IT465 Mini Project Report on

Real Estate Rental System On Blockchain

Submitted in partial fulfillment of the requirements for the degree of

BACHELOR OF TECHNOLOGY
in
INFORMATION TECHNOLOGY
by

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under the guidance of

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DECLARATION

I/We hereby *declare* that the IT465 Mini Project Report entitled ***"Real Estate Rental System On Blockchain"*** , which is being submitted to the **National Institute of Technology Karnataka, Surathkal**, for the award of the Degree of Bachelor of Technology in Information Technology, is a *bonafide report of the work carried out by me/us.* The material contained in this IT465 Mini Project Report has not been submitted to any University or Institution for the award of any degree.

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Place : NITK, Surathkal
Date : 10/11/2023

CERTIFICATE

This is to *certify* that the IT465 Mini Project Report entitled ***"Real Estate Rental System On Blockchain"*** submitted by

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as the record of the work carried out by them/, is *accepted as the B.Tech. IT465 Mini Project report submission* in partial fulfillment of the requirement for the award of degree of Bachelor of Technology in Information Technology in the Department of Information Technology, NITK Surathkal.

Signature of IT465 Mini Project Guide with date

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ABSTRACT

Fundraising campaigns originally emerged as an online fundraising method, designed to allow the public to contribute small amounts of money to support creative projects. It has since evolved to encompass investment opportunities in entrepreneurial ventures via intermediary platforms like broker-dealers. However, current platforms lack a Donor Guarantee Policy and offer limited control over contributed funds. This paper aims to propose a solution by leveraging blockchain technology for fundraising. By doing so, we can establish a secure, transparent, and trustworthy fundraising process. The primary objective of this paper is to create interactive interfaces for campaign initiation, donation, and approval requests, facilitating a straightforward experience for both campaign creators and donors. Furthermore, donors will have the ability to trace the allocation of their contributions, as all transactions will be securely recorded and stored within the blockchain as individual blocks.

Keywords— Blockchain, Real Estate, Transparency, Efficiency, Security

CONTENTS

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

1.1 Overview

In the context of contemporary real estate dynamics, the application of blockchain technology to rental systems emerges as a pivotal paradigm shift. This innovative approach promises to redefine conventional processes, introducing efficiency, transparency, and security into the realm of property rentals. Smart contracts, a cornerstone of this transformative framework, mechanize and uphold rental agreements, obviating the need for cumbersome intermediaries and mitigating the inherent risks associated with manual transactional processes. The blockchain infrastructure, by design, establishes an immutable and readily accessible digital ledger for rental contracts, mitigating the likelihood of disputes and ensuring a comprehensive historical record of tenancy. Furthermore, the prospect of fractional ownership within the rental paradigm introduces a layer of flexibility and investment accessibility previously unattainable. As we scrutinize the potential implications of this blockchain-driven rental system, it becomes evident that the decentralized, trustworthy, and streamlined attributes it offers hold considerable promise for landlords, tenants, and stakeholders within the broader real estate landscape.

1.2 Motivation

The incorporation of blockchain technology into the field of real estate applications is motivated by a strong desire to overcome the inherent problems and inefficiencies that have long characterised traditional industry operations. With its decentralised and tamper-proof record, blockchain delivers an unparalleled degree of transparency, reducing the risk of fraud and disputes in real estate transactions. Smart contract implementation automates and simplifies rental agreements, minimising dependency on middlemen and creating a more efficient and secure environment. Furthermore, blockchain adoption adds a new dimension of fractional ownership, providing greater accessibility and flexibility in real estate investing. This innovative strategy is driven

by a mission to improve not just operational procedures but also general confidence and dependability in the real estate market. The impetus for using blockchain in real estate applications stems from a deliberate pursuit of innovation, transparency, and efficiency, with the goal of eventually promoting a paradigm change towards a more equal and technologically sophisticated property market.

