ROHINI COLLEGE OF ENGINEERING AND TECHNOLOGY

PALKULAM, KANYAKUMARI DISTRICT

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

NAAN MUDHALVAN

PROJECT TITLE :

CLIMATE TRACK SMART USING BLOCKCHAIN

TEAM ID : NM2023TMID06771

TEAM MEMBER	NM ID
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Project Report Format

1.INTRODUCTION

1.1Project Overview

Climate TrackSmart is an innovative blockchain-based solution aimed at addressing the critical challenges of climate change and environmental accountability. The project leverages blockchain technology to create a transparent, secure, and immutable system for tracking, verifying, and incentivizing sustainable practices and carbon reduction efforts.

1.2Purpose

1)Transparency and Trust: Climate TrackSmart aims to create a transparent and trustworthy platform for tracking and validating environmental data. Blockchain's immutable ledger ensures that all recorded information is tamper-proof and can be independently verified, fostering trust among participants.

2)Verification of Sustainable Practices: By using smart contracts, Climate TrackSmart can automate the verification of sustainability efforts. This helps ensure that actions taken to reduce carbon emissions and promote environmental responsibility are accurately recorded and authenticated.

3)Incentivizing Sustainable Behavior: The project intends to encourage individuals and organizations to engage in sustainable practices by offering rewards and incentives. These rewards can be in the form of blockchain-based tokens, providing tangible benefits for environmentally responsible actions.

4)Collaboration and Data Sharing: Climate TrackSmart promotes collaboration between different stakeholders, including individuals, businesses, governmental bodies, and environmental organizations. It facilitates the sharing of environmental data and best practices, creating a collective effort to combat climate change.

5)Empowering Individuals and Organizations: The platform empowers individuals and organizations to take control of their environmental impact. By tracking and measuring their carbon footprint and other sustainability efforts, users can make informed decisions to reduce their environmental impact.

2.LITERATURE SURVEY

2.1Existing problem

1)Data Accuracy and Trust: Ensuring the accuracy of data recorded on the blockchain can be a challenge. Without accurate data, the verification and tracking mechanisms may be compromised, leading to incorrect assessments of environmental actions.

2)Data Integration: Integrating data from various sources, including IoT devices, sensors, and government databases, can be complex. Inconsistent data formats and standards can hinder the seamless flow of information into the blockchain system.

3)Scalability: As more users and organizations join the platform, the blockchain network may face scalability issues. High transaction volumes can lead to slower processing times and increased costs.

4)Regulatory Compliance: Different regions and countries may have varying regulations and standards for tracking and verifying environmental data. Ensuring compliance with these regulations can be challenging, especially in a global context.

5)User Adoption: Encouraging individuals and organizations to actively use the platform and accurately input their environmental data can be a hurdle. Users may be hesitant to share sensitive information or may lack the technical knowledge to participate effectively.

2.2 References

1) https://www.mural.co/templates/empathy-map-canvas

2) https://www.mural.co/templates/empathy-map-canvas

3) https://metamask.io/

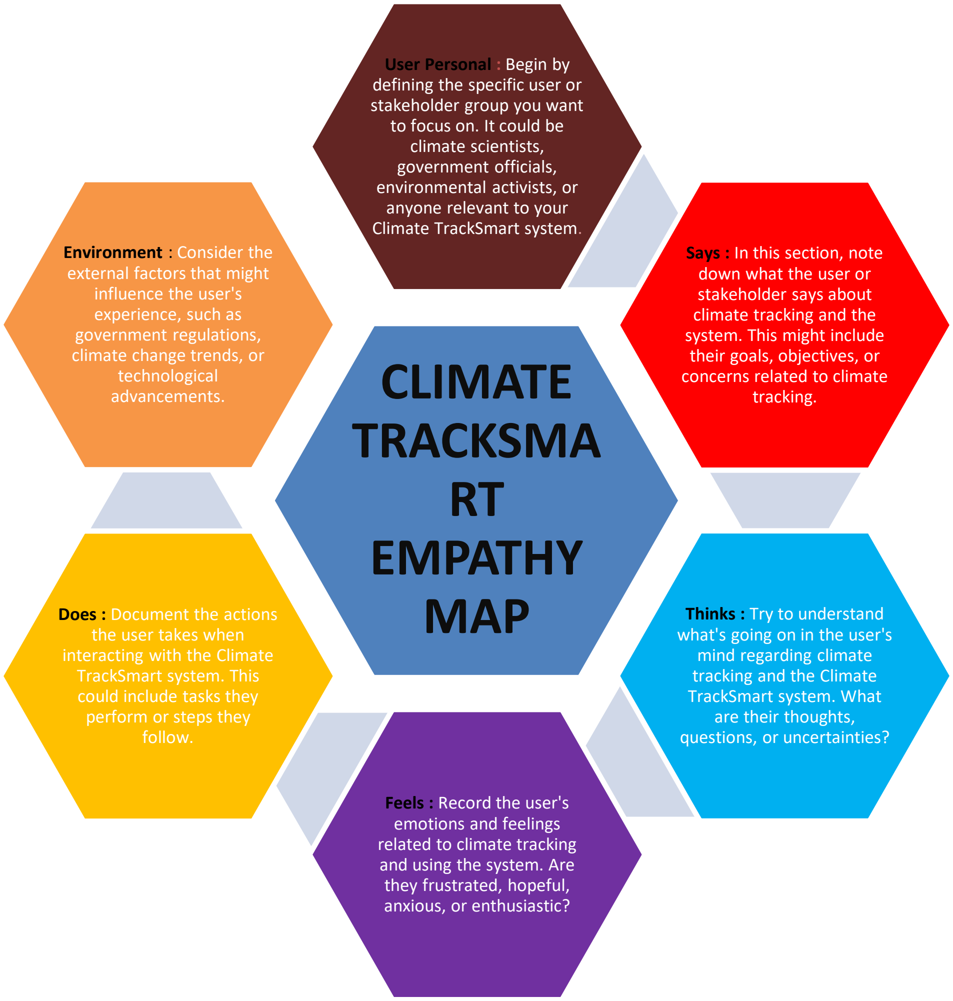
2.3 Problem Statement Definition

In the face of escalating climate change and environmental degradation, there is an urgent need for a transparent and secure system to track, verify, and report critical climate-related data and actions.

Existing methods for monitoring and managing climate initiatives lack the trust, security, and interoperability required for global collaboration. Additionally, the lack of transparency and accountability in tracking climate efforts hinders the accurate measurement of progress towards international climate goals, such as the Paris Agreement.To address these challenges, the 'Climate Tracksmart' project seeks to leverage blockchain technology to develop a decentralized, tamper-proof, and efficient system for tracking and verifying climate-related data, including carbon emissions, renewable energy production, reforestation efforts, and other environmental initiatives.

3.IDEATION & PROPOSED SOLUTION

3.1Empathy Map Canvas



CLIMATE TRACKSMART EMPATHY MAP

User Personal : Begin by defining the specific user or stakeholder group you want to focus on. It could be climate scientists, government officials, environmental activists, or anyone relevant to your Climate TrackSmart system.

Says : In this section, note down what the user or stakeholder says about climate tracking and the system. This might include their goals, objectives, or concerns related to climate tracking.

Thinks : Try to understand what's going on in the user's mind regarding climate tracking and the Climate TrackSmart system. What are their thoughts, questions, or uncertainties?

