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Crowdsourcing and Crowdfunding Platform using Blockchain and Collective Intelligence

Er.Waheeda Dhokley[1] , Saurabh Gupta[2*] , Ganesh Pawar[3] , Abrar Shaikh[4]

[1,2,3,4]Dept. of CS, M.H. Saboo Siddik College of Engineering, Mumbai University, Mumbai, India

**Corresponding Author: saurabhgupta14077041@gmail.com*

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Abstract- Startup companies are newly born companies or entrepreneurial ventures which are predominantly based on brilliant idea, innovation and statistical study. One of the preeminent obstacle of Startup's is to seek capital and Human Intelligence to solve complex tasks of the product and in return bolster their project growth which can be achieved by 'Crowdfunding' and 'Crowdsourcing'. Crowdfunding is a platform offering entrepreneurs and project owners the possibility to raise money from an undefined group of online users ie 'Crowd' while Crowdsourcing involves obtaining work,human intelligence or opinions from a large group of people which submit their data via the Internet. In this paper, we conceptualize a blockchain-based system "CrowdSF" for crowdsourcing and crowdfunding. In which we will try to integrate both platform together where idea creator can recruit the worker to execute the project or seek masses for funding their project at one single platform with security.

Keywords: Blockchain, Collective intelligence, Crowdfunding, Crowdsourcing, Startup.

I. INTRODUCTION

Crowdsourcing, a term that was coined by Jeff Howe of Wired Magazine, is used to describe the procedure of outsourcing to a large body of independent workers rather than through a single entity or company.[1] Crowdfunding is a special type of crowdsourced product that is used as a method for generating funds ie. crowdfunding seeks little amounts from bulk of individuals to fund businesses, creative projects, charities and more. Crowdsourcing and crowdfunding weights their disruptive power in using the"crowd" to shape a new type of large-scale outsourcing or funding platform .Specific priority is given to how the multiple portrayal of the participants, from provider of ideas to users, customers, investors, or brand ambassadors, create unintended impacts on the market structure and may usher new opportunities and challenges for innovation management [2]. Currently, many large companies choose crowdsourcing as a problem-solving method, ranging from web development and mobile development to production of products such as mugs and clothes.

Crowdsourcing and Crowdfunding platform have emerged progressively in recent years.This platforms are predominantly based on Centralized System which brings their own inevitable drawbacks. Such systems are subject to weakness for their vulnerability to DDoS attack, remote hijacking and mischief attacks. Consequently a single point of failure will lead to fatal vandalism to the system.With Crowdsourcing platform such as OpenIDEO , INNOCENTIVE and Mechanical Turk has emerged lately.

Our CrowdSF aims at combining the success of those contemporary crowdsourcing platform suppliers with the advantages of current developments in blockchain technology. Our system will uses Ethereum-based smart contracts between Creator and Workers , the system will provide a transparent and straightforward display of the worker's qualifications and diligence for a natural distinction between high and low-quality workers on the basis of their Credit or Reputation score which they will acquire after every task they successfully execute. We will also introduce Backers in the system,which will back the idea of Creator and fund their project by providing them capital. Leading to crowdfunding.

Our application CrowdSF works on 3 main layers, the application layer, blockchain layer and storage layer. Workers with special skills could query and complete tasks which are posted by Creators in the application layer. The blockchain layer uses the task state changes as input to achieve consensus between workers and creators. Because of the limited data storage capacity in blockchain, We are using MongoDB database as a storage layer. System will encrypt the data and generate a hash key of the hash key data. Hash data will be stored in MongoDB while the hashkey will be stored in

Blockchain. This will make the Blockchain network Light-weighted.

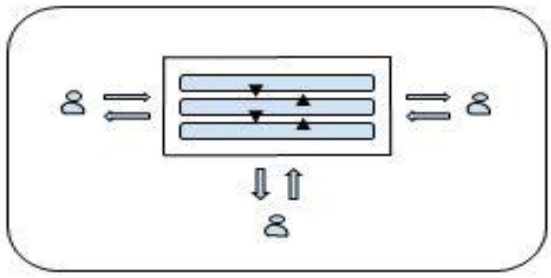

Fig. 1

In this paper, we are proposing to create a platform including both domain ie. crowdsourcing and crowdfunding integrated together where idea creator can recruit the worker to execute the project or seek masses for funding their project with security. The remainder of the paper is organized as follows. In section 2, we present the Literature Surveyed. Overview of the system is given in section 3. In section 4, description of our proposed framework will be illustrated. Later, we present a concrete crowdsourcing scheme under the framework and analyze the security properties in section 5. Finally Conclusion and References are included in this paper.

