Design of Decentralized Blockchain Framework to Authenticate A Product in Supplier Integration

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Abstract: Lately, blockchain has gotten expanding consideration and various applications have risen up out of this innovation. Blockchain is a chain of “blocks that stores data with digital” signatures in a decentralized, centralized and distributed network. Besides virtual currency, blockchain automation is utilized in financial applications and social welfare system and healthcare facilities. An eminent Blockchain system is the digital currency Bitcoin provides the authenticity of conditional document in the transaction. In this manner, any system utilizing Blockchain innovation as the foundation for engineering guarantees information is more secure. This article utilizes the distributed Blockchain innovation that guarantee that customers don't completely depend on the traders to decide whether items are authentic. We depict a decentralized Blockchain framework with items against duplicating, in that way suppliers can utilize this framework to give good, certifiable items without overseeing direct-run stores, which diminishes the expense of the item for quality confirmation.

Keywords: Blockchain, Authentication, Supplier integration, Forgery

I. INTRODUCTION

A. INSPIRATION

A Blockchain is an Openly available distributed ledger that stores transaction operations between the parties efficiently, well organized and in a verifiable and persistent way. The exchange of fake merchandise is developing and is influencing the deals and benefits of organizations influenced by this phenomenon. To guarantee the recognizable proof and recognizability of genuine items all through the logistics network, this paper presents a completely practical blockchain framework to stop item forging. Companies just need to pay low transfer costs, and they don't have to stress over the chance of getting fake items.

The associated anti forging technology is presented already, but still imperfect. For instance, in "Maker chain: A “blockchain with synthetic impression” for autonomous-resembling cycle in collective assembling"[1] introduces an anti-forging technique made out of compound mark to speak to remarkable highlights of customized items, and [2] presents another decentralized logistics network (block-flexibly) using blockchain and NFC innovations . Yet, these techniques actually can't forestall vendor offering fake items to customer. These days, small scale and medium scale enterprises (SMEs) regularly have budgetary strains, that can't be contrasted and enormous organizations with solid monetary assets. In the brand the executive’s area, SMEs will unavoidably need to lessen costs and will be in all probability incapable of implementing techniques which avoids duplicated products.

Here, we put forward idea to actualize a Blockchain design gave by Ethereum to register item proprietorship on the Blockchain. By utilizing properties of Blockchain like untrace capacity and transparency, and the affirmation that each information cannot duplicate on the Blockchain, customers do not have to completely depend on any mediator to recognize the origin of the item. This paper presents Small and medium scale Enterprises can execute anti-forging application framework and they are required to pay low transfer charges to accomplish secure and unforgeable fake product verification.

B. COMMITMENT

The organizations utilizing this framework can expand customers confidence on brands. Taking care of the issue of Small and medium scale enterprises, that can't bring up legitimately worked stores and couldn't help out enormous scope chain sellers. In an outline of our framework, it is expected to tackle the issue of brand hostile to duplicating confirmation, focusing on extending sales channels, and giving to little sellers the opportunity to demonstrate the wellspring of every part of the item.

The framework is established over Blockchain, and organizations which execute this framework will have to make a payment expected to build and change the agreement status. Utilizing completely unveiled shrewd agreement data, anybody can without much of a stretch demonstrate the genuine wellspring of the commerce and may likewise fill in as verification as the buyer's acquisition of products. For vendors, it is conceivable to demonstrate if they give veritable merchandise by utilizing this enemy of fake Blockchain framework and presently don't need to be worried about contending with fakes sold at low costs.

II. BACKGROUND

1. OVERVIEW OF THE BLOCKCHAIN

Blockchain is a localized platform. It refers to distributed maintain of document file as an authentic database such that there is no single party control over the over it. Blockchain work like a Public ledger and it ensures number of different aspects like Commitment, Consent, Reliability, Privacy and Bona fide. Initially blockchain was used largely on Bitcoin. (Fig. 1). In blockchain the new block is generated there it collects and verifies the information. Bitcoin is the first example blockchain which is a POW algorithm consensus mechanism. All nodes solve SHA256 calculation which is very complex but easy to verify the data. The new block is added at the right side of the node which solves the problem at the earliest.