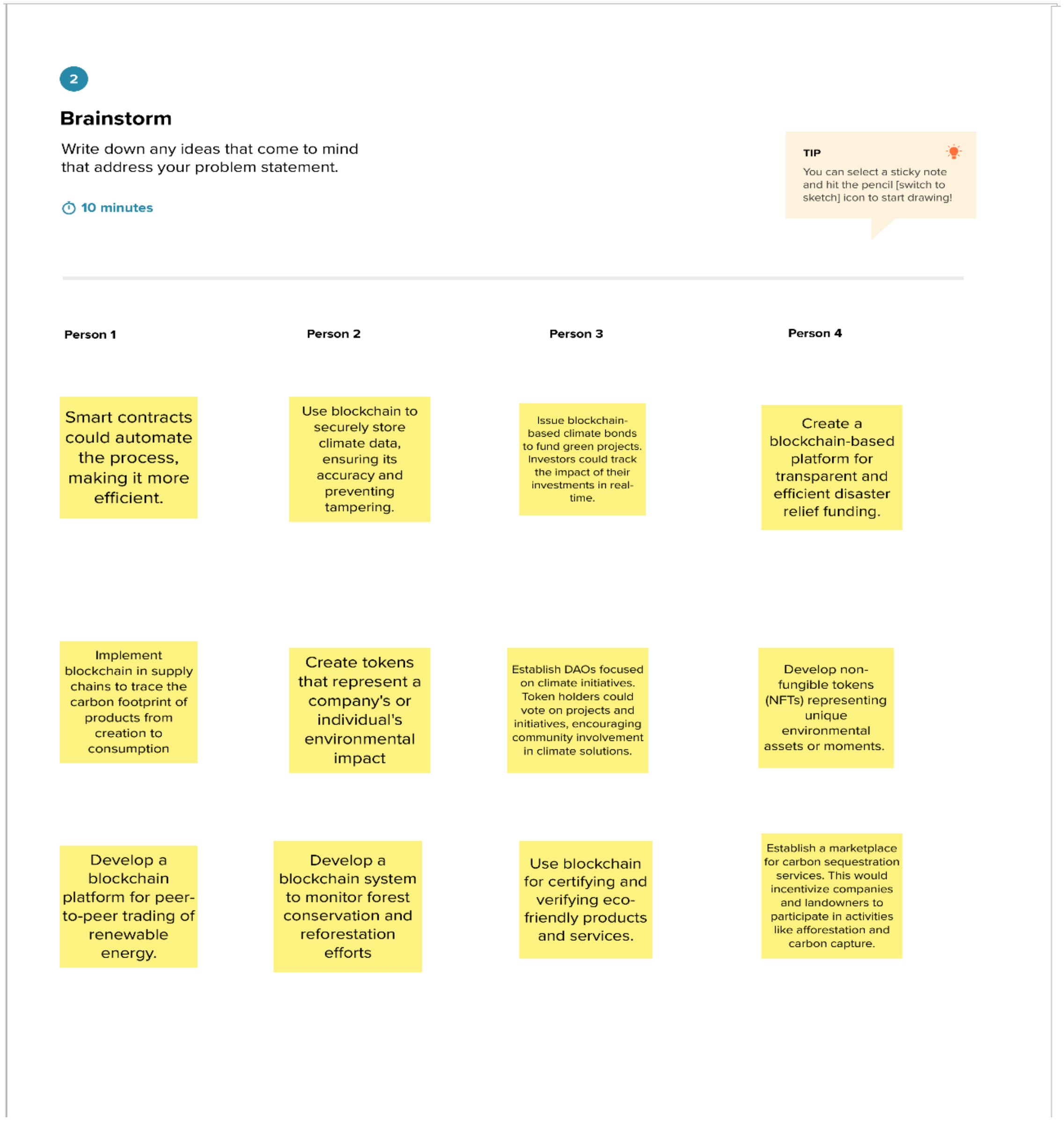
Feels : Record the user's emotions and feelings related to climate tracking and using the system. Are they frustrated, hopeful, anxious, or enthusiastic?

Does : Document the actions the user takes when interacting with the Climate TrackSmart system. This could include tasks they perform or steps they follow.

Environment : Consider the external factors that might influence the user's experience, such as government regulations, climate change trends, or technological advancements.

3.2 Ideation & Brainstorming

Team Gathering, Collaboration and Select the Problem Statement



2

Brainstorm

Write down any ideas that come to mind that address your problem statement.

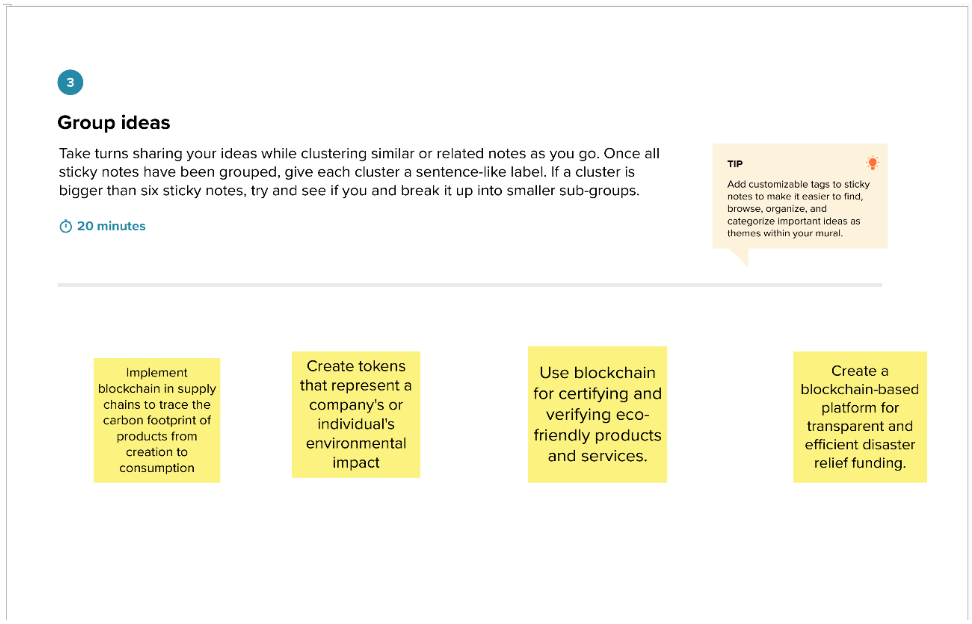
10 minutes

TIP

You can select a sticky note and hit the pencil [switch to sketch] icon to start drawing!

Person 1	Person 2	Person 3	Person 4
Smart contracts could automate the process, making it more efficient.	Use blockchain to securely store climate data, ensuring its accuracy and preventing tampering.	Issue blockchain-based climate bonds to fund green projects. Investors could track the impact of their investments in real-time.	Create a blockchain-based platform for transparent and efficient disaster relief funding.
Implement blockchain in supply chains to trace the carbon footprint of products from creation to consumption	Create tokens that represent a company's or individual's environmental impact	Establish DAOs focused on climate initiatives. Token holders could vote on projects and initiatives, encouraging community involvement in climate solutions.	Develop non-fungible tokens (NFTs) representing unique environmental assets or moments.
Develop a blockchain platform for peer-to-peer trading of renewable energy.	Develop a blockchain system to monitor forest conservation and reforestation efforts	Use blockchain for certifying and verifying eco-friendly products and services.	Establish a marketplace for carbon sequestration services. This would incentivize companies and landowners to participate in activities like afforestation and carbon capture.

Brainstorm, Idea Listing and Grouping



3

Group ideas

Take turns sharing your ideas while clustering similar or related notes as you go. Once all sticky notes have been grouped, give each cluster a sentence-like label. If a cluster is bigger than six sticky notes, try and see if you and break it up into smaller sub-groups.

20 minutes

TIP

Add customizable tags to sticky notes to make it easier to find, browse, organize, and categorize important ideas as themes within your mural.

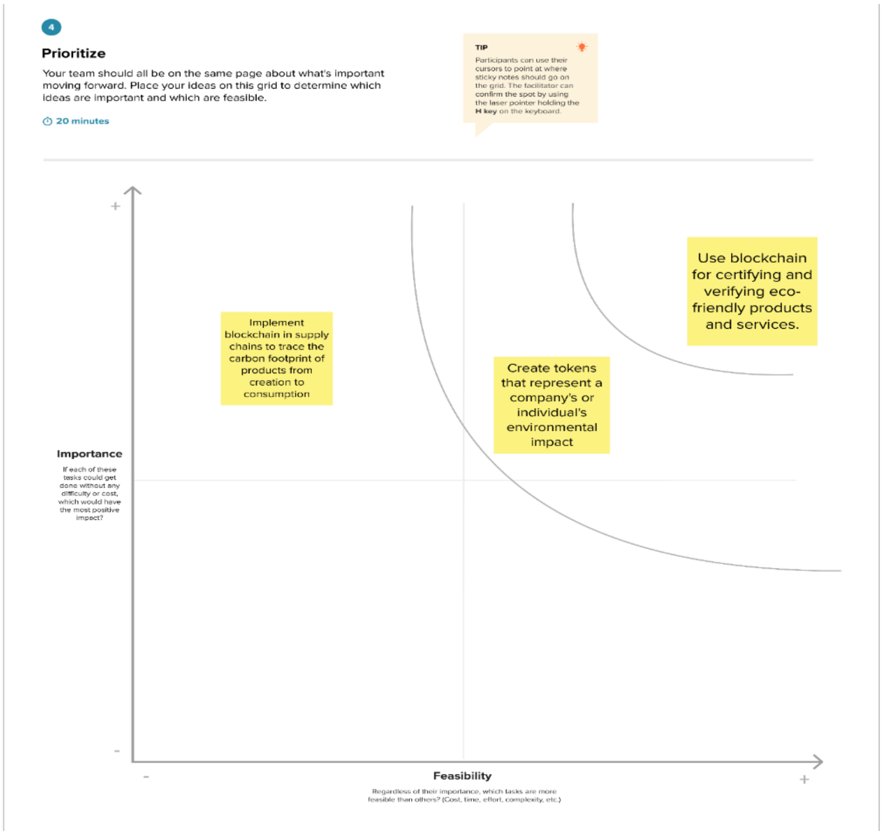
Implement blockchain in supply chains to trace the carbon footprint of products from creation to consumption

Create tokens that represent a company's or individual's environmental impact

Use blockchain for certifying and verifying eco-friendly products and services.

