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Anti-Counterfeit Product System Using Blockchain Technology

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Abstract: ***Fake Products is a serious issue, as in today's world we can't really distinguish between real and fake product. And some people make these fake products just to make some profit without thinking about its impact on user and also affects company's name, profit and sales. Blockchain technology can be used to detect whether the product is real or fake and assure user about the authenticity of the product. Blockchain is a trending technology and lot of applications are using this technology. Blockchain technology is the technology where information is stored in the form of blocks in many databases which is connected with the chains and it doesn't require any third-party users for permission. Benefits of blockchain is that it is immutable and secure. It is decentralized and distributed. We can use Quick Response [1] (QR) code or an encrypted unique code which is a very efficient technique to detect fake product. When the QR code is scanned or the unique code in entered, it will redirect us to the blockchain containing the information of the product and provides us the details of the manufacturer and information of owner to make decision easy for buyer if they are looking to buy the product.***
Keywords: Blockchain, Fake Product, Ownership, QR code, Anti-counterfeit

I. INTRODUCTION

Fake products create a huge negative impact in the market for both buyers and sellers. The sellers fails to deliver the product as per the consumers expectations and the consumers starts to doubt the quality and standards of the company which ultimately results in the negative marketing of the brand whose fake products are being circulated in the market. The most critical part about counterfeit products is that it can be really harmful for the consumers. Since, the fake or counterfeit products are not restricted to any particular sector in the market therefore it has become really important for us to detect these products and find a way to keep them out of the market. These products can be really dangerous if we consider very dominating sectors of market like pharmaceutical and food supplies. To tackle such problems, we need to maintain a data which is easily accessible to consumers where they can verify the details about the products and build a level of trust regarding the product authenticity.

As we all know that no product is safe from counterfeiting due to the continuous growth in counterfeit products in the supply chain. It is degrading company's name and their profit, it also affects the costumer, for example if this counterfeiting is done in pharmaceutical field, then it will directly affect the customers health. To counter this problem, the research work has been proposed but not yet perfected. In this project, we will be using blockchain technology to find genuineness of the product.

Blockchain technology is generally a ledger system which holds all the data of the transactions that take place on it. The unique thing about this technology is that the ledger that we mentioned here is a distributed ledger across a peer-to-peer network.

In this project, we propose a system where we store product's detail and its ownership status on architecture provided by Ethereum and we use smart contract to update the owner of the product when the product is sold. We will be using QR code which will be scanned by customer such that he/she will be able to find out the details of the product like manufacturing details, current owner etc. And will be able to determine whether the product is fake or real.

A. Blockchain Technology

Blockchain is a decentralized and distributed ledger that contains the records of transaction and maintain it over a peer-to-peer network. The idea of blockchain was first suggested by Satoshi Nakamoto in his whitepaper "Bitcoin: A Peer-to-Peer Electronic Cash System [2]" which came out in 2009 where he gave the concept of cryptocurrency or we can say a digital cash system.

The blockchain is termed as decentralized as there is no centralized authority or a central database that manages the blockchain [5]. There is a peer-to-peer network where we have multiple nodes connected in a network such that the data is distributed over the network and there is no central server with all the information. Since the network is distributed and there is no single source for its operation therefore it becomes really difficult to hack or gain access of the blockchain.

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As the name suggests, blockchain is a chain of blocks. All the information that is available on the blockchain is stored in the form of blocks. The blocks contain various information about the transaction records or the data, the hash of previous block in the blockchain, timestamp, its own hash code and some other values like nonce. All these values together are secured cryptographically [3] through strong hashing algorithms like SHA-256 [4]. Since the data in block is secured through such hashing algorithms, even a minor change or attempt of data manipulation get detected very easily because even a small change in the data completely changes the hash value of that block and this leads to case of miss match values since the next blocks uses the hash value of previous blocks. This feature helps blockchain to maintain immutability and makes it difficult to temper the data of the blockchain.