Each node stores blockchain data as local copy then the data is exchanged with other nodes in the network and each node maintains complete blockchain data of all the transaction. Once the transactions are initiated each node will verifies with local copy and included into the blockchain data.

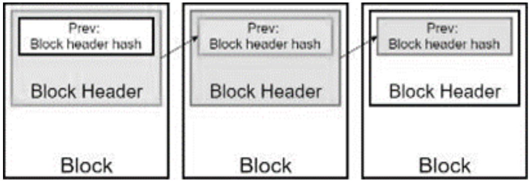

Fig 1. Connections of the blocks in Blockchain.

2. BLOCKCHAIN FEATURES

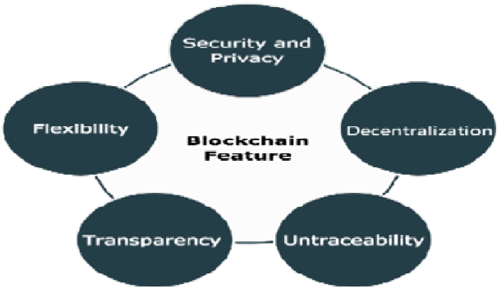

Fig 2. Characteristics of the Blockchain feature.

In the present social framework, a huge piece of the monetary behaviour of people relies upon faith where two different parties cooperate with a mediator regularly, in this manner shaping a faith accord.

By using the Blockchain one can make an information record framework that doesn't rely upon a faithful mediator as an intermediary in activity so it can be shared transparently shared with other nodes and reliable enough. The attributes of Blockchain platform are depicted in detail beneath (Fig. 2).

a) Privacy and Reliability: Public key encoding in cryptography is utilized to ensure information reliability. Customers can produce key sets of their own, together with public key and private key. The public key is utilized to confirm the credibility of the marked information and Private key is utilized to sign information. However long the customer keeps the private key safe, the information will stay secure. Every customer is unknown, and every customer may have numerous addresses in blockchain. At the point when the framework is working, just one address can be used to identification of user and remaining anonymous address rarely map the real user thereby it ensures privacy of the user.

b) Decentralization: By using distributed tasks and capacity, every node in blockchain performs checking, dispatch and maintaining of data at local copy. Blockchain innovation is independent, has unified control and does not depends on third party control.

c) Untrace ability: Due to some reasons if the block is corrupted or modified in the blockchain immediately measures are taken and it is identified and dismissed.

d) Transparency: In blockchain the information is totally open and anybody can freely assess. Inside the data pass stream, anyone can easily observe who is sending information to whom. Each node in blockchain manages log information file of each transaction.

e) Flexibility: Blockchain platform is free source and anybody can utilize it to perform changes on blocks into their own version so that users can redevelop new platform in blockchain. There are many flexible blockchain platforms available. Blockchain is a limitless technology so that users can create many applications depending on blockchain.

III. BLOCK CHAIN ARCHITECTURE

A transaction can be initiated by a node in a decentralized blockchain network by using the private key encryption it gives digital signatures. The digital assets can be transferred between the peers on blockchain network using the transaction. A Transaction can be referred as structure of data that can be stored in transaction pool, by using the Gossip protocol the transactions are propagated in the network. Based on some prior criteria peers verify and validate the transactions. Miners are the nodes who use their automated energy to enquire blocks in the transaction. Once it is verified it will be included into the block. The miners can create the new block only after puzzle is solved in less amount of time. A small compensation is given after successfully generating a new block. The consensus protocol can be used to verify all the new block which are created by the peers. The consensus protocol is a method that ensures a distributed network that comes to a general agreement on definite matters. The local copy in the memory of each Peer's is updated when the new block is appended to the existing blockchain. Thus, the transaction is confirmed. By