Create a blockchain-based platform for transparent and efficient disaster relief funding.

Idea Prioritization



4

Prioritize

Your team should all be on the same page about what's important moving forward. Place your ideas on this grid to determine which ideas are important and which are feasible.

20 minutes

TIP

Participants can use their cursors to point at where sticky notes should go on the grid. The facilitator can confirm the spot by using the laser pointer holding the **H key** on the keyboard.

Implement blockchain in supply chains to trace the carbon footprint of products from creation to consumption

Create tokens that represent a company's or individual's environmental impact

Use blockchain for certifying and verifying eco-friendly products and services.

Importance

If each of these tasks could get done without any difficulty or cost, which would have the most positive impact?

Feasibility

Regardless of their importance, which tasks are more feasible than others? (Cost, time, effort, complexity, etc.)

4.REQUIREMENT ANALYSIS

4.1 Functional requirement

1)node-v20.9.0-x64

2)12_Problem_Statement_12_Climate_change

4.2 Non-Functional requirements

Security and Privacy: The system must ensure the highest level of data security and privacy to protect sensitive climate-related information.It should use strong encryption and access control mechanisms to prevent unauthorized access to data.

Performance: The system must be able to handle a high volume of transactions efficiently, with low latency and minimal downtime.

Response times for data retrieval and verification should be within acceptable limits.

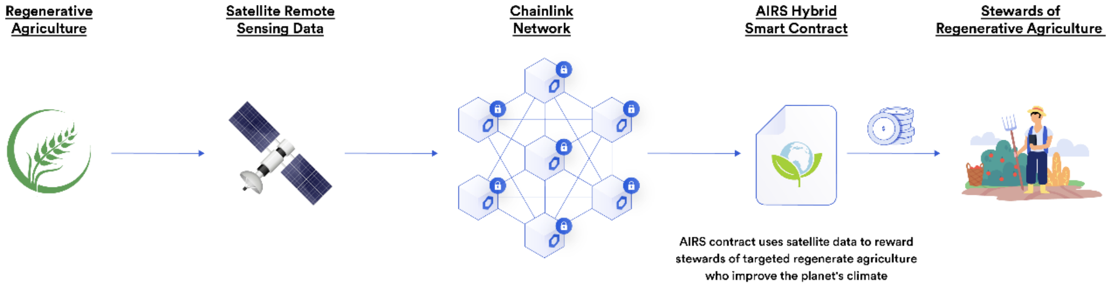
Scalability: The system should be scalable to accommodate future growth in data and user activity.It must support a growing number of participants and climate initiatives without a significant drop in performance.

Reliability: The system must have a high level of reliability, with built-in redundancy and fault-tolerant mechanisms.It should be resilient to hardware failures and network issues.

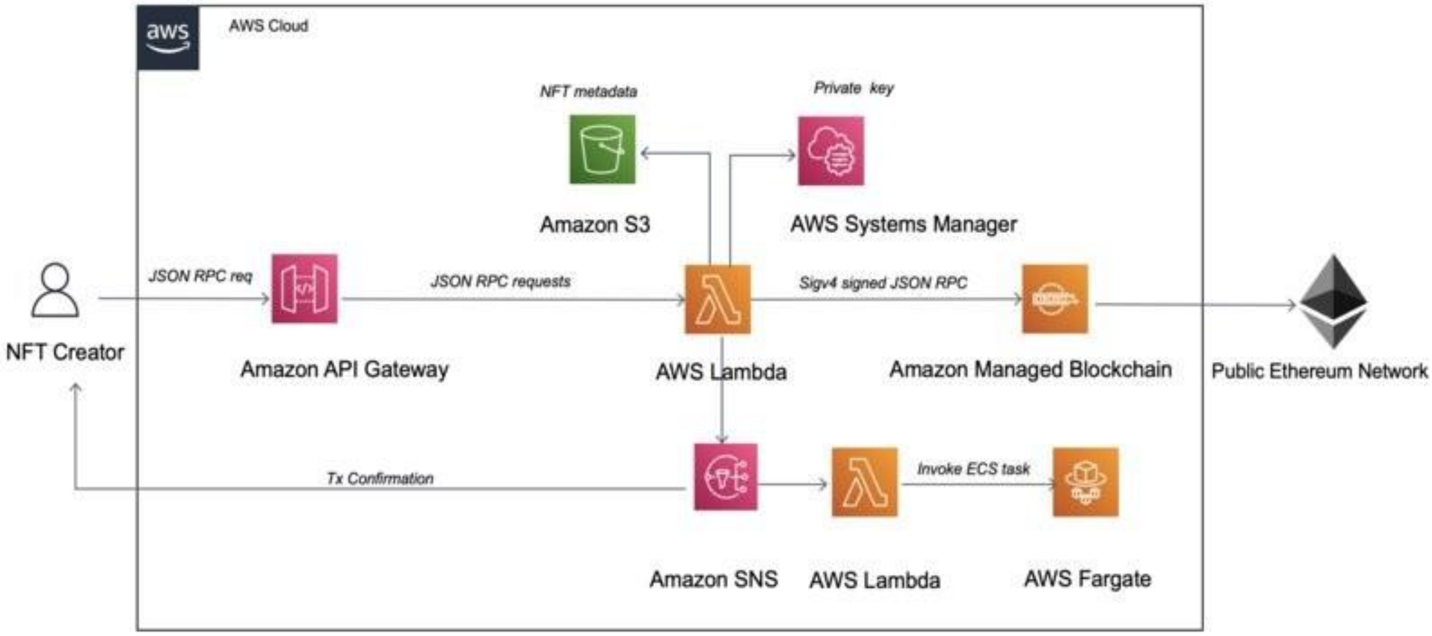
Interoperability: The blockchain platform used should be compatible with widely accepted standards to ensure interoperability with other systems and data sources.It should support common APIs for easy integration with external applications.

