K S R INSTITUTE FOR ENGINEERING AND TECHNOLOGY

TIRUCHENGODE: 637 215

Computer Science and Engineering

NAAN MUDHALVAN

SB8024- Blockchain Development

by Naan Mudhalvan Scheme – 2023

TEAM ID: NM2023TMID11686

PROJECT DOMAIN: BLOCKCHAIN TECHNOLOGY

PROJECT TITLE: TRACKING PUBLIC INFRASTRUCTURE AND TOLL PAYMENTS USING BLOCKCHAIN

TEAM MEMBERS

REGISTER NUMBER	NAME
731620104005	BRINDHA L
731620104007	DEEPIKA S
731620104011	DHARANI S
731620104061	YAMUNA K

TABLE OF CONTENTS

1. INTRODUCTION

1.1 Project Overview

Introducing a blockchain-based solution for tracking public infrastructure and toll payments! In an era of advancing technology, the traditional systems for managing infrastructure and collecting tolls face numerous challenges, including inefficiency, fraud, and lack of transparency. Leveraging the power of blockchain technology, we have developed a cutting-edge solution that ensures secure, transparent, and tamper-resistant record-keeping for public infrastructure while streamlining toll payments. This innovative approach promises to revolutionize the way we manage and maintain our critical infrastructure, ultimately benefiting both the public and the authorities responsible for their upkeep. Let's explore the exciting possibilities of this transformative system!

1.2 Purpose

Blockchain technology provides a transparent and immutable ledger of all transactions. This can enhance transparency in public infrastructure projects and toll collection systems, reducing the potential for fraud and corruption. Blockchain can make it difficult for fraudulent activities to occur by ensuring that transactions are verified and recorded in a tamper-proof manner. Blockchain can streamline toll payment processing by reducing the need for intermediaries and speeding up transaction settlement. By eliminating intermediaries and automating processes, blockchain can reduce operational costs associated with infrastructure maintenance and toll collection. Blockchain can decentralize control, reducing the influence of a single authority over infrastructure management and payment collection, potentially making it more democratic. Blockchain offers robust security features, protecting sensitive data and ensuring it remains confidential and tamper-proof.

2. LITERATURE SURVEY

2.1 Existing problem

Implementing blockchain for tracking public infrastructure and toll payments faces several challenges. Integration into existing systems can be complex and costly, requiring cooperation among stakeholders and possible changes to legacy infrastructure. Scalability issues may hinder the ability to process a high volume of toll transactions efficiently. Balancing transparency with privacy in toll payment systems is difficult. Regulatory compliance varies by jurisdiction, adding complexity. User adoption of blockchain and digital payment methods can be challenging, particularly for those unfamiliar with these technologies. Security risks, both on the blockchain and in infrastructure, must be carefully managed. The initial costs can be substantial, and ongoing maintenance is essential. Ensuring interoperability for cross-border transactions and overcoming resistance to change from existing authorities are additional hurdles. Environmental concerns regarding blockchain's energy consumption also merit consideration. Addressing these problems is crucial for the successful integration of blockchain into infrastructure and toll payment systems.

2.2 References

Some notable sources include academic journals like the "International Journal of Engineering Research & Technology (IJERT)" and "Blockchain Technology in Transportation" by the American Association of State Highway and Transportation Officials (AASHTO). Additionally, you can find insights from blockchain technology and transportation conferences and webinars, such as those organized by industry associations like the Transportation Research Board (TRB). Furthermore, consulting firms and technology companies often publish reports and case studies on the application of blockchain in transportation and infrastructure. Government agencies involved in transportation and infrastructure management may also provide valuable resources and guidelines related to this topic. It's essential to review a combination of these sources to gain practical implementations.

