iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 10 **Issue:** VI **Month of publication:** June 2022

DOI: https://doi.org/10.22214/ijraset.2022.43738

www.ijraset.com

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 10 Issue VI June 2022- Available at www.ijraset.com

Anti-Counterfeit Detection System Using Blockchain

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Abstract: ***In recent years, counterfeit products have played an important role in the manufacturing industry. This affects company name, sales, and corporate profits. Blockchain technology is used to identify real products and to detect counterfeit products. Blockchain technology is a distributed, customized, and digital book that stores information in the form of blocks in multiple archives linked to chains. Blockchain technology is a secure technology so any block cannot be changed or hacked. By using Blockchain technology, customers or users do not have to rely on third-party users to ensure product security. The concept of Product Copy Management System against counterfeit products that can be used in a series of postal merchant supply chain using QR code. By using a blockchain-based application platform that will help overcome the problems associated with an effective supply chain management system and provide a way to prove product ownership.***
Keywords- Blockchain, QR Code, Supply Chain, Solidity, Counterfeit products.

I. INTRODUCTION

The existing procurement management system did not work well in tracking product ownership. There are many products available in the supply chain that need to be verified to ensure that the product is genuine or counterfeit. Due to counterfeit or counterfeit products manufacturers face many problems that lead to huge losses. To find the real product we can use blockchain technology.

Blockchain is an appointment for old recording information that is troubling or difficult to break, rob, or cheat technology. Blockchain is actually a digital record of duplicate deals and distributed across a network of PC programs on the blockchain. Each block in the middle of a series contains multiple transactions, and each time a blockchain transaction occurs, a record of that activity id is added to each group's record. The site allocated to a number of resources is known as Distributed Ledger Technology (DLT). Blockchain is a type of DLT in which transactions are encrypted with a fixed cryptographic code called a hash.

Blockchain is proven to be consistent, which helps with integrity and commitment and, to a certain extent, privacy through the use of public and personal keys. Blockchain technology is a secure technology and therefore any block cannot be modified or controlled. Blockchain Technology is not just a cryptocurrency, and it can have several functions in government, finance and banking, accounting, and Business Processing. By using Blockchain technology, users or customers do not have a third party functionality to provide proof of product security.

The blockchain is used to store data collected by WSN monitoring the power distribution grid. It uses data stored in a blockchain, created by a directed acyclic graph (DAG). With non-technical losses also a merging algorithm was created to critique fraud.

Blockchain technology helps eliminate the problem of counterfeiting. Blockchain technology is much safer. Once the data is stored in the network hash code is generated in that product and you are likely to take care of all the sales records of the current owner and its owner as the sequence will be created for those product agreements. All sales records will be stored within the block type within the blockchain. Within the proposed system we assign the QR code generated to a particular product and thus the end client ignores that QR code in order to disclose all the information for that product. After checking the QR code we will identify whether the product is genuine or counterfeit.

II. LITERATURE REVIEW

Counterfeit products are growing rapidly with a large number of internet and black markets. Therefore, there is a strong need to address the challenges of finding counterfeit products and to design appropriate technologies to improve acquisition accuracy. This is one of the most important research areas to explore in today's world. This paper discusses various ways to identify counterfeit products.

It discusses how to improve supply chain management by adopting blockchain technology and proposing a blockchain supply chain management framework. It will provide a basic structure and ideas to develop technologies related to information resource management in distributed, visible organizations, especially distributed management theory, corporate and spatial management.

This paper highlights some shortcomings and presents two possible ways to improve the basic platform (blockchain technology) to support e-voting and other similar applications. Blockchain technology has many promises; however, in its present state, it may not reach its full potential. Based on CMCR, Protocol and Verification with Block-chain algorithm to protect user's confidential information from public access. Considering a user with high proximity, they use a block-chain-based authentication method, and establish relationships with the Hash function for better protection. Then, they use the encryption protocol in the text recommendation process to ensure the security of the information. Tests have proven that improvements have achieved better results.