CHAPTER 2

LITERATURE REVIEW

2.1 Background and Related Works

Blockchain technology has ushered in a new era in the field of charitable fundraising and philanthropy, offering solutions to age-old challenges tied to transparency, accountability, and trust. The study "Improving real estate CRM user experience and satisfaction: A user-centered design approach" (2023)[1] integrates a mobile CRM system with an electronic CRM system to enhance user experience, confirmed through user research, usability interviews, and satisfaction surveys, employing the DSR technique for artifact creation and assessment. The proposed desktop interface solution aims to improve CRM ease of use and user satisfaction, benefiting the real estate industry by strengthening professional connections and facilitating performance oversight. Similarly, "Decentralised real-estate using blockchain" (2023)[2] This paper describes a real estate management system powered by blockchain technology that will provide a transparent, secure, and efficient real estate. A more recent paper, "Decentralised real-estate using blockchain" (2022)[3], suggests removing a mediator but falls short by neglecting real-world complexities. Its theoretical approach lacks practical consideration for the challenges inherent in real-world applications.

The literature survey underscores the prevalent challenges in real estate applications, emphasizing the failure rates of e-CRM projects despite significant technological investments. It highlights the necessity for a user-centered approach in CRM design, with a proposed integration of mobile CRM to enhance user experience. Importantly, the literature survey recognizes the potential of blockchain technology in addressing these challenges, stressing its role in increasing transparency, security, and efficiency in real estate transactions. The pivot to blockchain emphasizes its pivotal importance in revolutionizing traditional processes and overcoming the limitations identified in the existing literature. Our Dapp uses fundamental principles that have been mentioned in these papers to build a reliable system that can ease the process of renting a property.

2.2 Outcome of Literature Review

The literature highlights blockchain and smart contracts as promising solutions for problems faced in the real estate industry. The following aspects were found to be improved when a blockchain-based system was used instead of traditional centralised solutions.

- Transparency: Blockchain provides an immutable and transparent ledger, reducing the risk of fraud and enhancing trust in various applications, including real estate.
- Security: The decentralized nature and cryptographic principles of blockchain make it resistant to tampering and unauthorized access, ensuring the integrity and security of data.
- Efficiency: Smart contracts automate and streamline processes, reducing the need for intermediaries and facilitating faster, more efficient transactions in sectors like real estate.
- Reduced Costs: By eliminating intermediaries, blockchain can significantly reduce transaction costs, making it an economically attractive option for various industries.
- Decentralization: Blockchain operates on a decentralized network, mitigating the risk of a single point of failure and providing a more robust and resilient system.
- Traceability: The traceable nature of blockchain allows for a comprehensive audit trail, valuable in industries like supply chain and real estate, ensuring accountability and compliance.
- Global Accessibility: Blockchain's decentralized nature allows for global accessibility, enabling cross-border transactions and fostering financial inclusion.
- Smart Contracts: Self-executing smart contracts automate agreements, reducing the need for manual intervention and minimizing the risk of disputes.

- Data Integrity: The distributed and consensus-driven nature of blockchain ensures data integrity, preventing unauthorized alterations and maintaining a reliable record of information.

2.3 Problem Statement

To create a blockchain-based platform to rent properties. This rectifies inherent issues, including a lack of transparency, susceptibility to fraud, and inefficiencies in traditional processes. By leveraging blockchain technology, the objective is to establish a tamper-proof and transparent ledger for property transactions, streamline processes through smart contracts, and elevate overall security and trust within the real estate ecosystem. This is done while maintaining a centralised mySQL database to keep a check on the platform and reduce spam and inappropriate things from being put on the platform.

2.4 Objectives of the Project

(1) Enhance Transparency: Implement blockchain to establish a transparent and immutable ledger for real estate transactions, fostering greater visibility and trust among stakeholders.

(2) Mitigate Fraud Risk: Utilize blockchain's cryptographic principles to reduce vulnerability to fraud, ensuring the integrity and authenticity of property-related data.

(3) Streamline Transaction Processes: Integrate smart contracts to automate and streamline various stages of real estate transactions, reducing reliance on intermediaries and expediting the overall process.

(4) Improve Security: Leverage the decentralized nature of blockchain to enhance the security of sensitive real estate data, safeguarding it from unauthorized access and tampering.

(5) Facilitate Trustworthy Record Keeping: Implement blockchain to create a tamper-proof and easily accessible digital record of property ownership, minimizing the risk of disputes and providing a comprehensive historical account.

CHAPTER 3

PROPOSED METHODOLOGY

3.1 Overview

Real estate on the blockchain represents a paradigm shift in the traditional property investment landscape, leveraging the synergies between crowdfunding and cryptocurrency. Blockchain technology, a decentralized and transparent ledger, addresses inherent challenges in traditional real estate fundraising. Smart contracts, a cornerstone of blockchain innovation, play a crucial role by automating and streamlining the investment process.

