Detection of Counterfeit Goods Using Blockchain

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ABSTRACT

Counterfeit products are a serious problem in today's world, as it is not possible to actually distinguish between genuine products and counterfeit products. Others simply manufacture these counterfeit products to make a profit without considering the impact on the user, which also affects the company name, profits, and sales. The anti-counterfeiting system that is being used are mostly centralized. Blockchain technology can be used to detect whether a product is genuine or fake and guarantee the authenticity of the product to the user. Blockchain is a trending technology and many applications use it. Blockchain technology is a technology in which information is stored in blocks in many databases connected to the chain and does not require the consent of a third-party user to gain access. The advantage of blockchain is that it is immutable and safe and decentralized. You can use a QR code (quick response) or a unique encrypted code. This is very important and efficient technology for detecting counterfeit products. Scan the QR code or enter a unique code to go to the blockchain containing the product information and provide manufacturer details and owner information to help buyers decide whether to buy the product.

Keywords: *counterfeit products, anti-counterfeiting system, blockchain technology, QR Code.*

1. INTRODUCTION

1.1 Motivation

Fake products create a huge negative impact in the market for both buyers and sellers. 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 These products can be really dangerous if we consider very dominating sectors of market like pharmaceutical and food. 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 affecting the consumer.

1.2 Blockchain Technology

Blockchain is a distributed ledger that keeps a record of transactions and manages them over a peer-to-peer network. The idea of blockchain was first proposed in 2009 when Satoshi Nakamoto presented the concept of cryptocurrencies. It's a digital cash system. Blockchain is called decentralized because there is no centralized authority or database to manage the blockchain. Because you have a peer-to-peer network that connects multiple nodes in your network, your data is distributed throughout your network and there is no central server with all the information. Therefore, hacking or accessing the blockchain becomes very difficult because the network is distributed and there is no single source for its operation.

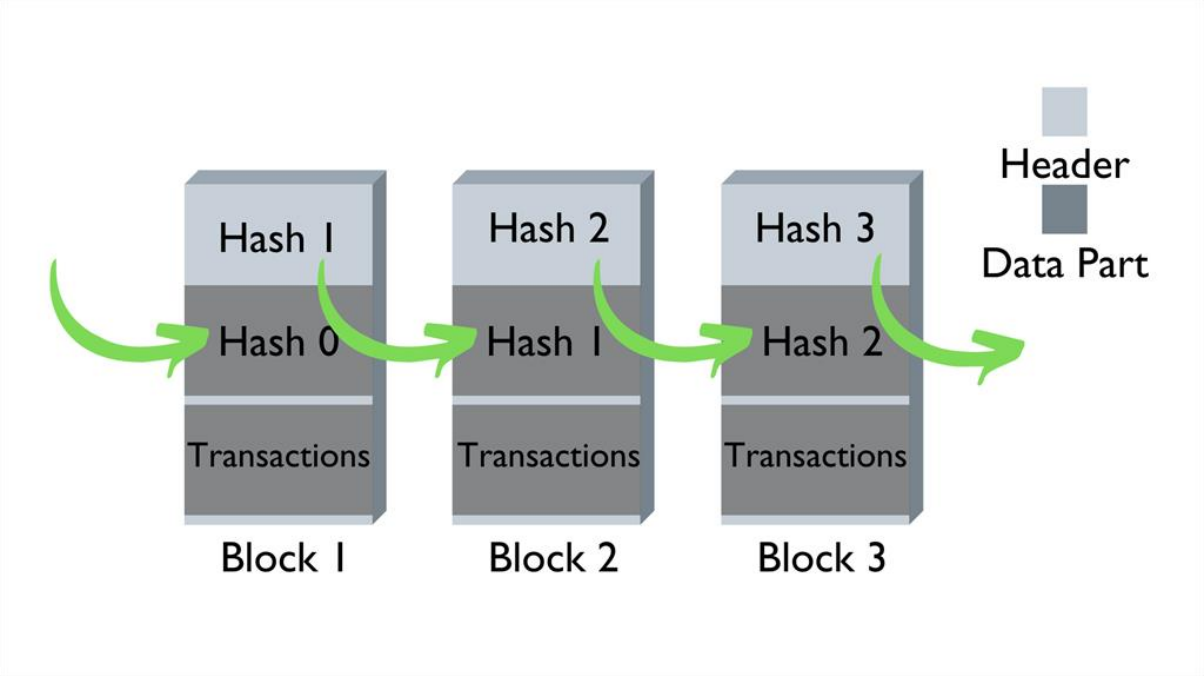


Figure 1: Structure of block in a blockchain

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 through strong hashing algorithms like SHA256. 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.

