Electronic Voting based on Blockchain: "In a Democracy"

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Electronic Voting based on Blockchain: "In a Democracy"

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Abstract - *Voting is the most important process of any democracy being it "bi" or "multi" party form. Voting ensures that its representative maintains a healthy balance of social and political equity. In a mature democracy, voting by people offers their representation in the political system. The privacy of voters is a major concern in any voting during elections for their leaders along with their integrity of the vote. The blockchain being an immutable distributed ledger based on a consensus algorithm is the most agile form of E-voting. In this paper, we discuss some aspects of a smart contract named "VotingContract" and demonstrated its implementation.*

Key Words: Blockchain, E-voting, I-voting, trust based systems, distributed computing, Ethereum

1. INTRODUCTION

Voting the most fundamental part of every form of democracy, be it presidential form or parliamentary form of democracy. Democracy first comes into existence in ancient Greece where democracy can be consideration of a balance of power between the individuals who are doctors and individuals who are sweetshop elected via voting of people. Both of them have their ideologies and belief to offer to people. For example, sweetshop individuals can suffice the thirst of hunger of people by giving food in exchange for money while individuals who are doctors can keep people fit by treating the bad health due to uncertainty in health in exchange for money. In this instance, money is the power of the vote, it has much meaning depending on how much are people aware of their fundamental rights and rule of Law while supporting any one of them via voting in the election by people, for people and elected of the people. It is to be noted, that democracy can be multi-party too in any emerging power to make the elected people more accountable to the public concerns of social and economic infrastructure etc via voting while elected people have a duty to maintain the moral ethics of democracy.
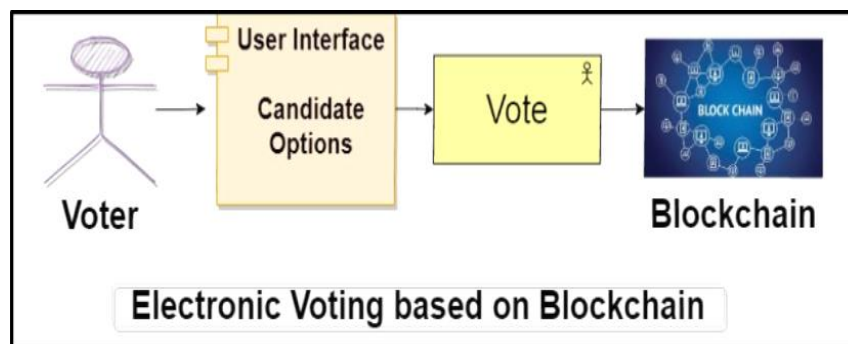

Figure1: Diagram showing Electronic Voting based on Blockchain

Voting can be paper-based as in various countries and can be EVM-based as introduced in 1999 in India. Estonia leads the world in making digital voting a reality as parliamentary election in the Baltic nation in 2019 has happened [1, 2]. Now a blockchain application to I-voting is being the talk of the day as it is irreplaceable and is trusting with a secure vote. One person, One Vote is can be ensured by Blockchain.

2. BLOCKCHAIN

The most lucrative prospects for bitcoin are not related to the money itself. Rather, they are the product of rapid advancements in blockchain technology. As businesses discover innovative ways to use blockchain, it is increasingly being adopted in a wide range of industries. Big Data has proved to be indispensable for blockchain through supporting predictive analytics, information surveillance, and other features, according to industry sources. Some papers said, "Blockchain does more than protect data." [3, 4]. By checking data at the input and avoiding malicious actors, it increases the level of knowledge gained from the data. In terms of usage cases, blockchain combined with data analytics has the potential to change almost every market.

Crypto-currency analyzed prediction will benefit greatly from data analytics, as they will be able to use Big Data to make accurate predictions of the currency. Blockchain technology brings a high level of reliability, trustworthiness, and veracity to data.

The blockchain has high-energy usage and scaling [5, 6]. The root issue is that all blockchain transfers must be handled by about everyone, and everyone must have a copy of the global ledger. The banks that use blockchain are JPMorgan Chase, US Bancorp, Wells Fargo, Citigroup, PNC, Fifth Third Bank, and Signature Bank. The Blockchain Economy would help in the assembly of the ecosystem along with digital currency and digital communities   [8-22].

Blockchain technology will be used to store electronic medical records. "Simply Vital Health" company is using blockchain to help patients get organized treatment [23,24]. This saves both time and money for companies while simultaneously ensuring that everybody involved follows the rules.

