

# Time Bank using Public Blockchain



Sindhura Arepalli, A. Naga Kalyani, Chandrasekhar Uddagiri

**Abstract:** Time banking is a mode of exchange that lets people to use time as exchange currency instead of money. By registering in a time bank, people agree to take part in a system that involves earning and spending 'Time Credits'. When they spend a unit of time on an activity to serve others, they receive one time credit. Later when they need service from others, they can use the time credits that they have earned and saved. Time credits are also transferable to their nominees. Block Chain technology is used to implement this design to ensure robustness, transparency and security. Ethereum, which is a public Block Chain protocol was used to remove third party intervention. Block chain is used as ledger to keep track of the activities in the time bank accounts, such as sign up, recording the credits, tracking the events etc.

**Keywords :** Blockchain, Ethereum, Time credits, Time bank.

## I. INTRODUCTION

A blockchain is said to provide an integrated and protected data storage and also allows provides transparency of the whole process. There are permission less (e.g., Bitcoin/Ethereum) as well as permissioned (e.g. Hyperledger/Corda) blockchains. The choice between them is not trivial. Based on the application scenario, there are valid use cases for each of the above mentioned blockchains that need to be carefully determined [1].

In Blockchain, we do not need any central authority. All the transactions of assets of those of capital are transparent. A blockchain based credit system has the ability to break the credit monopolization that is prevailing in a country or any large financial institutions [2].

Smart cities have the capability to deliver innovative ideas and solutions and also direct interaction between citizens and local government. Though there are many benefits of this, digital disruption has many challenges that need to be faced. Usage of Blockchain here will make it extremely robust and secure and there by resolve the majority of challenges [3].

Contracts verification is very important. Blockchain technology can be efficiently used to verify contacts. This tech-nology will help in taking the consent of the contractor in

every contract, while protecting their privacy [4].

There are many agencies these days that are using centralized services rather than the decentralized services. The dis-advantage of these centralized services over the decentralized services is that the entire service is governed and monitored by a top executive or some higher authority and the details of the actual people who will serve the needs personally is not mentioned. Therefore the client does not get to know the efficiency of the servicer. This problem can be solved by decentralized services wherein there will be no mediator and there will be direct interaction between the client and the service provider. This gives assurance to the client about the provider's ability. This solution is applied in one of the lead-ing taxi services called Uber. Here a driver has the authority to choose his pickup. There is no intervention of any higher authorities and it is completely a client- service man transaction. Decentralized services are very important in several aspects and many major services are now following this. The main concept to be considered in this regard is automatic correspondence of the client request with the attender's availability of time, his location etc [5].

ChronoBank is one of the implementations of block chain technology which describes a system which is designed which is used to tokenize labor-hours using blockchain. This can be used in various economic localities. The proposed system leverages smart contract techniques to automate a process whereby a country-specific 'labor-hour' token may be redeemed for real labour-hours via legally binding (traditional) contracts with labor-offering companies [6].

Another implementation of blockchain is a service to implement distributed electronic voting systems. Distributed ledger technology's ability is used in the implementation of the application which decreases the total cost of hosting an election throughout the nation. Voter's privacy is guaranteed in the de-centralized application [7].

A similar approach is implemented in Switzerland where people can serve old aged people and earn some credits. Time Bank will count the time spent in help and issue a time bank card to withdraw time and also time interest.

A severe issue found in contracts management is that a collapse in coin prices will not actually work as a deterrence against the attacks when using the proof-of-stake method. In order to solve this problem, a new consensus method is devised which uses credibility score and described hybrid blockchain created by alternately using this new method and proof-of-stake [8].

Food safety had a serious problem in china. The advantages and disadvantages of using both RFID and blockchain in the building of the agri-food supply chain traceability system is analyzed, verified and implemented to eradicate the problem [9].

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## Time Bank using Public Blockchain

There are many advantages of blockchain when we compare it to the traditional distributed databases used for bio-medical applications.

