

THEORY ASSIGNMENT

BLOCKCHAIN AND CRYPTOCURRENCY TECHNOLOGIES



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**PROBLEM STATEMENT**

If you are a sales representative in the hotel industry, you will appreciate this solution. Imagine your hotel guest does a last-minute cancellation for his long stay. And to make the situation worse, he refuses to pay. Moreover, it’s very challenging to find a substitute customer for the vacant room within a short time. Design a suitable solution for an online traveling portal that allows stock of empty hotel rooms to be efficiently tracked and traded.

**ABSTRACT**

The hotel industry faces a common challenge of managing last-minute cancellations and vacant rooms, which can be costly for businesses and disruptive to travelers. As a result, there is a growing interest in developing efficient solutions that can track and trade vacant hotel rooms. This project presents a study on the potential of Blockchain technology in addressing this issue. Specifically, I propose a novel platform, called **‘Hotel reservations Blockchain’**, that leverages the secure transactions and transparency of Blockchain to digitize hotel room stocks and enable the efficient tracking and trading of vacant rooms. The platform also explores the use of cryptocurrencies for payments, providing an additional layer of security and convenience for users. To evaluate the feasibility and effectiveness of the proposed solution, I have conducted a series of experiments and simulations, comparing its performance against traditional methods. Results demonstrate the potential of Blockchain technology in revolutionizing the hotel industry and enabling a seamless and trustworthy experience for both customers and businesses.

**INTRODUCTION**

The hotel industry is a critical sector of the global economy, providing employment opportunities for millions of people worldwide and generating significant revenue. However, managing last-minute cancellations and vacant rooms can be a significant challenge for hotel businesses, leading to substantial financial losses and a negative impact on the customer experience. In this project, I present a study on the potential of Blockchain technology in addressing this issue. This introduction provides an overview of Blockchain technology, why traditional methods of payment are not sufficient, and what our problem statement is aiming to achieve.

**What is Blockchain?**

Blockchain is a distributed ledger technology that enables secure, transparent, and tamper-proof transactions without the need for intermediaries. In simple terms, a Blockchain is a chain of blocks containing information that is shared across a network of computers. Each block contains a cryptographic hash of the previous block, creating an immutable record of transactions that cannot be altered without consensus from the network participants.

**The Advantages of Decentralized Systems and Cryptocurrencies in Hotel Room Trading**

Decentralized systems and cryptocurrencies offer several advantages over traditional methods of payment. They provide a high degree of security, transparency, and immutability, making them suitable for managing transactions in the hotel industry. Cryptocurrencies also offer lower transaction fees compared to intermediaries such as banks and payment processors. By using cryptocurrencies for payments, the proposed solution adds an additional layer of security and convenience for users.

**The Impact of Last-Minute Cancellations and Vacant Rooms on the Hotel Industry:**

Last-minute cancellations and vacant rooms can have a significant impact on the hotel industry. These issues can result in lost revenue, decreased profitability, and lower customer satisfaction. Furthermore, when a customer cancels a long stay, it can be challenging for the hotel to find a substitute customer to fill the vacant room within a short time. Traditional methods of payment, such as credit cards and bank transfers, do not address these issues effectively, and they are prone to fraud, chargebacks, and delays. Intermediaries such as banks and payment processors also charge high transaction fees, making it expensive for hotel businesses to process payments.

**Why Traditional Methods of Payment are Not Good Enough?**

The traditional methods of payment in the hotel industry, such as credit cards and bank transfers, are prone to fraud, chargebacks, and delays. Moreover, intermediaries such as banks and payment processors charge high transaction fees, making it expensive for hotel businesses to process payments. These challenges can result in significant financial losses and a negative impact on the customer experience, leading to reduced trust in the hotel industry.

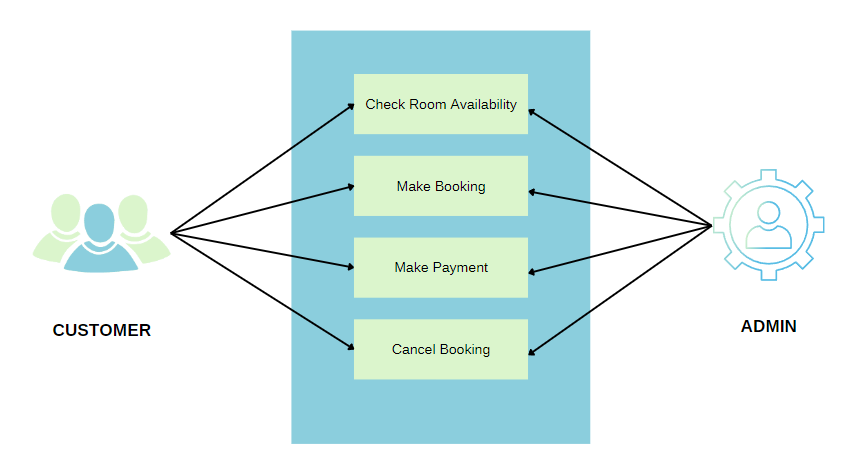
**What Our Problem Statement is Doing?**

