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Fake Product Identification Using Blockchain

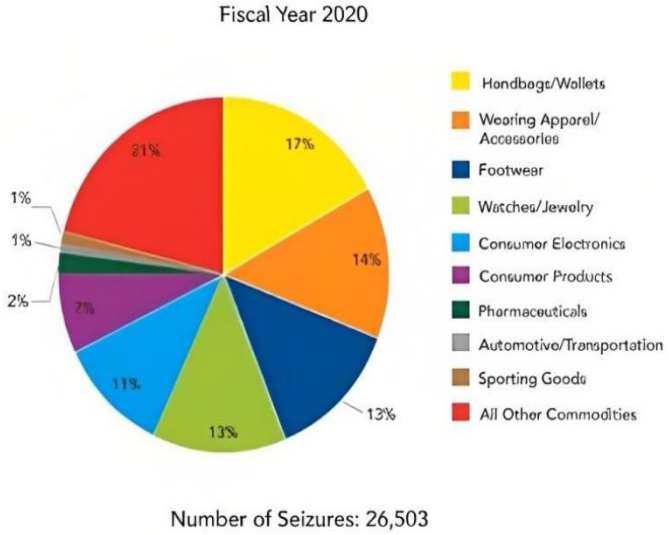
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***Abstract:** One of the greatest challenges in today's retail market is the counterfeiting of products. Counterfeiting Products are merely low-quality counterfeits of a certain brand. Over time, many different methods have been adopted to prevent the proliferation of counterfeitproductssuchasRFIDtags,Artificial intelligence, machine learning, QR codebase system, and many more. Nevertheless, the disadvantages of such methods aresevere, e.g., QR codes that may be copied from real products to fake ones, and artificial intelligence and machine learning must have high computational power for carrying out operations; however, a large number of other techniques currently exist but this method was not developed. We've tried to improve it in this project. With the help of the blockchain, detection of counterfeit products technology. The way we do it is to store the supply chain. Products at all stages of the product's transaction with a new party with the help of a QR code. Blockchain helps us to store the supply chain of goods as a blockchain system makes a decentralized system and one of the main advantages of blockchain is that if the data is recorded in the system, then nobody can change it at any cost so it makes our data more Secure and guarded against third parties.*

***Keywords:** Blockchain,supplyChain,bitcoin,decentralization, Counterfeited Product identification, QR code.*

I. INTRODUCTION

Any product is subject to several risk factors such as counterfeiting and duplication, that can affect the brand name, reputation, revenue, or customer satisfaction at all stages of development. Counterfeit products are rapidly being tradedand marketed. Full operation of a blockchain system is suggested to identify and monitor counterfeit goods or products, while at the same time combating this phenomenon. Only companieshave tospend verylittleeffort,and they don't. longer need to worry about counterfeit products. Due to Counterfeit products, manufacturers are going to lose a lot of money. The reputation of a company's name and its brand value because customers thought that it was a product manufactured by the company That's why, based on a counterfeit product, they look at it. A decentralized distributed ledger technology system can be adopted to resolve this problem. Blockchain is a distributed decentralized-based This is the technology to store data in blocks within a database, and it links with chains. If new data are added to databases, it will update existing data by linking a chain of these records to an existing block. Blockchain does not allow any user to updatethe existing data each time blockchain will add data as a new block to existing data. Therefore, the data in the blockchain that leads to data security and data protection cannot bedeleted or modified.The issue of counterfeit products is being addressed by Blockchain technology.The figure below indicatessome of the common counterfeited products in 2020.



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II. BLOCKCHAIN

Blockchain is a community of computers that stores and disseminates the digital log of transactions, in its most fundamental form. A record of its miles shall be entered on every man's or woman's ledger at each time a new interested party is legitimately taking over the account. There are many transactions with each of the blockchains.

Ablockchain,orasetofdocumentsthatareinterconnectedin the manner of cryptography, is an emerging series of documents. It is due to the fact that records can no longer be changed once they have been entered; this does not allowthem to be altered again without affecting subsequent blocks.Although data on the community are available. However, Its possible to modify the Blockchain, which is an exampleof a distributed computing device with a high level of Byzantine error. tolerance. It's said to be "an open, distributed record system that reports transactions

Betweentwo parties quickly and in a verifiable mannerpermanentshape," the blockchain is a decentralized database.

A. Working of Blockchain

When a new transaction is entered, it is then transmitted in a network of peer-to peer computers scattered across the world. The network of computers then solve the equations to confirm the validity of the transaction. They are called miners. Once confirmed to be legitimatetransactions, they are clusteredtogether into blocks. Theminer then receives an award as a proof of work. These blocks are then chained together creating a long history of all transactions that are permanent. The transaction is complete.Whole procedure is done as shown in figure below :

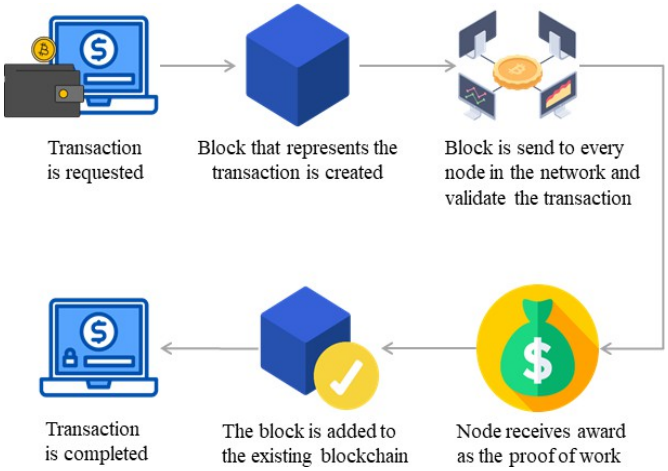


Figure1:WorkingofBlockchain

B. ETHEREUM

In late 2013, ethereum was first presented in a White Paper by programmers and cofounders of bitcoin mag Vitalik Buterin, who intended to create decentralised packages. Buterin urged the use of Bitcoin and blockchain technology in more than just financial transactions, saying that a scripting language is needed for apps to be developed. This may result in actual International Assets, such as shareholdings and real property,being added totheBlockchain. Buterinproduced the colored cashchallenge's white paper explaining capability use cases for blockchain generation in 2013 whilst working briefly with eToro CEO Yoni Assia's a part of this venture. But afterfailingtoreachagreementastohowtheprojectshould proceed, he recommended that a new platform be set up with moreuniversalscriptinglanguagewhichmightultimatelylead to Ethereum.

