

A Track Donation System Using Blockchain

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Abstract— Charities face a difficult funding environment, mainly because charities are not highly transparent. Day over day It became more difficult to know whether donations are reaching the right place, or taking another course, such as financing suspicious campaigns, terrorist projects, etc. As a result, donors lose faith in these organizations, leading to a halt to interactions with charitable organizations. This makes it more difficult for charities to raise money at a great cost. This research proposed a solution to the mentioned problem using Blockchain technology, a decentralized database that provides security, transparency, and lower funding cost by eliminating the presence of third parties between donors and charities. A new track donation model was proposed which introduced several new participants that control the process of donation and remove suspicion of the charity. All donations can be tracked in Blockchain, allowing donors to know where and how their money is being used. The proposed model was implemented using Hyperledger composer then it was tested to obtain a live full track of a donation process. All donations are made using smart contracts, which allow donors to know exactly when and how their donations will be received. The Blockchain track donation system results in time-saving, reducing the cost of donation, and reduces the risk of reaching suspicious campaign donations or terrorist projects. A website was created as a facilitator for users for ease of use of the proposed system.

Keywords—Blockchain, Donation, Charity, Smart Contract

I. INTRODUCTION

Blockchain is a new generation of transactional applications technology that establishes trust or it can be

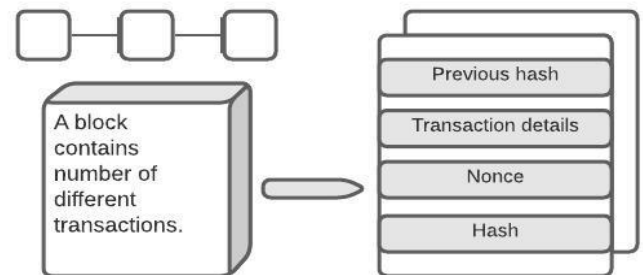


Fig.1. Blockchain Four Main Headers

considered as a shared immutable and permanent ledger for recording and tracking some required features of transactions like transparency, accountability and execution while streamlining business processes. It can be considered as an operating system for interactions. Blockchain has the potential to vastly reduce the cost, complexity, and existence of a third party in transactions between memberships. Blockchain is related to cryptocurrencies such as Bitcoin. It is a special kind of database with confirmed, authorized, validated, and distributed transactions [1]. The validated transactions are maintained by a decentralized group of computers distributed around the world. Instead of centralized authority. Those transactions are packaged into blocks, each block is linked to previous blocks of transactions through a chain called Blockchain.

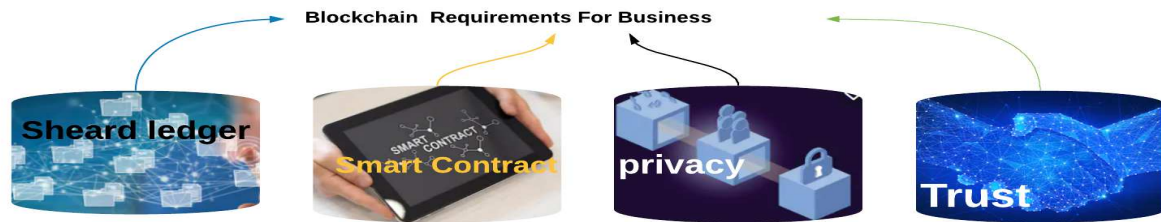


Fig.2. Blockchain requirements for business

In Blockchain, Four main headers are contained in each block: (1) Previous Hash: previous block location is determined by this hash address, (2) Transaction Details: information and details of validated transactions, (3) Nonce: a cryptography arbitrary number to differentiate the hash address for the block, (4) Hash Address of the Block: the previous headers are sent through a hashing algorithm that produces the unique hash address or the hash of the block. Blocks cannot be manipulated or changed due to the decentralized nature and the structure of Blockchain. Once a transaction is recorded in a block it cannot be manipulated or changed.