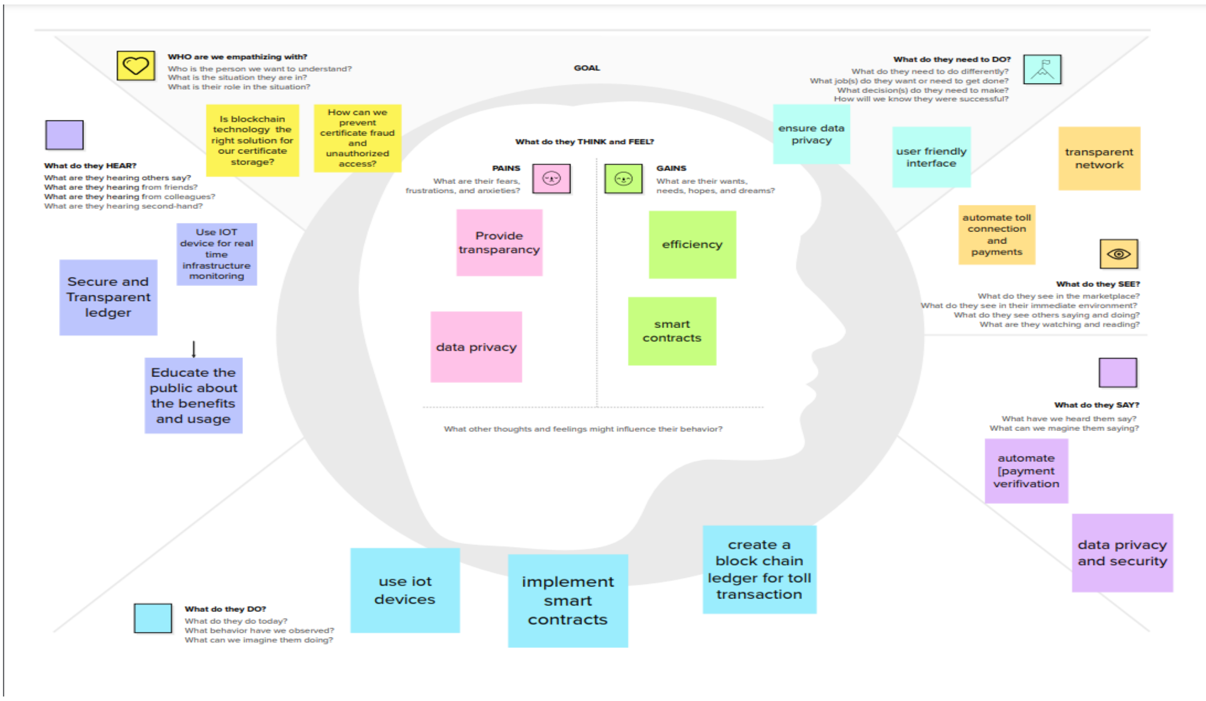
2.3 Problem Statement Definition

The problem statement for tracking public infrastructure and toll payments using blockchain revolves around the need to enhance transparency, security, and efficiency in these critical areas while addressing various challenges. The existing infrastructure and toll payment systems often lack transparency, leading to potential fraud and mismanagement. Implementing blockchain technology requires overcoming integration challenges, ensuring scalability, and navigating complex regulatory environments. Privacy concerns must be balanced with the inherently transparent nature of blockchain, and user adoption and resistance to change are significant barriers. Security and maintenance are ongoing issues, and the initial costs can be substantial. Interoperability is essential for cross-border toll payments, while environmental concerns regarding energy consumption in blockchain operations also need consideration. The problem statement seeks to address these issues, emphasizing the need for a well-planned, collaborative approach to implement blockchain technology effectively in public infrastructure tracking and toll payments, fostering trust and efficiency in these critical domains.

3. IDEATION & PROPOSED SOLUTION

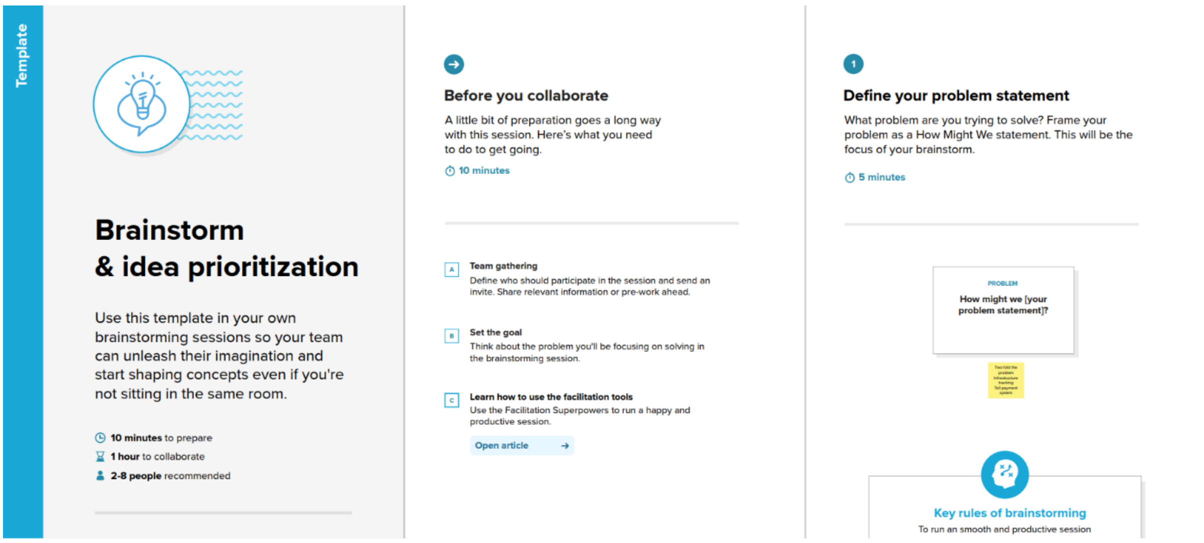
3.1 Empathy Map Canvas

Creating an empathy map canvas for tracking public infrastructure and toll payments using blockchain involves understanding the perspectives and needs of key stakeholders. First, consider the government authorities who are responsible for infrastructure management. They may value transparency, cost-efficiency, and compliance with regulations. For toll collection agencies, efficiency and accuracy in payment processing are critical, as well as trust in the technology. Road users, on the other hand, seek convenience, privacy, and ease of payment. They may be apprehensive about adopting blockchain technology and need assurance about its security. To address these diverse needs, the empathy map canvas should include features like transparent reporting for government authorities, seamless and automated toll collection for agencies, and user-friendly mobile apps for road users. By addressing these different perspectives and needs, a blockchain solution for tracking public infrastructure and toll payments can gain broad acceptance and support.



3.2 Ideation & Brainstorming

Brainstorming ideas for tracking public infrastructure and toll payments using blockchain involves exploring innovative approaches. One idea is to implement a blockchain-based system that utilizes IoT sensors on infrastructure elements like roads and bridges. These sensors can detect vehicle presence and trigger smart contracts for toll payments as vehicles pass through designated points. Additionally, integrating a blockchain-based token system could simplify cross-border toll payments and promote a universal payment method. To enhance transparency, a public-facing blockchain explorer could provide real-time data on infrastructure conditions, maintenance schedules, and toll revenue allocation. Using a consortium blockchain network involving government agencies, transportation companies, and blockchain developers could ensure collaborative governance and compliance with regulations. Moreover, leveraging blockchain's immutability, historical infrastructure data can be stored securely, aiding in long-term planning and maintenance. This brainstormed solution combines IoT, blockchain, and data transparency to create an innovative and efficient public infrastructure and toll payment tracking system.



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!

Brindha

- Blockchain Toll collection system
- Smart contracts for infrastructure maintainence
- anonymous payments

Deepika

- Public infrastructure Tokenization
- Blockchain supplychain for construction
- DAO

Dharani

- Infrastructure Identity
- Maintainence record
- blockchain based identity

Yamuna

- Decentralized discussion making
- Blockchain for public funds allocation
- environmental impact tracking

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.