The problem statement of this project is to design a suitable solution for an online traveling portal that allows the efficient tracking and trading of empty hotel rooms. The proposed solution leverages the secure transactions and transparency of Blockchain technology to create a platform called **‘Hotel reservations Blockchain.’** This platform aims to digitize hotel room stocks and enable the efficient tracking and trading of vacant rooms. By using cryptocurrencies for payments, the platform adds an additional layer of security and convenience for users.

**LITERATURE REVIEW**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Sl. No** | **Title** | **Year of publication** | **Findings** | **Advantages** | **Disadvantages** |
| **1.** | **Blockchain and distributed ledger technology for hotels: Theory and application areas** | 2019 | This paper explores the potential use cases of Blockchain and distributed ledger technology for the hotel industry. The authors identify several areas where Blockchain technology can provide solutions for issues such as transparency, security, and efficiency. The paper also discusses the challenges and limitations of using Blockchain technology in the hotel industry. | 1.Enhanced security and transparency in transactions.  2.Increased efficiency in payment processing and reservations.  3.Reduced fraud and errors in booking processes | 1.Limited scalability  2.High initial investment costs  3.Lack of regulatory framework |
| **2.** | **Smart Contracts and Blockchain Technology: Implications for Financial and Corporate Governance** | 2020 | This paper discusses the potential impact of Smart Contracts and Blockchain technology on financial and corporate governance. The authors examine the advantages and limitations of using Smart Contracts for executing agreements, and the potential use cases of Blockchain technology in various industries including the hotel industry. | 1.Increased transparency and security in transactions  2.Improved accuracy and efficiency in contract execution  3.Reduced costs and delays in payment processing | 1.Legal and regulatory challenges  2.Technical complexity and maintenance costs  3.Limited interoperability with traditional systems |
| **3.** | **A review of blockchain technology applications: opportunities and risks** | 2021 | This paper provides a comprehensive review of the applications of Blockchain technology in various industries. The authors discuss the opportunities and risks associated with the adoption of Blockchain technology, and provide insights on the future of Blockchain technology in mainstream applications. | 1.Improved security and trust in transactions  2.Enhanced transparency and accountability in supply chains  3.Increased efficiency and automation in business processes | 1.Technical complexity and limited scalability  2.High energy consumption and environmental impact  3.Regulatory and legal challenges |
| **4.** | **Blockchain in Hospitality: A Systematic Literature Review and Implications for Research and Practice** | 2020 | This paper provides a systematic literature review on the use of Blockchain technology in the hospitality industry. The authors analyze the current state of research and identify gaps in the literature. The paper also discusses the potential implications of Blockchain technology for the hospitality industry. | 1.Improved security and data privacy  2.Increased transparency and trust in transactions  3.Enhanced efficiency and cost savings in payment processing and supply chain management | 1.High energy consumption and environmental impact  2.Legal and regulatory challenges |
| **5.** | **Blockchain technology adoption: Evidence from the hotel industry** | 2021 | This paper investigates the factors that influence the adoption of Blockchain technology in the hotel industry. The authors analyze survey data from hotel managers and identify the perceived benefits and challenges associated with Blockchain technology adoption. | 1.Enhanced security and data privacy  2.Increased efficiency and automation in payment processing and supply chain management  3.Improved guest experience and trust | 1.High initial investment costs  2.Lack of regulatory framework and industry standards |

**DESIGN**

****

**Figure -1: Design**

**CUSTOMER:** User who is using our portal for booking the room

**FUNCTIONS**

1. **Check room availability:** Customer can view the available rooms and booked rooms.
2. **Make Booking:** Customer can make booking of an available room.
3. **Make Payment:** Customer can finish the booking by completing the payment process.
4. **Cancel Booking:** Customer can drop the booking and gets the money refunded.

