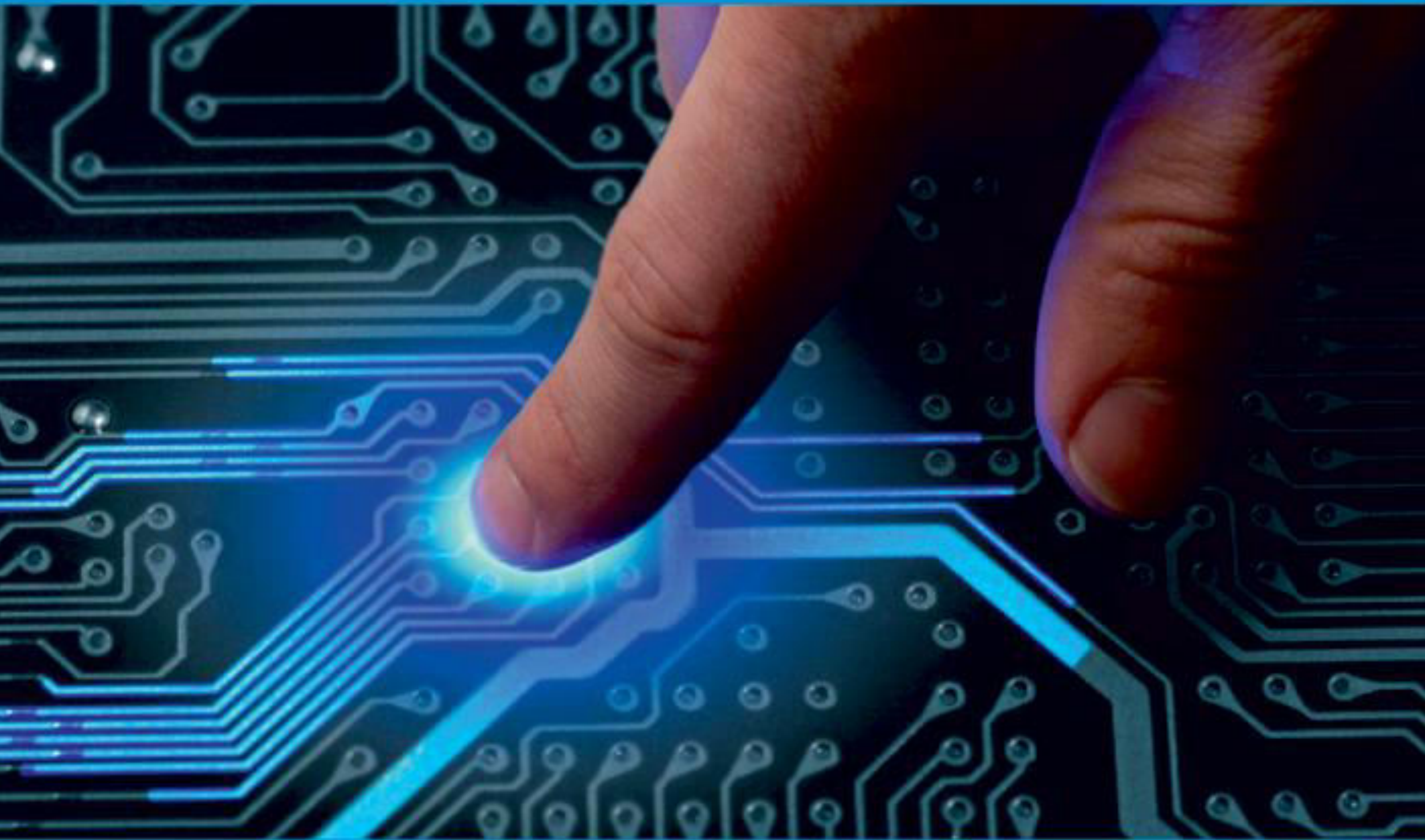
IJIRCCE

e-ISSN: 2320-9801 | p-ISSN: 2320-9798



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

Volume 12, Issue 4, April 2024

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 8.379

9940 572 462 6381 907 438 ijircce@gmail.com www.ijircce.com

International Journal of Innovative Research in Computer and Communication Engineering

