Anti-Counterfeiting of Products Using Blockchain

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ABSTRACT

In the modern world, industrialization has played a key role the in the development of the mankind. Enormous indus- tries/brands have come into existence to cater to the ever-growing demand for goods of consumers. While the original brands are serving the people with integrity, many illegal elements in the industry are producing copycat products with the cheapest quality and sell them as original products to the consumers. Such malpractice is known as counterfeiting of products which is a pressing problem that industries are facing nowadays. To counter this global problem we propose a solution, which will track the supply chain of the product by leveraging Blockchain technology. The system will aim to minimize the counterfeiting of products and in turn, increase the consumption of genuine products.

Index Terms—anti-counterfeiting, blockchain, supply chain, malpractices

I. INTRODUCTION

With the advent of industrial and technological revolution, the demand of products for the needs of people is ever growing. To cater this need many industries came to existence who were serving to the people by producing quality products. But the negative elements of the society invented a way to copy the products originally manufactured by these brands with the cheapest quality and sell them as genuine products. This practice is commonly known as product the counterfeiting. Counterfeiting of products is a very big illegal industry in itself. This malpractice is happening in almost all industries including, electronics, cosmetics and personal care, phar- maceuticals, clothing, heavy duty machineries, automobiles, sports

goods, agricultural products, etc. The consumption of such fake products has severe impact on the people, suppose, if a person replaces the braking pads of his/her vehicle with the fake braking pads unknowingly, then this can even lead to his family's death while driving. According to the report by the Organisation of Economic Co-operation and Development (OECD) in March 2019, it is found that overall 3.3% of global trade is done using counterfeit products, and it has been increasing since then. [6]. The real problem here is that the customer is not having any system to verify that what he/she is buying is genuine. When he/she buys a fake product considering it as genuine, and finds its quality not up to the mark, then the customer blames the real company which results in degradation of company's reputation and overtime the consumer's

trust in the brand is eroded. We should not only think about scale of the problem, but also about its damaging effects including health and safety risks, financing criminal activities such as attacks and bombings, corruption, poor working conditions [5]. Some counterfeit products are also price tagged high in order to give a false assurance to the customer that it is a genuine product. The advent of e-commerce industry has literally revolutionised the counterfeiting industry, making it really difficult to tackle. These people can now sell their products on e-commerce platforms such as Amazon, Flipkart, Alibaba, eBay, etc. by pretending themselves as the original brands and sell fake products without any fear. Although these big platforms have taken necessary steps to prevent this problem but it couldn't stop these issues completely. The concerning problem is the mismanagement of supply chain which provides a way for the illegal people to exploit the vulnerabilities of this system. One more problem which is arising because of the malpractices of people i.e. some people buy the products in bulk so they get these products in relatively cheap prices and they sell it on the MRP [Maximum Retail Price] of the product. The issue here is only the seller is getting profited and the customer is not. So, our proposed system also aims to tackle this problem.

II. LITERATURE SURVEY

There is a lot of scope in this area and many systems/solutions have been proposed to tackle this problem. In the project proposed in paper "Detection of Counterfeit Products using Blockchain" [1], the main idea behind de- tection of fake products is going through the entire supply chain history of the product. But it is much sophisticated to understand the transactions history table and get idea about the products authenticity. Also the drawback is that in the case where the product is original but its supply chain is little disoriented, the system will deduce the product to be a fake though it is not. Also the QR can easily be copied on to the counterfeit product. This case has not

been handled in this system. Another system is "Identifying Counterfeit Products using Blockchain Technology" [3] which works on the concept of transfer of ownership of products from one stakeholder to another. By scanning the QR code generated by the DApp for each product connected to the Blockchain, the consumer may confirm the product supply chain history and other vital details. But same as above the QR could be manipulated. As the result after scanning of QR shows the original supply chain, the system gives feedback as genuine product though the original product belonging to that QR is already been sold. The product once sold doesn't modify anything onto the Blockchain, thus allowing malpractices to take place just by using one unique product to sell hundreds of counterfeit products using same QR. One more existing project is "A Block chain-Based Application System for Product Anti- Counterfeiting" [2], uses the digital signatures to verify the identities of the stakeholders, but this system is more focused on validation of the seller and buyer rather than the product been exchanged. It uses digital signature to verify the identity of entities taking part in the supply chain. It assumes that the product as genuine as long as the persons exchanging the product is genuine. But this is not always the case; counterfeit products can be easily introduced along the transactions taking place.

