcome these challenges Block-chain is being adopted. The Proposed System will be used in pharmaceutical industry to track the drugs from its manufacturing until its deliver to patient. In this paper we explain how to use blockchain technology in pharmaceutical supply chain to add traceability, visibility and security to the drug supply system.

**KEYWORDS:** Counterfeit Drugs, Supply Chain, Blockchain, Pharmaceutical Industry, traceability, visibility

## I. INTRODUCTION

The Production and distribution of counterfeit drugs is an urgent and increasingly critical worldwide issue, especially in developing countries. The market value of pharmaceutical counterfeiting has reached billions of dollars annually. Pharmaceutical Research & Development is a complex process that takes several years from drug discovery to drug development and regulatory approval. When all the process is done and a standard product is developed, the next challenge for manufacturers is to deliver the product to the intended customer in its original form and to ensure that the customer get the genuine product that is developed by the legitimate manufacturer, not by counterfeiter. But the current Supply Chain Management (SCM) system of pharmaceutical industry is outdated, and doesn't provide visibility and control for manufacturers and regulatory authority over drugs distribution and it cannot withstand the 21<sup>st</sup> century cyber-security threats. This situation of SCM leads to the production, distribution, and consumption of counterfeit drugs. Counterfeit drugs have created a particularly dangerous public health risk and increasingly keen worldwide issue especially in developing countries. These counterfeit drugs directly and indirectly adversely affect health. Indirectly, these drugs do not contain the dosage or active agent required to kill the disease, that finally cause drug-resistant strains, and then even using the original drugs are useless. More directly, such counterfeits may contain active ingredients, but the amount is too low or too high, or produced in an impure manner that contains toxic ingredients, in this case it can cause very serious health problems. For the prevention of counterfeit drugs, the best available solution to develop a perfect supply chain management is the blockchain technology. Blockchain technology is a distributed ledger system. Block-chain is the best fit in those scenarios where privacy protection and data security is the highest priority.

## II. RELATED WORK

Literature Survey is the most important step in any kind of research. Before start developing we need to study the previous papers of our domain which we are working and on the basis of study we can predict or generate the drawback and start working with reference of previous papers.

In this section, we briefly review the related work on traceability of the counterfeit drugs and their different techniques. In this paper, author explains how to use blockchain technology in pharmaceutical supply chain .The proposed system will be used in pharmaceutical industry to track drugs in supply chain .after the usage of a drug, its effect on patient will be recorded to a database for future statistics [1].

In this paper, the author concentrated on traceability of drugs throughout pharma supply chain is a difficult task and another serious issue in combating counterfeit medicines in healthcare systems is the maintenance and sharing of health

records. The security of E-health records is of prime concern as they are prone to confidentiality and integrity threats [2].

In this paper, author explores the possibility to deflate counterfeit using blockchain technology. This paper provides an overview of different solutions in anti-counterfeiting area, different blockchain technologies and what characteristics make blockchain interesting for the use case. Increasing awareness, fighting counterfeiters on a legal level, a good alert system, and having tamper-proof packaging are all important aspects. In this system the customer can assure that the scans weren't faked [3].

In this paper, authors discussed the problems with the traditional methods of data handling and drug traceability and how blockchain overcome those problems. Moreover, we have proposed a system which is capable of tracing drugs in the supply chain and reduce counterfeiting of drugs. some projects and applications working in the direction of drug traceability and data handling such as Blockverify,Mediledger,MedRec,MedicalChain etc. are also discussed[4].