Through careful application design and the implementation we can decrease the potential challenges in using blockchain technologies in this field [10].

Smart contracts are nothing but computer programs which can be executed by using a network consisting of mutually distrusting nodes, we can do this without using any external trusted authority. We do this in a platform named Ethereum [11].

Cryptocurrencies usually record the transactions in blockchain data structure which is decentralized. Ethereum supports the required feature of encoding the scripts for the transaction processing [12].

### A. Preliminaries of Time Bank

The concept behind time bank is that a person gets paid for the time he/she spent on a service. The payment is generally not in the form of actual money. Instead, a digital crypto currency is used in transactions. The credited tokens or value can be claimed later for similar services received. We can categorize the users into two types namely the attender and the client. Both of them have their individual responsibilities. A person providing the services is the attender and the person who requires the service or help is the client. Sevaexchange is one organization that is using time bank in a very efficient way. It is an AI and blockchain based application implementing Timebank. It is a platform where volunteers earn time credits in return to the help they do. They make people socially connected and active.

### B. Preliminaries of Block Chain

Blockchain was first introduced by Satoshi Nakamoto in 2008 (refer white paper on bitcoin) the form of crypto currency called bit coin, which later became a revolution in technology enabling development of smart contracts. Block-chain allows digital information to be distributed. Blockchain can be described as an immutable record of data which cannot be owned by any single entity out of the cluster of computers managing it.

“The blockchain is an incorruptible digital ledger of economic transactions that can be programmed to record not just financial transactions but virtually everything of value.” Is the statement given by Don & Alex Tap Scott the authors of Blockchain Revolution.

### C. Smart Contracts

Smart contracts also known as the crypto contracts are used for the digital transactions running on blockchain, specifically using ethereum protocol. This is achieved by writing a program in solidity language. The transaction takes place between the parties under certain mutually agreed conditions. This is very similar to what happens in any normal contract. It defines the rules and penalties related to an agreement. Apart from these, it can also automatically enforce those obligations.

Public block chain prevents any intermediate user to intervene in the entire system whereas in a private blockchain there will be an intermediate authority or mediator. Time banking was invented by Edgar Cahn, an American professor of law in the year 1980. This was invented to address unfulfilled societal needs in the wake of cuts to social programs during the Reagan administration. Time banking is a mode of exchange that allows people to swap time and skill instead of money. The transactions take place not in the form of money, instead we use a different unit called time credit. Time credits are the credits given to attendees based on the time they spend serving the client. Accumulating these time credits will help people to get services done for them later. This is simply done by redeeming time credits. The main motive behind this proposal is helping out those people who cannot afford paying to fulfill their service needs such as health care. Therefore, they can earn time credits by simply serving someone during their young age or when they are in a healthy state. This helps us improve the social bonding in the community or society. The usage of blockchain in this application is very relevant due to the properties of a blockchain such as transparency, security, and hassle free cost effective nature. Tampering of data by any unauthorized person is impossible in blockchain. Therefore, it is highly secure. As there is no central point to be exploited, the system is protected against hacking attacks and frauds.

The first step involved in this model is identifying the main users. The users are divided into two types- the attendees and the clients. Refer Fig.1 to understand the tasks of both the users.

