Ethfund: Ethereum - Based Crowdfunding Dapp

Smita Mande
Department of Engineering, Sciences and Humanities (DESH)
Vishwakarma Institute of Technology, Pune
Maharashtra, India
smita.mande2@vit.edu

Mustansir Bohari
Department of Artificial Intelligence and Data Science
Vishwakarma Institute of Technology, Pune
Maharashtra, India
mustansir.bohari21@vit.edu

Asif Mursal
Department of Artificial Intelligence and Data Science
Vishwakarma Institute of Technology, Pune
Maharashtra, India
asif.mursal21@vit.edu

Omkar Mundlik
Department of Artificial Intelligence and Data Science
Vishwakarma Institute of Technology, Pune
Maharashtra, India
omkar.mundlik21@vit.edu

Vinit Mundhada
Department of Instrumentation and Control Engineering
Vishwakarma Institute of Technology, Pune
Maharashtra, India
vinit.mundhada21@vit.edu

Jayesh Mundphane
Department of Mechanical Engineering
Vishwakarma Institute of Technology, Pune
Maharashtra, India
jayesh.mundphane21@vit.edu

Abstract *- The rise of information technology has led to a surge in interest of investors and businesses in advanced futuristic technologies like Blockchain and Cryptocurrency. Crowdfunding is the process of supporting a project by obtaining modest contributions from a large number of individuals, usually online. Modern day crowdfunding websites are centralized, prone to cyberattacks, charge high amounts of transaction fees, have print rules and regulations and intellectual property risk. Blockchain has emerged as a technology which promises decentralization of a system along with a highly secured system. Blockchain is a distributed immutable ledger used to record transactions. Our project proposes a model to switch traditional crowdfunding processes on a Blockchain called Ethereum. Apps made on Ethereum use the same frontend as that used in traditional websites but the backend instead of being a centralized database is an open peer-to-peer network. Our proposed work has a promising future and lots of room for development.*

Keywords *- Blockchain, Crowdfunding, Decentralization, Ethereum, Smart Contract.*

I. INTRODUCTION

The notion of a secure chain of blocks is not novel in the twenty-first century. Stuart Haber proposed it in 1991 as a method for digitally timestamping electronic documents to safeguard them against tampering [1]-[2]. However, it became well-known recently when it was used with Blockchain technology to hold transactions of a digital currency called "Bitcoin"[3].

The process of using small sums of money from a large number of people to finance budding business projects is known as crowdfunding. Crowdfunding, which links investors and business owners via social media and crowdfunding websites has started encouraging more entrepreneurs by extending the pool of investors beyond the traditional group of business owners, relatives, and venture capitalists (private investors who invest money in high-potential businesses in exchange for a cut of the profits or an equity stake) [4].

Crowdfunding can be made a sole revenue model for a journalist or a publication, and it can replace the legacy business models for journalism that enforces prejudiced journalism favouring a specific group. The emergence of crowdfunding is a welcome trend at a time when independent journalists are having difficulty raising funds for serious journalism. The objective of this project is to establish a space through which these individuals can easily acquire funds to engage in objective journalism that advances society.

One intriguing aspect of crowdsourcing is that it allows dilettantish (retail) investors to fund early-stage ventures. Prior to the rise of crowdfunding, this asset class was only open to accredited (professional) investors. Therefore, it is reasonable to think about crowdfunding as a way to democratize the financial sector [5].

In our project we focus on encouraging young entrepreneurs to show their talent and the investors to invest their money without any trust issues between project managers and the investors. The system used for transparency is Ethereum Blockchain Technology.

Because of its ability to hold data and execute code in a decentralised and immutable manner, blockchain is seen as a potentially disruptive technology in a number of sectors, including banking [6], business process management [7], data provenance [8,9], supply chain management [10], and healthcare [11].

A. Blockchain

Blockchain can be seen as a decentralized database that holds recorded transactions securely using cryptography. There are many ways to store information. For example, you can write down information on a piece of paper or you can enter data in an excel spreadsheet. A shopkeeper notes all transactions and records of sales on a ledger to store that information. Similarly, in blockchain, information is stored in the form of blocks. These blocks are linked to one another forming a linear chain.