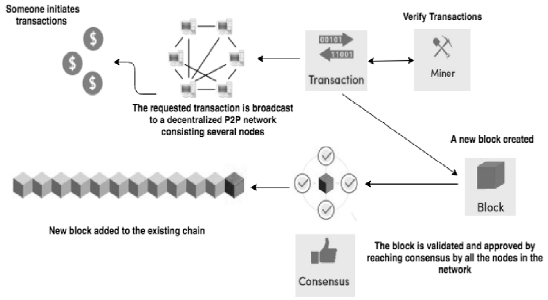
Someone initiates transactions
$
$
$
The requested transaction is broadcast to a decentralized P2P network consisting several nodes
00101
11001
Transaction
Verify Transactions
Miner
A new block created
Block
New block added to the existing chain
Consensus
The block is validated and approved by reaching consensus by all the nodes in the network

Fig 3: Functional diagram of blockchain network

using the cryptographic hash pointer, the next block links are added with newly created block. The block gets its first verification only after transaction gets the second verification. Likewise, with all the time a new block is appended to block chain, the transaction operation will be processed and validated. Generally, a transaction requires six verifications in network to be referred as feasible and final. Shown in Fig 3.

IV. BITCOIN - BLOCKCHAIN 1.0

Bitcoin is distributed virtual cash that doesn't depend on explicit money organizations to circle. As per the first Bitcoin whitepaper, the fundamental reason for this computerized digital currency was to permit a distributed electronic money clearance framework between various gatherings by avoiding intermediate parties. A Bitcoin transaction moves bitcoin amount to another bitcoin address. It takes 10 minutes to incorporate the transaction in a block. The major component of bitcoin is unspent transaction output (UTXO), which is the output of a transaction. The Blockchain consensus protocol can be used to exchange virtual currency and ensures virtual cash security. shown in Fig.4 When the customer's private key spilled, or failed to remember, the customer's Bitcoin is vanished. It is the principal standard of Blockchain platform. It has accompanying 4 attributes:

- Distributed shared organization
- Fixed money circulation
- public transaction record
- Decentralized transaction confirmation

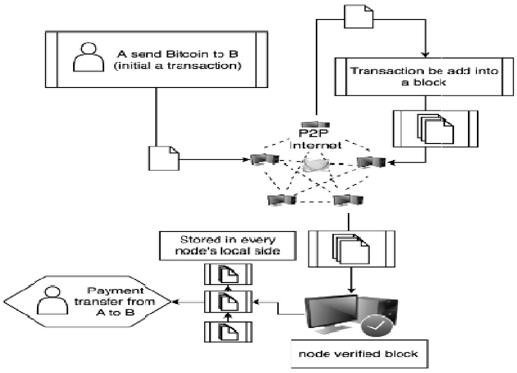
A send Bitcoin to B (initial a transaction)
Transaction be add into a block
P2P internet
Stored in every node's local side
Payment transfer from A to B
node verified block

Fig 4. Flowchart of Bitcoin.

Bitcoin is first example of Blockchain 1.0. The data kept in block belongs to operations blockchain and is utilized for decentralized electronic money. Afterward, there were other innovative work dependent on Bitcoin, for example, color coin.[3]. Additionally, there are some other practically same convention electronic money, for example, Litecoin.[4].

V. BLOCKCHAIN LATER VERSIONS – ETHEREUM

In July 2015 Vitali Buterin launched Ethereum [5],[6] wilderness framework and kept on improving it right up 'til the present time. Ethereum is a Blockchain stage. Not at all like the Blockchain innovation utilized by Bitcoin, Ethereum is not only used to perform transactions which exchange information and is better compelling, efficient and stronger than its partner Bitcoin. Ethereum is a Blockchain stage that can construct crypto contracts utilizing Turing-fulfilment programming language. Anybody can compose crypto contracts or additional decentralized systems on the Ethereum. Customers can also set transaction formats, authentication and state change conditions, etc, and fabricate any ideal principles for Ethereum.

Ethereum Customers will initially compose a crypto contract making use of Solidity, at this point customers will change the crypto contract agreement Solidity code into Ethereum bytecode, and adds the bytecode into the transfer and sends the transfer into the network. When Ethereum miners get the transfer of task, they store the transfer in a block and execute bytecode in a VM of Ethereum for all the times when crypto contract is invoked. Shown in Fig. 5.

