Blockchain-based Distributed Secure Crowdfunding and Decision-Making Platform for Large-scale Business Projects in Public and Private Sectors

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Abstract. Business projects are one of the major pillars of the economy of any country. People may have excellent business ideas, but they may not have money to start them. Getting a loan may not be an easy task for a novice businessman. On the other hand, there can be many people who are seeking investment opportunities. However, they may not have sufficient funds to invest in business alone. When investing as groups, conflicts in negotiations will rise. Moreover, the issue of trust will increase. This research, we are proposing a new crowdfunding and decision-making platform for major projects in public and private sectors using blockchain technology. A businessman can submit his business plan and invite people to invest in if they like the given agreement. Investors can invest any amount and propositionally attend on decision making of each activity in the project by casting their votes. This platform helps to invest in large business projects over the lack of trust and issues of the existing investment methods. Because the reliability and the security of the system are higher as the agreement and the votes are written in the distributed ledger permanently, and decision-making happens without the involvement of humans.

Key words: Blockchain, CrowdFunding, Secure Voting, Distributed Computing, Large Business Projects

Introduction
Business projects act as a significant role in the county's economy. That creates huge job opportunities for the people (Parker, Van Alstyne, & Choudary, 2016). But here, there have two main issues for beginning the new business project. Those are fundraising and decision making. Most of the people are get foreign investment or loan to fundraising. But foreign investment provides a cynical impact on the country's investment. That would appear in some kind of modern-day economic colonialism, which gives them exposure to foreign businesses' exploitation.

Getting loans are other risks to the business; they are hit with higher interest rates. You should pay back to the bank or loan company to an additional amount whatever your business income. Decision making is the most critical thing in those projects. The reason for the main project failures is wrong decisions that are get by some authorities. As well as agreements in some projects are hidden to the people. This paper introduced a blockchain-based crowdfunding platform for development projects in the public and private sectors. Hence, the system would encourage people to invest their savings in large-scale projects. It will eventually lead to reduce the number of foreign loans and distribute the profit within the community. Further, this will solve the problems of secure, reliable, and distributed decision-making in public and private sector projects.

Recently, blockchain technologies have begun to use numerous kinds of projects in everywhere. Blockchain technology is the process of the store the data that is distributed and will be secure, reliable, immutable, and anonymous and community acceptable (Al-Jaroodi & Mohamed, 2019). Smart contracts are used to store the data in the blockchain, a distributed ledger, and cannot be changed. The contract is an agreement between people in the form of computer code. Every transaction information is already within the smart contracts and that executes automatically. Nick Szabo has introduced the smart contract concept in 1994.

Blockchain technology and smart contracts capable of doing a task in real-time with low cost and greater security (Mohanta & Panda, 2018).

Crowdfunding is a on the contribution of a wide number of individuals to finance the production of a particular work (Gerber, Hui, & Kuo, 2012). Already some crowdfunding platforms have been extended on the blockchain, compensating people's economic contributions to a project with real shares of the project. Blockchain allows the funding process safe and allows fully transparent access from anywhere in the world. Ethereum is a new era and that is the world's leading programmable blockchain, by using it developers can build new kinds of applications.

The objectives of the platform are summarized as follows:
- Blockchain technology-based secure, decentralized platform that allows people to obtain funding and voting for large business projects in the public and private sectors.
- Implement a distributed, automated, and secure voting system for decision making in large projects.
- Facilitate small and middle investors to invest money in large business projects.

Backgroud
A. Ethereum network

Ethereum is a distributed blockchain-based public and open-source platform. We can build applications that are accessible anywhere in the world by coding in the ethereum network (Antonopoulos, 2018). Ether has a related cryptocurrency in the ethereum network. Ether can be transported within accounts over transactions and that is utilized to recompense miner nodes who preserve the blockchain development (Wang, 2018). There are three features in etherum network.
- Smart Contracts: Rules are declared within the code
- Smart Property: Is an ownership of a real non-digital asset.
- Tokens: different currencies existing in the blockchain.

B. Blockchain

Blockchain technology operates immutable data in an encrypted and secure way with transactions that cannot be changed and authorize distributed public ledgers (Ølnes, Ubacht, & Janssen, 2017). That records all transactions in an efficient, transparent, secure, and decentralized manner. Blockchain enables various partners that are connected to the network, usually public, to track information over a secure network and that no need third-party verification.