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This paper proposed Ethereum blockchain technology at a designated healthcare website. With this shared network infrastructure, different health care professionals can access the same information. [8] The current paper explains how the blockchain is important in storing health care data in the cloud.It also enhances data security and privacy while storing data. When new patient health care data is created (e.g. from consultation, with medical practice such as surgery), a new block is consolidated and distributed to all peers in the patient network.

After most of your peers approve the new block, the system will put it in a chain. With the rapid growth of the internet of things, many researchers are looking at the use of appropriate technology for tracking systems in food supply chains. Folinas et al. (2006) [9] have shown that the efficiency of a tracking system depends on the ability to track and trace each product and transportation units, in a way that enables continuous monitoring from basic production to final disposal by the consumer. .

Shanahan et al. (2009) [10] proposed a RFID-based framework for tracking beef from farm to slaughter. Busing RFID for individual cattle identification, the program has proposed as a solution for access to tracking records and fraudulent activities.

To create an automated system that combines online tracking data and chill chain status monitoring information, Abad et al. (2010) [11] attempted to validate an intelligent RFID tag designed for real-time tracking and monitoring of cold food chains under the chain study of intercontinental fresh fish logistics. Matholi et al. (2010) [12] developed a Flexible Tag Data- logger (FTD) attached to bottles to collect environmental data, (such as light, humidity, and temperature) to track wine bottles in a supermarket.

Historical data stored in FTD can be read to mobile phones or a Personal Digital Assistant (PDA) with an integrated infrared port to check the safety status of wine bottles.

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III. BLOCKCHAIN

Blockchain is a distributed site that participates between network nodes. As a database, blockchain stores information electronically in a digital format. Blockchain is best known for its important role in cryptocurrency systems, such as Bitcoin, for maintaining a secure and segregated record of transactions. The establishment of the blockchain ensures the security of the information record and creates trust without the need for a trusted third party.

One important difference between a standard database and a blockchain is the way information is structured. Blockchain collects information together in groups, known as blocks, that store data sets. Blocks have a certain storage capacity and, when filled, are closed and connected to a pre-filled block, which creates a sequence of information known as a blockchain. All new information following the newly installed block is collected into a newly constructed block that will be added to the series when completed.

A database usually organizes its data into tables, while a blockchain, as its name implies, organizes its data into pieces or blocks connected together. This natural setting creates an irreversible timeline of information when used during ecological separation. When a block is completed, a timestamp is set and becomes the location of this point line. Each block inside the chain is given a time stamp when added to the chain. Blockchain can provide increasing visibility of the supply chain, as well

as reduced costs and risks throughout the supply chain. In particular, the implementation of the blockchain supply chain can bring the following important benefits:

- Primary potential benefits
- Increase traceability of material supply chain to ensure corporate standards are met
- Lower losses from counterfeit/grey market trading
- Improve visibility and compliance over outsourced contract manufacturing
- Reduce paperwork and administrative costs
- Secondary potential benefits
- Strengthen corporate reputation through providing transparency of materials used in products
- Improve creditability and public trust of data shared
- Reduce potential public relations risk from supply chain malpractice
- Engage stakeholders

Blockchain can enable more explicit and more accurate tracking in supply chain: Organizations can digitalize digital assets and create a seamless record that separates everything that is made, making it possible to track assets from production to delivery or use by the end user. This increased supply of light supply gives more visibility to businesses and consumers. Blockchain can drive the supply chain transparency to help reduce the fraudulent assets of high value assets such as diamonds and pharmaceutical drugs. Blockchain can help companies understand how ingredients and finished goods are transferred through each subcontractor and reduce profit losses from fraudulent and gray market trading, as well as increase confidence in end-users by reducing or eliminating the impact of counterfeit products. In addition, entities may maintain additional control over the execution of an external contract. Blockchain provides all organizations within the network to provide appropriate access to the same information, which may reduce communication or data transmission errors. Less time can be spent verifying data and more can be spent on delivering goods and services — either to improve quality, reduce costs, or both. Finally, the blockchain can streamline management processes and reduce costs by enabling effective testing of supply chain data. Procedures that include self-assessment for compliance or credit purposes that may take weeks can now be accelerated using a spreadsheet of all relevant information.

