A Framework for Crowdfunding Platform Using Ethereum Blockchain Technology

Jatin Manav Mutharasu, Utshav Pandey, B. Rethick, Bhavika Kulkarni, and Prof. Mohandas Pawar

1 Introduction

1.1 Crowdfunding

In crowdfunding, companies pitch their idea to a large network of people and provide them an opportunity to invest in it if they find it promising rather than call for a small knowledgeable group of investors as mentioned in [1]. Crowdfunding has become a valuable means of raising capital investment and has given non-traditional projects, such as ideas of start-ups or hopeful creatives, a new audience to pitch their idea. Small Companies especially benefit from the use of crowdfunding as discussed in [2]. Such businesses may find it hard to obtain funding from traditional sources such as bank loans due to their lack of historical data. There are different types of crowdfunding:

1.1.1 Equity-Based Crowdfunding

The investors will be granted a share in the enterprise or startup with equity-based crowdfunding, depending on how much money they invest. Equity-based crowdfunding is linked to complex contracts involving due diligence and a high degree of investment, which means that funders are fully aware of the advocates and the company. It could make equity investments in an online audience seem nonsensical [3].

1.1.2 Reward-Based Crowdfunding

The bonuses are earned by crowd funders who donate funds or contribute to the fundraising, depending on the amount of the money raised by the organization or project. The reward might be a product or other goodies that they develop. Crowd-

J. M. Mutharasu (✉) · U. Pandey · B. Rethick · B. Kulkarni · Prof. M. Pawar
MIT School of Engineering, Pune, India
e-mail: mohandas.pawar@mituniversity.edu.in

funding on a reward basis is particularly popular among entrepreneurs as described in [4].

1.1.3 Donation-Based Crowdfunding

With donation-based crowdfunding, people contribute different sums of money according to the idea put forward by the beneficiaries without any hopes and rewards or costs. Such crowd financing usually starts to support voluntary organizations, disaster relief, and the collection of emergency funds [5].

1.2 Blockchain

Blockchain is an upcoming comprehensive system used in areas such as cryptocurrency, banking, insurance, government, music, identification, supply chain, information management, and many others. By understanding the underlying mechanisms that power blockchain, one can join the discussion and explore use cases for blockchain in your own life and work. It is a distributed ledger which permits storing of the data, as mentioned in [6], in an immutable and auditable way. Two types of blockchains exist private and public blockchains. There are nevertheless also numerous variations, such as hybrid blockchains and consortium blockchains. Let us research what characteristics all blockchains share before we concentrate on the individual characteristics of each blockchain. A collection of nodes running in a peer-to-peer network (P2P) is included in each blockchain. Every node in a network has a shared copy of the ledger which is updated in regular intervals. Each node can validate transactions, begin or accept transactions and generate blocks. Now let's have a look in detail about the four types of blockchains that are possible as seen in [7].

1.2.1 Public Blockchain

A public blockchain is essentially a shared ledger network which is not limiting and can be accessed without permission. Anyone who has a way to the internet can sign up for an approved node on a blockchain platform and join the blockchain network. This enables the delivery of the data and guarantees its integrity as seen in [8]. A node or user in the blockchain is allowed to view, inspect transactions, or perform proof of work on a block input [9] and also mining for current block. The primary use of public blockchains is in cryptocurrencies mining and exchange. Ethereum [10] and Bitcoin [11] are the most frequently used public blockchains.

1.2.2 Private Blockchain

A private or permissioned blockchain is essentially a blockchain operated in a closed network. Private blockchains are used in an organization or company where only a few predefined members participate in the blockchain network. The controlling association shall be responsible for the degree of protection, permits, accessibility. So, private blockchains have a small, restrictive network but are similar to public blockchains. First, permission must be given to any node in a private blockchain, leading to greater confidence. As studied in [12], this contributes to improved results. Private blockchain networks are utilized in many domains which include voting [13] and supply chain management [14] and Digital ID [15].