5. PROJECT DESIGN

5.1 Data Flow Diagrams & User Stories

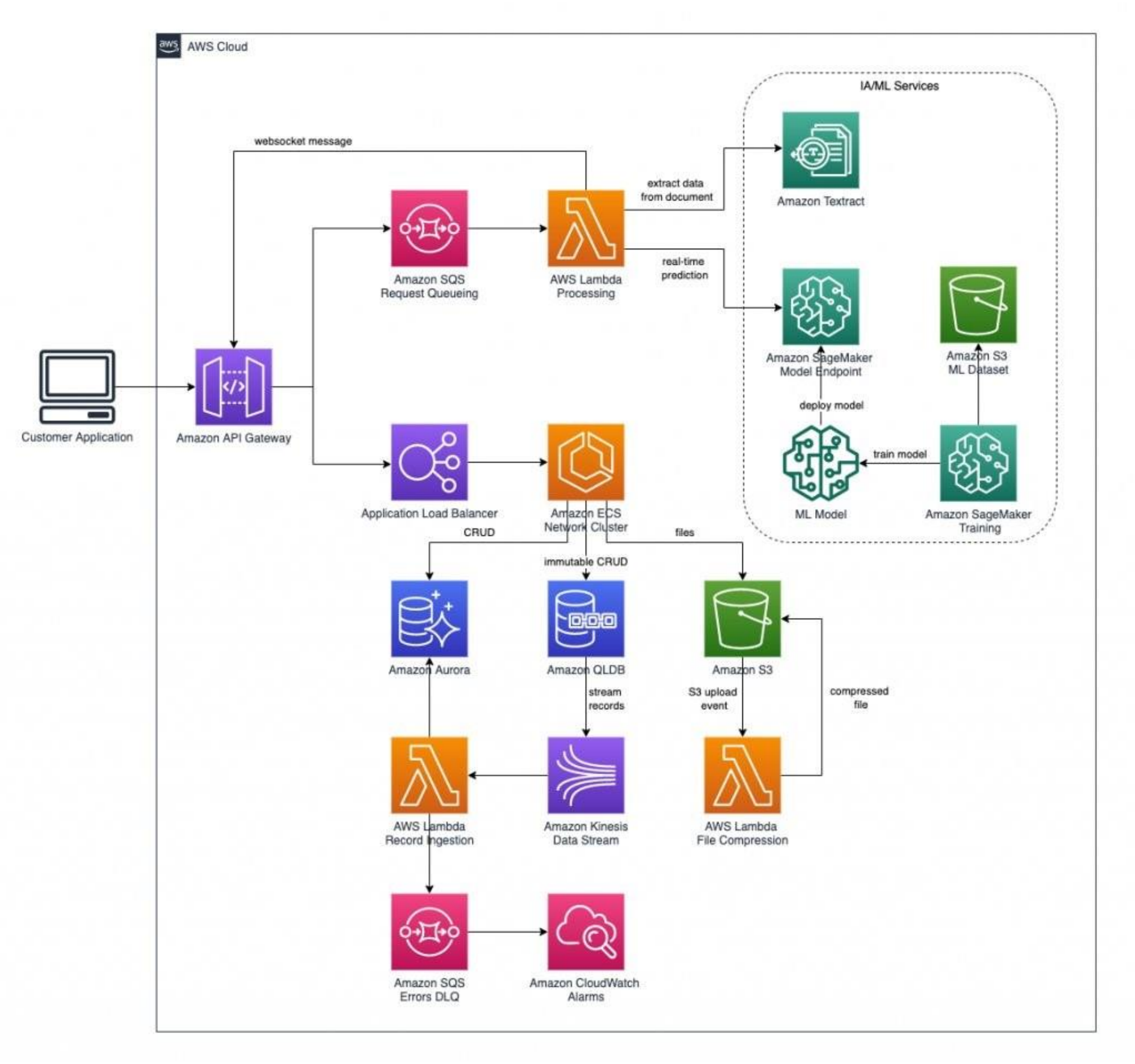

Regenerative Agriculture
Satellite Remote Sensing Data
Chainlink Network
AIRS Hybrid Smart Contract
Stewards of Regenerative Agriculture
AIRS contract uses satellite data to reward stewards of targeted regenerate agriculture who improve the planet's climate

5.2 Solution Architecture

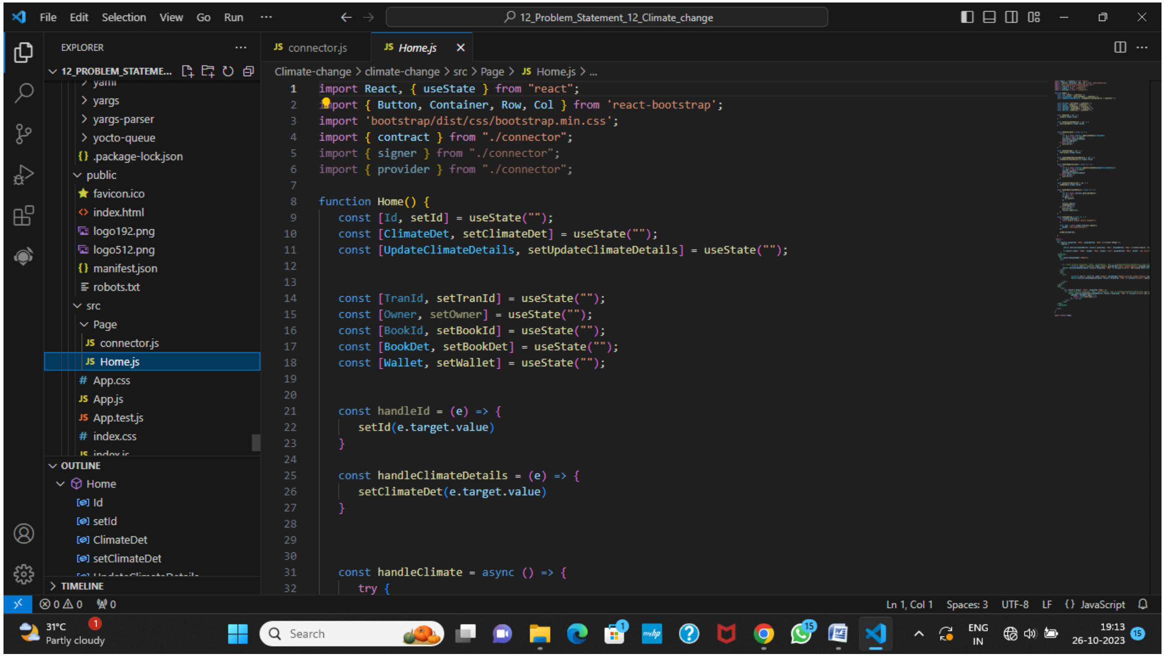


6. PROJECT PLANNING & SCHEDULING

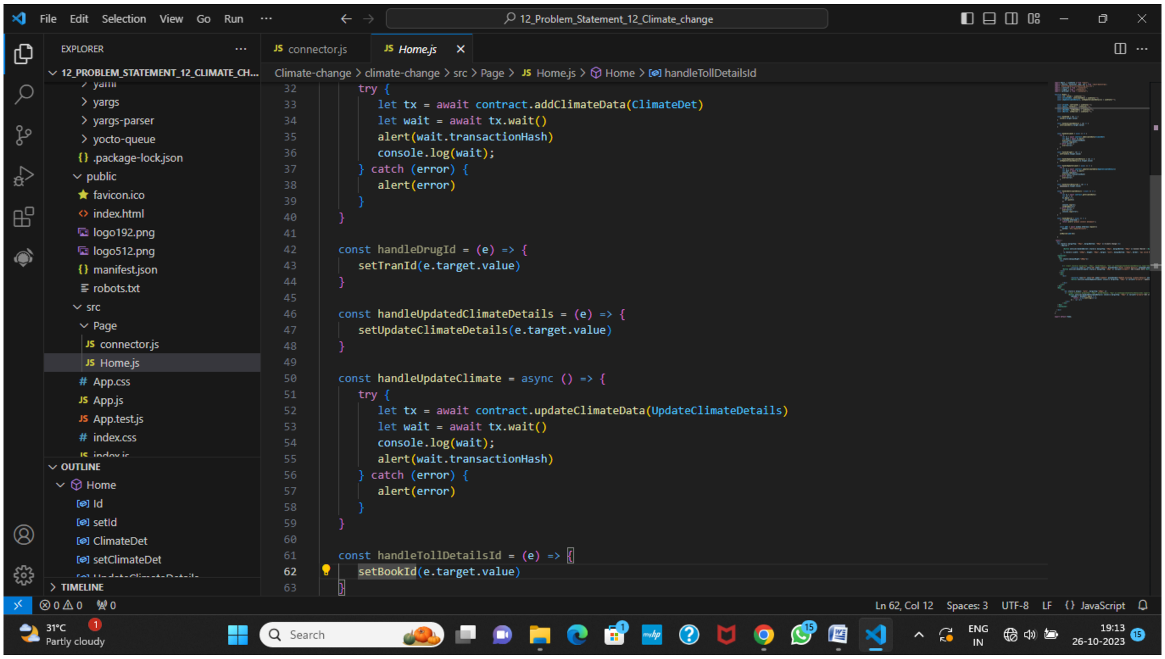
6.1Technical Architecture



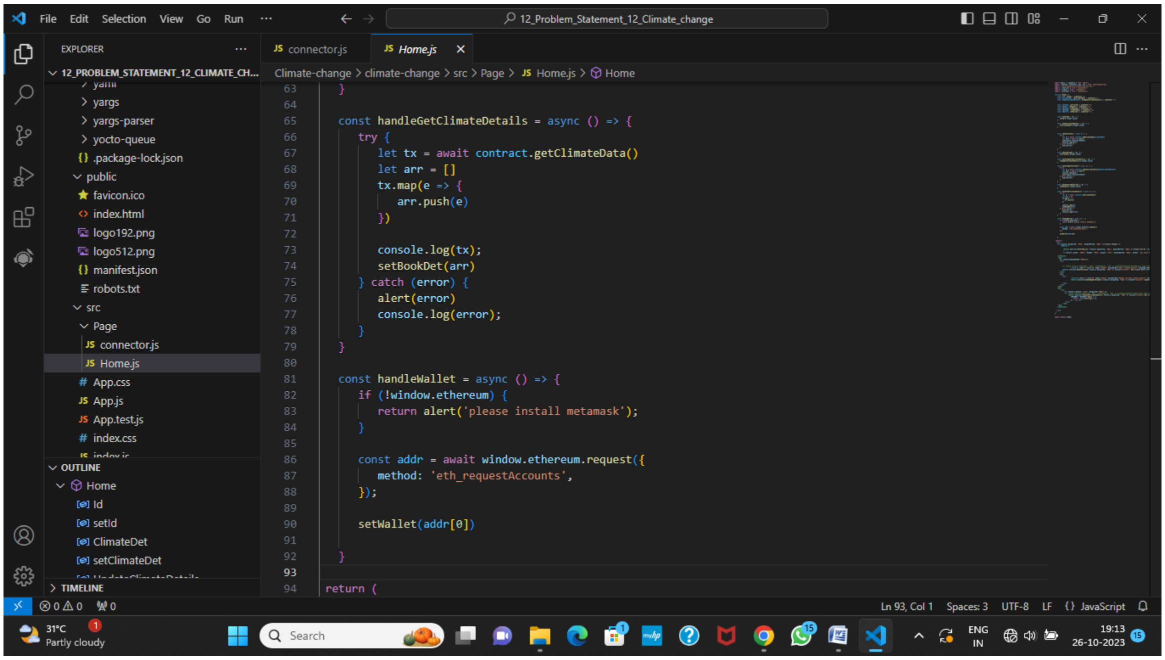
7. CODING & SOLUTIONING (Explain the features added in the project along with code)