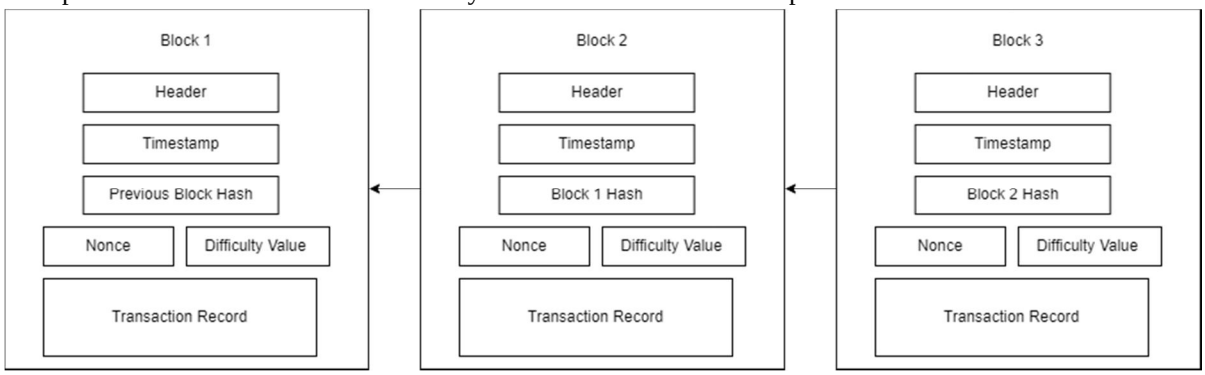


Figure 1 Structure of Block

A node can be any electronic device which maintains a copy of blockchain and these nodes are connected to form the P2P network. Each of these nodes have their own copy of blockchain and it is updated as soon as the new block is minted to the blockchain.

B. Blockchain Working

Whenever a user requests a transaction on blockchain, the requested transaction is passed to the P2P network where it is broadcasted to the nodes on the network [16]. After this, the validators on the network validates the transaction and user status. This is done using some known algorithms. The verified transaction can contain information of cryptocurrencies, contracts or other information. After successful verification the transaction is combined with other transaction records and a new block of data is formed. The new block is then added to the blockchain and the copy of blockchain for each node on the network is updated.

C. Smart Contracts

Smart contracts [6][7] are programs that are stored on Ethereum blockchain which runs when the predetermined conditions are met [8]. These smart contracts basically replaces the involvement of third-party members or any intermediary from any kind of traditional contract works or agreements so that the outcome is instant and time loss is negligible. Also, the workflow is automated and hence the process gets simpler. When the actions made by smart contracts are completed, it updates the blockchain with the transaction record [9]. Once the transactions are recorded on blockchain, they cannot be changed. Since smart contracts are collection of programs which specified conditions, they can be used for various actions like making transactions, renting a house or issuing tickets, etc.

II. LITERATURE SURVEY

A. AI Based Fake Product Detection System

The paper entitled 'IMPROVING FAKE PRODUCT DETECTION USING AI- BASED TECHNOLOGY [11]' describes how an ai based system can be used to reduce fake products where we do not require any special device to verify the authenticity of the product. Machine learning uses the data set and training data provided it to generate the outcome whether the product is genuine or not. It analyses the logos or the information captured by the end user through their device and verifies it with the data available. After detection the server returns the result to end user to make further decision.

B. RFID Anti-Counterfeiting

The paper entitled 'RFID Anti-Counterfeiting for Retailing Systems [12]' describes how we can use RFID counterfeit system. In this system the author proposes a system consisting of two protocols. The first one is tag authentication protocol which allows users to authenticate the product without revealing their important information and the other one is data correction protocol which ensures the correctness of the tag status.

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C. Image Watermarking QR code System

The paper entitled 'Research on Anti-counterfeiting Technology Based on QR Code image Watermarking Algorithm [13]' explains how we can embed the carrier image to the QR code to enable image watermarking in QR code. It is a more robust DWT and SVD based watermarking algorithm. n. The experiment proved that this method can resist compressive attack, rotation attack, noise attack and so on.

III. PROPOSED WORK

The blockchain technology is known for its immutable and decentralized properties. It keeps track of all the transaction that take place on the given blockchain. Taking advantage of these features we can introduce blockchain for managing the supply chains or product authentication purposes.

The proposed system will be a Dapp i.e., a decentralized application which will be using Ethereum network as the main blockchain for keeping all the records and managing the transactions regarding the products of the companies listed on Dapp. The reason for implementing system on Ethereum is that it supports smart contracts which allows users and suppliers to easily manage changes and keep the data record updated.

