A Block Chain based Management System for Detecting Counterfeit Product in Supply Chain

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Abstract - **In recent years, Counterfeit goods play a vital role in product manufacturing industries. This Phenomenon affects the sales and profit of the companies. To ensure the identification of real products throughout the supply chain, a functional block chain technology used for preventing product counterfeiting. By using a block chain technology, consumers do not need to rely on the trusted third parties to know the source of the purchased product safely. Any application that uses block chain technology as a basic framework ensures that the data content is 'tamper-resistant'. In view of the fact that a block chain is the decentralized, distributed and digital ledger that stores transactional records known as blocks of the public in several databases known as chain across many networks. Therefore, any involved block cannot be changed in advance, without changing all subsequent block. In this paper, counterfeit products are detected using barcode reader, where a barcode of the product linked to a Block Chain Based Management (BCBM) system. So the proposed system may be used to store product details and unique code of that product as blocks in database. It collects the unique code from the customer and compares the code against entries in block chain database. If the code matches, it will give notification to the customer, otherwise it gets information from the customer about where they bought the product to detect counterfeit product manufacturer.**

Keywords - Block chain; Traceability; Counterfeit products; Supply chain; Security.

I. INTRODUCTION

A *block chain technology* is a digital ledger of record of transactions, which based on decentralized network (Fig.1) in a peer-to-peer network around the world [7] .Block chain, is focussed primarily online transactions and disseminated digital ledger system.
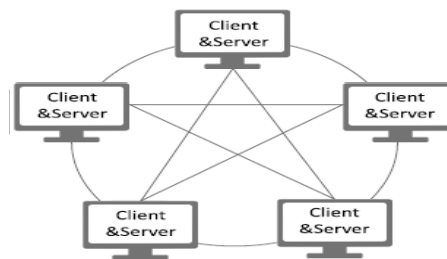

Fig. 1 Decentralized network

Block chains consist of blocks or data records and each block is linked to the next block in an irreversible chain [8] and the transactions are gathered as a block –hence the term "block chain". While comparing with traditional centralized database, the information cannot be handled due to block chain's feature of distributed nature and confirmed guarantees by the peers. If someone wants to perform a transaction, it goes to the network directly and algorithms find the authenticity of the transaction. After the transaction is verified, the new one is linked with the previous transaction forming a chain of transactions. This chain is called the block chain.

The agreement between two people in the form of a computer code is called as *Smart Contract.* They run on the *block chain*, so they are stored on a public database

and cannot be changed [9]. The combination of block chain technology and smart contract gives more flexibility to design, develop and implement in real-time with minimum cost. Block chain-based smart contracts provide number of advantages: they are quick and real-time refurbish, minimum cost and lower risk in execution, no intermediaries and high accuracy. More sensitive business areas such as supply chain [11], IoT (Internet of Things) [15] and banking [13] are deployed as permissioned smart contracts [14].

II. PRELIMINARIES

A. Block Chain Technology in Supply Chain

The supply chain management system consists of several stages and various sectors of applications in supply chain. Block chain system makes supply chain sector more reliable [9]. Authors proposed POM (Product Ownership Management) system [1], which makes the effort of counterfeiters to duplicate of real product since they cannot prove the possession of products on this system. Then they introduced a protocol that enables each stage of supply chain to transfer and prove the ownership of RFID (Radio Frequency Identification) tag, which allows users to automatically and uniquely identify the products and track inventory.

Nowadays, small-sized enterprises often have financial burdens, which never compare with large companies with strong financial resources. In the brand management sector, small-sized enterprises will unavoidably need to reduce costs and will be most likely unable to prevent counterfeited goods. To ensure the identification and traceability of real products throughout the supply chain, the paper is to propose a block chain management system to prevent product counterfeiting and Product Authentication Using QR (Quick Response) Code [2] by manufacturer. QR codes provide a robust mechanism for combating counterfeit practice with products. Encrypted QR codes are mainly used in security and proprietary applications. Benefits of block chain in the supply chain are increasing transparency, scalability, providing security and increasing innovative technologies

[10]. Block Chain Technology provides secure business operations in logistics [11] and reduces added costs, human errors and time delays.

B. Background Study and Related Work

They proposed the POM [1] system, which tries to copy the real products of counterfeiters because they cannot prove the existence of products in this system. If the seller does not possess their ownership, consumers can reject the purchase of counterfeit products even with a genuine product code. This technique can discover several fake products such an approach is vulnerable against identical tags. Once the attacker copies the RFID tags attached to the authentic product, and then this counterfeit duplicate label is inserted in the supply chain.

