RV COLLEGE OF ENGINEERING

BENGALURU- 560059

(Autonomous Institution affiliated to VTU, Belagavi)

DEPARTMENT OF INFORMATION SCIENCE AND ENGINEERING

"Fake Product Detection System"

BLOCKCHAIN TECHNOLOGY AND USE CASE (18IS7F2)
Experiential Learning VII Semester

Academic year 2023-2024
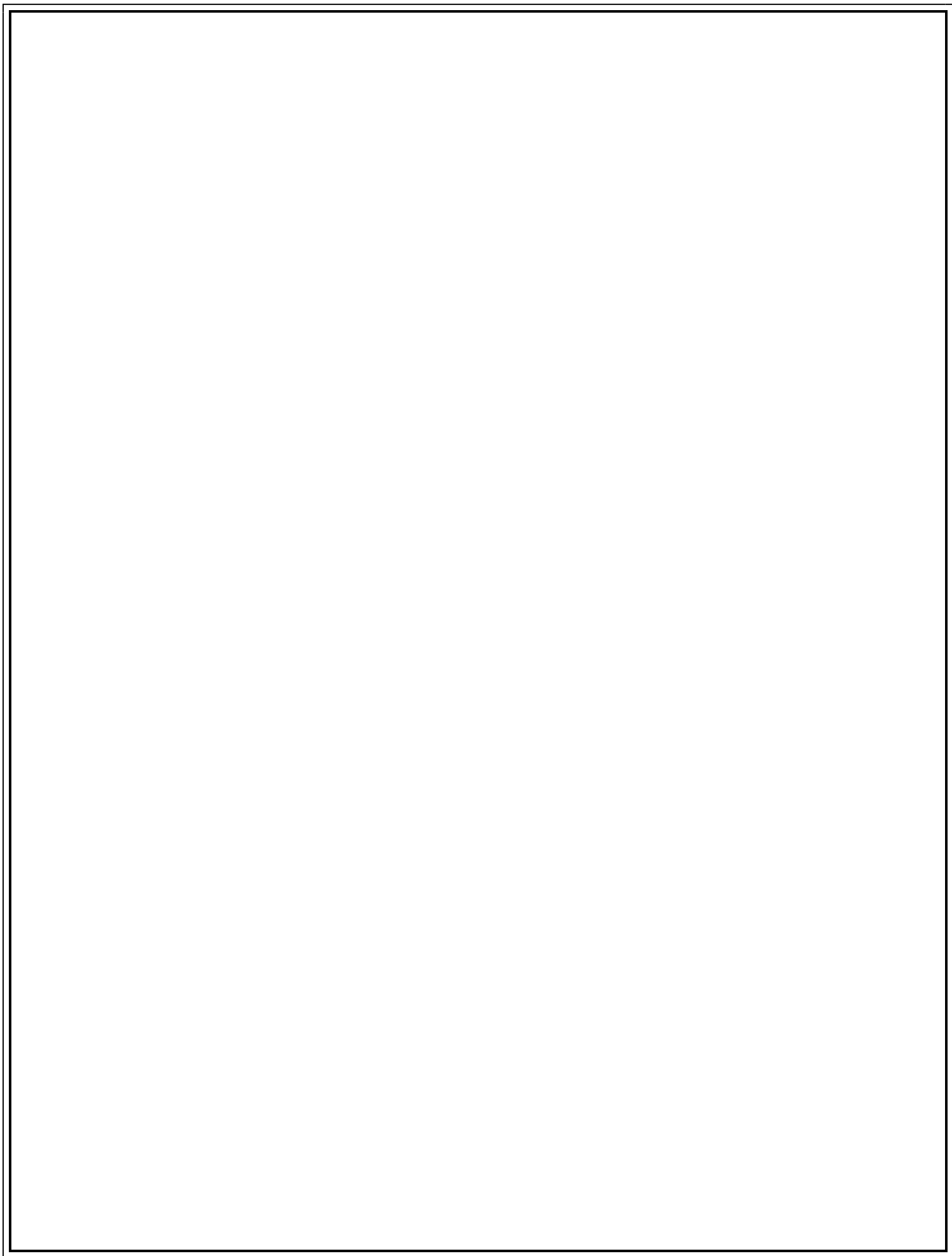
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CERTIFICATE

Certified that the work titled **"Fake Product Identification System"** has been carried out by **Abhishek R** (1RV21IS400), bona fide student of RV College of Engineering, Bengaluru, who has submitted in partial fulfillment for the Assessment of Course: **Blockchain Technology and Use Case (18IS7F2) – Experiential Learning** during the year 2023-2024. It is certified that all corrections/suggestions indicated for the internal assessment have been incorporated in the report.