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.

1.3 Consensus Algorithms

The consensus algorithm is the process by which all peers in a blockchain network reach a common consensus on the current state of the distributed ledger. In this way, the consensus algorithm realizes the reliability of the blockchain network and establishes the trust between unknown peers in a distributed computing environment. Basically, the consensus protocol ensures that the new block added to the blockchain is the only version of the truth agreed upon by all the nodes on the blockchain. The blockchain consensus protocol consists of specific goals such as consensus, collaboration, cooperation, equality of all nodes, and mandatory participation of all nodes in the consensus process. Therefore, the consensus algorithm aims to find a common consensus that will win the entire network. Some of the consensus algorithms are – Proof of Work (PoW), Proof of Stake (PoS), Proof of Capacity (PoC), Proof of Elapsed Time (PoET), Practical Byzantine Fault Tolerance (PBZT), etc.

1.4 Smart Contracts

Smart contracts are computer programs that run when certain criteria are met. These smart contracts essentially eliminate the need for third-party participants or any middleman in any type of traditional contract labour or agreement, resulting in a result that is instantaneous and with no time lost. In addition, the workflow is automated, making the procedure easier. When smart contracts finish their actions, the transaction record is updated on the blockchain. It is impossible to modify transactions once they have been recorded on the blockchain. Because smart contracts are a collection of programs that set specific conditions, they can be used for various actions such as transactions, renting a house, issuing tickets, and so on.

2. LITERATURE REVIEW

We present here a table of different literature on blockchain technology in different marketplaces.

Marketplace	Article	Blockchain Used	Aim	Advantages	Disadvantages	Applications
Supply Chain Management (SCM)	[1]	Public	Thematic analysis of blockchain based agri-food SCM	New opportunities and environment consideration	Data collected through secondary sources	Hyperledger, Electron React, RabbitMQ react, Charma-Way, X-Road
	[2]	Public/Private	Robust drug recalling SCM system	Monitoring drug with safety and transparency	Limited to domestic business	
	[3]	Public/Private	Blockchain-driven SCM with RFID integration	Understanding resource use, industry network, etc.	Lack of technological awareness of BCT to leverage it for CSCM	
	[4]	Public	Challenges of blockchain in German OEMs	aggregating product information	Too many prerequisites to start the application	
Healthcare	[5]	Private	Privacy preservation of IoT healthcare	secure data collaboration for the IoT environment	only relying on the protocol	Hyperledger, Electron React, RabbitMQ react, Charma-Way, X-Road
	[6]	Public	Survey on data minimization techniques	Comparative analysis of privacy properties	Further works and researches are required	
	[7]	Public/Private	Use of blockchain in healthcare industry	Covered many aspects of uses in healthcare	Openness, confidentiality, speed, and scalability related issues	
	[8]	Public	blockchain-based solution for the protection of cloud-outsourced healthcare data.	reduced computational complexity, security, and privacy protection	Further works and researches are required to provide a better solution	
Food Safety	[9]	Public	Blockchain as a tool to sustainability in food chain supply	Finding displayed with potential and resistance	Findings based on a small dataset, no distinction in the types of food supply chain	Hyperledger, Electron React, RabbitMQ react, Charma-Way, X-Road

Marketplace	Article	Blockchain Used	Aim	Advantages	Disadvantages	Applications
Food Safety	[10]	Public/Private	To improve the agriculture food supply chain system	integrity, security, and traceability of data and lowered corruption	Further works and researches are required to provide a better solution	Hyperledger, Electron React, RabbitMQ react, Charma-Way, X-Road
	[11]	Public/Private	Overview of adoption and policy of blockchain in agri-food industry	Ideas to eliminate some of the problems that faced while execution	Small scalability is considered.	
	[12]	Public/Private	Traceability System for Food Supply Chain	Security, decentralized, RFID tags,	System model in research phase obly	
	[13]	Public/Private	Framework to monitor interaction between nodes	Customer satisfaction feedback, transaction is very well documented	electronic payments and proof of delivery not discussed	
Land	[14]	Private	Create land registry system through blockchain	Increased reliability, security and decentralized	Only a conceptual framework, not an actual application	Hyperledger, Electron React, RabbitMQ react, Charma-Way, X-Road
	[15]	Private	Step by step analysis of many kinds of literature	Explained shortcomings, the evolution of identity issues	user control and consent criteria are lacking in the approach	
	[16]	Private	smart land acquisition framework in view of Ghana's land acquisition challenges	Integrative review and SWOT analysis of the proposed framework	The study was limited due to a lack of literature. Further research and surveys required	
	[17]	Public	property registry management framework to overcome recent limitations	Improved Consensus algorithm, use of sidechain for storage and privacy	No generic blockchain architecture, need to reduce blockchain overhead	