Each block is made up of three different things. First any data or information you store in the block. Second, each block has its unique hash. This is a way to uniquely identify a block from others. Third, each block stores the hash of the block before it. In this way all blocs are linked to one another. Thus, if you try to tamper the information on the blockchain then you need to change information on a particular block which would change its hash code and as a result the hash off all those blocks after that particular block would change. This would result in change of complete blockchain. But as this network is decentralized and peer-to-peer, every node on the network has the complete copy of the blockchain. This network's nodes all generate consensus. They agree on the existence of valid blocks and invalid blocks. As a result, other

nodes in the network will reject the blockchain that has been tampered.

Therefore, in order to successfully alter a blockchain, you must modify each block in the chain, redo the proof-of-work or proof-of-stake calculations for every block, and seize control of more than 50% of the peer-to-peer network. When that happens, other people will accept your modified block. Doing this is essentially impossible. The authors of [20] put out a paradigm that concentrates on how a group of volunteers might finish a project without the aid of any outside institutions. This keeps it extremely secure and nearly impenetrable to cyberattacks.

Blockchain lessens the concerns of security, keeping tabs on the usage of funds and the influence it holds, by facilitating the peer-to-peer investment procedure for investors. We have used the Ethereum blockchain to develop a decentralised fundraising platform. An investor will be able to monitor his funds using our application, knowing where they are being utilised and by whom. Subsequently, decentralised crowdfunding will eventually eradicate frauds and improve transparency [12].

B. Crowdfunding through Blockchain

Crowdfunding using blockchain allows decentralization i.e., it will prohibit the control of smart contracts by a particular platform or organisation. Peer-to-peer networks collectively adhere to a protocol for inter-node communication and validate new blocks, making the blockchain secure and reliable so no block can be changed without the consent of more than 50% of nodes [13]. All of us could create projects and fund the projects we like with null processing charges. Smart contracts can handle all transactions in a manner that preserves all the money in it and prevents it from being sent to third parties.

Companies create their own cryptocurrencies called Initial Coin Offerings (ICO). It is a term for initial release of a new digital asset. It is similar to Initial public offering (IPO) in the stock market. It functions similarly as other crowdfunding websites. A group of people who are interested in supporting a project are invited to contribute funds when the project's creator posts information about it online. Similar to how the stock market operates, initial coin offerings involve investors purchasing cryptocurrency tokens that represent shares in the project [14].

C. What is the current state of crowdfunding ?

All crowdfunding transactions currently take place on various crowdsourcing platforms, which charge investors and contributors subscription or transaction fees to execute their requests which might be too high.

Along with the cost associated with involving other parties, another issue with traditional systems is the accessibility of resources. Usually, the third parties have biases either in favour of the funders or the developers. Although it appears fair, the traditional methodology is not truly just. This is a result of the implicated third parties' inescapable bias [15].

D. Ethereum

It is a kind of open public blockchain with the unique feature of ‘smart contract’. It enables executable codes which can handle transactions made over Ethereum. A smart contract is a programmatic agreement created and executed in the form of a code or a computer program. Solidity is one of the most popular languages that may be used to create a smart contract. There are various networks for Ethereum, one of which is the main network and the others virtual networks for testing [12].

II. LITERATURE REVIEW

In the present, crowdfunding is expanding rapidly, and numerous platforms have been developed in recent years. Secure and reliable crowdfunding is necessary for the development of a country's economy. Christofer Laurell et. al in [17] discusses the connection between crowdfunding and viability in social media. Crowdfunding through blockchain technology will help to provide opportunities smartly and securely. Authors of [18] provide an insight on the deep association between crowdfunding and the long-term growth of smart cities and smart countries. The writers of [19] discuss the significance of comprehending the investor's behaviour and emotions. The authors offered insight into the decision-making process used by crowd investors.

The authors of [19] put out a paradigm that concentrates on how a group of volunteers might finish a project without the aid of any outside institutions. In a crowdfunding scenario, Paper [21] suggests a recurrent auction process for cost-effective project assignment. When compared to other current methods, the study of the results obtained indicates that the suggested algorithm could increase both the investor's return and the developer's project allocation.

In 2016, Danhong Chen in [22] talks about building a college students entrepreneurship crowdfunding website. An in-depth investigation of college students' entrepreneurial crowdfunding websites, from conception to promotion, is conducted in this paper.. He also talks about it as a market feedback platform. The essay uses a college students entrepreneurship crowdfunding website as its primary research tool and therefore only discusses student entrepreneurs in its discussion.

