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E-Voting Using Blockchain

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Introduction

The right to vote is a constitutional right given to every citizen of any democratic country and Citizens, as stakeholders of the state, elect their respective representative via elections (ROJAS, 2005). Voting is still being conducted through paper ballots, regardless of the numerous technological advancements in today's society making elections inefficient as well as outdated (Javier Díaz-Santiso, 2021).

Due to social revolution brought by the Internet, Electronic Voting (E-voting) system has become the most viable option for election making the cumbersome and inefficient balloting system obsolete and in a few years e-voting is set to replace traditional paper ballot voting system completely (Simkhada, 2012). Countries like the United Kingdom, the United States of America, and Switzerland have implemented this technology in a variety of polls ranging from local elections to national elections and referendums as well as countries like India and Brazil have completely adapted e-voting in all types of elections (Simkhada, 2012).

Even though democracies have started to use electronic voting for national scale elections, there are still no ideal, dependable, and efficient electronic voting system for people since the election requires one or more authorities for both authentication and protecting voters' privacy, and it is also difficult for voters to believe in the public authority that, it will always follow the rules or never be breached (Wei-Jr Lai, 2021).

Since, a centralized e-voting system creates a single point of failure which makes it more prone to various cyber-attacks as well as vulnerable to sabotaging, natural disasters etc., so the ideal solution would be a user-friendly e-voting system that is immune to cyberattacks and ensures user privacy but does not rely on people for vote counting or an external third party to manage the data collected i.e., an e-voting system hosted on a blockchain network (Javier Díaz-Santiso, 2021).

The blockchain is globally divided and fully decentralized, meaning it has no supervisor or someone that can be blamed or rewarded (Söze, 2017). The Blockchain is made up of multiple irreplaceable blocks, i.e., a chain system (whenever a new block is established and included to blockchain, it replicates itself on its system, which remains on the internet,

then simply syncs the same information on all the nodes operating in blockchain) representing a single source of truth (Söze, 2017). These features qualify blockchain to host major events like elections in its network.

1.1 Problem Scenario

- Paper ballot voting requires cumbersome manual work, a huge budget, and a substantial amount time and manpower for the overall election process (Simkhada, 2012). For example, the Election Commission prints around 20 million ballot papers, for which the country spends around NPR 110 million only on paper supply (Rijal, 2022).
- The existing system cannot guarantee prevention from unlawful manipulation of the data before or after casting a vote (Javier Díaz-Santiso, 2021). For example, some people seized the polling stations, tore up the remaining ballot papers, and ran away with the ballot boxes in two polling stations in Rautahat (Rijal, 2022).
- Due to the complexity of the balloting system every election many votes are disqualified because of various human errors.
- It also affects voter engagement. In the context of Nepal, about 4 million Nepalese could not vote simply because they were in a foreign country during election (Rijal, 2022).
- The voting sometimes gets halted and does not proceed as planned due to various natural disasters and human interferences (Javier Díaz-Santiso, 2021). For example, in the previous election, 79 polling centers were halted, and voting was postponed in 28 municipalities of 16 districts due to various reasons (Rijal, 2022).

1.2 Project as a Solution

- E-voting is a faster and more economy efficient and can be the best alternative in countries like Nepal where the infrastructure is poor and the population highly dispersed (Simkhada, 2012).
- The use of blockchain network covers up the security problems occurring in a regular centralized e-voting system (Javier Díaz-Santiso, 2021).
- The proposed project increases the accessibility for the voters and simultaneously decreasing voter fraud (Javier Díaz-Santiso, 2021).

- The chances of voting being halted drops to negligible as the blockchain network would be unaffected even after failure of one or more nodes (Cabanac G, 2022).
- The e-voting system could provide sufficient transparency while not raising any privacy issues (Cabanac G, 2022).
- Through the proper use of smart contracts each ballot could be counted anonymously, correctly, and efficiently (Javier Díaz-Santiso, 2021).

2. Aim and Objectives

2.1 Aim

- The aim of this project is to create an electronic voting system that provides decentralization as well as immutability and improves the current voting systems in terms of performance and reliability.