Marketplace	Article	Blockchain Used	Aim	Advantages	Disadvantages	Applications
Finance	[18]	Public/Private	Investigate performance from blockchain to address the problem of adoption	Explored using network theory, outputs, and proof to prioritize blockchain	lack of access to an experienced expert	Hyperledger, Electron React, RabbitMQ react, Charma-Way, X-Road
	[19]	Private	blockchain-based healthcare consumer loan system	good security, time efficiency, secure and efficient information sharing	Only a demo, need further work for improvement	
	[20]	Public	The article examines how DLT influences the world of Islamic finance.	greater portability of products, services by enhancing the level of data authenticity recorded on the blockchain	fragmented and ill-organized body of substantive jurisprudence	
	[21]	Public/Private	applications of blockchain in radiology	Quantitative image analysis, security, authentication, and privacy control	limited experience of the final user, quite expensive and energy consuming	

Table 1: Literature analysis of different kinds of literature in blockchain

3. RESULTS

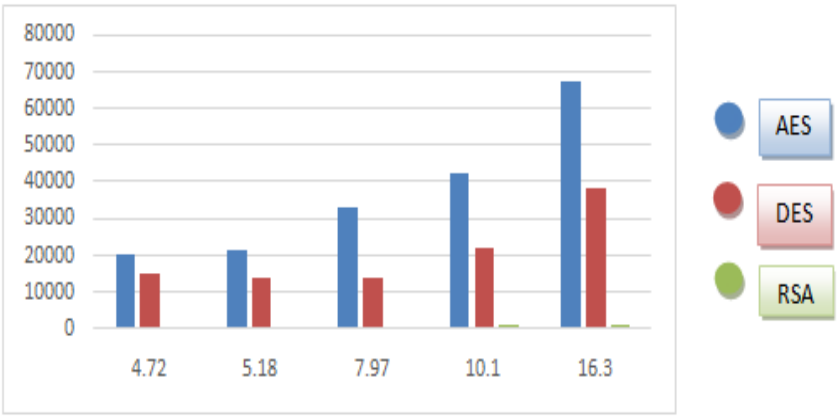
In this section, we will try to get the results to show the comparison between several algorithms in cryptographical, hashing, and consensus so that they can be used in the development of the prototype. The graph of all those results is shown.

3.1 Cryptographic Algorithms

Three different algorithms are chosen – RSA, DES and AES [22]. The corresponding results that are found are displayed. From the graph it becomes evident that AES outperforms the others making it the best in terms of memory utilization.