Ethereum, a leading open-source blockchain platform, emerges as a key player in this transformative space. With its built-in smart contract functionality, Ethereum facilitates the creation of programmable contracts that automatically execute predefined conditions. The platform introduces Ether as its native cryptocurrency, serving multifaceted purposes within the network, including transactions and smart contract executions. Ethereum's pioneering concept, the Ethereum Virtual Machine (EVM), establishes a decentralized runtime environment capable of executing applications across a network of public nodes.

This technological framework revolutionizes real estate transactions by introducing transparency, efficiency, and accessibility. Through blockchain-based crowdfunding, investors can participate in real estate projects with fractional ownership, breaking down traditional barriers to entry. The automated and trustless nature of smart contracts ensures secure and seamless disbursement of funds, reducing the need for intermediaries and minimizing the risk of fraud.

In summary, the convergence of blockchain, crowdfunding, and cryptocurrency introduces a transformative model for real estate investment. Ethereum's innovative features enhance the decentralization potential, making real estate on the blockchain a promising solution to the challenges of traditional fundraising and paving the way for a more inclusive and efficient real estate market.

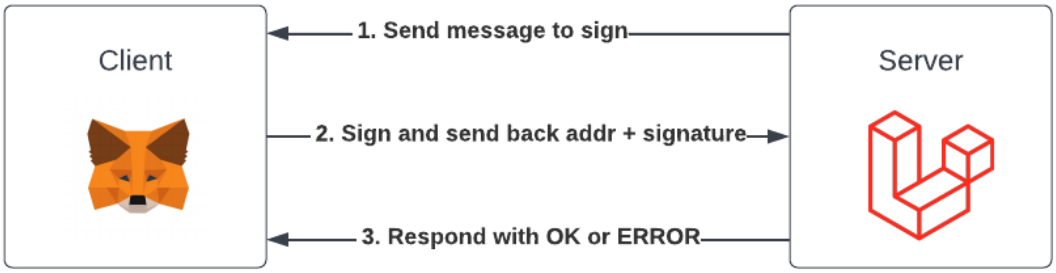

Figure 3.2.1: MetaMask Authentication

3.2 Metamask Authentication

Metamask, a popular cryptocurrency wallet and gateway to the decentralized web, provides a seamless and secure authentication method for users engaging in real estate transactions on the blockchain. By integrating Metamask login into the real estate platform, users can experience a streamlined and user-friendly approach to access and manage their accounts.

The Metamask login process involves a simple browser extension installation and setup, allowing users to create a secure digital identity tied to their Ethereum address. Once integrated, users can sign in to the real estate platform with a single click, leveraging the cryptographic security of their Metamask wallet.

The advantages of using Metamask login in the real estate blockchain platform are manifold. Firstly, it enhances security by eliminating the need for traditional username-password combinations, reducing the risk of unauthorized access. Secondly, the integration simplifies the onboarding process for users, as they can seamlessly connect their Metamask wallet to the platform without the hassle of creating and remembering new login credentials. Moreover, Metamask's compatibility with Ethereum smart contracts aligns perfectly with the platform's utilization of smart contracts for crowdfunding and fund disbursement. This synergy ensures a seamless and secure transaction experience, enhancing trust among users.

In conclusion, incorporating Metamask login into the real estate blockchain platform elevates user authentication to a new level of efficiency and security. It aligns with the decentralized ethos of blockchain technology, providing users with a conve-

nient and secure gateway to participate in real estate crowdfunding and investment activities.

3.3 Solidity Smart Contracts

The incorporation of Solidity contracts stands as a cornerstone in the implementation of a real estate project on the blockchain, leveraging the Ethereum platform's smart contract functionality. Solidity, a purpose-built programming language for Ethereum, empowers the creation of self-executing contracts that play a pivotal role in revolutionizing real estate transactions.

One of the primary advantages of utilizing Solidity contracts in real estate on the blockchain is the automation of contractual agreements through smart contracts. These contracts, encoded in Solidity, autonomously execute predefined conditions and actions when triggered by specific events. In the context of real estate, this could involve the automatic transfer of ownership or disbursement of funds when certain contractual conditions are met. This not only streamlines the transaction process but also minimizes the need for intermediaries, reducing the associated costs and potential points of friction.