C. COUNTERFEIT

Counterfeit refers to the imitation of genuine goods for purposes of stealing, destroying or altering their authenticity. use in criminal activities or other ways of convincing peopleto believe that counterfeits have a higher value than they do. genuine article. Counterfeit products shall be considered as fakes and illegally copied copies of the real product. They're products that are fake. They are often created with a view to making money from the greater value of counterfeit goods. Thereis awidespread useoftheterm"counterfeit." Itrefers to counterfeit money and official documents, as well asimitations of goods like jewellery, handbag, shoes, cosmetics.

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D. WhatdoesBLOCKCHAINdo?

The major goal of blockchain is to make records immutable,as it has been pointed out in the above discussion. In almost five steps, there is a simple explanation of the Blockchain's functioning:

1) The authentication of the user must be performed bythe blockchain clientwhen entering the transaction.
2) The new block containing transaction information will be established once the authentication has been completed.
3) Every node in your computer network is allocated a newly formed block.
4) The approved nodes perform the verification steps and when they have verified that transaction information has been entered into existing blocks, itis added by way of a chained mechanism.
5) The updates continue to be transmitted from one network to another. Thus, above finalize that the transaction history is stored in blockchain databases.

E. Benefits Of Blockchain

1) Accuracy: as we know that the blockchains are distributed systems. A blockchain database is spread amongst thedifferentnetworksnodesthatarepartofthecomputernetwork. This means that the user never comes to know from where the database of blockchain is coming. This result is that this technology does not involve humans at all. which leads to reduced human error and thus decreases the number of errorsA computing errorcaused by Blockchain technology,resulting in this great accuracy.
2) Cost Reductions:Blockchain eliminates the involvement of third parties, such as banks, which has a very positive impact on cost reductions in transactions. For example, a small fee is deducted from the bank's payment to provide services wheneveranenterpriseowneracceptspaymentsbycreditcardNevertheless, there will be no andminimal transaction feeson the Blockchain because it does not have Central Authority.
3) Decentralization: As we know from the above definition of blockchain that blockchain is a decentralized distributed system. So, the blockchain database has many copies and is spread across the different computers in computer networks. Therefore, if we are going to make a new block in the database, every computer has to add it as part of their blockchain and reflect this change. As a result, it's harder to hack the blockchain. Even if a hacker tried to make a changeto the blockchain thenonly thatcopy is affected other remains the same. As a result, the decentralization property of blockchain has been helpful in data protection.
4) Efficient transaction: Blockchain is a type of transactions. Decentralized and it's not supervised by an authority of any kind. Because we're aware that the authorities are operating their business. And if we start a transaction during theworking hours, it'll be three days before the transaction iscompleted on Friday This means that the Blockchain's up and running 24 hours a day until Monday. Also, the transactioncan be completed more quickly with blockchain 10 minutes. Also, it takes almost the same amount of time to build a Blockchain Complete trade between countries, if it is performed by another country. Due to the fact that there is a difference in time, authorities are taking more time zonesissue and many more reasons. Thus, Blockchain provides an efficient way of carrying out transactions.
5) .Transparency:Cryptocurrenciesprovidetransparencyasthe majority of them are freely available software. So, we'll have the ability to check our code, which will give us some suggestions for improving blockchain technology. Therefore, for users, the blockchain is a complete transparency. Only if themajorityofnetworkusers'consent, theseproposals will be put into practice.

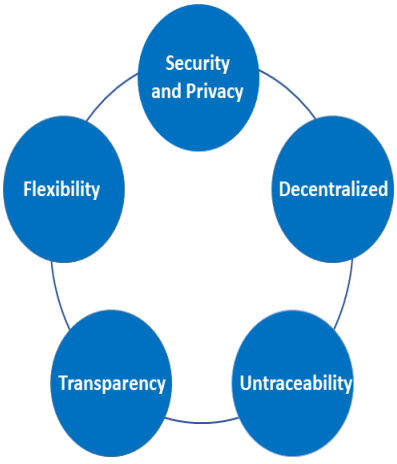


Figure 2:Featuresof Blockchain

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III. TECHNOLOGIES AND ALGORITHM USED

A. SHA-256

SHA-256 (Secure Hash Algorithm 256-bit) is a cryptographic hashing algorithm that yields a 256-bit fixed- size output from an input message of any length. To make the input message a multiple of 512 bits, extra bits are inserted as padding. The algorithm is given a set of starting hash values, also known as initialization vectors, which area collection of constant values.A set of mathematical operations are performed on each 512-bit block of the padded message during processing.

A new hash value is generated by combining the resultsof each block with the existing hash value and then applying acompression function. Theconcatenation ofthehash values generated for each block is the final hash value. The SHA-256 algorithm converts the input message into a fixed-size output by combining bitwise operations, modular arithmetic, and logical operations. Since it is intended to be a one-way function, it is computationally impossible to identify two distinct inputs that result in the same hash value. Digital signatures, authentication, and verification are just a few of the uses for which SHA-256 is frequently employed. Although it is thought to be a secure and reliable hash function, it is not impervious to some assaults, such as collision attacks, in which an attacker can discover two different inputs that result in the same hash value.