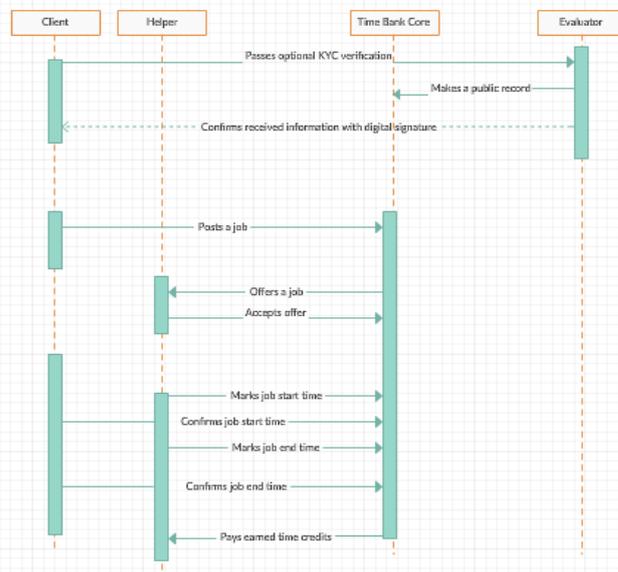


Fig 1. Sequence diagram

The task to be accomplished can be divided into two temporal situations i.e. immediate and scheduled. Any service can be one of these.

In immediate work, the work is accomplished immediately whereas in a scheduled work, the work will be done with prior planning.

## II. PROPOSED DESIGN

The proposed design is a time bank using public block

The client informs their requirement and the helpers willing to do that service take up the job at the scheduled time. In client’s perspective, they are just supposed to request the service they need. Whereas in the attenders perspective, he/she can either choose to serve the client or reject it based on the availability of time. If the helper decides to choose the work, he will be given time credits after the service is done. See Fig.2 for a detailed idea of the model.

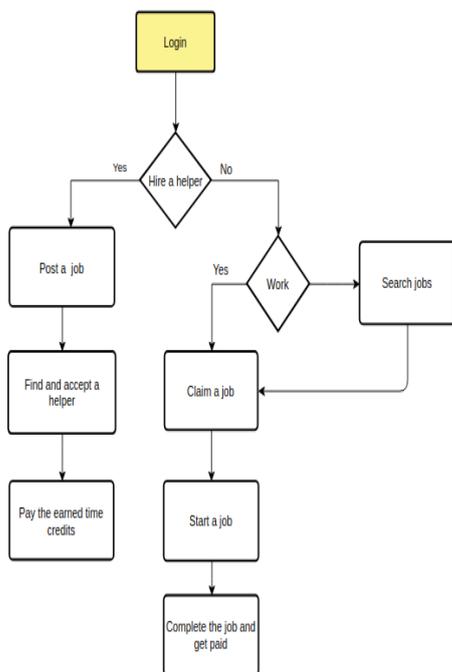


Fig 2. Flow chart

### III. IMPLEMENTATION

In Fig.3, we will elaborate how the user information that will be stored in the smart contract and credit transfer smart contract, without the intervention of a third-party.

```

contract UserData {
    struct User {
        string name;
        string location;
        string skills;
    }
    struct JobDetails {
        string jobTitle;
        address writtenBy;
        uint256 timestamp;
        string jobDetails;
    }
    // Each address is linked to a user with name, location and skills
    mapping(address => User) public userInfo;
    // The jobs that each address has
    mapping(address => JobDetails[]) public userJobs;
    JobDetails[] public jobs;
    // Sets the profile of a user
    function setProfile(string memory _name, string memory _location, string memory _skills) public {
        User memory user = User(_name, _location, _skills);
        userInfo[msg.sender] = user;
    }
    // Adds a new job
    function postJob(string memory _jobTitle, string memory _jobDetails) public {
        JobDetails memory job = JobDetails(_jobTitle, msg.sender, now, _jobDetails);
        userJobs[msg.sender].push(job);
        jobs.push(job);
    }
}
  
```

Fig 3. Code snippet for smart contract

Ethereum platform is used here for the implementation. The intention of using Ethereum is for building decentralized applications by creating an alternative protocol, the provision of different set of tradeoffs contributes to the belief that it will of large use for a large category of applications that are decentralized, with emphasis on the situations where security

for rarely used applications, rapid development time and the ability of interaction among different applications plays an important role. Ethereum blockchain serves a network which users can utilize for building apps of their own (which are commonly called as dApps) and the cryptocurrencies.