Danhong Chen along with Zhanyang Song and Tianyu Yi published another research paper in 2016. In [23] they talk about different types of crowdfunding like forward purchasing crowdfunding, public welfare crowdfunding, stock ownership crowdfunding, creditor right crowdfunding. Paper explains about crowdfunding and its architecture. However, it also has drawbacks, such as a lack of recommendations for configurations, design concepts, profitable uses, and technology.

Weilin Zheng et.al in the year 2019 published a paper on ‘NutBaaS: A Blockchain-as-a-Service Platform’. [24] introduces a number of more sophisticated technological services, including Identity Chain technology and smart contracts security vulnerability detection. Additionally, it talks about the BaaS infrastructure's dependability and the additional trust issues that it raises. It also points out some shortcomings of blockchain technology. The complexity of blockchain technology makes it challenging and expensive for the majority of developers and teams to create, maintain, and watch over a network that supports their apps.

Felix Hartmann et. al in 2019 in [5] compares the success characteristics of conventional and blockchain-based crowdfunding. Crowdfunding's intriguing feature is that it makes initial investments available to non-professional (retail) investors. Before the popularity of crowdsourcing, only

accredited (professional) investors were allowed to invest in this market. Blockchain-based crowdfunding is still mostly unorganized as compared to crowdfunding of the first generation.

In the year 2020, Vikas Hassija et. al in [26] proposed a blockchain-based crowdfunding for future smart and connected nations called Bitfund. On the basis of blockchain technology and Ethereum smart contracts, it proposed a distinctive and safe crowdfunding platform. Additionally, based on the Hungarian algorithm, it presented an iterative auction technique for cost-effective project assignment.
Uzair Bagadia et.al in [12] demonstrates how adopting Ethereum might increase transparency and, to some extent, prevent frauds in crowdfunding. But it does not consider the behaviour of investors and developers.

Nikhil Yadav in [13] talks about venturing crowdfunding using smart contracts in blockchain. It describes in a nutshell every part of the project: Project creation, spending requests, Voting System, Implementation and result analysis. Decentralization, which implies that no single platform or group of people may manage the smart contracts, makes the network as a whole transparent and makes crowdfunding possible.

Just a year ago i.e., in 2021 Ye Fan et. al in [29] proposes an idea that if unreasonable expenditures are done, the donation will automatically be taken out of the recipient's wallet and refunded to the investor or donor. It presents a theoretical idea. But no detailed framework is proposed.

III. Methodology

In our project, we have used Ethereum blockchain due to its applicability in a huge number of cases. Ethereum block chain uses smart contracts, which is the brain of our application. Simply said, a smart contract functions as an account that is controlled by code rather than a human [12]. The quantity of ether that the account possesses will be tracked by the smart contract in field balance. Storage field for data storage and code containing the contract's raw machine code.

First step after selecting the project domain and topic was to select a blockchain. We had three options – Ethereum, Solana and creating a new blockchain. A new blockchain must be built from the ground up, which takes time and involves technical expertise in decentralized ledgers, cryptography, consensus algorithms, and blockchain design.

Ethereum supports up to 15 TPS (Transactions per second) while Solana supports up to 65,000 TPS. On Ethereum network average fee per transaction is $15 on the other hand Solana has average fee per transaction of $0.0015. However, since blockchain is a peer-to-peer network, more nodes (validators) there are, the more secure the network is. Ethereum has over 2,00,000 validators while Solana has over 1,500 validators. Apart from this when we talk about building Dapps, Ethereum is the clear winner as it has been in the crypto-space for a long time. Ethereum hosts around 3,500 Dapps while Solana hosts around 350 Dapps.

Thus, it was comparatively easier to find tutorials and articles related to Solidity (Programming language for writing smart contracts that interact with Ethereum network) and Ethereum as compared to Solana. Considering all these factors we chose Ethereum as a blockchain to build our Dapp.

Second step was to create a front-end for our website. Front-end is the part of the website that directly interacts with the user. We created the complete front-end user interface of our Dapp from scratch without using any framework or library. Creation of the web pages was done by using HTML, CSS and JavaScript.

Third step following the creation of the front-end was to create our back-end. This involved creating a Smart Contract (using Solidity programming language) which would control all the transactions and logical decisions to be taken on the website. Crowdfunding may involve several transactions and user's personal information, thus controlling actions by a legal method is necessary. Smart contracts are therefore being employed, which will carry out transaction protocols automatically. Here, we've employed smart contracts, in which every piece of data is encrypted [31].