Brindha

- Blockchain-based Toll Collection System
- infrastructure maintanence tracking

Deepika

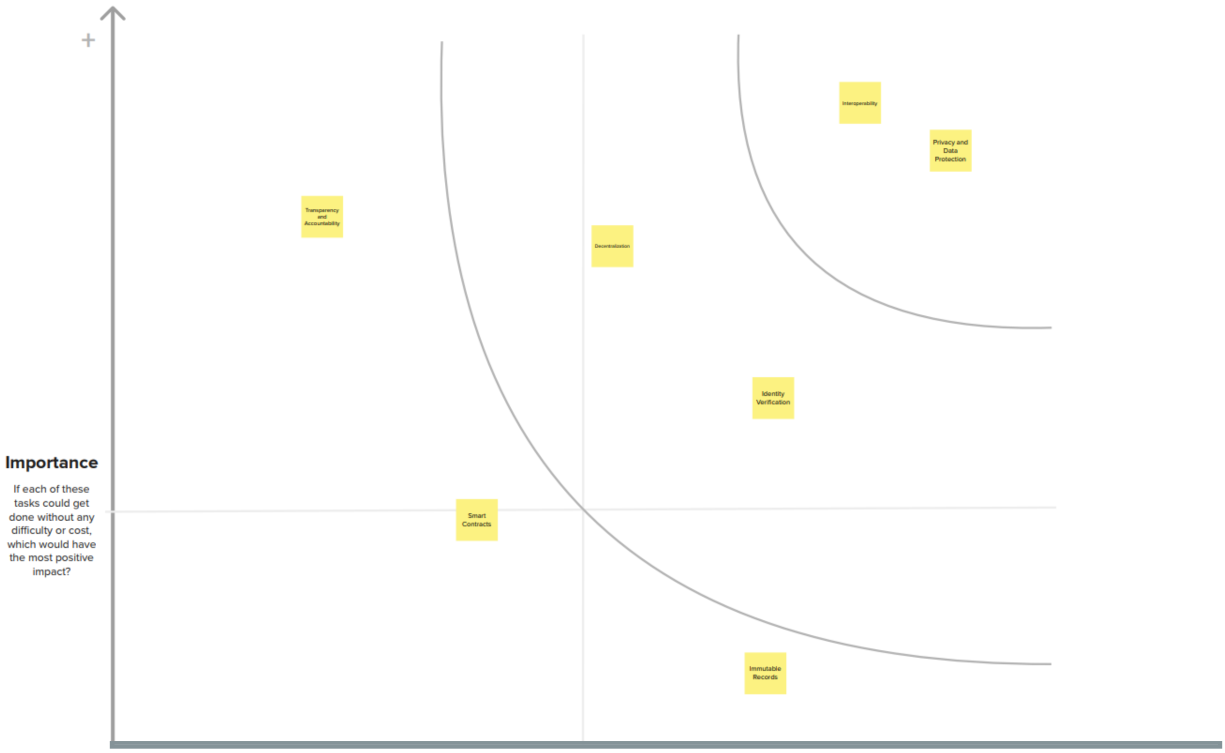
- real time monitoring
- iot integration

Dharani

- toll payment mobile app
- identity and acsess management for infrastructure

Yamuna

- tokenized infrastructure investment
- supply chain transparency


+
Importance
If each of these tasks could get done without any difficulty or cost, which would have the most positive impact?
Transparency and Accountability
Decentralization
Interoperability
Privacy and Data Protection
Identity Verification
Smart Contracts
Immutable Records

4. REQUIREMENT ANALYSIS

4.1 Functional requirement

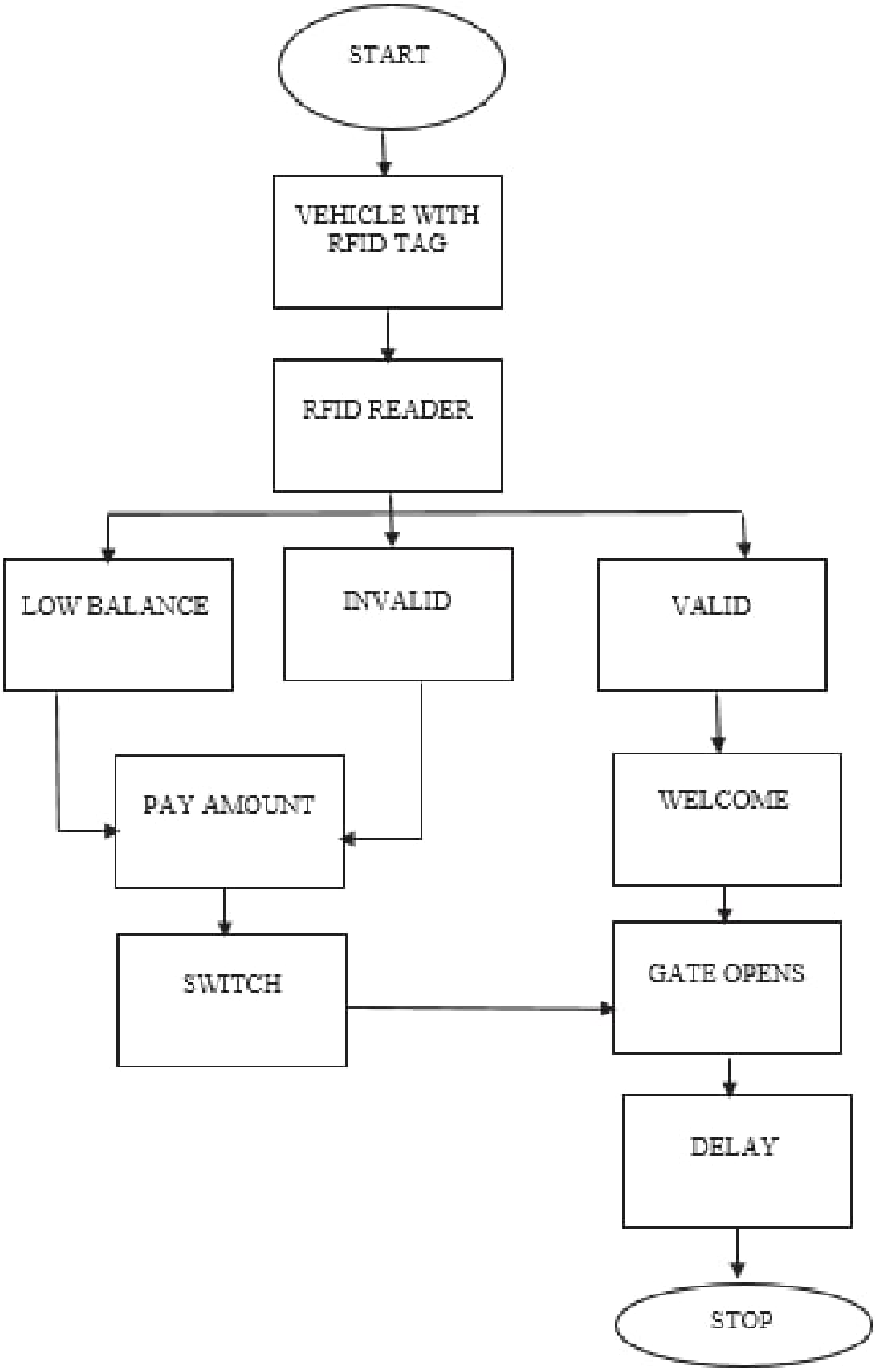
The functional requirements for tracking public infrastructure and toll payments using blockchain encompass various key elements. Firstly, a secure and decentralized blockchain network should be established to store transaction data, ensuring data immutability, transparency, and resistance to tampering. Smart contracts are necessary to automate toll collection and payment verification processes, linking infrastructure usage to payments seamlessly. User-friendly interfaces and mobile applications should be developed to enable easy user interactions with the system, enhancing user adoption. Additionally, the system must be able to handle a high volume of transactions efficiently to address scalability. It should also offer options for cross-border payments and support various payment methods, including digital currencies. Compliance with local regulations and reporting requirements is vital, requiring the ability to customize rules and data sharing mechanisms according to regional laws. Security features such as encryption, access control, and regular security audits should be integrated to protect sensitive data and the blockchain network. Finally, real-time monitoring and reporting tools should be available to infrastructure management authorities for tracking and maintaining the public assets effectively. These functional requirements, when implemented, will create a robust and user-friendly system for tracking public infrastructure and toll payments using blockchain.