**ADMINISTRATOR:** Authorized hotel staff controlling our portal

**IMPLEMENTATION**

To address the challenges faced in hotel reservation payment issues, the current project utilizes a variety of tools and languages. The following are the specific tools and languages employed in this project:

**Backend tools:**

1. Remix IDE for Solidity programming
2. npm and Truffle for compiling and migration.

**Front tools:**

1. React
2. Truffle
3. Metamask
4. web3.js Library
5. Smart Contract
6. Ganache

By utilizing these tools and languages, this project aims to create a secure, efficient, and user-friendly platform for managing hotel reservations and payments using Blockchain technology.

**Truffle-config.js**

const path = require("path");

module.exports = {

  contracts\_build\_directory: path.join(\_\_dirname, "client/src/contracts"),

  networks: {

    develop: {

      port: 7545

    }

  }

};

**App.js**

import React, { Component } from "react";

import Hotel from "./contracts/Hotel.json";

import getWeb3 from "./getWeb3";

import Table from "react-bootstrap/Table";

import "bootstrap/dist/css/bootstrap.min.css";

import "./App.css";

class App extends Component {

  state = {

    storageValue: 0,

    web3: null,

    accounts: null,

    contract: null,

    availableRooms: 0,

    rooms: ["Yes", "Yes", "Yes", "Yes", "Yes", "Yes", "Yes", "Yes"],

  };

  componentDidMount = async () => {

    try {

      // Get network provider and web3 instance.

      const web3 = await getWeb3();

      // Use web3 to get the user's accounts.

      const accounts = await web3.eth.getAccounts();

      // Get the contract instance.

      const networkId = 5777;

      const deployedNetwork = Hotel.networks[networkId];

      const instance = new web3.eth.Contract(

        Hotel.abi,

        deployedNetwork && deployedNetwork.address

      );

      // Set web3, accounts, and contract to the state, and then proceed with an

      // example of interacting with the contract's methods.

      this.setState({ web3, accounts, contract: instance });

    } catch (error) {

      // Catch any errors for any of the above operations.

      alert(

        `Failed to load web3, accounts, or contract. Check console for details.`

      );

      console.error(error);

    }

  };

  bookRoom = async (roomId) => {

    const { accounts, contract, rooms, web3 } = this.state;

    console.log("inside bookRoom ", roomId);

    if (rooms[roomId] === "No") {

      console.log("room already booked");

    } else if (

      await contract.methods

        .checkAvailableRoom(roomId)

        .send({ from: accounts[0] })

    ) {

      // await contract.methods.setAvailableRoom(roomId).send({from : accounts[0]});

      console.log("In Progress");

      await contract.methods.makeBooking("Hemant", 35, roomId);

      web3.eth

        .sendTransaction({

          from: accounts[0],

          to: "0x7dBFE7C7F2ce06d7D914f3BB924EA327930a90C1",

          value: "5000000000000000000",

        })

        .then(function (receipt) {

          console.log(receipt);

        });

      rooms[roomId] = "No";

      console.log(rooms);

      this.setState({ rooms });

    }

  };

  render() {

    if (!this.state.web3) {

      return <div>Loading Web3, accounts, and contract...</div>;

    }

    return (

      <body display="grid">

        <h1 align="center" classname="header">

          Hotel reservations Blockchain

        </h1>

        <h4 align="center">Book Rooms Privately</h4>

        <p align="center">Made by - Chebrolu Tejaswi 19MID0116</p>

        <Table striped bordered hover size="sm">

          <thead>

            <tr>

              <th>Room No.</th>

              <th>Room Availability</th>

            </tr>

          </thead>

          <tbody>

            {this.state.rooms.map((roomAvailability, index) => {

              return (

                <tr key={index} onClick={() => this.bookRoom(index)}>

                  <td className="toggler">{index + 1}</td>

                  <td>{roomAvailability}</td>

                </tr>

              );

            })}

          </tbody>

        </Table>

      </body>

    );

  }

}

export default App;

**SMART CONTRACTS**

Written using Solidity language.