Fourth step was compiling the smart contract that will get you the Bytecode and ABI (Application Binary Interface). The ABI would be used in our front-end application while bytecode would be deployed on our Ethereum network. As we need real-time money to deploy our Bytecode on Ethereum main net we used a local Ethereum test network called as Ganache.

Fifth step involved integrating our front-end with our back-end. Web3.js was used to do this. Using HTTP, IPC, or WebSocket, you can communicate with a local or remote Ethereum node using the Web3.js family of libraries [21].
Sixth and final step involved testing our Dapp. We analysed and removed bugs from our website. Re-tested complete Dapp for many times and made sure it was ready to be deployed on Ethereum main net.

This paper suggests a Dapp with two different user types: one who initiates a project and another who contributes funding to it. User profiles of proposed users are as follows:

A. Creator profile

Users who visit the website hoping to raise funding for his desired project are addressed as Creators. Once the creator decides the financial terms, he needs to go on the Create project page and fill in all the details related to his project like project name, project description, amount of funds needed, date before which the funds must be raised and a logo of their project.

B. Investor Profile

Users who visit the website to discover new projects that have potential to scale and become better, can see all the listed projects on the site. An investor who wants to contribute to the ongoing project may enter his desired investment amount in eth. Once he proceeds the transaction will be processed through Metamask and the entered amount will be deducted from the investor's wallet. These ethers will then be transferred to a smart contract.

Smart contract holds the given amount until the deadline mentioned by the creator of the project is reached. If the amount needed has been raised then the funds will be transferred to Creator's wallet. The money is refunded to the appropriate investors if the funding target is not met.

A conceptual model known as system architecture outlines the behaviour and organisation of a system. It shows workflow of application as well as displays all its components and their interrelation.

Smart contract holds the given amount until the deadline mentioned by the creator of the project is reached. If the amount needed has been raised then the funds will be transferred to Creator's wallet. The money is refunded to the appropriate investors if the funding target is not met.

A conceptual model known as system architecture outlines the behaviour and organisation of a system. It shows workflow of application as well as displays all its components and their interrelation.

System architecture for our Dapp is given below.

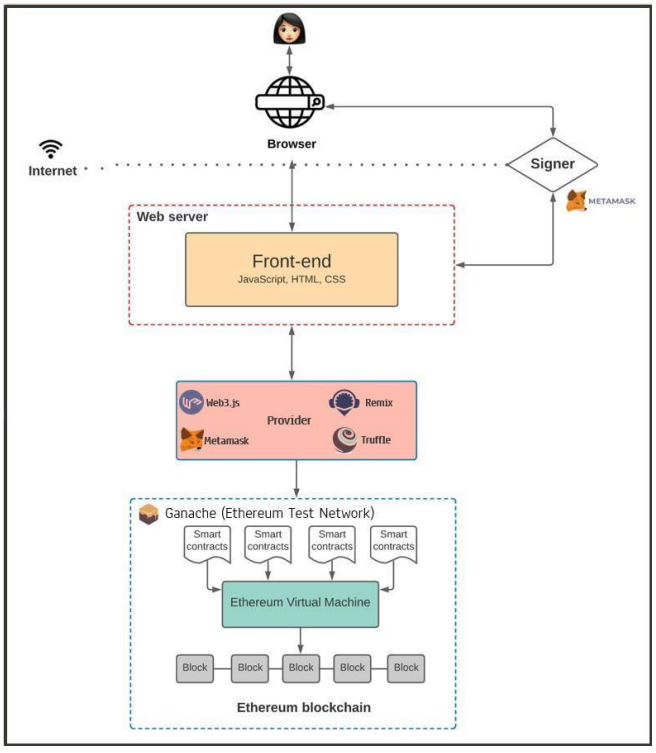

Figure. 1. System Architecture

IV. Result and Discussions

Our knowledge of the adoption and use of these platforms is improved through empirical research of how crowdfunding has changed in light of potential competitors' technologies. Through the use of crowdfunding, it is possible to reach a wide audience by overcoming geographical limitations[33]. Additionally, crowdfunding has restrictions because its platforms are constrained by national borders and legal systems, whereas blockchain technologies are not. The relationship between crowdfunding and blockchain is a key area of study because of the disruptive potential that these two phenomena, together with the subsequent phenomenon of cryptocurrencies and ICOs, have [34].