4.2 Non-Functional requirements

The system must exhibit high performance, with fast transaction processing and minimal latency to maintain the smooth flow of toll payments and infrastructure tracking. Robust security measures are paramount, safeguarding sensitive data, ensuring the integrity of the blockchain, and preventing unauthorized access, data breaches, and cyberattacks. The system must be able to scale to accommodate increased transaction loads and data growth without compromising performance or efficiency. Privacy features should be implemented to protect user data, and sensitive transaction information, adhering to privacy regulations while still ensuring transparency within the blockchain. The system should be highly reliable, with minimal downtime and robust failover mechanisms in place to prevent disruptions in toll collection and infrastructure tracking. The system needs to be interoperable with various other systems, including legacy infrastructure, payment networks, and different blockchain platforms, facilitating seamless data exchange and cross-border payment processing. Adherence to local and international regulations is crucial to avoid legal issues and ensure that all financial and reporting requirements are met. The system must maintain transparent, easily auditable records of all transactions and infrastructure maintenance activities, aiding in compliance verification and dispute resolution. To keep operational costs in check, the system should be designed to operate efficiently, minimizing energy consumption and other resource requirements. Sustainable practices, including energy-efficient consensus mechanisms, should be considered to align with environmental goals and reduce the carbon footprint of the blockchain network. These non-functional requirements are essential for creating a blockchain-based system that can effectively track public infrastructure and toll payments while upholding security, scalability, and compliance standards, and ensuring user privacy and trust.