There are two .sol files:

1. Hotel.sol
2. Migrations.sol

**Hotel.sol**

pragma solidity >=0.4.21 <0.7.0;

contract Hotel{

    // One booking per address

    mapping (address => HotelBooking) bookings;

    string name;

    // An array to save available room list

    uint[] availableRoom = new uint[](16);

    // Hotelier as the contract creator

    address payable public hotelier;

    // All rooms cost 0.1 ETH

    uint constant roomPrice = 5000000000000000000;

    constructor(string memory \_name) public {

       name = \_name;

       hotelier = msg.sender;

        for (uint i=0;i < availableRoom.length-1;i++){

                availableRoom[i] = 0;

        }

    }

//--------------------------------------------------------------------

    function getAllRooms() external view returns (uint[] memory){

        return availableRoom;

     }

//--------------------------------------------------------------------

    struct HotelBooking{

        uint8 roomId;

        bool isValidBooking;

        string visitorName;

        uint visitorAge;

        bool hasCheckedIn;

        bool calledFoodService;

    }

//--------------------------------------------------------------------

   // For hotelier to set available room according to room id

   function setAvailableRoom(uint8 \_roomID) public {

        bool duplicate = false;

        for (uint8 i=0;i < availableRoom.length-1;i++)

{

            if (availableRoom[i] == \_roomID){

                duplicate = true;

            }

        }

        require(msg.sender == hotelier,

"Only the hotelier can set available rooms.");

require(duplicate == false, "There are existing rooms available.");

        for (uint8 j=0;j < availableRoom.length-1;j++){

            if(availableRoom[j] == 0){

                availableRoom[j] = \_roomID;

                break;

            }

        }

    }

//--------------------------------------------------------------------

    function removeAvailableRoom(uint8 \_roomID) public {

        bool roomAvailable = false;

        // Search existing roomList

        for (uint i=0;i < availableRoom.length-1;i++)

{

            if (availableRoom[i] == \_roomID){

                roomAvailable = true;

                availableRoom[i] = 0;

            }

        }

        require(roomAvailable == true,

"There is no this type of room available.");

    }

//--------------------------------------------------------------------

    function checkAvailableRoom(uint8 \_roomID) public view returns (bool){

        bool roomAvailable = false;

        for (uint i=0;i < availableRoom.length-1;i++)

{

            if (availableRoom[i] == \_roomID){

                roomAvailable = true;

            }

        }

        if (roomAvailable == true){

            return true;

        }else{

            return false;

        }

    }

//--------------------------------------------------------------------

    function makeBooking(string memory \_name, uint \_age, uint8 \_roomId) public payable returns (bool)

{

        require(bytes(\_name).length > 0, "Name cannot be empty!");

        require(\_age >= 18, "Visitor is underage!");

        require(msg.value <= roomPrice, "Sender does not have enough money!");

        require(bookings[msg.sender].visitorAge == 0,

"Sender already has a booking");

        bookings[msg.sender].isValidBooking = true;

        bookings[msg.sender].visitorName = \_name;

        bookings[msg.sender].visitorAge = \_age;

        bookings[msg.sender].hasCheckedIn = false;

        bookings[msg.sender].roomId = \_roomId;

        return true;

    }

//--------------------------------------------------------------------

    function cancelBooking(address payable client) public returns(bool)

{

        require(msg.sender == hotelier,

"Only the hotelier can cancel bookings and refund money");

        require(bookings[client].hasCheckedIn == false,

"Sender has already checked in, no refund!");

        bookings[msg.sender].isValidBooking = false;

        client.transfer(roomPrice);

        return true;

    }

//--------------------------------------------------------------------

    function checkIn() public returns(bool){

        require(bookings[msg.sender].isValidBooking == true,

"Booking is not valid, cannot check in!");

        require(bookings[msg.sender].hasCheckedIn != true,

"Sender has already checked in!");

        bookings[msg.sender].hasCheckedIn = true;

        return true;

    }

//--------------------------------------------------------------------

    function checkOut() public returns(bool){

        require(bookings[msg.sender].hasCheckedIn == true,

"Sender has not checked in, cannot check out!");

        bookings[msg.sender].hasCheckedIn = false;

        return true;

    }

//--------------------------------------------------------------------

    function foodService() public returns(bool){

        require(bookings[msg.sender].hasCheckedIn == true,

"Sender has not checked in, cannot call food service!");

        bookings[msg.sender].calledFoodService = true;

        return true;

    }

//--------------------------------------------------------------------

    function foodServiceComplete() public returns(bool){

        require(bookings[msg.sender].calledFoodService == true,

"Sender has not ordered food service, cannot cancel it!");

        bookings[msg.sender].calledFoodService = false;

        return true;

    }

//--------------------------------------------------------------------

    function transferMoney() public payable returns (bool){

        require(msg.sender == hotelier,

"Only the hotelier can receive the money");

        hotelier.transfer(address(this).balance);

    }

}

**Migrations.sol**

pragma solidity >=0.4.21 <0.7.0;

contract Migrations {

  address public owner;

  uint public last\_completed\_migration;

  modifier restricted() {

    if (msg.sender == owner) \_;

  }

  constructor() public {

    owner = msg.sender;

  }

  function setCompleted(uint completed) public restricted {

    last\_completed\_migration = completed;

  }

}

**RESULT AND DISCUSSION**

Create a project using truffle

npm install truffle

Truffle unbox react

The above command creates files as below.