III. BLOCKCHAIN

The blockchain is most simply described as a distributed immutable ledger technology that allows for the recording, upkeep, and sharing of knowledge by a community. The term 'blockchain' was coined from its form, i.e. block and chain; individual blocks connected together in a series to form the chain. It is a brand-new kind of database with digital transaction records. It is not under the authority of any person or organisation, and none of them has the power to go back and alter a transaction history. For the network's users, decentralized ledger technology comes up with transparency, security and immutability. Due to the

distributed nature of blockchain technology, it is very hard to compromise or attack the system. Blockchain is a tamper-proof technology as a result. The blockchain technology prevents the modification or deletion of any already completed transactions. Therefore, it offers all previous transactions transparency and immutability. "Blockchains are distributed, not centralised; open, not hidden; inclusive, not exclusive; immutable, not alterable; and safe, in contrast to the Web or Internet alone. Blockchain provides us with unprecedented ability to produce and exchange value in society".

Blockchain technology combines a variety of other tech- nologies, including consensus processes, node-to-node net- works, smart proofs, and encryption, to produce a new database. Additionally, it records the time, date, participant information, and any additional judicial or contractual facets of the transaction. Cryptocurrencies like Bitcoin and Ethereum are primarily powered by the blockchain technology, which makes digital trading secure through time-stamping and dis- tributing the verification of transaction records [7].
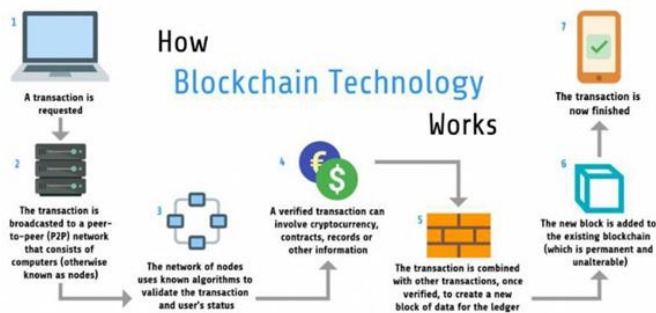
A. Working of Blockchain

Fig. 1. Working of Blockchain [9].

Generally, a block on a blockchain is made up of these three components : data, a hash, and the hash of the block that came before it. Each block's cryptographic hash also contains the last block to stay linked to the chain. Blockchain's fundamental unit is the block. A block is a grouping of data or information in the blockchain. By joining the block on the blockchain

with other blocks in chronological sequence, A chain of linked blocks is created after the block receives additional information. As a result, it creates a database of transactions that is shared among many network peers, or computers or servers. The miners choose a unique number called Nonce that is added to a hashed or encrypted block and can only be used once to resolve a cryptographic issue and produce the chain's next block. It is known as Evidence of Work.

A hash is a special code or number in alphanumeric form that is created whenever a transaction occurs in the blockchain. The basis of a hash is a timestamp, its own data, and a hash of the previous one. Every transaction that takes place on the blockchain is recorded in a block, which must first be validated before it can be added to the chain (see Figure 1). The authenticity of a block must be validated by the majority of nodes (clients or servers) and the nodes with the highest stack in the chain of the distributed network before it is added to the chain. A hash, or distinctive identification code, is produced after the block has been validated. By doing this, we can validate and conduct transactions without the interference of a third party. Block header hash, block height, and block number can all be used to identify a block. The hash function, a computer technique, is used to identify the data in the blocks. This feature makes the data unchangeable and locks it so that only Blockchain participants may access it. Each block has a unique hashing algorithm. The data is permanently recorded and unchangeable on Blockchain. It can be altered slightly to a new block to be added to the chain. Blockchain works like a time-stamped digital notary to guard against information alteration.

B. Metamask

Metamask is a browser extension, it acts as a wallet to do the transaction on ethereum blockchain. Each functionality on a blockchain is treated as a transaction and each transaction has address and amount associated with it. Metamask wallet provides a place where all the address and balance associated with it can

be managed easily to avail ease in doing transac- tions and thus working on a Dapp [8].

IV. PROPOSED SYSTEM

The proposed system will aim to tackle all the three prob- lems including supply chain management, preventing counter- feiting of products and selling the product as specified by the manufacturer.

