

Platform for Tracking Donations of Charitable Foundations based on Blockchain Technology

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Abstract—Donors have distrust about how donated money is spent. Currently, blockchain technology is being implemented in different sectors. Blockchain technology allows you to make the process of donations and transactions of funds transparent. Single platform for tracking donations that will track all information about donations, transactions and donors need to be developed. This paper considers description of implementation of the platform for tracking donations based on blockchain technology. The System offers transparent accounting of operations donors, charitable foundations and recipients based on blockchain technology, charitable platform should provide transparent donation route, enable public users and donors to track and monitor where, when and to whom went resources of charity funds.

Keywords—Donation System, Digital Charity, Blockchain, Smart-contracts, Ethereum, Tracking Donation, Charitable Foundations, Transparency

I. INTRODUCTION

According to the research of National Research University Higher School of Economics, 57% of people make donations [1]. The share of Russian donations to charities in relation to GDP is 0.34%. A donor has the right to demand a report on the expenditure of funds, 30 % of donors follow the path of their donations. However, most of the donations are in the informal sphere. The funds are transferred to the needy in person (alms, through family and friends, through the place of work/study or through the initiative of civil society) and formally fundraising is not organized in nature, on permanent basis and accountability. Even if the funds were donated through a Bank account, Internet or mobile communication (via SMS), donors in most cases do not know how their funds were spent. This work provides practices in the blockchain projects for social purposes architecture solution, platform design and REST API implementation.

II. BACKGROUND RESEARCH

A. Distributed ledger, Blockchain

Ledger is a collection of data, including in electronic form, structured and stored for the purposes of accounting, retrieval, processing and control [2]. Distributed ledger – a data structure, an uncommitted set of copies of which can come to a final consistent state (eventual consistency), using a given consensus algorithm.

Blockchain technology implements a distributed ledger. Blockchain is a network of participants (full nodes) each of them contains data. Inserting of new data occurs after achieving a consensus of network participants. Blockchain provides immutability, transparency and security of data. Through distributed and openness, blockchain provides security, immutability and transparency of data [3] [4].

B. Cryptocurrency, tokens

Cryptocurrency is a type of digital currency, the emission and control of which are based on cryptographic methods [5]

[6]. Bitcoin cryptocurrency is the most famous implementation of blockchain technology [7].

Tokens (or crypto tokens) asset or utility that is created based on cryptocurrency [8].

C. Smart contracts

The next stage of technology development was smart contracts (Ethereum, Hyperledger fabric). Smart contracts give opportunity to implement business logic in blockchain that will be observed. A smart contract can perform calculations, store information, and automatically send funds to other accounts [9].

D. Platform model

In the context of the development of information technology, we can observe the change of traditional approaches to doing business. In the last few years, the ability to transform existing business models has become increasingly important in order to succeed in industry. Platform economy - economic activities based on platforms, which are understood as online services that gives opportunity to provide transactions (as seen in Figure 1) [10]. A platform conducts all stages of a transaction from provision of communication between a contractor and a customer to receipt of payment.

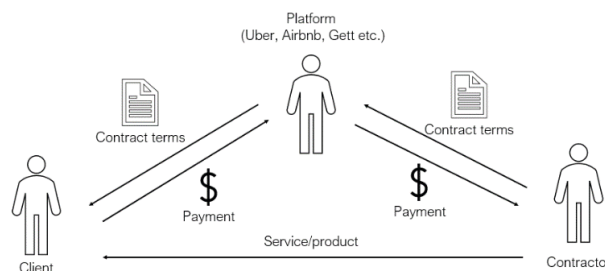


Fig 1. Platform model representation

III. PROBLEM STATEMENT

According to the development plan published by the state corporation ROSTEC in the field of technology development of the distributed register one of the priority sectors of technology implementation is the activities in the field of health and social services. According to the plan it is expected that 75% of private companies and 100% state-owned companies must move to systems of using the technology of the distributed registry [11].