IV. ETHEREUM AND SMART CONTRACTS

Ethereum is an open- source public service that uses blockchain technology that allows smart contracts and cryptocurrency trading securely without a third party. There are two accounts available through Ethereum externally possessed accounts (controlled by private keys made by human users) and contract accounts. Ethereum allows developers to deploy all kinds of decentralised apps.

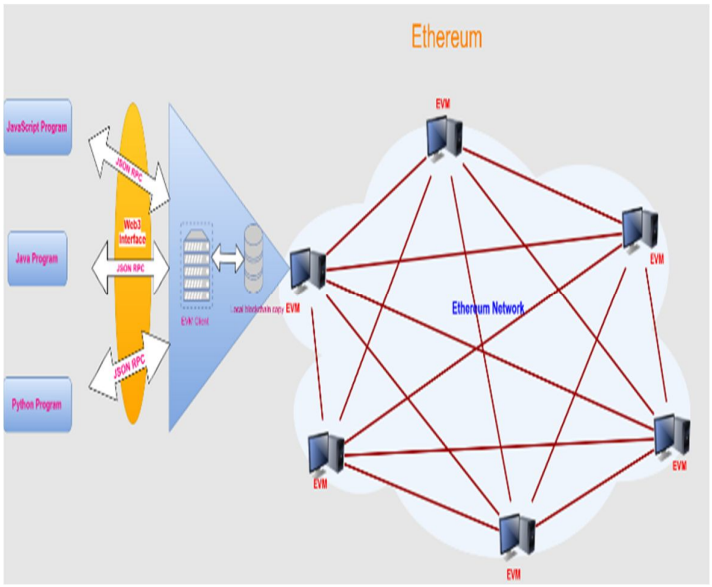

Fig 1 - Interaction of Javascript Code with Ethereum Node

A. Etherium

Ethereum's mission is to create another shared work protocol, to provide a unique set of trades that we believe will be truly useful in the external division of segregation operations, with special emphasis on conditions where time for rapid development, security of small and unusual jobs; Ethereum does this by establishing what is the last non-authoritative base name for unauthorized power, marketing formats and country conversion activities. A blank definition of a word coin is usually written in two lines of code, and some principles such as currencies and currency systems are usually made up of less than twenty. Smart contracts, cryptographic "boxes" contain value and are only open if certain conditions are met, can also be built on stage, with greater force than those given Bitcoin scripting due to increased Turing-absoluteness, value- mindfulness, value blockchain - mindfulness and -state blockchain in the programming language embedded in Turing-complete, which allows anyone to write smart contracts and assigned tasks in an environment where they will produce their own authorized laws, marketing formats and land reform activities.

B. Ethereum Accounts

"Ether" is the internal crypto-fuel component of Ethereum, which is used to pay transaction fees. Generally, there are two types of accounts, the first being foreign accounts, which are governed by secret keys, and the second are contractual accounts, which are governed by their own contract code.
An external account does not have a code, and a person can send messages from an external account by creating and registering work during the contract account, whenever the code account code is valid after receiving the message, allowing it to be read and write to the internal store and send further messages or make contracts respectively.

C. Messages and Transactions

The term" transaction" is used in Ethereum to relate to the data package that stores a message or data to be transferred from an externally possessed account. Transactions contain:

- A signature identifying the sender
- The recipient of the message
- The amount of ether to transfer from the sender to the recipient
- A voluntary data field
- A STARTGAS value, representing the maximum number of computational steps the transaction execution is allowed to take
- A GASPRICE value, representing the fee the sender pays per computational step

D. Messages

Contracts have the capability to send " messages" to other contracts. Messages are virtual objects which exists only in the Ethereum execution environment and are never serialized. A message contains:

- The sender of the message (implicit)
- The recipient of the message
- A voluntary data field
- The amount of ether to transfer alongside the message
- A STARTGAS value

Basically, a message is like a transaction, except it's produced by a contract and not an external actor. A message is produced when a contract presently executing code executes the CALL opcode, which produces and executes a message. Like a transaction, a message leads to the receiving account running its code. Therefore, contracts can have connections with other contracts in exactly the same way that external actors can.
Note that the gas allowance assigned by a transaction or contract applies to the total gas consumed by that transaction and all sub-executions. For illustration, if an external actor A sends a sale to B with 1000 gas, and B consumes 600 gas before transferring a communication to C, and the internal prosecution of C consumes 300 gas before returning, also B can spend another 100 gas before running out of gas.