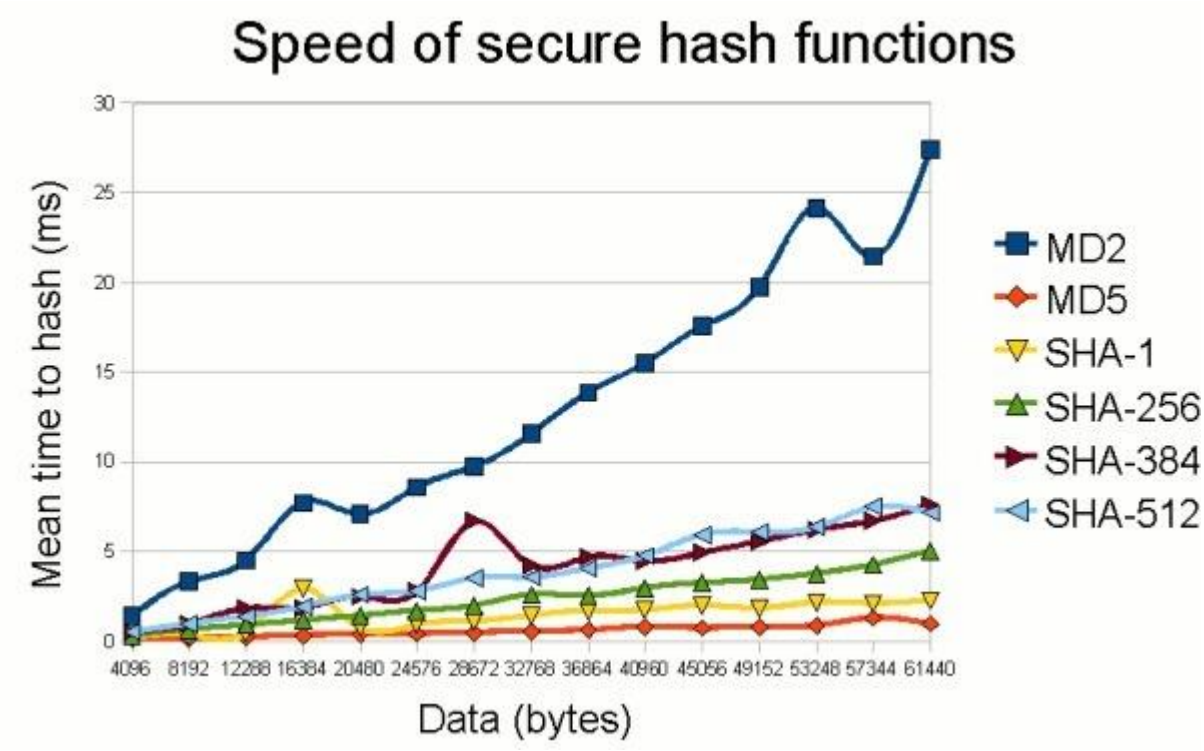
File sizes (bytes)	AES	DES	RSA
4.72	20316	14800	668
19732	8388		30405
5.18	21592	13920	548
21592	8868		843146
7.97	33020	13856	768
33020	11724		52187
10.1	42068	21984	845
42068	13988		67890
16.3	67320	38368	1078
67320	20316		81241

Table 2: Memory utilization values



3.2 Hashing Algorithms

In this section a comparison among some of the famous hashing algorithms are provided in the form of a graph [24].



Graph 2: Comparison of speed of different hashing algorithms

The graph proves that for a tiny chunk of data, there is no such difference in speed of the hashing algorithms but this changes when the size of the data set is increased, showing a sudden rise in the average time to hash of MD2. MD5 remains the best hashing algorithm in terms of speed.