Author proposed a decentralized Block chain technology [3] approach to make sure that users do not trust on the sellers to find if products are real. Therefore, manufacturer can use this system to provide real products without managing the stores, which operated directly. It can considerably reduce the cost and product quality assurance. The system can effectively lower the threshold of the genuine products and provide with limited financial resources to the companies. It is also an easier approach to provide consumers with the confidence that they will not purchase fake products. However, there is no code simplicity and redundancy.

Authors have proposed an anti-counterfeiting scheme based on RFID [4], which is used to detect fake products at the time of purchase by a consumer. In this system, they proposed to use lightweight and low-cost tag used for deployment in large-scale industry. There is no option for product return scenarios, security verification and applications to test. In this paper, they proposed an open architecture product to trace the genuineness and quality of products, and to manage the internet-based credit of manufacturing using chemical among various builders. The method of that signature is to represent the special characteristics of personalized products.

The maker chain decentralized application (DApp) used to reveal the approach through which piece of makers can self-organizing themselves around

customized demands [5]. It incorporates a low-cost and easy implementing chemical signature twinning with QR code to improve security and prevent fake products. Distributed manufacturing prototypes and mass personalization are not yet widely practiced on a large-scale environment.

In this paper, they proposed the block supply-chain based new decentralized supply chain [6] that finds attack on fake products using Near Field Communication (NFC) technologies and block chain. The block supply chain has product tracking and traceability technology and detects attacks of moderation, replication and re-application of tags. For this chain, they introduced a new scalable and secure protocol. It is very efficient and robust for large networks. It will be suitable choice for large block chains that require total centralization. The number of is static, which is an element of knowledge that can be overridden by an opponent. Still, there are some shortcomings in supply chain. Authors proposed a paper to analyse trust issues and resolving problems in supply chain using validation [12].

III. PROPOSED FRAMEWORK

In this proposed framework, we have proposed a blockchain based management (BCBM) system that will find counterfeit products in supply chain.

A. METHODOLOGY FOR PROPOSED WORK

In this architecture fig. 2, we can understand that the system will detect counterfeit products using barcode reader, where a barcode of the product is tied to a block chain system so that you can scan the barcode using your smart phone, It will notify you whether the product is fake or not.
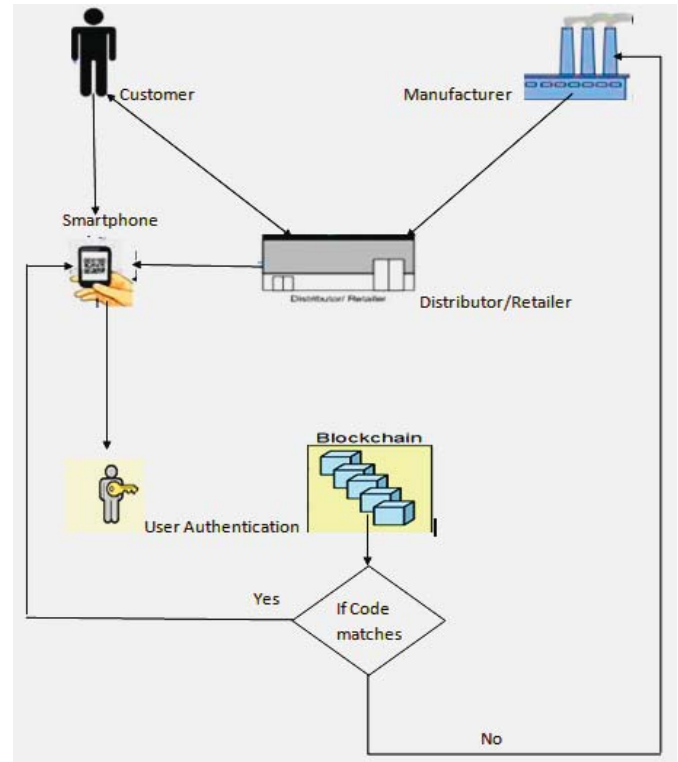

Fig. 2 work flow of proposed work

B. SYSTEM ARCHITECTURE

In this system architecture fig.3, Customer has to register/login to their website before scanning the QR code of the product. After the completion of authentication process, a unique code from the customer will compare the code against entries in block chain database.
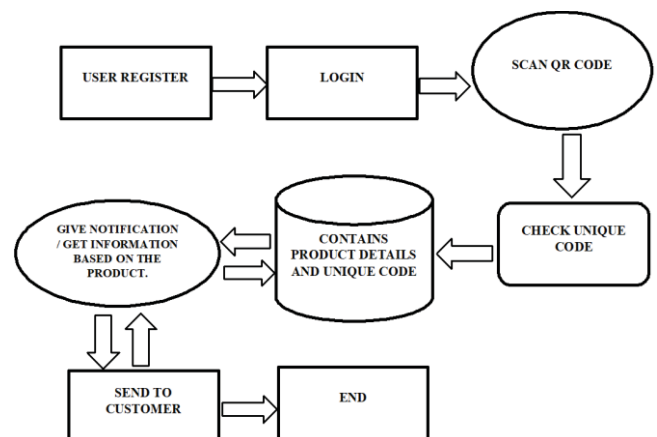

Fig. 3 proposed system architecture

If it matches, notification is given to the customer that it is not a fake product. Otherwise, it gets information from the customer about where they bought the product to detect counterfeit product manufacturer.

