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An Immutable Data Storage using Algorand Blockchain (ABC) Consensus Mechanism in the Supply CHAIN

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Abstract: *In recent years, many frameworks and applications have been proposed to ensure tamper resistant data in supply chain using Block chain technologies. Block chain technology as a base design ensures that the content of the information is 'tamper-resistant'. So far, no other study was presented with a low impact on the environment and minimum cost for each transaction sent by the supply chain. In order to protect the access of malicious user, we tend to propose an immutable data storage environment that is based on Algorand Blockchain. It uses the Pure Proof-of-Stake mechanism of consensus that needs less computational power, and is highly scalable and environmentally sustainable. It will make the data immutable and available in real-time for final consumers. Hence it can tolerate malicious users and achieving consensus without a central authority.*

Keywords: Block chain, Supply chain, Algorand Blockchain, Sustainability

I. INTRODUCTION

Supply chain could be a whole system of producing and delivering a product or service, from sourcing the raw materials to the last word delivery of the merchandise or service to complete users. Because of the centralized data, product authentication and traceability cannot be achieved. The revolution of supply chain relies on reliable and efficient data management [6], within which the knowledge collected from supply chains are presupposed to be stored, integrated, and retrieved with reliability and high efficiency. Due to these issues, people are heading towards the appliance of the block chain technology on Supply Chain. So far, there are some systems developed for particular supply chain applications, as an example, Food [5] and Agriculture [4] supply chain. Particularly, the large number of stakeholders results in scalability issue of the block chain network. In terms of the massive amount of data generated from the provision chain, the throughput of the system and also the latency of every single transaction should make sure to form the system more user-friendly. Blockchain offers an immutable transactions and access to distributed data in a decentralized network where suppliers and customers interact with each other [7].

II. LITERATURE REVIEW

2.1 Supply Chain Management with Block Chain

Supply chain management (SCM) is the integration of raw material, data, and financial flows in a network of companies or organisations. Multiple supply chain partners need to work together collaboratively to make and deliver products and services to the consumer. To achieve traceability, it is possible to enable data sharing between different groups without any anonymous user interaction [3]. In SCM, it is very difficult task to find the real products for the consumers. It would be interesting to explore the ways that a block chain network and other non-block chain- based markets could interact in fig.2.1. The traditional supply chain was fully depended on centralized system. But now it may be used based on distributed, decentralized and digital ledger i.e. Block chain technology [1].

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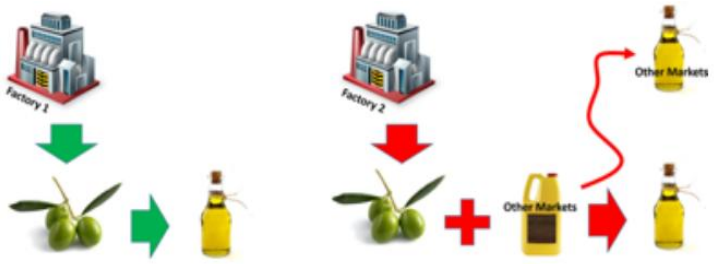

Figure 2.1: A fraud opportunity due to external markets not integrated into the block chain

A block in "block chain" refers to a set of transactions and verified by the other nodes in fig.2.2. The chain part refers to the combination of block transactions and the proof (a cryptographic hash).

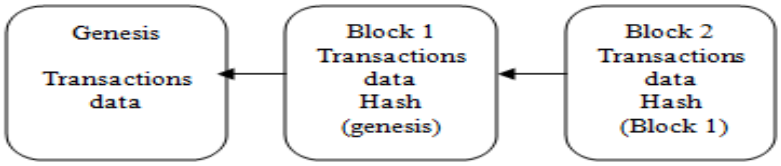

Figure 2.2: Blocks in Blockchain

In POM (Product Ownership Management) system [2], it 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.

2.2 Why Algorand Platform?

Algorand is an open source blockchain that is foundational, public and permission less pure proof-of-stake (PPoS) protocol. Several techniques to manage block-chain based ledgers have been proposed: proof of work [8], proof of stake [10] and practical Byzantine fault tolerance. The problem with several blockchain platforms is they sacrifice at least one of the key properties of security**,** scalability, and decentralization. These problems are solved by a new Pure Proof of Stake consensus protocol, which is the protocol that the Algorand blockchain uses [9]. Each blockchain has its own native currency that plays a critical role in incentivizing good network behaviour. The Algo also acts as a utility token. When you're building an application, you need Algos to pay transaction fees and to serve as minimum balance deposits if you want to store data on the blockchain.