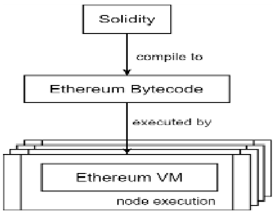

Fig 5. State conversion in Ethereum crypto contract.

To link with a crypto contract on Ethereum, the customer needs to send data bundled in a transfer to speak with crypto contract and set of standards and rules are to be set in the crypto contracts. If the event is successful, then the crypto contract will be modified on every miner's copy on local storage. Shown in Fig. 6. Ethereum is another illustration of Blockchain 2.0. Many other versions of Blockchain 2.0 and after applications also exist, for example, Hyperledger [7]. Blockchain 2.0 and later versions, can not only store transaction record in a block also any data or information. So, it provides greater flexibility and adaptability higher than that of Blockchain 1.0.

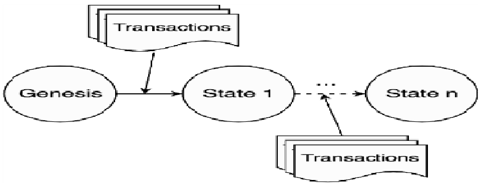

Fig 6. Blockchain transactions.

6. COMPARING BLOCKCHAIN VERSIONS

Table1. Comparing blockchain 1.0, 2.0 and later versions.

Features	Blockchain	
	1.0	2.0 and after
Turing Completeness	No	Yes
State	2 states	Multi state
Block Time	Long	Short
Block Storage	Fixed script	Diversity of context height

Both Blockchain versions 1.0, 2.0 utilize the Blockchain idea for the structure, though broad contrasts as far as execution and use exists. The above Table records very critical contrasts amongst Blockchain 1.0, 2.0 and later forms, explaining why later forms of blockchain are utilized as the framework for proposition.

•Turing Completeness: Bitcoin Contents doesn't brace loops so avoids infinite loops. Then again, Ethereum gives greater adaptability in script or content writing, and gives Turing fulfilment as it avoids loops.

•State: Unspent exchange yield (UTXO) in Bitcoin contain two states, they are spent or unspent and no provision to create more stages but Ethereum provides greater flexibility of multi stage to create crypto contracts.

•Block Time: The bitcoin blockchain takes almost 10 minutes for formation of blocks whereas, Ethereum Blockchain takes 12 seconds, that is essentially quicker than Bitcoin Blockchain. The transaction can be established in faster manner due to lesser block time. Likewise, the security issues arising out of the more limited block time is already resolved by Blockchain 2.0 and later forms.

•Block Storage: A Block in Bitcoin can store fixed contents and fixed information alone. Due to self-implemented scripts large number of various systems can be developed over Ethereum.

Our backend platform is Ethereum that is an example of Bitcoin Blockchain 2.0. For customizing our crypto contracts framework Ethereum would be the right decision as an alternative to bitcoin. The block time of our framework would be short enough to meet the needs and standards of the customer.

III. ASSOCIATED WORK

Many Blockchain-based systems are being progressively created. A portion of the systems concentrate around remittance validation, for example, digital currency [8], stock trading [9], or monetary protections. Few concentrates upon merging Blockchain with the IoT, for example, documenting the tool information of IoT [10]. Additional Blockchain localized systems, for example, betting, online casting a ballot, car leasing, etc.

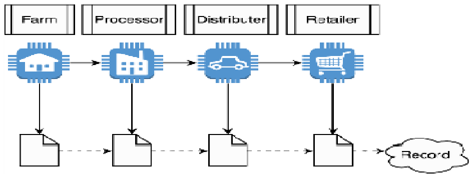

Fig 7. Logistics network data documentation on Blockchain.

In this part we concentrate on a logistics network system, the account information measure on the logistics network is like our framework's transaction data documentation, shown in Fig.7. The first exploration in logistics network management over Blockchain is deliberated below. The creators of [11] showed fake items are a significant problem that present-day brands with worldwide logistics network consistently require to endorse. By administering Blockchain in the logistics network information file, they can closely track the progress of items. [12] investigates the points of interest and hindrances of restricting RFID[13] and Blockchain over the logistics network, and enclose the cycle of data management in Blockchain application.