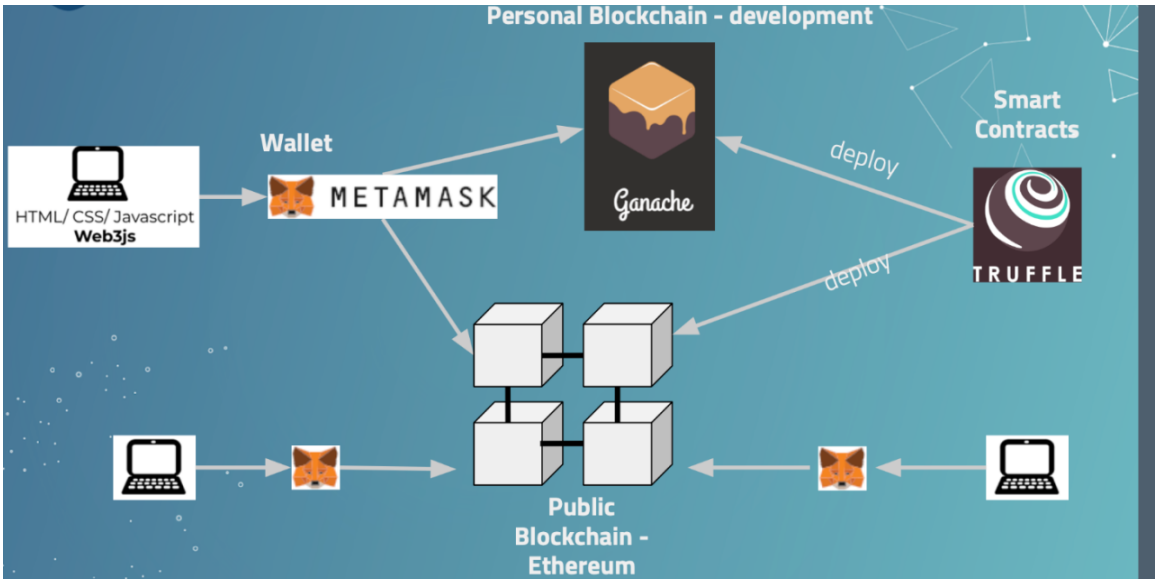

Figure 3.3.1: Solidity Workflow

3.4 Proposed System Architecture

1. Frontend (Client Side):

    - Next.js: The frontend of the application is built using Next.js, a React framework. It facilitates server-side rendering for improved performance and SEO.
    - TailwindCSS: Used for styling and theming, TailwindCSS provides a utility-first approach, making it flexible and highly customizable.
    - MetaMask Integration: MetaMask integration on the client side allows users to interact seamlessly with the Ethereum blockchain, providing a secure and user-friendly experience.

2. Smart Contracts (Blockchain Layer):

    - Solidity: Smart contracts, written in Solidity, are developed and managed using the Hardhat framework. Hardhat streamlines the development, testing, and deployment of Ethereum smart contracts.
    - Ganache: A local blockchain for development and testing purposes, Ganache allows developers to simulate Ethereum network behavior in a controlled environment.
    - MetaMask Integration: MetaMask is utilized on the blockchain layer for secure and user-friendly interaction with Ethereum, enabling users to manage their cryptocurrency and interact with smart contracts.

3. Backend (Server Side):

    - Node.js: The backend is implemented using Node.js, providing a non-blocking, event-driven architecture for efficient handling of server-side operations.
    - MySQL Database: Node.js interacts with a MySQL database to store non-blockchain data efficiently. It manages user data, property information, and other relevant details.

4. Database : We have 3 tables in our mySQL database, namely bookingTable, realestate and user. bookingTable is used to store which user is renting which propery and for how long .Table realestate is used to store the created rental properties and its details. Last but not the least user table stores the created properties of the respective user and also the properties that he is paying rent for.

5. Client-Server Communication: The frontend communicates with the backend through API calls, enabling the exchange of data and ensuring a smooth user experience. Node.js acts as the intermediary, processing requests from the frontend, interacting with the database, and triggering actions on the blockchain layer through smart contract interactions.

6. User Authentication and Security: User authentication is implemented on the server side, ensuring secure access to the system. MetaMask integration and Ethereum addresses are utilized for user identity and transaction security on the blockchain layer. The user even has his own profile where his created properties is displayed along with his rented properties.

7. External Services: External services like MetaMask are integrated for cryptocurrency management and secure transaction authorization. Hardhat facilitates smooth interaction with the Ethereum blockchain, ensuring the execution of secure and transparent real estate transactions.