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Ethereum State Transition Function

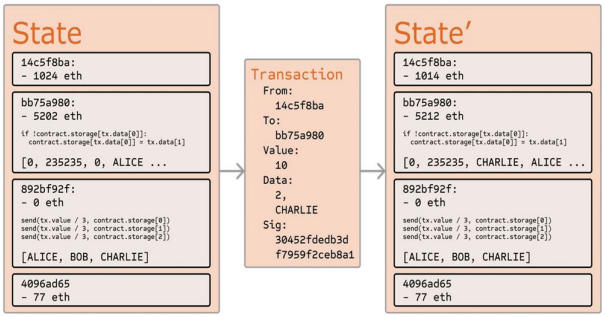

Fig 2 - State transition function after succesful completion of a transaction

E. Code Execution

The code for Ethereum contracts is written during standard, stack-based bytecode language, defined as "Ethereum virtual machine code" or "EVM code". The code contains a series of bytes, where each byte represents a function. Generally , code execution is an infinite loop that consists of repeatedly completing the operation at the present program counter (which begins at zero) then incrementing the program counter by one, until the top of the code is reached or a mistake or STOP or RETURN instruction is detected. The operations have access to 3 sorts of space during which to store data:

- The stack, a last-in-first-out container to which values are often pushed and popped
- Memory, an infinitely expandable byte array
- The contract's long-term storage, a key/value store. Unlike stack and memory, which reset after computation ends, storage persists for the future .

The code can also access value, sender and incoming message data, as well as block header data, so the code can return more information as output.

The official version of EVM coding is incredibly simple. While the Ethereum virtual machine works, its full computational status is usually defined by a tuple (block status, transaction, message, code, memory, stack, pc, gas), where block status is a universal status -Account and includes balance and storage. At the beginning of each kill cycle, the current command is obtained by taking a pcth byte of code (or 0 if pc> = len (code)), and every command has its own meaning of how it affects the tuple. for example, ADD removes two objects from the stack and pushes their value, lowers gas by 1 and raises the computer by 1, and SSTORE pushes two of the highest objects into the stack and places the second item in the final position of the contract in the indicated location. with the first thing. While there are some ways to improve Ethereum machine integration with timely integration, Ethereum's basic implementation often clears a few hundred lines of code.

V. SOLIDITY

Solidity is a mathematical programming language designed to develop intelligent contracts that run on Ethereum Virtual Machine. Smart contracts are programs that are used within a peer-to-peer network where no one has special authority over the transaction, and thus allow for the use of value tokens, ownership, voting, and other sensible forms. Solidity is a contract-based programming language, which is advanced to implement smart contracts. Strength is strongly influenced by C ++, Python and JavaScript and is designed to target Ethereum Virtual Machine (EVM). Solidity is written mathematically, supporting legacy, libraries and complex forms of user-defined programming language. You can use Solidity to create consumer contracts such as voting, large-scale funding, blind auctions, and multi-signed wallets.

Strength may be a mathematical programming language designed to develop intelligent contracts operating on Ethereum Virtual Machine, also known as EVM.

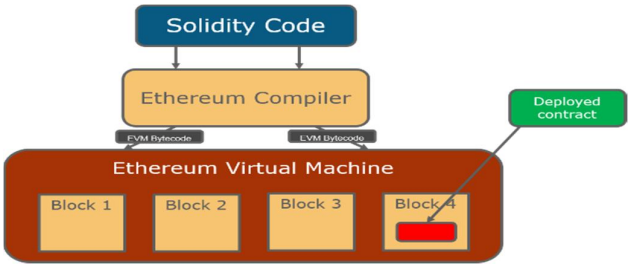

Fig 3 - Ethereum Blockchain Architecture

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As specified Wood is designed around the user-defined description of the telephone system results also included within the proposal, called "Natural Language Definition" ECMAScript syntax to be familiar to existing web developers unlike ECMAScript does not change. typing and different return types.