2.2 Objective

The objectives for the completion of the proposed project are:

- To learn more about HTML, CSS and JavaScript and be able to create a user-friendly website for e-voting system.
- To dive deeper into the study of blockchain network and its functionalities.
- To become familiar with truffle (coding environment for blockchain).
- To learn more about Web3.js libraries and its alternatives.
- To understand and become capable of implementing smart contracts as per the requirements of the project.

3. Expected Outcomes and Deliverables

After the completion of the project, an e-voting website with the following features is expected:

- The project will be built as a User-friendly website with easy-understandable UI.
- The project will include user registration, user login, and admin login.

- The application will store voter information so that voters may login and use their voting rights.
- At the time of registration, voters will be asked for their full name, age, mobile number, email address, and other information, after which they will be granted the right to vote.
- The user can vote for one of the candidates on the ballot. Voters can only vote for one candidate every election.
- The user can vote for one of the nominees. Voters can only vote for one candidate every election.
- Voters can also access a list of Candidates in their region via the website.
- The admin has complete control over the system and can regulate and delete any information.

4. Project risks, threats and contingency plans

In every project, there are certain risks and threats hindering developer from completing the project. Most of the projects developed does not go as planned due to various reasons some reasons are given below with their contingency plans:

4.1 Risks and Threats

- Possibility of program failure and appearance of bugs during deployment.
- Possibility of hardware failure during presentation.
- Problem may arise using libraries and connecting front-end and blockchain network.
- Mistakes made during programming and not meeting scope of the project.
- Changes may occur in the working of the Ethereum Blockchain Network or solidity smart contracts.

4.2 Contingency Plans

- Backup software shall be stored in multiple places.
- Backup libraries shall be reviewed and kept on standby.

- Other blockchain networks like Solana shall be kept on standby if there may arise any problems.
- Use of version control system like git should mitigate the problem of software backups.

5. Methodology

5.1 Selected Methodology

The methodology chosen for the development and completion of this project is Prototype Methodology. It is explained below:

- Prototype Methodology

When users do not know the specific project needs ahead of time, the prototyping model is employed. In this approach, a prototype of the eventual product is created, tested, and improved based on consumer input until a final acceptable prototype is reached, which serves as the foundation for building the final product (Young, 2013).

Any type of modification is welcome in the prototyping technique, and the product may be created to account for the changes. Some outdated elements that were examined might be deleted in order to make the project more effective, efficient, practical, and market ready. It is also one of the top alternatives for developers since it makes it simple and reasonable for developers to design the product and make adjustments as needed (Geeks for Geeks, 2022).

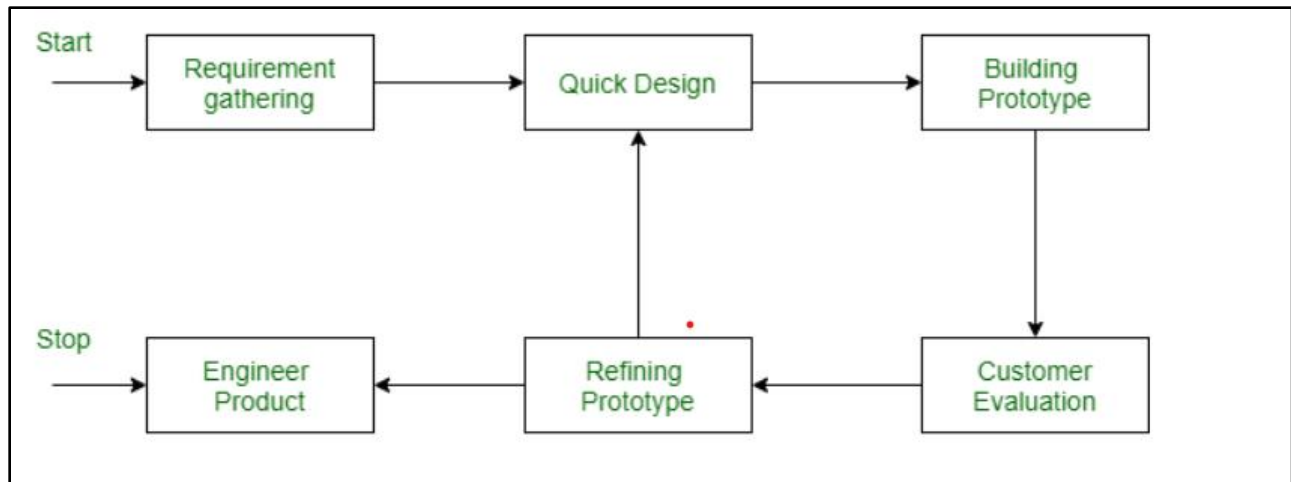


Figure 1: Prototype Methodology (Geeks for Geeks, 2022)