IV. SYSTEM DESIGN

We presented an inimitable and absolute item Anti forging framework, which authenticates the products in supplier integration which depends on Blockchain. Here, suppliers can utilize this framework to stores important data on item sales in the Blockchain which are available to anybody. The aggregate sum of sales that are traded by the vendor and the quantity of items at present left by the vendor are crystal clear to customers. The customers can utilize the capacities given by our framework to promptly perform vendor side check, and this confirmation can't be made shown in Fig 8.

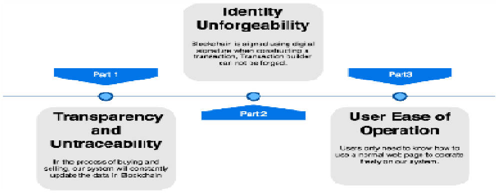
Identity Unforgeability
Blockchain is signed using digital signature when constructing a transaction, Transaction builder can not be forged.
Part 1
Part:2
Part3
Transparency and Untraceability
In the process of buying and selling, our system will constantly update the data in Blockchain
User Ease of Operation
Users only need to know how to use a normal web page to operate freely on our system.

Fig 8. Aim of our Framework.

i). MODEL

Our item anti forging framework depends on Blockchain is made out of three different functions, The Supplier function, The Vendor function and The Consumer function, we examine them below:(Fig. 9)

1) Supplier Function: For the vendor's part, the given capacities incorporate including new vendor's location contracts, counting the quantity of items that the vendor could sell, and recovering data on vendors so the most recent selling condition can be recovered. In the buyer's part, it is conceivable to ask about the item the vendor showcased to the purchaser, and check whether the item has yet been traded or

affirm if the present condition of the item has been confirmed by the customer's asymmetric public key.

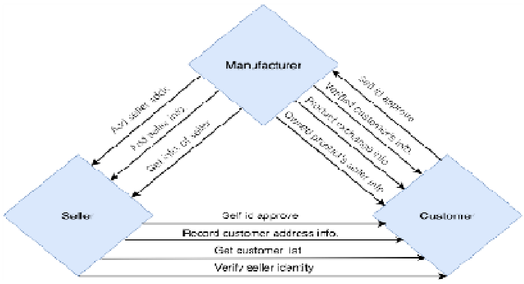

Fig 9. Model of our Framework.

2)Vendor Function: In the buyer's section, the vendor can utilize the framework's capacities to encode the authenticate data with an asymmetric private key, and the purchaser can utilize the vendor's asymmetric public key to confirm if the vendor is the thing that he professes to be. Subsequent to purchasing and selling, the vendor indicates the buyer's location in the agreement for the maker to acquire the data. The vendor can get to data about his items, for example, trading records, and the number of his remaining items in the stock.

3)Customer Function: In the vendor's section, the purchaser can confirm either if the vendor has a good business association with the maker and furthermore check whether the vendor's stock has not been at this point trade out. In the supplier's section, the buyers can demonstrate that their character is steady with his location and on account of a very much protected agreement directions, the shoppers can acquire specific person purchased details and condition of the item.

ii). FUNCTION

In our plan, the supplier is liable for sending vendor data on the agreement, which includes the quantity of items the vendor can trade and the location of the vendor which contains his address. On acquiring the supplier's approval, the vendor will get a specific measure of documentation permissions for the items that vendor can trade on the agreement. When customer buys an item, the vendor stores customer's location through the framework to the agreement to finish the exchange. Customers can utilize the framework to legitimately look for whether the vendor is in the agreement and whether there are unsold items accessible for trading. Upon buying the supplier is provided with the information by the customer that the item needs to be dispatched and encrypted with the customer owned private key. The supplier gets the encoded information and utilizes customer's public key in order to re-establish it. In the event that the data is predictable with customers data, the supplier will send item to the customer and complete the buying process as shown in Fig.10

V. EXECUTION

Here, we clarify the attributes of our plan in our framework, along with full depiction of capacity and UI of our framework. We will probably utilize the Blockchain highlights to give a more absolute, advantageous, and cost-effective item anti forging solution to suppliers, vendors and customers.