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 | Monthly Peer Reviewed & Referred Journal |

|| Volume 12, Issue 4, April 2024 ||

| DOI: 10.15680/IJIRCCE.2024.1204063 |

Enhancing Electoral Integrity with Block Chain Technology

Mrs. M. A. Yaazhini, Sam Joel R, Surya Kumar P, Vijay R, Yogesh Pathi M V

Assistant Professor, Department of Computer Science Engineering, Mahendra Institute of Technology, Namakkal District, Tamil Nadu, India

Department of Computer Science Engineering, Mahendra Institute of Technology, Namakkal District, Tamil Nadu, India

Department of Computer Science Engineering, Mahendra Institute of Technology, Namakkal District, Tamil Nadu, India

Department of Computer Science Engineering, Mahendra Institute of Technology, Namakkal District, Tamil Nadu, India

ABSTRACT: We presented a systematic review of the state of research into blockchain-based e-voting systems. This study is motivated by the need to comparatively assess benefits, challenges, and impacts and open future research in comparison to other types of voting systems. Furthermore, a discussion of technology aspects to address the required properties was lacking. Significant studies emerged, proposing a novel approach to utilizing blockchain technology for recording votes for different voting scenarios. These systems aimed to address common limitations in existing voting systems and involved a critical evaluation of popular blockchain frameworks suitable for e-voting applications. During the years, the primary research emphasis shifted towards enhancing security and developing robust frameworks for blockchain-based e-voting systems. In recent years, the other aspects of e-voting systems, scalability and cost efficiency, have received more attention. Moreover, the importance of privacy-preserving protocols grew significantly, prompting the development of coercion-resistant and privacy-preserving e-voting protocols.

KEYWORDS: blockchain; voting; genetic algorithm; electronic voting

I. INTRODUCTION

Blockchain technology has been recognized as a potential solution for secure and transparent e-voting systems. By leveraging the decentralization, immutability, and transparency of blockchain technology, e-voting systems can prevent fraud and manipulation, improve voter anonymity, and increase trust in the electoral process. Moreover, blockchain-based e-voting systems can reduce the cost and time associated with traditional voting systems.

Traditional voting mechanisms commonly rely on centralized entities, which can give the opportunity for vulnerabilities such as the tampering of results or electoral fraud. The decentralized and immutable features inherent in blockchain technology offer a promising solution to the vulnerabilities related to traditional and other e-voting approaches. Blockchain technology has the ability to create a tamper-proof and transparent platform for conducting e-voting. Blockchain-based e-voting systems provide secure, verifiable, and auditable voting procedures through the integration of cryptographic techniques and consensus protocols.

The growing interest in blockchain-based e-voting systems indicates the importance of a comprehensive and systematic evaluation of the current knowledge in this domain. One of the aims of this review is to identify the main benefits of e-voting systems based on blockchain technology through an in-depth review of the previous research. These benefits include heightened security, transparency, decentralization, and privacy. Additionally, we intend to identify the challenges and limitations that come with these systems, which include privacy and security concerns, scalability issues, and technical limitations.

International Journal of Innovative Research in Computer and Communication Engineering

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 | Monthly Peer Reviewed & Referred Journal |

|| Volume 12, Issue 4, April 2024 ||

| DOI: 10.15680/IJIRCCE.2024.1204063 |

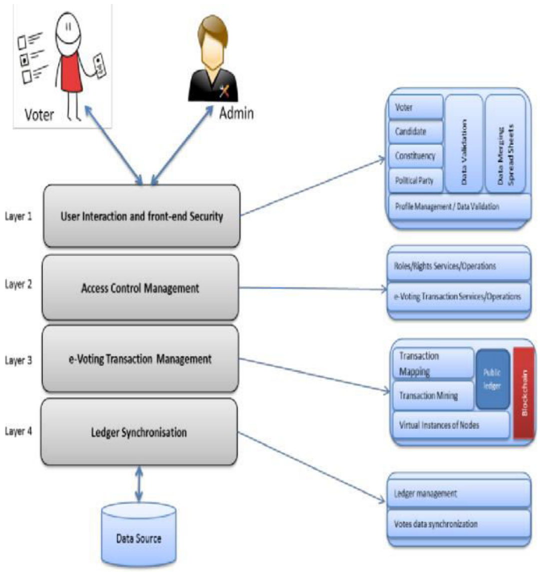


Fig 1: Secure Digital Voting System

Moreover, a comprehensive understanding of the technologies and implementations involved in blockchain-based e-voting platforms is imperative in order to evaluate their feasibility and functionality. Furthermore, this systematic review provides technical insight into common blockchain frameworks, consensus algorithms, and security and privacy-enhancing techniques used in these systems. In addition, we aim to conduct an examination of the impacts of proposed blockchain-based e-voting systems in the literature on various aspects of the voting process, including security, privacy, efficiency, and scalability.

