

# Efficient approach for Tendering by introducing Blockchain to maintain Security and Reliability

Ajeenkya Ambegaonker  
Department of Computer Science and  
Engineering  
SVKM's NMIMS  
Mumbai, India  
ambegaonkerajeenkya@gmail.com

Utkarsh Gautam  
Department of Computer Science  
and Engineering  
SVKM's NMIMS  
Mumbai, India  
gutkarsh263@gmail.com

Dr. Radha Krishna Rambola  
Department of Computer Science and  
Engineering  
SVKM's NMIMS  
Mumbai, India  
radhakrishna.rambola@nmims.edu

**Abstract** - The problem with present tendering is its reach which is limited to number of people, though the internet is expanding and tendering is also not far from this, we have some online system for tendering but it is not secure as it should be because tendering has confidential data which is not supposed to be leaked and Blockchain solves that problem efficiently. The motive of this research is to find the better ways for tendering, as tendering is very essential part of businesses and development so improvement of this system leads to better development. Time efficiency, employment, fair system are some of the factors which can be improved by the proposed system of this research.

**Keywords:** Blockchain, Security, Credit System for tenderer.

## I. INTRODUCTION

Tendering is the process of choosing the best company to do a job by asking many companies to do that job, each company make their offer to do the job and the best offer is chosen. we need a secured database to store those offers and the solution for security is blockchain, the concept was proposed in [1] and the idea was proposed in [2], Blockchain is a type of distributed ledger for maintaining a permanent and tamper-proof record of data and there are numerous applications of it other than bitcoin as mentioned in [10] and [11], we will take the offers on blockchain and the selection will also be done by system itself, as the blockchain based tendering system allows anyone to post their tenders onto the blockchain and anyone to take the project which would allow businesses to expand to other countries and would eventually lead to development of the society as a whole. Moreover selection of tenders would be automatic and that will ensure the impartiality. We applied blockchain in system due to its major advantages like security and transparency as blockchain is a distributed ledger. A transparent system ensures the impartiality and machine based selection process ensures the accuracy with minimum possible time. The system will be based on the idea of smart contracts[4], transaction requests will be in form of coins and one company can send only one request as proposed in[6]. We also use proof of stake[5] for more security in blockchain to prevent the majority attack on our system.

## II. TENDERING SCENARIO

In the present tendering system the tenders are published in the following ways:

- Published in news papers.
- Displayed on organization's website
- Displayed on the notice board of the respective organization.

Then the tenders are filled by the tenderers with the required details and submitted to the organization's office. Here there are chances of filling the tenders incorrectly. Then the tenders are chosen manually which takes a lot human effort and possibilities of error would also increase. The present system of tendering needs some advancements to increase efficiency and accuracy. As huge companies are creating monopoly in there fields, there are not so many opportunities for new companies. The competition in tendering is necessary for better and fast development, which would be possible through open tendering. There are many online procurement services but the only problem they face is that with increasing number of users the risk of security would increase and this problem can be resolved by applying blockchain system. There has been an attempt to solve this problem using blockchain in [2] but they have implemented the system on Ethereum which is an open-source, public, blockchain-based distributed computing platform and operating system featuring smart contract functionality as mentioned in [9].

## III. IMPLEMENTATION ON BLOCKCHAIN

In the following we describe working of the tendering system on blockchain network which solves the problems addressed in the previous section.

### A. Basic Structure of the System

As shown in the Figure 1, firstly we will create the basic structure of the blockchain which has the country nodes connected with each other, here all the countries would be mentioned which participates in this system, all the country blocks would be connected to each other. After the country block comes the state block which is further connected to

the respected country block. This alone would create a network of blockchain which will join a new tender block in the respective state and country block which will be mentioned in while creating a new tender. By making this structure it would be easy and time efficient to locate a block in the network also the verification process would be conducted here.