Faculty in-charge   **Head of Department**

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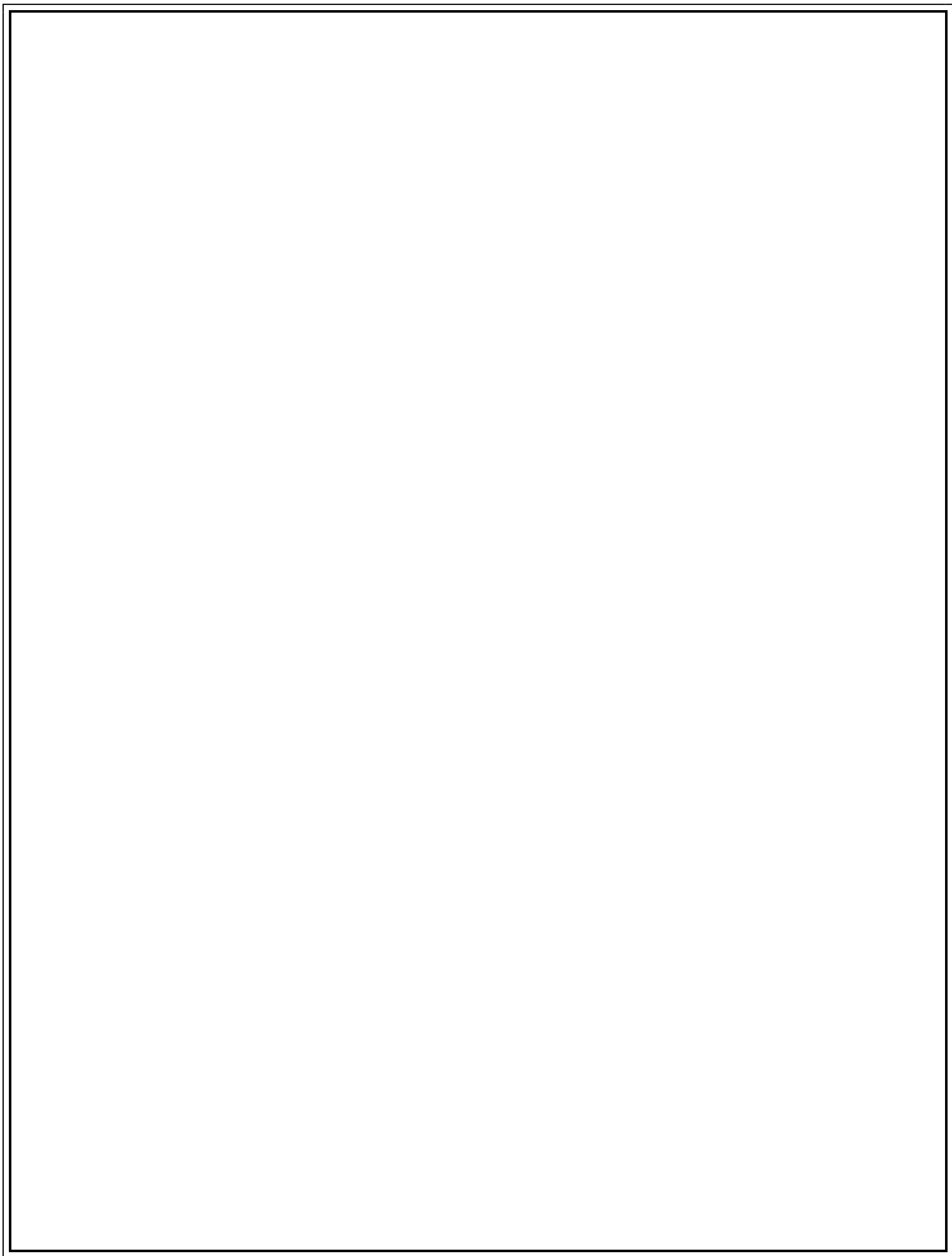
ABSTRACT

One of the biggest challenges in today's retail market is the counterfeiting of products. Counterfeiting products are just low-quality copies of some genuine brand. Many different methods have been adopted from time to time to combat the counterfeiting of the products such as RFID tags, artificial intelligence, machine learning, QR code-base system, and many more. But these methods have their disadvantages such as QR code can copy from a genuine product to a fake product, artificial intelligence and machine learning need high computational power to do operations, and many more methods adopted but a fulfilled method has not been developed. In this project, we have tried to improve the detection of fake products with the help of blockchain technology. Our method is to store the supply chain of products at every stage of the transaction of a product to a new party with the help of a QR code. Blockchain helps us to store the supply chain of products as a blockchain-based 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 protected from the third parties.