B. METAMASK

MetaMask is a browser extension and mobile applicationthat allows users to control their cryptocurrency wallets and access Ethereum-baseddecentralized applications (dApps) using MetaMask, a browser extension and mobile app. It serves as alink between a user's web browser and the Ethereum blockchain, offering an intuitive and safe way to engage with decentralized apps. Users are able to send and receive Ethereum and other ERC-20 tokens, examine account balances, manage multiple Ethereum wallets, interact with smart contracts, and establish and manage multipleEthereum walletsusing MetaMask. Additionally, it offers a function for securely managing and saving private keys, which are necessary for accessing and controlling cryptocurrency wallets. Decentralized exchanges (DEXs), gamingplatforms,andappsfordecentralizedfinance(DeFi)are just a few of theweb3-enabled dAppsand platformsthat are supported by MetaMask. Users caneasily link their web3-enabled dApp accounts across different platforms, offering a convenient and consistent experience. For Chrome, Firefox, and Brave browsers as well as mobile devices running iOS and Android, MetaMask is accessibleas a browser plugin. With millions of users all over the globe, it is among the most widely used Ethereum wallet solutions.

C. SOLIDITY

The Ethereum network uses the programming language Soliditytocreate smart contracts. It isahigh-level computer language that focuses on contracts and objects and is intended to be used to build smart contracts that execute on the Ethereum Virtual Machine. (EVM).

The norms and regulations specified in the contract codeare automatically enforced by smart contracts, which are self-executing contracts stored on the blockchain. They can be used to automate a variety of operations and deals, including the transfer of tokens, the trading of assets, andthe execution of sophisticated financial instruments. A variety of features aresupported by the statically typed language Solidity, including inheritance, modules, and sophisticated user-definedtypes. Because ofitsresemblance to JavaScript and C++, developers with prior expertise in these languages will find it simple to pick up and beginusing Solidity programming right away. The Ethereum Virtual Machine executes the bytecode that Solidity codehas been converted into. Deployed on the Ethereum blockchain, Solidity-written smart contractscan beaccessed and used by other smart contracts, decentralized apps (dApps), and users. For creating smart contracts on the Ethereum network, Solidity has emerged as one of the most used programming languages. Developers use it frequently to create new digital assets and construct decentralized applications.

D. GANACHE

With the help of Ganache, a private blockchain forEthereum development, programmers may build and test Ethereum-based apps in a local environment. It offers a portable, customisable blockchain that runs locally on a developer's computer, enabling quick prototyping andtesting without the need for a real network connection.There are two varieties ofGanache: Ganache CLI (Command Line Interface) andGanache GUI (Graphical User Interface). For administering the blockchain and engaging with smart contracts, Ganache CLI isa command- line tool that may be combined with other developmenttools and scripts. Ganache GUI is a standalone desktop programme. With Ganache, programmers can set up numerous accounts, each of which has a unique Ethereum address and private key that can be used to communicate with the local blockchain.

Additionally, it enables a number of testing and debugging functions, such as setting the gas price and limit, manipulating blocks, and inspecting transactions.OneofthekeybenefitsofutilizingGanache isthat it lets programmers test their smart contracts and applicationsin a safe settingwithout taking on the costs and hazards of putting them into production on the main Ethereum network. This enables developers to rapidly test for potential vulnerabilities and edge cases, revise and improve their code, and guarantee thattheir applicationsare operating as intended before releasing them to a live network.

IV. WORKING MODEL

A. *Proposed System*

Counterfeit has spread worldwide and has huge effects on organizations,manufacturers,andconsumers. Itaffectstheinfluenceofthe organizationandthewellbeingoftheconsumers.Indiaisnotexcluded.Theproposedsystemisaimedatconsumerproducts,andithelpstracktheproduct s by maintaining the product and the supply chain integritybyusingBlockchain.Thisgivesthecustomersthepower to track the history of the entire product from manufacturertocustomerusingblockchainandQRcode.

B. *System Model*

The proposed system will be a decentralized application (Dapp)whichwillbeimplementedusingtheEthereum Network as the main blockchain for keeping all the recordsandmanagingthetransactionsregardingtheproducts ofthecompanieslistedonDapp. Thebasic system architecture is shown in figure below:

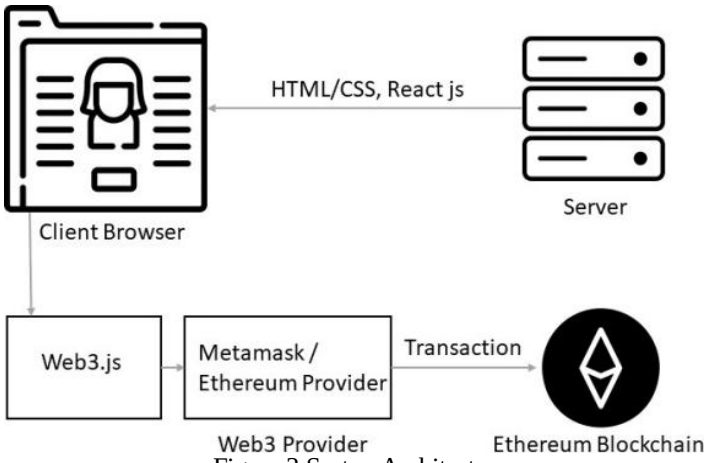


Figure 3:SystemArchitecture

C. *Flow of Proposed System*

Themainaimofthisproposedsystemistomaintainthe Genuityoftheproductbyhelpingthecustomertrackthe supply chain history of the product.System give customersthepowertotrackthehistoryofanentireproductfrommanufacturertocustomerusingblockchain.Thisproduct anti-counterfeiting system based on Blockchain iscomposedofthreeroles,theManufacturerrole,theSeller role,andtheConsumerrole, asdiscussedand shownin figure 4.