1.2.3 Consortium Blockchain

A blockchain consortium is semi-permissioned in which multiple organizations control a blockchain network. This is contrary to what we have seen in a private blockchain that is operated by only one entity. In [7] we saw that in this type of blockchain, several associations can act as a node and trade commercial data, or mine. Consortium Blockchains are typically used by banks [16], energy trading [17], etc.

1.2.4 Hybrid Blockchain

A hybrid blockchain is a public and private blockchain aggregate. It uses the attributes of both, hence a private permission operation and a public permission-free operation can both be performed. Users control who has access to data stored in a blockchain via such a hybrid network. Only a predefined division of blockchain records can be accessed publicly and designating the rest as confidential in a privately owned network. The hybrid blockchain framework can be expanded to allow users to search easily for a private blockchain with multiple public blockchains. A transaction is typically performed inside the private network of a hybrid blockchain. But users can also issue it for verification in the public blockchain. The public blockchains extend the hashing process and include other verifying nodes. As defined in [7], this improves the certainty and clarity of the blockchain.

1.3 Ethereum

While every blockchain can process code, most are severely restricted. Ethereum is distinctive. Rather than providing a collection of restricted services, Ethereum provides developers to implement whatever services they want. This implies developers

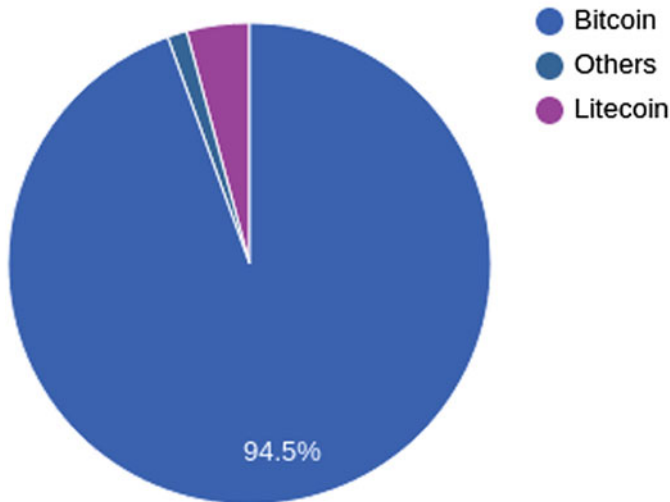**Cryptocurrency Market Capitalization (May 13, 2013)**

Fig. 1 The market share of different cryptocurrencies as of May 13, 2013

can make thousands of diverse applications that operate way past anything we have witnessed before as explained in [10] (Fig. 1).

Buterin was fascinated by the blockchain technology and co-founded Bitcoin Magazine. He began imagining a network which would go beyond Bitcoin's financial use cases and publish a 2013 White Paper explaining, with a general scripting language, how it would become Ethereum. The main Bitcoin differentiator was the network's ability to trade more than cryptocurrencies. Buterin and the other Ethereum founders started a campaign to encourage crowdsourcing in 2014, selling participants Ether to raise more than 18 million dollars from their vision. Ethereum began its first live release in 2015, known as Frontier. Since then, the platform has evolved steadily and hundreds of developers are now interested.

1.4   Smart Contracts

A Smart Contract is just an expression to describe a code of machines that can facilitate trade in money, material, property, shares, or anything that is of significance. When operating on the blockchain a smart contract becomes like a self-operating computer application that executes when explicit requirements are satisfied. As mentioned in [18, 19] they run on the blockchain because smart contracts operate accurately as configured without any licencing chance, downtime, fraud, or interference from third parties. While every blockchain can process code, most are firmly lim-