The reasons for choosing this methodology are given below:

- The design of this model is scalable and errors are easily detected.
- Developers can easily locate missing functionality which makes debugging easier.
- There is room for improvement, which implies that future requirements may be readily met.
- It is perfect for an online system and it improves both developers' and users' understanding of the system.
- Integration needs are clearly defined, and deployment channels are determined early on.
- It has the ability to actively include users in the development phase.

5.2 Considered Methodology

- Waterfall Methodology

The fundamental life cycle model for software development is the waterfall model. It is crucial since the conventional waterfall model serves as the foundation for all other software development life cycle models. The life cycle is divided into many segments

according to the traditional waterfall paradigm. This model takes into account the possibility of starting a phase after the preceding phase has ended. That is, the input for the following phase will be the output of the previous one. As a result, the development process may be viewed as a waterfall's sequential flow. The phases do not overlap in this instance (Geeks for Geeks, 2022).

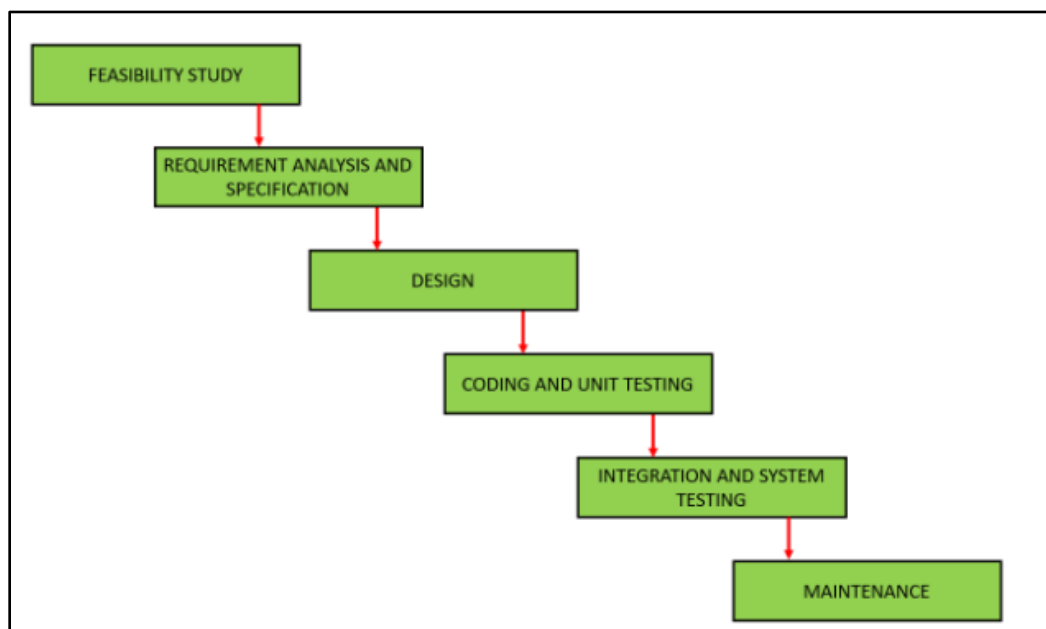


Figure 2: Waterfall Methodology (Geeks for Geeks, 2022)

- Agile Methodology

It is a process in which the need and its solution emerge via the collaborative activity of teams and the client. The activity is divided into numerous phrases, and continual improvement and iteration are accomplished by communicating with stakeholders. Sprints are the names given to the divided portions (Young, 2013).



Figure 3: Agile Methodology (JavatPoint, 2022)

6. Resource Requirements

- A Laptop with decent performance and stable internet connection for developing and storing all the codes.
- For Front-end Web Development: HTML, CSS, JavaScript & Bootstrap will be used. These languages will be used to develop the login page, user interface, buttons etc.
- Solidity language will be used for making the Smart Contract. It is used for all the operations being conducted like voting, counting votes, checking eligibility etc.
- Ganache will be used to simulate a Personal Ethereum Blockchain for developing and testing. It is used by the developer for its virtual Ethereum environment and currency given for testing.
- Truffle, a blockchain coding environment will be used to write all the codes.
- Web3.js is a library which will be used to connect blockchain network and front-end website.