Index Terms - Counterfeit(Fake) product, QR code,Blockchain, Supply Chain, Transaction history.
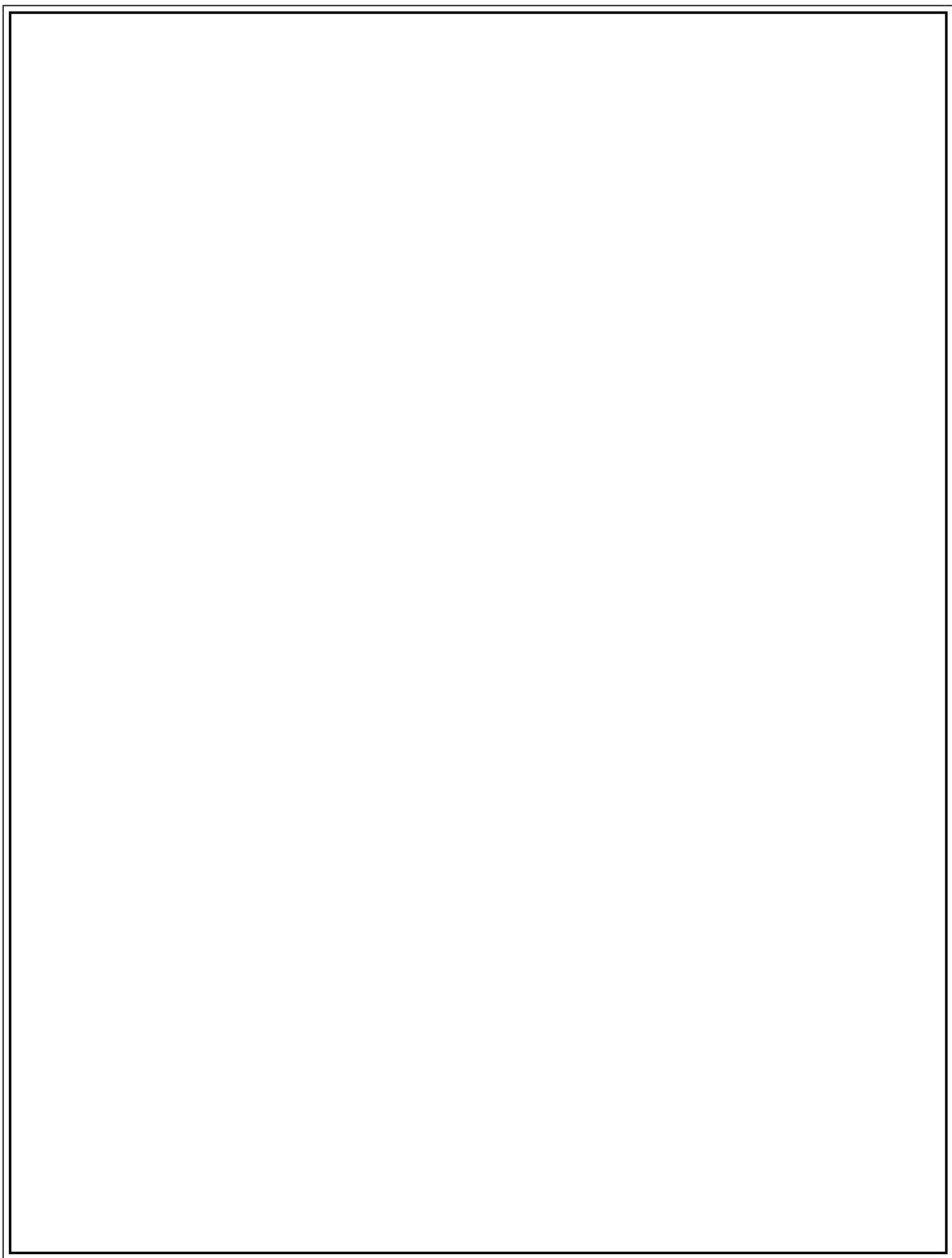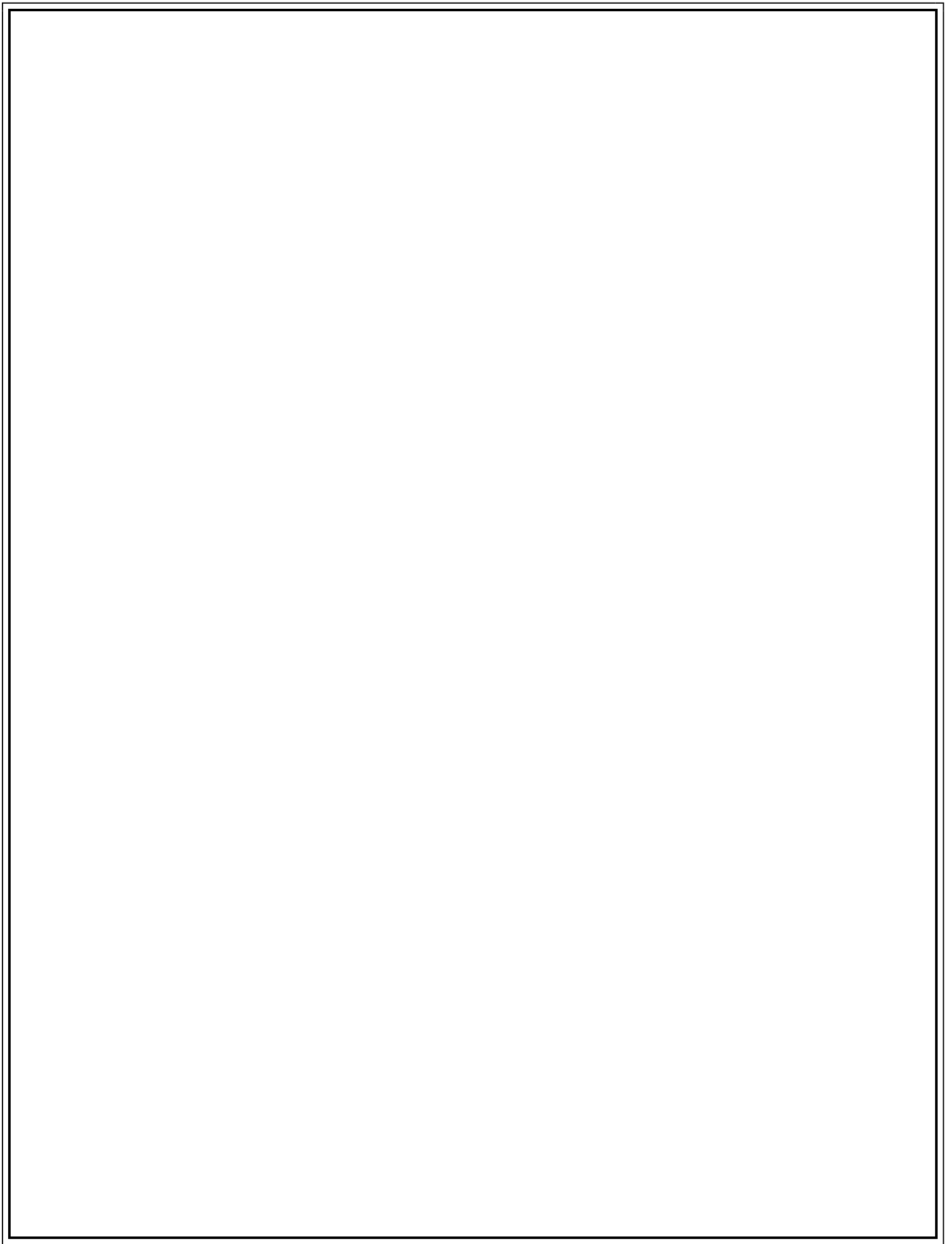
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Chapter 1

INTRODUCTION

Counterfeit products have become a pervasive issue in today's global marketplace, posing significant threats to consumer safety, brand reputation, and economic integrity. From pharmaceuticals and electronics to luxury goods and automotive parts, counterfeiters exploit vulnerabilities in supply chains to produce and distribute fake products that often mimic the appearance and functionality of genuine items. The consequences of counterfeit goods extend beyond financial losses, as they can endanger lives, compromise consumer trust, and undermine the competitiveness of legitimate businesses.