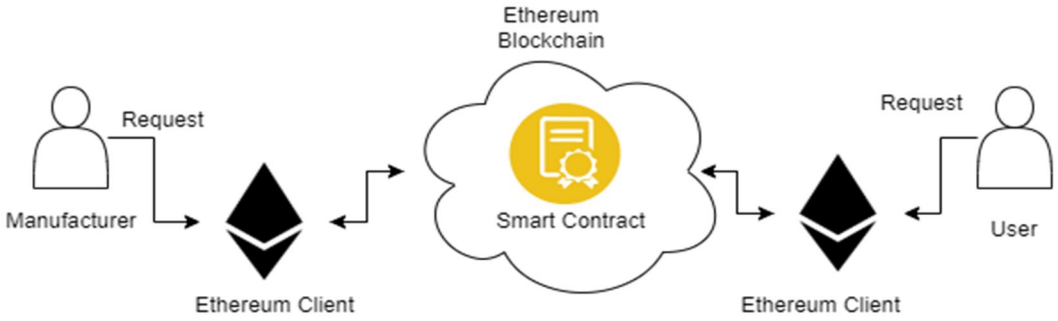


Figure 2 Basic System Overview

Smart contracts can define rules, like a regular contract, and automatically enforce them via the code. The smart contract once deployed cannot be deleted and the interactions made with it are irreversible in nature so the record of transaction made with smart contract is immutable and is available to all users on the given blockchain.

A. Basic Steps Of The System

1) *Company Enrollment on The System:* The company who wants the facility of product tracking through blockchain need to register with system. After, verification of the company is completed manually the company will receive a unique Company id and address to manage their products on the system. For each newly registered company or manufacturer, a new smart contract will be deployed with the ability to manage the product data and personal information of the company so that all the authority of the product will remain with the original company.
2) *Product Listing by Company:* The registered company on the network can now add their products on the network. The initial ownership of the product will be given to the company listing the product. Company has to provide all the details of the product while listing it on the network. Once, the product is added to the network a unique product id will be generated using cryptographic hashing algorithms. This product id will be used to generate a unique QR code for the product which can be used later to identify product.
3) *Shipping Product to Customer:* In this step the seller needs to ship the product to the customer. Once, the product is sold to someone else the seller needs to replace the ownership status of the product with the new buyer of the product. After conforming this transaction, the previous owner, the product will not have any kind of right on the product and since the product ownership transfer is one to one. The genuineness and originality of the product is maintained. Also, the smart contract is modified with the updated status of ownership of that product.
4) *End User Detail Management:* For the ease of use and accessibility, there will be a user section where each user who is registered with the network has the ability to find the details of all the products that are owned by them. Also, they will have the authority to transfer the ownership of the product if they want to sell the product to someone else. There will be a feature given to the user to scan the QR code or enter the product id to fetch the details of that particular product which they want to buy in future or want to check the authenticity and other information of the product. This helps user develop a sense of trust and reliability.

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IV. SYSTEM ARCHITECTURE

The proposed system will be able to allow both user and manufacturers to interact with the Ethereum based smart contracts and make changes to only those properties for which they have access. Since the blockchain is decentralized and the proposed system is based on Ethereum blockchain. It is different from Web 2.0 based server client system and is based on Web3 [14].