3. ELECTRONIC VOTING BASED ON BLOCKCHAIN

Ethereum smart contract has been used to build a blockchain-based electronic voting system. Since all data is stored in the blockchain after using a certain amount of token, there is no risk of an illegal vote. Below is the code for the blockchain-based voting system.

```solidity
pragma solidity ^0.7.0;
contract VotingContract {
struct Elector {
    uint wght;
    bool voted;
    address delgte;
    uint vote;
}
struct CandidateStruct {
    bytes32 candidateName;
    uint voteCnt;
}
address public chairperson;
mapping(address => Elector) public voters;
CandidateStruct[] public candidateStructs;
constructor(bytes32[] memory proposalNames) {
    chairperson = msg.sender;
    voters[chairperson].wght = 1;
    for (uint i = 0; i < proposalNames.length; i++) {
      candidateStructs.push(CandidateStruct({
        candidateName: proposalNames[i],
        voteCnt: 0
      }));
    }
}
function delgte(address to) public {
    Elector storage sender = voters[msg.sender];
```

```
    require(!sender.voted, "Already voted.");
    require(to != msg.sender, "You cannot assign yourself.");
    while (voters[to].delgte != address(0)) {
                    to = voters[to].delgte;
                    require(to != msg.sender, "Invalid assigned.");
    }
            sender.voted = true;
    sender.delgte = to;
    Elector storage delegate_ = voters[to];
    if (delegate_.voted) {
       candidateStructs[delegate_.vote].voteCnt += sender.wght;
    } else {
       delegate_.wght += sender.wght;
    }
}
function vote(uint proposal) public {
    Elector storage sender = voters[msg.sender];
    require(!sender.voted, "You had been already voted.");
    sender.voted = true;
            sender.vote = proposal;
            candidateStructs[proposal].voteCnt += sender.wght;
}
function winnerCalculate() public view returns (uint winningProposal_){
    uint winningVoteCount = 0;
    for (uint p = 0; p < candidateStructs.length; p++) {
      if (candidateStructs[p].voteCnt > winningVoteCount) {
        winningVoteCount = candidateStructs[p].voteCnt;
        winningProposal_ = p;
      }
    }
}
 function giveRightToVote(address voter) public {
    require(msg.sender == chairperson, "Permission given to you");
    require(!voters[voter].voted, "Assigned voter has already voted");
    require(voters[voter].wght == 0);
            voters[voter].wght = 1;
}
function winnerCandidateName() public view returns (bytes32 winnerCandidateName_){
    winnerCandidateName_ = candidateStructs[winnerCalculate()].candidateName;
```
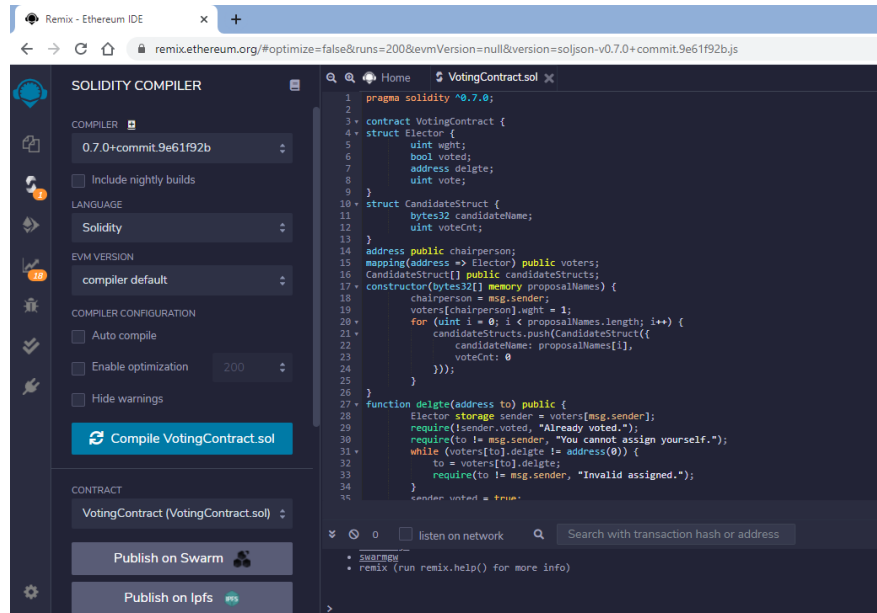
```
        }
    }
```


Figure2: Successful compilation of Voting Contract in Remix IDE using solidity compiler ver. 0.7.0

Figure 2 demonstrates a successful compilation of a smart contract named "Voting Contract" in Remix IDE. On the Remix IDE, the "VotingContract" is written in the Solidity language with compiler version "0.7.0". After the use of "VotingContract", the duplication and redundancy will be reduced. The casted vote will be recorded and would not be altered in the future. The data generated here will be decentralized and shared across the network. The read on the blockchain is free while voting on a blockchain requires gas as per as procedure of Ethereum.

4. CONCLUSIONS

In a democracy built on the vote, voting is the primary means of making selection. The blockchain-based voting mechanism described in this paper may be used in E-voting to provide confidence and elect a stable government in a healthy democracy. The merit of blockchain is that it allows for a transparent system and records data of votes are unchanged.

A mobile application could be developed in the future for anywhere and anytime E-voting based on blockchain. The time it takes to hold an election and declare the results is reduced due to the use of less labor with electronic voting based on blockchain. The practical implications in the electoral voting system based on blockchain have benefits of speed, accessibility, cost-effectiveness, transparency and security.