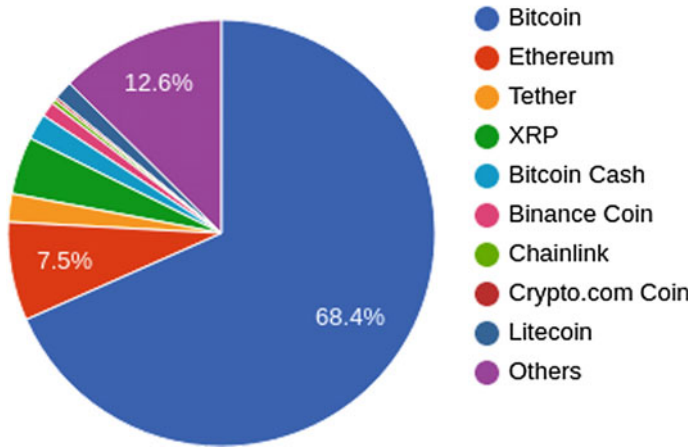**Cryptocurrency Market Capitalization (December 31, 2019)**

Fig. 2 The market share of different cryptocurrencies as of December 31, 2019

ited. Ethereum is unique in this aspect. Ethereum allows developers to offer whatever resources they need rather than offering a small amount of help. This allows developers to produce thousands of distinct applications that work way beyond anything we have thought of earlier (Fig. 2).

1.5 Blockchain-Based Crowdfunding

Though traditional crowdfunding systems do well, there are major concerns from the sponsors of the project. As stated in [20] for example, incentive-based crowdfunding or reward-based crowdfunding projects give the project supporter some incentive depending on how much money they deposit but, sometimes they're conned or the incentives are given very late. These issues can be solved using a blockchain-based approach to these issues that delivers faster transfers and withdrawals as compared with normal means. Another major issue that blockchain solves is fake data and misleading transactions, which could pose problems for the company. Many Blockchain technologies use proof of work which guarantees that there are no fraudulent transactions or false data present that can impact the initiative as well as removing the need for an intermediate portal to commit their valuable assets to the proposed project. This can be an important aspect of improving the initiative. Reward-based crowdfunding is a modern concept that promotes and democratizes the process of fundraising for launching risky and creative ventures in a range of economic fields. Reward-based blockchain platforms are really great for launching new products, services, and brands since It's one of the cheapest ways to raise capital. They are also prefer-

able to other platforms for expanding into new territories as the process is fairly simple with no previous experience needed and the exposure on the platform can help to build awareness of customers and brands.

2   Literature Survey

Research work in the field of blockchain-based crowdfunding deals with the effects of blockchain-based technology in initial coin offerings [21, 22], donation-based crowdfunding [18], and general comparisons between traditional and blockchain-based approaches [20, 23]. There is a lack of research work in the field of reward-based crowdfunding using blockchain technology. This paper hopes to solve this research gap by providing a framework for reward-based crowdfunding using blockchain technology.

In 2019, Hartmann et al. [23] presented what blockchain-based crowdfunding is, how it is comparable to that of the traditional crowdfunding system, and what makes it unique and different from the conventional system. Although both traditional crowdfunding and blockchain-based versions are popular, understanding is insufficient when it comes to blockchain-based explications, and it is important to understand that to solicit investors. Understanding these certain concepts will help others to know how blockchain frameworks work and how it supplements the existing traditional system.

In 2019, Saadat et al. [20] inscribed that although initially blockchain has been implemented only for cryptocurrencies, now there is a surge in the use of blockchain as many foundations are preferring the use of it. Soon, blockchain will replace all other transaction platforms. One such platform is crowdfunding because some of the campaigns are not standardized and some turn out to be a fraud. It explores the use of Ethereum-based dApp to solve many issues. It exploits the use of smart contracts and how it will be automatically used and how it will help solve problems in the current system.

In 2019, Brennecke et al. [21] formulated that crowdfunding has been gaining acknowledgment from entrepreneurs for raising resource funding. It explains crowdfunding as a public solicitation to invest in a project which is published by the ones in need via the internet. It exploits the use of ICO's for developing blockchain-based variants for crowdfunding as this crowdfunding ecosystem relies on P2P transactions. Thus it will make the crowdfunding notion between the ones seeking funds and the ones helping them to raise it fascinating. It will make transactions more reasonable, more productive, and more transparent.