C. MODULES AND DESCRIPTIONS

Manufacturer

A manufacturer is a person or company that produces finished goods from raw materials using a variety of tools, equipment and processes and then sells the products to consumers, wholesalers, distributors, retailers or other manufacturers for the manufacturing process. They will manufacture the product with details such as product name, location, timestamp, ingredients, and usage details. Manufacturer generates an encrypted QR code which cannot be reused by the manufacturer for different product and attaches the transaction to the block chain-based management system.

Smartphone

It helps customer to scan the product using QR code scanner. Therefore, customer itself can detect counterfeit products. It also helps them to raise complaint against real manufacturer.

QR (Quick Response) code

A barcode is a label that contains information about the item to which is attached. QR codes are using as an anti-counterfeiting element to help consumer to identify whether the product is real or fake.

User Authentication

If the user wants to check their product, they can go to the corresponding product's website. In that website, user will be authenticated if they have registered. If the user is willing to scan QR code of the product, it collects the unique code from the customer and compares the code against entries in block chain database. If the code matches, it will give notification to the customer, otherwise it gets information from the customer about where they bought the product to detect counterfeit product manufacturer. The QR code consist the details of product which is manufactured by manufacturer. The transaction between manufacturer and consumer is secure and tempered-resistant. Each transaction of block in block chain will contain a unique QR code, which cannot be reused by the manufacturer for different product.

Technology	Supported Analysis			
	prediction	*real-time*	*belief*	*safety*
QR Code	1	1	1	3
Watermarking	3	3	3	3
RFID	3	3	2	1
Mobile phone	3	2	1	2

Block Chain Based Management (BCBM) System

Blockchain based management (BCBM) system may be used to store product details and unique code of that product as blocks in database. Illegitimate participant can't get access to the block of transaction. If any participants want details of product, then public key must be shared by that participant to the manufacturer. Manufacturers encrypt the QR code and send back to the participant. The QR code will be decrypted by the valid participant by their private key.

IV. ANALYSIS & CHALLENGES

A. DATA ANALYSIS OVER TECHNOLOGIES

Different analysis can be performed on fake product detection technologies, including prediction, real-time, belief and safety (see Table I).

Prediction

Prediction is a statement about the future. This analysis will generate prediction about future using emerging technologies.

Real-time

If the relevant data is available in the system, the data will be processed, analysed and distributed immediately.

TABLE I

Belief

This analysis used to find that whether the technology is trustworthy or not based on the levels.

Safety

It protects and provides security over the product against counterfeits.

B. CHALLENGES IN COUNTERFEIT PRODUCT REVIEW DETECTION

1) Counterfeiting is one of the biggest challenges to the genuine products. It will create a loss in income and also damage the brand name of the company.

2) Sometimes it is found that vendors are getting compensation with websites that promote their products to give discounts and improve the value of the product through fake reviews.

3) There is a knowledge lacking about the counterfeit product, so customer cannot able to distinguish real and fake products.

V. CONCLUSION

Nowadays, counterfeit products are growing exponentially in online and black-market. The block market is a biggest challenge in supply chain. The government has introduced several laws and regulations against fake products even though the government cannot control counterfeit products. Therefore, there is a need of an approach for detecting counterfeit products and providing security techniques to alert both manufacturer and consumer in supply chain. Manufacturers may use the block chain management system to store relevant product sales information within the block chain, which is accessible to all. The total number of sales the seller can sell and the rest left behind by the seller are transparent. The user can perform vendor-side verification using an encryption algorithm. Only way to decrypt is to use a private key of the owner. In this paper, we proposed block chain management system activates the consumer and enterprise vendor to track and identify the real product using a Smartphone. It also will detect counterfeit products as well as authenticity of manufacturer for both end user and enterprise vendor.

VI. FUTURE WORK

The block chain technology has a big efficiency for enhancement and application in the logistics and supply chain. This decentralized technology may be useful for all applications and economic strengthening will be the future challenging one for securing counterfeits in supply chain.

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