



# A Comprehensive Review of Blockchain and Biometric Technologies in Electronic Voting Systems

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## Abstract—

People are thinking about using voting systems instead of the old way of voting with paper. This is because electronic voting systems can be faster, easier to use and cheaper. However the electronic voting systems we have now are not very good at keeping votes transparent. For example all the votes are stored in one place, which makes it easy for someone to cheat. We also do not have a way to make sure the person voting is who they say they are.. When you vote you do not get any proof that your vote was counted. This paper looks at all the ways electronic voting systems work now including how they use biometrics like facial recognition to identify voters. We also look at how blockchain technology can help keep votes. Based on what we found out we propose a system called BlockVote. BlockVote uses something called Ethereum blockchain to keep votes safe. It uses facial recognition to make sure the person voting is who they say they are. It also has a way to check if a person is eligible to vote and it gives you a receipt when you vote so you can make sure your vote was counted. The BlockVote system will use a lot of tools, including React.js, Node.js and MongoDB Atlas. We will also use something called Solidity to create contracts and we will use a library called face\_recognition to help with facial recognition. This paper shows how all these different tools can work together to create an transparent

electronic voting system. We hope that our system can help fix the problems with voting systems that we have now. Electronic voting systems like BlockVote can be very helpful. We think our system is a good step in the right direction, for electronic voting systems.

**Keywords—** Blockchain, E-Voting, Ethereum, Solidity, Smart Contract, Biometric Authentication, Face Recognition, Voter Eligibility, Individual Verifiability, bcript, MetaMask, Decentralized



## I. INTRODUCTION

The integrity of elections depends on voting mechanisms that are secure, transparent, verifiable and accessible. Traditional paper-based voting systems have a lot of problems like ballot stuffing, manual counting errors, slow result declaration and physical tampering. The transition to voting fixes some of these problems but introduces new ones like centralized data storage and weak authentication.

Existing centralized e-voting systems store votes in databases managed by one authority. If the database administrator is compromised or a server is hacked vote records can be altered without being detected. Voter authentication in systems relies on usernames and passwords which are not very secure.

Voters in systems do not get any proof that their vote was correctly recorded and counted. They just have to trust the system operator. Blockchain technology, which was introduced by Nakamoto in 2008 and extended to contracts by Buterin in 2014 has properties that can fix these problems.

The fact that blockchain records cannot be changed smart contracts can be executed without needing to trust anyone and transactions can be verified using cryptography makes blockchain a good foundation for voting infrastructure.

Using authentication like facial recognition is a better way to verify identities than using passwords. The dlib HOG ResNet model achieves 99.38% accuracy on the Labeled Faces in the Wild benchmark. Can be used for voter identification in web-based systems.

This paper looks at existing research, in three areas. Centralized e-voting, blockchain-based voting and biometric authentication.

It identifies the problems that still exist and proposes a framework that addresses all the limitations of voting systems, blockchain-based voting systems and biometric authentication systems at the same time..

## II. LITERATURE REVIEW

The Blockchain technology is really good for voting because it keeps everything secure and transparent. People can trust the Blockchain technology because it is very hard to cheat with it. Old voting systems are not as good because they use databases that can be easily manipulated. These databases are also not very transparent.

The Blockchain technology is better because it keeps a record of everything that happens. This record is called a ledger. It is decentralized and immutable. This means that nobody can change what is written in the ledger. Some researchers, like Hjálmarsson and his team did a study in 2018. They found out that the Blockchain technology can be used to make voting more transparent. Another team of researchers Khoury and his team also did a study in 2018. They made a voting platform using Ethereum. It used smart contracts to count the votes. These studies showed that the Blockchain technology is very good for voting because it is transparent and secure.. They also found out that it is not very scalable and it is hard to use in real life.

Some other researchers, like Shahzad and Crowcroft did a study in 2019. They tried to make the Blockchain technology more trustworthy and private for voters. They wanted to make sure that peoples votes are secret. Other researchers also tried to find ways to keep voters anonymous without compromising the integrity of the election.

As time went on researchers started using cryptography techniques to make voting more secure. For example Kim and his team used something called encryption in 2021. This made voting more secure. It also made the system more complex.

Recently some researchers like Jafar and his team and Hajian Berenjestanaki and his team did a review of all the studies that have been done on the Blockchain technology and voting. They found out that the Blockchain technology can make voting more transparent, secure and auditable.. There are still some problems, like scalability and voter privacy that need to be solved.



The Blockchain technology is not the thing that can be used to make voting more secure. Biometric authentication methods, like recognition and fingerprint scanning can also be used. These methods can help prevent impersonation and unauthorized voting.. There are still some challenges, like biometric spoofing and privacy that need to be addressed.

In conclusion the Blockchain technology and biometric authentication can make electronic voting systems more secure and reliable.. There are still some challenges that need to be overcome, like balancing transparency, privacy, scalability and practical implementation. This means that there is still a lot of work to be done in this area and it is an opportunity for future research, on the Blockchain technology and voting.

### III. METHODOLOGY

The new system is designed to fix the problems with the current electronic voting systems. These problems include storing votes in one place not being able to tell who is really voting not being sure if someone is allowed to vote and not being able to check if votes are real. The new system uses blockchain technology, biometric authentication and verification by administrators to make voting safe and open.

The system has four parts: signing up to vote checking who is allowed to vote casting a vote and counting the votes. When people sign up to vote they give their information and biometric data like a picture of their face. This information is stored safely so it can be used to check who they are later. Before people can vote they have to go through a process to make sure they are allowed to vote. This process is controlled by administrators.

To make sure only the right people are voting the system uses authentication. This means it checks the picture of the persons face to make sure it matches the one they gave when they signed up. This helps stop people from pretending to be someone and voting. All the votes that are accepted are stored on a blockchain network. This is like a list of everything that has happened. It cannot be changed. This makes it harder for people to cheat and change the votes.

The system also has a way for people to check that their vote was counted without showing who they voted for. This is done by giving each vote a code that the voter can use to check. The system also has password protection and controls who can access the voting information. The final results of the election are taken directly from the blockchain records so they are safe and honest.

The new system uses blockchain technology to store votes, biometric authentication to check who is voting, verification by administrators to make sure people are allowed to vote and a way to track votes to make electronic voting systems safer more open and more reliable. The blockchain technology is used to make sure the votes are safe. The biometric authentication is used to check who is voting. The verification by administrators is used to make sure people are allowed to vote. The vote tracking is used to make sure votes are counted correctly. The new system is designed to make voting safe and open. The blockchain technology and biometric authentication are used to make sure votes are safe and honest. The verification, by administrators and vote tracking are used to make sure people are allowed to vote and votes are counted correctly.

### IV. CONCLUSION

Blockchain technology is a way to make electronic voting systems secure and transparent. When we look at what people have written about this we can see that using a decentralized ledger can really help make elections fair. It does this by keeping vote records that cannot be changed making it easy to check what is happening and stopping people from messing with the system. Also using authentication, like fingerprints or face recognition makes sure that the person voting is who they say they are and reduces the chance of someone pretending to be someone else.

There are still some problems that need to be solved though. We need to figure out how to make the system work for a lot of people make sure it is private stop people from cheating with biometrics and deal with issues. Another big problem is finding a balance between being transparent and keeping voters anonymous.



Overall, blockchain and biometric authentication can really change the way we vote in the future.. We need to do more research to make sure the system works for a lot of people keeps private information safe and can be used in real elections. To make this happen we should look into ways of keeping information secret managing identities, in a decentralized way making sure biometrics are real and testing the system on a large scale. This will help us create voting systems that people can trust.

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