III. SYSTEM ARCHITECTURE AND REQUIREMENTS

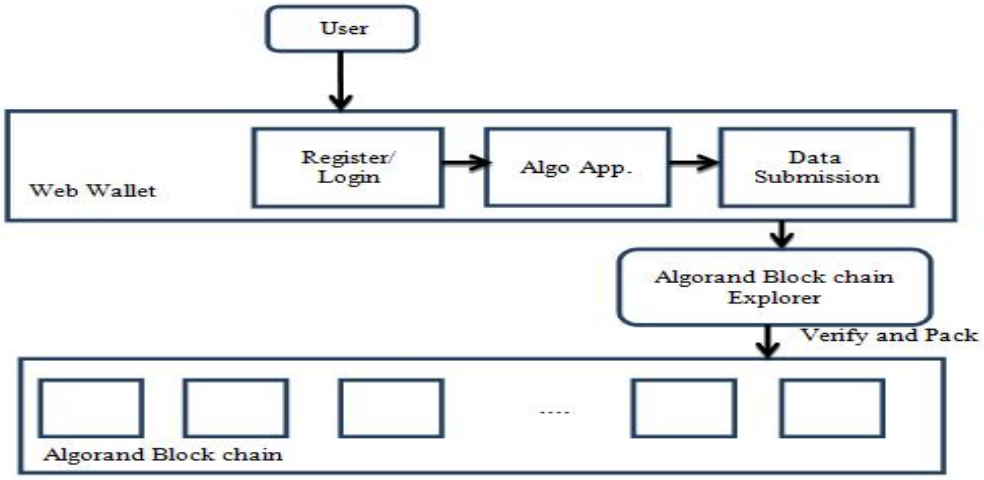

Figure 3.1: Functionality of storing data using Algorand Block chain

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Initially, a web wallet is created with Algorand Blockchain coins (also called "Algo") for supply chain operators. Algorand's native currency is called the Algo. If you hold Algos, you can register to participate in the process of proposing and voting on new blocks. We should login into the application and add as well as import an account for the web wallet. Finally an account has been created for the Algorand application. In particular, the data is encapsulated in JSON format to be sent to Algorand Blockchain as transactions. Each operator has its own wallet on Algorand, and the JSON generated is sent to a node in Block chain to guarantee the immutability of the data registered.

More specifically, once the product details are entered and the transaction is registered on the Blockchain. The blockchain is tamper proof so nobody can change the recorded data. The product id can be used in many ways of a product like QR code or Bar code which will have all the details from the blockchain explorer. We can able to check the transaction details on the Algorand portal ("Algo Explorer").