The complete website consists of six web pages linked to one another – Ethfund landing page, login, register, about, create project, fund project. Landing page consists of links to all pages. Create project page consists of details required to be entered while creating a new project. Fund project page displays all the projects listed on the website till date. And each project on clicking opens up a new page displaying project details, description, funding details and an option to fund the project.

Given below are some screenshots of the final website.

Figure. 2. Screenshot 1 – Landing Page

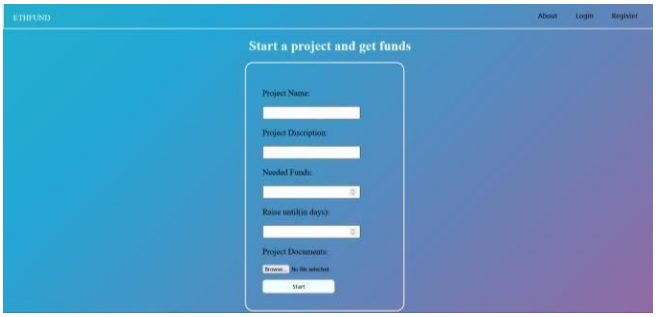

Figure. 3. Screenshot 2 – Create Project Page

Figure. 4. Screenshot 3 – Fund Project Page

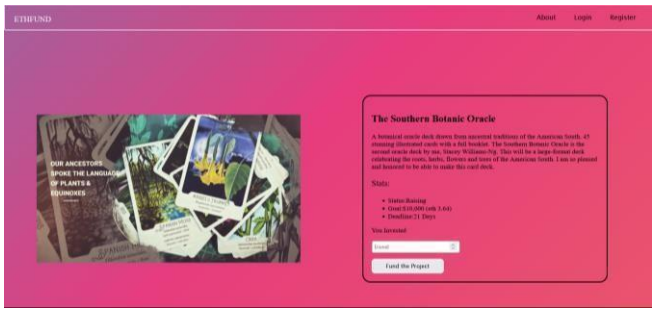

Figure. 5. Screenshot 4 – Demo Project

V. Limitations

Blockchain technology needs to address a number of existing problems before it can become a core technology for a variety of fields in the future. First, the Blockchain technology must become scalable and overcome its current drawbacks, which include low throughput, high latency, and rising storage requirements. For particular, it must look at significantly enhancing transaction execution speed by making use of multicore and cluster architectures' high concurrency.[35].

Crowdfunding campaigns occasionally provide false-negative outcomes. This is particularly the case when taking into account the concept of idea verification. Entrepreneurs can, for instance, mistakenly think that the project's failure originated from its inability to meet market demands. The fact that you must wait until the allocated period has passed before collecting the funds is one downside of crowdfunding campaigns.

Crowdfunding was first expected to democratise access to capital [36]. However, developments in the study of financial regulation [37] and the economic geography of crowdsourcing [38], [39] demonstrate that it hasn't been the case: geographical factors continue to influence investment choices via sentimental ties and local expertise [39], [41], cultural ties [38], and jurisdiction-specific regulations that restrict foreign investment [43]. For instance, equity and debt-based crowdfunding [37] is subject to restrictions on public advertising (e.g., in Australia and some regions of Europe), fundraising amount caps (e.g., in Europe), restrictions to specific investors exclusively (like those in the United States), across international borders (like those between United states and Europe [45]), or to all investors (like those in the United States) [34].

VI. Future Scope

Blockchain's initial implementation of cryptocurrencies like Bitcoin attracted a lot of attention. Blockchain technology has the ability to fundamentally alter how we interact, connect, and run emerging enterprises in the near future. Recently, academics, entrepreneurs, and researchers have been actively exploring various facets of blockchain technology [35].

Blockchain has enormous potential for creating a transparent, democratic, and secure framework for global industries. Numerous features of all Blockchain implementations will remain to be popular research areas such as consensus mechanism, network layer, cryptography and second layer solutions.

VII. Conclusion

Blockchain technology offers creative solutions to the challenges facing public welfare crowdfunding, enhancing the organisations' and businesses' credibility, enhancing the scrutiny of recipients' eligibility information, as well as increasing the flow of donations' transparency and resolving the issue of donations' supervision. [49].

Up to a point, Ethereum can enhance transparency and do away with unlawful crowdfunding practices. Additionally, it will increase public confidence in the entire fund-raising system by encouraging contributions from the general public. This has demonstrated how solidity can be used to create smart contracts. We have thought about two distinct aspects of real-world crowdfunding applications.: 1. Flexible project allocation and 2. Secured and Decentralized system. In the ICT sector, crowdfunding on the blockchain is an idea that is still in its infancy. Our proposed work has a promising future and plenty of room for improvement and growth given the development of Blockchain.