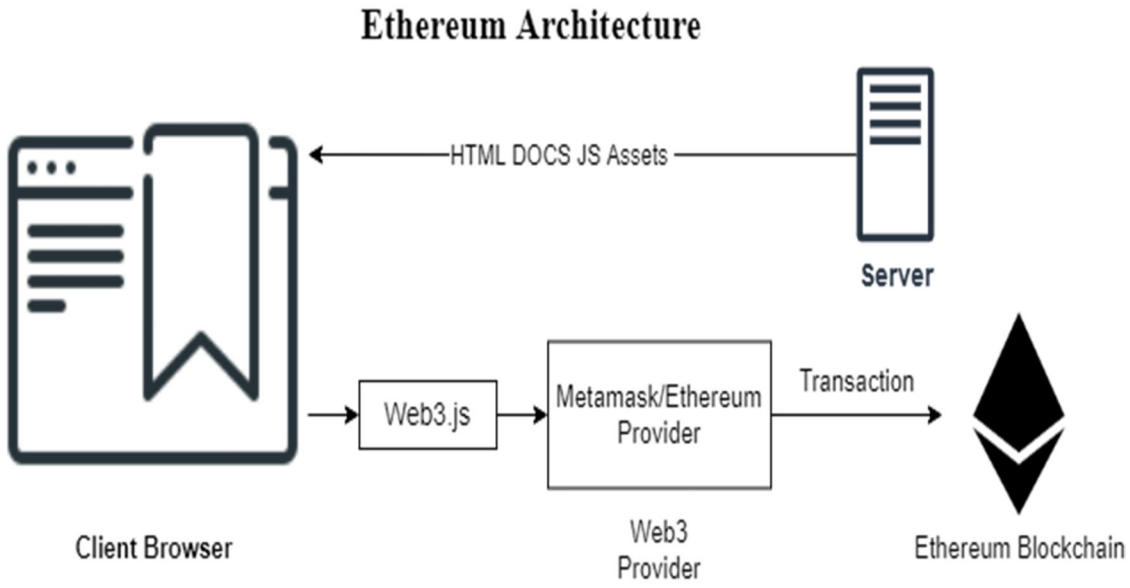


Figure 3 Ethereum Architecture

In the Ethereum architecture the backend-based data is managed by the blockchain which means blockchains act as backend for the client. The request or transactions made by user are recorded on the blockchain and the response is sent to them. The centralized server can be used in the system to manage the frontend resources such as HTML and CSS and user interface.

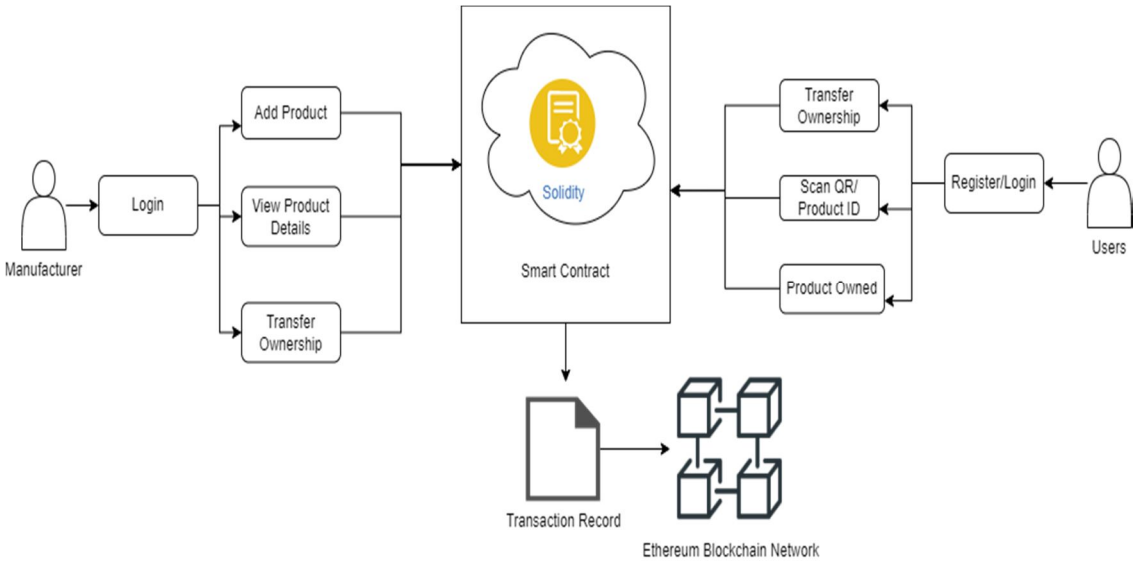


Figure 4 Proposed System Architecture

In the proposed system, the manufacturer and user both will be allowed to make some kind of transaction in the smart contract. The smart contract will be separate for each company and the company where they will get the features to add/modify product details, view listed products and transfer ownership to buyer. All the transactions made by company will directly update the smart contract and the transaction record will be moved to blockchain after verification.

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For consumers or normal users, the features will be limited to transferring the ownership status of the products owned by them and also the ability to scan the QR code or entering some unique product id to fetch the details of the product. When user scans for some product then the request will be made to blockchain which will retrieve the smart contract of the company that manufactured the product and then return the details of the exact product. These requests are also in the form of transactions and hence they will also get recorded on the blockchain.