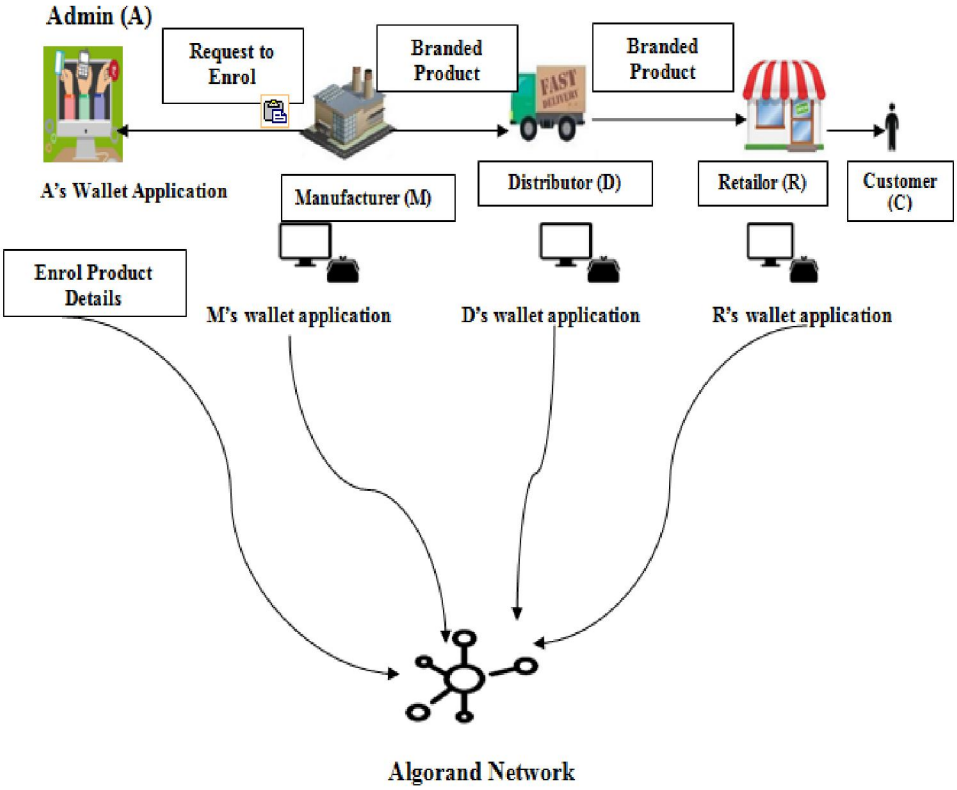

Figure 3.2: Block diagram of the proposed ABC network

Manufacturer (M) sends request for enrolling product details to Algorand network using wallet application. Since each component of a product is marked with a unique identification (UID) number and written into a QR code, customer(C) can check the product details easily. Manufacturer initiates the transaction to both distributor (D) and retailer(R). After receiving products, customer reads the tag and checks the genuineness. The Algorand blockchain is tamper proof so nobody can change the recorded data.

IV. COMPARISON BETWEEN BLOCKCHAIN PLATFORMS

The comparison of various blockchain platforms is as follows:

Block Chain Name & Symbol	Consensus Mechanism	Transactions Per Second (TPS)	Advantages
Bit coin (BTC)	Proof of work (PoW)	7	Accessibility and liquidity
Ethereum (ETH)	Proof of work	30	Fast and scalable
Binance Smart Chain (BNB)	Proof of Staked Authority	160	High Transaction speed
Algorand (ALGO)	Pure Proof of Stake.	1000	Speed, scalable and secure

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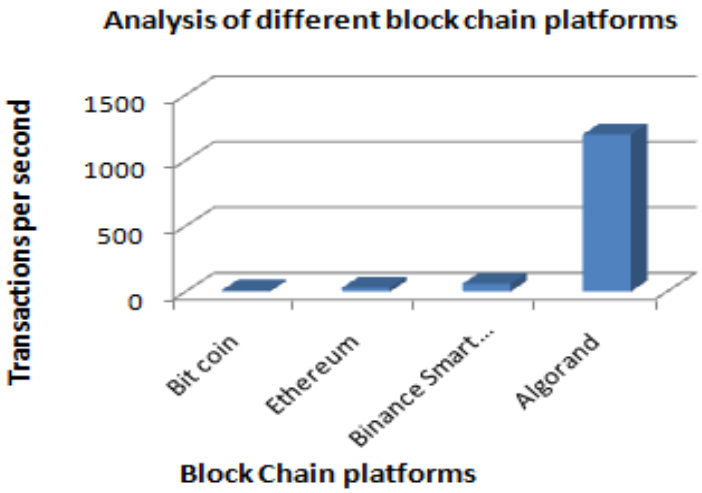

Figure 4.1: Comparison of different block chains

We have compared four blockchain platforms based on their transactions in fig.4.1. Parameters such as symbols, consensus mechanism, number of transactions, and advantages were used to compare between these four platforms.

V. SNAPSHOTS

With the web wallet, we are in control over our funds. So we can receive, send, store and exchange our cryptocurrency within the mobile interface.

5.1 Login

It helps users act directly with the Algorand blockchain whereas handling their own private keys by either storing them securely and encrypted in their native browser or by employing a Ledger hardware wallet. Since MyAlgo Wallet is a web wallet, we need to visit its official website to access the wallet. Password is used to confirm the ownership of the wallet and protect the information on it.