1) *Manufacturer:*

Manufacturer logs into the manufacturer account and generatesQRCodeforProductandaddsotherrequired detailsoftheproductandbyusinghisethereumwallet,themanufactureraddsablocktoEthereumblockchain.Theuseridofourlocaldatabaseandthe walletaddressoftheentitywillbemappedtogether,ifboththethingsarethere,thatisamanufacturerlogsinfromhisownaccountanduseshisownwalletth enonlytheblockwillbeadded to the digital ledger.

2) *Supplier:*

Supplier logs into supplier account and scans the QR codeontheproduct.Thesellercanaccessinformation abouthisproductsthatthemanufacturerhasentered.Itaddsitsowndetailsoftheproductlikeshopdestinationandpushesitintotheblockchain.Tho sedetailscanbe viewed by the buyer.

3) Customer:

Customerscancheckttheintegrityoftheproductbyscanning QRcodewhichwilllistthehistoryoftransactionsandthusverifyingthegenuinityofthe product.Atthe time of customer purchasing the product after the QR scan in supply chain history, if the last location is not matchedwiththepurchaselocation,thecustomerwill know that the product is not genuine.It concludes that theQRcodewascopiedandthecustomerbecomesawareof counterfeiting.

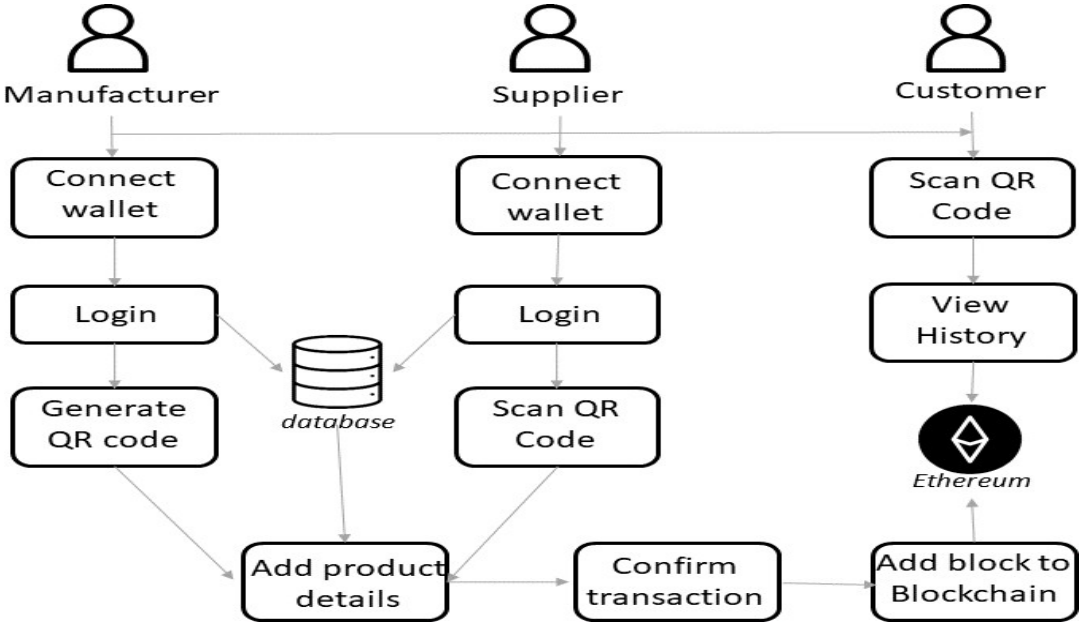


Figure 4:Theprocessofdetectingacounterfeitproductbythe customerwhilepurchasing

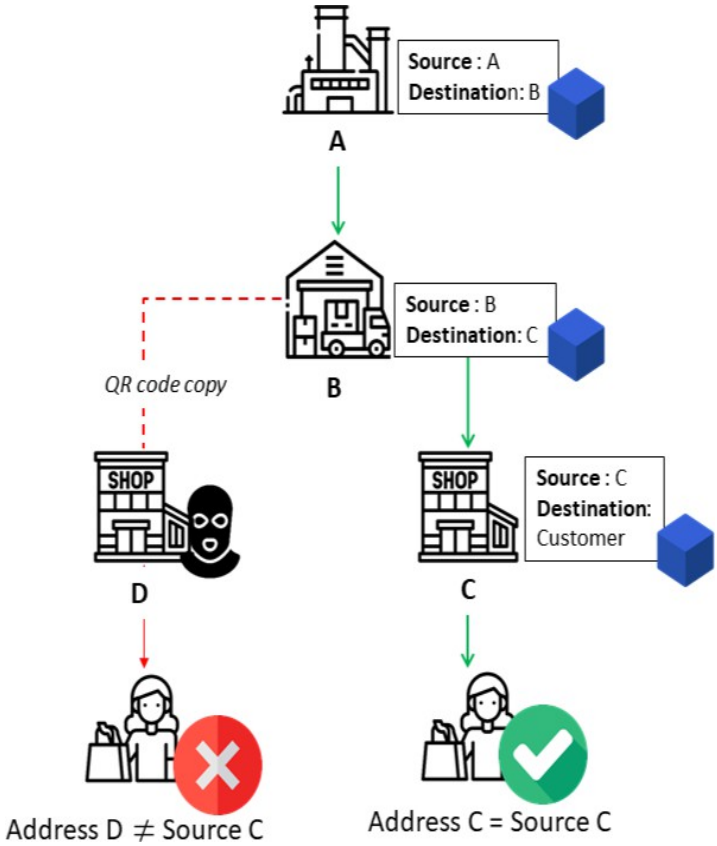


Figure 5:Dealingwith Counterfeit Product

V. LITERATURE SURVEY

A. *Literature Survey*

Table1:DeepLiteratureSurveyofBlockchainBasedSystems

SrNo.	PaperTitle	Publication Details	AuthorName	Limitations	Challenges
1	FakeProductDetectionusing Blockchain	IEEE-Access2020	TejaswiTambe, Sonali Chitkala	LimitedCoverage	DataAccuracy
2	DetectionofCounterfeitProducts using Blockchain	IRJMETS2022	KunalWon-Shik, Isha Sondawale	Cost	Privacyand confidentiality
3	IdentifyingCounterfeitProducts usingBlockchain TechnologyinSupply ChainSystem	IJARIIE2022	PramitDutta	TechnicalComplexity	Scalability
5	FakeProduct DetectionUsingBlockchainTechnology	IJARCE2022	SriKrishna Shastri C,VishalK	Lackof Standardization	Efficiency
6	Blockchainbased productidentificationsystem.	ITMWebof Conference2022	M.Suhana S.Sujatha	LessSecure	Privacyand confidentiality
7	Anti-Counterfeiting BlockchainUsinga TrulyDecentralized, DynamicConsensus Protocol	PDXScholar	NaifAlzahrani,Nirupama Bulusu	TechnicalComplexity	Complexity
8	FakeProductIdentificationSystem Using Blockchain	IEEE2022	Anita Kanavalii, KushagaraGupta	TechnicalComplexity	DataAccuracy
9	A Blockchain-Based FakeProductIdentificationSystem	IEEE2022	Yasmeen Dabbagh,ReemKhoja	Cost	Efficiency

B. *Algorithmic Survey*

Table2:AlgorithmicSurveyofResearchStudies

SrNo.	AlgorithmUsed	Time Complexity	Space Complexity	Advantages	Disadvantages
1	SecureHashAlgorithm (SHA)	O(n)	O(1)	Strong Security, Largekeyspace.	Deterministic.
2	ProofofWork(PoW)	Slowerthan Proof of Stake	Slowerthan Proof of Stake	Decentralized, SimpleDesign.	Consumeslarge amount of energy