The current volume of the market of systems of the distributed registry of the Russian Federation is 2.4 billion rubles. The potential volume of the market in 2024 will be 317 billion rubles. The total potential direct economic effect from realization of the potential of technology in Russia will amount to 782.1 billion rubles, the indirect economic effect obtained at the expense of transparency, immutability and

automated updating of data from the implementation of the roadmap in 2024 will be 853 billion rubles [11].

According to Rosstat research, in 2017 there were more than 9600 charitable foundations and about 1700 charitable organizations (movements, institutions) in Russia. Donors have every reason to fear that charitable funds will not reach people who really need them. According to the same HSE survey in 2017, 68% of citizens are willing to donate more if there is evidence of where and what they are going. By law, foundations are required to maintain public records (in particular, to publish reports on their websites), and now all reports are prepared by employees of a foundation manually [1]. The problem of mistrust of donors and overloading of funds can be solved by organizing an external database, records in which are recorded in the blockchain.

Therefore, it is important to develop a social platform based on blockchain technology that can help non-profit organizations, foundations, volunteers and social entrepreneurs in their work and make donation processes transparent and understandable for all parties (donors and charitable funds).

Blockchain will allow all users of the platform to see their account and a description of each payment of the organization it supports. Also, the technology of distributed ledger will guarantee a donor that the amount will reach the goal, and without any intermediaries. Transparency of transactions is achieved due to the fact that information about any actions is not stored on a separate server but exists on all devices connected to the network. It is assumed that the approach of social blockchain in the charity system will help Russian charities become more transparent, significantly simplify the work with reports and documentation and increase the trust of donors. Charity information will become more transparent to the public, structured and organized in a distributed database.

The project is implemented as a part of a government grant for applied research in the interests of the government of the Russian Federation on the subject of «Digital economy of the Russian Federation» at Higher School of Economics [12].

IV. MAIN OBJECTIVE

The main objective of the project is to develop the platform in which charitable organizations will be integrated. The main purposes of the platform are the following:

- Make the work of charitable foundations with reporting documentation more convenient. Due to the fact that the data on donations will be aggregated in one place it will allow to prepare reports automatically.
- Increase the transparency of charitable foundations by creating a common platform based on blockchain technology.

The tasks of the project are divided into two types: research part, requirements analysis and implementation of the platform. The main tasks in the projects are the following:

Research part and requirements analysis:

- Research charitable organization sector (process of work of charitable organizations, channels of funds, statistics);
- Explore the possibility of integrating different charities CRM-system to the platform;
- The platform requirements analysis;
- Database design considering the possibility of integration with the different charitable foundation databases;
- Analysis and choice of system architecture.

The platform implementation:

- Setting up a server based on Linux 16.2;
- Creating a database (tables, functions, procedures);
- Smart-contracts implementation;
- Server-side implementation (REST API);
- Client application implementation (Website).

V. EXISTING SOLUTIONS ANALYSIS

The analysis shows socially significant companies/projects based on blockchain technology that exist at the moment (shown below, in Table 1).

The use of blockchain technology in social projects occurs for the following reasons:

- Ability to raise funds in cryptocurrency;
- Data storage in blockchain (a secure and unchangeable distributed ledger);
- The motivation of donors and volunteers (through awards in the form of tokens for participation in promotions and donations).

TABLE 1. COMPARATIVE ANALYSIS OF SOCIAL PROJECTS BASED ON BLOCKCHAIN

№	Charitable foundation / projects	Country	Blockchain platform / cryptocurrency	Blockchain technology using
1.	GiveTrack	USA	Bitgive / BTC	The platform for raising funds for charitable purposes on cryptocurrency Bitcoin.
2.	GiveCrypto.org	USA	BTC/BCH/ETH/LTC/ZEC/XRP	The platform for raising funds for charitable purposes in different cryptocurrencies.
3.	United Way Worldwide	USA	BTC	The charity with the opportunity of donation in cryptocurrency Bitcoin.
4.	Coin 4 clothes	Canada	BCH	Offers earn BCH for donations in the form of clothing. The project provides education and support to each clothing donor by