V. CONCLUSION

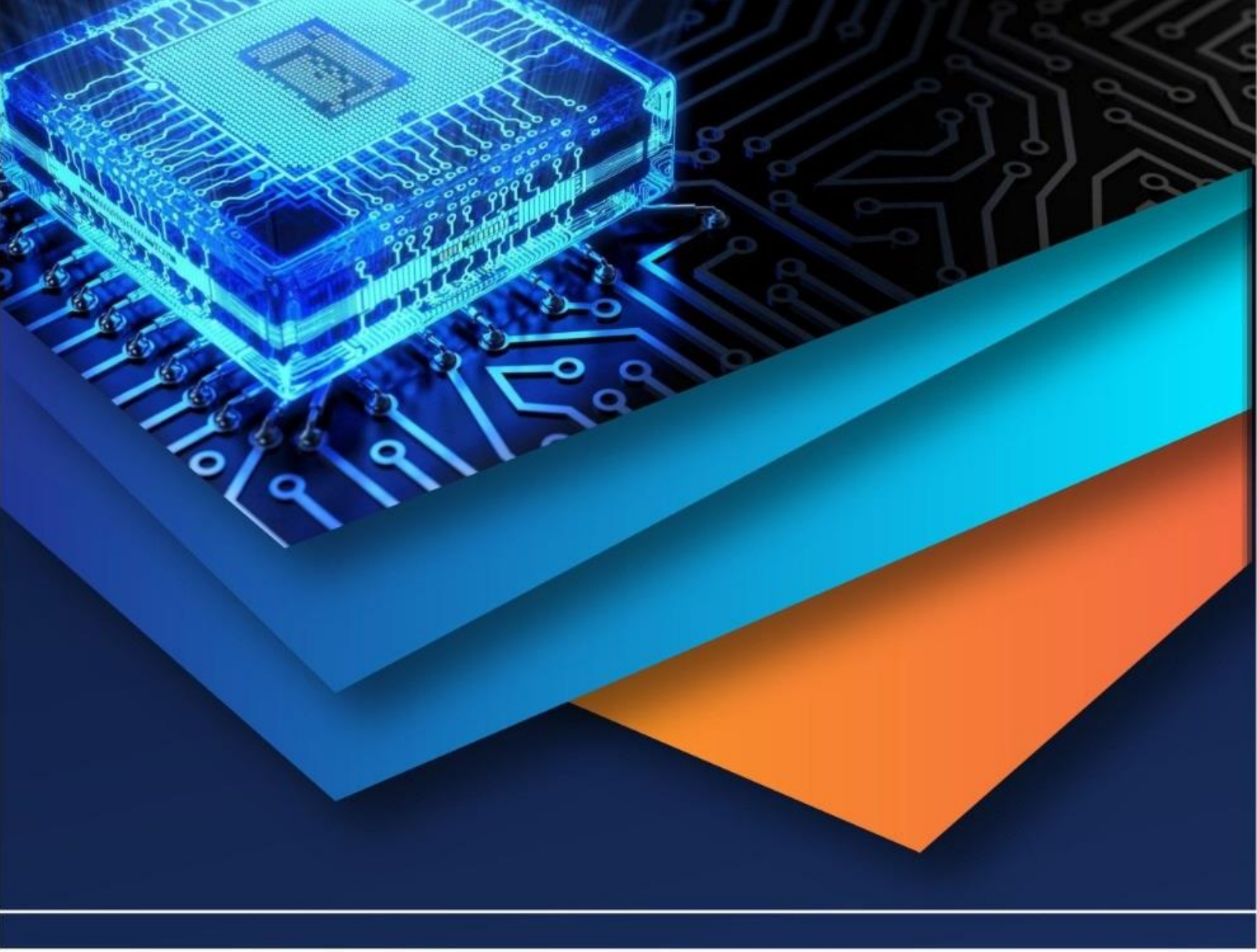
Blockchain technology is known for its security and privacy with the easy access of great information through its data handling through distributed network. Blockchain has gained immense popularity in the world of finance and comes under the category of fintech which is Finance and Technology. Companies have started to adopt it at a very fast pace [15] due to its useful features.

Blockchain has been found as a great tool for the purpose of fake product identification and elimination from the supply chain or the retail market. The proposed system will allow user to easily identify and gather information about the product that they want to check. This will help users to make better choice in the market and also allow them to trust the seller and the manufacturer. They don't have to rely on a third party to verify the authenticity of the product which will help in smooth and risk-free experience for them. Also, it will help the manufacturing companies to worry less about the counterfeit products in the market and they can work better on the customer feedback to improve their services. It will also prevent their economic losses and allow them to easily keep track of the product that they have released in the market. If blockchain is able to bring stability and develop trust among customers in the market then it can give huge boost to the economic growth of a country and prevent them from big losses which happens due to fraud. Overall, the blockchain technology can emerge as a life saver for the companies and provide a new system for trade which is more secure and user friendly.

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