The high level architecture of the proposed system includes mainly three stakeholders namely, the Manufacturer, the Mid- dlemen and the Customer. The system will leverage the features of Blockchain technology to create and maintain a supply chain history for every product.
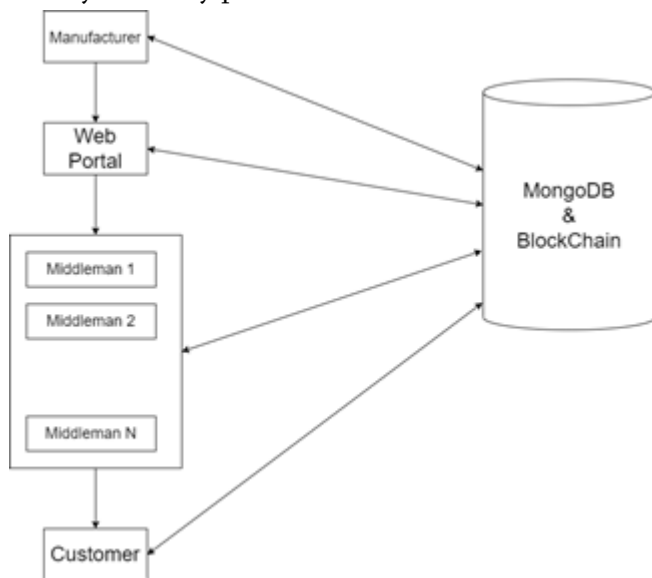

Fig. 2. High level system architecture.

The workflow of the system will be, the Manufacturer will add the product to the portal by specifying the necessary details including how the product should be sold and the next bearer of the product. This will create a unique ID and a QR code for that individual product which will be applied on the product. When the product reaches its next specified bearer i.e. the first middleman in the chain, then the middleman will scan the QR code and the system will validate product's acceptance by adding new block to the Blockchain. Now, this middleman can specify the next bearer of this product through its dashboard. So, this process

continues till it reaches the last middleman in the chain. When the last middleman receives the product he/she will scan the QR and the system will validate its acceptance by adding new block to the Blockchain. Now, this person will hand over the product to the customer. The customer can now scan the QR code to get the complete details of the product including the supply chain history, how the product is expected to be sold and genuineness of the product.

A. Manufacturer

The manufacturer will be the entity responsible for the pro- duction of the genuine product. The Manufacturer will login to the system with its Metamask wallet. The Manufacturer can add the product and also track the supply chain of the product. The customer can add the product to the system by specifying product name, description, price, date of manufacturing, date of expiry, location of manufacturing, mode of sales(individual or in pack), next bearer of the product. After that a unique ID and a QR code will be generated by the system for that individual product and the QR code will be applied to the product physically. A new block for this product will be created which will include all the above mentioned details and along will the details of the Manufacturer. From now on, the progress of the product's supply chain will also be visible to the manufacturer.

B. Middlemen

The middlemen are a group of people bridging the gap between the manufacturer and the end customer. When a middleman receives a product from the previous entity, he/she logs in to the system with the Metamask wallet and scans the QR code, the system validates the specified middleman in the block and the credentials of this middleman. If it matches then it will be verified and then this middleman can now specify the next bearer of this product. A new block will be added to the chain of this product which will include the name and location of this middleman and the name

of the next specified bearer of the product. This process continues till it reaches the last middleman in the supply chain.

C. Customer

The customer is the actual consumer of the product and he/she is interested in verifying the genuineness of the product, know the supply chain history of the product and the product's actual details. When the product reaches the last middleman in the chain, it handovers the product to the customer and now the QR code gets invalidated i.e. new blocks cannot be added to it now. The customer scans the QR code and he/she can verify the person and location specified in the details is the same with actual location and person. If it matches then the product has come from a legitimate supply chain and the product is genuine. He/she will also verify the selling guidelines of the manufacturer and also the dates of manufacturing and expiry, etc. All these details will help to the user to have the confidence that the product is genuine.

V. CONCLUSION

The proposed system will be able to counter the major prob- lems in the existing systems and successfully avoid/prevent the counterfeiting of products. The whole system will be based on Ethereum Blockchain technology and MERN stack for the development of web portal and all the required interfaces. The smart contracts will be developed using the Solidity. A Metamask wallet will be required by all the stakeholders in the ecosystem for accessing the system. The customer or end user will not require any credentials to access the details of the product. He/she will only be required to scan the QR code to get all the details of the product on the web portal. In the future scope of this project, it can be integrated with the company's website as well. This system will prove to be effective and efficient to decrease the product counterfeiting and hence increase the consumption of genuine quality product from legitimate brands. This will be beneficial for the consumers, the brands and for the well of the society.

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