3	ProofofStake(PoS)	Fasterthan Proof of Work	Depends upon network size and traffic	Consumelessamount ofenergy.	Securityrisk.

C. Live Survey

Table3:LiveSurveyofRecentBlockchainBasedSystemsonVariousOrganizations

SrNo.	Organization Name	YearEstablished	StatedWord	Algorithmused	Time & Space Complexity
1	RealItems Foundation	2017	REAL Items are verifiable products with a blockchain smart labels each with a digital identity stored on blockchainwithNon-Fungible Tokens.	NFT Standard Algorithms	Directlydependent onnumberofinput nandnetworksize.
2	IBMResearch	2018	Developed supply chain system for tracking specific goodsandmedicinetracking system help developing countries.	Proof of Work, SHA algorithms for Security	Lesserascompared tostandardsystem due to limited network size.

D. Analyses Of Various Anticounterfeiting Technologies

Different anti-counterfeiting technologies are displayed in the following table [1], along with comparisons between them.

Index	Technology	Product Type	Advantage	Limitation	Blockchai n
1	RFID	Any	Dependable track and trace in any setting.	Reader conflict. Cannot communicate through metal items.	No
2	Magnetic strips	Hotel key cards	Less vulnerable than barcodes. Quick and simple to use.	May sustain damage from even minor scratches Doesn't operate at a distance.	No
3	Security Hologram	Currency	If removed, it leaves behind residue.	Production takes a lot of time and money. Easily replicable.	No
4	Barcode scan	Daily use products	1. Efficient execution. 2.Scalable	1. Simple to copy. 2. Modifiabl e.	No
5	Fingerprinting	Digital Content	1. Extreme security. 2. Exclusive to the user	Failures of the system. High price.	No
6	Blockchain	Any	1. Can be applied at the time ofmanufacturing 2. Data once stored cannot be modified.	Requires a lot of memory. It is costly to implement	Yes

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VI. RESULTANDDISCUSSION

The proposed system allows both manufacturers and suppliers to interact with the system to add their respective blocks containingthetransactiondetailstotheblockchainwithoutmodifyingtheother'sblock.Sincethecodeisrunningonalocalnetworkganachehas beenusedforlocaltesting.Thecontractsarethencompiledanddeployedusingtruffle.Theinterfaceiscreatedusing HTML,CSS,andJavaScript .Toallowinteractionwiththe Ethereumblockchain Web3.jslibraryisusedwhichis used to perform actions like reading, and writing data from smart contracts. MetaMask is installed on a browser which is a wallettointeractwiththeEthereum blockchain.Accountsfrom ganacheareimported intotheMetaMask.Toaddsupplierand manufacturer blocks they must confirm the transactions using their account MetaMask wallet which is connected using Web3.js. The end-user can then check the supply chain by scanning the QR code to check the integrity of the goods.