Compared to other EVM targeted languages of the time such as Snake and Mutan, Solidity contained a number of significant differences.

Complex changes of contract members including map layout and position layout have been supported. Contracts support the asset, which includes multiple assets with a C3 line. A virtual binary interface (ABI) that performs many secure functions within a single contract was introduced with it (and later supported by Snake). A standard user-defined writing system for pronunciation results is included during the proposal, called "Definition of Indigenous Languages"

VI. RESULTS

In the developed system the manufacturer will enroll him with valid information on the blockchain with company name and other details and assigns a unique ID to each product with QR code. The manufacturer ships the products to the Distributor where a distributor can check the manufacturer details and ownership of the products, etc. Distributor verifies the genuineness of the EPC using assigned QR code and issues a transaction.

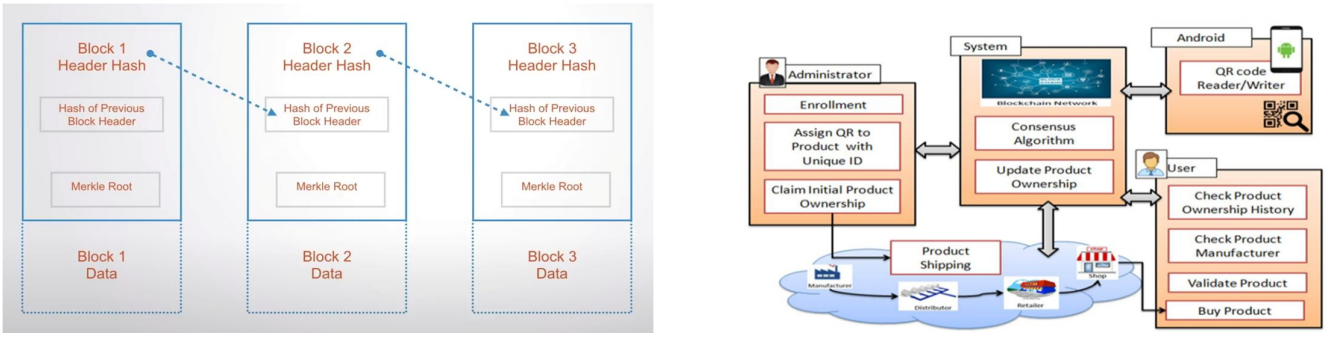


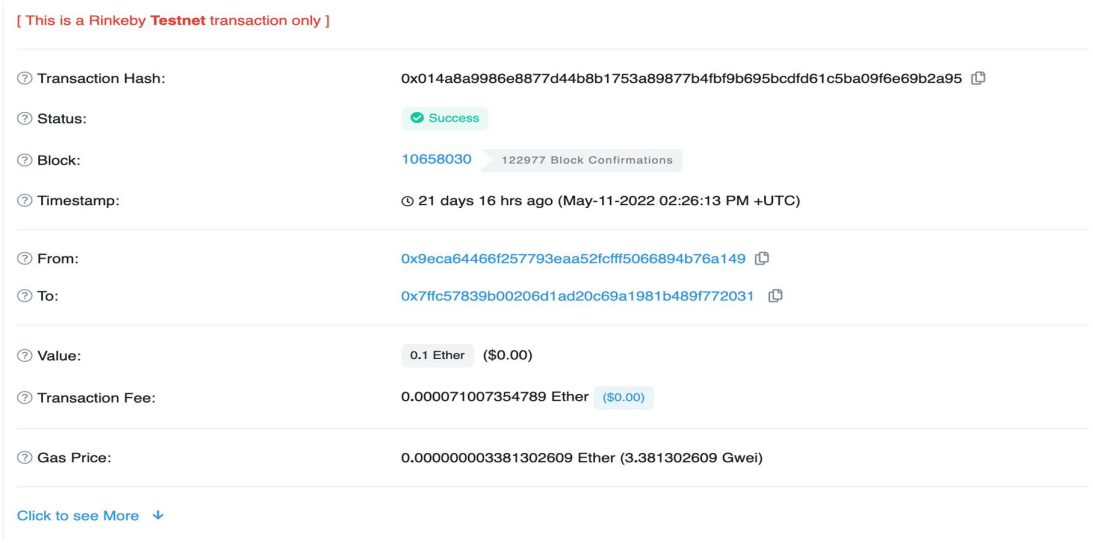
Fig 4 – Software Architecture

After the creation of QR Code Scanner application and integrating it with our blockchain database, we were able to scan for an authentic product and also distinguish between fake products. We used transaction hashes as a means to test the authenticity of the product and also converted them to QR Code so that the hashes could be scanned easily and the authenticity of the product can be checked.

