A
Project Report
on

CREATING A DECENTRALISED CROWDFUNDING APP USING BLOCKCHAIN TECHNOLOGY

Submitted to

Sant Gadge Baba Amravati University, Amravati

Submitted in partial fulfilment of
the requirements for the Degree of
Bachelor of Engineering in
Computer Science and Engineering

Submitted by

Tanay Hisariya
(PRN: 203120373)
Prithvirajsingh Thakur
(PRN: 203120352)

Under the Guidance of
Dr. R. A. Zamare
Asst. Professor, CSE Dept.

Department of Computer Science and Engineering
Shri Sant Gajanan Maharaj College of Engineering,
Shegaon – 444 203 (M.S.)

Session 2023-2024

SHRI SANT GAJANAN MAHARAJ COLLEGE OF ENGINEERING,
SHEGAON – 444 203 (M.S.)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

CERTIFICATE

This is to certify that **Mr. Tanay Hisariya and Mr. Prithvirajsingh Thakur** students of final year Bachelor of Engineering in the academic year 2023-24 of Computer Science and Engineering Department of this institute have completed the project work entitled "**CREATING A DECENTRALISED CROWDFUNDING APP USING BLOCKCHAIN TECHNOLOGY**" and submitted a satisfactory work in this report. Hence recommended for the partial fulfilment of degree of Bachelor of Engineering in Computer Science and Engineering.

Dr. R. A. Zamare
Project Guide

Dr. J. M. Patil
Head of Department

Dr. S. B. Somani
Principal
SSGMCE, Shegaon

SHRI SANT GAJANAN MAHARAJ COLLEGE OF ENGINEERING,
SHEGAON – 444 203 (M.S.)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

CERTIFICATE

This is to certify that **Mr. Tanay Hisariya and Mr. Prithvirajsingh Thakur** students of final year Bachelor of Engineering in the academic year 2023-24 of Computer Science and Engineering Department of this institute have completed the project work entitled "**CREATING A DECENTRALISED CROWDFUNDING APP USING BLOCKCHAIN TECHNOLOGY**" and submitted a satisfactory work in this report. Hence recommended for the partial fulfillment of degree of Bachelor of Engineering in Computer Science and Engineering.

Internal Examiner
Dr. R. A. Zamare

Name and Signature
Date: 10/5/24

External Examiner
Krushna Y. Gawadatkar

Name and Signature
Date: 10/05/24

ABSTRACT

Crowdfunding is a new and innovative strategy for funding different sorts of ventures, wherein individual founders of the ventures can demand funds. A decentralized user network with transaction tracking in an accessible distributed ledger is made possible by blockchain technology. Blockchain is a unique, autonomous, and transparent mechanism that maintains the transparency of party trades. Blockchain's features enable a transparent and cost-effective platform for a multitude of applications. Based on the need for an effective platform to create smart nations and the inherent advantages of blockchain technology, a global crowdfunding platform is proposed. Blockchain is secure because it can be used with smart contracts to establish a campaign aimed at raising money in a decentralized way. This has liberated fundraising from the constraints of centralized methods and increased its accessibility, flexibility, and efficiency. Crowdfunding with blockchain technology has immense potential for growth and impact, and it is an exciting development in the world of fundraising.

Keywords: Crowdfunding, Blockchain Technology, De-Fi, Smart Contract, Web3, D-APP, Smart Contract, Cryptocurrency.

ACKNOWLEDGEMENT

It is our utmost duty and desire to express gratitude to various people who have rendered valuable guidance during our project work. We would have never succeeded in completing our task without the cooperation, encouragement and help provided to us by then. There are a number of people who deserve recognition for their unwavering support and guidance throughout this report.

We are highly indebted to our guide **Dr. R. A. Zamare** for her guidance and constant supervision as well as for providing necessary information from time to time. We would like to take this opportunity to express our sincere thanks, for her esteemed guidance and encouragement. Her suggestions broaden our vision and guided us to succeed in this work.

We are sincerely thankful to **Dr. J. M. Patil** (HOD, CSE Department, SSGMCE, Shegaon), and to **Dr. S B Somani** (Principal, SSGMCE, Shegaon) who always has been kind to extend their support and help whenever needed.

We would like to thank all teaching and non-teaching staff of the department for their cooperation and help. Our deepest thank to our parents and friends who have consistently assisted us towards successful completion of our work.

Tanay Hisariya
Prithvirajsingh Thakur

CONTENTS

LIST OF ABBREVIATIONS

DeFi - Decentralized Finance

CFP - Crowdfunding Platform

D-App - Decentralized Application

ETH - Ethereum

OOP - Object-oriented Programming

EVM - Ethereum Virtual Machine

CLI - Command-line interface

SSR - Server-side rendering

SEO - Search engine optimization

LTS - Long-Term Support

NPM – Node packet manager

API - Application Programming Interface

LIST OF FIGURES

INTRODUCTION

In recent years for modern finance, the fusion of blockchain technology with crowdfunding represents a monumental leap forward, promising to revolutionize the way projects are funded and executed. Blockchain, characterized by its decentralized and immutable ledger system, ensures transparency, security, and efficiency in recording transactions. Ethereum, a leading blockchain platform, introduces the concept of "smart contracts," enabling automated execution of agreements on the blockchain. This convergence opens up new possibilities for crowdfunding, a process wherein funds are raised from a collective of individuals rather than traditional financial institutions.

1.1 Preface

Traditionally, crowdfunding involves three key parties: project managers, crowdfunding platforms, and contributors. The process leverages the power of social media and the internet to quickly reach a wide audience, facilitating rapid fundraising for creative endeavours. However, traditional crowdfunding platforms are not without their challenges, including fraud and high fees. Blockchain-based crowdfunding seeks to address these issues by utilizing peer-to-peer smart contracts, thereby eliminating intermediaries and reducing transaction costs.

One of the primary advantages of blockchain-based crowdfunding is its ability to connect entrepreneurs with funders on a global scale. By leveraging the decentralized nature of blockchain, crowdfunding platforms can facilitate direct interactions between project creators and investors, transcending geographical barriers. Furthermore, investors benefit from increased access to information about projects in their early stages, enabling more informed investment decisions.

Despite its numerous benefits, traditional crowdfunding platforms still face significant challenges, particularly regarding fraud and investor protection. Integrating smart contracts into the crowdfunding process can mitigate these risks by establishing transparent and enforceable agreements between contributors and project owners. Funds are held in escrow until predetermined conditions are met, ensuring that contributors' investments are protected.

In summary, the convergence of blockchain technology and crowdfunding holds immense promise for transforming the way projects are funded and executed. By harnessing the transparency, security, and efficiency of blockchain, crowdfunding platforms can overcome the limitations of traditional models and unlock new opportunities for innovation and collaboration on a global scale. However, realizing this potential requires addressing regulatory, technological, and security challenges to build a robust and trustworthy ecosystem for blockchain-based crowdfunding.

1.2 Motivation

The motivation driving this project lies in the recognition of the systemic challenges that entrepreneurs encounter when seeking traditional funding avenues. These hurdles often impede the realization of innovative ideas, stifling the potential for progress and growth. By integrating blockchain technology into the crowdfunding landscape, we aspire to dismantle these barriers and offer a more accessible and streamlined path to capital. Through the inherent transparency and security of blockchain, crowdfunding becomes not merely a financial mechanism but a catalyst for empowering entrepreneurs and driving forward transformative ideas.

Moreover, our motivation extends beyond individual entrepreneurial success to encompass the broader ambition of fostering collaboration and advancing the development of smart nations. By embracing blockchain-based crowdfunding, we aim to create a dynamic ecosystem where communities can come together to address pressing societal challenges. This approach unlocks the collective intelligence and resources of diverse stakeholders, enabling the co-creation of innovative solutions that have the potential to shape the future of society.

At its core, this project is fuelled by the belief that technology, when harnessed thoughtfully and inclusively, can serve as a powerful force for positive change. By leveraging the synergies between crowdfunding and blockchain technology, we seek to democratize access to capital, amplify entrepreneurial needs, and foster a culture of innovation and collaboration. Through this project, we envision not only the empowerment of individuals and communities but also the cultivation of a more resilient and adaptive global ecosystem, where creativity thrives and progress knows no bounds.

1.3 Problem statement

To create a crowdfunding app using blockchain is to address the inefficiencies, lack of transparency, and susceptibility to fraud plaguing traditional platforms, while also allowing users to create and manage campaigns and raise funds seamlessly. With blockchain's decentralized nature, such an app can offer enhanced security and transparency, fostering trust among participants and facilitating global access to funding opportunities. Moreover, by empowering users to directly manage their campaigns, the app promotes autonomy and efficiency, ultimately driving greater innovation and impact in fundraising campaigns.

