

# Sustainable Member Motivation System Proposal for NGOs: NGO-TR

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**Abstract**—Non-governmental organizations (NGO) depend on their members to survive. They need to reach the potential volunteers. They also aspire to keep track of their members' effectiveness and to motivate those members to be more active. The volunteers need a transparent system, where their privacy is preserved. Our meetings with several NGOs show that there is a solid need for a transparent, effective and trustworthy system, where NGOs can track their members' effectiveness, create enthusiasm and even collaborate with the volunteers from other NGOs. A system, where gamification principles are used for member motivation and the reputation of any member is calculated by his/her activities, is proposed. The blockchain technology will be used for the gamification process and the decentralized digital identity management. The decentralized digital identity management approach will help in providing the volunteers to gain full control over their identities and ensure the privacy. A design approach for the proposed system, the expected requirements and some possible use case scenarios have been presented. The prototype is implemented via Hyperledger Fabric and Hyperledger Indy software platforms, as a proof of concept. Chaincodes are to be implemented for the system to work autonomously.

**Keywords**— Non-governmental organizations, social projects, gamification, blockchain, decentralized digital identity

## I. INTRODUCTION

Non-Governmental Organizations (NGOs) aim to make the society socially active. Recent researches demonstrate that educated people in the USA and Europe trust NGOs more than companies and the media [1]. NGOS consist of members (volunteers) who came together for a purpose on voluntary. This voluntary potential is one of the most significant resources for the development of the NGO. Ensuring volunteers to become more active in the NGO is a challenge to be accomplished. Encouraging people to volunteer can be accomplished by building reliance between the participant and the NGO and strengthening their loyalty by giving responsibility to them [2].

We propose a sustainable member motivation and management system which we call NGO-TR. This system will use gamification techniques and the blockchain technology. The system will support multiple NGO's and multiple volunteers.

The reliability of the members and their performances in the activities determine the reputation of the member and most NGOs need a profiling system that they can assess the reputations and track the progress of each volunteer. Processes

are expected to perform transparently and reliably in such a system. Profiling can mean disturbing to some, this process can also be accomplished by taking privacy measures. Gamification techniques can be used to make this process fun. These methods can be used to increase the participation and encouragement of members, as the volunteers can be motivated to increase their reputation by being a more active volunteer [3]. Achieving these processes autonomously is important for trust and reliability. Autonomous systems can be accomplished by using blockchain technology. Smart codes can be used to establish trust between parties.

There will be multiple NGO parties and multiple volunteers and the volunteer may not prefer to share his/her identity with all. In traditional methods, the identity data is stored in some centralized authority and the users assume that their data's privacy and integrity is preserved. Decentralized digital identity management approach can be used to give the volunteers full control over their identities and ensure the personal data privacy and integrity [4].

In the next section, fundamentals is explained. Related works are given in section 3. The proposal of the system is explained in section 4. Finally, results and conclusion are given.

## II. FUNDAMENTALS

### A. Sustainable Volunteer Motivation and Management

The reasons that lead volunteers to engage in voluntary activities in an NGO can be various. Volunteers can categorized diversely according to their experience, aims and expectations. The management should try to reach the desired efficiency and performance of the volunteers, which is a big challenge. The sustainability of volunteering should be aimed. An efficient volunteer management is necessary to provide all these [5].

If volunteer management is implemented with more systematic and proven criterias, modern and effective solutions to the difficulties experienced with volunteers can be improved. Many of the issues related to volunteer management will be eliminated if the following systematic steps are considered:

- Determining the required volunteers
- Defining the roles of volunteers
- Supplying proper roles to the volunteers

- Informing their roles to the selected volunteers
- Providing trainings to the volunteers
- Evaluating and analysing the feedbacks from the volunteers
- Tracking the volunteer potential and ensuring mutual satisfaction

The systematically and transparently tracking of all these necessary steps can be facilitated in the NGOs with the use of the autonomous systems. The sustainability will increase, when volunteers track the progress they have made both personally and collectively. The adaptation of autonomous systems to NGOs will bring the ability to track the tasks achieved by all members within the organization transparently. The situation will create a confidence atmosphere between the NGO and the volunteer, as well as increasing the volunteer's devotion and performance [5].

One of the major issues in voluntary management is finding non-pecuniary motivation sources for sustainability. Non-governmental organizations can take some encouraging steps to increase voluntariness. Transparent scoring systems can be a good idea if it is well designed with gamification principles. This can be used to increase volunteers' attention and motivation. The transparent scoring systems can be used to evaluate volunteers by their activities and increase their competence within the community [5].