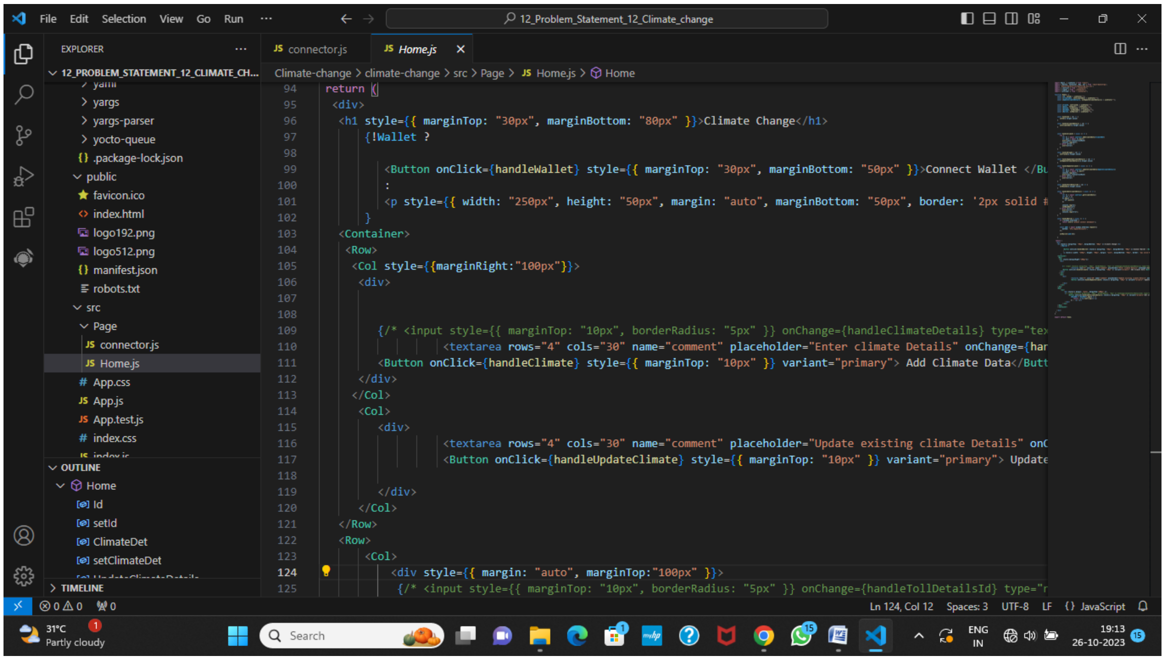
```
import React, { useState } from "react";
import { Button, Container, Row, Col } from 'react-bootstrap';
import 'bootstrap/dist/css/bootstrap.min.css';
import { contract } from "./connector";
import { signer } from "./connector";
import { provider } from "./connector";

function Home() {
   const [Id, setId] = useState("");
   const [ClimateDet, setClimateDet] = useState("");
   const [UpdateClimateDetails, setUpdateClimateDetails] = useState("");


   const [TranId, setTranId] = useState("");
   const [Owner, setOwner] = useState("");
   const [BookId, setBookId] = useState("");
   const [BookDet, setBookDet] = useState("");
   const [Wallet, setWallet] = useState("");


   const handleId = (e) => {
      setId(e.target.value)
   }

   const handleClimateDetails = (e) => {
      setClimateDet(e.target.value)
   }



   const handleClimate = async () => {
      try {
```



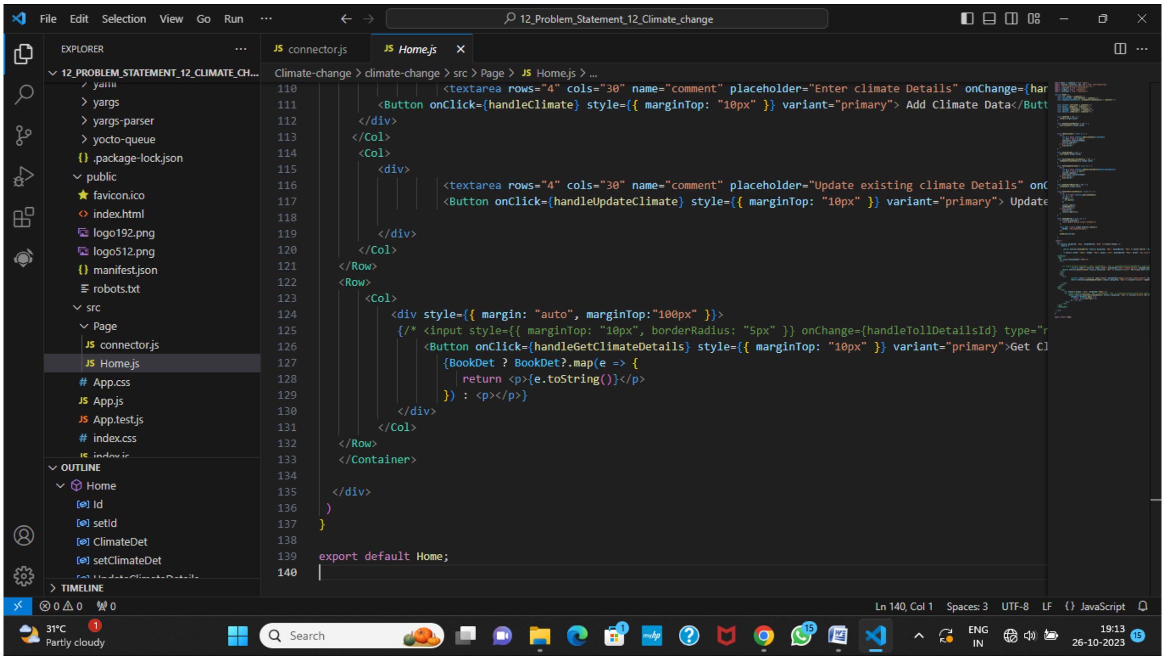
```
      try {
         let tx = await contract.addClimateData(ClimateDet)
         let wait = await tx.wait()
         alert(wait.transactionHash)
         console.log(wait);
      } catch (error) {
         alert(error)
      }
   }

   const handleDrugId = (e) => {
      setTranId(e.target.value)
   }

   const handleUpdatedClimateDetails = (e) => {
      setUpdateClimateDetails(e.target.value)
   }

   const handleUpdateClimate = async () => {
      try {
         let tx = await contract.updateClimateData(UpdateClimateDetails)
         let wait = await tx.wait()
         console.log(wait);
         alert(wait.transactionHash)
      } catch (error) {
         alert(error)
      }
   }

   const handleTollDetailsId = (e) => {
      setBookId(e.target.value)
   }
```



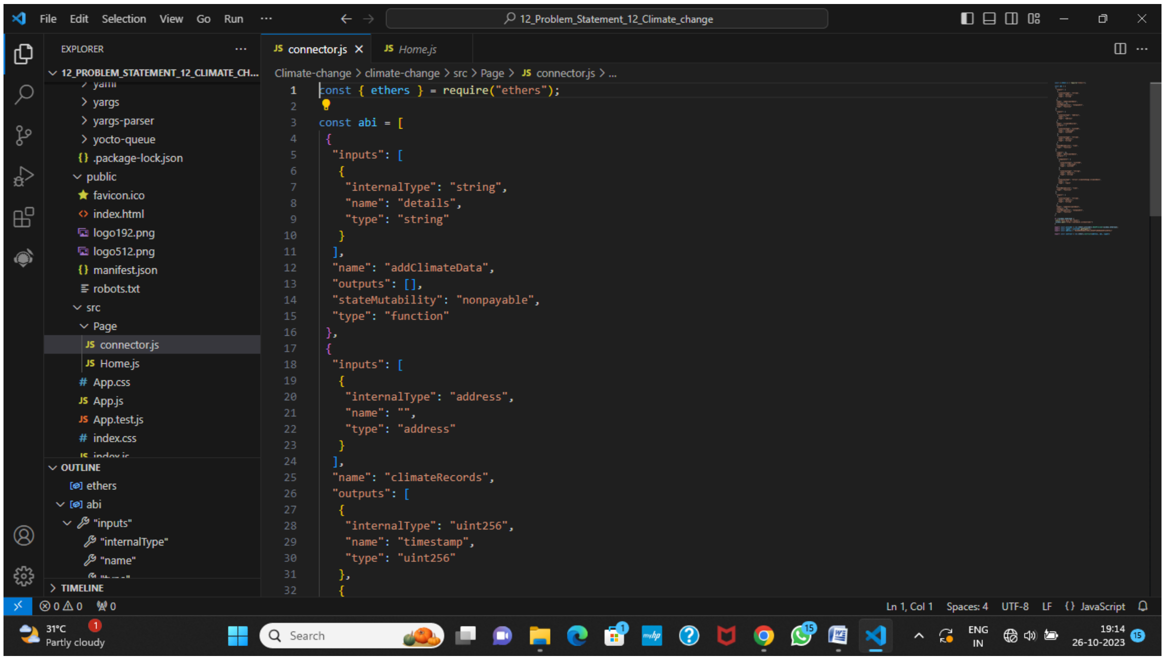
```
  }

  const handleGetClimateDetails = async () => {
     try {
        let tx = await contract.getClimateData()
        let arr = []
        tx.map(e => {
           arr.push(e)
        })

        console.log(tx);
        setBookDet(arr)
     } catch (error) {
        alert(error)
        console.log(error);
     }
  }

  const handleWallet = async () => {
     if (!window.ethereum) {
        return alert('please install metamask');
     }

     const addr = await window.ethereum.request({
        method: 'eth_requestAccounts',
     });

     setWallet(addr[0])

  }

return (
```