The Blockchain technology needs to meet four main requirements to cope with modern business applications shown in figure 2, which are: (1) Immutability of shared ledger: no one can tamper or modify a transaction if it was validated or records of the shared ledger, the hash of the block is updated thus violating the integrity of the stored data Blockchain. (2) Smart contract: Software protocol that provides a well-defined set of constraints and rules to be executed automatically that accesses a shared ledger. Applications can execute transactions to be distributed in a shared ledger through smart contracts without the need of a third party while reducing the delay and costs associated with traditional contracts. Smart contracts encapsulate constraints, terms, rules, and conditions of transaction execution. (3) Privacy: achieving appropriate visibility, securing transactions, authentication, and verification for the shared ledger. Appropriate privacy terms and confidentiality between participants is the main issue in Blockchain besides a defined identity for each participant [2]. (4) Trust: It is accomplished by choosing specific members of the business network to verify and validate transactions in a Blockchain for business. It is also possible to encourage various members to support various types of transactions [3]. This allows any data or record across the network to have a verifiable audit trail. Once the Blockchain has met the previous requirements, it became applicable in many fields of business and life applications.

This research extends the vital role of Blockchain technology to be applicable in the field of money tracking to help Nonprofits organizations to prove their transparency and confidence to the donors. Besides linking Blockchain technology to the field of money tracking, this paper aims to introduce a suitable solution to the problem of tracking donation by introducing new components of the traditional system of donation that manage the process of donation step by step. Hence, the user can track the funds at any step in a transparent way and the authority of Nonprofits in spending funds will be eliminated and passed to other participants including the donor.

II. PROBLEM STATEMENT

Nonprofits face significant confidence-related challenges as they suffer from the lack of accountability and transparency of how funds are distributed. Some donors and charities asked for the intervention of third-party websites to track charities and the transparency of their donation. A charity organization with supervision and donation track has more donations than one without supervision. So unsupervised charities lose trust and confidence over time even if they are trusted. Over time, the process of donation became more obscure for donors and makes charities lose trust and confidence.

Some solutions were proposed to secure the process of donation from the donor side like [4] proposed in 1995 a primitive way for donation by allowing a credit cardholder to donate to a charity chosen by the cardholder anytime he makes a transaction using the credit card. Several charities employ individuals or organizations to collect money and attract potential donors. Usually, there are also costs associated with such organizations, a certain portion of the funds received by these charities that might otherwise be used for the charitable purposes of the organizations must now be spent on costs associated with attraction and soliciting funds or hiring the employed organizations. It would therefore be useful to have a donation transaction apparatus and process that decreases manpower requirements and/or costs associated with at least some donation transactions.

A technique in [5] for facilitating donations to charities is given for the donation transaction was proposed in 1999. The apparatus is designed to accept money or, in some modalities, authorization for the transfer of cash or funds or credit charges, and preferably provides the user with a donation receipt that can be used by the user to file or document income tax returns.

Another electronic directed donor system of charitable donations is [6] which was explicitly designed in 2005 for the Internet, from which donors can direct the disposal of donations. Participating charitable institutions can specify the necessary goods and services and donors can donate money to be used by the institutions for these particular needs.

In [7] authors aim to build an adaptive framework for various charity organizations with Software Product Lines (SPL) as their solution to dealing with the problems of charities. They presented a forum to build ABS charity structures as a central architecture to support SPL.

All the mentioned solutions were concerned with the way of securing the process of donation and making it easier for the donor and did not concern whether the donations were received by needy people or not. They are only concerned with how donations can reach charity or bank in an easy and safe process using old and traditional techniques.

III. RELATED WORK

Blockchain has been employed in different fields of lives and applications. Some modern researches focused on deploying it and getting profits from it in many business fields. Some of these modern real-world applications are:

A. *Supply chain management:*

The overall reliability of supply chains is improved by Blockchain. It offers precise identification of the position of goods in the supply chain. It thus eliminates the need for trials dependent on paper. It helps to avoid losses in production and to track the quality of goods. A feasibility study was done in [8] where the authors have investigated the impact of Blockchain on Supply Chain Management and the potential design issues by a generic stochastic model.

B. *Digital IDs:*

Microsoft is working on developing IDs to empower disadvantaged people and refugees, with an estimation of 1 billion people not having an identity worldwide. This will lead to connecting them to the formal financial sector. Via its Authenticator app, it aims to do this. Authenticator does not use a password, it uses an additional layer of security that recognizes a returning user or a computer using a code or a token. For consumers, it is an ideal way to manage their digital identities.[9] Discussed the potential benefits and impact of employing Blockchain for a more robust identity system where it proposed a digital identity verification framework with record attestation and sharing based on Blockchain technology.