				teaching them how to store their coins, how to send and receive transactions, and where they can spend them. The charity fund provides clothing to the needy in Canada.
5.	Fidelity Charitable	USA	BTC/ BCH / ETH / LTC /XRP	The charity with the opportunity of donation in different cryptocurrencies.
6.	Clean Water Coin	USA	WATER	In transactions or token issue, a commission goes to projects related to clean water (CharityWater.org).
7.	Alice.si	Europe	ETH	The platform for raising funds for charitable purposes based on Ethereum platform.
8.	AidCoin	Europe	AID	The platform for raising funds for charitable purposes based on Ethereum platform.
9.	UNICEF projects on blockchain	World	BCH, BTC, ETH, LTC, XPR	Integration blockchain technology in projects in several sectors.
10.	Ant Love	China	-	The platform for raising funds for charitable purposes based on blockchain.
11.	Blockchain charity foundation (Binance charity)	Europe	BTC	The platform for raising funds for charitable purposes on cryptocurrency Bitcoin.

VI. PLATFORM FUNCTIONALITY

The functionality of the platform was collected through cooperation with charitable foundation «Our children». The functionality of the platform is represented for two types of actors (Donor and Charitable foundation) (as seen in Figure 2).

The functionality for a donor:

- Get information about a donation via website. A donor can get information about his donation through a unique identifier. A donor will be provided with information on the flow of funds for different companies.

The functionality for charitable foundation:

- Update information about donations. Foundations need to be able to record information about donations (manually or via REST request).

- Report export. Based on donations information a charity will be able to export the report to Ministry of justice and report for publication on the website.

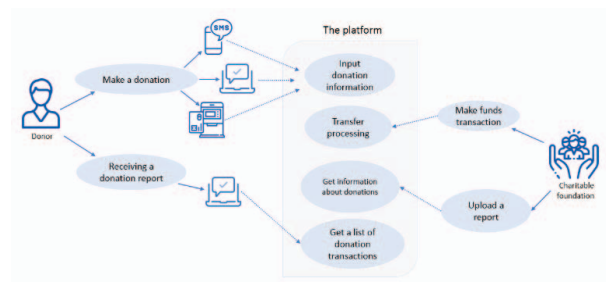


Fig 2. Platform functionality

The integration of the platform with charitable Foundation systems takes place through the REST API which is provided (as seen in Figure 3). All donations and movements of charitable funds will have to be registered through the REST API.

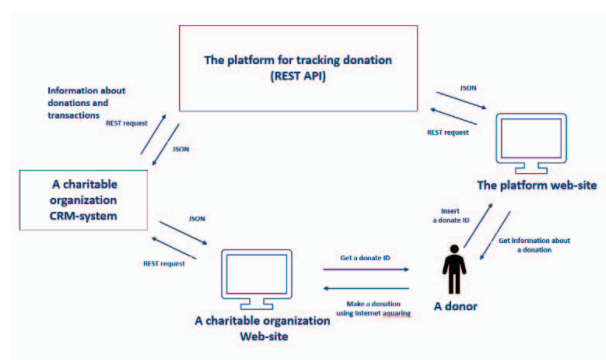


Fig 3. Platform integration with charitable foundations systems

VII. THE ARCHIECTURE SOLUTION

Figure 4 shows traditional client-server architecture. All business logic is implemented on server-part (backend). Client's application interacts with backend via internet.

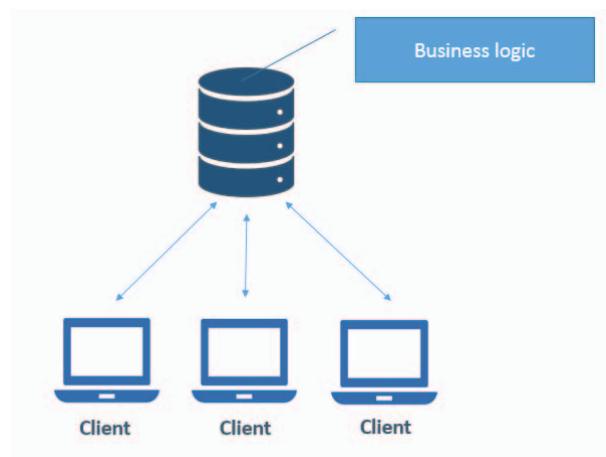


Fig 4. Client-server architecture

Figure 5 shows the architecture of a decentralized blockchain-based application. Examples of such applications can be Bitcoin. In this case, the data in the network is distributed, and all business logic is implemented in the blockchain.