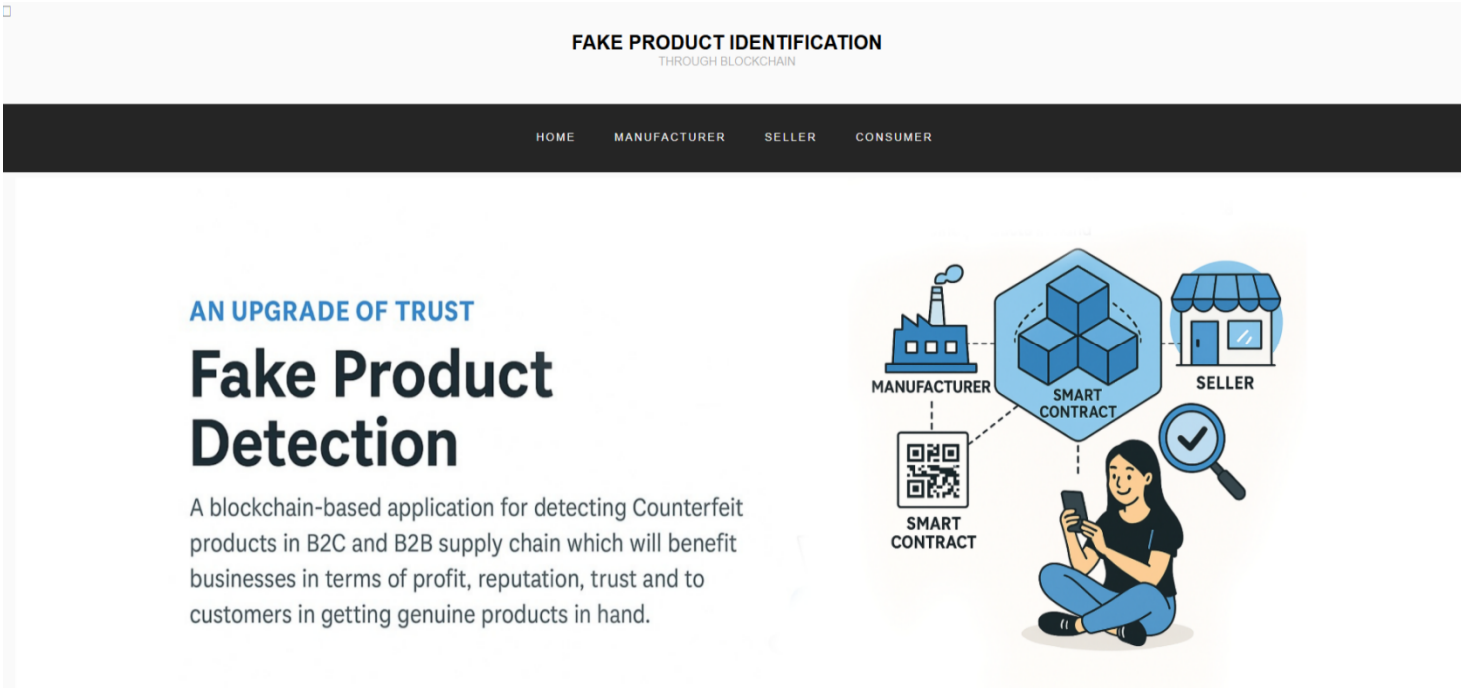


Fig4.1:Accountscanbecategorizedintomanufacturer,supplier,andcustomer.

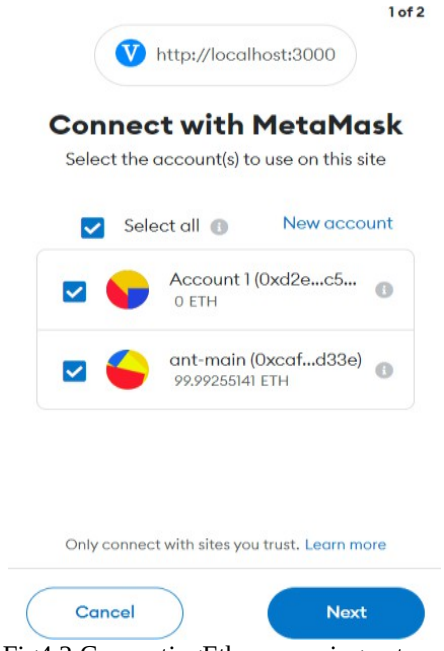


Fig4.2:ConnectingEthereumusingmetamaskwallet.

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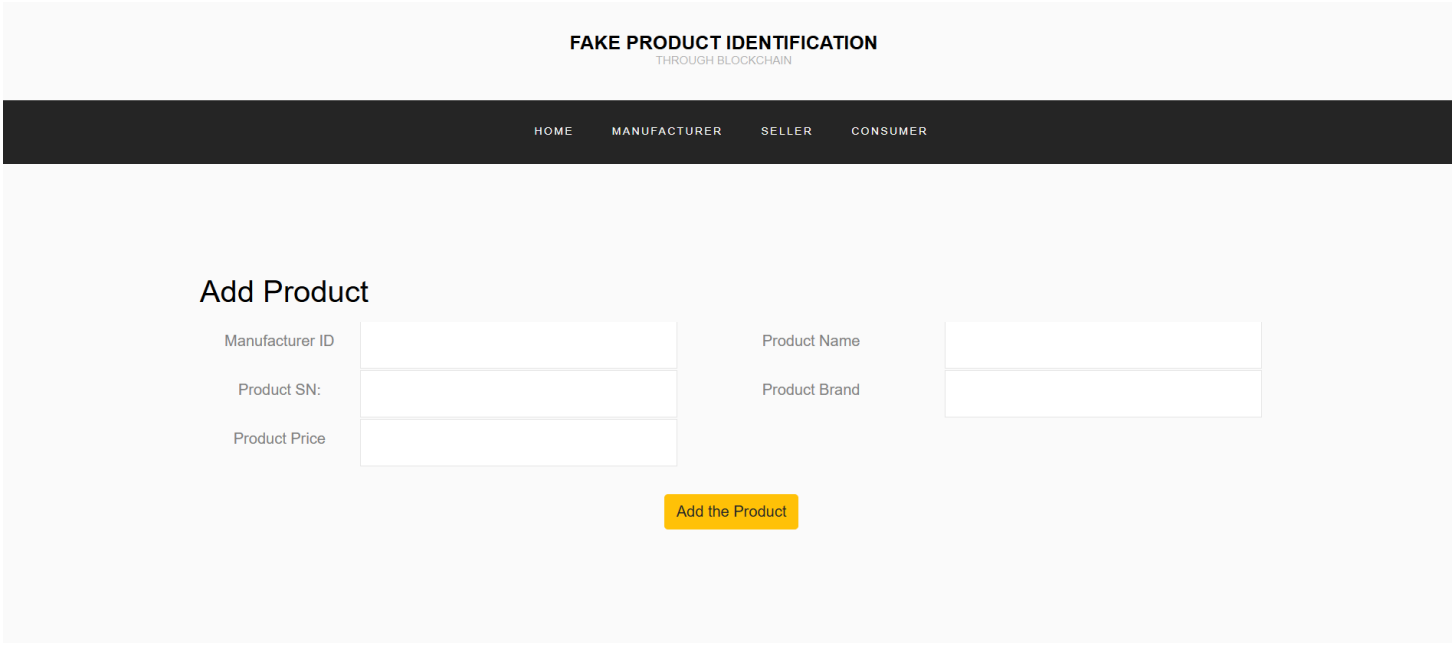