This thesis explores the possibility to reduce counterfeit using blockchain technology. It is conducted in cooperation with modium.io AG. Modum.io is a startup which uses blockchain technology to ensure that pharmaceuticals are transported within the allowed temperature range. This thesis provides an overview of different solutions in the anti-counterfeiting area, different blockchain technologies and what characteristics make block chains especially interesting for the use case. In this section we briefly review discuss about the existing methodologies. From a product perspective, there are general technologies to reduce counterfeits. **Overt:** Overt technologies includes holograms, color shifting inks, security threads, water marks etc. the advantage of overt technologies is that they can be checked by the end-consumer. **Covert:** This includes UV, bi-Fluorescent and pen-reactive ink, as well as digital watermarks and hidden printed message. Covert technologies help to identify counterfeits in the supply chain and are especially efficient combined with overt technologies. **Track and Trace:** This includes Radio Frequency Identification (RFID) tags, Electronic Product Codes (EPCs) and barcodes. Track and trace technologies allow for simpler tracing of products, there by tag or barcode is included by the manufacturer. Distributors & retailers scan the identification, enabling the reduction of counterfeits, as the history of a product and update the status. This method not only tackles the counterfeit problem, but also enables track and trace through the whole product life cycle. [5].

This paper is the first Blockchain System that proposes a fully functional anti-product forgery system. By paying a very low transaction fee, users of our system no longer need to be concerned about the possibility of acquiring a counterfeited product. Manufacturers can use the system to store relevant information on product sales in, the total amount of sales that can be sold by the seller and number of products currently left by the seller is transparent. [6] This study will test the feasibility of applying the technology and its principles in a pharmaceuticals surveillance system and its resistance to tampering [7].

**BLOCKCHAIN:** Block-chain is an electronic cryptographic ledger that follows a decentralized network model. Block-chain is the best fit in those scenarios where privacy protection and data security is the highest priority. Therefore pharmaceutical supply chain presents a further use case of Block-chain technology. In case of block-chain there is no central point of failure as the data is distributed and is sorted in blocks. Block-chain technology helps in overcoming the security problems in healthcare.

### III. PROPOSED SOLUTION

#### PROBLEM STATEMENT:

To design System for traceability and detection of fake medicine supply chain using blockchain which provides traceability of drugs from manufacturer to end consumer and detection of manufacturing process of medicines to overcome drug safety issue.



#### IV. PROPOSED METHOD

The blockchain is useful in keeping track of the entire manufacturing chain of the drug. Each new transaction added to a block is immutable and time stamped which means that the information cannot be tampered with. Companies can either have a public or private blockchain. On these block chains, the companies can have a distributed ledger shared among the parties involved in the manufacturing and distribution of the drug. Moreover, access is only limited depending on information sharing contract between the two parties. Through blockchain, we are able to get the complete trail of the drug. Each time the drug moves from one entity to another, the information is stored on the blockchain technology which makes it easy to track the drug and wipe off counterfeits from the shelves.

Blockchain technology can offer full protection from counterfeit drugs entering the supply chain. Its merit lies in an inherent feature, which allows data to no longer be stored centrally. Instead, that data can be stored on a distributed network of nodes in a decentralized database. Each entry is individually encrypted. Any changes have to be verified by all nodes within the system, making blockchain solution virtually impossible to hack, because the data cannot be manipulated after the fact. The technology also opens up the possibility of each customer being able to verify the genuineness of the drugs they purchased – by scanning QR code on packing via an application. This makes it easier for each buyer to see if their drug is original or fake.

The QR code included by the manufacturer. Distributors scan the identification, enabling them to check the authenticity of the drug and update the status. Finally, retailers can also scan the drug, to check the history and authenticity of the drug. This approach does not only tackle the counterfeit problem, but also enables track and trace through the whole product lifecycle.