1.4 Objectives and Scope

The objective of this project is to design, develop, and evaluate a decentralized crowdfunding platform utilizing blockchain technology. Specifically, the project aims to achieve the following:

1. Platform Development: Develop a user-friendly and secure crowdfunding platform that leverages blockchain technology to facilitate transparent and decentralized fundraising processes.
2. Blockchain Integration: Implement blockchain technology, specifically Ethereum, to establish a distributed ledger for recording transactions and smart contracts for executing crowdfunding agreements autonomously.
3. User-Friendly UI: To implement a feature for users to create crowdfunding campaigns, including campaign details like title, description, etc which will be recorded on the blockchain.
4. Enhanced Security: Ensure the security and integrity of the crowdfunding platform by Implementing smart contracts at the backend for transactions, reducing third-party interactions.
5. Transparency and Trust: Foster transparency and trust among platform users, including project creators and backers, by providing visibility into transaction history and project details stored on the blockchain.

By achieving these objectives, the project aims to contribute to the advancement of crowdfunding practices by harnessing the transformative potential of blockchain

technology to create a more inclusive, transparent, and efficient fundraising ecosystem.

The project's objectives are to investigate the viability and difficulties of creating a blockchain-based crowdfunding platform, examine its possible features and use cases, and create a decentralized application that enables users to quickly and simply create their own fundraising campaigns while also taking part in multiple campaigns at once.

The following is a description of the project's scope:

Templates for Smart Contracts. The templates consist of the crowdfunding contract (Campaign.sol) that creates crowdfunding pools on the blockchain and the contract factory (CampaignFactory.sol) that is initially put on the blockchain. To implement their own crowdfunding contracts, users can make calls to the current contract factory. Additionally, users can interact with various campaigns directly by calling functions in the contracts.

Decentralized Program. The D-App functions as a React-based web page that can speak with the blockchain directly without the need for a server. This website allows users to create campaigns, monitor campaign details, and submit and approve withdrawal requests in addition to querying and sending data to the blockchain. Users wishing to transmit queries or transactions to the blockchain must rely on bitcoin wallets that function as browser plugins.

.

1.5 System Overview

Through crowdsourcing, which can be viewed as an open call for financial resources, users can gather resources by persuading a large number of investors or contributors to each provide a little amount of money. Because of the Internet's ability to spread, fundraisers can post ideas or particular statements on a platform with ease in order to generate money to support their efforts. The majority of crowdsourcing occurs on crowdfunding platforms (CFPs).

This decentralized crowdfunding platform integrates blockchain technology with a user-friendly interface to facilitate transparent and secure fundraising processes. At its core, the platform leverages the Ethereum blockchain for its distributed ledger capabilities and support for smart contracts. Through Ethereum smart contracts, crowdfunding agreements are automated and enforced, eliminating the need for intermediaries and fostering trust among participants. The user interface, accessible via web or mobile devices, serves as the primary interaction point for project creators and backers. Here, project creators can easily create fundraising campaigns, set goals, and provide project details, while backers can explore campaigns, contribute funds, and track campaign progress seamlessly.

Authentication mechanisms are employed to verify user identities and secure user accounts, while cryptographic techniques ensure the encryption of sensitive information and data integrity. Fund transfers and transaction processing occur securely and efficiently on the blockchain, with updates to transaction history and execution of smart contracts performed in a decentralized manner. Analytics and reporting features provide valuable insights into campaign performance, enabling project creators and backers to make informed decisions. Scalability is prioritized to accommodate a growing user base and increasing transaction volumes, while regulatory compliance measures ensure adherence to relevant crowdfunding regulations and legal requirements. Overall, the platform offers a transparent, secure, and user-friendly environment for crowdfunding activities, harnessing the transformative potential of blockchain technology.

LITERATURE REVIEW

Numerous blockchain-related investigations have been conducted over the last several years, and the number is increasing every day. Blockchain technology has various advantages and may be applied in a range of businesses, but more research is required because this technology is still in its development stages.

The process of raising modest sums of money from a large number of people is known as crowdfunding. Products and businesses that might not have been able to raise money on their own are frequently the most successful ones on crowdfunding sites. Crowdfunding impacted diverse entities, facilitated by blockchain technology for online fundraising campaigns. It serves businesses, entrepreneurs, NGOs, and individuals, addressing non-profit, personal, and business causes. While crowdfunding offers opportunities, concerns persist due to lack of regulation, fraudulent campaigns, and project delays. Blockchain is seen as a solution, ensuring secure transactions in crowdfunding platforms. [1]

The integration of blockchain technology, particularly through smart contracts, ensures a secure and transparent crowdfunding process. The study aims to enhance user interaction by providing interactive platforms for campaign development and financial contributions, fostering a dynamic relationship between campaign creators and donors. Notably, the use of blockchain technology, beyond its cryptocurrency roots, demonstrates its versatility across industries, with crowdfunding websites emerging as a promising application area. The literature survey exploring the advantages and challenges associated with this novel approach, emphasizing the role of Ethereum smart contracts in mitigating issues such as fraud, lack of control, and ensuring the successful execution of crowdfunding campaigns within designated time limits. [2]

Crowdfunding is an innovative avenue for startup fundraising, emphasizing its diverse forms and the overarching goal of securing funds for the production or provision of services. Acknowledging the crucial role of the internet and social media in this process, the abstract highlights blockchain as a decentralized and secure technology fostering transparency in interactions. Trust between investors and stakeholders forms the bedrock of crowdfunding, and blockchain-based smart contracts emerge as a promising tool. The literature review is about to go into the

principles of crowdfunding, its existing constraints, and the revolutionary effect of blockchain technology in augmenting legitimacy and drawing significant financing. Additionally, the paper aims to explore emerging blockchain-based crowdfunding systems, providing insights into their structures, implementations, and outcomes. [3]

The main objective of the developers is to use a decentralized application powered by the Ethereum Blockchain to overcome the shortcomings of current crowdfunding platforms. As a result, they intend to provide a platform where all mission specifics, withdrawals, and cash are stored on an accessible open blockchain network. Exchanges should only need to be recorded once when using a shared ledger, eliminating the need for repeated efforts. This method relies on the simplicity and safety of the crowdsourcing platform; it is non-transferable and non-reversible to ensure every transaction. [4]

The critical point of the creator's examination is the production of a Smart contracts. Most importantly, smart contracts will empower individuals to distinguish the two sides of the exchange, so there is a lesser likelihood of extortion. Smart contracts are likewise quicker than regular asset moves since they are mediator free. Speed improvement can help in times when deadlines arrive. This technology will fabricate more transparent correspondence among investors and new companies, so blockchain-empowered crowdfunding projects have higher efficiency on account of smart contracts. [5]

The financial sector has been impacted by the explosive growth of cryptocurrencies and blockchain technology in recent years, which has given rise to a new crypto-economy. Next-generation decentralized applications that don't require a third party to be trusted have then surfaced as a result of smart contracts, computer protocols that are made to automatically facilitate, validate, and enforce agreements made by a number of dishonest parties. Even while smart contracts have many advantages, a number of worries, including security risks, weaknesses, and legal problems, still prevent them from being widely used. This paper provides a thorough overview of blockchain-enabled smart contracts from both a technical and practical standpoint.[6]

Investors are competing to find the greatest talent available as a result of the explosive rise of information technology and the skill associated with it.

Furthermore, candidates have a wide range of possibilities to pick from due to the vast spectrum of technological developments. In a situation like this, it's critical to securely and economically connect the right investors and engineers. Blockchain technology facilitates the establishment of an open distributed ledger-based decentralized user network. These characteristics of blockchain provide an open and affordable platform for various applications. We suggest a global crowdfunding platform called based on the need for an efficient platform to raise capital for establishing smart nations and the intrinsic qualities of blockchain technology.[7]

By using blockchain as a distributed computing platform, users can implement software modules, or "smart contracts," for a variety of cutting-edge decentralized applications without the need for a reliable third party. However, there is a cost associated with the benefits of smart contracts. Smart contracts have a number of possible security risks, flaws, and other problems, just as with most technology. It can be quite challenging to write safe and secure smart contracts because of different business logics, platform constraints, and vulnerabilities. Lately, formal techniques have been promoted to lessen these weaknesses.[8]

Blockchain was first exclusively utilized as the basis for cryptocurrencies, but as time goes on, we can see how this new, growing technology is being employed across a wide range of businesses. Blockchain is anticipated to be used by the majority of technologies worldwide in the future as a productive means of conducting online transactions. Not only that, but several projects' completion was also much delayed. By integrating Ethereum smart contracts with the crowdfunding platform, this project seeks to address these issues by avoiding fraud and guaranteeing that projects can be completed within the allotted time.[9]

Smart contracts on the blockchain are computer programs that represent an agreement between parties that are not trustworthy. If certain requirements are satisfied, smart contracts can be carried out on a blockchain system without the assistance of a reliable third party. In recent years, blockchain technology and smart contracts have attracted a lot of attention—even from academic circles. We do a comprehensive mapping analysis of all the peer-reviewed, technology-focused studies on smart contracts. We are interested in identifying academic research trends and adoption as well as providing a survey of the scientific literature. In order to

determine how academic researchers have adopted smart contract technology and established scientific outputs, we exclusively concentrate on peer-reviewed scientific publications. All study articles were retrieved from the primary scientific databases, and we employed the methodology.[10]