Fig4.3:ManufactureraddsproductdetailsusingtheMetaMaskWallet.

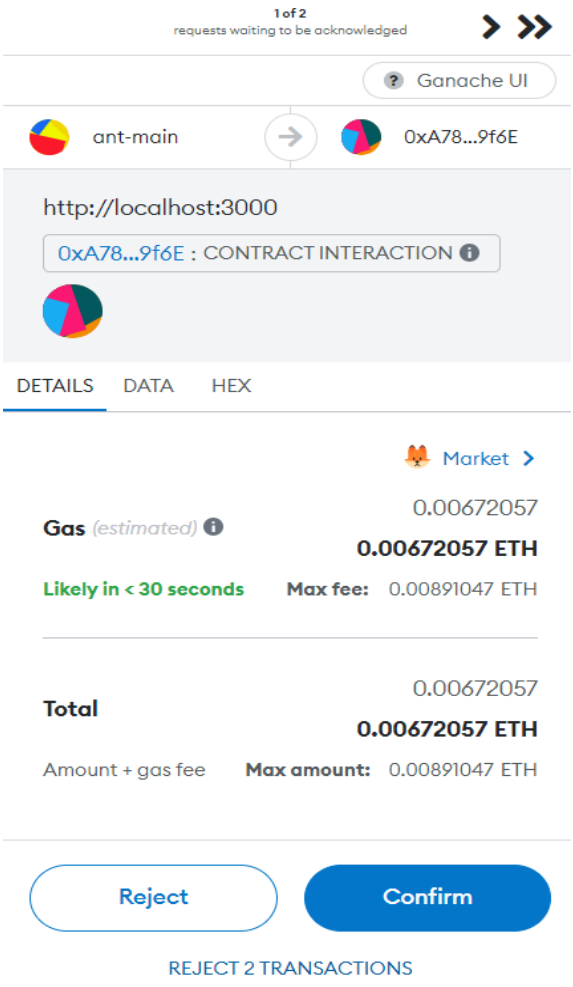


Fig4.4:AMetaMaskconfirmationpopupisdisplayedwhichasksfortheconfirmation

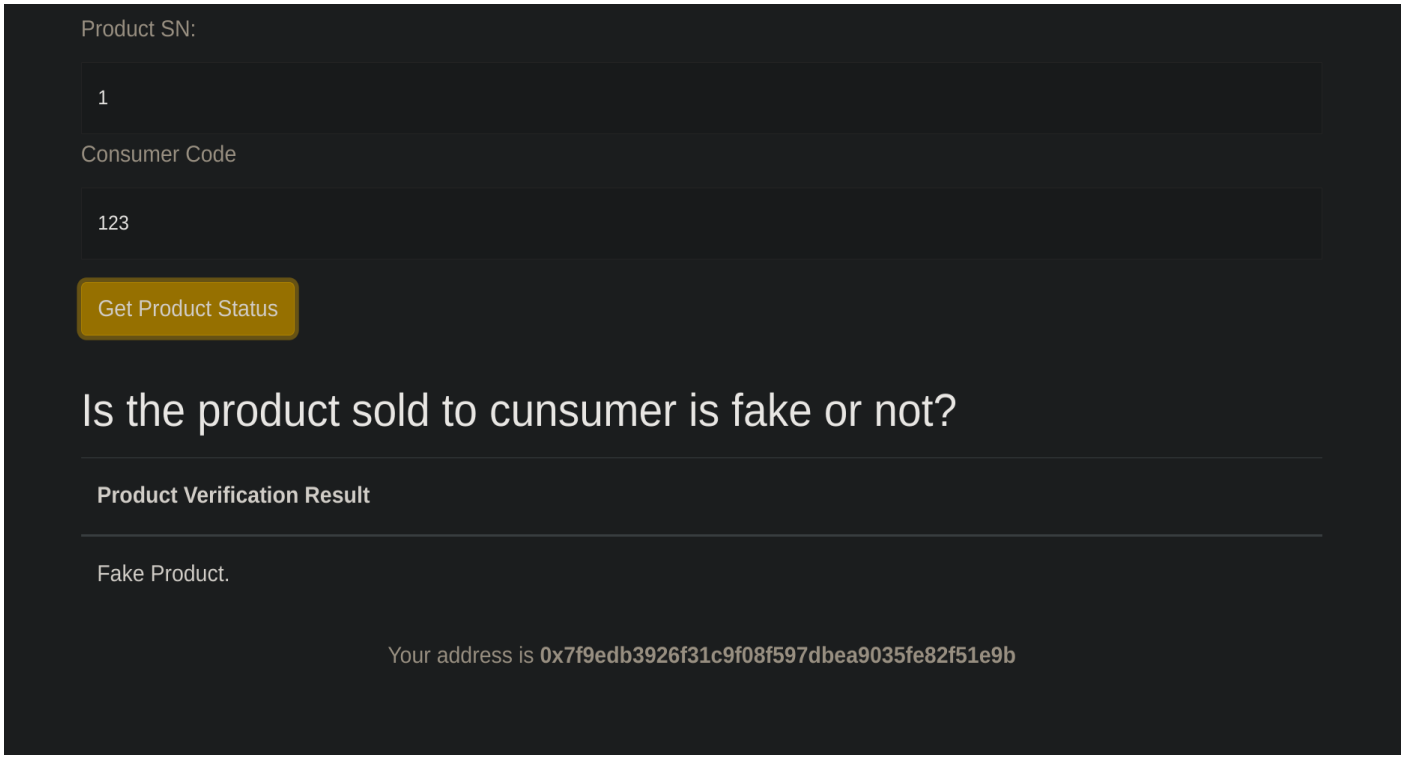


Fig4.5:ProductVerificationbyConsumer.

VII. CONCLUSIONS

Usingblockchain,manufacturerscancreateauniqueandimmutabledigitalidentityforeachproduct,enablingthetraceability andverification ofproductinformation throughout the supply chain. This allows consumers to easily verify the authenticityof a product, reducing the risk of purchasing counterfeit or fake products.

Manufacturers andSuppliers canusethesystemtostore productdetails inBlockchainwhich offers certainpropertiessuchas securityandprivacyofthedataonthenetwork.Thecustomerviewsthegood'ssupplychainhistoryandverifiesifthegoods are genuine.