### B. Blockchain

Blockchain is a technology where the aim is to establish trust without intermediaries. Blocks are created by keeping each record linked to each other. This forms a decentralized and secure structure which is called the ledger. The records are ensured that they are tamper-proof. This data is kept in devices called the nodes.

There are different blockchain structures that vary according to the anonymity of the nodes and the trust between the nodes. These are shown in Fig. 1 [7]. Any node in the open/permissionless blockchain can join and exit the network at any time, download protocols and view transactions. The validators are anonymous and there is lack of trust in Open/Permissionless blockchain structures. Bitcoin is an example of a Open/Permissionless blockchain. In the permissioned blockchain, only consortium members can join, exit, download protocols and view transactions.

Validators are not anonymous and there is trust in closed/permissioned blockchain structures. This structure is suitable for the enterprise solutions. This solution is also energy efficient and scalable. Hyperledger is an example of this blockchain structure. Hyperledger is preferred in this project because of this features.

Hyperledger Umbrella Project was launched by IBM in December 2016. It was later incorporated to the Linux Foundation. Hyperledger Indy (<http://www.hyperledger.org>) is a framework designed for the distributed digital identities. It can work with 2600 credentials in a minute [11]. Users can manage their identities on their own without any need of an organisation with Indy [12].

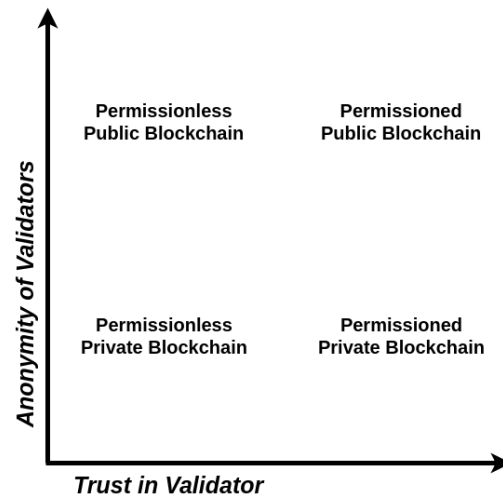


Fig. 1. Anonymity/Trust of Validators

### C. Gamification

Gamification is one of the most popular approaches in our age which is focused on the interaction of people with devices [10]. It is a concept which uses the power of the games in order to create motivation for not so entertaining purposes [11]. It can be used for an enterprise to manage the engagement of members and enhancement of productivity [10]. As an example, an automobile retail chain received 95 percent voluntarily participation rate with gamification efforts [12]. Thus, it can be implemented in NGO's to benefit from these features. According to self determination theory; people have three psychological needs which are the needs of competence, autonomy and relevance. If these needs are met, people are naturally motivated [13]. In the system we propose, it will let the person gain credits by his/her actions while providing the autonomous run of the system. The competence is to be satisfied by the reputation and the volunteers activities will be profiled to assess that. The motivation is to be met by the sense of belonging and the gamification techniques will be used to reach this goal.

### D. Decentralized Identity Management

User information is usually kept in several databases in each service provider. This solution is inefficient, hard to secure and hard to maintain. Identity control mechanisms are needed where the user has the total control of his/her data. Decentralized approach to the digital identity issue can provide that control and privacy to the user over their identity data [4]. The main technique that is to be studied is the Zero Knowledge Proof (ZKP). ZKP is the method that is used to prove an argument without revealing any information about it [14]. Thus, an identity can be claimed and proved without actually sharing the credentials by using ZKP and decentralized digital identity management. These solutions ensure data integrity and will reduce the risks of the data breaches. Users will have the right to share the requested parts of their personal data. Decentralized applications will be able to reach the shared data when access granted through the blockchain based solutions [15-16].

## III. RELATED WORKS

We had proposed a NGO communication platform in an old publication [17]. NGO's were at the center of that study and there were trust issues which we believe can be solved with the blockchain technology. Blockchain based digital

identity management solutions are summarized in [16]. Transforming organizations through gamification is covered in [10]. There are blockchain based products which use gamification principles in the market such as Whappy (<https://www.whappy.it>) and Open Social (<https://www.getopensocial.com>). Table 1 compares these solutions with our solution NGO-TR. Open Social group claims that social rewards have no real-world value and have a cryptocurrency token based rewarding model [18]. Whappy uses blockchain to make gamification and loyalty programs reliable [19]. NGO-TR is not a commercial solution and does not depend on cryptocurrency. It is energy efficient as it does not use PoW consensus protocol.