Blockchain technology gained popularity as a study topic a decade ago due to its distributed consensus, peer-to-peer transactions, anonymity, and decentralization features. Technical difficulties and regulatory issues are eclipsed by blockchain technology. A collection of tamper-resistant, self-executing, and self-verifying programs is called a smart contract. A smart contract that integrates blockchain technology can do a task quickly, cheaply, and with a higher level of security. This paper initially describes the different parts and operation of a smart contract. Second, list and evaluate the many applications for smart contracts as well as the benefits of implementing them in blockchain applications. Finally, the study ends with a discussion of the difficulties in deploying smart contracts in future real-world scenarios.[11]

Blockchain technology allows for decentralized consensus and has the ability to expand the contracting field through algorithmic and tamper-proof smart contract executions. In the meanwhile, disseminating knowledge is necessary to generate decentralized consensus, which inevitably modifies the informational landscape. We examine how decentralization impacts the efficacy of consensus and how the fundamental characteristics of blockchain alter the structure of industry and the competitive environment. Through increased entrance and competition, smart contracts can reduce informational asymmetry and increase welfare and consumer surplus. However, greater collusion may be encouraged due to the irreducible distribution of information during consensus building. Blockchains can support market equilibria that result in a greater variety of economic outcomes overall. We also talk about the consequences of antitrust laws for blockchain applications, including dividing users and consensus record-keepers.[12]

METHODOLOGY

There are two layers in the entire application (or platform) architecture: the frontend layer and the blockchain layer. Any user can interact with the blockchain to query data, change transactions, and publish smart contracts. The blockchain layer is responsible for managing the platform's blockchain and smart contracts. The frontend will function as a user-friendly web application. Since the frontend reads data directly from the blockchain rather than requiring a server to store it, it may be thought of as a distributed platform. This makes the D-App completely decentralized in contrast to the conventional App architecture (Figure3.1), with the frontend hosted on peer-to-peer networks rather than centralized hosting servers (Figure 3.2). This guarantees that no single entity controls the D-App.

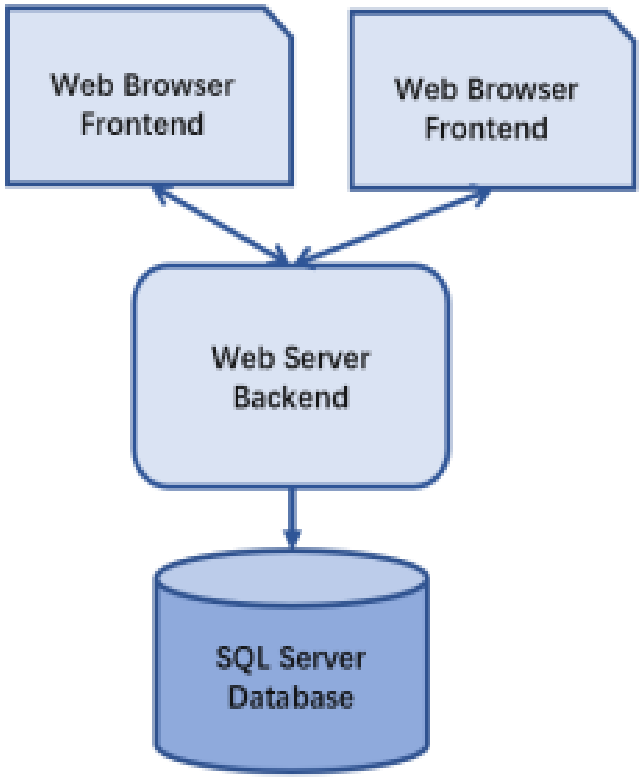

Figure 3.1: Traditional Application Architecture

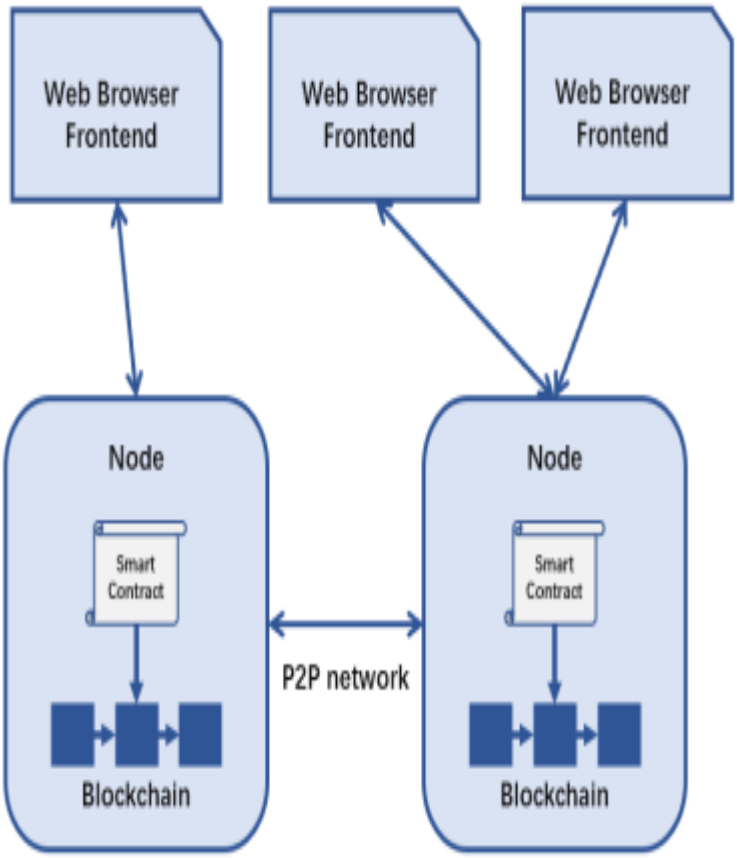

Figure 3.2: D-App Architecture

3.1 Blockchain

Within a corporate network, asset tracking and transaction recording are made easier by blockchain, an immutable, decentralized database. It is possible to have both tangible and intangible assets. On a blockchain network, almost anything valuable can be posted and traded, lowering risk and increasing efficiency for all parties. The distributed ledger and its immutable transaction record are available to all network users. Because transactions are only recorded once in this shared ledger, there is no longer any duplication of effort found in traditional commercial networks. Once a transaction is entered into the shared ledger, it cannot be altered or tampered with by another participant. Before both transactions are displayed, errors in transaction records must be fixed with a new transaction. A set of guidelines known as a blockchain is used to store information.

The platform is built on blockchain. Any public blockchain that supports the Ethereum Vitrail Machine (EVM) can serve as the foundation for the crowdfunding platform (CFP). Token transfers, simple information queries, and the implementation of smart contracts must all be supported by the blockchain. Solidity is a popular object-oriented programming (OOP) style smart contract programming language that is extensively supported by many blockchain platforms. Smart contracts on the blockchain are written in Solidity. The application's original goal was to run on any blockchain that supported the EVM smart contract, but the choice of blockchain has also had a significant impact on the development and testing process because it has determined the ecosystem to which the application is currently attached and has implications for the application's future development. Ethereum is the preferred platform for many DeFi initiatives since it is the creator of smart contracts. However, there are also a lot of other options that are worthwhile taking into account. Ethereum was chosen as a blockchain for D-App development following investigation. The decentralized private blockchain network Ganache Test Net is where the smart contracts are implemented. Without having to worry about losing actual money, it enables developers to test and launch their D-Apps in a safe and secure environment.

3.2 Ganache

Smart contracts and D-Apps can be tested in a sandbox setting using Ganache, a personal Blockchain for Ethereum development. It may be used to evaluate the functionality of D-Apps and smart contracts by simulating various network constraints, such as bandwidth limitations and latency. It offers an easy-to-use interface for viewing and debugging Blockchain statuses, events, and transactions. An integrated Ethereum client, Web3.js, is available with Ganache and supports the most recent Ethereum standards.For testing different scenarios, it enables numerous Ethereum accounts with specified balances. Popular Ethereum development tools like as Remix, Hardhat, and Web3.js can be integrated with Ganache.It provides

advanced users with an automated testing and Blockchain network customization command-line interface (CLI). Ganache can be purchased separately.

3.3 Smart Contract

In Solidity, the smart contracts are written. Solidity is a high-level, object-oriented language used to create smart contracts. It is a language with curly brackets intended for the Ethereum Virtual Machine (EVM). Python, JavaScript, and C++ all have an impact on it. Among its many features, Solidity is statically typed, supports libraries, inheritance, and sophisticated user-defined types. Solidity is the most widely used language for Ethereum smart contracts. It is supported by a rich documentation, a large developer community, and a multitude of tools and resources. Remix IDE was initially used to design and test the smart contracts. After that, the contracts are assembled and added to the blockchain using truffle. Below is a general introduction to Hardhat and Remix IDE.

3.2.1 Remix IDE

Remix IDE is an online integrated development environment (IDE) intended for Ethereum and other blockchain platform smart contract development. It offers an easy-to-use interface for blockchain smart contract coding, testing, debugging, and deployment. Before putting smart contracts on the blockchain, Remix IDE offers a virtual machine and an integrated compiler for sandbox testing.