- MetaMask, an extension for transaction in blockchain network will be used in order to operate the transactions. It will be used in order to cast a vote i.e., making transaction in blockchain network.

7. Work-Breakdown Structure

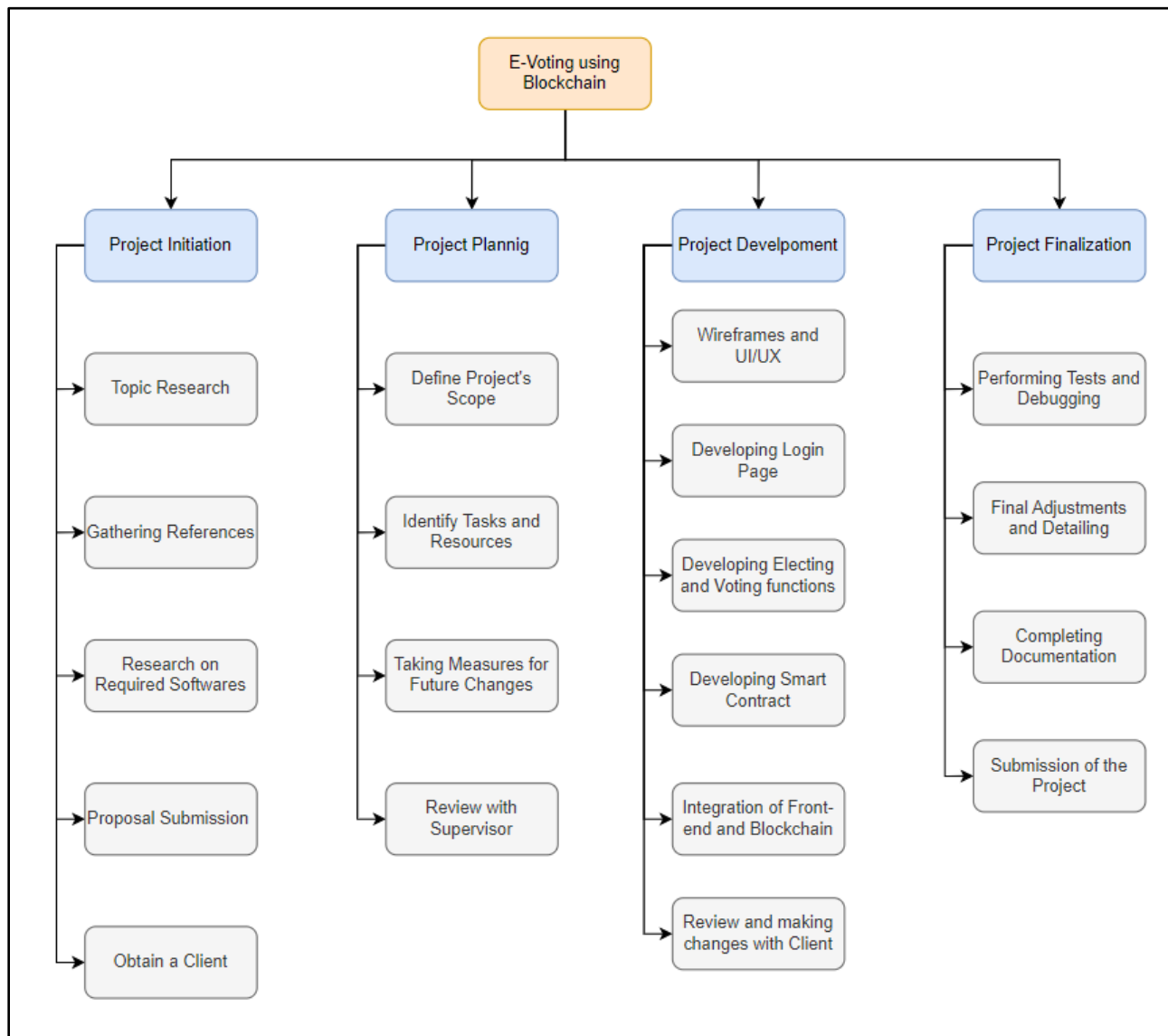


Figure 4: Work Breakdown Structure

8. Milestones

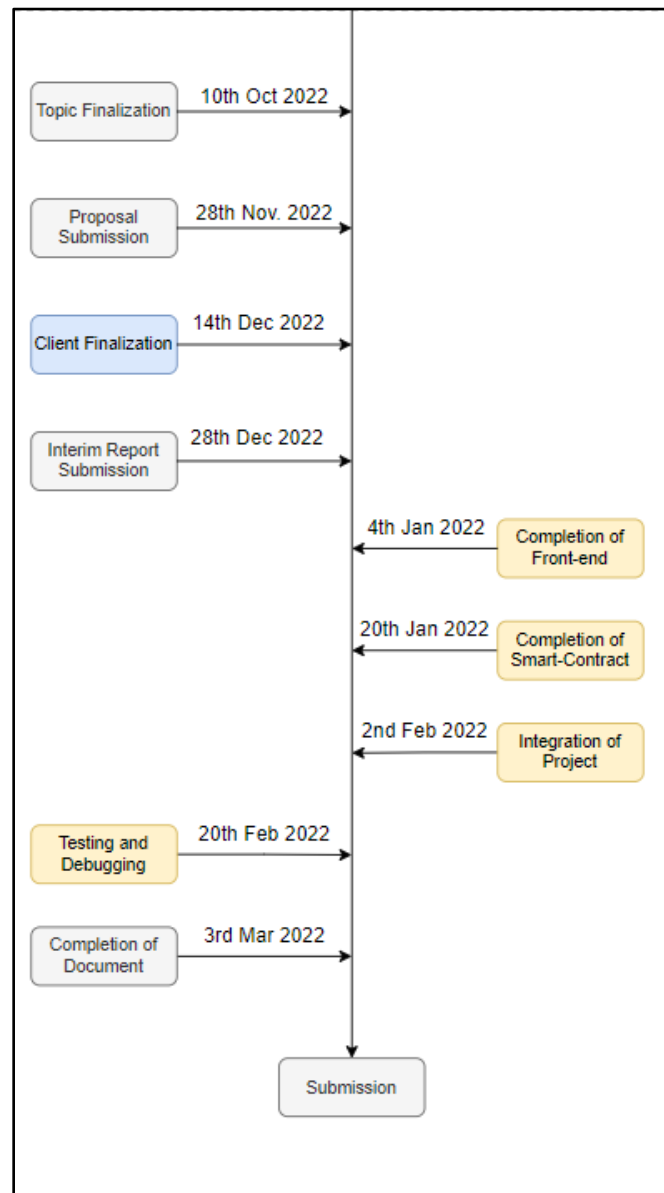


Figure 5: Milestones

9. Project Gantt Chart

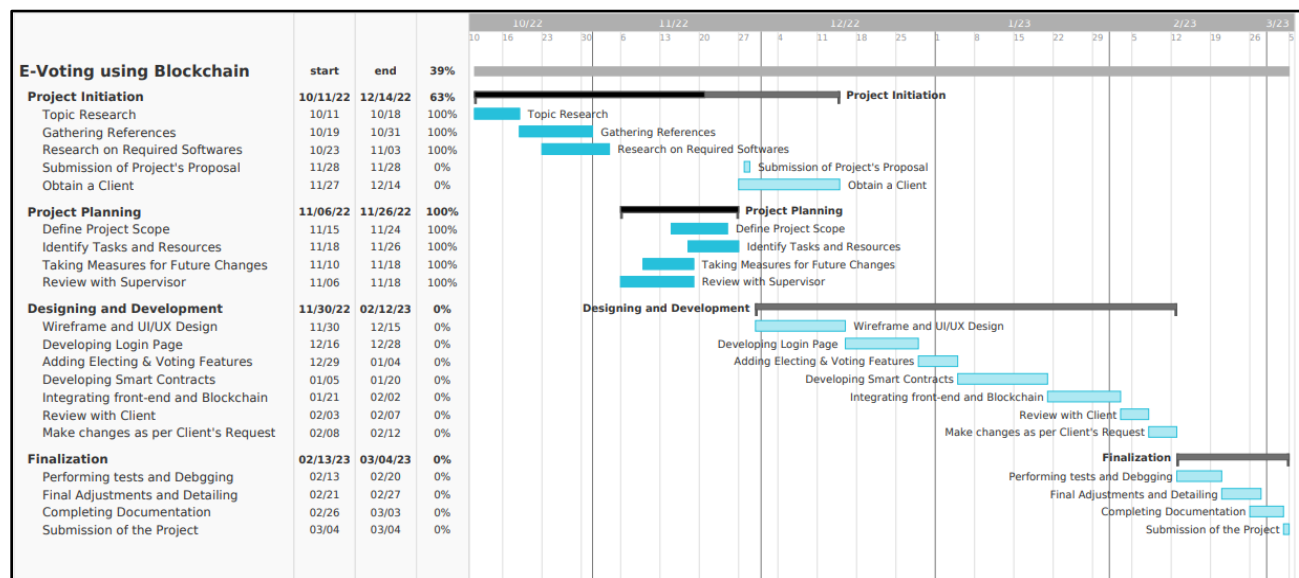


Figure 6: Gantt Chart

10. Conclusion

At Conclusion, Blockchain is a distributed public ledger that is irreversible and resistant to manipulation. Blockchain does not rely on trust and does not use a third party to facilitate communication. Voters can cast ballots without visiting a polling place using a blockchain-based E-voting system; all they need is a computer and an internet connection. It will save time, effort, and money, as well as encourage young tech-savvy voters to vote (Söze, 2017).

Blockchain technology provides a new way to overcome the limits and adoption of obstacles of electronic voting systems, ensuring election security and integrity while also laying the groundwork for transparency. It is feasible to transfer hundreds of transactions per second into an Ethereum private blockchain, employing every component of the smart contract to reduce the load on the blockchain (Vikram Dhillon, 2017).

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Appendix

Originality report

COURSE NAME