In 2016, Jacynycz et al. [24] inferred crowdfunding being implemented over centralized platforms and these platforms are commission-based ones. It discussed the use of an Ethereum-based decentralized platform being implemented for crowdfunding campaigns. The pros of using this approach are that no one can tamper with its code and charge commissions to its users. This system will not only be used by the ones proposing the project but also the ones funding it. The blockchain-based

approach will meddle the frauds in this field and empower its users in a more decentralized fashion.

In 2015, Ante et al. [22] explored the determinants of a blockchain-based Initial Coin Offering's Success based on varied factors. They have found that ICOs resemble established crowdfunding and venture capital markets and that the funds raised by an ICO depend on factors such as human capital, consistency of the business model, project growth, and their presence on social media. They have stated that the importance of social media cannot be quantified and further analysis is needed. Hence they have concluded that ICOs are a neoteric way to fund start-ups that shift closer to conventional structures as markets develop and blockchains become widely accepted.

In 2019, Zichichi et al. [18] constructed a blockchain-based Crowdfunding built over the Ethereum network called LikeStarter. They have chosen a donation-based approach to crowdfund and place emphasis on funding creative pursuits. It has been built in the form of a social networking site to promote able artists hence raising money for their future projects. Published content receives appreciation in the form of likes, comments, and shares. Every like corresponds to a transaction transferring ether to the crowdfunding beneficiary. A beneficiary can also offer rewards to his fans to attract further contributions.

In 2018, Zheng et al. [18] discussed the advantages and disadvantages of blockchains. They noticed that no blockchain study existed both in technology and implementation and tried to fill this void. Blockchain is lauded for its decentralized infrastructure and peer-to-peer nature. It has shown the potential to transform traditional industries with its anonymity, persistence, and decentralization. They have also studied the typical consensus algorithms used and compared them with each other. They have analyzed the praxis of blockchain and further studied the factors which may inhibit the widespread adoption of such applications. They have also inferred solutions that can rectify this and further improve the existing solutions.

In 2019, Yaga et al. [25] provided a technical overview and tried to help people understand the workings of blockchain technology. They began with the history and implementation of blockchain in Bitcoin. Bitcoin has played an indispensable role in the popularity of blockchain technology. They have further classified the types of blockchain present and the advantages of each. They have explained the working of blockchain along with a thorough explanation of each component. They have thoroughly explained why the blockchain functions as it does. They have compared various consensus models in depth and stated each of their advantages and disadvantages. They have further stated that a blockchain relies on existing technologies but uses them in new and compelling ways (Table 1).

3 Proposed System

Proof of work is a consent protocol in which transactions are checked and fraudulent transactions are prevented by nodes on a blockchain network. It varies from other

Table 1 Literature Survey

Year	Methodology	Features	Challenges
2019 [18]	This uses blockchain, digital signature, taxonomy of blockchain, consensus algorithms, finance, IoT, selfish mining, big data analysis, smart contracts, artificial intelligence	There is a broad range of blockchain implementations which vary from cryptocurrency, financial services, risk, IoT, public to social services	This article provides Taxonomy of bitcoin, Typical implementations of Consensus Network Algorithms, reviews software blockchain, and addresses the technological issues and new trends in task management
2019 [20]	In order to solve fraud problems, this project uses Ethereum's intelligent site contracts to provide the contracts within the prescribed time period	The Highlight of Crowdfunding is that in a short time it can collect the sum of money needed. This plans to add ERC-223 tokens in contracts as they provide further advantages	The biggest issue with the present world-wide crowd financing scene is that campaigns are not monitored and some crowd financing projects have been fraudulent
2019 [21]	Initial coin offer (ICOs) for peer-to-peer (P2P) funding was listed as one of the most promising and recognizable applications	These tokens can reflect any typical category of asset, and are now being used, for example, to define shareholdings in an organisation, consumer trust in online applications, fiat currency deposits, and cryptocurrency applications balances	The problem is to describe the core concepts and the variations between the ICOs and conventional financing and their possible effects on crowdfunding are discussed
2018 [22]	In this initial coin offering (ICO) success, investment fund blockchain, and crowdfunding was used.	ICOs are the big function which presents parallels with the traditional market for venture capital and crowdfunding	The major issue is to identify correlations between characteristics of funding performance including characteristics of human capital, efficiency of business model, project creation, and events in social media
2019 [23]	The Initial Coin Offerings (ICO), and recently Security Token Offers (STOs), are represented in this blockchain-based crowdfunding	The key function is to help regulations and market participants understand blockchain-based crowdfunding	The concern is that in comparison to conventional crowdfunding over recent years there has been a lack of clear understanding of the success of blockchains based ventures