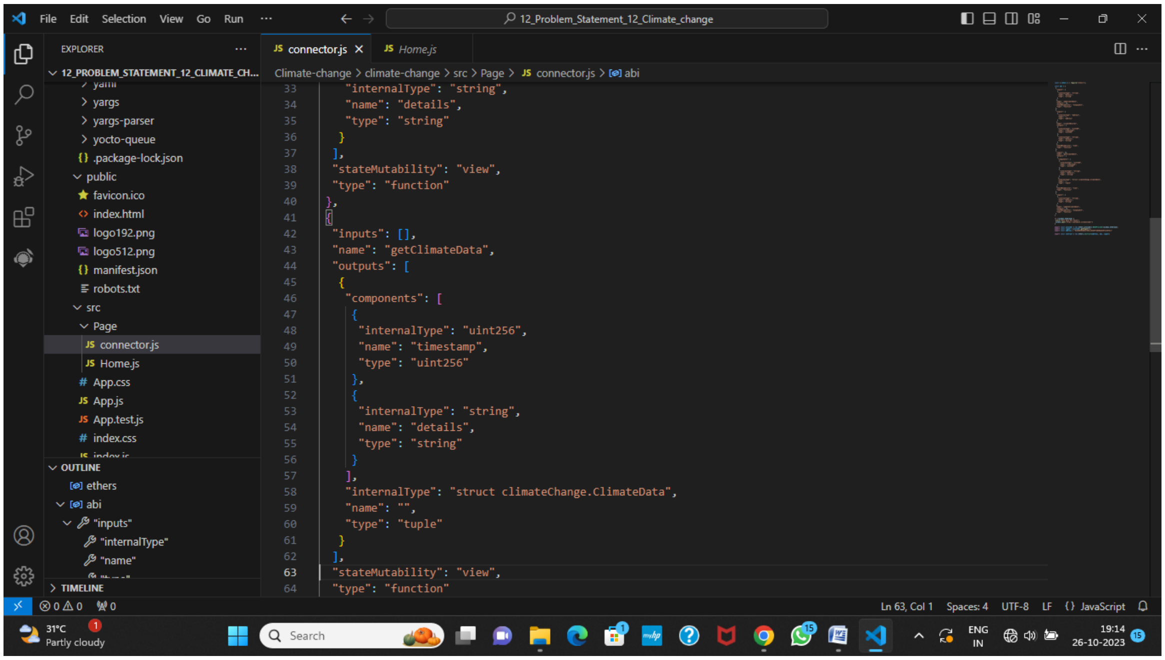
```
return (
 <div>
  <h1 style={{ marginTop: "30px", marginBottom: "80px" }}>Climate Change</h1>
     {!Wallet ?

        <Button onClick={handleWallet} style={{ marginTop: "30px", marginBottom: "50px" }}>Connect Wallet </Bu
        :
        <p style={{ width: "250px", height: "50px", margin: "auto", marginBottom: "50px", border: '2px solid #
     }
  <Container>
   <Row>
    <Col style={{marginRight:"100px"}}>
     <div>


        {/* <input style={{ marginTop: "10px", borderRadius: "5px" }} onChange={handleClimateDetails} type="tex
              <textarea rows="4" cols="30" name="comment" placeholder="Enter climate Details" onChange={har
        <Button onClick={handleClimate} style={{ marginTop: "10px" }} variant="primary"> Add Climate Data</Butt
     </div>
    </Col>
     <Col>
        <div>
              <textarea rows="4" cols="30" name="comment" placeholder="Update existing climate Details" onC
              <Button onClick={handleUpdateClimate} style={{ marginTop: "10px" }} variant="primary"> Update

        </div>
     </Col>
  </Row>
  <Row>
     <Col>
        <div style={{ margin: "auto", marginTop:"100px" }}>
         {/* <input style={{ marginTop: "10px", borderRadius: "5px" }} onChange={handleTollDetailsId} type="r
```



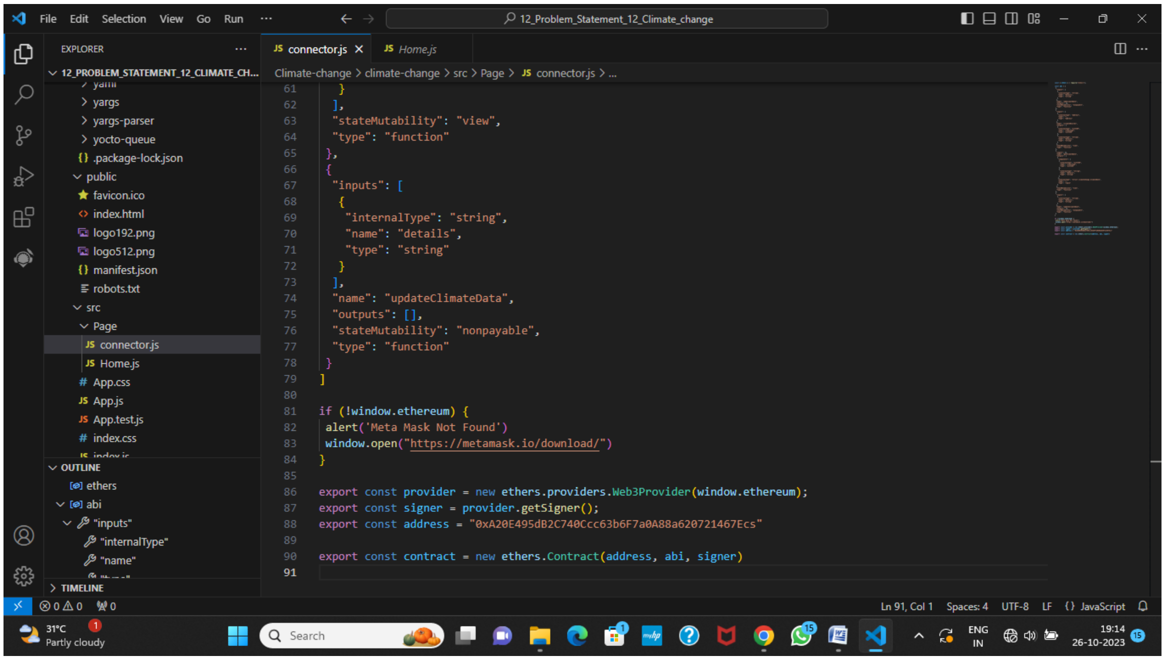
```
                   <textarea rows="4" cols="30" name="comment" placeholder="Enter climate Details" onChange={har
         <Button onClick={handleClimate} style={{ marginTop: "10px" }} variant="primary"> Add Climate Data</Butt
      </div>
     </Col>
      <Col>
         <div>
                   <textarea rows="4" cols="30" name="comment" placeholder="Update existing climate Details" onC
                   <Button onClick={handleUpdateClimate} style={{ marginTop: "10px" }} variant="primary"> Update

         </div>
      </Col>
   </Row>
   <Row>
       <Col>
           <div style={{ margin: "auto", marginTop:"100px" }}>
            {/* <input style={{ marginTop: "10px", borderRadius: "5px" }} onChange={handleTollDetailsId} type="r
                <Button onClick={handleGetClimateDetails} style={{ marginTop: "10px" }} variant="primary">Get Cl
                   {BookDet ? BookDet?.map(e => {
                      return <p>{e.toString()}</p>
                   }) : <p></p>}
            </div>
         </Col>
   </Row>
   </Container>

  </div>
 )
}

export default Home;