II. RELATED WORK

The recent mainstream introduction of globally-reaching Internet technologies such as crowdsourcing and crowdfunding have meteorically rise interest among the emerging researchers.We will substantially review about crowdsourcing , crowdfunding , blockchain crowdsourcing platform and collaborative filtering.

2.1 Crowdsourcing System

Most of the companies are introducing crowdsourcing to enrich their engineering capabilities and seek solutions to unsolved technical challenges and the need to adopt newest technologies.As crowdsourcing requires, depending on the definition, 'outsourcing' a task or tasks to a large crowd [6], advances in technology have facilitated the efficiency of this method. Codelco Tech is a mining company that solved a historical challenge in this industry by joining forces with ennomotive, a company that provides solutions through their open innovation platform [9]. Most of the Crowdsourcing platform has centralized system.The crowdsourcing services, like worker selection, incentive mechanism and truth discovery, are provided by these centralized crowdsourcing system. Platform such as WAZE and OpenIDEO are great example of Crowdsourcing platform.. Such Centralized system are not as robust as a P2P and if the server fails, the whole network goes down which can be catastrophic.

2.2 Crowdfunding System

For starters, financing or acquiring capitals for a business, project or venture requires asking a number of people for large sums of money. Crowdfunding simply just forwards this idea around, using the internet to talk to a large crowd or people ie. not only thousands but million potential investors or funders.On such platforms, those seeking funds will set up a profile of their project on the platform and ask internet crowd to contribute or fund. They can then use social media, alongside traditional networks of friends, family and work acquaintances, to raise money.There are three category of Crowdfunding System : Reward based Crowdfunding , Debt based Crowdfunding and Equity Crowdfunding.

- Rewards-based, or seed, crowdfunding is a type of small-business financing in which entrepreneurs solicit financial donations from individuals in return for a product or service [3].Donors have a social or personal motivation for putting their money in and expect nothing back, except perhaps to feel good about helping the project [10].
- Debt-based crowdfunding is another example of crowdfunding which is known as peer-to-peer lending or P2P.In this, individuals lends money to businesses or other individuals with the expectation that it will be repaid together with interest added to their funding or investment.
- Lastly in Equity crowdfunding, a large number of people contribute money to a business in return for shares in the company or ventures. {4]

However,Crowdfunding also comes with a number of lurking risks or hurdles. Studies shows that crowdfunding contains "high levels of risk, uncertainty, and information asymmetry" for the creator and investors or funders.[5]

2.3 BlockChain based platform:

Trudex is a blockchain based crowdsourcing platform for crypto-coins that emerged is called Initial Coin Offering (ICO). It is basically a sort of Initial Public Offering (IPO) without all the legal and structural restrictions. It's mostly used in the Initial Coin Offering of those companies which creates their own new cryptocurrency as they tap social media to bring in the abundance of new crypto investors. Cryptos are built in Blockchain technology and is essentially an approach of recording transactions that offers immutability ie. transactions can't be changed or can be manipulated as well as have decentralized nature[6]. Some tech startups or budding companies are using the blockchain in this way to create new cryptos that are binded to their business. The research on blockchain-based crowdsourcing has also gained considerable interest in industry recently, such as

microwork , Gems . We too conceptualize a blockchain-based decentralized framework with much broader goals, such as providing a direction for system designers to design a class of decentralized protocols in crowdsourcing

2.4 Collaborative Filtering

Collaborative filtering is a rapidly advancing research area. Classic methods include neighborhood methods such as memory based or user based collaborative filtering [7]. The category of collaborative filtering (CF) does not use user or item information with the exception of a partially observed rating matrix. The matrix for rating holds ratings of items in columns by users in rows and is basically binary, for example 'Like' versus 'do not like' or for example, one to five stars ratings in Netflix movie recommendation. Rating matrix can also be gathered essentially based on user activity.[8] Tapestry is one of the earliest implementation of collaborative filtering-based recommendation system. This system relied on explicit opinions of people from a close-knit community, such as office workgroup.