Table 1 (continued)

Year	Methodology	Features	Challenges
2016 [24]	In this paper, Bitcoin, Blockchain, Bounty, Crowdfunding, Cryptocurrencies, Distributed Applications, Ethereum, Peer-to-Peer Networks, and Smart contract are used	This method does not need a central and trustworthy agency unlike traditional crowdfunding platforms	The issue is the idea, the reward and also enticing future developers to do so, is completed in a given time period
2019 [25]	The technologies used are blockchain, consensus model, cryptocurrency, cryptographic hash function, asymmetric-key cryptography, distributed ledger, distributed consensus algorithm, smart contracts, data oracle	Blockchain allows the user group to archive related transfers in a ledger within that group, so that it is under regular service in the network with blockchain and there should be no trade changed after it has been released	The challenge is to help readers understand how blockchain technology works
2020 [26]	In this paper, effective crowdfunding is implemented to fabricate a trustworthy current model, transparently, honestly, decentrally and cost-effectively	The function of the blockchain crowdfunding tools including anti-tampering, anti-fraud, open leather solutions can aid to provide information and data security	The challenge is to make the existing model of a pool of people contributing a small amount of money for the scheme or maybe cause and predict some Economic, or non-economic returns to a network focused on blockchain crowdfunding
2020 [27]	It is centered on the need for an innovative crowdfunding site for the creation of smart regions and the intrinsic functionality of blockchain technology	The two key aspects are a balanced project distribution that empowers developers and adjust the parameters iteratively in order to find the optimum solution, the latter is the effect of other developers' bids on the winning solution	The problem is that the numerous middlemen and intermediaries do not encourage the skilled professional tools to be used appropriately mostly because of their self-interest and lack of an effective structure or a platform to connect the talent with the appropriate talent hunters

negotiation processes, such as Proof of Stake which are used in the same way but have different approaches. In proof of work, mining is a part of the process of consensus, whereas in proof of stake, blockchain network mining is not accessible. All the participants have each got stakes instead. Smart Contracts are written in Solidity and then deployed to the Ethereum blockchain. Smart Contracts use a Programming code agreement between the two entities. Once the data is stored in the blockchain, the data can not be manipulated in the public database. These contracts are compiled to Application Binary Interfaces which provide an interface to interact with the blockchain. This system uses ReactJS to provide a seamless front-end user experience. Node.js and Express.js are used to build the backend API. When a new request is sent by the user, it is handled by calling the respective function from the ABI with the help of Web3.js which in turn adds a transaction to the blockchain. Web3.js is a javascript library that allows you to interact with a local or a remote Ethereum node. It provides an interface that allows the user to call functions from the ABI. This way the Web App is used to interact with the blockchain. All transactions in the Ethereum blockchain require gas to be validated. Hence, a small amount of ether is required to fund the transaction. This is accomplished by using a browser extension known as MetaMask. MetaMask is a bridge that allows users to have access to tomorrow's distributed platform. It allows running Ethereum-based decentralized apps in your browser without using a full Ethereum node. Every time a transaction is to be performed a small amount of ether will be deducted as gas to fund the validation of the transaction. It makes the device connect to another Ethereum node called Infura by which smart contracts can be executed. It manages the Ethereum wallet. All the transactions both sending and receiving happen through it which uses ether as the medium for the transaction. This transaction is then added to the pending queue in the Ethereum network with a bounty of the gas money that you paid. After the transaction is validated by a miner, It is appended to the Ethereum Network (Fig. 3).