3.2.2 Hardhat

Hardhat is an Ethereum software development environment. It is made up of various parts that you may use to edit, compile, debug, and deploy your D-Apps and smart contracts. These parts come together to form a comprehensive development environment. The primary interface that you use with Hardhat is called Hardhat Runner. It's an adaptable and expandable task runner that assists you in organizing and automating the repetitive processes involved in creating D-Apps and smart contracts.

3.4 Frontend

For illustration, a straightforward decentralized web application is suggested. The website is built using React and uses web3.js to communicate with blockchain smart

contracts. Contributions and transactions require the MetaMask wallet extension. The list of thorough introductions is below.

3.3.1 Next.js

Next.js is an open-source web development framework based on React and has gained significant popularity due to its amazing features. It is developed by Vercel and Next.js stands out for its robust capabilities, including server-side rendering (SSR) and enhanced search engine optimization (SEO). Next.js provides built-in routing, making it simple to create dynamic routes and handle navigation within your application.

3.3.2 Web3

A JavaScript package called Web3.js offers a straightforward and uniform method of interacting with the Ethereum network. It gives developers a set of standardized interfaces and tools for creating D-Apps, abstracting away the complexities of direct contact with the Ethereum blockchain. The goal of Web3.js is to give developers an object-oriented, high-level API that makes dealing with the Ethereum network easier. It has features for managing contracts, creating and signing transactions, managing events, and managing accounts. The fundamental Ethereum JSON-RPC API, which is used to interface with the Ethereum node, is the foundation upon which these services are built. It is a crucial part of the Ethereum ecosystem and is frequently used by programmers creating marketplaces for non-fungible tokens (NFTs), decentralized finance (DeFi) apps.

3.3.3 MetaMask

A cryptocurrency wallet called MetaMask functions as a browser extension that lets users communicate with blockchains. It offers customers a bridge to link their web browser to the Ethereum blockchain and a digital wallet to safely store and manage their accounts. With MetaMask, users can effortlessly make and receive payments, sign messages, and engage with smart contracts by abstracting away the complexity of working with the blockchain.

IMPLEMENTATION

4.1 Requirements

1) Hardhat v2.22.3
2) Ganache v7.9.2
3) Solidity v0.8.25
4) Node v20.12.2
5) Web3.js v4.8.0
6) npm v9.0.0

Other Requirements:

7) Any chromium-based browser (like Chrome, Edge)
8) MetaMask browser extension

4.2 Installation

1) To install Node.js on your system, follow these steps:

1. Download Node.js Installer: Visit the official Node.js website at https://nodejs.org and download the Windows installer (MSI package) for the LTS (Long-Term Support) version. LTS versions are recommended for most users due to their stability and support.

2. Run the Installer: Once the download is complete, locate the downloaded MSI package and double-click on it to run the installer.

3. Follow the Installation Wizard: The Node.js installation wizard will guide you through the installation process. Click "Next" to proceed.

4. Accept the License Agreement: Read and accept the terms of the license agreement, then click "Next".

5. Choose Installation Options: You can choose the installation directory and select additional components to install. For most users, the default options are sufficient. Click "Next" to continue.

6. Complete the Installation: Click "Install" to begin the installation process. Depending on your system configuration, you may need to provide administrator privileges to complete the installation.

7. Wait for Installation to Complete: The installer will now extract and install Node.js and npm (Node Package Manager) on your system. This process may take a few minutes to complete.
8. Finish Installation: Once the installation is complete, you will see a confirmation message. Click "Finish" to exit the installer.
9. Verify Installation: Open Command Prompt or PowerShell and type the following commands to verify that Node.js and npm have been successfully installed:

    node -v

    npm -v

These commands should display the installed versions of Node.js and npm respectively. That's it! You've successfully installed Node.js on your Windows 11 system. You can now start using Node.js to develop and run JavaScript applications.

2) To install Hardhat, follow these steps:

1. Open Command Prompt or PowerShell: Navigate to the Start menu, search for "Command Prompt" or "Windows PowerShell," and open it.
2. Check npm Version: To ensure npm is installed and to check its version, type the following command and press Enter:

    npm -v

This command will display the installed version of npm on your system.

3. Install Hardhat: If npm is installed, you can proceed to install Hardhat by typing the following command and pressing Enter:

    npm install -- global hardhat

npm will then download and install Hardhat and its dependencies. This process may take a few minutes depending on your internet connection speed.

4. Verify Hardhat Installation: Once the installation is complete, you can verify that Hardhat has been installed correctly by typing the following command and pressing Enter:

hardhat --version

This command should display the version of Hardhat that was installed on your system.

5. Final Check: You can also recheck the npm version to ensure that the installation of Hardhat did not affect it. Type the following command and press Enter:

   npm -v

This will confirm that the npm version remains unchanged after installing Hardhat. Now you have successfully installed both npm and Hardhat on your Windows 11 system. You're all set to start developing Ethereum smart contracts using Hardhat!

3) To install Ganache, follow these steps:

1. Download Ganache: Visit the official Ganache website at https://www.trufflesuite.com/ganache and download the installer for Windows.
2. Run the Installer: Once the download is complete, locate the downloaded installer file (usually a .exe file) and double-click on it to run the installer.
3. Follow the Installation Wizard: The Ganache installation wizard will guide you through the installation process. Click "Next" to proceed.
4. Accept the License Agreement: Read and accept the terms of the license agreement, then click "Next".
5. Choose Installation Options: You can choose the installation directory and select additional components to install. For most users, the default options are sufficient. Click "Next" to continue.
6. Complete the Installation: Click "Install" to begin the installation process. Depending on your system configuration, you may need to provide administrator privileges to complete the installation.
7. Wait for Installation to Complete: The installer will now extract and install Ganache on your system. This process may take a few minutes to complete.

8. Finish Installation: Once the installation is complete, you will see a confirmation message. Click "Finish" to exit the installer.
9. Launch Ganache: After installation, you can launch Ganache by locating it in the Start menu or by double-clicking the Ganache icon on your desktop.
10. Start Using Ganache: Once Ganache is launched, you can start using it to set up your local Ethereum blockchain for development and testing purposes.

That's it! You have successfully installed Ganache on your Windows 11 system. You can now use Ganache to simulate an Ethereum blockchain environment locally for your smart contract development and testing needs.

4) To install the MetaMask extension on chrome, follow these steps:

1. Open Google Chrome: Launch Google Chrome browser on your computer.
2. Visit the Chrome Web Store: Go to the Chrome Web Store by typing the following URL into the address bar and pressing Enter: Chrome Web Store
3. Search for MetaMask: In the search bar located at the top left corner of the Chrome Web Store, type "MetaMask" and press Enter.
4. Find the MetaMask Extension: Look for the official MetaMask extension among the search results. It should have the MetaMask logo—a fox's face. Alternatively, you can click on this direct link to MetaMask: MetaMask Extension
5. Add to Chrome: Once you've found the MetaMask extension, click on the "Add to Chrome" button next to it.
6. Confirm Installation: A confirmation dialog will appear. Click "Add Extension" to confirm and begin the installation process.
7. Wait for Installation to Complete: Google Chrome will download and install the MetaMask extension. This process usually takes just a few moments.
8. Access MetaMask: Once the installation is complete, you'll see the MetaMask icon added to the top-right corner of your Chrome browser, next to the address bar. It looks like a colourful fox face. Click on the MetaMask icon to open the MetaMask extension.

9. Set Up MetaMask: If you're opening MetaMask for the first time, you'll be guided through the setup process. Follow the prompts to create a new wallet or import an existing one. Make sure to securely store your seed phrase, as it's crucial for accessing your wallet in the future.

That's it! You've successfully installed the MetaMask extension on Google Chrome. You can now use MetaMask to manage your Ethereum wallet, interact with D-Apps, and send or receive Ether and tokens.

4.3 Setup

1. Install Dependencies: Open your terminal / command prompt and navigate to your project directory. Use npm (Node Package Manager) to install project dependencies by running the command:

   npm install

2. Compile Contract Source using Hardhat: Once the dependencies are installed, compile your Solidity smart contracts using Hardhat. In the terminal, run the command:

   npx hardhat compile

3. Open Ganache to Local Blockchain: Launch Ganache, which provides a local blockchain environment for development and testing. Ganache allows you to simulate a blockchain network on your local machine, complete with pre-funded accounts and transactions. Once Ganache is open, you'll see a list of accounts with pre-funded Ether. Ganache will also provide the RPC URL and chain ID needed to connect MetaMask.

   a) Create New Workspace: In Ganache, create a new workspace by clicking on the "New Workspace" button. This will allow you to configure a new blockchain environment for your project.
   b) Add the Hardhat Configuration File: Add the ‘hardhat-config.js’ file from your project to the workspace. This configuration file contains the settings for connecting Ganache with your Hardhat development environment.

c) Change the Port in Server Settings: In the Ganache server settings, change the port to match the specific port specified in your 'hardhat-config.js' file. This ensures that Ganache and Hardhat are using the same port for communication.

4. Open MetaMask and Configure with Ganache: Open the MetaMask extension in your browser. If you don't have MetaMask installed, you can download and install it from the Chrome Web Store. In MetaMask, click on the network dropdown menu and select "Custom RPC". Enter the RPC URL and chain ID provided by Ganache. This will connect MetaMask to your local Ganache blockchain, allowing you to interact with it through MetaMask.