C. Smart Contract

A smart contract is part of the blockchain. That is automatically executed when predetermining rules and conditions met. A smart contract runs on blockchain technology, which is a distributed ledger. A smart contract contains an executable code that is executed on the blockchain to apply an agreement between two or more parties (O'Shields, 2017).

D. EthereumDApps

A decentralized application is a computer application that runs on distributed ledgers such as Ethereum Blokchain (Karatas, 2018). Ethereum network allowed developers to run DApps on top of their platform.

E. Crowdfunding

Crowdfunding consists of obtaining a huge amount of financial contributions from various people who often do not know each other (Bradford, 2012). You can go through the invaluable process of looking at your business from the top level by creating a crowdfunding campaign. In crowdfunding, unlike the usual way of fundraising, a small number of wide contributions from many customers support investments.

Crowdfunding expresses a combination of social network participation and entrepreneurship. Customers in crowdfunding act the role of investors. "Kickstarter" and "Patreon" are examples of crowdfunding platforms that, concerning the crowdfunding of startup companies and, more importantly (Zichichi, Contu, & D'angelo, 2019).

Related Works

There are some studies based on blockchain-based crowdfunding done by some researches. Filippi in 2016 (2016) done research "Blockchain-based Crowdfunding: what impact on artistic production and art consumption" in here proposed impact when applying blockchain-based crowdfunding to artistic production and art consumption.

Saadat et al (2019) proposed research "Blockchain-based crowdfunding systems" in here they study about inbuilt crowdfunding platforms like kickstarter.com and how blockchain technology apply to the crowdfunding platforms.

Gebert (2017) done research based on "Application of blockchain technology in crowdfunding" in this research study about the crowdfunding platforms using blockchain base technology in the European Union.

Hjálmarsson et al (2018) proposed research "Blockchain-based voting system" they identify the limitation of electronic voting systems in technological and legal, also interpret the requirements of building electronic voting systems.

Md. Nazmus Saadat et al (2019) did research "Blockchain-based crowdfunding systems in Malaysian Perspective". They aim to apply Ethereum smart contracts to crowdfunding by investigating current problems in crowdfunding in Malaysia.

Zichichi et al (n.d.) introduced "LikeStarter". This research presents a blockchain-based decentralized social network site including crowdfunding mechanisms built on top of the Ethereumblockchain. Users of "LikeStarter" can raise funds for other users through a simple "like" and that is helpful to users becoming famous in the social network.

Saraf and Sabadra (2018) done research, "Blockchain in Developing Countries". This research presents key concerns that have been proposed concerning businesses in the developing world and evaluate the possible use of blockchain to address them.

Methods

There have more business projects in the world. Road Construction, building factories, and starting a new software company can get some examples for the public as well as private sector projects. This platform is consisting of three smart contracts that can handle crowdfunding without the need for a third entity.

- Project_Smartconctract: Include all terms and conditions to start the funding process. In here defined the period to invest money.
- Voting_Smart contract: In the voting smart contract determine all rules and conditions as well as data in the voting process. Each member can vote. The vote is weighted based on the invested money of members.
- Profit_Smart contract: Project Smart Contract includes all conditions for profit-sharing among the people.

```
progma solidity ^0.4.0;
contract Ballot{
        struct Voter{
                bool voted;
                uint8 vote;
                uint weight;
                address delegate;
        }
        struct Proposal{
                uint noOfVote;
                bytes32 name;
        }

        address public chair;
        mapping(address => Voter) public voters;
        Proposal[] public proposals;

constructor(byte32[] memory proposalTypes) public {
        chair = msg.gender;
        voters[chair].weight = 1;

        for(uint i = 0; i< proposalTypes.length; i++){
                proposals.push(Proposal({
                        name: proposalType[i],
                        noOfVote: 0;
                }));
        }
}
```