III. Overview of System

Blockchain system has edge over traditional centralized System. Combining the advantages of Blockchain we will be creating crowdsourcing and crowdfunding framework on the same platform named ***CrowdSF*** . Each CrowdSF client is designed as the user interface , and it will operate locally on user's personal computer without depending on any central server. Our decentralized platform consists of three groups of roles: Creator, workers and Backers which will work on our blockchain based system.This system will allow the Creator and Worker to interact with underlying blockchain. CrowdSF will Support all the operations of Crowdsourcing such as Registration, Posting task, Receiving Solutions,Evaluating Solution and operations of Crowdfunding such as funding the project, maintaining updates of project , uploading the project. System will use Collective Information to enhance the recommendation process for the Users. Creator and workers reach an agreement on top of blockchain which is used to achieve eventual consensus on the state of each task. CrowdSF will use ethereum based smart contract which is essentially a self-executing digital contract in a secure environment with no intervention and verified through network peers. The main reason for difficult to realize smart contract before is that it's hard to find a secure environment which is decentralized, unalterable and programmable. The advantage of blockchain technology could solve this problem perfectly.

IV. CrowdSF Architecture

CrowdSF architecture is divided into three layers: Application Layer,.Blockchain Layer and Storage Layer . A React based Webapp will be operating on Application Layer. All the data of Creator's idea or profile of Worker's can be viewed on this layer. Ethereum Based Blockchain will be used in blockchain layer . The blockchain layer uses the task state changes as input to achieve consensus among Workers and Creator and Backer.

As there exist lots of data collected from Creator and workers, because of the limited data storage capacity in blockchain. We will store all data in the MongoDB and its encrypted Hash key in Blockchain. We believe this separation can improve CrowdSF's data storage significantly and make blockchain network light-weighted.

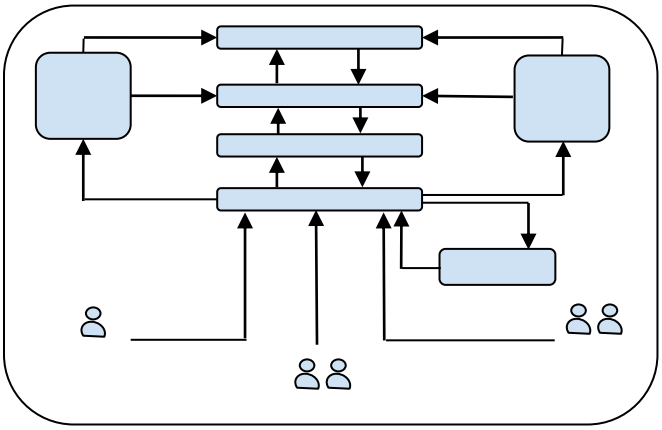

Fig.2

Workflow of System

In this section, we describe the general process of our framework. Based on CrowdSF client, our framework consists of six steps as following steps:

- There will be a Universal login for users. User can use system as creator, backer, and worker. When a user start a campaign(project) a creator tag will be given to him. Same with backer and worker. Creator will have the option for crowdsourcing for the project or just requesting for funding through Crowdfunding Process.
- Creator will give all details of campaign. He will add images of his idea(product), videos, detail description about the campaign so that backers can understand the campaign well. After this creator's campaign will be displayed and everyone can see the campaign and they can work or back the campaign.

- Our system then take all these details of campaign and will encrypt it. As Blockchain cannot store more data, a hash key will be generated each time following the merkle tree.The hash key will then go in blockchain layer and encrypted data will go in storage layer. By doing this we can guarantee the data have not been altered in the storage layer.Therefore, we can safeguard data security and avert data from being leaked to irrelevant users.
- For Crowdsourcing, Creator will post tasks and are required to pay reward in advance and payments are deposited on the blockchain. Meanwhile, a rule for workers is set by requesters to ensure that qualified workers could ultimately receive the task. An evaluation function is also required, and thus the solution can be evaluated by miners on the blockchain instead of the Creator or the crowdsourcing system.
- Workers will be selected based on their Reputation Points. Workers need to submit the solutions of the idea within the specific time period so that workers can collect more points and rewards in return. If there is a new Worker, he/she will get default Reputation Point of the system. Collective Intelligence will help workers to find new creative campaigns. Collaborative Filtering will be used to give skilled Worker more opportunities to work based on their previous works (through reputation point) .
- This campaigns crowdfunding is 'All or Nothing' i.e creator should get all his required funding within specific time interval of 1 month(max). If he fails then all the funding will be return backers. After successful funding creator can start working on his campaign.
- For avoiding fraud spending, Creator has to send a request to all backers for using the money funded to the campaign. All the backers then approve or reject the creator's request. To approve the request the half of backers should say 'yes'. If not then request will be rejected.
- The approve requested ethers or Rewards will then directly deposited to the workers accounts, to make system more transparent and trustworthy.