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STUDENT NAME

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REPORT CREATED

28 Nov 2022

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2 of 6 passages

Student passage^{CITED}

...making the cumbersome and inefficient balloting system obsolete and **in a few years e-voting is set to replace traditional paper** ballot voting system completely (Simkhada, 2012). Countries like the...

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Other countries, including Nepal, are cautiously following this trend. **In a few years, e-voting is set to replace traditional paper** balloting in most countries.

E-Voting: Possibilities and Challenges in the Nepalese Context
<http://www.neajc.org/events/workshop2009/KumarSimkhada.pdf>

3 of 6 passages

Student passage^{CITED}

Paper ballot voting **requires cumbersome manual work, a huge budget, and a substantial amount time** and manpower **for the overall election**

[Top web match](#)

Traditional **paper** balloting **requires cumbersome manual work, a huge budget, and a substantial amount time for the overall election** process. In contrary, e- ...

E-Voting: Possibilities and Challenges in the Nepalese Context
<http://www.neajc.org/events/workshop2009/KumarSimkhada.pdf>

4 of 6 passages

Student passage^{CITED}

E-voting is a **faster and more** economy efficient and **can be** the best **alternative in countries like Nepal** where the **infrastructure is poor and the population highly**

[Top web match](#)

In contrary, **e-voting, a faster and more** economical approach, **can be** effective **alternative in countries like Nepal where the infrastructure is poor and the population highly** dispersed.

E-Voting: Possibilities and Challenges in the Nepalese Context
<http://www.neajc.org/events/workshop2009/KumarSimkhada.pdf>

5 of 6 passages

Student passage FLAGGED

Blockchain technology provides a new way to overcome the limits and adoption of obstacles of electronic voting systems, ensuring election security and integrity while also laying the groundwork for...

[Top web match](#)

The authors demonstrated that **blockchain technology provides a new way to overcome the limits and adoption obstacles of electronic voting systems, ensuring election security and integrity and laying...**

In-depth Analysis of Securing E-voting through Blockchains -

IJARIE

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6 of 6 passages

Student passage CITED

It is feasible to transfer hundreds of transactions per second into an Ethereum private blockchain, employing every component of the smart contract to reduce the load on the

[Top web match](#)

It is feasible to transfer hundreds of transactions per second into an Ethereum private blockchain, employing every component of the smart contract to reduce the load on the blockchain.

In-depth Analysis of Securing E-voting through Blockchains -

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