CHAPTER 4

RESULTS AND ANALYSIS

The core functionality of this project lies in its innovative approach to property rental, introducing a decentralized and transparent system facilitated by blockchain technology. The initial phase involves users renting a property through the blockchain platform. The utilization of smart contracts ensures that the terms of the rental agreement are self-executing and tamper-proof, mitigating the risk of disputes and enhancing the overall efficiency of the rental process.

The Home is shown in Fig. 4.0.1 with an appropriate display of rentable properties.

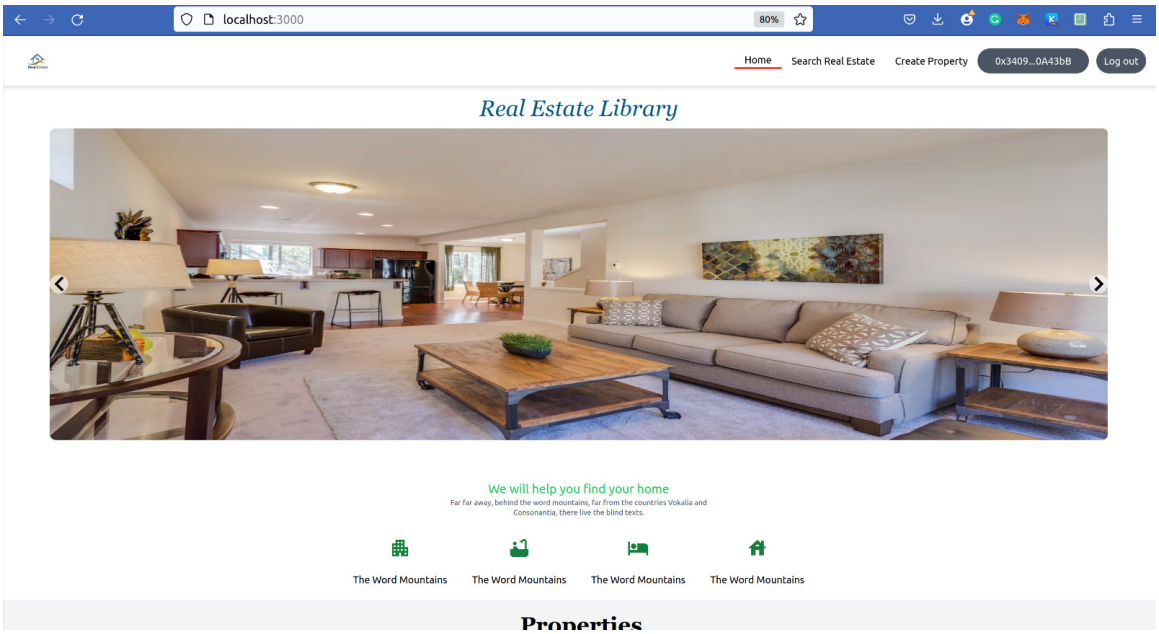

Figure 4.0.1: Home Page

The UI is designed to be user-friendly. On starting the Dapp for the first, the user is usually asked to Sign in through his metamask wallet. The next step is creating a property on the blockchain. A property that has been put up for rent by an owner cannot be bought by the owner. As shown in Fig. 4.0.2, our Dapp provides an elegant UI for the purpose of creating a property. The process gives a convenient form that, once filled, will generate a transaction to make sure the enlisted property is transmit-

