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Decentralized Autonomous Organizations

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***Abstract*— This paper takes an in-depth look at decentralized autonomous organizations (DAOs) and their integration with smart contracts, addressing current challenges in centralized decision-making. The proposed solution emphasizes decentralized decision-making, community ownership, and automation, with a focus on security and compliance. The article analyzes the key differences between DAOs and traditional organizations, explores the benefits of DAOs, and presents a practical implementation guide for Ethereum-based transactions using MetaMask. It predicts widespread adoption of DAOs and increased integration with Web3 technologies, innovative token models, and broader industry applications, making it a valuable resource for understanding and implementing DAOs and smart contracts.**

Keywords—blockchain, MetaMask, economy, Ethereum, localhost, hardhat, web3, node.js.

I. INTRODUCTION

"This statement highlights problems in modern organizations due to centralized decision-making and manual processes, leading to issues like inconsistency and trust concerns. The proposed solution is to promote decentralized decision-making, community ownership, and automation with a focus on security and compliance, aiming for global implementation. Additionally, the paper explores how traditional organizations face centralization and inefficiency issues in today's digital age and examines the potential of Decentralized Autonomous Organizations (DAOs) and smart contracts to enhance organizational dynamics."

II. Problem Definition

In modern organizations, centralized decision-making and manual administrative processes lead to problems like inconsistencies, limited inclusiveness, and trust issues. To address these challenges, the proposed solution involves promoting decentralized decision-making, community ownership, and automation while ensuring security and compliance. The ultimate aim is to enhance and globally implement this evolving technology.

III. Problem overview

This paper explores how traditional organizations face issues like centralization, opacity, and inefficiency in today's digital world. It focuses on Decentralized Autonomous Organizations (DAOs) and the challenges of implementing them, with an emphasis on smart contracts. The paper aims to demonstrate how DAOs, enabled by smart contracts, can transform and improve organizational dynamics.

IV. Methodology

This research work introduces several blockchain and smart contract development tools and technologies:

1.Gitpod: It is a cloud-based IDE which allow software programmers to create, test, and code their projects entirely within a web-based browser [4].

2.Remix IDE: A comprehensive suite of tools for developing, deploying, analyzing, and validating smart contract applications compatible with Ethereum and the Extended Virtual Machine (EVM) [5].

3.MetaMask Wallet: A mobile app and web plugin that facilitates remote management of Ethereum wallet private keys, allowing interaction with decentralized apps (dapps) and functioning as a digital wallet for cryptocurrencies such as Ether [4].

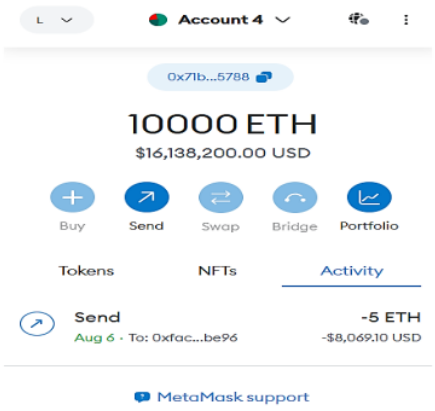

Figure: MetaMask wallet

4.Hardhat Configuration: A framework designed for building digital currency applications [4], comprising various components that enable customization, compilation, debugging, and deployment of dapps and smart contracts, providing a complete development platform.

5.Localhost: The address of a host or system used to run a program, effectively serving as a virtual server. Developers can upload source code and export data to this localhost address for testing and development purposes.

V. Key Differences Between DAO and Traditional AO

Decentralized autonomous organizations and traditional autonomous organizations are the two governing bodies which differ in their approach of decision-making and transparency. Below are the key differences among the two entities:

1. Structure and Governance: The Traditional AO is a hierarchy-based administration where decision-making is performed at the top level while in DAO the process is distributed among various members and self-executing smart contracts.
2. Ownership Body: The TAO is headed by either the whole institution or by the individuals. On the other hand, DAO is collectively administered by the people who hold the tokens [14].