Figure 1. Sample code for voting_smart contract

Figure 1 shows a small part of the code in the voting smart contract and this represents a single voter. This includes information on whether voted and which option they choose. This struct represents a single proposal; therefore, the name shouldn't be greater than 32 bytes and voteCount variable represent the number of votes. The mapping keyword assigns each voter. Afterward, creates a new ballot to choose one of the proposals. This only represents the part of the code, however, finally, count the number of votes and select the winner.
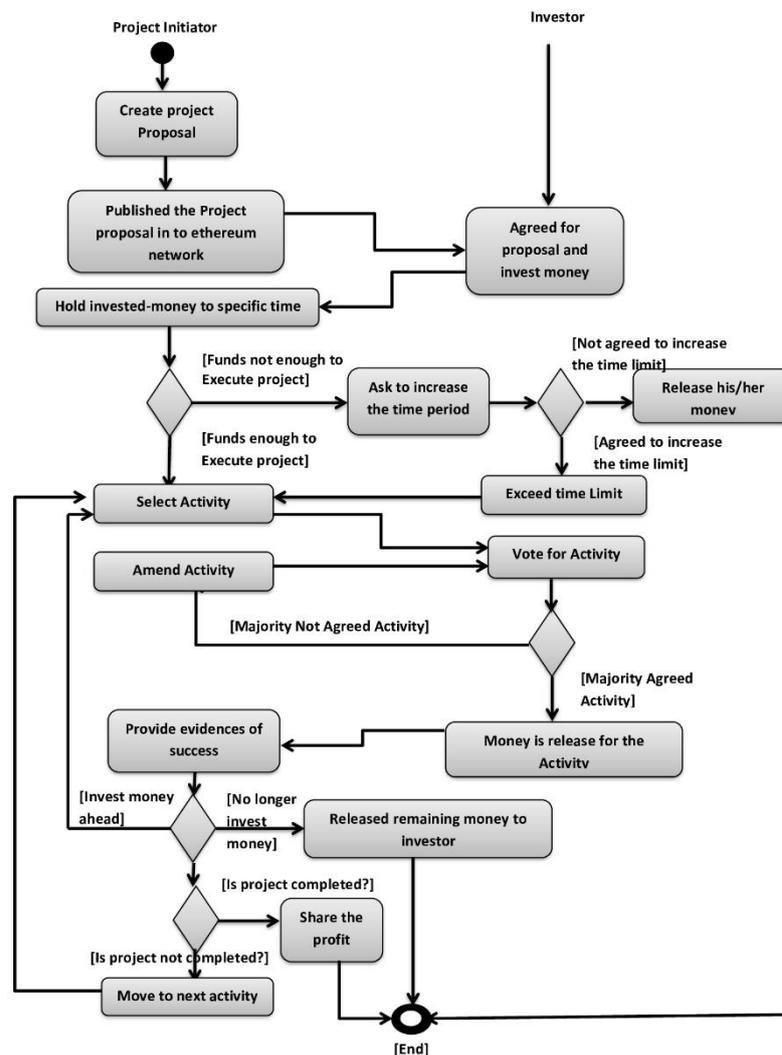
i. Crowdfunding platform

Figure 2. Process in a crowdfunding platform

A. Project Initiator

The project initiator creates a crowdfunding platform using a dApp. This decentralized application interacts with a smart contract for creating a crowdfunding platform. And also, he creates the project_smart contract and that is publishing to the etherem network.

B. Investors

An investor who agreed to the rules and condition in project_smart contract they have invested money to that project and get a digital token.

C. Process of platform

The project initiator submits the activity in the project. Inventors vote the activity whether that activity is the best one or not. Voting power is dividing based on the invested money. If some first inventor invested 10 000 and the second inventor invested 5000 then the first inventor voting power is higher than the second one. If investors accepted the activity of projects then holed money released proportionally to the invested money. Assume first activity cost is 50 000 then hole money released proportionally to the invested money.
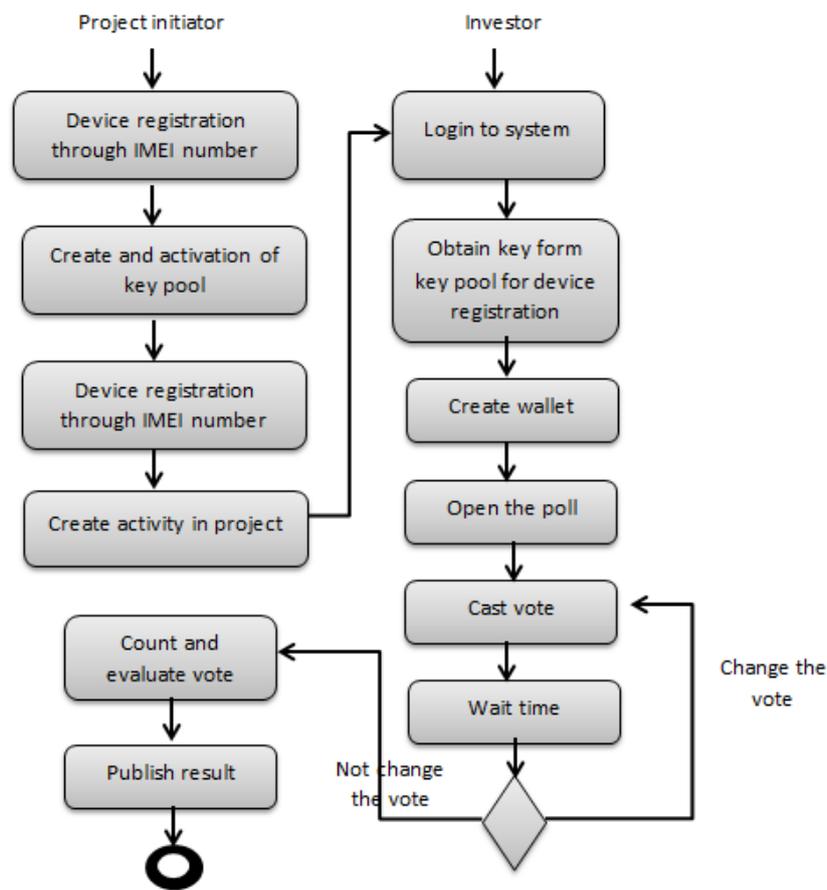
ii. Decision Voting