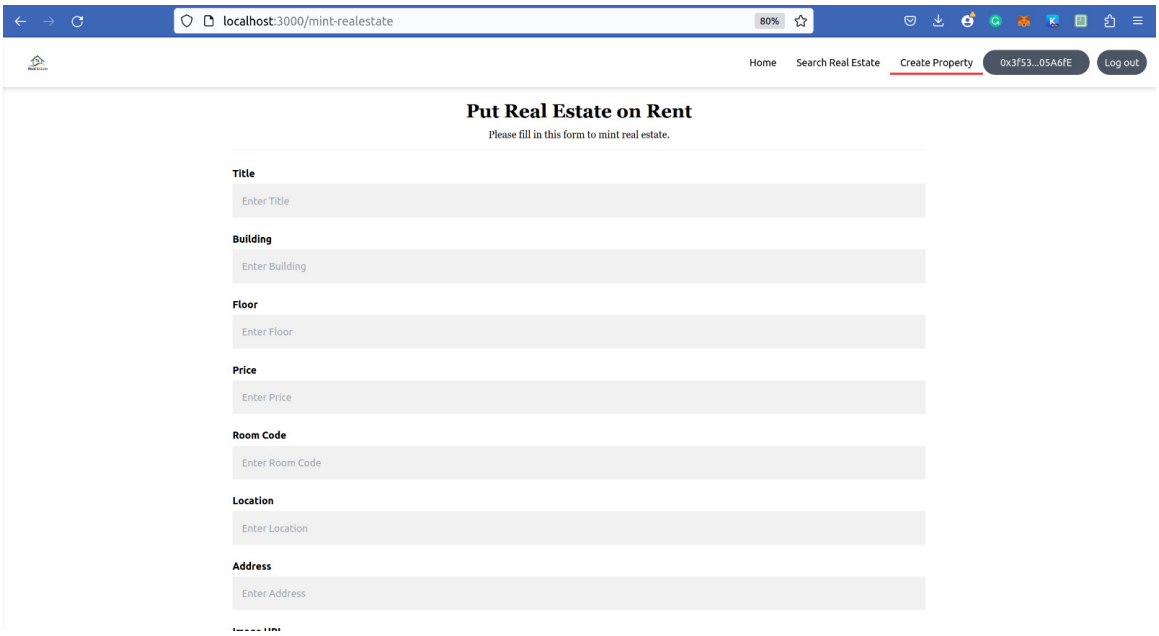

Figure 4.0.2: Property Creation

ted to the entire network. Once created, the properties show up on the profile page as shown in Fig 4.0.3.

Once the property is out for rent with appropriate information on the portal, we will be able to book that property easily within a few clicks streamlining the entire process of property lending. Once a property has been booked by an account, it will be not be available for use by other account on the booked days.

This project's potential impact on the real estate sector is significant. It addresses common pain points such as lack of transparency, inefficiencies in rental processes, and the challenges associated with fractional ownership. By leveraging blockchain, it not only enhances the overall user experience but also paves the way for a more accessible and inclusive real estate market. The decentralized, tamper-proof nature of blockchain transactions instills a new level of trust, laying the foundation for a transformative shift in how we approach property rental and ownership.