TABLE I. COMPARISON OF NGO-TR WITH OTHER SOLUTIONS

	Digital Identity	Gamification	Reputation	Blockchain Usage
Whappy	No	Yes	Yes	Make gamification and loyalty programs reliable
Open Social	No	Yes	Yes	Cryptocurrency Token based Rewarding model
NGO-TR	Yes	Yes	Yes	Digital Identity + Reward

#### IV. SYSTEM PROPOSAL

The system which is proposed to be used for the volunteer management and motivation is shown in Fig. 2. NGOs and the users interact with the system through the smart codes (smart chains). The system proposal includes the following subsystems which will be described in the following subsections:

- **Digital Identity System:** User details are kept in the digital identity system. Prototype is being implemented in the Hyperledger Indy blockchain framework. Privacy and integrity of the user data will be satisfied.
- **Profiling (User Activity) System:** User activities will be kept in a database with an activity history. All the successfully finished and unfinished activities will be kept with remarks if needed. This database can also be implemented as a blockchain ledger even it is not a must.
- **Gamification (Awarding) System:** User activities can be reviewed and rated by both the NGO and other volunteers that participated on a specific activity. Successful volunteering activities will be rewarded and total points of the volunteer will be kept in Hyperledger Fabric blockchain framework.

This system uses blockchain structure to ensure that the assets are kept without any manipulation and work autonomously. However, it will make sense when more than one party is involved in the consensus process. Following conditions are expected for a proper system setup:

- NGO have management in more than one region and more than one country. Each region of that NGO can be a node and this system will also ensure trust between regions and countries.

- More than one NGO can use this system and ensure trust between each other.
- Volunteers can be involved in more than one NGO and reputation is to be calculated by taking this into account.
- Sponsor firms and other organizations may be involved in the future phases of the project.
- NGO can request an active (enrolled) volunteer's personal information from directly the volunteer.

The datasets which are to be used can be classified as:

- **User Public Dataset:** Publicly available information.
- **User Personal Data (Digital ID):** The information to be shared on the consent of the volunteer.

##### A. Datasets & Profiles

User public datasets consists of public personal data and user activity records. The publicly available datasets will be processed to form the following two profiles:

- **Public profile:** This profile is formed of the selected information of the volunteer which the user wants to keep public. It is formed of username, avatar and other public information.
- **Activity profile:** This profile is formed from the user activity records which the user took part in it.
- These records can be kept in a relational database like MySQL or even Hyperledger Fabric can be used. Database can also be preferred in the system as the public records will not contain private personal data and there is no trust related issue. This selection is also based on performance issues as this data will consistently be analysed by the Machine Learning Techniques.

User personal data (Digital ID) will be kept private in a global blockchain network. This data will consist of volunteer's private information such as name, address, phone number etc. Hyperledger Indy will be used to form a prototype system. The personal data of the volunteers will be stored in the decentralized blockchain network.

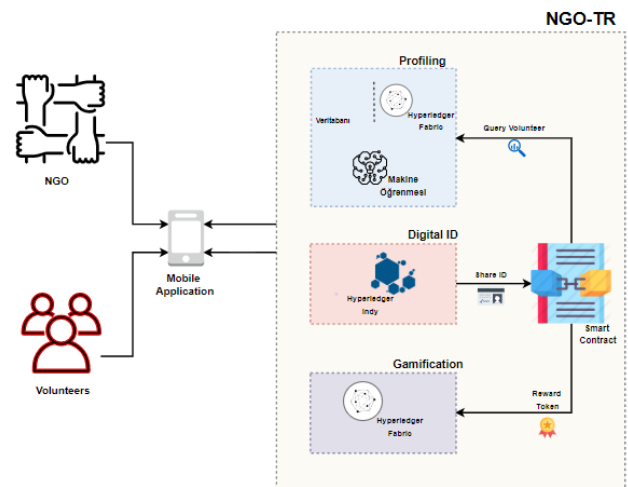


Fig. 2. NGO-TR volunteer management and motivation techniques

Workflow for an activity process is shown in Fig. 3. The NGOs or autonomous codes (chain code) will ask consent of the volunteer to reach some parts of his/her personal data. These data will be processed to form the private profile of that user. Volunteers can accept or deny personal information request of the NGOs.

