Pure Voting (PV): An Offline Voting Algorithm

Ikechi Saviour Igboanusi, Revin Naufal Alief, Muhammad Rasyid Redha Ansori,
Allwinnaldo, Jae-Min Lee, Dong-Seong Kim
Networked System Laboratory, IT Convergence Engineering,
Kumoh National Institute of Technology,Gumi, South Korea.
ikechisaviour@gmail.com, revinnaufal, rasyidred, winnaldo, ljmpaul, dskim(@kumoh.ac.kr)

Abstract—This work proposes the use of blockchain for offline voting. Using the Smart contract feature of the Ethereum blockchain network. The voter's registration is made. An offline token is generated which is used for offline voting. The offline token and the voting information are sent to the vote counters Smart contact. This is where the votes are counted and results extracted. However if a voter can share the cast vote to another voter who will send the new token to the vote counters. In a situation a vote is submitted by multiple voters, the counter has the ability to identify and count such votes only once.

Index Terms—Blockchain, decentralized application, offline transaction, pure voting, voting.

I. INTRODUCTION

The use of electronic means for voting (e-voting) has been a welcome development. It is no longer news that some countries have applied e-voting for their general elections. The work in [1] analyzed Switzerland which is one of the major democracies and how they granted their residents living abroad the right to vote to increase the number of voters. Overall, the findings of this study indicate that internet voting could be a useful tool for increasing electoral participation among foreign nationals.

According to authors in [2] E-voting offers a practical and affordable replacement for the current paper ballot-based voting system. It offers a number of advantages, including greater voter turnout and decision-making precision. However, that is not the only progress made in improving voting activity, it is also cheaper. The internet voting technology enabled by smartphones is holding a lot of promise. Although there have been numerous advancements, e-voting still has significant security issues that prevent its widespread use, especially when it is intended to be used on mobile devices.

In the field of electronic voting, there has been a lot of interest in the prospect of employing distributed ledgers and blockchain to assist voting procedures [3]. Most of these current concepts revolve around e-voting methods that use blockchain technology. Others concentrate on how blockchain can be used to guarantee both voter auditability and anonymity during the voting process. The application of blockchain in e-voting situations is a recurring theme in these research projects. In this paper, the authors elaborated on the integrity criteria that blockchain must provide for both online and offline voting, which is common in poor nations.
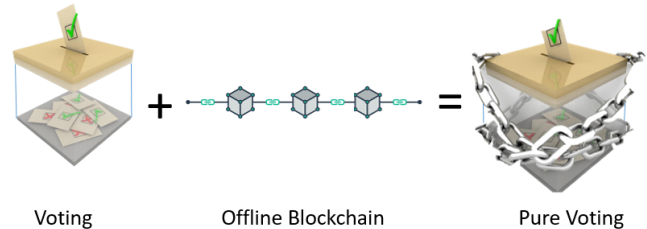

Fig. 1. The Pure Voting is a combination offline blockchain and voting.

The Pure Wallet (PW) electronic payment system expands the use of cryptocurrencies on the Blockchain to offline transactions [3]. Since this model focused on financial transactions, it will bring substantial benefits if this offline technology is applied to the voting system.

Using the smart contract available in the Ethereum blockchain network [4], this work proposes the Pure Voting technology which combines the offline blockchain model and the voting system as depicted in 2.