This system also uses a No-SQL database called MongoDB. to save details about the user and the projects proposed. It is an alternative for relational databases. As compared to the relational database, MongoDB stores data in JSON format as key-value pairs instead of storing them as tables. These key-value pairs are stored as documents and all these documents add on to make a collection. A collection can contain any number of documents. A document may have multiple key-value pairs. MongoDB stores this data in BSON format which stands for binary JSON, which is an extended version of JSON which supports more data types than JSON. Every time a user proposes a new project, a new entry is added to the database. This entry contains all the details about the system including the funding target, the project idea, the rewards to be distributed et cetera. After a crowdfunding campaign is successfully set up, it can start receiving funds. Different investors can invest in different projects to their likability. After an investment, a reward is promised from the company or individual who owns the campaign to each individual who invested a certain sum of money. The rewards may differ depending on the sum of money invested in the campaign. If it is a small amount then some goodies may be promised and in case of a hefty sum, a sample of their product is given to the investor.
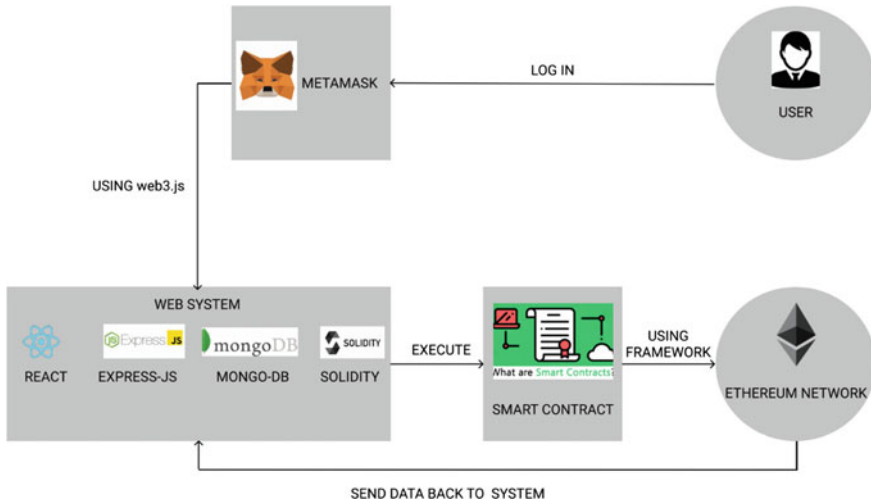
Fig. 3 The proposed system

4 Result

The Traditional Crowdfunding model is inefficient. It follows a centralized approach similar to venture capital firms with a single controlling platform. Funders have no assurance whether their funds are going toward the promised product. Traditional Crowdfunding platforms do not provide any assurance and this may scare potential investors. This affects entrepreneurs who have a good idea but do not have the funds required to start a business. Crowdfunding, with it's nature of multiple involved parties, can benefit immensely with the introduction of a decentralized approach. As seen in Fig. 4, blockchain-based crowdfunding is burgeoning in recent years. When a user first enters the platform's website, he is greeted by a home page where he can choose to create a new account, login, or explore existing campaigns. The homepage can additionally also highlight popular campaigns.