5. PROJECT DESIGN

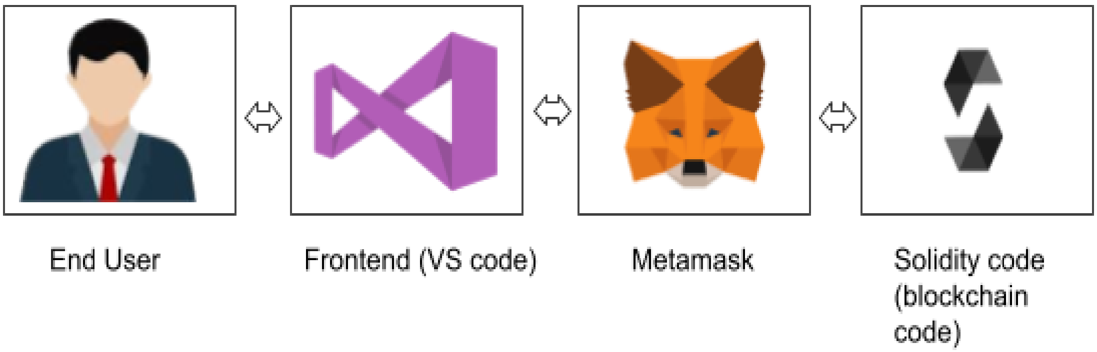
5.1 Data Flow Diagrams & User Stories

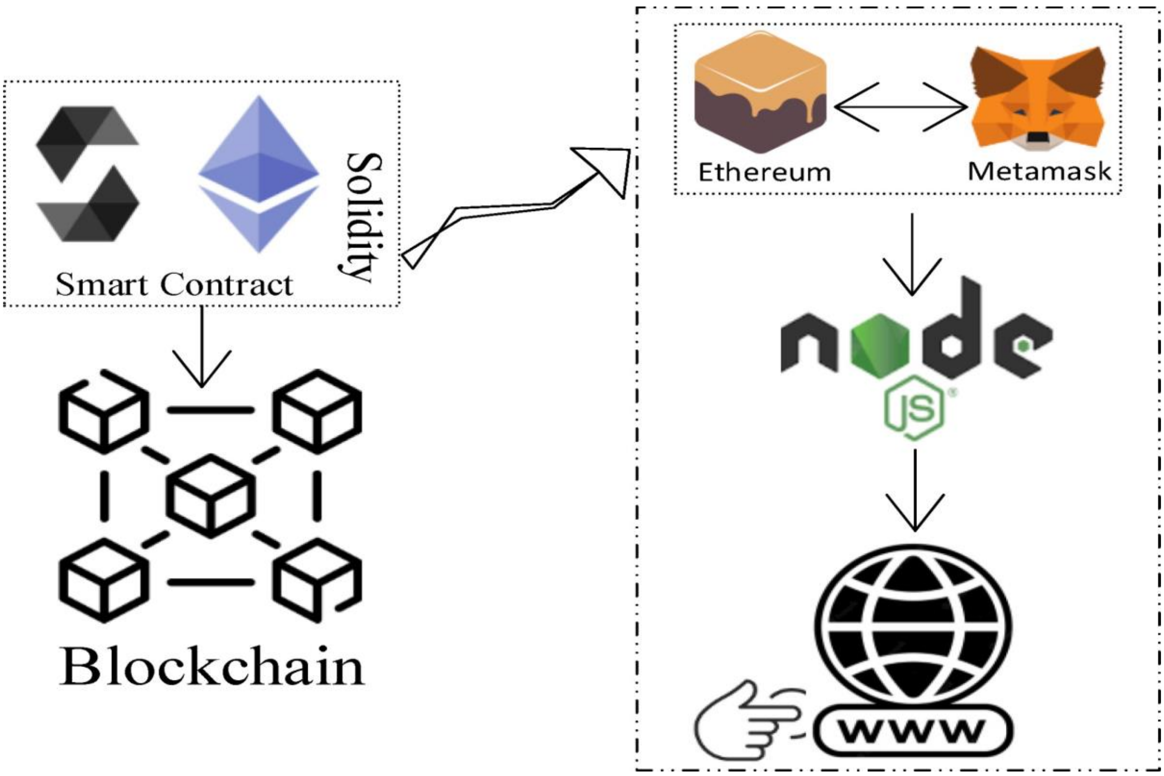


As a daily commuter, I want to be able to access real-time information about traffic conditions and road closures on major highways to plan my routes effectively. As a driver, I want to receive automated alerts on my smartphone when I approach a toll booth, so I can prepare for the toll payment in advance. As a frequent traveller, I want a mobile app that allows me to easily pay tolls using my preferred payment method, such as a linked credit card or a digital wallet. As a government official, I want a web-based dashboard that provides real-time data on toll collection revenues and traffic patterns to help with infrastructure planning and maintenance. As a budget-conscious driver, I want to receive regular reports on my toll expenses, so I can monitor and manage my transportation costs more effectively. As a logistics manager, I want to integrate the toll payment system with my fleet management software to keep track of toll expenses for each vehicle and optimize routing. As a city planner, I want access to historical data on toll revenue and traffic patterns to make informed decisions about future infrastructure investments and improvements. As a law enforcement officer, I want to use a system that provides real-time information on vehicles passing through toll booths to assist in tracking and locating suspect vehicles. As a toll booth operator, I want a user-friendly system to quickly process toll payments, issue receipts, and maintain accurate records of all transactions. As a data analyst, I want to have access to APIs or data feeds that provide toll collection and traffic data so I can perform in-depth analyses and generate insights for decision-makers.

5.2 Solution Architecture

Install sensors and cameras on infrastructure points (e.g., toll booths, bridges) to collect data on vehicle movement and toll transactions. Utilize GPS data from vehicles or mobile apps for location tracking. Gather toll payment data through various payment methods (e.g., electronic toll collection, mobile apps, credit cards). Implement a data ingestion layer to process and store incoming data. Use IoT platforms, APIs, and data pipelines to collect and standardize data from sensors, cameras, and payment gateways. Store data in a scalable and secure database, such as a NoSQL or relational database. Use cloud-based storage solutions for scalability and redundancy. Implement real-time and batch data processing to analyse incoming data. Use stream processing frameworks like Apache Kafka or cloud-based tools like AWS Kinesis for real-time processing. Employ data warehouses or big data technologies for batch processing and analysis.





6. PROJECT PLANNING & SCHEDULING

6.1 Technical Architecture

Install sensors and cameras at infrastructure points for real-time data collection. Utilize GPS data from vehicles or mobile apps for location tracking. Gather toll payment data from various sources, including electronic toll collection systems and mobile apps. Use an IoT gateway to collect data from sensors and cameras. Implement APIs to receive data from various toll payment methods and integrate with other systems. Store structured data like toll transactions and user information in a relational database. Use a NoSQL database for storing unstructured data, such as sensor readings and images. Utilize cloud-based storage for scalability and redundancy. Employ a stream processing framework (e.g., Apache Kafka) to analyse incoming data in real-time. Batch Processing: Use batch processing tools (e.g., Apache Spark) for historical data analysis and reporting. Implement BI tools like Tableau, Power BI, or custom dashboards for data visualization and reporting. Develop ML models for traffic prediction, toll fraud detection, and revenue optimization. Create a mobile app for users to check their toll payments and account balances. Develop a web portal for administrators to manage infrastructure and monitor traffic. Encrypt data both in transit and at rest to ensure security. Implement role-based access control to restrict data access to authorized personnel. Perform regular security assessments to identify vulnerabilities. Integrate with government systems for regulatory compliance and data sharing. Connect with banks and financial institutions for toll payment processing. Integrate with third-party services for additional functionalities. Design the system to scale horizontally to handle increased data loads. Implement redundancy for fault tolerance and high availability. Define data retention policies to archive historical data for compliance and analysis. Develop a disaster recovery plan to ensure data recovery in case of system failures or disasters. Implement monitoring tools to detect and address issues proactively.

6.2 Sprint Planning & Estimation

Sprint training and estimation for a project focused on tracking public infrastructure and toll payments should follow Agile principles. Begin with a project kick-off to define the product vision and goals. Then, break down the work into user stories or tasks. During sprint planning, the team estimates the complexity and effort for each task. Story points or relative sizing can be used for estimation. The team can decide on sprint duration, typically 2-4 weeks, based on the project's size and complexity. Daily stand-up meetings help track progress, identify roadblocks, and adjust priorities. After each sprint, conduct a sprint review to showcase completed work, gather feedback, and make adjustments. Sprint retrospectives are crucial for continuous improvement. Given the complexity of infrastructure and payment tracking, involving domain experts and stakeholders in sprint activities is essential for success. This iterative approach allows for flexibility and adaptability to changing requirements and ensures the project aligns with the evolving needs of the infrastructure and toll payment ecosystem.