II. SYSTEM MODEL

The proposed model is divided into internet-dependent and offline stages. As shown in Fig. 2, T_r and T_c denote the period before and after the offline voting activity and they happen on the internet, hence internet connection is needed to complete them. The offline stage is denoted with T_o which is when the voting process is actually done. Following the steps of Pure Wallet in [5], the offline token is generated by the registered voter SC which combines the information of the voter to generate an offline token. The offline token is a hash that accompanies the voting information when a is vote cast in an offline state. The offline voting ID and the voting information are sent to the vote counters SC to collate all the various votes and to identify the number of voters that voted for a particular candidate. The result is extracted and published. If the voter1 has no internet connection at the time T_o, to send the cast vote to the internet, the cast vote is sent to another user of the network voterN (who has access to the internet) over an offline network like NFC or Bluetooth to deliver the cast vote to the vote counters. The vote counters is more than one in the network. Each vote counter is assigned for a particular election that will make use of the information available in the
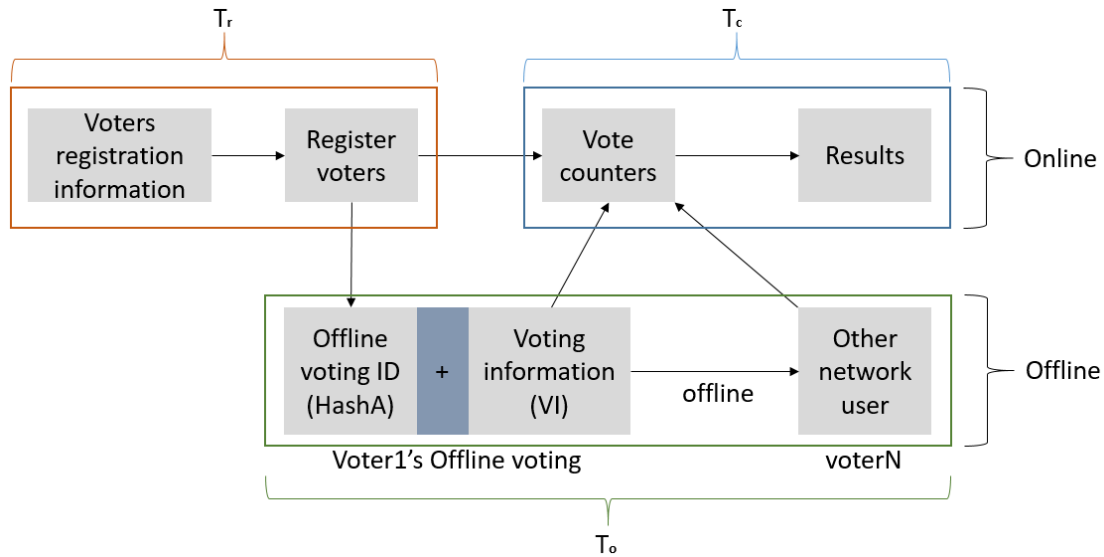
Fig. 2. The system model of the Pure Voting architecture.

register voters SC. for Example the same voters' registration can be used for presidential and governorship elections. Hence vote counter used for the presidency is different from the one used for the governorship.

To prevent double voting, the offline ID of any cast vote is checked in the list of IDs that have already cast their votes. Also to enhance flexibility, voter1 can share the cast vote with multiple users of the network to submit the cast vote to the vote counter without causing any negative effect on the results.

III. EXPECTED IMPACT OF PURE VOTING

The proposed Pure Voting model is set to enhance the entire voting process. Some of the expected impacts are listed below:

- Developing countries where there is a limited internet connection can benefit from this model. By applying Pure voting, people could cast their votes from the comfort of their homes or where ever they wish.
- By using blockchain technology, the voting process is made secure and transparent for societies with corrupt electoral bodies.
- The use of blockchain for election is cheap compared to the traditional method.
- This proposed model is expected to enhance democracy by making the process secure while extending the ability to vote to more people.

IV. CONCLUSION

The work proposed Pure Voting by use of blockchain to enable offline voting, which leverages the Pure Wallet architecture. However, unlike the Pure Wallet, Pure Voting takes input (voting information) in an offline state. The offline token combined with the voting information can be shared among voters. Any of the voters is capable of sending the

vote to the vote counter. The Pure Voting model is expected to have a significant positive impact on elections and democracy at large.

The implementation of this model for real-world use will be the future of this work. Works will also be done to enhance the security of the offline token and the voting information.

REFERENCES

[1] M. Germann, "Internet voting increases expatriate voter turnout," *Government Information Quarterly*, vol. 38, no. 2, p. 101560, 2021. [Online]. Available: https://www.sciencedirect.com/science/article/pii/S0740624X20303397

[2] E. Zaghloul, T. Li, and J. Ren, "d-bame: Distributed blockchain-based anonymous mobile electronic voting," *IEEE Internet of Things Journal*, vol. 8, no. 22, pp. 16 585–16 597, 2021.

[3] V. Lalitha, S. Samundeswari, R. Roobinee, and L. S. Swetha, "Decentralized online voting system using blockchain," in *2022 International Conference on Applied Artificial Intelligence and Computing (ICAAIC)*, 2022, pp. 1387–1391.

[4] Vitalik Buterin, "Ethereum: A next-generation smart contract and decentralized application platform," https://ethereum.org/669c9e2e2027310b6b3cdce6e1c52962/Ethereum_Whitepaper_-_Buterin_2014.pdf, 2014, [Online; accessed 22-May-2022].

[5] I. S. Igboanusi, K. P. Dirgantoro, J.-M. Lee, and D.-S. Kim, "Blockchain side implementation of pure wallet (pw): An offline transaction architecture," *ICT Express*, vol. 7, no. 3, pp. 327–334, 2021. [Online]. Available: https://www.sciencedirect.com/science/article/pii/S2405959521000928