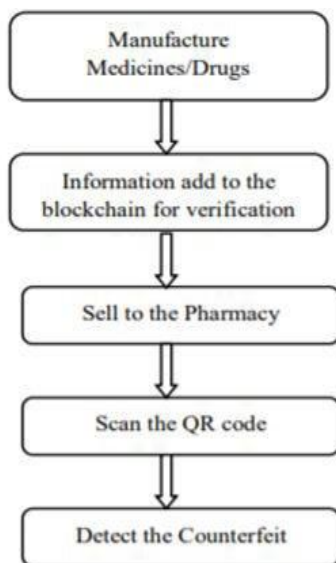


Fig 1. Flowchart of Application

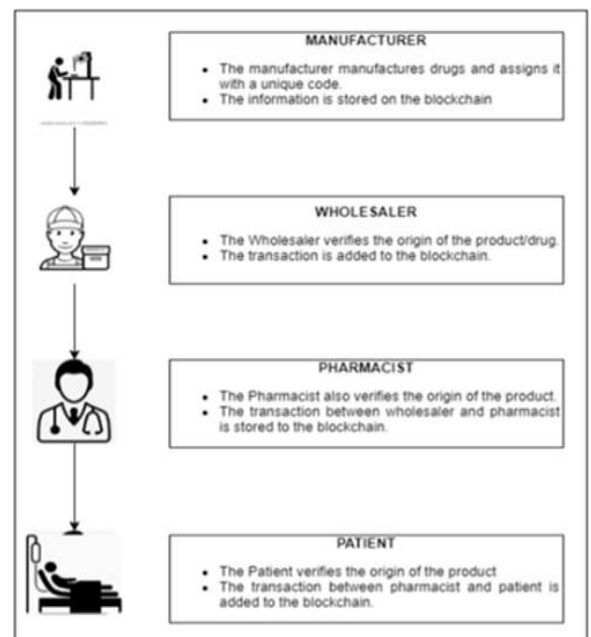


Fig 2. Flowchart of Supply chain Management

**SYSTEM ARCHITECTURE:**

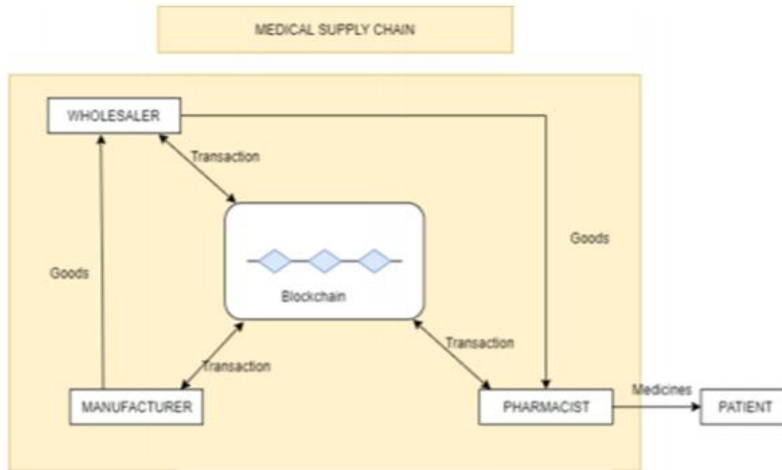


Fig 3. System Architecture of Application

**IV. IMPLEMENTATION**

In Fake Drug Identification System using blockchain is built as a web application built with the help of many tools and technologies.

Applications:

XAMPP - XAMPP is an abbreviation for cross – platform, Apache, MySQL, PHP, and Perl. XAMPP helps a local server to test website via computers and laptops before releasing it to the main server.

Blockchain:

Metamask – Metamask is an extension for the browser which makes it easy for web applications to communicate with Ethereum blockchain. Metamask manages your Ethereum wallet which contains your Ethers.

Ganache – Ganache is used for setting up a personal Ethereum Blockchain for testing solidity contracts. The solidity contracts are collection of code and data that resides at a specific address on the Ethereum Blockchain.

RemixIDE – RemixIDE is the integrated development Environment. It is a part of Remix project which is a platform for development tools that use plug-in architecture. The Remix IDE is a powerful open source tool that helps you write solidity contracts straight from the browser.

Website:

HTML – Markup language for creating web pages

CSS- Style sheet language used to describe the look and formatting of a document written.