4.1 Smart Contract

Smart contracts are account that holds objects on the ethereum blockchain. It contain code functions and can interact with other contracts, make decisions, store data, and send ether to others. It will contain detail about the task,reward, submission deadline and the solutions of number of workers.

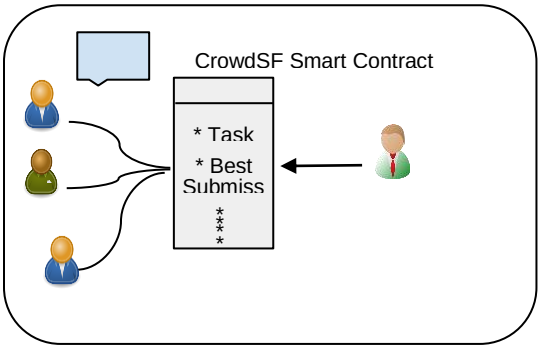

Fig.3

The creator will validate the solutions and award specified reward to the worker in return having best solution

4.2 Recommendation System

In the recommendation System for workers we will use Collaborative Filtering (CF) algorithms which is based on the idea that if two clients have similar rating history then they will behave similarly in the future .For CrowdSF,if there are two very likely workers and one of them works on a project and have positive feedback, then it is a positive indication that the second worker will have a similar pattern. This is a useful methodology because it is not based on additional information about the items (e.g., creator ,idea , domain) or the user (e.g., demographic information) to produce recommendations.

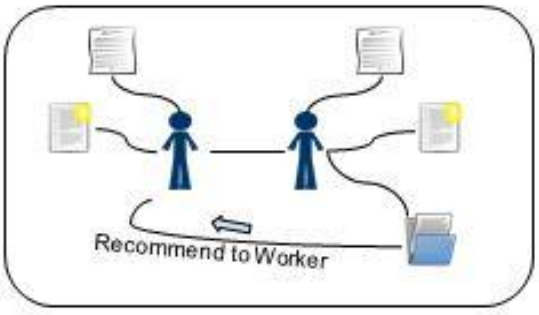

Fig.4

4.3 Workflow

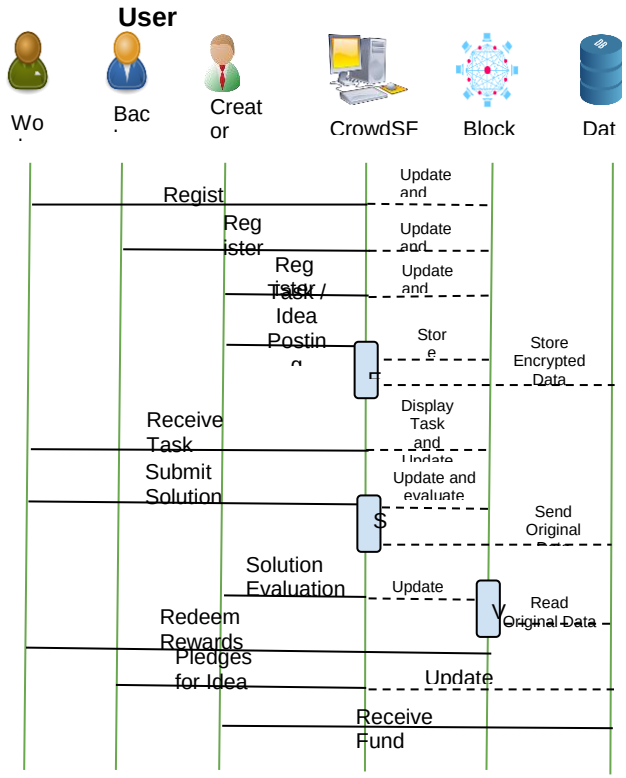

Fig.5

V. SECURITY ANALYSIS

As the saying goes,'The best defense is a good offense' and its nowhere more true than in enterprise security. Finding vulnerabilities and exploits before hackers do can prevent devastating breaches, data loss, and prevent crippling hits to your operations and your reputation.The security of CrowdSF comprehends with the security of blockchain. In our System Creator ,Backer and workers all can take part in mining, we assume that the attacker (including malicious requesters, backer, workers and miners) cannot break the fundamental defense of blockchain,ie because the attacker will not have the majority of power or resource to supervise the blockchain network and the mostly the bulk of miners are honest. The network has less latency and messages are synchronous between reliable miners. For Security, the system will require 10 minutes for each block to be successfully uploaded to the network. Each Miner will compete among themselve to upload their block on the network and earn rewards in return.