VII. PROJECT SCREENSHOTS

0x014a8a9986e8877d44...	Transfer	10658030	19 days 17 hrs ago	0x9eca64466f257793ea...	IN	0x7ffc57839b00206d1ad...	0.1 Ether	0.000071007354
0xedcc22ac2362ead804...	Transfer	10561500	36 days 13 hrs ago	0x8f4157f8d57c53f7920...	IN	0x7ffc57839b00206d1ad...	0.009 Ether	0.000050925
0xbe45d444992ead3952...	Transfer	10531167	41 days 20 hrs ago	0x8f4157f8d57c53f7920...	IN	0x7ffc57839b00206d1ad...	0.000001 Ether	0.0000315
0x681e5b38a68e88296c...	Transfer	10528082	42 days 9 hrs ago	0x46b0582ed8cb65afcc8...	IN	0x7ffc57839b00206d1ad...	0.01 Ether	0.000024254626
0x7ff318cdb0e2b0a1bc9...	Transfer	10338937	75 days 17 hrs ago	0x3e034dc9b877e103eb...	IN	0x7ffc57839b00206d1ad...	0.2 Ether	0.00029060209
0x16eac6ab4396bb5716...	Transfer*	10064706	123 days 17 hrs ago	0xfe3b557e8fb62b89f49...	IN	0x7ffc57839b00206d1ad...	0.000000000000001 Ether	0.00031836
0x0601bcf0b3b7d5a4c8...	Transfer	10064684	123 days 17 hrs ago	0xfe3b557e8fb62b89f49...	IN	0x7ffc57839b00206d1ad...	0.00001 Ether	0.000021
0xc610a6054816636a13...	Transfer*	10064684	123 days 17 hrs ago	0xfe3b557e8fb62b89f49...	IN	0x7ffc57839b00206d1ad...	0.000000000000001 Ether	0.000693528
0x1410c69a7ec61e23e3...	Transfer*	10064683	123 days 17 hrs ago	0xfe3b557e8fb62b89f49...	IN	0x7ffc57839b00206d1ad...	0.000000000000001 Ether	0.00031836
0x05341d6772a0f21270...	Transfer*	10064683	123 days 17 hrs ago	0xfe3b557e8fb62b89f49...	IN	0x7ffc57839b00206d1ad...	0.000000000000001 Ether	0.000693528
0xdccb299eeae23acdc6...	Transfer*	10064683	123 days 17 hrs ago	0xfe3b557e8fb62b89f49...	IN	0x7ffc57839b00206d1ad...	0.000000000000001 Ether	0.000693528
0x0121679e7bd31ba080...	Transfer*	10064683	123 days 17 hrs ago	0xfe3b557e8fb62b89f49...	IN	0x7ffc57839b00206d1ad...	0.000000000000001 Ether	0.00063048
0xee99bfdf57a0852874b...	Transfer	10064683	123 days 17 hrs ago	0xfe3b557e8fb62b89f49...	IN	0x7ffc57839b00206d1ad...	0.00001 Ether	0.000021
0x7d65c8b7261d583178...	Transfer*	10064620	123 days 17 hrs ago	0xfe3b557e8fb62b89f49...	IN	0x7ffc57839b00206d1ad...	0.000000000000001 Ether	0.00042032