To address this pressing challenge, innovative technologies such as blockchain have emerged as promising solutions to enhance product authentication and combat the proliferation of counterfeit goods. Blockchain, originally devised as the underlying technology behind cryptocurrencies like Bitcoin, is a decentralized and immutable ledger that records transactions across a network of computers. Its core features of transparency, immutability, and decentralization make it well-suited for creating secure and trustworthy systems for verifying the authenticity of products.

The proposed Fake Product Identification System (FPIS) harnesses the power of blockchain technology to establish a robust framework for identifying and validating genuine products. By leveraging blockchain's capabilities, the FPIS aims to instill confidence among consumers, enable transparent supply chain management, and empower stakeholders to take proactive measures against counterfeiters.

In this paper, we present an in-depth exploration of the FPIS, highlighting its key components, functionalities, and potential benefits. We discuss how blockchain technology is integrated into the system architecture to provide immutable product identification, transparent provenance tracking, and real-time authentication capabilities. Furthermore, we examine the implications of implementing the FPIS across various industries, from pharmaceuticals and luxury goods to electronics and automotive parts.

Overall, the FPIS represents a significant advancement in the fight against counterfeit products, offering a scalable and reliable solution that leverages the transformative potential of blockchain technology. Through collaborative efforts between industry stakeholders, regulatory bodies, and technology developers, the FPIS has the potential to revolutionize product authentication processes, safeguard consumer interests, and uphold the integrity of global supply chains.

1.1   Topic relevance

- **Immutable Voice, Unchained Expression:** Blockchain safeguards content and communication, ensuring the user's microblogs stand against manipulation and censorship.

- **Own Your Data, Embrace Privacy:** Decentralised storage and encryption empower the user to control his digital footprint, free from centralised data grabs.

- **Transparent Rewards, Thriving Community:** Blockchain fuels a trustless incentive system, directly rewarding valuable contributions and building a self-sustaining microblogging ecosystem.

1.2   Objectives

- **Blockchain Technology Integration:** Investigate the integration of blockchain technology, specifically the Ethereum blockchain, into the decentralised marketplace

- **User Experience and Adoption:** Evaluate the user experience of users interacting with the decentralised marketplace, especially focusing on the integration with the Metamask wallet.

- **User Empowerment and Data Ownership:** Explore mechanisms within blockchain technology that empower users with greater control over their personal data and digital identities on decentralised social media platforms.

- **Cryptocurrency Payments and Global Transactions:** Examine the implementation of cryptocurrency payments, specifically using Ether, within the marketplace.

- **Security and Fraud Prevention:** Evaluate security measures implemented in the decentralised media, blockchain-based security features and fraud prevention mechanism

Chapter 2

LITERATURE SURVEY

[1] Provides us with a simple flowchart which is useful to know that even if we need blockchain in our projects or not. It provides different scenarios and by bypassing these cases you come to know whether blockchain is needed or not..

[2] proposed a system for the detection of fake products. The proposed system is that we make a QR code for a product that will contain all its information and store that QR in a blockchain database when the customer or distributor buys the same product and scan the QR code which is embedded in the product and if it is matched with the stored QR code then the system considers the product genuine and if it does not match with the stored QR code then system consider it as a fake product.

[3] provides us the information about the supply chain management system using blockchain. Blockchain can provide a permanent, shareable, auditable record of products through their supply chain, which improves product traceability, authenticity, and legality in a more cost-effective way.

[4] provides us the information about the QR codes, their texture, and authentication. The popular use of high-quality printing and scanning QR codes makes it easier to counterfeit important printed matter, such as important documents, the anti-counterfeit label on merchandise, packaging, etc.

[5] proposed a simple QR code-based system which is embedded in the product at the time of manufacturing and the user verifies it by matching the product QR codes with the stored QR code.