Figure 3. Voting process

A. Voting initiator

Project initiator registers the device through unique IMEI number, create and activate key pool (key pool is a collection of random keys that is distributed independently on the key pool).

B. Investors

Investors can log in to the device after registration of IMEI of the device, then they can get a random key from the key pool then define the wallet for future funds, penalty or obtain vote state, then join for the poll and cast the vote. Investors get a chance to cast his vote. One vote for one project can change it before the deadline, only the last one count. For the elections, they are eligible for verifying themselves, cast ballots, submit the vote and confirm voting before the voting process is over.

C. Voting Process

Voting initiator creates voting ballots for the project using a dApp. Elections are created by interacting this decentralized application. After the deadline voting, smart contract interacts with the blockchain through the corresponding and adding it to the voting blockchain (Investors can change his vote any time before the deadline.). Voting power is divide into based on the invested money of each investor.

Voting power = Invested money/ No of keys

While the vote is storing as a transaction on the blockchain, a transaction ID receives every investor for their vote in verification purposes. When investors votes (after deadline), their wallet is reduced by the proportion of invested money, so they are unable to vote more

than once. A single transaction on the blockchain holds the transaction ID and the part where the transaction blocking is located. Wallet value will be increased by 1 after the election over. The wallet also includes the transaction and who received it and the total value transferred.

D. Calculation of Results

The calculation of the voting is performed on the voting_Smart contract. Each ballot smart contract makes its assessment for the corresponding location in their store. The results for each smart contract are published after the election.

Results and Discussion

We prepared a questionnaire for collecting the pros and cons of an investment methods in nowadays from people.

Table 1. Questionnaire for getting facts about today's investment methods

Code	Questions	Answers
Q1	What types of invested methods were used?	Shares
		Normal saving
		Insurance
		Online Marketing
		Fixed deposit
		Lending
Q2	What are the difficulties/problems faced in your investment methods?	Profit depends on high time period
		Low interest rate
		Challenges in building trust with stakeholders
		Additional charges added
Q3	If you co-investing on the business, what are the challenges you faced?	Decision making
		Rule making
		Do some illegal things other investors
		Problems comes in profit sharing
		I'm not a co-investor
Q4	What are the advantages if you have a platform like this?	Decrease the risk
		It would be helpful
		Improve the trust

Table 1 show the main questions from the questionnaire, which was analyzed to evaluate our platform. The questionnaire was distributed between entrepreneurs and employers who were found in the LinkedIn social network. There are 34 responses. All answers coded as 0 and 1 according to their responses. We were analyzed collected data by using Minitab statistical software as given bellow.
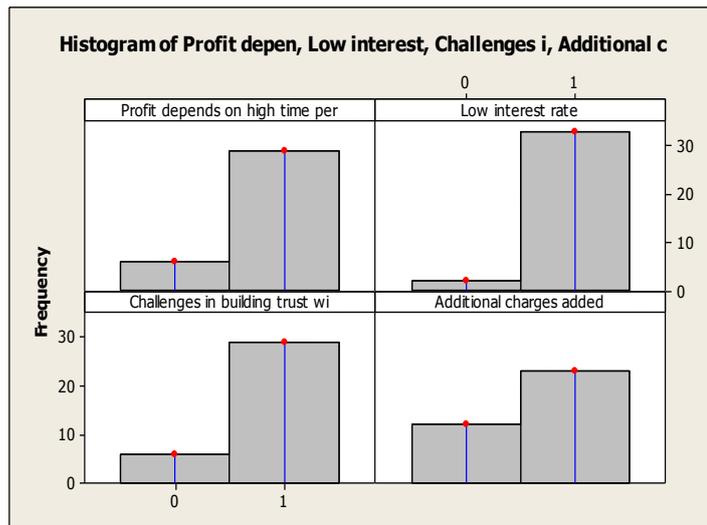
Figure 4. Histogram of Profit depends on the long period, Low-interest rate, Challenges in building trust with stakeholders, Extra charges