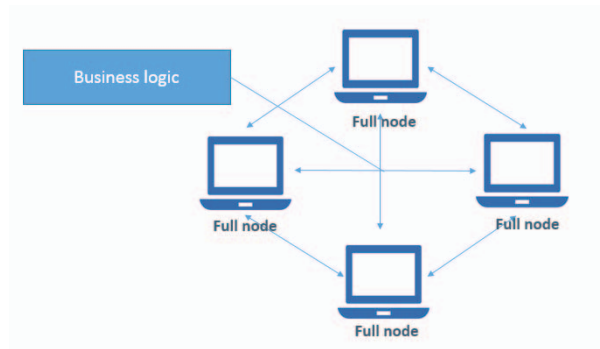


Fig 5. Architecture of decentralized applications based on blockchain

However, in the donation sector a huge amount of data is generated, it is information about donations, transactions, donors. At the moment, the writing of data to blockchain requires disk space at full nodes of a network and recording is not done very quickly. In our project with a large data flow, this causes problems.

Most blockchain-based projects are not fully decentralized. They are usually highly integrated with a typical client/server architecture (hybrid).

Figure 6 shows the platform selected architecture. All minor application data is stored in a centralized storage outside the blockchain. The master data is stored in the blockchain. All entries in the decentralized storage are made using smart contracts. Transfer and receipt of data from the blockchain and centralized storage is carried out using REST requests.

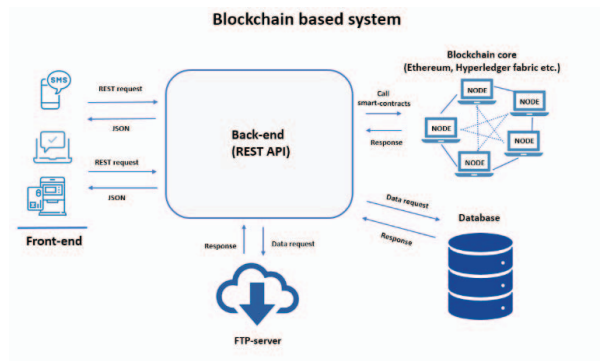


Fig 6. The architecture solution

The platform consists of the following parts:

- Server part;
- Smart contracts placed in the blockchain;
- Data base;
- File storage (FTP-server);
- Client part.

The main advantages of the chosen architecture are as follows:

- Save disk space on blockchain;
- A trusted authority to access the data;
- Fast data processing speed;
- Ability to implement client application to other platforms (REST API).

VIII. DATABASE DESIGN

Figure 7 shows architecture of the database. All charities prepare two types of reports. The first type of report for the Ministry of justice, the second which they upload to their website. Work with the preparation of reports takes a very long time because the reports have different structures. The database structure is satisfying for reporting for different charities.

The database is normalized to third normal form (3NF). Thus, it is possible to add new attributes without hard changes. In the database for each entity there is a flag that displays whether the hash of the entity is written to blockchain. When data is written to blockchain, the flag is changed to positive.