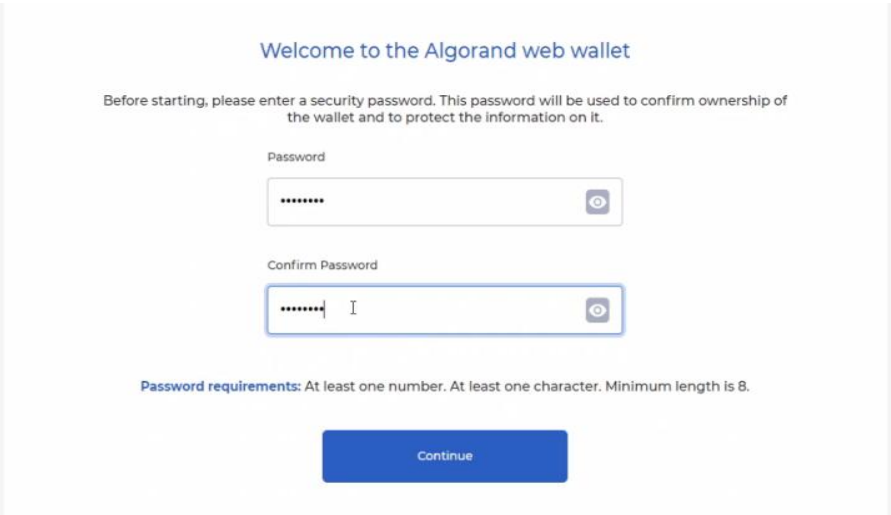

Figure 5.1: Algorand web wallet

5.2 MyAlgo Wallet

We can set now to send and receive ALGO tokens. While clicking on “Send” to send ALGO tokens and “Receive” to copy the deposit address. If we want to see the recent transfers, click on “*Transactions*” tab in the web page.

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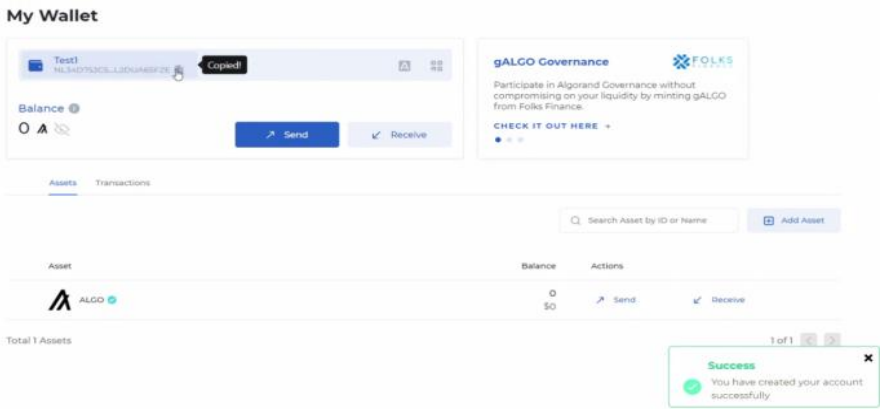

Figure 5.2: MyAlgo Wallet

5.3 Connection with Algorand Application

MyAlgo Wallet enables Algorand application to use web wallet to interact with the Algorand blockchain and users to access the applications in a private and secure manner.

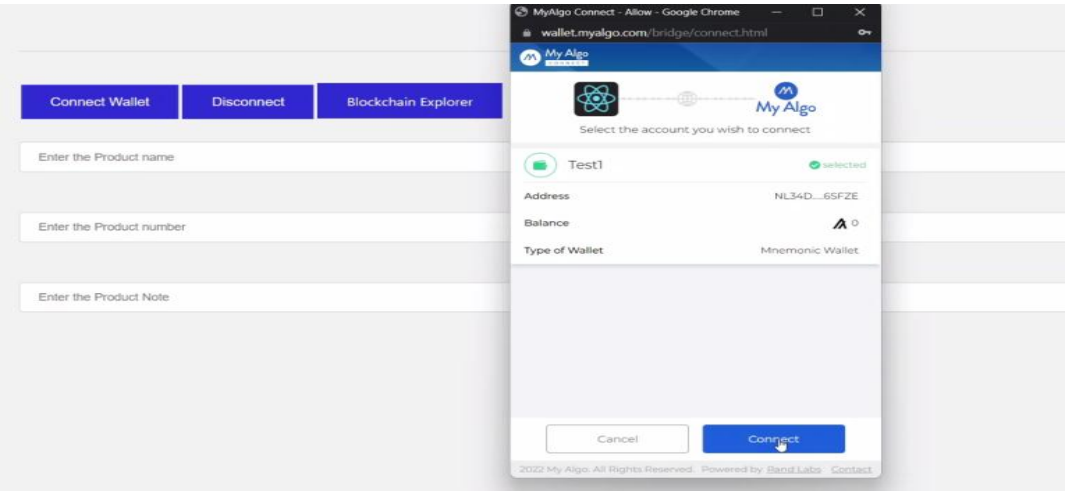

Figure 5.3: Algorand App.