Chapter 3

SYSTEM ARCHITECTURE AND TECHNOLOGY

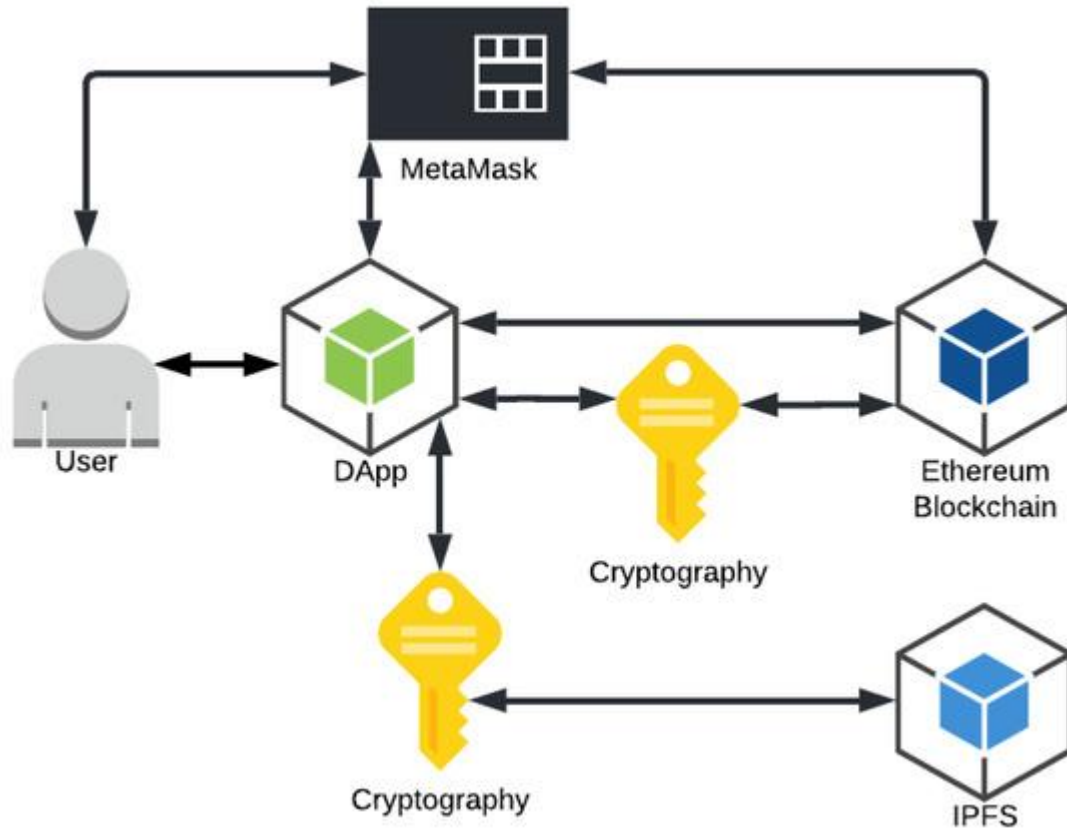## 3.1 Architecture Diagram

Figure 3.1. Architecture Diagram

3.2 Technology Used

1. **React**: Frontend Development

   Responsibilities:

   - Building a responsive and user-friendly interface for users.

   - Implementing components for NFTs listings, user profiles, and transactions

   - history.

   - Handling user interactions and ensuring an intuitive user experience.

2. **Node.js:** Backend Development

   Responsibilities:

   - Managing the server-side logic and handling requests from the frontend.

   - Integrating with the blockchain (smart contracts) to fetch and update data.

   - Implementing authentication, authorization, and business logic.

3. **Solidity:** Smart Contract Development

   Responsibilities:

   - Writing smart contracts that govern the rules of the decentralised media.

   - Defining functions for NFT listings, transactions, and certification verification.

   - Ensuring the security and integrity of the blockchain-based transactions.

4. **Ether.js**: Ethereum Integration

   Responsibilities:

   - Interacting with the Ethereum blockchain from the Node.js backend.

   - Facilitating communication with smart contracts deployed on the Ethereum network.

   - Handling transactions, querying data, and monitoring blockchain events.

Chapter 4

IMPLEMENTATION

4.1 Smart contract deployment:

```solidity
You, 2 months ago | 1 author (You)
1   //SPDX-License-Identifier: MIT
2   // Two pages to app: Home and Profile
3   // Must have NFT to post content
4   // NFT will represent avatar. Store username and image as NFT metadata
5   // For profile page, if user has not created an NFT yet then a form will appear that allows users to mint their own NFT profile.
6   // For profile page, if user has created an NFT then it will display the users profile picture and username at the top of the page
7   // and below that there will be a form at the bottom that allows users to create a new NFT for their profile.
8
9   pragma solidity ^0.8.0;
10          You, 2 months ago • first commit
11  import "hardhat/console.sol";
12  import "@openzeppelin/contracts/access/Ownable.sol";
13  import "@openzeppelin/contracts/token/ERC721/extensions/ERC721URIStorage.sol";
14
15  contract Decentratwitter is ERC721URIStorage {
16      uint256 public tokenCount;
17      uint256 public postCount;
18      mapping(uint256 => Post) public posts;
19      // address --> nft id
20      mapping(address => uint256) public profiles;
21
22      struct Post {
23          uint256 id;
24          string hash;
25          uint256 tipAmount;
26          address payable author;
27      }
28
29      event PostCreated(
30          uint256 id,
31          string hash,
32          uint256 tipAmount,
33          address payable author
34      );
35
36      event PostTipped(
37          uint256 id,
38          string hash,
39          uint256 tipAmount,
40          address payable author
41      );
42
43      constructor() ERC721("Decentratwitter", "DAPP") {}
44
45      function mint(string memory _tokenURI) external returns (uint256) {
46          tokenCount++;
47          _safeMint(msg.sender, tokenCount);
48          _setTokenURI(tokenCount, _tokenURI);
49          setProfile(tokenCount);
50          return (tokenCount);
51      }
52
53      function setProfile(uint256 _id) public {
54          require(
55              ownerOf(_id) == msg.sender,
56              "Must own the nft you want to select as your profile"
57          );
```

4.2   Meta Mask integration

```
You, 2 months ago | 1 author (You)
1   import { useState, useEffect } from 'react'
2   import { ethers } from "ethers"
3   import { Row, Form, Button, Card, ListGroup } from 'react-bootstrap'
4   import { create as ipfsHttpClient } from 'ipfs-http-client'
5   // const client = ipfsHttpClient('https://ipfs.infura.io:5001/api/v0')
6   const projectId = '2IBM9kLv4JwpxVLc85YEbo8n3Gj';
7   const projectSecret = '0c78915b765853d5b30956562f8214ea';
8   const auth = 'Basic ' + btoa(projectId + ':' + projectSecret);
9
10  const client = ipfsHttpClient({
11      host: 'ipfs.infura.io',
12      port: 5001,
13      protocol: 'https',
14      headers: {
15          authorization: auth
16      }
17  })
18
19  const Home = ({ contract }) => {
20      const [posts, setPosts] = useState('')
21      const [hasProfile, setHasProfile] = useState(false)
22      const [post, setPost] = useState('')
23      const [address, setAddress] = useState('')
24      const [loading, setLoading] = useState(true)
25      const loadPosts = async () => {
26          // Get user's address
27          let address = await contract.signer.getAddress()
28          setAddress(address)
29          // Check if user owns an nft
30          // and if they do set profile to true
31          const balance = await contract.balanceOf(address)
32          setHasProfile(() => balance > 0)
33          // Get all posts
34          let results = await contract.getAllPosts()
35          // Fetch metadata of each post and add that to post object.
```