C. *Healthcare:*

The patient has the right to access reliable data, being the focal point of the healthcare ecosystem. It can be regarded as a matter of life and death as well. Health data privacy and protection are very critical in the field of healthcare. It helps to monitor the number of prescription medicines in series and batch numbers. A new security architecture based on Blockchain was proposed in [10] to cope with the requirements of electronic medical records. The basics of Blockchain besides the current and future applications of Blockchain within the healthcare industry were illustrated in [11], [12]. An example of these applications was Guardtime which is a Netherland-based data security foundation that has partnered with the government of Estonia to make a Blockchain-based framework to verify patient identities.

D. *Wills or inheritances:*

It is now possible to replace paper wills or inheritances with digital ones that can be generated and stored using the Blockchain network. Since it will make the document both legally binding and crystal clear as to who should inherit the properties when people pass away, it must be used along with smart contracts. This puts to rest the end-of-life

worries. A neuron Blockchain algorithm was proposed in [13] to deal with the legal problems of inheritance.

E. *Food traceability and safety:*

The ability to track your food from its origin to your plate is the fascinating application of Blockchain in food protection. Using the immutable existence of the Blockchain, it is possible to track the transportation of food items from their source to their last destination. The source of the contaminant can be traced easily and reliably in the case of nutrition diseases. A traceability system in [14] can record and trace each step or movement of food in a supply chain.

F. *Digital voting:*

The main issues of Blockchain in digital voting [15], integration of digital national id with Blockchain [16], and secure voting systems [17] are some examples of how Blockchain is used in digital voting. With the transparent existence of the Blockchain, a trusted vote can be truly counted. The token-based system created using Blockchain technology would guarantee one unchanging vote per person for the system.

G. *Real estate:*

Details and special information about ownership are stored and saved in the Blockchain. This makes it very easy to trace the ownership and know the current ownership or any transfer of this ownership. It provides a clear picture of the history of any real state and legal ownership by eliminating the existence of any suspicious paper contracts. A special use case about the use of smart contracts in the field of real state was presented in [18].

H. *Money Tracking:*

With the growth of Blockchain technology, some researchers are concerned with the transparency of the process of donation as in [19] where the authors proposed a system that concerns integration between charitable foundations and aggregating data in one place. The system aimed at integrating different systems of charities foundation into one platform.

In [20], [21] authors introduced a system depending on tender submission between organizations to the charity chain. One of the Blockchain donation tracking models was [22] where authors depend on a strategy in which an electronic wallet is created for the donor and assigned a unique id. The charity fund verifies the applications of the recipient and decides the form of service, the production of the electronic donation collection wallet for the service donor's account, and the sum needed.

New research based on an Ethereum network was presented in [23]. The research proposed a decentralized donation monitoring system based on Blockchain using Ethereum Blockchain that will provide the intended recipients with full transparency, accountability, and direct reach. The authors introduced the government organization to approve the requirements of charities to be announced to donors. Hence, the system is concerned with proving the trust of charities.

Many successful projects depending on Blockchain and money tracking were spread all over the world in various fields of aids such as OIN.Space, luxury for donation tracking, the Leukemia Fund which is a Russian Blockchain reporting, The (WFP) UN world food program also used Blockchain tracking for distribution of assistance

to directly pay vendors in Jordan, facilitation of cash transfers for more than 10,000 Syrian refugees, and auditing of spending by beneficiaries, Akshaya Patra, the largest non-profit provider of cooked meals for school kids in the world, used a Blockchain solution to minimize the cost of each meal it provides, The Ethereum Blockchain electronic wallet for the Charity Fund for older people and the DataArt Blockchain project that was called Charity Lottery.

IV. PROPOSED DONATION SYSTEM

From the previous work in the field of donation, the authority of fund spending was passed from the charity and Nonprofits to another centralized foundation that controls the funds and this conveys the main problem of transparency and suspicion from charity to the new foundation. Hence, a new proposed system that consists of several new participants was proposed in that section of the paper where each participant was assigned a part of the authority of spending funds process. With specified roles for each participant that complements each other, the process of tracking donation became more modest and decentralized. Each participant in the system was defined and presented with its main role and process in the system, architecture and sequence diagrams were presented to clarify the role of each participant.