VIII. Appendix

Internet crowdfunding first gained popularity and mainstream use in the arts and music communities. The phenomenon of crowdfunding is more ancient than the term "crowdfunding". Crowdfunding is a part of crowdsourcing, which is a much wider phenomenon itself. Our aim is to decouple the financing of entrepreneurs from the harsh world of Private Equity. Through crowdfunding, a business venture can be financed with small sums of money from a large number of contributors.

IX. Acknowledgement

Our profound gratitude goes out to Prof. Smt. Smita Samrat Mande, who served as our mentor throughout the project, for her kind advice, unwavering encouragement, and elevating inspiration. We also thank the project coordinators for their advice, constructive criticism, and assistance in setting up the facilities required to complete the project work successfully. Additionally, it aids in our extensive research and knowledge acquisition.

X. References

[1] J. R. Anderson, Security Engineering: A Guide to Building Dependable Distributed Systems, 2nd ed. Indianapolis, IN, USA; Wiley, 2008.

[2] L. Lamport, ‘‘Password authentication with insecure communication,’’ Commun. ACM, vol. 24, no. 11, pp. 770–772, Nov. 1981.

[3] R. Schollmeier, ‘‘A definition of peer-to-peer networking for the classification of peer-to-peer architectures and applications,’’ in Proc. 1st Int. Conf. Peer Peer Comput., Linkoping, Sweden, 2001, pp. 101–102.

[4] Tim Smith. “Crowdfunding” investopedia.com. https://www.investopedia.com/terms/c/crowdf unding.asp (accessed //Date//, 2022).

[5] F. Hartmann, G. Grottolo, X. Wang and M. I. Lunesu, "Alternative Fundraising: Success Factors for Blockchain-Based vs. Conventional Crowdfunding," 2019 IEEE International Workshop on Blockchain Oriented Software Engineering (IWBOSE), 2019, pp. 38-43, doi: 10.1109/IWBOSE.2019.8666515.

[6] S. Nakamoto. Bitcoin: A peer-to-peer electronic cash system. White Paper, Accessed 2019-09-19. 2008. URL: https://bitcoin.org/bitcoin.pdf.

[7] C. Prybila, S. Schulte, C. Hochreiner, and I. Weber. “Runtime verification for business processes utilizing the Bitcoin blockchain”. In: Future Generation Computer Systems 107 (2020), pp. 816–831.

[8] P. Ruan, G. Chen, T. T. A. Dinh, Q. Lin, B. C. Ooi, and M. Zhang. “Fine-Grained, Secure and Efficient Data Provenance on Blockchain Systems”. In: PVLDB 12.9 (2019), pp. 975– 988.

[9] M. Sigwart, M. Borkowski, M. Peise, S. Schulte, and S. Tai. “Blockchain-based Data Provenance for the Internet of Things”. In: 9th International Conference on the Internet of Things. ACM, 2019, 15:1–15:8.

[10] F. Tian. “An agri-food supply chain traceability system for China based on RFID & blockchain technology”. In: 2016 13th International Conference on Service Systems and Service Management. IEEE, 2016, pp. 1–6.

[11] M. Mettler. “Blockchain technology in healthcare: The revolution starts here”. In: 2016 IEEE 18th International Conference on eHealth Networking, Applications and Services. IEEE, 2016, pp. 1–3.

[12] U. Bagadia, J. Bodkurwar, J. Bhat and A. Halbe, "Performance Analysis of Decentralized Ethereum Blockchain System," 2020 International Conference on Inventive Computation Technologies (ICICT), 2020, pp. 127-131, doi: 10.1109/ICICT48043.2020.9112550.

[13] N. Yadav and S. V., "Venturing Crowdfunding using Smart Contracts in Blockchain," 2020 Third International Conference on Smart Systems and Inventive Technology (ICSSIT), 2020, pp. 192-197, doi: 10.1109/ICSSIT48917.2020.9214295.

[14] Brian Edmondson. “How Bitcoin and Blockchain are changing crowdfunding.” thebalance.com. https://www.thebalance.com/how-bitcoin-andblockchain-is-changing-crowdfunding4173837.