4.3 Login Page

```html
<!doctype html>
<html lang="en">
  <head>
    <title>Fake Product Identification</title>
    <meta charset="utf-8">
    <meta name="viewport" content="width=device-width, initial-scale=1, shrink-to-fit=no">
    <link href='https://fonts.googleapis.com/css?family=Roboto:400,100,300,700' rel='stylesheet' type='text/css'>
    <link rel="stylesheet" href="https://stackpath.bootstrapcdn.com/font-awesome/4.7.0/css/font-awesome.min.css">
    <link rel="stylesheet" href="css/style.css">

  </head>
  <body>
  <section class="ftco-section">
      <div class="container-fluid px-md-5">
          <div class="row justify-content-between">
              <div class="col-md-8 order-md-last">
                  <div class="row">
                      <div class="col-md-6 text-center">
                          <a class="navbar-brand" href="index.html">Fake Product Identification <span>through Blockchain</span></a>
                      </div>
                      <div class="col-md-6 d-md-flex justify-content-end mb-md-0 mb-3">
                          <form action="#" class="searchform order-lg-last">

                          </form>
                      </div>
                  </div>
              </div>
              <div class="col-md-4 d-flex">
                  <div class="social-media">

              </div>
              </div>
          </div>
      </div>
      <nav class="navbar navbar-expand-lg navbar-dark ftco_navbar bg-dark ftco-navbar-light" id="ftco-navbar">
      <div class="container-fluid">

        <button class="navbar-toggler" type="button" data-toggle="collapse" data-target="#ftco-nav" aria-controls="ftco-nav" aria-expanded="false" aria-label="Toggle navigati
          <span class="fa fa-bars"></span> Menu
        </button>
        <div class="collapse navbar-collapse" id="ftco-nav">
```

```html
                <li class="nav-item "><a href="manufacturer.html" class="nav-link">Manufacturer</a></li>
                <li class="nav-item"><a href="seller.html" class="nav-link">Seller</a></li>
                <li class="nav-item"><a href="consumer.html" class="nav-link">Consumer</a></li>
            </ul>
          </div>
        </div>
      </nav>
    <!-- END nav -->



    </section>

    <div class="container-fluid px-md-5">
        <div class="row justify-content-between">
            <div class="col-md-12 order-md-last">
                <div class="row">
                    <div class="col-md-12 text-center">
                        <a class="navbar-brand" href="index.html">WELCOME </a>
                    </div>
                    <div class="col-md-6 d-md-flex justify-content-end mb-md-0 mb-3">
                        <form action="#" class="searchform order-lg-last">

            </form>
                    </div>
                </div>
            </div>
            <div class="col-md-4 d-flex">
                <div class="social-media">

        </div>
    </div>
    </section>

    <script src="js/jquery.min.js"></script>
    <script src="js/bootstrap.min.js"></script>
    <script src="js/main.js"></script>
    <script src="js/web3.min.js"></script>
    <script src="js/truffle-contract.js"></script>

    </body>
</html>
```