6.3 Sprint Delivery Schedule

A sprint delivery schedule for tracking public infrastructure and toll payments should be organized in iterative cycles to ensure continuous improvement and adaptability. In a typical two-week sprint cycle, the focus could be as follows: In Sprint 1, the team can set up the data collection infrastructure, including sensors and cameras at key locations.

Sprint 2 can be dedicated to building the data ingestion layer and defining data formats and protocols. Sprint 3 can focus on data storage and implementing a database or cloud-based storage solution. Sprint 4 might involve developing the real-time data processing capabilities, while Sprint 5 can be dedicated to analytics and reporting tools. Sprint 6 should include user interface development for administrators and the public, including mobile and web apps. In Sprint 7, security measures should be strengthened, and compliance requirements addressed. Sprint 8 can be used for integration with external systems, and Sprint 9 for scalability and redundancy measures. Subsequent sprints can be used for fine-tuning, additional features, and ongoing optimization. Regular testing, feedback, and sprint retrospectives should be part of each cycle to refine the system progressively. This iterative approach ensures that the tracking system evolves efficiently while maintaining flexibility to adapt to changing requirements.

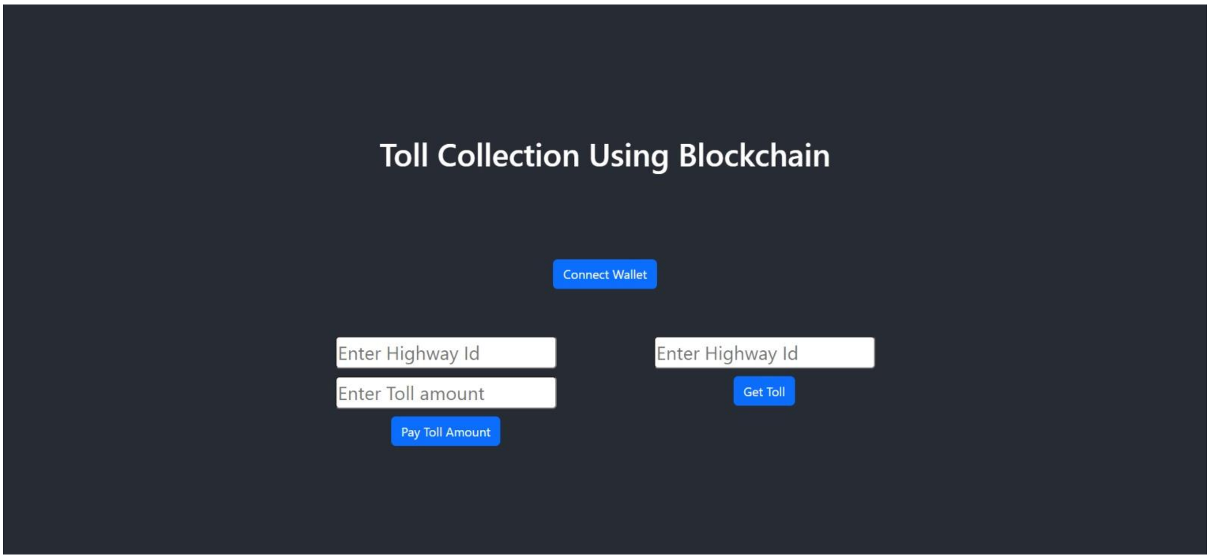
7. CODING & SOLUTIONING

7.1 Feature 1

```
// SPDX-License-Identifier: MIT
pragma solidity ^0.8.0;

contract tollCollection{
    struct TollData {
        uint timestamp;
        address collectedBy;
        uint amount;
    }

    mapping(address => mapping(uint => TollData)) public tolls;



    function payTollAmount(uint highwayId, uint _amount) public {

       // TollData memory newToll = TollData(block.timestamp, msg.sender,
amount);
        tolls[msg.sender][highwayId].timestamp = block.timestamp ;
        tolls[msg.sender][highwayId].collectedBy = msg.sender;
        tolls[msg.sender][highwayId].amount += _amount;
```

```
    }

    function getToll(uint highwayId) public view returns (TollData memory) {
        return tolls[msg.sender][highwayId];
    }

    // function updateToll(uint highwayId, uint amount) public {
    //     require(
    //         tolls[msg.sender][highwayId].timestamp > 0,
    //         "Toll data not found."
    //     );
    //     tolls[msg.sender][highwayId].amount = amount;
    // }
}
```