5.4 *Connection with Blockchain*

The data is encapsulated and sent to Algorand Blockchain as transactions. Everyone has its own wallet on Algorand, and the JSON generated is sent to a node in Block chain to guarantee the immutability of the data registered.

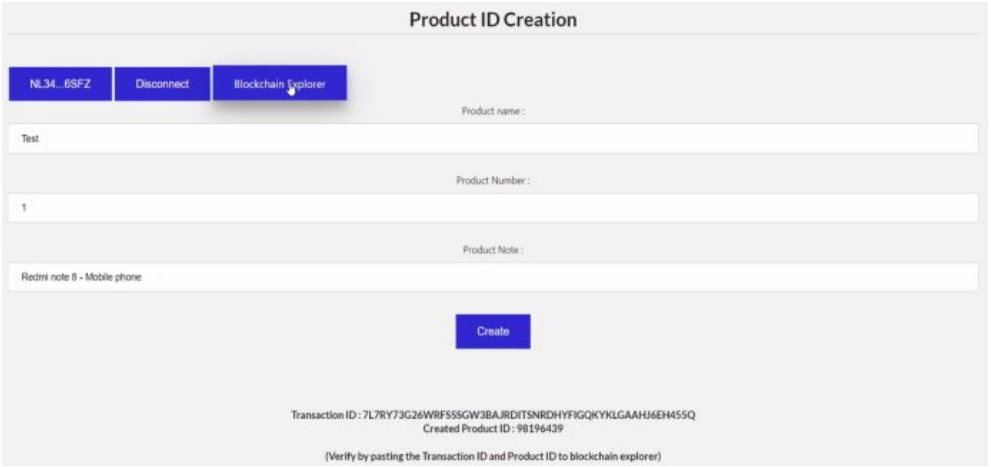

Figure 5.4: ID Creation

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5.5 Verification

Finally it will be verified with the help of AlgoExplorer. Also there was an asset id created. It provides a standardized, Layer-1 mechanism to represent any type of asset on the Algorand blockchain.

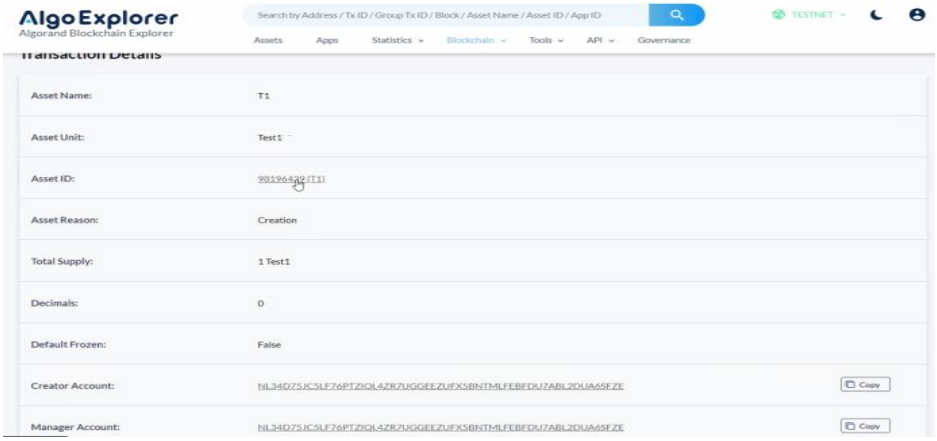

Figure 5.5: Verification Algorand Explorer

VI. CONCLUSION

In this paper, we have proposed a new Algorand blockchain that provides immutable data in the supply chain. We studied several blockchain platforms and also compared them with other blockchains. Among the all, we found that the Algorand is the suitable platform for storing immutable data in SCM. Especially when we are comparing with Ethereum platform, Algorand is a fast and scalable network that is suited for enhancing immutability in supply chain.

In the future work, we will consider traceability in supply chain and improve the entire real time system with secure manner.

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