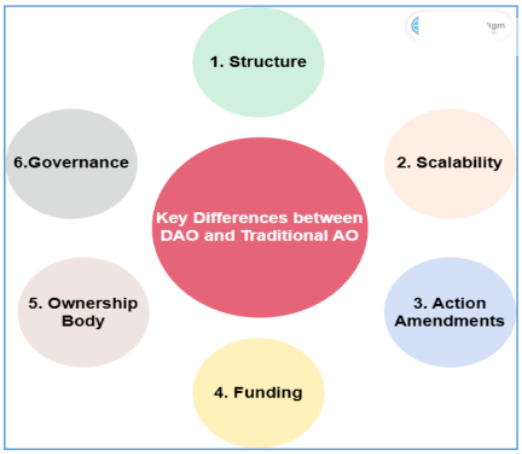

Figure: Differences between TAO and DAO

3.Funding: The TAO is generally funded by the resource such as the contributions and endowments but the DAO generates its revenue by buying and selling of the tokens [4].
4. Action Amendments: In case of TAO, resolutions might be tough to reverse due to complex protocols. But in DAO, decisions are reversed with the help of small minute changes in the codes of smart contracts [14].
5. Scalability: It is frequently hampered in traditional organizations by space and limits on resources [5]. For scalable and effective growth, Decentralized Autonomous Organizations, in contrast, make use of blockchain technology, a worldwide audience, token-based economies, and engagement with society.

VI. Main Components of DAO

DAO is initially built up on the constitutional working dynamics of blockchain technology but it also has various functioning components which constitutes its architecture.

1. Smart Contract: These self-executing agreements, encoded in code, automate key DAO functions such as proposal processing, voting, fund management, and token transfers [1]. They are at the heart of DAO management, ensuring compliance with predefined rules [3].

2.Token holders: These holders grant voting rights, decision-making rights, and sometimes financial incentives to collectively direct the actions of the DAO through a voting process [1].

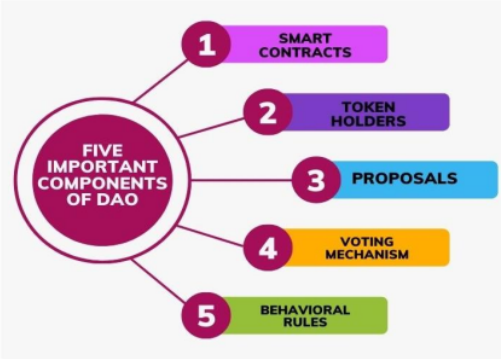

Figure: Components of DAO

3. Proposals: They cover a variety of topics, such as project funding, rule changes or amendments to governance rules [3].

4. Voting mechanism: The voting mechanism allows token holders to participate in decision-making [6]. DAOs typically use an on-chain voting system, allowing token holders to vote directly on the blockchain. The results of the vote determine the approval or rejection of proposed actions [13].

5. Behavior rules: DAOs establish a code of conduct or community guidelines that define the expected behavior, responsibilities, and ethical standards of participants [1].

VII. Advantages of DAO

Decentralized autonomous organizations (DAOs) offer several advantages due to their decentralized, blockchain-based nature and unique governance model.

Here are five key benefits of DAOs:

1.Decentralization and lack of trust: DAOs run on blockchain technology [13], eliminating the need for intermediaries, such as banks, making the organization more transparent and more resistant to censorship [7].

2.Community Administration: DAOs are typically governed by token holders who actively participate in decision-making through a voting mechanism thus allowing community members to shape the policies and projects of the organization [11].

3. Transparency and accountability: DAO uses blockchain technology to provide a high level of transparency [7]. All transactions, decisions, and actions are recorded on the blockchain, making it difficult to manipulate or hide information [9].

Figure: Advantages Of DAO

4. Efficiency and automation: DAOs typically rely on smart contracts, which are self-executing code with predefined rules which automate various functions, such as capital allocation, voting, and enforcement of decisions, reducing the need for human intermediaries and minimizing the risk of error or manipulation [9].

5. Global participation and inclusion: The DAO is open to anyone with access to the blockchain, allowing for global participation. This inclusivity allows people from different backgrounds and regions to contribute their skills and ideas, thereby driving innovation and diversity within the organization.