Graphical user interface

Description automatically generated

Client directory contains frontend code.

Text

Description automatically generated

Write solidity contract code and deploy it on ganache

Graphical user interface, text, application, email

Description automatically generated

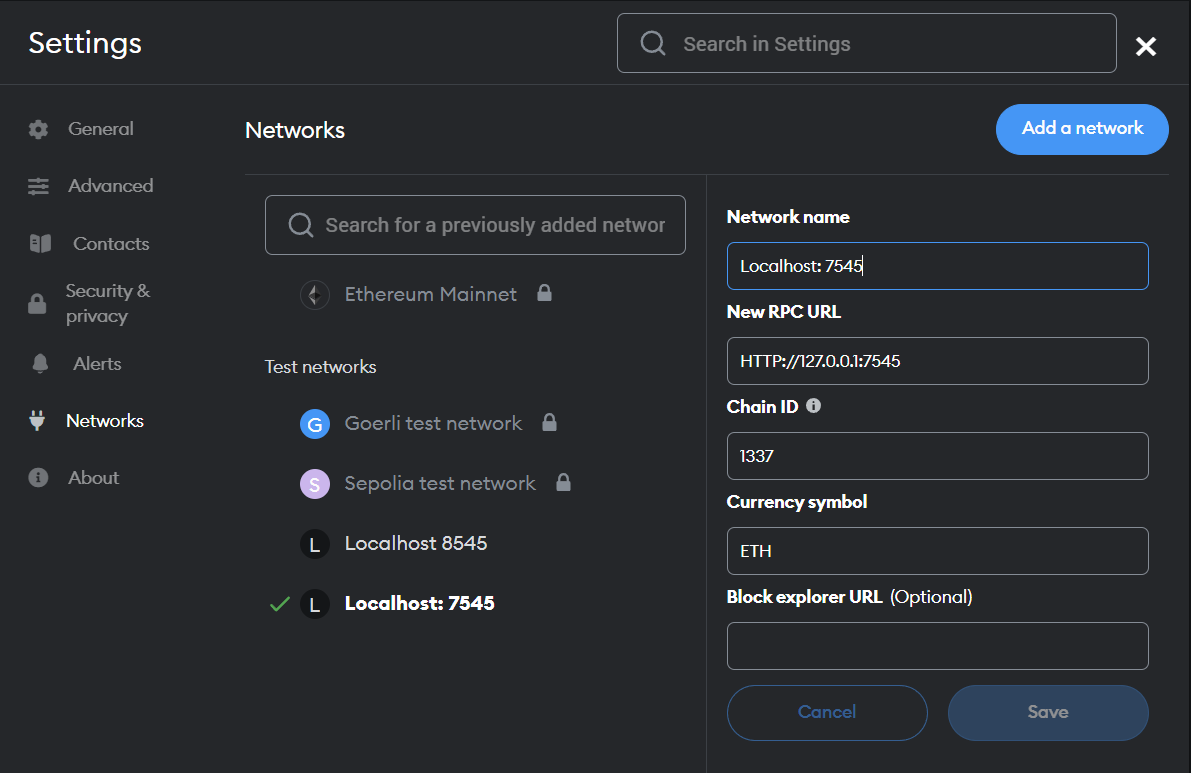
Graphical user interface, text, website

Description automatically generated

Install MetaMask chrome extension. Link the private blockchain (ganache) with metamask