Customers can be sure about the integrity of the goods they purchase. This system helps to lower the rate of counterfeiting and boost the economy. Further system can be extended to avoid frauds done in healthcare, voting system, online shopping, banking, and so on.

Moreover, these real-time systems can enable the creation of decentralized marketplaces that prioritize authenticity and transparency, reducing the risk of fraud and counterfeiting in online transactions.

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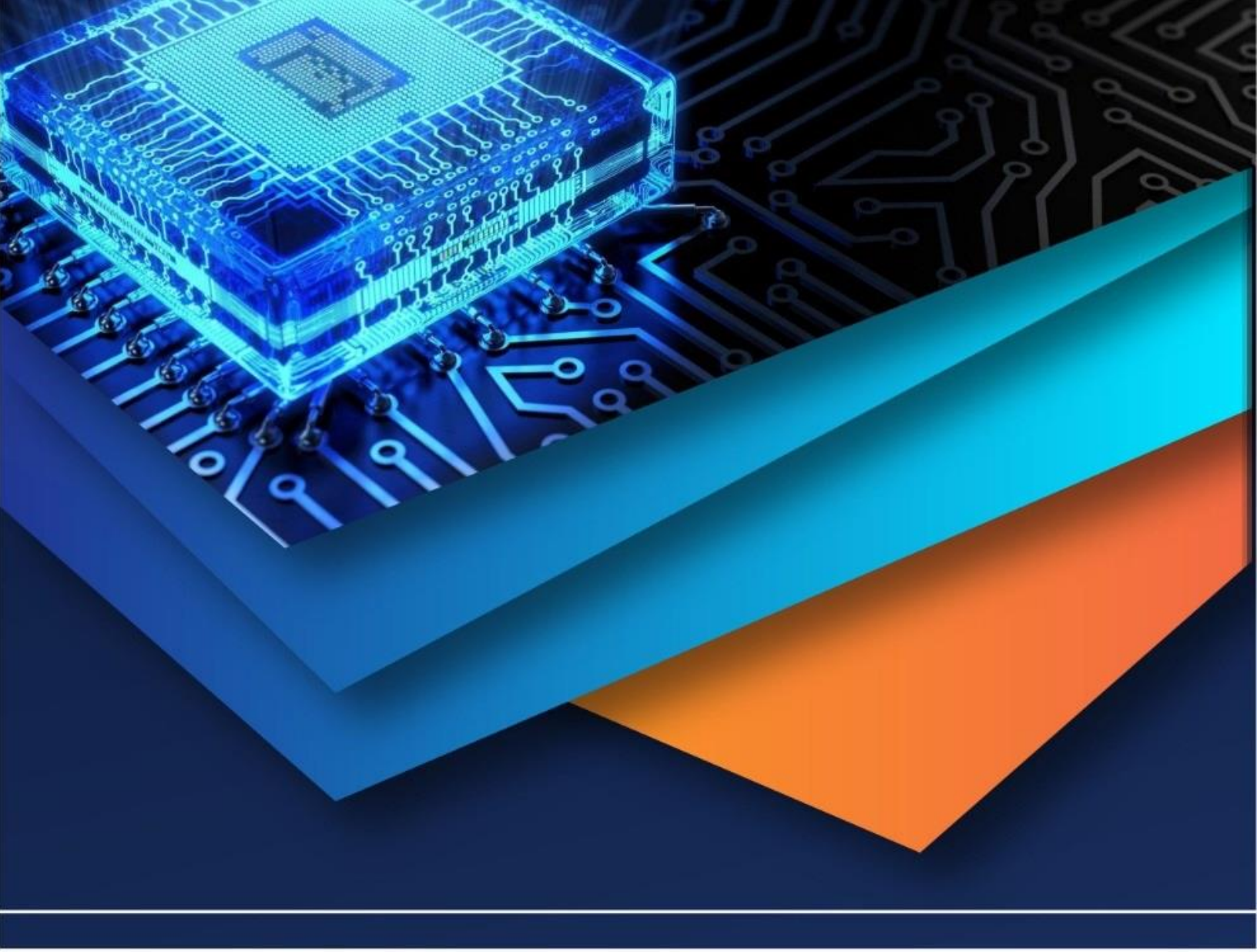
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