### B. Reaching Possible Volunteers Process

The system will be constructed in such a way that NGOs will not need to search for volunteers. The steps of reaching possible volunteers will be as follows:

Step 1: Propose an activity and specify the needed profile of the volunteers.

Step 2: An autonomous code will query the volunteer activity profiles with generic criterias. The generic criterias will be experience, history of activism or the reputation. The system will query the database and supply the list of volunteers regarding to those criterias. These criterias are also planned to be automatically generated with the machine learning algorithms.

Step 3: Smart contract will send invitations to this list of possible volunteers and then ask them for their enrolment in that volunteer activity.

Step 4: NGO will ask these users to access their personal data which is stored in Hyperledger Indy ledger. Volunteers can give permission to the NGO for the requested data. Then the NGO can use this information to contact them to collaborate in an event.

### C. Gamification (Awarding) Process

The NGO will reward the user with a specific amount of token after the event is completed. Current version of the Hyperledger Fabric does not support tokens, so assets will be used as a token. Token will be implemented in the future with the upcoming version of the Hyperledger Fabric. The token amount can be specified during the announcement of the activity and also the performance of the volunteer. These tokens will be used to form the value which will be used to show the global volunteer reputation. Gamification principles will be used to increase the volunteer motivation.

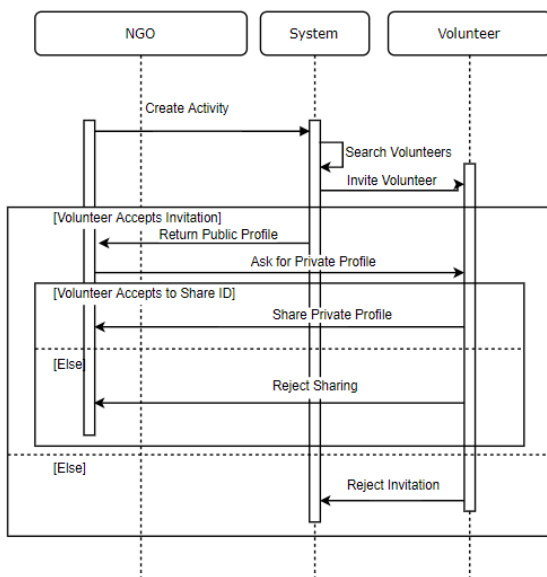


Fig. 3. Workflow for the Activity Process of NGO-TR

Gamification part will be implemented in the following studies. Different techniques will be tested with the volunteers of the Ahbap NGO and the appropriate game dynamics will be selected. The game dynamics which is planned to be implemented are [19]:

- Points
- Levels
- Challenges
- Badges
- Leaderboards

## V. IMPLEMENTATION

The implementation platform is selected as an ordinary PC with 8 GB of RAM, 1 TB of HDD and i7 Intel 2.7 GHz CPU. Hyperledger Fabric 1.4 is going to be used for tokenizing. The assets will be used for this, then tokens will be used with the Hyperledger Fabric 2.0 version. A couple of Hyperledger Fabric Peers representing different NGO nodes is installed and run in the Docker containers. Each NGO has its own channel in order to have transactions with its own members and a common channel for all nodes is going to be created. Each peer will have a database for keeping the assets (user public dataset) of the volunteers. Those assets will also keep the tokens (points) that a volunteer earned.

A mobile application is going to be used by NGOs for reaching the volunteers' public information which is stored in the Fabric ledger. Hyperledger Indy 1.9 is selected to manage the digital identities. The demo scenario is implemented as a proof of concept where it is shown that it's possible to share the requested volunteer (user private) data with the NGO. Project code and details will be reachable through the project github repo (<https://github.com/MSKU-BcRG/NGO-TR>).

## VI. RESULTS AND CONCLUSION

Our previous NGO communication platform proposal [17] was not focused on the volunteer and the NGO's didn't realize the benefits of such a communication platform. The world is changing as decentralized technology platforms ensure systems without intermediaries. In this NGO-TR proposal, we put the volunteer as the main user of the system and dream of a world where any citizen can contribute to any activity of any NGO. The volunteer does not need to be a member if the NGO permits that case.

NGO-TR system is proposed for increasing the members activeness in the NGOs in this study. The proposed system is designed to increase the volunteers' activeness and ensure the personal data privacy. All the activities will be transparent to all users in the system. The NGO's will be able to actively monitor the volunteers' activeness in the level that the volunteer permits.