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REFERENCES

[1] Mulholland, Patrick. Estonia Leads World in Making Digital Voting a Reality. 26 Jan. 2021, www.ft.com/content/b4425338-6207-49a0-bbfb-6ae5460fc1c1.

[2] Imtiaz Khan Reader (Associate Professor) in Data Science, and Ali Shahaab PhD Candidate. Estonia Is a 'Digital Republic' – What That Means and Why It May Be Everyone's Future. 29 Jan. 2021, theconversation.com/estonia-is-a-digital-republic-what-that-means-and-why-it-may-be-everyones-future-145485.

[3] Zyskind, G., & Nathan, O. (2015, May). Decentralizing privacy: Using blockchain to protect personal data. In 2015 IEEE Security and Privacy Workshops (pp. 180-184). IEEE.

[4] Dinh, Tien Tuan Anh, Rui Liu, Meihui Zhang, Gang Chen, Beng Chin Ooi, and Ji Wang. "Untangling blockchain: A data processing view of blockchain systems." IEEE Transactions on Knowledge and Data Engineering 30, no. 7 (2018): 1366-1385.

[5] Pipattanasomporn, Manisa, Murat Kuzlu, and Saifur Rahman. "A blockchain-based platform for exchange of solar energy: Laboratory-scale implementation." 2018 International Conference and Utility Exhibition on Green Energy for Sustainable Development (ICUE). IEEE, 2018.

[6] Dahlquist, Olivia, and Louise Hagström. "Scaling blockchain for the energy sector." (2017).

[7] Kshetri, Nir, and Jeffrey Voas. "Blockchain-enabled e-voting." IEEE Software 35.4 (2018): 95-99.

[8] Osgood, Ryan. "The future of democracy: Blockchain voting." COMP116: Information security (2016): 1-21.

[9] Hjálmarsson, Friðrik Þ., et al. "Blockchain-based e-voting system." 2018 IEEE 11th International Conference on Cloud Computing (CLOUD). IEEE, 2018.

[10] Ayed, Ahmed Ben. "A conceptual secure blockchain-based electronic voting system." International Journal of Network Security & Its Applications 9.3 (2017): 1-9.

[11] Moura, Teogenes, and Alexandre Gomes. "Blockchain voting and its effects on election transparency and voter confidence." Proceedings of the 18th annual international conference on digital government research. 2017.

[12] Park, Sunoo, et al. "Going from bad to worse: from internet voting to blockchain voting." Journal of Cybersecurity 7.1 (2021): tyaa025.

[13] Gritzalis, Dimitris A. "Principles and requirements for a secure e-voting system." Computers & Security 21.6 (2002): 539-556.

[14] Maaten, Epp. "Towards remote e-voting: Estonian case." Electronic voting in Europe-Technology, law, politics and society, workshop of the ESF TED programme together with GI and OCG. Gesellschaft für Informatik eV, 2004.

[15] Verma, Manish. "Amalgamation of Blockchain Technology and Knowledge Management System to fetch an enhanced system in Library", in IJIRT | Vol. 7, Issue 11, April 2021 (pp.474-477)

[16] Verma, Manish."Smart contract model for trust based agriculture using blockchain technology", in International journal of research and analytical reviews, Vol. 8 Issue 2, April 2021 (pp. 354-355)

[17] Verma, Manish. "Modeling Identity Management System Based on Blockchain Technology", in International Journal of Research Publication and Reviews, Vol. (2) Issue (4) (2021) (pp. 450-452)

[18] Bernard, Zoë. "Everything you need to know about Bitcoin, its mysterious origins, and the many alleged identities of its creator." Business Insider. Archived from the original on 15 (2018).

[19] Casino, Fran, Thomas K. Dasaklis, and Constantinos Patsakis. "A systematic literature review of blockchain-based applications: current status, classification and open issues." Telematics and Informatics 36 (2019): 55-81.

[20] Verma, Manish. "Emerging applications of blockchain technology", in International Research Journal of Modernization in Engineering Technology and Science Vol. 03, Issue 4, April 2021 (pp.1258-1260)

[21] Verma, Manish "Credible and Non-Corruptible Supply Chain Management using Blockchain Technology" Published in International Journal of Trend in Scientific Research and Development (IJTSRD), ISSN: 2456-6470, Volume-5 | Issue-3, April 2021, pp.1037-1039

[22] Verma Manish. "Building predictive model owned and operated by public infrastructure that uses blockchain technology", in International Journal For Science And Advance Research In Technology | Vol. 7,Issue 4, April 20

[23] Hendren, Lucas, and K. Kuzmeskas. "Health Nexus." (2017).

[24] Vora, Jayneel, et al. "BHEEM: A blockchain-based framework for securing electronic health records." 2018 IEEE Globecom Workshops (GC Wkshps). IEEE, 2018.

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