```



```
const { ethers } = require("ethers");

const abi = [
 {
  "inputs": [
   {
    "internalType": "string",
    "name": "details",
    "type": "string"
   }
  ],
  "name": "addClimateData",
  "outputs": [],
  "stateMutability": "nonpayable",
  "type": "function"
 },
 {
  "inputs": [
   {
    "internalType": "address",
    "name": "",
    "type": "address"
   }
  ],
  "name": "climateRecords",
  "outputs": [
   {
    "internalType": "uint256",
    "name": "timestamp",
    "type": "uint256"
   },
   {
```



```
    "internalType": "string",
    "name": "details",
    "type": "string"
   }
  ],
  "stateMutability": "view",
  "type": "function"
 },
 {
  "inputs": [],
  "name": "getClimateData",
  "outputs": [
   {
    "components": [
     {
      "internalType": "uint256",
      "name": "timestamp",
      "type": "uint256"
     },
     {
      "internalType": "string",
      "name": "details",
      "type": "string"
     }
    ],
    "internalType": "struct climateChange.ClimateData",
    "name": "",
    "type": "tuple"
   }
  ],
  "stateMutability": "view",
  "type": "function"
```



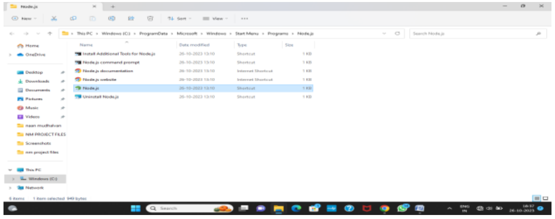
```
   }
  ],
  "stateMutability": "view",
  "type": "function"
 },
 {
  "inputs": [
   {
    "internalType": "string",
    "name": "details",
    "type": "string"
   }
  ],
  "name": "updateClimateData",
  "outputs": [],
  "stateMutability": "nonpayable",
  "type": "function"
 }
]

if (!window.ethereum) {
 alert('Meta Mask Not Found')
 window.open("https://metamask.io/download/")
}

export const provider = new ethers.providers.Web3Provider(window.ethereum);
export const signer = provider.getSigner();
export const address = "0xA20E495dB2C740Ccc63b6F7a0A88a620721467Ecs"

export const contract = new ethers.Contract(address, abi, signer)

```

8. PERFORMANCE TESTING

1)Information gathering:

(Setup all the Prerequisite)

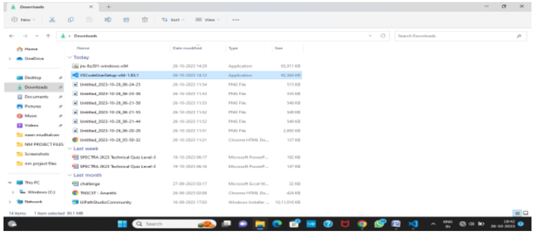
1. download node.js : Node.js



Name	Date modified	Type	Size
Install Additional Tools for Node.js	26-10-2023 13:10	Shortcut	1 KB
Node.js command prompt	26-10-2023 13:10	Shortcut	1 KB
Node.js documentation	26-10-2023 13:10	Internet Shortcut	1 KB
Node.js website	26-10-2023 13:10	Internet Shortcut	1 KB
Node.js	26-10-2023 13:10	Shortcut	1 KB
Uninstall Node.js	26-10-2023 13:10	Shortcut	1 KB

6 items 1 item selected 949 bytes

2. download vs code: Li4nk



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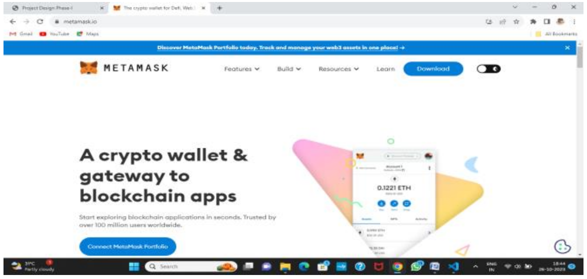
Today			
jre-8u391-windows-x64	26-10-2023 14:29	Application	65,911 KB
VSCodeUserSetup-x64-1.83.1	26-10-2023 14:12	Application	92,364 KB
Untitled_2023-10-26_06-24-25	26-10-2023 11:54	PNG File	515 KB
Untitled_2023-10-26_06-23-38	26-10-2023 11:53	PNG File	335 KB
Untitled_2023-10-26_06-21-58	26-10-2023 11:53	PNG File	549 KB
Untitled_2023-10-26_06-21-55	26-10-2023 11:52	PNG File	549 KB
Untitled_2023-10-26_06-21-44	26-10-2023 11:52	PNG File	549 KB
Untitled_2023-10-26_06-20-28	26-10-2023 11:51	PNG File	2,693 KB
Untitled_2023-10-26_05-58-32	26-10-2023 11:21	Chrome HTML Do...	127 KB
Last week			
SPECTRA 2K23 Technical Quiz Level-3	19-10-2023 06:17	Microsoft PowerP...	192 KB
SPECTRA 2K23 Technical Quiz Level-2	19-10-2023 06:16	Microsoft PowerP...	147 KB
Last month			
challenge	27-09-2023 03:17	Microsoft Excel W...	32 KB
TNSCST - Ananthi	28-09-2023 02:08	Chrome HTML Do...	424 KB
UiPathStudioCommunity	16-09-2023 17:03	Windows Installer ...	10,11,016 KB

14 items 1 item selected 90.1 MB

3. download metamask : https://metamask.io/



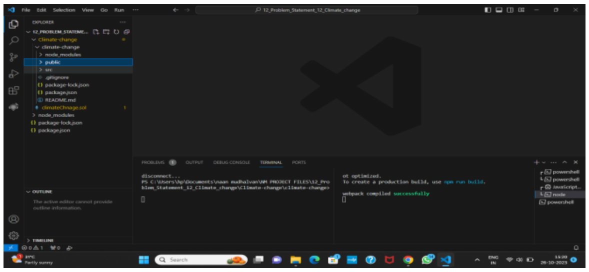
Discover MetaMask Portfolio today. Track and manage your web3 assets in one place! →

A crypto wallet & gateway to blockchain apps

Start exploring blockchain applications in seconds. Trusted by over 100 million users worldwide.

2)Extract the zip files:

(Open to vs code)

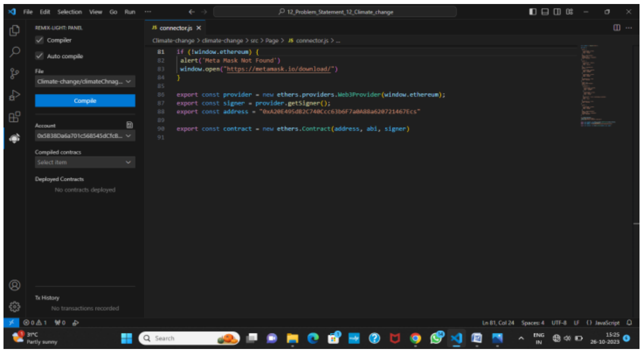


```
disconnect...
PS C:\Users\hp\Documents\naan mudhalvan\NM PROJECT FILES\12_Pro
blem_Statement_12_Climate_change\Climate-change\climate-change>
```

```
ot optimized.
To create a production build, use npm run build.

webpack compiled successfully
```

3) Remix Ide platform exploring:

(Deploy the smart contract code . Deploy and run the transaction. By selecting the environment - inject the MetaMask)

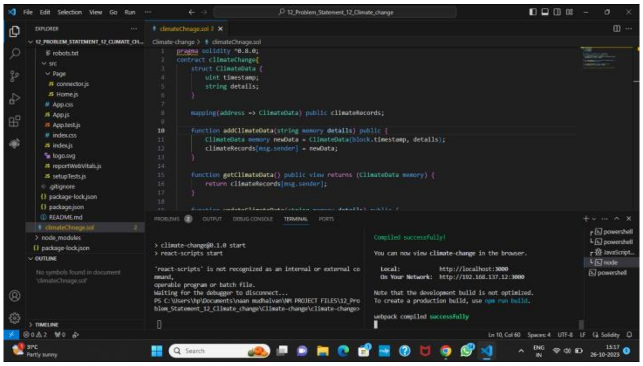


Climate-change > climate-change > src > Page > connector.js

```
if (!window.ethereum) {
 alert('Meta Mask Not Found')
 window.open("https://metamask.io/download/")
}

export const provider = new ethers.providers.Web3Provider(window.ethereum);
export const signer = provider.getSigner();
export const address = "0xA20E495dB2C740Ccc63b6F7a0A88a620721467Ecs"

export const contract = new ethers.Contract(address, abi, signer)
```

4) Open file explorer:

(Open the extracted file and click on the folder. Open src, and search for utiles. Open cmd enter commands. 1.npm install 2.npm bootstrap 3.npmstart)