We believe that such a tamper-proof, transparent and autonomous system will help in managing the NGOs in a more democratic way. This study is a proof of concept that such a system is possible. Gamification techniques will help in the sustainability of the volunteers activeness. The decentralized technologies with ZKP will resolve the problems of identity management and privacy. However blockchain technology is still evolving and there are still challenges to be solved. Even this means changing the code and even the system eventually, we believe it worths the effort.

Future works will include improving this system according to the feedbacks from the NGOs. The system will be tested with NGOs and machine learning algorithms will be run to optimize the profiling process.

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#### REFERENCES

- [1] R. Lehr-Lehnardt, "NGO legitimacy: reassessing democracy, accountability and transparency", In Cornell Law School Inter-University Graduate Student Conference Papers (p. 6), April 2005.
- [2] Birleşmiş Milletler Gönüllüleri (UNV) Programı Türkiye & GSM Gençlik Servisleri Merkezi, "Türkiye'de gönüllülük: gönüllülüğün rolünün ve katkılarının keşfedilmesi [volunteering in Turkey: the discovery of the role and contributions of volunteerism]", unpublished.
- [3] S. K. Bista, S. Nepal, N. Colineau, and C. Paris, "Using gamification in an online community", In 8th International Conference on Collaborative Computing: Networking, Applications and Worksharing (CollaborateCom) (pp. 611-618). IEEE, October 2012.
- [4] A. Bakre, N. Patil, and S. Gupta, "Implementing decentralized digital identity using blockchain", International Journal of Engineering Technology Science and Research, 4(10), pp. 379-385, 2017.
- [5] M. L. Arslan, "Sivil Toplum Kuruluşlarında Gönüllülük: Sorunlar ve Çözüm Yolları [Volunteering in Civil Society Organizations: Problems and Solutions]", unpublished.
- [6] S. Nakamoto, "Bitcoin: A peer-to-peer electronic cash system", unpublished.
- [7] A. Ö. Gür, Ş. Öksüz, and E. Karaarslan, "Blockchain based metering and billing system proposal with privacy protection for the electric network", In 2019 7th International Istanbul Smart Grids and Cities Congress and Fair (ICSG) (pp. 204-208). IEEE, April 2019.
- [8] The Linux Foundation, "BC aims to cut government red tape with Hyperledger Indy", unpublished.
- [9] C. Saraf and S. Sabadra, "Blockchain platforms: A compendium", In 2018 IEEE International Conference on Innovative Research and Development (ICIRD) (pp. 1-6). IEEE, May 2018.
- [10] B. Peischl, J. Schantl, and A. Holzinger, "Energizing people's work: transforming organizations through gamification", In 2014 11th International Conference on e-Business (ICE-B), pp. 201-208, August 2014.
- [11] M. Sailer, J. Hense, J. Mandl, and M. Klevers, "Psychological perspectives on motivation through gamification", Interaction Design and Architecture Journal, (19), pp.28-37, 2014.
- [12] K. Kapp, "Gamification: separating fact from fiction", unpublished.
- [13] S. Jessen, J. Mirkovic, and C. Ruland, "User and stakeholder requirements of eHealth support tool viewed in a self-determination theory lens", In 2017 IEEE 30th International Symposium on Computer-Based Medical Systems (CBMS), pp. 682-683, June 2017.
- [14] O. Goldreich (Ed.), "Providing sound foundations for cryptography: on the work of Shafi Goldwasser and Silvio Micali", Morgan & Claypool, 2019.
- [15] E. Karaarslan and E. Adiguzel, "Blockchain Based DNS and PKI Solutions", IEEE Communications Standards Magazine, 2(3), pp.52-57, 2018.
- [16] S. Y. Lim, et al. "Blockchain technology the identity management and authentication service disruptor: a survey", International Journal on Advanced Science, Engineering and Information Technology, 8(4-2), pp. 1735-1745, 2018.
- [17] E. Karaarslan, B. Yorgan, F. Civelekoğlu, and F. İkiz, "Sivil toplum kuruluşları iletişim platformu [Civil society organizations communication platform]", X. Türkiye'de İnternet Konferansı, 2006.
- [18] T. Potze, "Gamification on the blockchain; creating real value", unpublished.
- [19] A. Gazzero, "Enterprise gamification: the ultimate guide", unpublished.