Figure 4 exposes the number of responses to the question, "What are the difficulties/problems faced in your investment methods?". By using this graph, we can assume that most of the participators accepted there has a low-interest rate, profit depends on the long period, challenges in building trust among stakeholders, extra chargers added in today's investment methods.
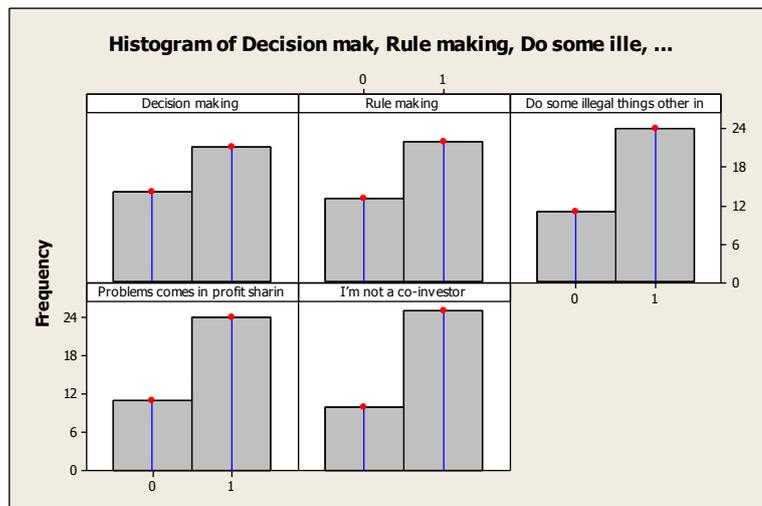

Figure 5. Histogram of Decision making, Rulemaking, Does some illegal things other investors, Problems comes in profit sharing, and I'm not a co-investor

Figure 5, exposes the number of responses to the question, "If you co-investing on the business, what are the challenges you faced?". By utilizing this graph, we can concede that most of the participators accepted problems in decision making, do some illegal things other investors, problems come in profit sharing in today's investment methods.
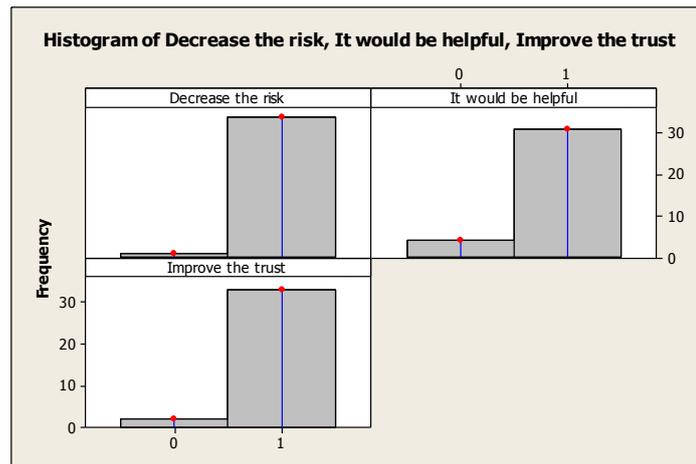
Figure 6. Histogram of Decrease the risk, It would be helpful, Improve the trust

Figure 6, presents several responses to the question, "If you co-investing on the business, what are the challenges you faced?". By using this graph, we can infer that most participators have a positive mind about our platform and they believe that can minimize the risk and increase the trust.

Conclusion

The blockchain-based secure and reliable crowd-funding and the voting system is a new move in the business world (Hassija, Chamola, & Zeadally, 2020). The majority of the community can invest their savings in large-scale projects and attend on decision making using this platform. It facilitates a group of trustless unknown people to do business negotiations by making business agreements and decision making transparent. Moreover, it encourages people who have good business ideas to find investors and making it happen. Results expose the lack of trust and issues of the existing investment methods and the positive trend of investment projects on the proposed platform.

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