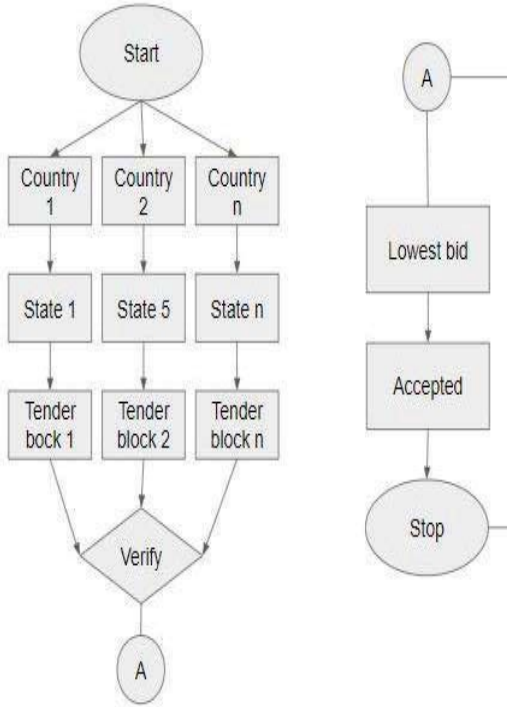


Fig. 1. Flowchart of the system

### B. Tender Block

Whenever a new tender is introduced by the registered tendering organization then it has to specify all the details regarding the tender like project details, credit limit of tenderer, deadline of submission and all other necessary things. After giving all the details a new block will be created in the mentioned country and its state which will hold its information. Whenever a tenderer has to participate in that tender it requests for a transaction on that block, the request contains all the information regarding the project details like what materials would they use, how many people would be working on that project, bidding amount and all the other necessary things. All the tenderers would request on that tender block and on the deadline of that block only 1 request among all the transaction requests would be accepted and n-1 would be rejected. Also, for this to achieve without any problems the anonymity of the tenderers among each other is very important and this can be done by following the concepts and methods given in [8].

### C. Verification of the Block

Anybody who wish to participate in the tender would be able to view the tenders but if they want to participate then they need to take approval of the respective authorities which would make the system less decentralized but more facile. It will use the general database system where concurrency control will play an important role which can be achieved as per [7]. Also, as the bodies who give permission for making of a bridge cannot give permissions to make hospital equipments so there would be a database in which every tenderer who has permission from its respective authority, which would be sorted by authority, would be in a database. While making a transaction request to the tender block the tenderer would be verified from the respective authoritative body and then allowed to make a bid (Figure 2). The tenderers whose request is accepted would form a new branch connected with the tender block as shown in Figure 3.

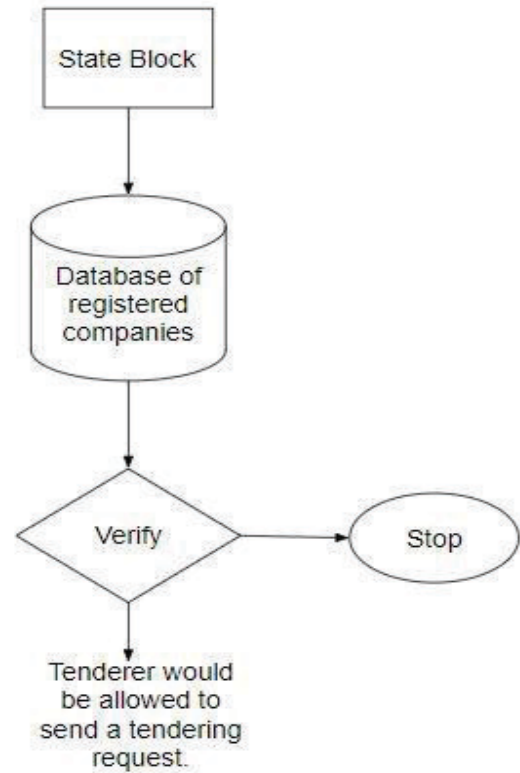


Fig. 2. Database Verification

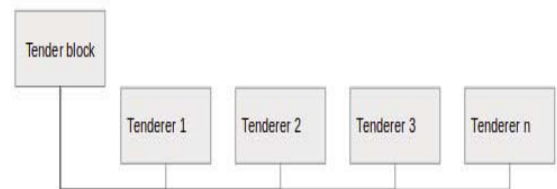


Fig. 3. Tender Block

#### D. Transaction Request

The bid that the tenderer would make would be some fixed percentage of the amount of their total cost, so automatically only the lowest among all would be selected at the time of deadline and this would be taken by the tendering organization as a safety deposit for the project. All the tenderers that participate in a bid would just request for the transaction and not create a block until the transaction is accepted which saves the memory and cost of creating the blocks of all the tenderers. If a tenderer wants to withdraw their tender the transaction request would be deleted.

#### E. Credit System for Tenderers

We are introducing a complaint portal along with this system where anyone can file a complaint for any project which will be forwarded to the respective company directly and the credit score of each company will be calculated based on many factors which evaluates their performance from which some are the ratio of resolved complaints to the registered complaints, [another factor]. Credit score of companies will directly measure the response rate of that company which can be used for selection of company for tendering. By using this credit score we would be able to pinpoint which companies work is below the standard and which companies are working to maintain their quality even after the completion of the project.

#### F. Maintaining the Security of Blockchain

As there is a threat of owning a majority of blockchain by a single firm and then shut down the system completely so we will use a different approach as mentioned in [3] a hybrid blockchain is used which has a credit for tenderer which creates a block after the transaction is accepted and thus their credit would increase and their stake would decrease this would prevent them to capture the majority of blockchain. The credit used in this is their credit of blockchain which is different from the credit of the tenderer.