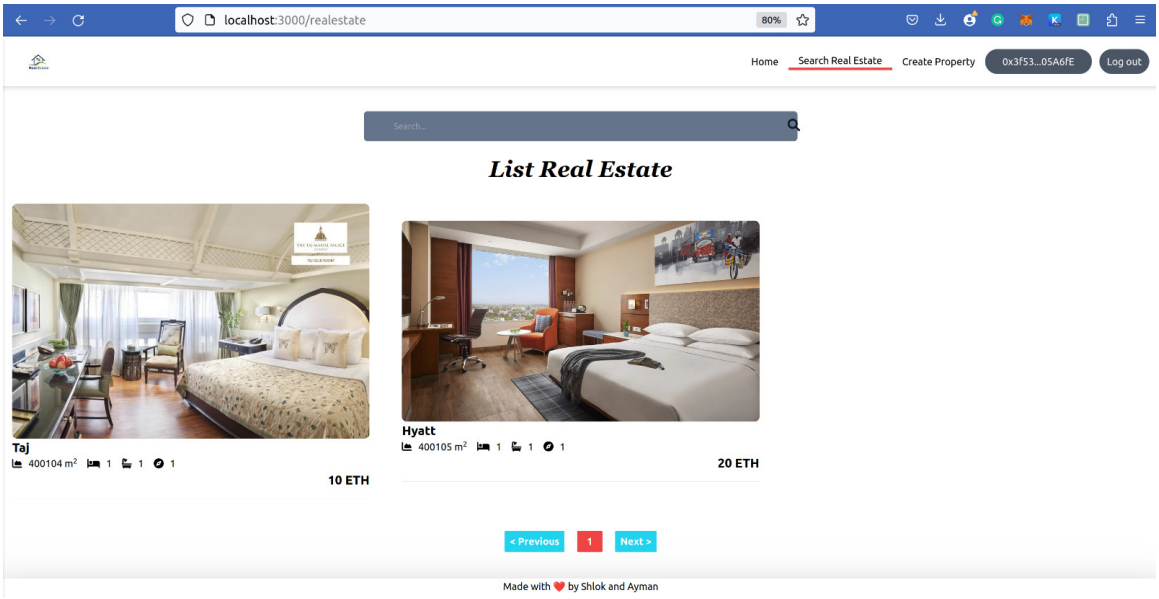

Figure 4.0.3: Search Pane

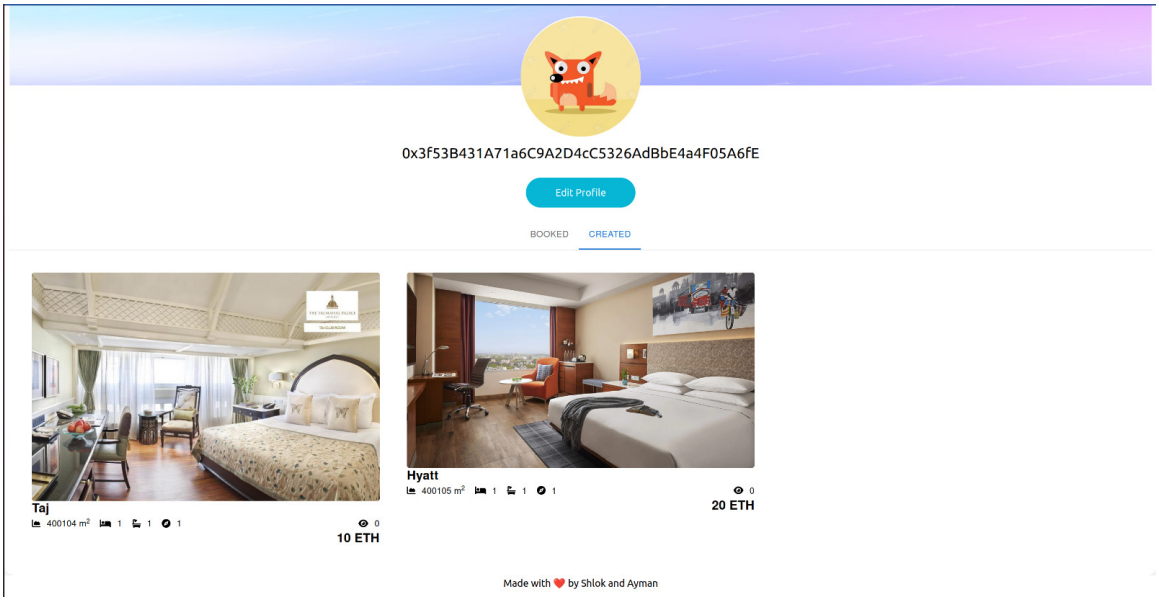

Figure 4.0.4: Profile Page

CHAPTER 5

CONCLUSIONS AND FUTURE WORK

In conclusion, while the integration of blockchain into the real estate rental system presents a groundbreaking solution, there are avenues for further improvements and anticipated results. One key area for enhancement lies in the continuous refinement of the user interface to ensure optimal accessibility and usability. User feedback and iterative testing can guide the evolution of the platform to meet evolving user expectations and preferences.
Moreover, exploring additional features such as predictive analytics for rental trends, leveraging blockchain data, could provide valuable insights for both property owners and tenants. The incorporation of machine learning algorithms could enhance the platform's ability to recommend suitable rental opportunities and investment strategies based on user preferences and market trends.

On the regulatory front, collaborating with industry stakeholders and policymakers to establish a framework for blockchain-based real estate transactions can contribute to broader adoption and legal recognition. This proactive engagement can pave the way for widespread acceptance and facilitate the seamless integration of the blockchain rental system into existing real estate practices.
As for the anticipated results, the project aims to achieve increased user satisfaction, transparency, and operational efficiency within the real estate rental domain. Success metrics would include reduced transaction times, minimized disputes, and a growing user base actively engaging in property rental and fractional ownership. Tracking these metrics over time will provide valuable insights into the project's impact and help refine strategies for sustainable growth.

In essence, while the current iteration of the blockchain-based real estate rental system marks a significant stride forward, ongoing commitment to innovation, user-centric design, and collaborative efforts with stakeholders will be pivotal for realizing its full

potential. The envisioned results include not only a transformative shift in the real estate landscape but also the establishment of a model that can be replicated and adapted across diverse sectors, further solidifying blockchain's role as a catalyst for positive change in various industries.

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Timeline of the B.Tech.(IT) Major Project

Publication Details