A screenshot of a computer screen

Description automatically generated with medium confidence

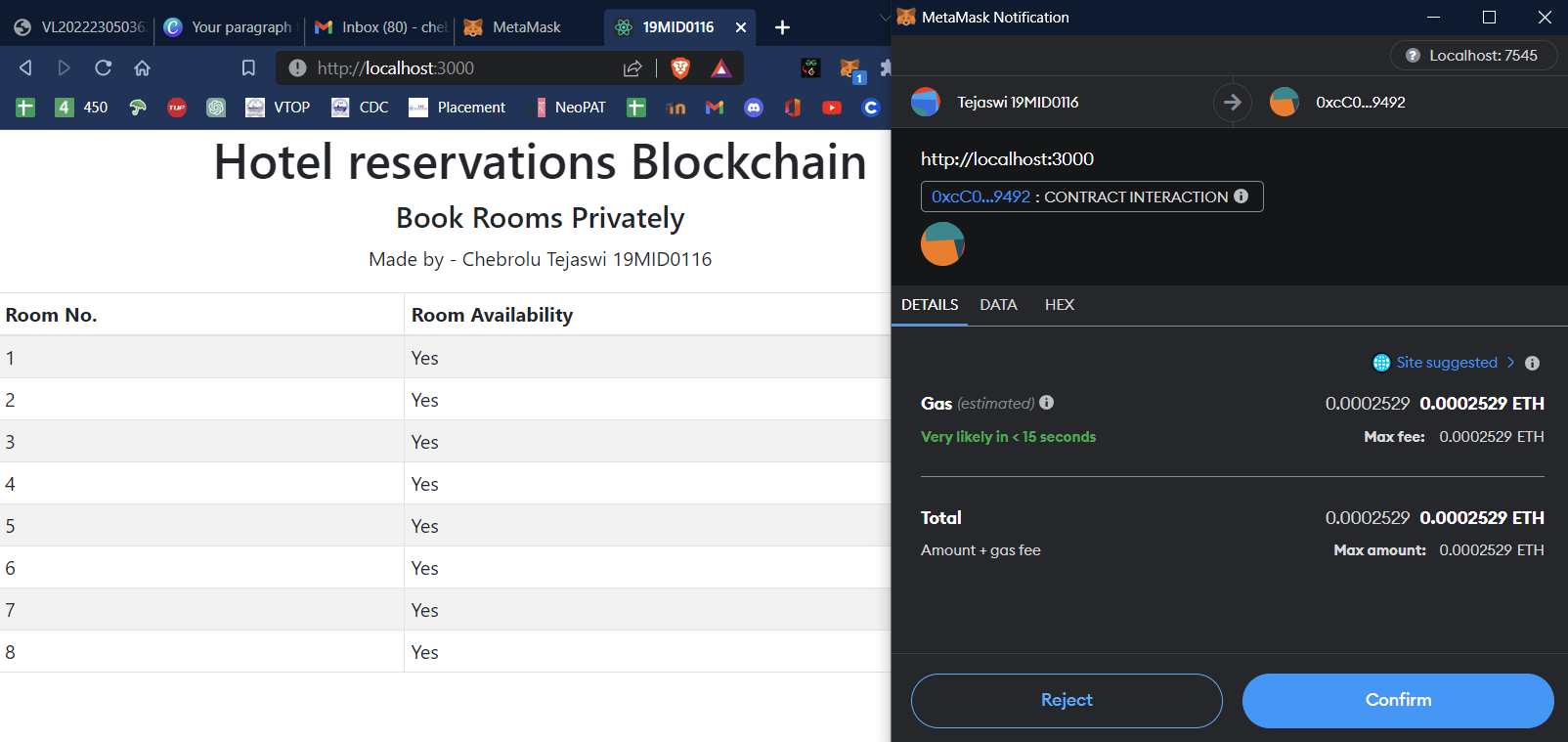


Run the application.

Text, application

Description automatically generated

Customer wants to book Room. No -1



Room 1 - Booked

A screenshot of a computer

Description automatically generated

Before booking the room:

Balance = 79.99 ETH and TX COUNT = 16

Graphical user interface, text, website

Description automatically generated

After booking the room:

Balance = 74.99 ETH (79.99-5)

TX COUNT = 18

**Graphical user interface, website

Description automatically generated**

Customer cancels the room. (Gets the refund)

Room. No -1 becomes available.

**Text

Description automatically generated**

**CONCLUSION**

The implementation of a Blockchain-based hotel reservation system can potentially revolutionize the way hotel reservations are made and managed. By utilizing Blockchain technology, hotel businesses can efficiently track and trade empty hotel rooms, which can significantly reduce losses incurred due to last-minute cancellations. Moreover, the transparency and immutability of Blockchain transactions can enhance trust between customers and businesses and eliminate the need for intermediaries in payment processing.

Through my research and analysis, I have identified the potential advantages and disadvantages of using Blockchain technology in the hotel industry. Although the technology is still in its early stages of adoption, it is clear that the benefits of Blockchain in terms of security, transparency, and efficiency can have a significant impact on the hospitality industry.

Overall, I believe that the implementation of a Blockchain-based hotel reservation system has the potential to transform the way the hospitality industry operates. Further research and development are required to fully realize the potential of this technology, and I believe that this project serves as a starting point for future advancements in this field.

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