7.2 Feature 2



8. PERFORMANCE TESTING

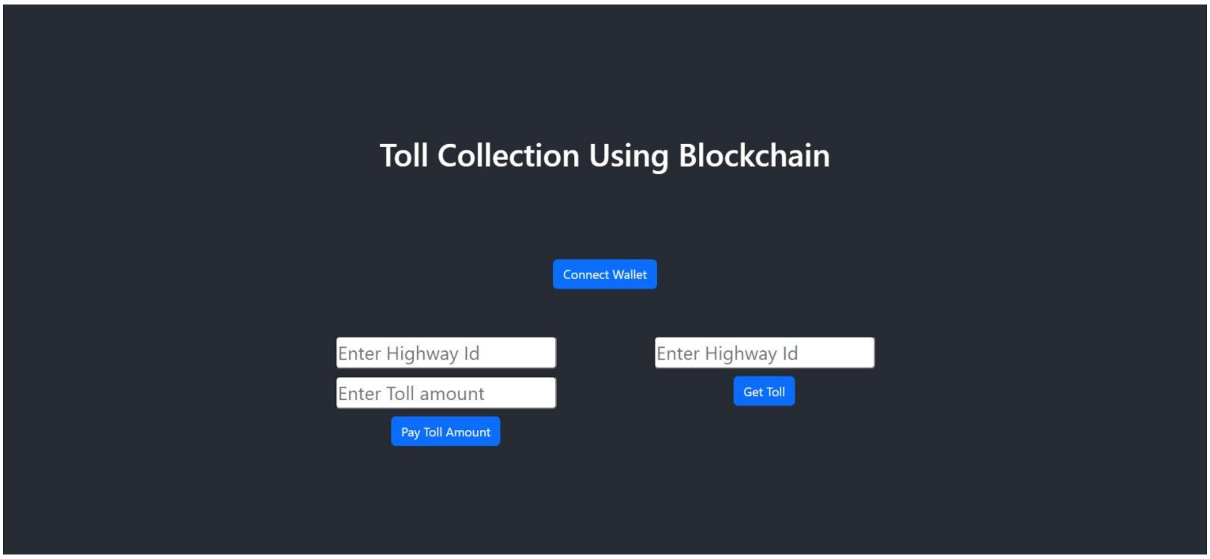
8.1 Performance Metrics

Measure the volume of vehicles passing through toll booths or using public infrastructure. This metric helps in understanding traffic patterns and congestion. Monitor the revenue generated from toll payments. This is a crucial metric for assessing the financial sustainability of infrastructure projects. Calculate the percentage of toll revenue collected compared to the total expected revenue. High collection efficiency is indicative of effective toll management. Evaluate the extent of traffic congestion on roads and bridges. High congestion levels can lead to delays and increased operating costs. Measure the average speed of vehicles on specific road segments. This metric is crucial for assessing traffic flow and identifying areas where speed improvements are needed. Track the number of accidents, incidents, and road safety violations on public infrastructure. Reducing safety incidents is a priority for any transportation system. Monitor the costs associated with maintaining and repairing infrastructure. Efficient maintenance practices can extend the lifespan of assets. Collect feedback from users through surveys or other means to gauge their satisfaction with the infrastructure and toll payment process. Assess the environmental impact of infrastructure projects, including factors like air quality, noise pollution, and carbon emissions. Identify and reduce revenue leakage due to toll evasion, fraud, or other irregularities. Measure the efficiency of toll booth operations, including wait times, transaction speed, and staff performance. Ensure that public infrastructure is accessible to all, including people with disabilities, and that toll payment methods accommodate a wide range of users.

Monitor the adoption of advanced technologies like electronic toll collection (ETC) systems, which can improve efficiency and reduce congestion. Assess the accuracy of revenue forecasts for infrastructure projects to ensure they align with actual revenue generation. Evaluate the effectiveness of public outreach and education campaigns related to toll payments, lane usage, and traffic management. Measure the downtime of toll booths due to maintenance or technical issues to minimize disruptions. Use data and analytics to optimize traffic flow, reduce congestion, and improve overall system performance. Analyse the utilization of public infrastructure to identify overused or underused segments and make necessary adjustments.

9. RESULTS

9.1 Output Screenshots



10. ADVANTAGES & DISADVANTAGES

Advantages

Toll payments help generate revenue for maintaining and improving infrastructure, such as roads and bridges. Monitoring public infrastructure enables authorities to identify and address maintenance issues promptly, ensuring safety and functionality. Data from toll systems can be used for traffic management and optimization, reducing congestion and travel times. Tracking payments holds users accountable for their usage of public infrastructure, discouraging evasion and ensuring fair payment. Infrastructure tracking can enhance safety by identifying potential hazards and addressing them proactively. Data collected from toll systems can be valuable for urban planning and future infrastructure development.

Disadvantages

Tracking individual's movements for toll payments raises privacy concerns, as it can be seen as an invasion of personal privacy. Storing payment and location data can make the system vulnerable to data breaches and misuse. Implementing and maintaining tracking systems can be costly, and these costs may be passed on to consumers in the form of higher toll fees. Despite tracking, some individuals may find ways to evade toll payments, leading to revenue loss and potential unfairness in the system. Toll systems can disproportionately affect low-income individuals who may struggle to pay tolls, potentially limiting their access to certain areas. Reliance on technology for infrastructure tracking can be problematic when technical issues or outages occur, disrupting services.

11. CONCLUSION

Tracking public infrastructure and toll payments is essential for improving transportation efficiency, ensuring revenue collection, and enhancing overall infrastructure management. Through the use of technology, such as electronic toll collection systems and data analytics, we can streamline toll payment processes, reduce congestion, and monitor the condition of critical infrastructure. This not only benefits governments and authorities but also provides a more convenient and efficient experience for the public. However, it's crucial to balance these advancements with privacy and security considerations, ensuring that personal data is protected and the systems are resilient to potential threats. In summary, effective tracking and management of public infrastructure and toll payments contribute to a safer, more reliable, and sustainable transportation network.

12. FUTURE SCOPE

The integration of toll payment systems with digital wallets and contactless payment methods will likely become more widespread, enhancing convenience for users. Blockchain can be used to create secure and transparent toll payment systems, reducing fraud and ensuring the integrity of transactions. Infrastructure will become smarter with the incorporation of sensors and IoT devices to monitor traffic flow, vehicle counts, and maintenance needs in real-time. Advanced data analytics will be employed to predict traffic patterns and optimize infrastructure maintenance and toll collection. AI-powered systems can help automate toll collection and identify toll violators more efficiently. Future systems will likely focus on reducing the environmental impact of toll roads, encouraging green transportation and assessing carbon footprints. User-friendly mobile apps will play a crucial role in providing real-time traffic information, toll pricing, and payment options. Enhanced measures will be put in place to protect the privacy and security of user data in toll payment systems. As autonomous vehicles become more common, integration with toll payment systems will need to adapt to accommodate these vehicles' unique needs. Efforts will be made to create standardized toll payment systems that work seamlessly across regions and even countries. Drones, satellites, and other remote sensing technologies will aid in infrastructure monitoring and maintenance. The development of sustainable and environmentally friendly infrastructure will be a significant focus, potentially incorporating renewable energy sources. Governments may continue to collaborate with private companies to fund, build, and maintain infrastructure, and toll collection methods will adapt accordingly.