5. Deploy Hardhat Contract: Deploy your compiled smart contracts to the Ganache network using Hardhat. In the terminal, run the command:
   npx hardhat run scripts/deploy.js --network ganache

6. Start Server: Start your development server to host your project website. For example, using webpack-dev-server:

   npm run dev

7. Login to MetaMask and Connect to Added Account: In MetaMask, switch to the network you added for Ganache. Import one of the accounts provided by Ganache into MetaMask.

8. Interact with Project Website: Open your project website in your browser. You should now be able to interact with your smart contracts through your website. MetaMask will prompt you to confirm transactions when interacting with your contracts.

By following these detailed steps and using code snippets, you'll be able to set up your development environment, deploy your contracts to a local blockchain, and interact with them using MetaMask and your web application.

APPLICATION DESIGN & RESULT ANALYSIS

The section of report discusses the D-App design and the application's goals in this chapter, as well as the broad overview of the crowdfunding process and the specific capabilities that users can access. Next, the application architecture is shown, along with specifics on the frontend and smart contract designs.

5.1 General Introduction

In order to enable groups and individuals to raise tokens from users for a range of objectives, including but not limited to charity, investment projects, and funding for entrepreneurs and startups, this project seeks to create a Blockchain-based DeFi Crowdfunding Platform. The platform's ecosystem is cleaner because its only objective is to maintain financing pools and assist crowdfunding initiatives. The smart contracts are going to be templated, making it simple for anyone to submit their campaigns. Furthermore, the platform would incentivize users to engage in campaign maintenance. Depending on the number of tokens they have contributed and the amount of money in the fund pools, backers can be given voting power for each campaign. This gives them the ability to vote on every withdrawal request the fundraiser posts. Backers can watch the success of different projects, providing extra support or limiting their economic activity. Fundraisers can use a crowdfunding campaign to raise money in the form of cryptocurrency tokens, which they can then withdraw by making requests. The remaining monies in the pool may be recovered if the project doesn't live up to the backers' expectations or doesn't follow the terms of the contract.

5.1.1 Fundraiser Operation Instructions

1) By calling the campaign factory contract on the blockchain, fundraisers can create their own customized smart contract to launch the crowdfunding campaign. The backers must authorize the fundraisers' requests to withdraw tokens from the pool, therefore their control over it is restricted. It is recommended that fundraisers explain the goals and specifics of their project to potential donors and offer justifications for each request in order to gain support.

2) For each campaign the fundraiser needs to clarify:

a) Description: provides the basic description about the crowdfunding project, including the purpose and management procedures.
b) Target: the max number of funds that needs to be raised for a crowdfunding project.
c) Lifespan: the time duration of the project. When the campaign terminates, the fundraiser will no longer be operational with the Campaign. The remaining funds in the pool will be returned to backers.

3) For each request the fundraiser needs to clarify:

a) Description: the basic description about the withdraw request, including the purpose and management process.
b) Amount: the withdraw value of funds.

5.1.2 Backers Operation Instructions

1. Users can browse all available crowdfunding projects. Users can easily make fund transactions with each other.
2. Users can invest in a Campaign by sending funds to a specific fund pool and become the backers of that campaign.
3. For each withdraw request posted by the fundraiser, the backers need to vote for the request using their voting power.
4. When the campaign ends, backers can send a refund request. Remaining funds in the fund pool are returned according to the backers' contribution amount..

5.2 Application Architecture

The frontend layer and the blockchain layer make up the D-App (Figure 5.2). On the Ganache Test net, where the Campaign Factory contract has been implemented, the blockchain layer operates. By invoking the functionalities within the Campaign Factory directly and deploying the Campaign contract into the blockchain, users can create custom contracts. Web3.js is used by the frontend layer to interface with the blockchain, while react is used in its construction. The application's core is provided by the blockchain layer, where all data and transactions are safely kept on the blockchain. Contracts can be tested in a sandbox setting by operating on the Ganache Test net. Fundraisers can easily deploy and customize the template offered by the

Campaign Factory contract. Users can interact with the blockchain layer using an easy-to-use interface provided by the frontend layer. The frontend can be expanded in the future because it is easily scalable and modular thanks to React. By serving as a standardized communication interface and abstracting away the difficulties of connecting with the blockchain directly, Web3.js serves as the middleware between the frontend and blockchain layer. Users can also utilize Truffle to conduct direct blockchain operations at the same time.

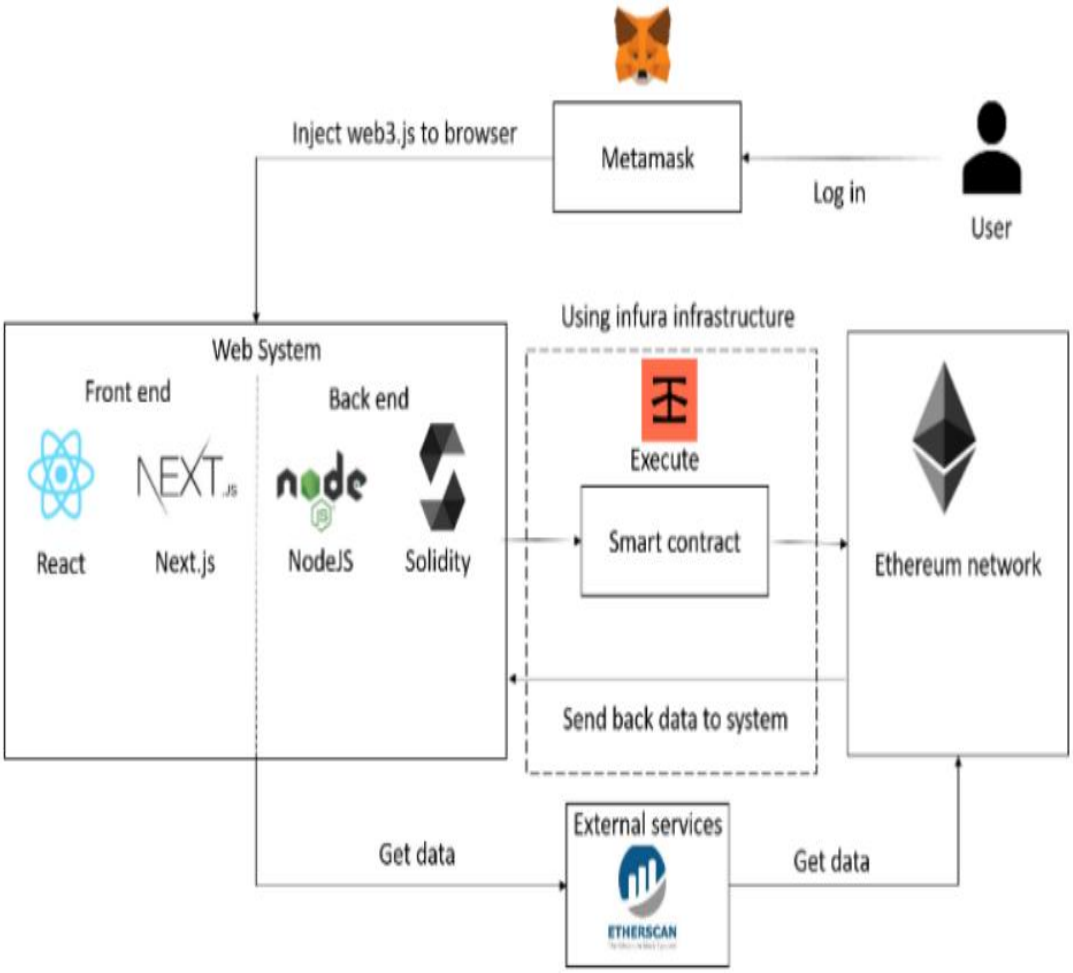

Figure 5.2: General Architecture

5.3 Campaign Design

The given Figure 5.3 below illustrates the crowdfunding campaign's workflow. The customized Campaign contract's smart contract address is referred to as the "campaign pool." The fundraiser is only able to submit a fresh withdrawal request when the prior one expires. The design states that any remaining cash will be

reimbursed following the Campaign's conclusion. However, smart contracts on the blockchain don't operate automatically; instead, the user must alter the contract's functionalities. As a result, the backers must use the campaign contracts' refund mechanism. Likewise, requests—including those for status updates and automatic transfers to fundraisers—are not immediately updated at the conclusion of the voting period. Fundraisers must use the Campaign Contact's finish request functions.