### IV. ANALYSIS

We can save some human efforts with increasing accuracy and reliability by introducing the machine in tendering system, we also have a new credit system for tenderers by which we can analyze the company's after-work service. The system will also have the detail of companies like number of employees, number of running projects etc. which can be used in calculating the company's potential for a project. As the system is based on blockchain it is secure to avoid any kind of malicious activities and transparent to public for assuring the impartiality. Also we can see the shift from offline to online happening in the procurement sector which makes this the right time to apply the blockchain technology right from the beginning of it.

TABLE I. YEAR-WISE GROWTH OF E-TENDERS IN INDIA

Serial no.	Year	Total no. of e-Tenders
1	2012-13	79963
2	2013-14	262807
3	2014-15	303697
4	2015-16	480377
5	2016-17	620480
6	2017-18	1012598
7	2018-19	583517

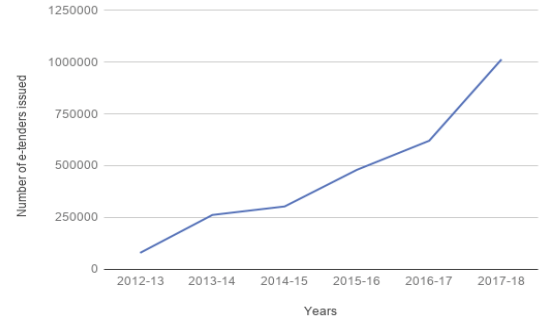


Fig. 4. Number of e-Tenders per year in India

In the above graph we can clearly see that the shift from offline tendering to online tendering is happening as the number of registrations of e-Tenders are growing every year in India. So, this is the right time to implement the Blockchain in the backend of the system to make the system more secure and reliable to use for the tenderers as well as the tendering organizations.

### V. CONCLUSION

The system which is proposed above acts as an incentive in systematizing the tendering processes of tendering organizations with the help of blockchain's tools and technologies, enabling them to harness various benefits of e-Tendering pertaining to efficient in terms of computation as well as cost of procurement, shortened tendering cycles, full transparency in the whole process, avoidance of human discretion/interference which will lead to lesser mistakes, availability of complete audit trail and evidential data. Also applying blockchain would ensure greater security than the traditional database based internet services. As this system allows tendering organizations from all around the world to publish their tenders in the blockchain it offers the tenderers variety of project which they can take without any problem, it also enable access to vast reach of tenders and uninterrupted secured bid submission facility for all, from all around the world.

As there is a trend towards shifting to the online service for procurement as we can see in Graph 1, so applying a technology which is beneficial than the traditional database at its initial stage is helpful for the society.

#### REFERENCES

- [1] S. Nakamoto, “*Bitcoin: A Peer-to-Peer Electronic Cash System*” <https://bitcoin.org/bitcoin.pdf>, 2008.
- [2] Freya Sheer Hardwick, Raja Naeem Akram, and Konstantinos Markantonakis, “*Fair and Transparent Blockchain based Tendering Framework - A Step Towards Open Governance.*” ISG-SCC, Royal Holloway, University of London, Egham, United Kingdom.
- [3] Hiroki Watanabe, Shigeru Fujimura, Atsushi Nakadaira, Yasuhiko Miyazaki, Akihito Akutsu, and Jay Kishigami, “*Blockchain Contract: Securing a Blockchain Applied to Smart Contracts*” 2016 IEEE International Conference on Consumer Electronics (ICCE).
- [4] N Szabo, “The idea of smart contracts”.
- [5] Sunny King, Scott Nadal, “*PPCoin: Peer-to-Peer Crypto-Currency with Proof-of-Stake*” [arxiv.org](https://arxiv.org/abs/1108.0582)
- [6] Ahmed Ben Ayed, “*A CONCEPTUAL SECURE BLOCKCHAIN-BASED ELECTRONIC VOTING SYSTEM*” International Journal of Network Security & Its Applications (IJNSA) Vol.9, No.3, May 2017.
- [7] Radha Krishna Rambola, Md. Zafar Imam & N. Ahmad “*An Efficient Approach Concurrency Control In Database Management System: A Performance Analysis*” published in International Journal of Computer Science and Network Security, V OL.13 No.7, July 2013(ISSN: 1738-7906).
- [8] D. Jayasinghe, K. Markantonakis, and K. Mayes, “*Optimistic Fair-Exchange with Anonymity for Bitcoin Users*”. IEEE Computer Society, 11 2014, pp. 44–51.
- [9] Wood, Gavin. “*Ethereum: A secure decentralised generalised transaction ledger.*” *Ethereum project yellow paper* 151 (2014): 1-32.
- [10] Underwood, Sarah. “*Blockchain beyond bitcoin.*” *Communications of the ACM* 59.11 (2016): 15-17.
- [11] Yli-Huumo J, Ko D, Choi S, Park S, Smolander K (2016) “*Where Is Current Research on Blockchain Technology?—A Systematic Review.*” PLoS ONE 11(10): e0163477. <https://doi.org/10.1371/journal.pone.0163477>