4.4 NFT Information:

```solidity
51      }
52
53      function setProfile(uint256 _id) public {
54          require(
55              ownerOf(_id) == msg.sender,
56              "Must own the nft you want to select as your profile"
57          );
58          profiles[msg.sender] = _id;
59      }
60
61      function uploadPost(string memory _postHash) external {
62          // Check that the user owns an nft
63          require(
64              balanceOf(msg.sender) > 0,
65              "Must own a decentratwitter nft to post"
66          );
67          // Make sure the post hash exists
68          require(bytes(_postHash).length > 0, "Cannot pass an empty hash");
69          // Increment post count
70          postCount++;
71          // Add post to the contract
72          posts[postCount] = Post(postCount, _postHash, 0, payable(msg.sender));
73          // Trigger an event
74          emit PostCreated(postCount, _postHash, 0, payable(msg.sender));
75      }
76
77      function tipPostOwner(uint256 _id) external payable {
78          // Make sure the id is valid
79          require(_id > 0 && _id <= postCount, "Invalid post id");
80          // Fetch the post
81          Post memory _post = posts[_id];
82          require(_post.author != msg.sender, "Cannot tip your own post");
83          // Pay the author by sending them Ether
84          _post.author.transfer(msg.value);
85          // Increment the tip amount
86          _post.tipAmount += msg.value;
87          // Update the image
88          posts[_id] = _post;
89          // Trigger an event
90          emit PostTipped(_id, _post.hash, _post.tipAmount, _post.author);
91      }
92
93      // Fetches all the posts
94      function getAllPosts() external view returns (Post[] memory _posts) {
95          _posts = new Post[](postCount);
96          for (uint256 i = 0; i < _posts.length; i++) {
97              _posts[i] = posts[i + 1];
98          }
99      }
100
```
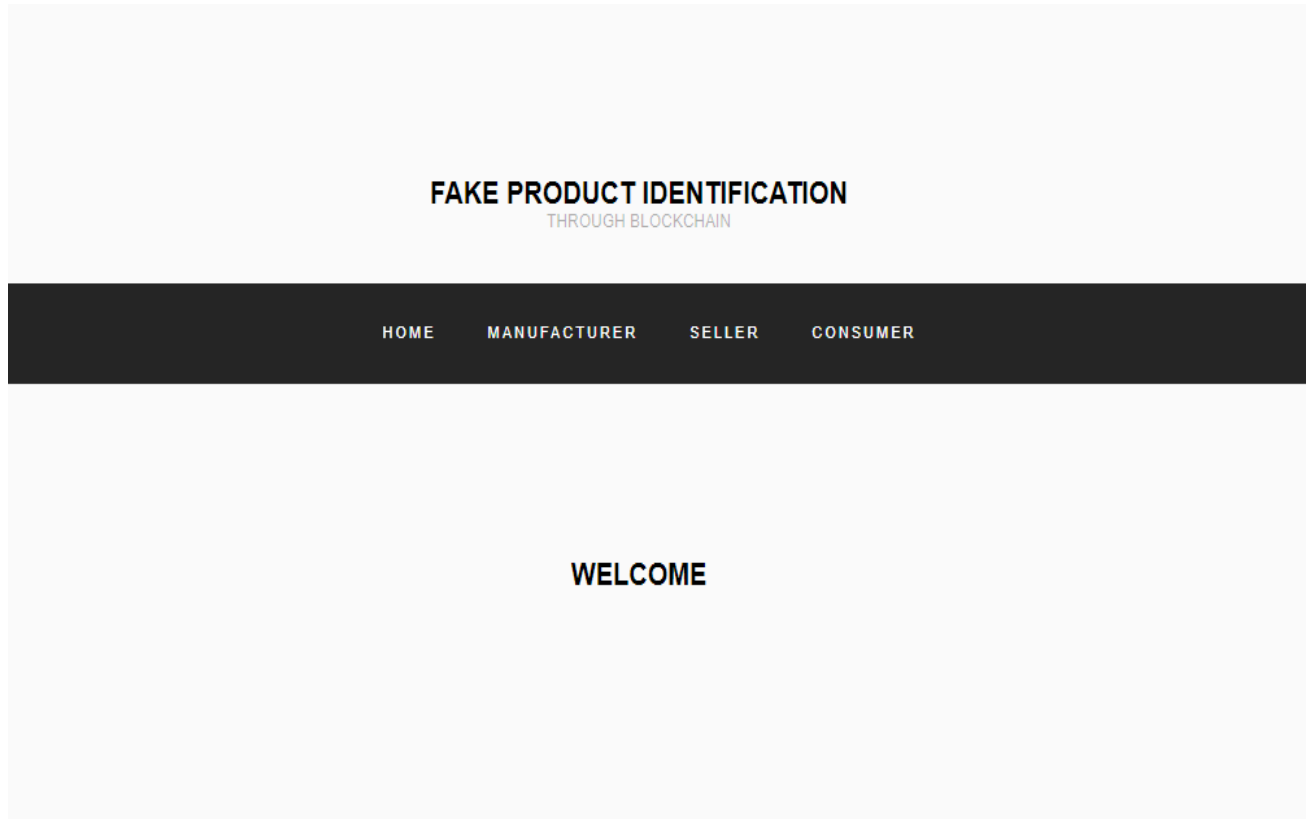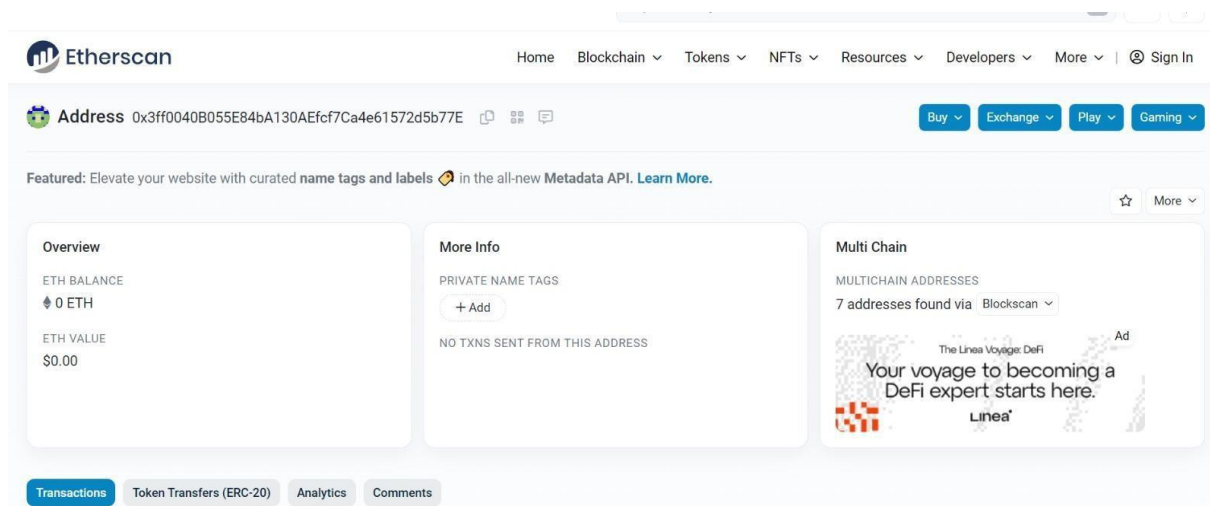
Chapter 5