The output of some of that interval has been provided below

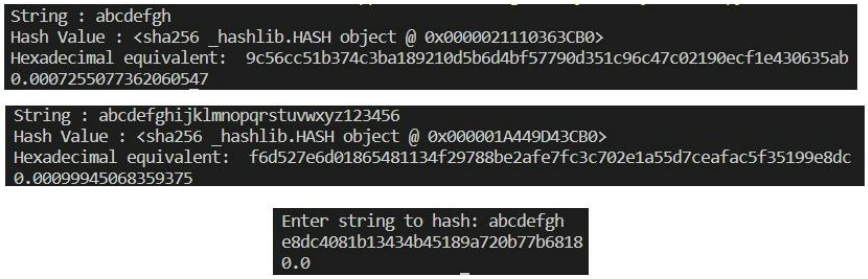


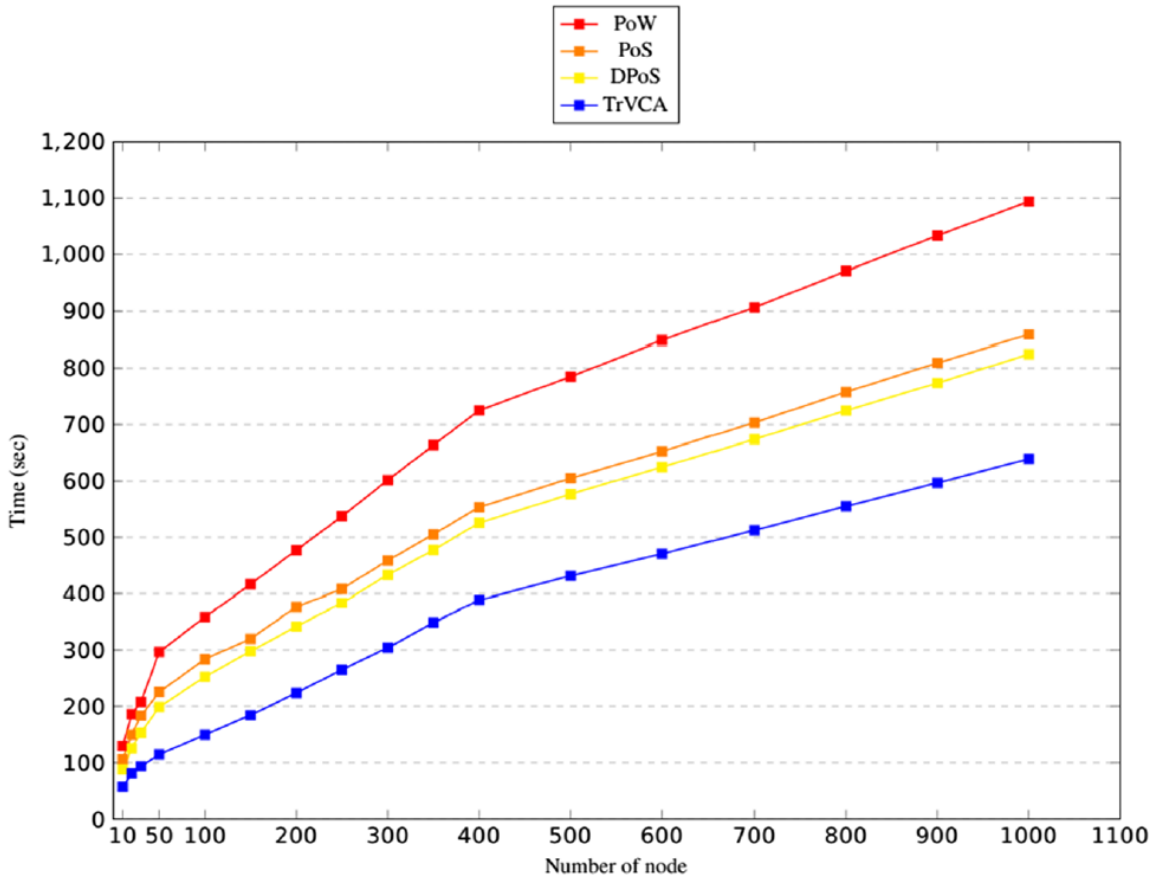
Fig 2: Output of compilation time of SHA256

3.3 Consensus Algorithm

A comparison of different consensus algorithms namely POW, POS, DPOS, and Trust Value based consensus algorithm [23] is given.

S. No.	No. of Node (N)	PoW	PoS	DPoS	TrVCA
1	10	129.8	106.2	88.3	**57.1**
2	20	186.2	149.6	125.6	**80.4**
3	30	207.6	183.4	153.2	**93.4**
4	50	296.4	225.3	198.7	**114.5**
5	100	358.2	283.7	252.4	**149.6**
6	150	416.6	319.6	297.6	**184.3**
7	200	476.9	376.3	341.3	**223.6**
8	250	537.3	408.4	383.6	**265.1**
9	300	601.6	458.7	433.2	**303.7**
10	350	663.7	505.3	477.4	**348.2**
11	400	725.1	553.5	525.5	**388.6**
12	500	784.9	604.8	576.9	**431.4**
13	600	848.6	652.7	624.8	**470.6**
14	700	906.5	703.5	674	**512.5**
15	800	970.7	757.7	724.8	**555.1**
16	900	1033.2	809.3	773.6	**596.8**
17	1000	1093.8	858.6	824.8	**639.3**

Table 3: Comparison of different consensus algorithms



Graph 3: Time comparison with increasing number of nodes

The graph shows make it all clear that the Trust Value based consensus algorithm takes the least time among all the other consensus algorithm.

4. CONCLUSION

Blockchain technology is known for its security and anonymity, as well as the ease with which great information may be accessed thanks to its distributed network data processing. Blockchain has exploded in prominence in the financial world, and it falls under the fintech (finance and technology) umbrella. Because of its valuable characteristics, businesses have begun to adopt it at a rapid rate. Blockchain has been discovered to be an excellent tool for detecting bogus products and eliminating them from the supply chain or the retail sector. Users will be able to make better market decisions and trust the seller and manufacturer as a result of this. They won't have to rely on a third party to check the product's validity, making for a more pleasant and risk-free encounter. It will also assist manufacturing companies in being less concerned about counterfeit products on the market, allowing them to focus more on consumer input to improve their

services. It would also help them avoid financial losses by allowing them to quickly track the goods they have launched on the market.

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