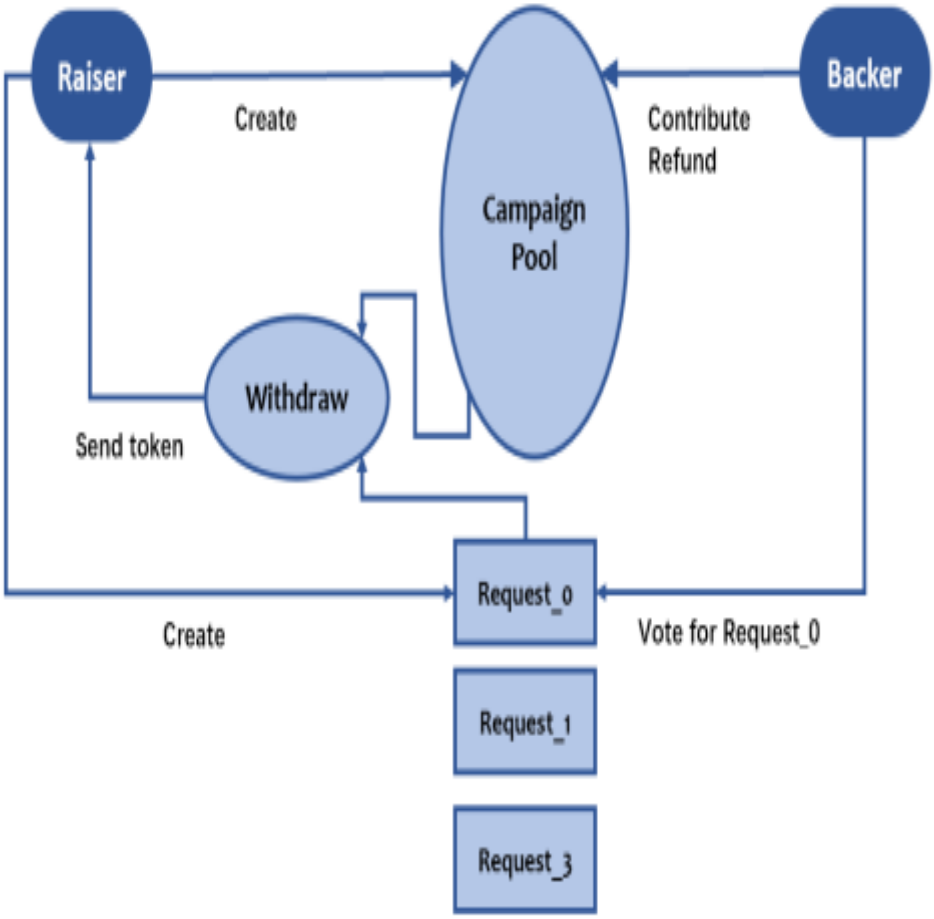

Figure 5.3: Campaign Workflow

Fundraisers cannot alter the duration of a project once they have established a campaign since this could affect backers' decisions by impacting the time it takes for them to obtain their refund. Campaigns must last between seven and three hundred days. Voting on the request was limited to seven days. Based on the Voting Power that the Request obtained; the smart contract evaluates the state of the Request after the conclusion of the voting session. The fundraiser can only get the withdrawal tokens once the request has received more than 50% of the total.

5.4 Frontend Design

The D-App's frontend functions like a web page. This was created with the help of the React-based Next.js environment and the Node.js node Modules. The UI layout is displayed below. On the blockchain, users can explore every Campaign project made by the "CampaignFactory" Contract and read the essential information from the Home Page (Figure 5.4.1). The web application will use Web3.js to query all of the data from the blockchain and smart contracts when the Refresh button is clicked. Campaigns allow users to directly contribute to them.

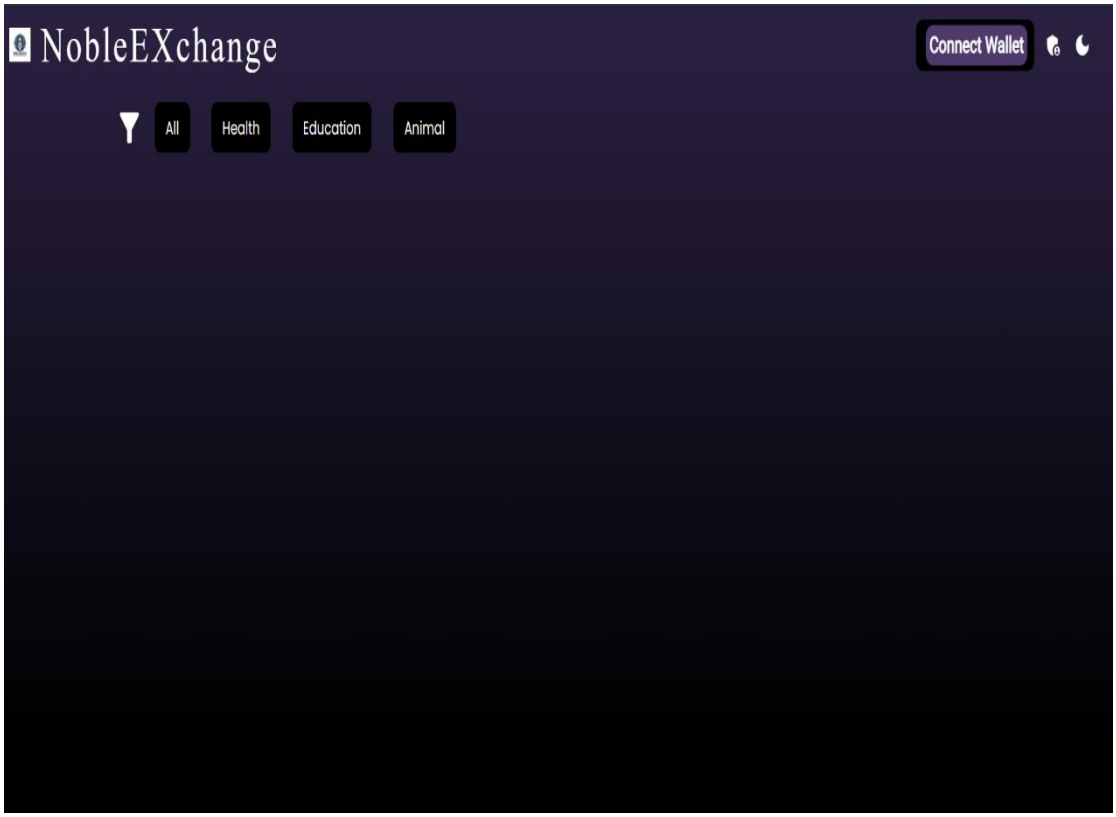

Figure 5.4.1: Home Page UI

By clicking the Create Campaign button, users can easily customize their own crowdfunding project easily. Fundraisers are required to give the description of the Campaign and set the target or lifespan of the Campaign (Figure 5.4.2).