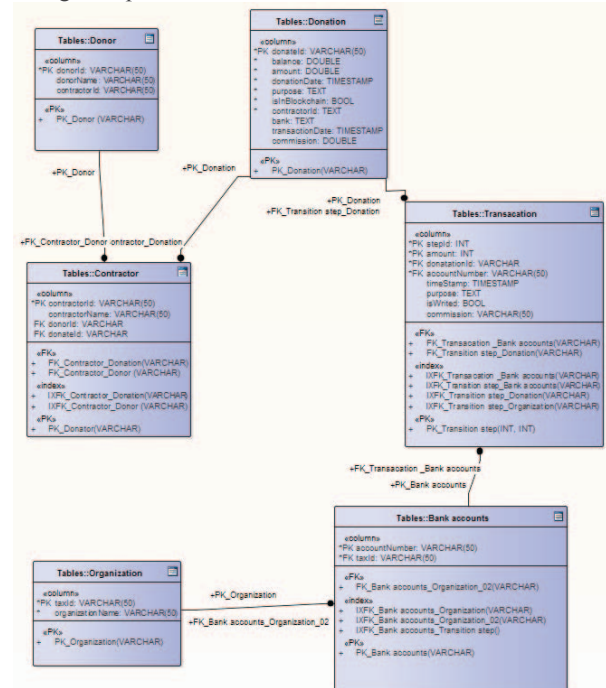


Fig 6. Database design

IX. BLOCKCHAIN PLATFORMS ANALYSIS

Developers use ready-made tools - blockchain platforms, and do not create a blockchain from scratch. There are a huge number of platforms that can be used to implement projects based on blockchain, such as Ethereum, EOS, Waves, Tron, Hyperledger Fabric, Corda, Exonum and others. Most of them duplicate the functionality of each other, so developers have a problem of choosing a platform for their projects. We conducted a comparative analysis of blockchain platforms by main criteria (shown below, in Table 2).

TABLE 2. BLOCKCHAIN PLATFORMS AND WEIGHT OF THEIR CRITERIA

Platform	Criterion						
	Smart contracts/chaincode	Commission	Private/public	Tokens	Throughput (transactions per second)	Block size (KB)	Consensus protocol
Ethereum	+	+	Public	+	25	1024	PoW
Waves	+	+	Public	+	100	1024	LPoS
Tron	+	-	Public	+	700	4	DPoS
EOS	+	-	Public	+	3000	Dynamic	DPoS
Hyperledger fabric	+	-	Private	-	3000 - 20000	Customizable	BFT
Corda	+	-	Private	+	170	Customizable	BFT
Exonum	+	-	Private	+	5000	Customizable	BFT

a. PoW (Proof-of-work), LPoS (Leased Proof-of-Stake), DPoS (Delegated-Proof-of-Stake), BFT (Byzantine Fault Tolerant)

Also, the choice of platform should be based on legal level. Will further smart contracts concluded on the chosen platform have legal force. As blockchain platform selected platform Ethereum. Currently undergoing official certification platform Masterchain. Masterchain is a fork of Ethereum platform. Masterchain uses Russian certified algorithms for cryptographic protection of information. In this way, the compatibility and authorization of the use of the platform at the state level will be ensured in the future [13].

X. TOOLS OF IMPLEMENTATION

The project uses Ethereum test network – Ropsten. For communication with blockchain server part use a standard library - Web3.js. Smart contracts implemented on Solidity language.

Server part (REST API) implemented using platform Node.js and framework Express on programming language JavaScript. Node.js has high productivity, an active community and is supported by large companies [14] [15].

MySQL is used as a centralized data storage (off-chain storage). Functions and procedures for quick interaction with the database have been developed.

Telegram bots was implemented to simulate process of donation and expenditure of funds on programming language Python.

XI. CONCLUSION

This project is implemented as a part of a government grant for applied research in favour of government of the Russian Federation by subject «Digital economy of the

Russian Federation» on the topic «Development of a platform for hosting and tracking donations of funds for charitable purposes using distributed registry technologies». This work is devoted to one of the most significant technology - blockchain. At the moment, blockchain technology is being implemented in many areas. There is a need for a single platform for charities and donors to increase transparency and simplify reporting. The analysis has showed that the use of blockchain technology in domestic charitable organizations, both individually and at the state level, will make donations not only more effective and reliable, but also more attractive to donors. It will also help to increase revenues, or at least reduce the amount of criticism from those who react negatively to budget cuts.

Currently minimum viable product of the future platform implemented. Ethereum currently used as blockchain platform. Smart contracts implemented using Solidity language. The server part of the platform was developed on Node.js platform using JavaScript. Telegram bots developed for simulating the process of donations and receiving chain of funds spending.

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