Remix IDE has been used here. Remix is nothing but a Solidity IDE. We use this to write, compile the code along with debugging Solidity code.

For the cryptocurrency wallet, Metamask extension has been used. Metamask acts as a bridge or mediator between normal browsers and Ethereum.

Apart from these, Visual Studio Code was used as source-code editor.

There will be 2 kinds of registrations, one for the client and one for the helper. The helper would post all his details which include his name, qualifications, past experiences, services he is willing to provide and the cost per each hour of service. He is supposed to post services mentioning the services he can provide along with per-hour charges. The client should register with his name and other details. He can then post one or more requirements. The helper can look out for clients. Similarly, the clients can look out for helpers. The job will be assigned whenever a perfect match is found. Once the service has been provided, the client has to pay the service charges and declare that the service has been provided. Only after this is done this service will add up to the experiences of the helper.

Here, the concept of time token is utilized. The feature of Time Tokens will permit the users to unlock the unique functionality of the system by the means of deposits in Time Tokens to Time Holder contract. The use of this Time Holder contract is to have a track of the Time Tokens of users which have been allocated by the user himself for the operations done within the system. Time credits are given to the helper for the services he has done. Labor-hour to-ken(LHT) is our fundamental unit of value. We credit time tokens to helpers based on this where he will be given time tokens based on the hours of service he has provided.

In the code, structs are made use of for User and Job Details: Each user will have a name, location and skills. The Job Details has the job title, the address of the user that posted the job, job details and the timestamp when it was written.

setProfile : This function receives the name, location and the skills of the user and it’s updating the mapping of that user. This mapping links the address of the sender with his user information. We are overriding that information here.

postJob : This function receives the job title and the job details. Then it creates a temporary job struct instance with the job title, the address of the user who posts the job, the current timestamp and the job details. Finally it adds the job to the array of jobs of that user and it also adds the job to the public array of all the JobDetails. The keyword now refers to the current/ present time in unix format of 10 numbers. We are using it for the timestamp of each job posted.

Enroll: This function enrolls a with the timebank, giving them 100 wei as a reward and returns their balance after enrolling.

**Transfer:** This function receives the address and the number of time credits to be transferred to the address. The balances of the from and to addresses is updated simultaneously. It is assumed that one time credit equals one wei.

## IV. CONCLUSION

This paper proposes and simulates a robust and generic model to address the service sectors such as senior citizen care. It's possible to purchase any services through public currency. However old age care is becoming unaffordable especially in countries such as Japan, China and Scandinavian countries etc, where the growth rate has been curtailed for past few decades. Old age care should be taken up by the society as a responsibility rather than a business model. This is possible only when this service is made available through a special currency/tokens that can be earned by a person during their young age or while a person is healthy enough to serve others and spent those credits during their old age or during an ailment. These tokens should be free from global factors such as inflation and the credits earned should be transferable only to the nominees and cannot be traded for any other service or public currency.

This model is possible only using a public blockchain such as Ethereum. There is no third party involvement and hence both rich and poor can utilize the service equally and as prescribed by the smart contract/protocol.

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## AUTHORS PROFILE



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**A. Naga Kalyani** has done B.Tech and M.Tech in Computer Science and Engineering. She is currently working as an Assistant Professor at BVRIT Hyderabad College Of Engineering for Women in CSE Department. She has 3 years experience in teaching. She is Certified on Teaching Methodologies Wipro Mission 10x, conducted by Wipro Pvt. Ltd and is also IBM DB2 730 Certified. Her area of specialization is Computer Networks and has been teaching the subject for 3 years. She is the Guest faculty for IEG to conduct Infosys Campus Connect programs. She has attended 5 days Mission 10x Workshop on Teaching Methodologies conducted by Wipro Pvt. Ltd, IBM DB2730 Workshop conducted IBM and 3 days workshop on Network Security and Cryptography conducted at NIT-Warangal



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