13. APPENDIX

Source Code

tollcollection.sol

```
// SPDX-License-Identifier: MIT
pragma solidity ^0.8.0;
contract tollCollection{
    struct TollData {
        uint timestamp;
        address collectedBy;
        uint amount;
    }
    mapping(address => mapping(uint => TollData)) public tolls;
    function payTollAmount(uint highwayId, uint _amount) public {
      // TollData memory newToll = TollData(block.timestamp, msg.sender,
amount);
        tolls[msg.sender][highwayId].timestamp = block.timestamp ;
        tolls[msg.sender][highwayId].collectedBy = msg.sender;
        tolls[msg.sender][highwayId].amount += _amount;
    }
    function getToll(uint highwayId) public view returns (TollData memory) {
        return tolls[msg.sender][highwayId];
    }

    // function updateToll(uint highwayId, uint amount) public {
    //     require(
    //         tolls[msg.sender][highwayId].timestamp > 0,
    //         "Toll data not found."
    //     );
```

```
  //    tolls[msg.sender][highwayId].amount = amount;
  // }
}
```

Page

connector.js

```
const { ethers } = require("ethers");
const abi = [
 {
  "inputs": [
   {
    "internalType": "uint256",
    "name": "highwayId",
    "type": "uint256"
   }
  ],
  "name": "getToll",
  "outputs": [
   {
    "components": [
     {
      "internalType": "uint256",
      "name": "timestamp",
      "type": "uint256"
     },
     {
      "internalType": "address",
      "name": "collectedBy",
      "type": "address"
```

},
{
"internalType": "uint256",
"name": "amount",
"type": "uint256"
}
],
"internalType": "struct tollCollection.TollData",
"name": "",
"type": "tuple"
}
],
"stateMutability": "view",
"type": "function"
},
{
"inputs": [
{
"internalType": "uint256",
"name": "highwayId",
"type": "uint256"
},
{
"internalType": "uint256",
"name": "_amount",
"type": "uint256"
}
],
"name": "payTollAmount",

```
  "outputs": [],
  "stateMutability": "nonpayable",
  "type": "function"
 },
 {
  "inputs": [
   {
    "internalType": "address",
    "name": "",
    "type": "address"
   },
   {
    "internalType": "uint256",
    "name": "",
    "type": "uint256"
   }
  ],
  "name": "tolls",
  "outputs": [
   {
    "internalType": "uint256",
    "name": "timestamp",
    "type": "uint256"
   },
   {
    "internalType": "address",
    "name": "collectedBy",
    "type": "address"
   },
```

```
    {
     "internalType": "uint256",
     "name": "amount",
     "type": "uint256"
    }
   ],
   "stateMutability": "view",
   "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 = "0xBb4282D33fEe2962A22a407E9499109E5f8B6DAb"
export const contract = new ethers.Contract(address, abi, signer)
```

home.js

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

function Home() {
  const [Id, setId] = useState("");
  const [TollAmount, setTollAmount] = useState("");
  const [Manufacturer, setManufacturer] = useState("");
  const [date, setDate] = useState("");
```

```
  const [TranId, setTranId] = useState("");
  const [Owner, setOwner] = useState("");
  const [BookId, setBookId] = useState("");
  const [BookDet, setBookDet] = useState("");
  const [Batch, setBatch] = useState("");
  const [Qty, setQty] = useState("");
  const [Cus, setCus] = useState("");
  const [Wallet, setWallet] = useState("");
  const handleId = (e) => {
    setId(e.target.value)
  }
  const handleTollAmount = (e) => {
    setTollAmount(e.target.value)
  }
  const handleToll = async () => {
    try {
      let tx = await contract.payTollAmount(Id.toString(),
TollAmount.toString())
      let wait = await tx.wait()
      alert(wait.transactionHash)
console.log(wait);
    } catch (error) {
      alert(error)
    }
  }
  const handleDrugId = (e) => {
    setTranId(e.target.value)
  }
  const handleNewOwner = (e) => {
```

```
  setOwner(e.target.value)
}
const handleTransfer = async () => {
  try {
    let tx = await contract.transferDrugOwnership(TranId.toString(), Owner)
    let wait = await tx.wait()
    console.log(wait);
    alert(wait.transactionHash)
  } catch (error) {
    alert(error)
  }
}

const handleTollDetailsId = (e) => {
  setBookId(e.target.value)
}
const handleDrugDetails = async () => {
  try {
    let tx = await contract.getToll(BookId.toString())
    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 (
  <div>
<h1 style={{ marginTop: "30px", marginBottom: "80px" }}>Toll Collection Using Blockchain</h1>
      {!Wallet ?

        <Button onClick={handleWallet} style={{ marginTop: "30px", marginBottom: "50px" }}>Connect Wallet </Button>
        : <p style={{ width: "250px", height: "50px", margin: "auto", marginBottom: "50px", border: '2px solid #2096f3' }}>{Wallet.slice(0, 6)}....{Wallet.slice(-6)}</p>
      }
  <Container>
   <Row>
    <Col style={{marginRight:"100px"}}>
     <div>
     <input style={{ marginTop: "10px", borderRadius: "5px" }} onChange={handleId} type="number" placeholder="Enter Highway Id" value={Id} /> <br />
```

```
<input style={{ marginTop: "10px", borderRadius: "5px" }} onChange={handleTollAmount} type="number" placeholder="Enter Toll amount" value={TollAmount} /> <br />
<Button onClick={handleToll} style={{ marginTop: "10px" }} variant="primary"> Pay Toll Amount</Button>
</div>
</Col>
<Col >
<Button onClick={handleDrugDetails} style={{ marginTop: "10px" }} variant="primary">Get Toll</Button>
{BookDet ? BookDet?.map(e => {
return <p>{e.toString()}</p>
}) : <p></p>}
</div>
</Col>
</Row>
</Container>
</div>
)
}
export default Home;
```

GitHub & Project Demo Link

GitHub Link

https://github.com/brindha-02/NM-BLOCKCHAIN-TRACKING-PUBLIC-INFRASTRUCTURE-AND-TOLL-PAYMENTS.git

Project Demo Link

https://drive.google.com/file/d/1tmBjTpgfoTcvhuqqW_sWfgWlUA3DEOkP/view?usp=drivesdk