RESULTS AND OUTPUTS

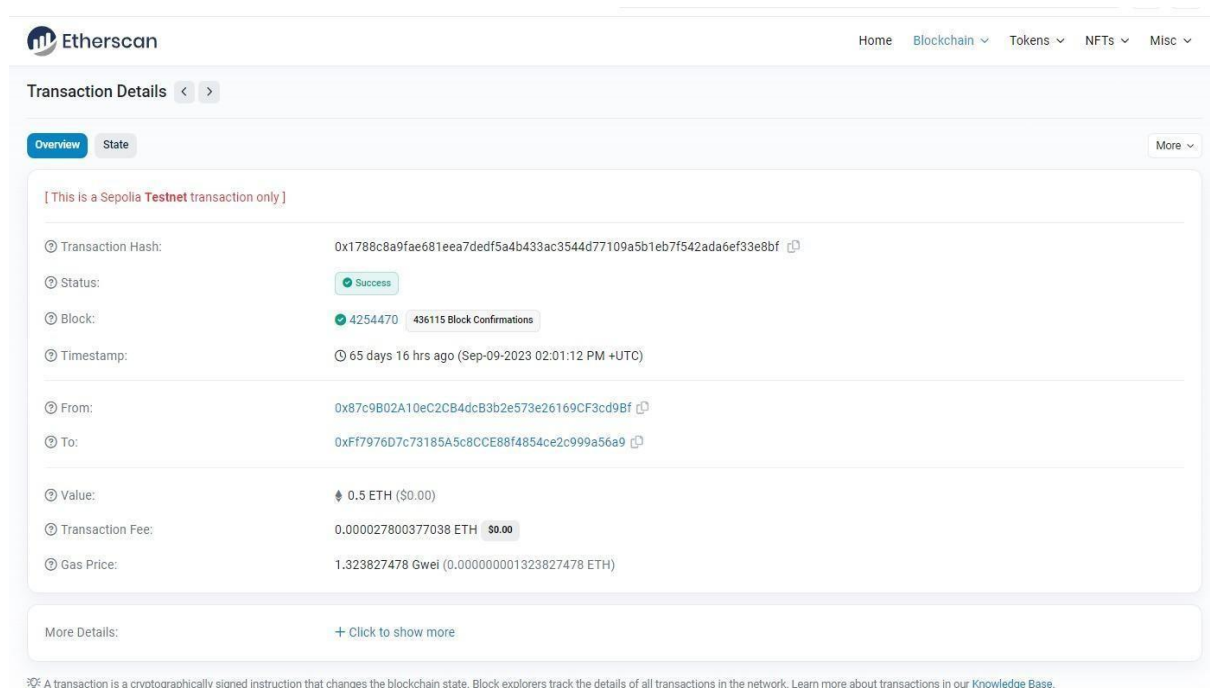**Figure 5.1.** Home Page

Figure 5.2. Metam Mask Receipt

Figure 5.3. Metamask Transaction Hash
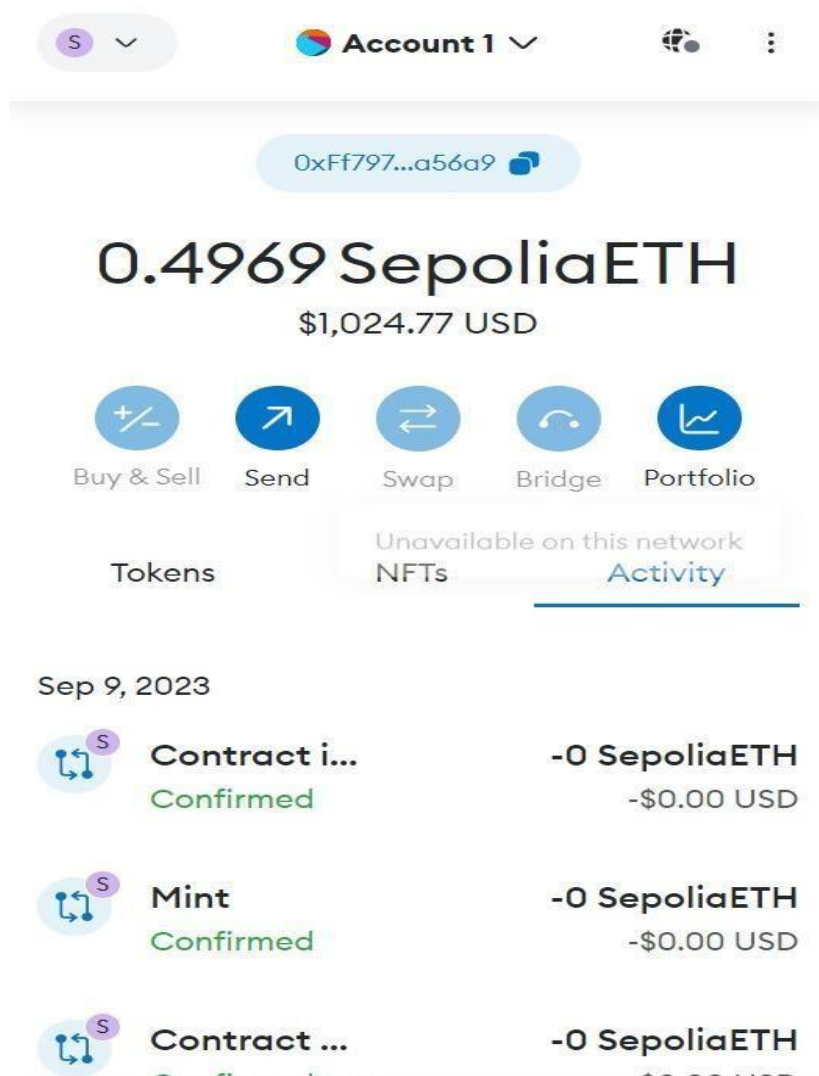
Figure 5.5. Metamask Image

Figure 5.6. Metamask Image

Chapter 6

CONCLUSION AND FUTURE SCOPE

Thus from the above discussion, we can say that developing a completely functional application that can detect whether the product is fake or genuine really helps the retail market to grow and provides security to the end user that the product he is buying is really genuine and is branded and also it helps manufacturers to maintain its company reputation and company value. In today's modern technology world, the only emerging technology that provides more security and functionality for stored data is blockchain. Thus blockchain-based application is a lifesavers for all customers and manufacturers.

In this paper, we have proposed a fully functional application that helps users to detect whether the product is fake or real. The manufacturer for the first time stored the detail of the product in the blockchain and generated an embedded QR code to add other details by other parties. At the time of receiving the product, other parties will add their details of ownership of the product. In the end, the customer can scan the QR code and can check the history of the product, and decide whether the product is genuine or not.

 The proposed system really helps the retail market, manufacturers, and consumers from counterfeiting mproducts but the system failed when a QR code is taken from a genuine product and given to a fake product then the product which is sold first become genuine it does not matter it is a genuine product or fake product but another product is treated as a fake product. Also storing the supply chain of every product require a huge amount of memory which is going to make this system expensive.

The future work is to implement this model and try to resolve the limitation such as embedding some material in the product so that when a person tries to take the QR code, the chip or something will send the signal.

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