Test transactions appear like this



Transactions where product authenticity is confirmed

```
@Override
protected void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);
    setContentView(R.layout.activity_main);
    txtaddress = findViewById(R.id.text_address);
    address = "0x198cbb3bc53e0446622cd4df8a90b9c39e4de9b4";
    sharedPref = new SharedPref( context: this);
    StrictMode.ThreadPolicy policy = new StrictMode.ThreadPolicy.Builder().permitAll().build();
    StrictMode.setThreadPolicy(policy);
/enter your own infura api key below
    web3 = Web3j.build(new HttpService( url: "https://rinkeby.infura.io/v3/dee26646475845de9ecf9cc37a477552"));

    setupBouncyCastle();

    //  this is the pathname for the file that will be created and stores the wallet details
    EditText Edtpath = findViewById(R.id.walletpath);
    final String etheriumwalletPath = Edtpath.getText().toString();

    file = new File( pathname: getFilesDir() + etheriumwalletPath);// the etherium wallet location

    iniSpinner();
    //create the directory if it does not exist
    if (!file.mkdirs()) {
        file.mkdirs();
    } else {
        Toast.makeText(getApplicationContext(), text: "Directory already created",
                Toast.LENGTH_LONG).show();
    }
}
```

```
private void setupBouncyCastle() {
    final Provider provider = Security.getProvider(BouncyCastleProvider.PROVIDER_NAM
    if (provider == null) {
        // Web3j will set up a provider  when it's used for the first time.
        return;
    }
    if (provider.getClass().equals(BouncyCastleProvider.class)) {
        return;
    }
    //There is a possibility  the bouncy castle registered by android may not have a
    //so we  substitute with the one bundled in the app.
    Security.removeProvider(BouncyCastleProvider.PROVIDER_NAME);
    Security.insertProviderAt(new BouncyCastleProvider(),  position: 1);
}

public void ShowToast(String message) {
    runOnUiThread(() -> {
        Toast.makeText( context: this, message, Toast.LENGTH_LONG).show();
    });
}

public void makeTransaction(View v) throws Exception {
    EditText Edtvalue = findViewById(R.id.ethvalue);

    EditText product = findViewById(R.id.product);
    EditText brand = findViewById(R.id.brand);

    StringBuilder s = new StringBuilder(product.getText().toString());

    StringBuilder s1 = new StringBuilder(brand.getText().toString());
    if (s.length() == 0) {
        product.setError("Value Required");
        return;
    }
    if (s1.length() == 0) {
        brand.setError("Value Required");
        return;
    }

    if (Edtvalue.getText().toString().length() == 0) {
        Edtvalue.setError("Value Required");
        return;
    }
```

```
@SuppressLint("SetTextI18n")
public void retrieveBalance(View v) {
    //get wallet's balance
    try {
        EthGetBalance balanceWei = web3.ethGetBalance(address, DefaultBlockParameterName.LATEST).sendAsync()
                .get();
        TextView txtbalance = findViewById(R.id.text_balance);
        txtbalance.setText("" your balance in wei is : "" + balanceWei.getBalance());
    } catch (Exception e) {
        ShowToast("balance failed");
    }
}

String address;

@SuppressLint("SetTextI18n")
public void getWallet(String pass, String walletname) {
    try {
        credentials = WalletUtils.loadCredentials(pass, source: file + "/" + walletname);
        txtaddress.setText(""Your address is "" + credentials.getAddress());
        address = credentials.getAddress();
    } catch (Exception e) {
        e.printStackTrace();
    }
}

@SuppressLint("SetTextI18n")
public void createWallet(View v) {

    EditText walletP = findViewById(R.id.walletpath);
    EditText Edtpassword = findViewById(R.id.password);
    final String password = Edtpassword.getText().toString();
    if (walletP.getText().toString().endsWith(".json")) {
        getWallet(password, walletP.getText().toString());
    } else {  // this will be your etherium password
        try {
            // generating the etherium wallet
            Walletname = WalletUtils.generateLightNewWalletFile(password, file);
            ShowToast("Wallet generated wallet name is " + Walletname);
            Log.d( tag: "name", Walletname);
            credentials = WalletUtils.loadCredentials(password, source: file + "/" + Walletname);
            txtaddress.setText(""Your address is "" + credentials.getAddress());
            if (sharedPref.getFiles() != null) {
                Set<String> stringSet = sharedPref.getFiles();
                stringSet.add(Walletname);
```

Code Snippets

VIII. CONCLUSION

Blockchain is based on open source. The system developed will facilitate easier and faster interoperability between systems. It can efficiently scale to handle larger volumes of data and more blockchain users. Thus, proposed system is useful for end user to detect fake products in supply chain. End user can scan QR code assigned to a product and can get all the information like transaction history, current owner based on which end user can check whether the product is genuine or not.