[15] Brian Edmondson. “How Bitcoin and Blockchain are changing crowdfunding.” thebalance.com. https://www.thebalance.com/how-bitcoin-andblockchain-is-changing-crowdfunding4173837.

[16] Z. Wang, L. Yang, Q. Wang, D. Liu, Z. Xu and S. Liu, "ArtChain: Blockchain-Enabled Platform for Art Marketplace," 2019 IEEE International Conference on Blockchain (Blockchain), 2019, pp. 447-454, doi: 10.1109/Blockchain.2019.00068.

[17] C. Laurell, C. Sandstrom, and Y. Suseno, “Assessing the interplay between crowdfunding and sustainability in social media,” Technological Forecasting and Social Change, vol. 141, pp. 117–127, 2019.

[18] A. Motylska-Kuzma, “Crowdfunding and sustainable development,” Sustainability, vol. 10, no. 12, p. 4650, 2018.

[19] E. Lins, K. J. Fietkiewicz, and E. Lutz, “How to convince the crowd: An impression management approach,” in 2016 49th Hawaii International Conference on System Sciences (HICSS). IEEE, 2016, pp. 3505–3514.

[20] P. Soares, R. Saraiva, I. Fernandes, A. Neto and J. Souza, "A Blockchain-based Customizable Document Registration Service for Third Parties," 2022 IEEE International Conference on Blockchain and Cryptocurrency (ICBC), 2022, pp. 1-2, doi: 10.1109/ICBC54727.2022.9805500.

[21] “Web3.js – Ethereum JavaScript API” web3js.readthedocs.io https://web3js.readthedocs.io/en/v1.7.0.

[22] D. Chen and T. Yi, "Establishment and Operation of College Students Entrepreneurship Crowdfunding Website Based on the Crowdfunding Mode," 2016 8th International Conference on Intelligent HumanMachine Systems and Cybernetics (IHMSC), 2016, pp. 230-233, doi: 10.1109/IHMSC.2016.256.

[23] Z. Song, D. Chen and T. Yi, "The research on construction and application of college students entrepreneurship crowdfunding platform," 2016 Chinese Control and Decision Conference (CCDC), 2016, pp. 4483-4486, doi: 10.1109/CCDC.2016.7531792.

[24] W. Zheng, Z. Zheng, X. Chen, K. Dai, P. Li and R. Chen, "NutBaaS: A Blockchain-as-aService Platform," in IEEE Access, vol. 7, pp. 134422-134433, 2019, doi: 10.1109/ACCESS.2019.2941905.

[25] D. Li, Q. Guo, D. Bai and W. Zhang, "Research and Implementation on the Operation and Transaction System Based on Blockchain Technology for Virtual Power Plant," 2022 International Conference on Blockchain Technology and Information Security (ICBCTIS), 2022, pp. 165-170, doi: 10.1109/ICBCTIS55569.2022.00046.

[26] Vikas Hassija, Vinay Chamola, Sherali Zeadally, BitFund: A blockchain-based crowd funding platform for future smart and connected nation, Sustainable Cities and Society, Volume 60, 2020, 102145, ISSN 2210-6707, https://doi.org/10.1016/j.scs.2020.102145. (https://www.sciencedirect.com/science/article/pii/S2210670720301323)

[27] P. Shen et al., "A Survey on Safety Regulation Technology of Blockchain Application and Blockchain Ecology," 2022 IEEE International Conference on Blockchain (Blockchain), 2022, pp. 494-499, doi: 10.1109/Blockchain55522.2022.00076.

[28] X. Liang, N. An, D. Li, Q. Zhang and R. Wang, "A Blockchain and ABAC Based Data Access Control Scheme in Smart Grid," 2022 International Conference on Blockchain Technology and Information Security (ICBCTIS), 2022, pp. 52-55, doi: 10.1109/ICBCTIS55569.2022.00023.

[29] Y. Fan, C. Ao and L. Jingren, "Research on the Application Model of Public Welfare Crowdfunding Based on Blockchain Technology," 2021 2nd International Conference on E-Commerce and Internet Technology (ECIT), 2021, pp. 441-445, doi: 10.1109/ECIT52743.2021.00098.

[30] L. Ambrosini, M. Piškorec and C. J. Tessone, "Visualization of Blockchain Consensus Degradation," 2022 IEEE International Conference on Blockchain and Cryptocurrency (ICBC), 2022, pp. 1-2, doi: 10.1109/ICBC54727.2022.9805498.