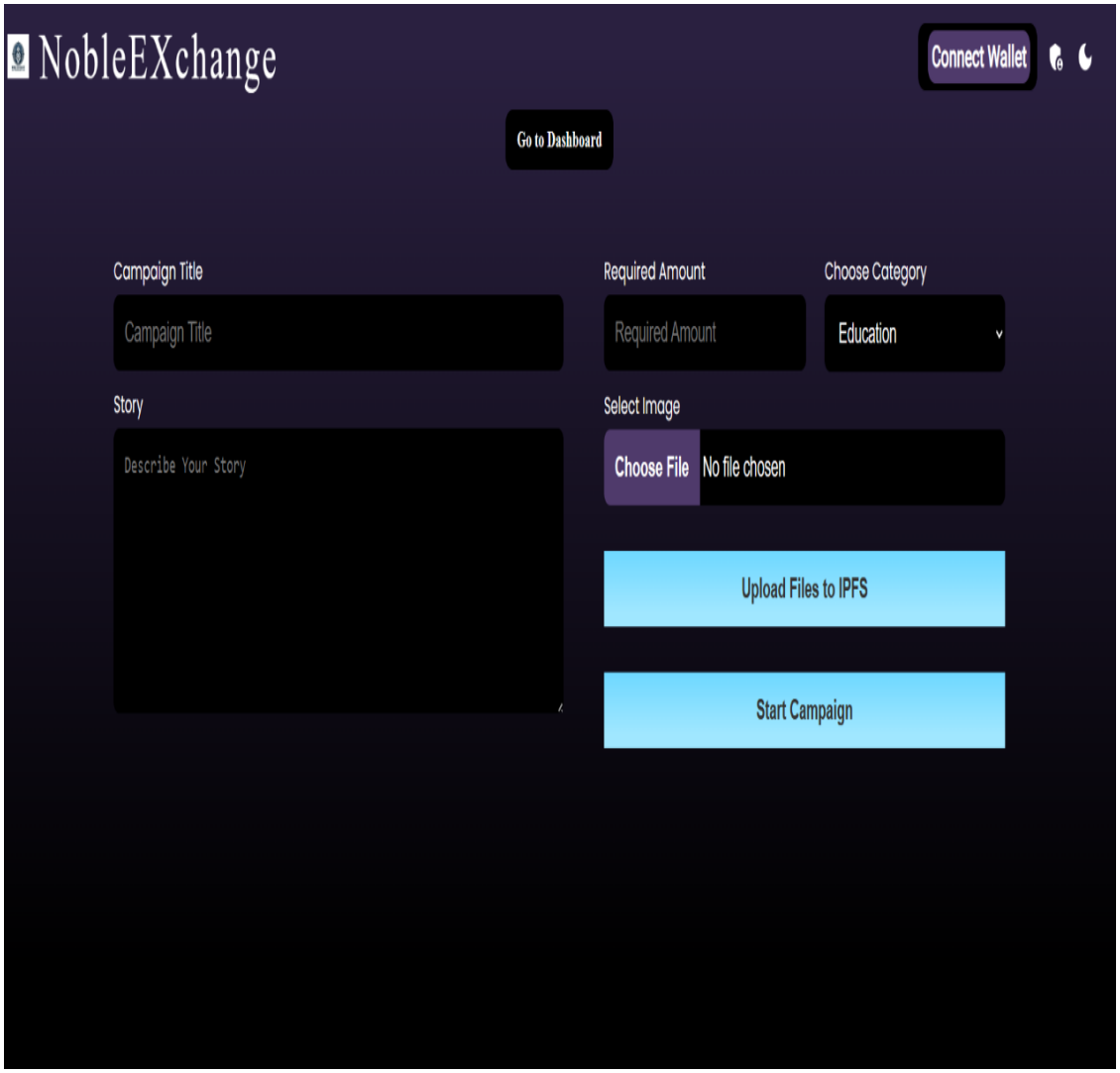

Figure 5.4.2: Create Campaign UI

Users may be redirected to the Campaign detail page by clicking the Campaign on the home page (Figure 5.4.2). The Campaign detail page will obtain comprehensive details about the Campaign by utilizing the contract address to retrieve data from the blockchain when the refresh button is clicked. All of the campaign's detailed information, including the contract address, raiser address, current balance, project target, campaign description, board, lifespan, and backers' information (including their contribution balance to the fund pool), is readily available to users in the box.

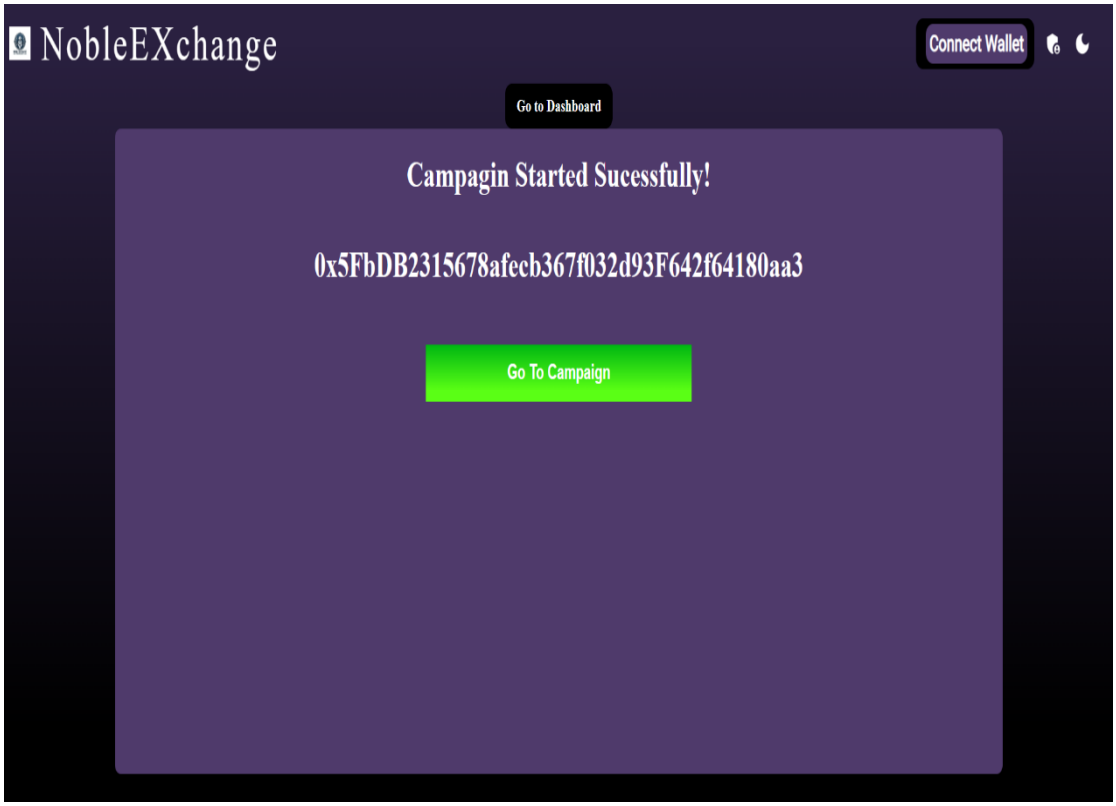

Figure 5.4.3: Campaign Transaction Successful

There will be a gas tax if users want to create campaigns, create requests, approve requests, or finalize requests—any operations that require changing the smart contract or use payable functions. To sign the transactions, users can rely on third-party wallet extensions like MetaMask (Figure 5.4.3).

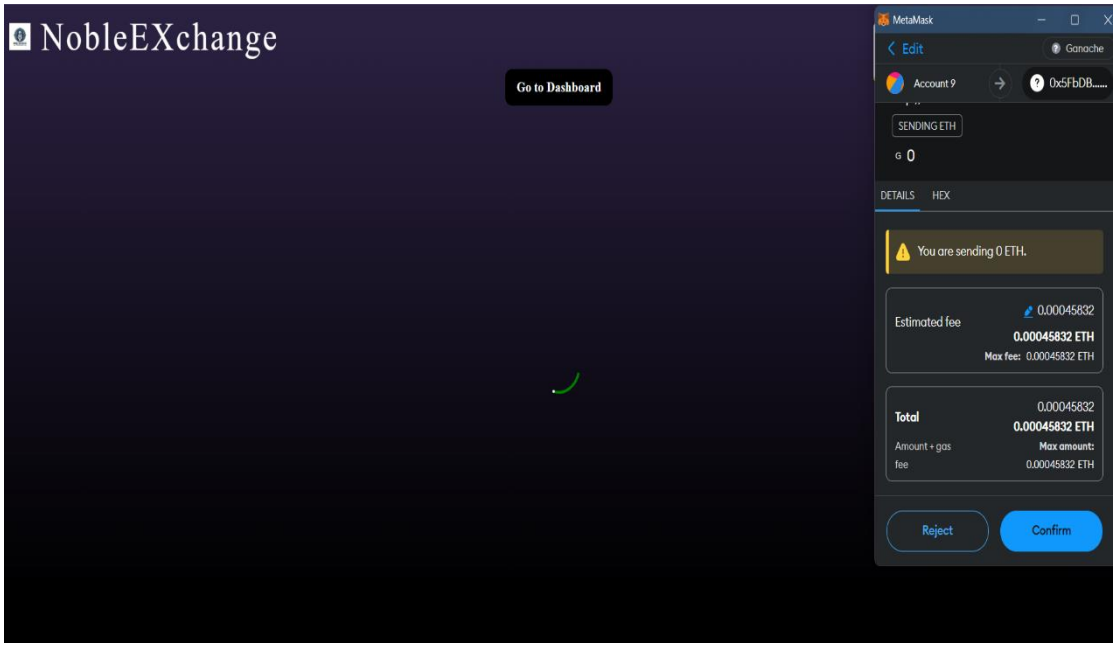

Figure 5.4.4: Sign Transaction using MetaMask

The third-party block explorer can be used by users to track the transactions of various accounts (Figure 5.4.5). A web-based application called Block Explorer lets users examine and evaluate the data contained in a blockchain. It can show a visual depiction of the blockchain's transaction history and enable users access to account details. This was visible in the section on Ganache transections.

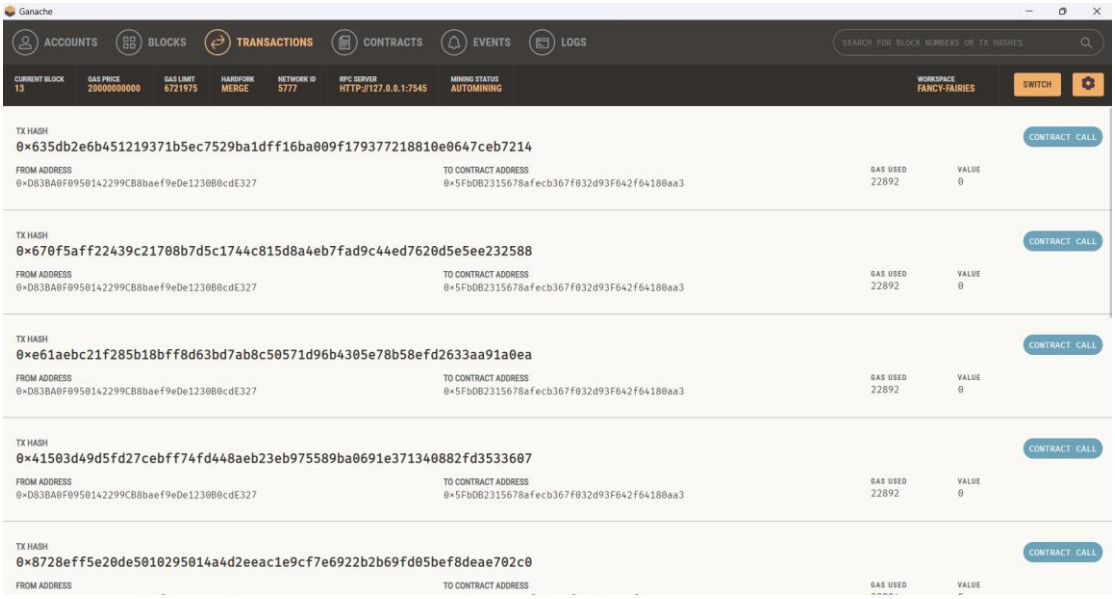

Figure 5.4.5: Block Explore

5.5 Result Analysis

In creating a crowdfunding web app using blockchain technology, we've achieved several significant outcomes:

1. Decentralized Fundraising Platform: By leveraging blockchain technology, we've created a decentralized fundraising platform that allows project creators to raise funds directly from contributors without the need for intermediaries like banks or traditional crowdfunding platforms. This decentralization ensures transparency, security, and autonomy in the fundraising process, empowering both project creators and contributors.