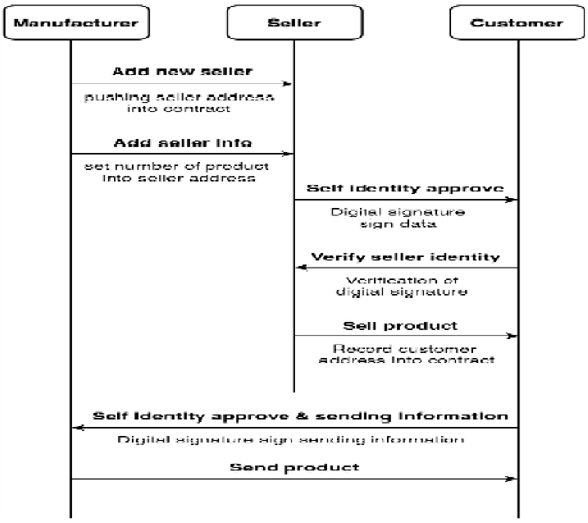
Manufacturer
Seller
Customer
Add new seller
pushing seller address into contract
Add seller info
set number of product into seller address
Self identity approve
Digital signature sign data
Verify seller identity
Verification of digital signature
Sell product
Record customer address into contract
Self identity approve & sending information
Digital signature sign sending information
Send product

Fig 10. Buying process flowchart in our framework

A. FRAMEWORK DESIGN

Ethereum is used as the Blockchain OS at the backend by our framework and also Ethereum's exclusive high-level programming language Solidity [14] to compose shrewd agreements. Solidity underpins legacy, libraries importing, and so on. Solidity is intended for EVM. It supports loops and Turing completeness. This framework depends on Ethereum's Blockchain. Here we use Geth [15] that is Go Ethereum for simplicity of testing, which constructs a Private chain and can append the shrewd agreement.

The User Interface is a web page that can be visible to the customer. The server web page is made by utilizing the http-server [16] suite, which is given in web3.js [17] and node.js [18]. The general framework relationship is shown in Fig. 11.

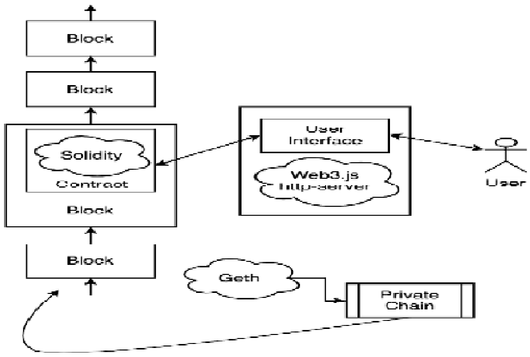

Fig 11. Operational structure of our Framework.

B. SYSTEM OPERATION

1)Logon Procedure: Before setting up an association with the framework, the customer needs to pick which record to log in. The customer's records are associated with Geth Go Ethereum. Once Geth is started, the customer can pick the record which in turn associated with consecutive number of records catalog in Geth. After that if the customer types key in record folder, that is an encoded record that stores the asymmetric private key. In conclusion, the customer can enter details in the agreement address so that spare catch the essential data. As in Fig. 12.

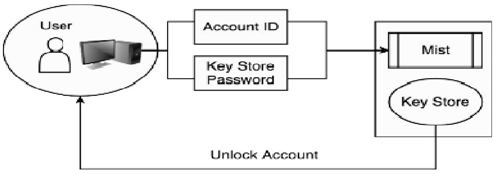

Fig 12. Login procedure of our Framework.

2)Public data of Agreement: Here the objective of data divulgence, the vendors data is shared to all public. This framework gives shrewd agreement information search capacities, which restores vendor catalog, customer catalog, group of vendor data, and the excess count results of every vendor. The information storage design in the shrewd agreement is shown below in Table 2.

Table 2. Information storage form in framework.