[31] A. Jain, A. Kumar Tripathi, N. Chandra and P. Chinnasamy, "Smart Contract enabled Online Examination System Based in Blockchain Network," 2021 International Conference on Computer Communication and Informatics (ICCCI), 2021, pp. 1-7, doi: 10.1109/ICCCI50826.2021.9402420.

[32] Q. Guo, S. Chen, J. Wang and X. Pan, "Research and Design of Electric Power Engineering Project Management System Bsed on Blockchain Technology," 2022 International Conference on Blockchain Technology and Information Security (ICBCTIS), 2022, pp. 80-84, doi: 10.1109/ICBCTIS55569.2022.00029.

[33] D. Verhoeven, and S. Palmer, “Because it takes a village to fund the answers: Crowdfunding university research,” in Crowdfunding the Future— Media Industries, Ethics, and Digital Society. L. Bennett, B. Chin, and B. Jones, Eds. New York City, NY, USA: Peter Lang, 2015, pp. 133–156.

[34] C. I. Bogusz, C. Laurell and C. Sandström, "Tracking the Digital Evolution of Entrepreneurial Finance: The Interplay Between Crowdfunding, Blockchain Technologies, Cryptocurrencies, and Initial Coin Offerings," in IEEE Transactions on Engineering Management, vol. 67, no. 4, pp. 1099-1108, Nov. 2020, doi: 10.1109/TEM.2020.2984032.

[35] M. N. M. Bhutta et al., "A Survey on Blockchain Technology: Evolution, Architecture and Security," in IEEE Access, vol. 9, pp. 61048-61073, 2021, doi: 10.1109/ACCESS.2021.3072849.

[36] E. Mollick and A. Robb, “Democratizing innovation and capital access,” California Manage. Rev., vol. 58, no. 2, pp. 72–87, 2016.

[37] M. Herzenstein, S. Sonenshein, and U. M. Dholakia, “Tell me a good story and I may lend you my money: The role of narratives in peertopeer lending decisions,” J. Marketing Res., vol. 48, pp. 138–149, 2011.

[38] G. Burtch, A. Ghose, and S. Wattal, “An empirical examination of the antecedents and consequences of contribution patterns in crowd-funded markets,” Inf. Syst. Res., vol. 24, no. 3, pp. 499–519, 2013.

[39] O. Lehner “The formation and interplay of social capital in crowdfunded social ventures,” Entrepreneurship Regional Develop., vol. 26, no. 5/6, pp. 478–499, 2014.

[40] J. Wang and B. Palanisamy, "Protecting Blockchain-based Decentralized Timed release of Data from Malicious Adversaries," 2022 IEEE International Conference on Blockchain and Cryptocurrency (ICBC), 2022, pp. 1-2, doi: 10.1109/ICBC54727.2022.9805506.

[41] G. Giudici, M. Guerini, and C. Rossi-Lamastra, “Reward-based crowdfunding of entrepreneurial projects: The effect of local altruism and localized social capital on proponents’ success,” Small Bus. Econ., vol. 50, no. 2, pp. 307–324, 2018.

[42] H. Liu, H. Zhang, B. Chen and A. W. Roscoe, "Committable: A Decentralised and Trustless Open-Source Protocol," 2022 IEEE International Conference on Blockchain and Cryptocurrency (ICBC), 2022, pp. 1-2, doi: 10.1109/ICBC54727.2022.9805541.

[43] J. H. Block, M. G. Colombo, D. J. Cumming, and S. Vismara, “New players in entrepreneurial finance and why they are there,” Small Bus. Econ., vol. 50, no. 2, pp. 239–250, 2018.

[44] R. Zhou and Z. Lin, "A Privacy Protection Scheme for Permissioned Blockchain Based on Trusted Execution Environment," 2022 International Conference on Blockchain Technology and Information Security (ICBCTIS), 2022, pp. 1-4, doi: 10.1109/ICBCTIS55569.2022.00012.

[45] D. Brüntje and O. Gajda, Crowdfunding in Europe: State of the Art in Theory and Practice. Berlin, Germany: Springer, 2015.

[46] I. Fedotov, A. Khritankov and A. Barger, "Optimizing multi-party agreement protocols," 2022 4th Conference on Blockchain Research & Applications for Innovative Networks and Services (BRAINS), 2022, pp. 55-58, doi: 10.1109/BRAINS55737.2022.9909284.