A. Proposed System architecture

The proposed system concerns with eliminating the absence of monitoring and censorship of charities, so the proposed system introduces two major participants. These new participants act as the dominant component of the system as they take the decision and verify any transaction in the system. Donors, charities, and beneficiaries are the main building blocks of any system. With the aid of new dominant participants like monetary funds and global citizen, the transparency of the donation process is verified as illustrated in figure 3. The main participants and their roles are:

1) *Donor*: any individual or organization that needs to make a trusted donation process by choosing one of the trusted charities that are supervised by the blockchain system. Besides choosing a charity, a donor can also choose a specified beneficiary with a certain amount of donation that the beneficiary needs which is declared by temporary changing Blockchain records, depending on other received donations.

2) *Charity*: The organization that is supervised to be a trusted organization by joining the Blockchain system. This organization is responsible for introducing social case research about each beneficiary and the amount of required donation for each one of them to the global citizen. After approval from the global citizen about these social case research, charities can announce the required donations for the intended donors.

3) *Monetary fund*: a financial organization or government organization that is responsible for receiving the donation from the donor and send the specified amount of donation required by the charity after verification of the beneficiaries and their needs by Global citizen.

4) *Global citizen*: a neutral and non-profitable organization that acts as a verifier for each social case sent from the charities and have the decision if the monetary fund can send a donation for charities or not depending on social case researches.

5) *Beneficiaries*: needy persons who can apply a donation request for any donation charity in the Blockchain.

B. Proposed System Scenario

The system follows predefined steps for confirmation of the donation process as shown in figure 4 that can be simplified as follows:



Fig.3. Proposed Blockchain Track Donation System Architecture

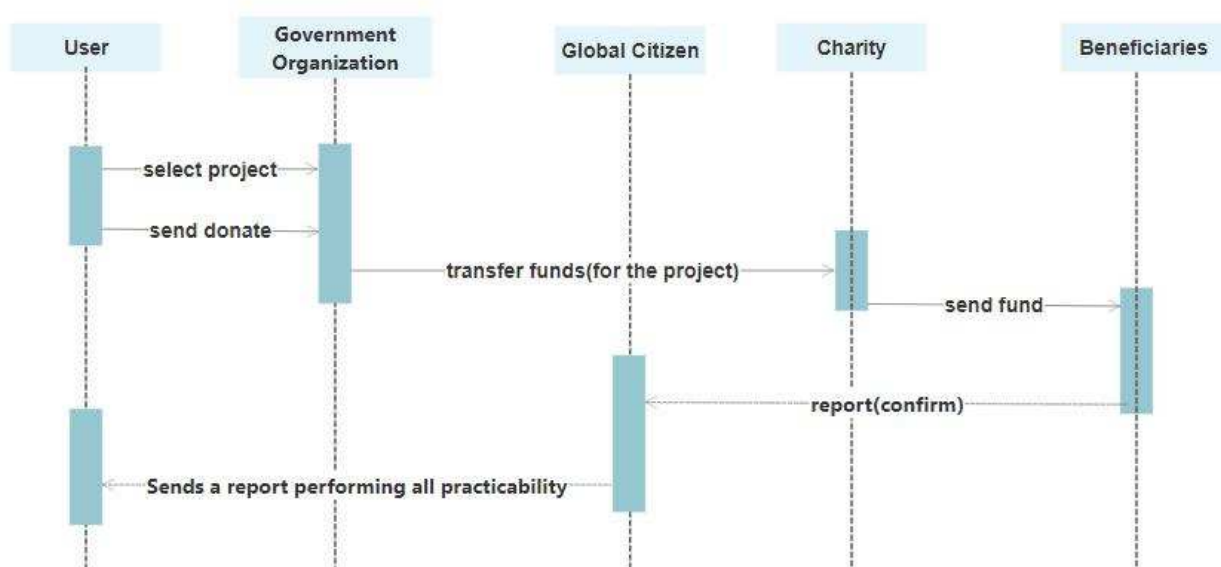


Fig.4. The Proposed System Sequence Diagram

- 1) *Application and registration of beneficiaries:* The first step before any transactions or donation to be executed, the beneficiary applies for a donation request to the charity which then introduces the available applications to the global citizen with the required amount of funds.
- 2) *Verification of the beneficiary social case:* After applications have been sent to the global citizen, it makes social case research about the beneficiaries. After verification, only applications that fulfill the rules are sent to charities to be announced to donors.
- 3) *Donor decision for donation:* after social state verification of needy people, the donor can decide donation for which beneficiary and which amount or type

of donation whether it is cash or material aid.