2. Smart Contract Implementation: We've implemented smart contracts using Solidity, a programming language for writing Ethereum smart contracts. These smart contracts govern the crowdfunding process, automatically executing predefined rules and conditions, such as releasing funds to project creators when

fundraising goals are met or refunding contributions if the project fails to reach its target.

3. Integration with MetaMask: Our web app integrates with MetaMask, a popular Ethereum wallet and gateway to blockchain applications. This integration enables users to securely interact with our crowdfunding platform using their Ethereum accounts, providing seamless access to contribute funds, create campaigns, and manage projects.

4. User-Friendly Interface: We've designed a user-friendly interface that simplifies the crowdfunding experience for both project creators and contributors. Intuitive navigation, clear instructions, and interactive features guide users through the crowdfunding process, making it easy to create campaigns, browse projects, and make contributions.

5. Security and Trust: Blockchain technology ensures the security and trustworthiness of our crowdfunding platform. Contributions are securely stored on the Ethereum blockchain, providing immutable records of transactions and ensuring transparency in fundraising activities. Smart contracts enforce predefined rules, eliminating the risk of fraud or mismanagement.

6. Global Accessibility: Our crowdfunding web app is accessible to users worldwide, regardless of geographical location or financial infrastructure. Contributors can participate in fundraising campaigns from anywhere with an internet connection, fostering global collaboration and innovation.

7. Community Engagement: By creating a decentralized crowdfunding platform, we've fostered community engagement and participation in the fundraising process. Contributors have a direct stake in the success of projects they support, leading to increased engagement, accountability, and collaboration within the community.

Overall, the creation of a crowdfunding web app using blockchain technology represents a significant milestone fundraising Platforms. Through the integration of blockchain, smart contracts, and user-friendly interfaces, we've established a robust platform for transparent, secure, and inclusive fundraising, paving the way for a more equitable and collaborative future.

CONCLUSION

6.1 Conclusion

The integration of blockchain technology into crowdfunding represents a novel and forward-thinking approach. The successful coding and deployment using Solidity signify an important milestone in our journey. While the decentralized web application we've developed is exploratory in nature, it presents essential functionalities for project creation and contribution. Nonetheless, challenges persist, encompassing both legal and technical realms. Despite these obstacles, the evolving landscape of blockchain technology gives confidence in the promising trajectory of our proposed work. There is ample opportunity for refinement and enhancement in crafting a more secure and user-friendly crowdfunding platform, reflecting the continuous evolution and maturation of blockchain technology.

6.2 Future Scope

The impact of blockchain on crowdfunding is significant, showcasing immense potential for the future. As blockchain technology continues to evolve, we anticipate widespread adoption for secure online transactions on a global scale. Specifically, within crowdfunding platforms, the utilization of blockchain, particularly through Ethereum smart contracts, addresses prevalent issues such as regulatory oversight and fraudulent activities. This project's objective of employing smart contracts with internal consensus mechanisms is poised to automate crowdfunding agreements, thereby mitigating fraud risks and ensuring timely project completion

REFERENCES

[1] Sumathi Vp; Harish Krishna.S; Lakshya Jain; Hisham Ahmed "Crowd-Funding Using Blockchain" in 2023 2nd International Conference on Advancements in Electrical, Electronics, Communication, Computing and Automation (ICAECA), Coimbatore, India, June 2023.

DOI: 10.1109/ICAECA56562.2023.10200116

[2] R NaveenKumaran; S K Geetha; Kaushik Selvaraju; C Kishore; A Nagha Rathish "Blockchain Based Crowd Funding" in 2023 International Conference on Computer Communication and Informatics (ICCCI), Coimbatore, India, January 2023.

DOI: 10.1109/ICCCI56745.2023.10128334

[3] Priya Shelke; Shreyas Zanjal; Rishikesh Patil; Digvijay Desai; Harish Chavan "Blockchain Technology Based Crowdfunding Using Smart Contracts" in 2022 International Conference on Augmented Intelligence and Sustainable Systems (ICAISS), Trichy, India, November 2022.

DOI:10.1109/ICAISS55157.2022.10010749

[4] S Saranya; Sai Phanindra Muvvala; Vitul Chauhan; Raja Satwik "Crowdfunding Charity Platform Using Blockchain" published in July 2022 in International Conference on Inventive Computation Technologies (ICICT), Nepal, July 2022.

DOI: 10.1109/ICICT54344.2022.9850562

[5] Sayyam Gada; Akash Dhuri; Denish Jain; Smita Bansod; Dhanashree Toradmalle "Blockchain-Based Crowdfunding: A Trust Building Model" in 2021 International Conference on Artificial Intelligence and Machine Vision (AIMV), Gandhinagar, India, September2021.

DOI: 10.1109/AIMV53313.2021.9671003

[6] Shafaq Naheed Khan, Faiza Loukil, Chirine Ghedira-Guegan, Elhadj Benkhelifa & Anoud Bani-Hani "Blockchain smart contracts: Applications, challenges, and future trends" in 2021 Special Issue on Blockchain for Peer-to-Peer Computing, April 2021.

DOI: 10.1007/s12083-021-01127-0

[7] Vikas Hassija , Vinay Chamola , Sherali Zeadally "BitFund: A blockchain-based crowd funding platform for future smart and connected nation' in 2020" in 2020 Sustainable Cities and Society ScienceDirect Journal , September 2020.

DOI: https://doi.org/10.1016/j.scs.2020.102145

[8] Amritraj Singh, Reza M. Parizi, Qi Zhang, Kim-Kwang Raymond Choo, Ali Dehghantanha "Blockchain smart contracts formalization: Approaches and challenges to address vulnerabilities" in Computers & Security ScienceDirect Jornal, January 2020.

DOI: https://doi.org/10.1016/j.cose.2019.101654

[9] Md. Nazmus Saadat, Kuala Lumpur "Blockchain based crowdfunding systems" in 2019 Indonesian Journal of Electrical Engineering and Computer Science, Malaysia, July 2019.

DOI:10.11591/ijeecs.v15.i1.pp409-413

[10] Maher Alharby; Amjad Aldweesh; Aad van Moorsel "Blockchain-based Smart Contracts: A Systematic Mapping Study of Academic Research" in 2018 International Conference on Cloud Computing, Big Data and Blockchain (ICCBB), Fuzhou, China, November 2018.

DOI: 10.1109/ICCBB.2018.8756390

[11] Bhabendu Kumar Mohanta; Soumyashree S Panda; Debasish Jena" An Overview of Smart Contract and Use Cases in Blockchain Technology" in 2018 9th International Conference on Computing, Communication and Networking Technologies (ICCCNT), Bengaluru, India, July 2018.

DOI: 10.1109/ICCCNT.2018.8494045

[12] Lin William Cong Zhiguo He "BLOCKCHAIN DISRUPTION AND SMART CONTRACTS" in NATIONAL BUREAU OF ECONOMIC RESEARCH WORKING PAPER SERIES, 1050 Massachusetts Avenue Cambridge, March2018.

DOI: https://www.nber.org/system/files/working_papers/w24399

PROJECT TEAM MEMBERS

Name – Prithvirajsingh Devendrasingh Thakur Address – Amravati 444604 Email– thakurprithviraj.555444@gmail.com Phone – 7058706530	
Name – Tanay Rajesh Hisariya Address – Pulgaon 442302 Email– tanayhisariya@gmail.com Phone – 9356957974	

ORIGINALITY REPORT

27%	23%	7%	9%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	wp.cs.hku.hk Internet Source	8%
2	Submitted to Visvesvaraya Technological University, Belagavi Student Paper	2%
3	www.ijisae.org Internet Source	1%
4	www.coursehero.com Internet Source	1%
5	R NaveenKumaran, S K Geetha, Kaushik Selvaraju, C Kishore, A Nagha Rathish. "Blockchain Based Crowd Funding", 2023 International Conference on Computer Communication and Informatics (ICCCI), 2023 Publication	1%
6	coinbaise-wallat-extensionn.webflow.io Internet Source	1%
7	Submitted to NCC Education Student Paper	<1%