4.1 Campaign Creation

When a user decides to create a new campaign, they enter any details associated with the campaign in the website. After entering all associated data, they can create a transaction to deploy the data to a blockchain. This entry will contain all associated details such as campaign id, target amount, campaign name, campaign address, and incentives for funders. This way the data that is stored is immutable. This entry ensures that there is proof of the initial promise by the company which hence provides
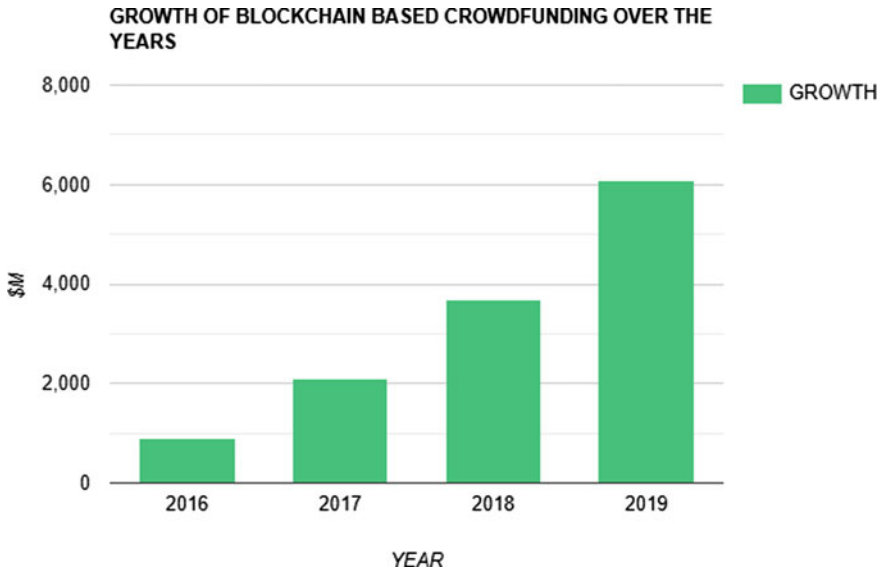
GROWTH OF BLOCKCHAIN BASED CROWDFUNDING OVER THE YEARS

Fig. 4 Capital raised by blockchain-based crowdfunding platforms

a testament in case they try to renege. This initial deployment will also take a small amount of gas in the form of ether.

4.2 Explore Campaigns

The explore page provides new users the opportunity to view all the existing crowd-funding campaigns along with the capital raised by them. It contains a catalogue of all the campaigns that are started by the user and have not yet reached their target amount. Each campaign has a small card along with some associated information about the campaign. The user can then choose to click on the campaign and view all the information provided by the company. If the user is logged in, the user can then decide if he wants to invest/donate in the campaign.

4.3 Invest in Campaign

If a user finds the company's pitch appealing, he can choose to donate to the campaign. All of the transactions take place using ether. A user can enter the amount he wants to invest in the provided field. Then the respective function from the smart contract will

be called. This transaction will be added to the blockchain. The incentive obtained will be based on the initial contract decided upon by the founding company.

4.4 Campaign Failure

If the campaign fails to reach the target amount in the specified duration, the smart contract ensures that the investors receive their originally invested amount. This data is present in the blockchain in the form of transactions and can be used for the same. This way every investor receives their investment back.

4.5 Campaign Success

If the campaign reaches the target amount in the specified duration, every investor receives the promised reward. The list of rewards offered is stored in the blockchain along with the list of all the investors and the amount invested. Since all of the data is stored in a blockchain, it cannot be modified later.

5 Conclusion

This paper presents the working model consisting of Ethereum and Crowdfunding which in turn provides a prominent platform. Crowdfunding helps in launching new businesses and a reward-based approach helps start-ups maintain their equity early on unlike an ICO approach. At the same time, Ethereum ensures that the business remains accountable and does not renege on its terms while also increasing the confidence of investors. This also encourages more people to invest in the product. Hence, both the business and the consumer benefit from an Ethereum based crowdfunding approach. With each passing day, people are understanding Blockchain technology much better and thus the scope for attracting interested audiences for our crowdfunding platform increases. Though this paper won't be the elixir to existing problems, we believe that combined with the understanding of the readers there will be desirable results.

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