- 4) *Transfer of funds to a government organization (monetary funds):* The government organization receives the donations from the donor directly after verification of the donor's account. When the global citizen sends a confirmation about donations to this government organization, this organization transfers required funds to the specified charity which sends funds to the required beneficiary.
- 5) *Donation transfer to beneficiaries:* charities receive funds from monetary fund then send it to the required beneficiaries which in turn sends a report to global citizen with the received funds and donations.
- 6) *Sending report to the donor:* if the transaction of the donation was done correctly, the global citizen sends a

Transaction Report				
<div> <div>ENTER YOUR Email :</div> <div>ahmed@gmail.com</div> <div>Apply</div> <div>Print</div> </div>				
MoneyID	Amount	Date	ProjectID	TransactionID
18	23000	2020-08-16T00:28:44.700Z	P2	404a07e25af07a8a588a57912513361cef070fcd078788b0d13ae42ed0112816
51	23000	2020-08-15T23:58:51.981Z	P1	e72269e1064ffa4bc899c60abcd240a22d79e0224143248ecf888c44c8e24a66
16	5000	2020-08-16T00:29:09.845Z	P3	082d76bf29533991f541270c5398482b332f66fed5fa89b01b5e2913d9dda19b

Fig. 5. Blockchain Track Donation System Report



Fig. 6. Projects announced to users in Track donation website

report to the user with the same specified donations and confirming the process of donation. Of course, all these processes were saved as immutable records in the Blockchain as all the mentioned participants have accounts and privileges to track the processes of donation in the Blockchain.

C. Proposed System Implementation

1) The implementation was done using Hyperledger Composer to build the network. By using Hyperledger Composer playground for defining and testing models like assets, participants, and scripts. The business rules in transactions and smart contracts are implemented and transactions were invoked using Hyperledger Composer.

2) Model files are created describing assets (objects to be owned or controlled like goods or money), participants (business network members), and scripts (transactions processors that provide implementation with JavaScript of transactions).

3) Defining privacy rules that can be simple or complex in access control files.

4) The business network was created by running docker and fabric, then creating admin cards.

5) Generating the skeleton of the app using Yeoman and filling the files with code that has been done in the playground.

6) Creating the file of Business Network Archive (BNA) then deploying the .BNA file on the Fabric.

7) After creating the network and participants, the scenario of the proposed system will be created and transactions will be verified. Each transaction will have a unique ID. The donor will receive a report for each

transaction or donation process in the network in the form of figure 5.

8) The proposed system was implemented and designed on a website to facilitate the donation process. All participants have a username and password to access their accounts to track any selected transaction. The donor can choose any charity or any project of donation with a specified amount of required funds that are changed temporarily according to current donation processes as illustrated in figure 6, the transaction report that is delivered to the donor from the system website was presented in figure 4 where the ID of the transaction, amount of money, very accurate time and date of transaction, and the chosen donation project number of the specified charity.

V. CONCLUSION

The proposed system concerns with the confirmation of transferring aids and donations to beneficiaries with predefined constraints. Third-party between donors and poor people was removed as all network participants were assigned in the Blockchain system by predetermined authentication techniques. The system was split into several participants with specified roles. The proposed model has been turned into a real system that was tested and implemented using Blockchain technology. As a result, each transaction has its participants and their assets with a smart contract which make the transaction a successful one. By using a smart contract, terms, and rules that once it has been verified the transaction will not be changed anymore. A report with a transaction ID was sent to the user to verify transactions. The implemented system saved time, reduced the cost of donation, and reduced the risk of reaching suspicious campaign donations or terrorist projects. A website from which users can track or send and

receive reports was created and a final report form was generated to ensure the transparency of the donation process.

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