VIII. Challenges of DAO

1.Security risks: Smart contracts are prone to bugs, vulnerabilities [3], and exploits that can lead to financial loss or disruption in the DAO [1].

2.Data Manipulation: Dependency on external data sources can introduce vulnerabilities if they are not properly secured, potentially leading to data manipulation or contract enforcement [9].

3.Lack of accountability: Some DAO participants may be anonymous, making it difficult to hold individuals accountable for malicious actions or misconduct. In the absence of centralized authority, it may be difficult to take legal action against DAO wrongdoers [1].

4.Token Concentration: A small number of token holders can accumulate significant voting power, which can lead to centralization of decision-making and the exclusion of smaller stakeholders [15].

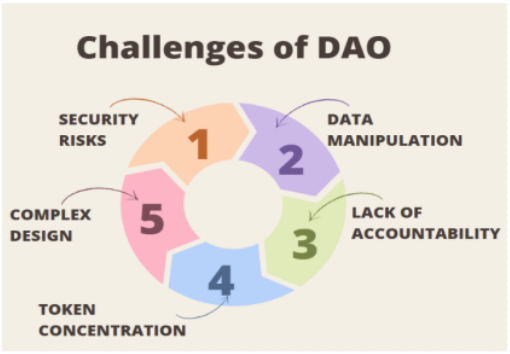

Figure: Challenges of DAO

5.Complex design: Complex DAO designs can cause unintended consequences or increase the likelihood of security breaches [12]. Ensuring that DAOs are user-friendly and accessible to participants without technical expertise is important for wider adoption [16].

IX. Implementation of a DAPP

Our implementation focusing on creating a DAPP that performs Ethereum-based transactions using a MetaMask wallet and headset setup [8]. We also aim to provide a user interface through a website for users so they can transact on ether conveniently and securely. The website is will be self-contained and virtually indestructible [8].

Step 1: Deploying Contract on Hardhat Network Install Node.js and npm:

a. To run the npm commands at the initial level, make sure that node.js is present in the system.

b. Write your smart contract code (e.g., in Solidity) and save it in a .sol file within your project directory.

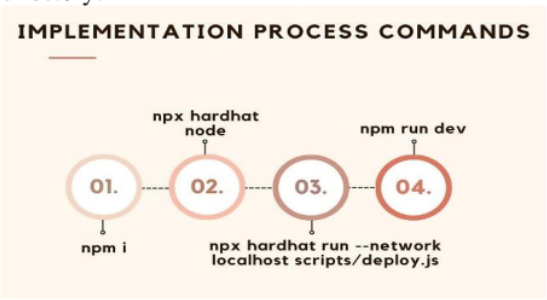

Figure: Implementation commands

c. Run Hardhat scripts or tasks to compile and deploy smart contract to the Hardhat network. By using commands “npm i, npx hardhat node, npx hardhat run --network localhost scripts/deploy.js”.

Step2: Frontend Implementation on localhost:3000

a. Using command “npm run dev” through port 3000 we can create Dapp on the web browser

Step 3: Connection with MetaMask

a. Install MetaMask:

i. Install the MetaMask extension for your web browser (e.g., Chrome, Firefox).

ii. Create a MetaMask Wallet:
Create or import a wallet within MetaMask. Ensure you are connected to the Ethereum network where you deployed your smart contract (e.g., Hardhat network or a local network).

Step 4: Use of Deploy and Withdraw Buttons to Transact Ethereum

a. Implement Deploy and Withdraw Functions:
In your frontend code, create functions that allow users to deploy the smart contract and interact with it, such as withdrawing funds.

b. Use the Web3.js library or ethers.js to interact with the Ethereum network and smart contract. Connect MetaMask to the Frontend.