Comparing with the traditional crowdsourcing system in which money is rewarded or exchange, here we use virtual coins in blockchain. Coins can be obtained either by mining or transferring it with others. We will assume that each particular user who has the secret key can securely acquire and transfer it with the client wallet. The data will be encrypted in order to prevent the users privacy from being exploited. The solution will be encrypted by leveraging a secure public key encryption algorithm. Workers will than use the corresponding requester's public key which will be available online to encrypt the solutions. Creator could decrypt the solutions successfully by the secret key. Specifically, the solutions are saved as cipher text in distributed database.

The potential malicious Creator and workers have specifically different goals to maximize their own profits. Security against malicious workers is straightforward, the only ways that malicious workers can cheat are: (i) submitting more than one answers in Answer Collection phase; (ii) sending the contract a fake instruction in the name of requester in Reward phase; (iii) altering the policy specified in the contract. The first threat is simply handled by the common-prefix-linkability and unforgeability of common prefix linkable anonymous authentication. The second there at can be approached by predicting others' answers, and it is prevented due to the semantical security of public key encryption.The third threat is simply handled by the security of digital signatures. The last issue is trivial, because the blockchain security ensures the announced policy is immutable.

Malicious Creator aims to collect useful solutions without losing the deposit, which is false-reporting attack in essential. To accomplish this goal, such creators misreport the evaluation solution as below par standard even if workers contribute high-quality of solution.Furthermore, they may even contradict that they have obtained the solutions. Besides, we require requesters make a deposit in our protocol, while they may benefit from not following or even breaking the protocol, which means that malicious requesters may attempt to generate a fork chain after they acquire the solutions initially.

In Crowdfunding, there can be a scenario where the people had funded and backed the project but the creator is unable to produce or execute his/her project or campaign. This may lead to a scam of fraud Spending of the fund alotted to them.For curbing such exploits, Creator has to submit or update their work detail on time to time basis. Backers which had funded to that particular campaign will get notification of the work. While spending the fund, Creator will have to take approval of spending from the backers. If more than certain default percentage of Backers responds with 'Yes' vote , than the creator will have the authority to use the fund alotted to them. This process will help in curbing the scam of Fraud spending.

VI. CONCLUSION

Crowdfunding and Crowdsourcing in India are still in its infancy. However, it does face its share of challenges. Being an extremely new concept, the Indian population still has not widely accepted online crowdfunding or crowdsourcing. The initial hesitancy though, should be expected and would not prove to be a major obstacle given its due time.Despite the initial challenges, the future of crowdfunding and crowdsourcing in India is undoubtedly bright. Most of the skepticism regarding online crowdfunding would subside gradually. India's vast population means that India potentially has a huge donor base and workforce, the likes of which is unparalleled to other countries.

The primary requirements of any business are business capital and human resources.This is especially true in the cases of startup ventures and low level companies as these usually struggle with gathering resources. Hence our platform would be ideal for such companies our startup to accomplish their needs.

As centralization of system provides several benefits with respect to maintenance and updation of the system and its data, it eventually falters when it comes to the security issues. Hence use of blockchain in architecture will strengthen security aspect of the system. The scope of such platforms in India is bright but only if we actively participate.With the arrival of crowdfunding & online crowdsourcing, we finally have the chance to help budding companies flourish . We know that Minute drops of water over time, constitute an entire ocean. We may not have millions to spare, but if all of us pitch in, support whatever small amount we can, we would raise enough to make a difference.

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Authors Profile

Mrs.Waheeda Adam Dhokley. Works as an Assistant Professor at M.H. Saboo Siddik College of Engineering in Computer Engineering Department Qualifications:- B. E. (Comp.) M. E. (Comp.). Also, having a teaching experience of more than 12 years in this institute.

Mr. Saurabh Gupta Currently pursuing Computer Engineering from M.H. Saboo Siddik College of Engineering and belongs to Computer Engineering Department.

Mr. Ganesh Pawar Currently pursuing Computer Engineering from M.H. Saboo Siddik College of Engineering and belongs to Computer Engineering Department.

Mr. Abrar Shaikh Currently pursuing Computer Engineering from M.H. Saboo Siddik College of Engineering and belongs to Computer Engineering Department.