Climate-change > climateChnage.sol

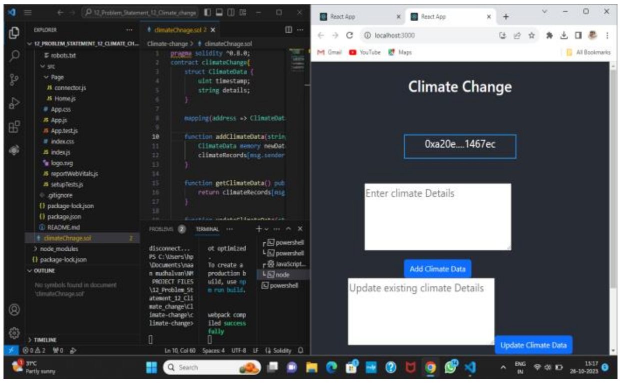
```
pragma solidity ^0.8.0;
contract climateChange{
    struct ClimateData {
        uint timestamp;
        string details;
    }

    mapping(address => ClimateData) public climateRecords;

    function addClimateData(string memory details) public {
        ClimateData memory newData = ClimateData(block.timestamp, details);
        climateRecords[msg.sender] = newData;
    }

    function getClimateData() public view returns (ClimateData memory) {
        return climateRecords[msg.sender];
    }
```

```
> climate-change@0.1.0 start
> react-scripts start

'react-scripts' is not recognized as an internal or external co
mmand,
operable program or batch file.
Waiting for the debugger to disconnect...
PS C:\Users\hp\Documents\naan mudhalvan\NM PROJECT FILES\12_Pro
blem_Statement_12_Climate_change\Climate-change\climate-change>
```

```
Compiled successfully!

You can now view climate-change in the browser.

  Local:            http://localhost:3000
  On Your Network:  http://192.168.137.12:3000

Note that the development build is not optimized.
To create a production build, use npm run build.

webpack compiled successfully
```

5) Localhost Ip address:

(copy the address and open it to chrome so you can see the front end of your project)



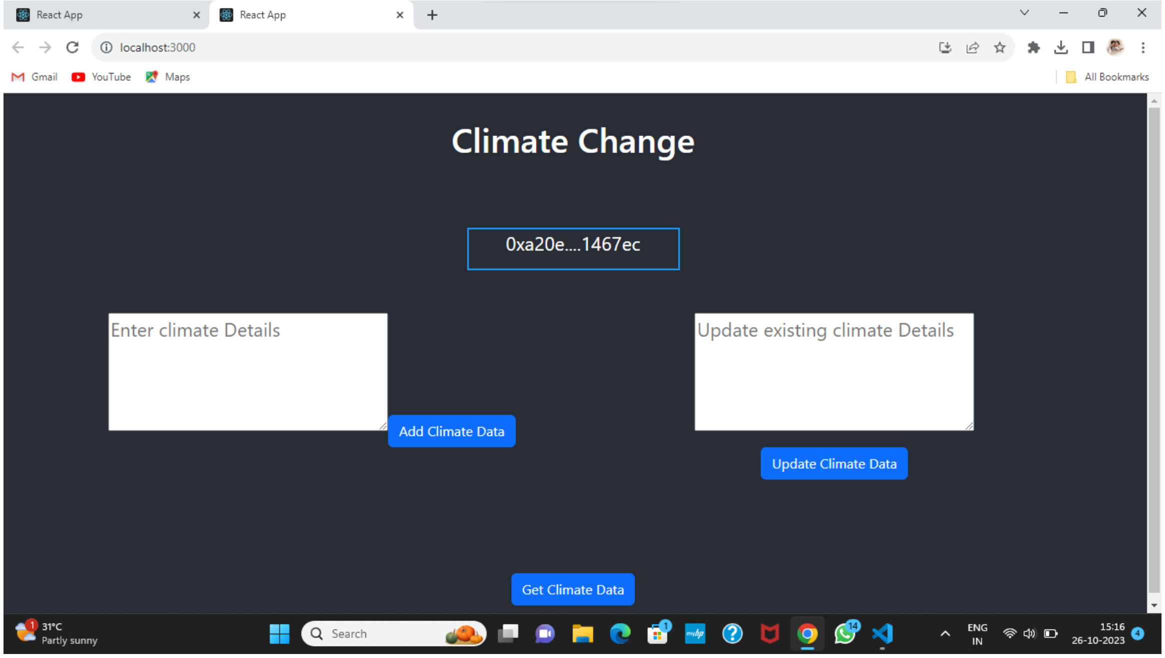
```
pragma solidity ^0.8.0;
contract climateChange{
    struct ClimateData {
        uint timestamp;
        string details;
    }

    mapping(address => ClimateDat

    function addClimateData(strin
        ClimateData memory newDat
        climateRecords[msg.sender
    }

    function getClimateData() pub
        return climateRecords[msg
    }
```

```
disconnect...
PS C:\Users\hp\Documents\naan mudhalvan\NM PROJECT FILES\12_Problem_Statement_12_Climate_change\Climate-change\climate-change>
```

```
ot optimized.
To create a production build, use npm run build.

webpack compiled successfully
```

9.RESULTS

9.1 Output Screenshots



10.ADVANTAGES & DISADVANTAGES

ADVANTAGES:

1)Transparency and Trust: Blockchain's decentralized and immutable ledger ensures transparency and trust in climate data. All stakeholders can access and verify information, reducing the risk of data manipulation and fraud.

2)Data Integrity: Blockchain's cryptographic hashing and consensus mechanisms protect data from tampering. Climate data, emissions records, and sustainability initiatives can be securely recorded and tracked, ensuring their accuracy and reliability.

3)Traceability and Accountability: Climate initiatives and carbon offset projects can be traced throughout their lifecycle. This traceability enhances accountability for organizations and governments, helping to ensure they meet their climate goals and commitments.

4)Efficient Carbon Markets: Blockchain can streamline the trading of carbon credits and offsets. Smart contracts can automatically execute transactions when predefined conditions are met, reducing administrative overhead and facilitating a more efficient carbon market.

5)Decentralization: The decentralized nature of blockchain reduces the reliance on a single entity, which can lead to greater resilience and less susceptibility to fraud or manipulation.

DISADVANTAGES:

1)Scalability: Blockchain networks, especially public ones, can experience scalability issues when dealing with a high volume of transactions and data. This can lead to slower transaction processing times and increased costs.

2)Energy Consumption: Many blockchain networks, such as Bitcoin and Ethereum, are energy-intensive due to their consensus mechanisms. This high energy consumption could counteract the environmental benefits of climate tracking initiatives, especially if powered by fossil fuels.

3)Complex Implementation: Implementing blockchain technology for climate tracking can be complex and require significant technical expertise. Many organizations may struggle with the initial setup and ongoing maintenance.

4) Integration Challenges: Integrating blockchain with existing systems and data sources can be challenging and expensive. It may require significant changes to existing processes and infrastructure.

5)Security Concerns: While blockchain is considered secure, it's not immune to cyberattacks. Smart contracts and blockchain networks can be vulnerable to bugs and vulnerabilities that could lead to security breaches.

11.CONCLUSION

In conclusion, the use of blockchain technology for smart climate tracking holds significant promise in addressing pressing environmental challenges, but it is not without its complexities and challenges. By harnessing the advantages of transparency, data integrity, and accountability, blockchain can play a pivotal role in improving the monitoring and management of climate-related data and initiatives. It offers the potential to revolutionize how we track and manage environmental information, including carbon emissions, sustainability projects, and carbon markets.

However, it is essential to recognize and address the disadvantages and challenges associated with implementing blockchain for climate tracking. Issues related to scalability, energy consumption, integration, security, privacy, and regulation must be carefully considered and mitigated.

12.FUTURE SCOPE

1)Carbon Markets and Trading: Blockchain can facilitate efficient and transparent carbon credit trading, enabling organizations to buy and sell carbon credits in a secure and automated manner. This can create a more dynamic and robust carbon INKmarket.

2)Supply Chain Sustainability: Blockchain can be used to track and verify the sustainability of products throughout their entire supply chain. This can help consumers make informed choices and hold companies accountable for their environmental impact.

3)Renewable Energy Certificates (RECs): Using blockchain, renewable energy certificates can be securely tracked, ensuring that the energy generated from renewable sources is accurately accounted for and credited to the appropriate entities.

4) Climate-Linked Financial Instruments: Blockchain can be used to create innovative financial instruments, such as green bonds or climate-linked derivatives, that are directly tied to environmental performance metrics. This could attract more investment in sustainable projects.

5)Automated Compliance and Reporting: Smart contracts can automatically verify and report on compliance with environmental regulations and commitments. This reduces administrative burdens and ensures accuracy in reporting.

6)Climate-Resilient Supply Chains: Block chain can enable the tracking of climate-related risks in supply chains, allowing businesses to make informed decisions about adapting to climate change impacts.

13. APPENDIX Source Code

Project Demo Link :
https://drive.google.com/file/d/1JslRqcCKqk_DOyGvWZWwtmhW_vjzT8Jq/view?usp=drivesdk