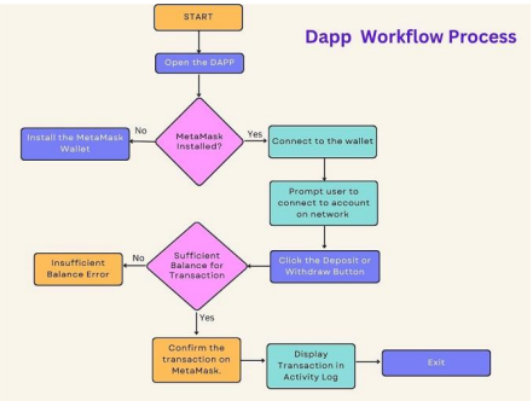

Figure: Working of Dapp

c. Ensure your frontend code integrates with MetaMask. You can use the MetaMask JavaScript library to interact with the MetaMask wallet.

X. Results

Below are the results of the Implementation of the DAPP:

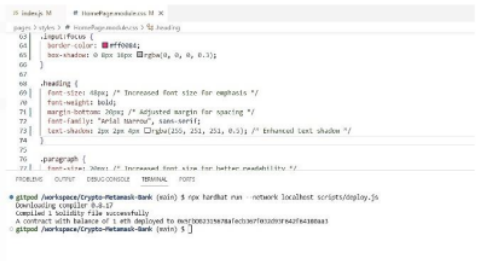

Figure: Deployment of the contract

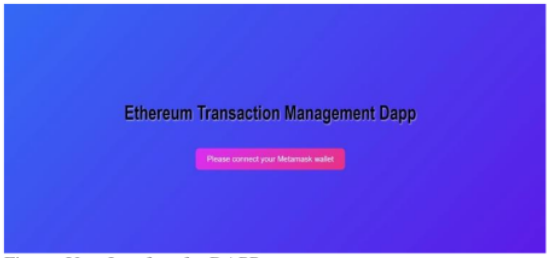

Figure: User Interface for DAPP

Figure: Performance of the Transaction

Figure: Successful Transaction

The above figures show the deposit and withdraw button which are used to perform the transaction. The recent transaction is then displayed in the activity log area.

XI. Future Trends of DAO

Predicting the future of Decentralized Autonomous Organizations (DAOs) in 2023-2024:

1. Widespread Adoption: DAOs will see increased adoption across various industries, including arts, entertainment, and healthcare [7].
2. Web3 Integration: DAOs will continue leading the Web3 movement, collaborating with dApps, DeFi, and blockchain platforms [1].
3. Token Innovation: Expect experimentation with new token standards and governance models beyond ERC-20 [4].

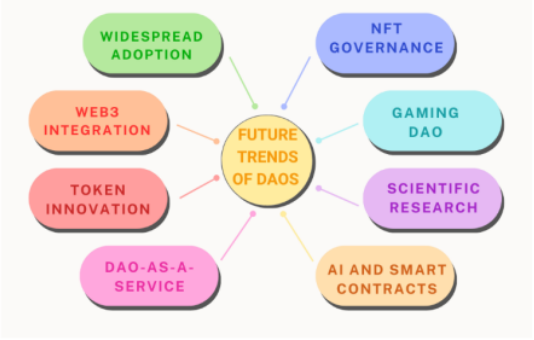

Figure: Future trends of DAO

4.DAO-as-a-Service (DaaS): DaaS providers will simplify DAO creation and management for organizations.

5.NFT Governance: DAOs will influence the governance of NFT markets and digital art collectibles [1].

6.Gaming DAOs: DAOs will gain traction in the gaming industry, influencing game development and virtual economies [8].

7. Scientific Research: Scientific communities may use DAOs for collaborative and transparent research, incentivized by tokens [7].

8.AI and Smart Contracts: AI-driven smart contracts within DAOs will become more sophisticated, automating complex processes [8].

XII. Conclusion

In conclusion, this exploration of Decentralized Autonomous Organizations (DAOs) has highlighted their transformative potential through blockchain technology [13]. DAOs offer decentralized governance, transparency [13], efficiency, and global inclusivity, making them a compelling model for modern organizations. However, challenges like security risks, accountability issues, and complex design must be addressed. The future of DAOs looks promising with widespread adoption and integration into various industries, signaling a shift toward decentralized decision-making [11]. Despite challenges, DAOs have the potential to reshape traditional organizations for greater transparency, inclusivity, and innovation [9].

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