Structure Name	Type	Name of the Variable
Product	Address	CustomerAddress
	Bool	Change
Vendor	Address	VendorAddress
	Unit	VendorProductNumber
	Unit	PresentProductNumer
	Product	Products

3) Appending new vendor and product number details: In this framework, suppliers will check the vendor's data which includes appending new vendors location and quantity of items that are traded by each vendor. If the shrewd agreement is handled by supplier then the method in shrewd agreement will generate vendor struct and puts quantity of items that can be traded.

4) Preparing interchange for consumers items: Initially the consumers give identity verification and the location to which the item is dispatched. The supplier first confirms whether person is right and afterwards decides whether customer item data is in shrewd agreement. At that point he will perform interchanging of items.

5)Storing details of customer on shrewd agreement: Once after performing trading operation between the vendor and customer, the vendor will append customer location in the shrewd agreement.

6)Authenticating Identity: Customers can utilize their location as their portrayal. The 20 bits at the last of customer's asymmetric public key is reserved for storing their location. If the customer needs an improvement in Ethereum condition then the customer can use their asymmetric private key to perform digital signature. The customer identity is kept secret until the private key of the customer is protected.

Prior to directing an exchange with the vendor, the customer requires to approach the vendor for a proof of character. The customer will furnish the vendor a message that will be encoded. At that point, the vendor will call a activity to encode the message, the activity will link the message and the present time, and will continue to encode them. The framework will return parameters like v,r,s and encoded time. The vendor will reply back to customer with this parameter. as shown in below fig13.

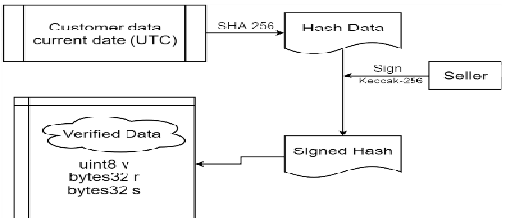

Fig 13. Workflow diagram of vendor signed information.

Once customer secures the basic data to confirm the personality of the vender, the customer will at that point invoke our framework authentication capacity to confirm whether the vendor character is right. The buyer should include parameters like v, r, s, encoding time, vender address, and message that buyer requested vendor to scramble.

The capacity will at that point bring True back in the event that the vendor is who he professed to be. Conversely, return False in the event that the vendor isn't genuine. Shown in fig 14.

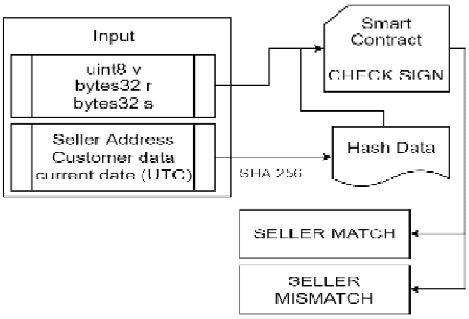

Fig 14. Workflow diagram of customer verifies vendor identity.

When the seller adds the contract product field, the shipment address information which is encrypted using consumer's private key will be sent by the customer so that hash code of scrambled message is analysed and validated by the supplier. Thus, the consumer has to give the vendor address, mail address, the phone number of the consumer. The framework will do acknowledge this information with customer's own private key, then gives information to the supplier. Fig. 15

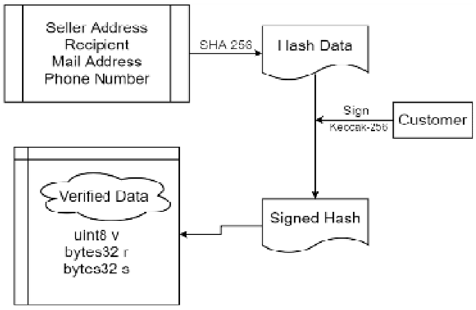

Fig15. Workflow diagram of customer signed data.

The supplier uses this system to check if the information coming from consumer is the encoded data. The supplier has to give input like the consumer location, vendor address, consumer phone number and mail address. Also, the parameters v, r, and s. Our framework will verify if the Customer is the same person. as shown in Fig. 16.