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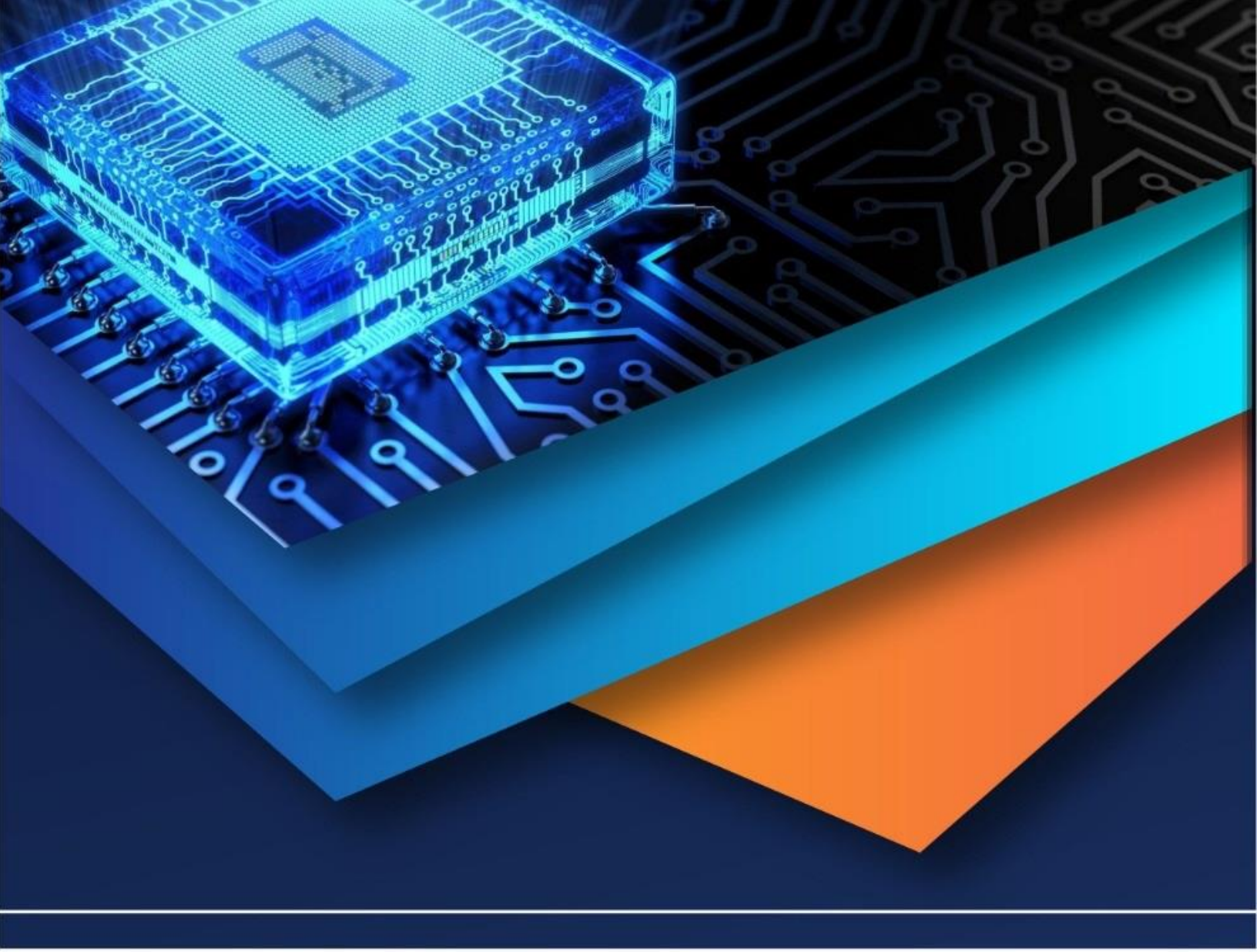

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IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

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