PHP- Open Source Scripting languages

JavaScript – Scripting languages for web pages

Bootstrap- Templating

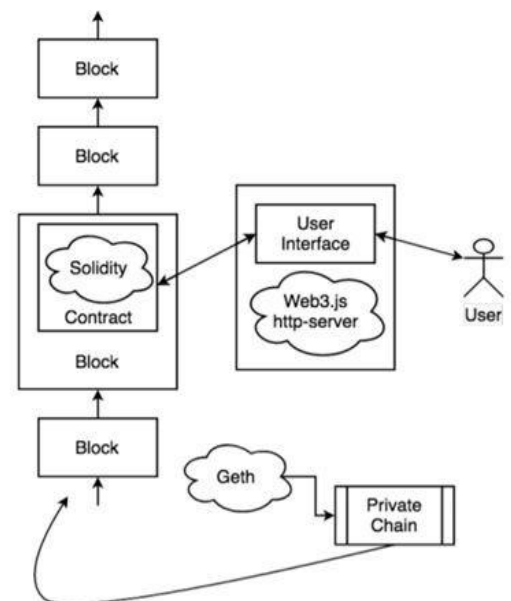


Fig 4. Architecture Overview of Our System

**V. APPLICATION MODULES**

Our Application has four different kinds of modules like manufacturer, Retailer, Distributor and customer modules. Each module has their own purpose.

Manufacturer module-

Check Drugs – To check drug whether it is in Blockchain Network i.e. whether drug added by authorized manufacturer or not.

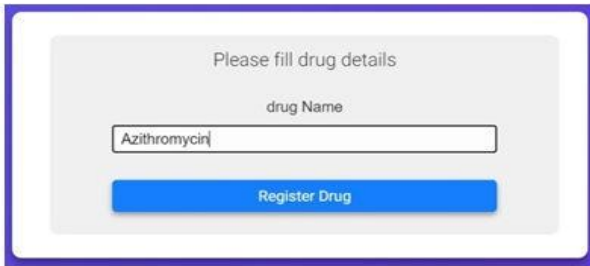


Fig 5. Registering Drug in Application |



Fig 6. QRcode Generated by Application

Register Drug- Whenever manufacturer registers drug a unique QR code is generated and it is added with respective to drug in blockchain.

Scan Shipment – To update location and information to respected drug which is in blockchain network.

Distributor and Retailer Module -

Check Drug – To retrieve drug information.

Scan Shipment – To update location and information to respected drug which is in blockchain network. Here, Distributor checks with the QRcode on medicine in application, It Application shown information then it means he make sure that medicine is not fake.

So, he updates his location to the respective Drug in blockchain with the help of application.

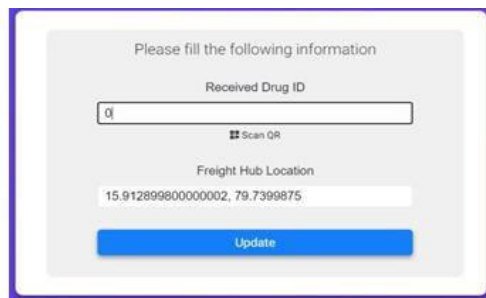


Fig 7. Updating location in Application by Distributor

Customer Module:

Check drugs – To retrieve drug information which is in blockchain network if scanned drug is not present then no information will be displayed.



Fig 8. Information about Drug retrieved By customer

## V. CONCLUSION AND FUTURE ENHANCEMENTS

**CONCLUSION:** The application will help with two main issues: first it will allow companies to track their products down the supply chain, creating an airtight circuit, impermeable to counterfeit products. second. it will also allow stakeholders, and especially labs, to take action a posteriori in case of a problem by identifying the exact location of their drugs.

The proposed framework can provide both manufacturer's authenticity as well as drug security. The current methodologies, the proposed framework is based on blockchain and is hence highly secure and capable of dealing with the fake menace.

This framework is a robust track and trace mechanism to help the distributors, the retailers and the patients. With this system, the products journey from manufacturing to customer can be recorded, and the customer is assured that the scans weren't faked. Manufacturer is able to prove their product is authentic and is also able to track their product's pathway this mechanism should be easy to implement by all manufacturers. This setup is easy to implement and requires less operation cost.

### FUTURE ENHANCEMENTS:

- Can implement this idea in other fields.
- Manufacturer can also adopt RFID or NFC tokens instead of QR codes to further strengthen their system.
- Adding consent of the patient regarding their treatment history and preferences on blockchain will allow stakeholders to access consents from any place and elevate the care provided to the patient. Future research can be done to secure data of clinical trails through blockchain.
- The combination of IOT and blockchain technologies might enable many more interesting use cases on how to reduce counterfeits.

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