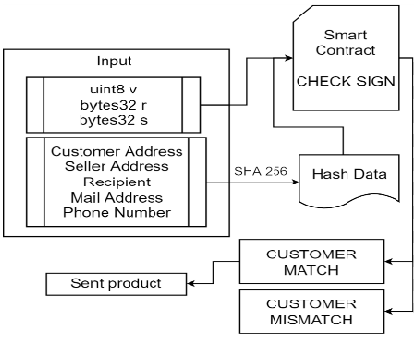

Fig 16. Workflow diagram of supplier verifies customer's address.

VI. CONCLUSION

In this paper, the block chain describes about fully operational item anti-forgery mechanism structure through which users can get trustworthy product by paying less transaction fee. The information relevant to product sales on the system can be used by manufactures which can be assessable to all users. The number of items currently left and the total number of item sales sold by the vendor are crystal clear to the customer. The customer can perform vendor -side verification and enquiry about the product by using the various functionalities which are provided by the system. The system gives digital signature which can be used to authenticate user's identity. The decryption of the private key is highly impossible unless the private key is misused or leaked unknowingly. This system can efficiently reduce the forgery of branded products, top rated goods. Thus, the customers can purchase the products with high confidence so that companies will get high profit with less financial risk without having any fear forgery.

VII. SUBSEQUENT WORK

The investment involved in execution of any transactions on Ethereum blockchain is propositional to the simmpleness of the code with less redundancy related to the application which supports on distributed environment. So that consumer can believe in distributed application of blockchain.

REFERENCES

[1] J. Leng, P. Jiang, K. Xu, Q. Liu, J. L. Zhao, Y. Bian, and R. Shi,``Makerchain: A blockchain with chemical signature for self-organizing process in social manufacturing,'' *J. Cleaner Prod.*, vol. 234, pp. 767_778, Oct. 2019.

[2] N. Alzahrani and N. Bulusu, ``Block-supply chain: A new anti- counterfeiting supply chain using NFC and blockchain,'' in *Proc. 1st Workshop Cryptocurrencies Blockchains Distrib. Syst. (CryBlock)*, 2018, pp. 30_35.

[3] M. Rosenfeld. (2012). [Online]. Available: https://bitcoil.co.il/BitcoinX.pdf

[4] (2018). *Litecoin*. [Online]. Available: https://litecoin.info/ index.php/MainPage

[5] (2019). *Github*. [Online]. Available: https://github.com/ ethereum/wiki/wiki/White-Paper

[6] G. Wood, ``Ethereum: A secure decentralised generalised transaction ledger,'' *Ethereum Project Yellow Paper*, vol. 151, p. 1_32, Apr. 2014.

[7] (2018). *Hyperledger*. [Online].Available: https://www.hyperledger.org/

[8] (2018). *Abra*. [Online]. Available: https://www.abra.com/

[9] (2018). *Tzero*. [Online]. Available: https://www.tzero.com/

[10] S. Panikkar, S. Nair, P. Brody, and V. Pureswaran, ``ADEPT: An IoT practitioner perspective,'' IBM Inst. Bus. Value, New York, NY, USA, White Paper, 2015, pp. 1_18.

[11] S. Matthew English and E. Nezhadian, ``Application of bitcoin data- structures & design principles to supply chain management,'' 2017, arXiv:1703.04206.[Online] .Available: http://arxiv.org/abs/1703.04206

[12] F. Tian, ``An agri-food supply chain traceability system for China based on RFID & blockchain technology,'' in Proc. 13th Int. Conf. Service Syst. Service Manage. (ICSSSM), Jun. 2016, pp. 1_6.

[13] S. Shepard, RFID: Radio Frequency Identi_cation. New York, NY, USA: McGraw-Hill, 2005.

[14] (2018). *Solidity*. [Online].Available: http://solidity. readthedocs. io/en/ v0.4.24/

[15] (2018). *Geth*. [Online]. Available: https://geth.ethereum. org/

[16] (2018). *Http-Server*. [Online].Available: https://www.npmjs. com/ package/http-server

[17] (2018). *Web3.js*. [Online].Available: https://github.com/ ethereum/web3.js/

[18] (2018). *Node.js*. [Online]. Available: https://www.myetherwallet.com/