Overall, the purpose of this review is to conduct an extensive review of the current state of the literature related to blockchain-based e-voting systems. We look into the benefits, challenges, technological aspects, impacts, and potential research and development areas in the context of e-voting systems using blockchain technology. We conduct a combined review method, employing the principles of systematic literature review to choose and classify scientific papers. Additionally, we examine the technology implemented in these with respect to the already mentioned key concerns. The evaluation follows the PRISMA guidelines [1], which guarantee a rigorous and transparent methodology for the synthesis of available research data. The PRISMA protocol (Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols) is a reporting guideline designed to aid researchers in the preparation and documentation of systematic review and meta-analysis protocols.

II. RELATED WORK

The blockchain concept is an ever-evolving living process that will continue to exist for as long as it can successfully transmit its genetic code from one generation of blocks to the next. Information written on a following block is verified and validated by software programs in the blockchain, and any peer on the network can do so by utilizing a hash code to make a verification. This particular blockchain will be updated with several cutting-edge technologies in the form of computational elements to simplify and expedite conducting financial transactions. These transactions are logged in the distributed ledger, ensuring transparency and the inability to alter previous records. While it is theoretically possible to tamper with the data recorded on the blockchain, this would require the majority of peers to be corrupt and willing to participate in the tampering, and it would have to be done systematically and without interruption. The blockchain is decentralized, meaning that no one controls the ledger and copies of the ledger are always accessible to all peers. New data is recorded to a single block that many peers can verify, and the data from all previous blocks is combined into a single ledger distributed among peers; this is not possible in a public blockchain network that is independently controlled. Therefore, blockchain helps ensure the safety and openness of digital government records while contributing to their decentralization and adaptability. Utilizing technology can significantly enhance essential governmental functions within the E-core, including overseeing decentralized government information databases and validating diverse public transactions and digital services for citizens and businesses. These technological solutions

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 | Monthly Peer Reviewed & Referred Journal |

|| Volume 12, Issue 4, April 2024 ||

| DOI: 10.15680/IJIRCCE.2024.1204063 |

have the potential to substantially elevate trust in the e-voting system, thereby fostering greater public confidence in its reliability and effectiveness.

Our research focuses on the potential of blockchain technology to revolutionize electronic voting, aligning with the findings of that extensively elaborate on blockchain's core attributes: immutability, transparency, security, and decentralization. By leveraging these attributes, we aim to significantly enhance the integrity of electoral results significantly, ensuring tamper-proof and transparent voting mechanisms. This aligns with the urgent need for resilient, technologically advanced solutions that can adapt to evolving societal and global circumstances. While our citations primarily highlight foundational studies, we acknowledge the expansive literature landscape in this field. In future iterations, we intend to broaden our literature review to encompass a more comprehensive array of works while emphasizing the relevance of our proposed solution. Our research endeavors not only to fortify the foundations of democracy in Morocco but also to contribute innovative approaches that could have a transformative impact on electoral systems globally. The importance of our research lies in its potential to offer a robust and adaptable solution to the persistent challenges facing electoral processes, as identified in many scholarly works. By integrating the principles of blockchain technology into electronic voting systems, we aspire to address vulnerabilities, streamline result declarations, and uphold the democratic values essential to societies worldwide.

III. METHODS

The default settings that should be used vary depending on the system; however, several metrics should be considered. The mutation rate should be low enough to maintain the best solutions identified, but high enough to explore new areas of the search space. A mutation rate of 0.01 to 0.1 is commonly utilized. The population size should be big enough to preserve demographic variety without becoming computationally costly. A population size of 50 to 100 people is commonly utilized. The number of generations should be determined by the desired level of convergence and the available computer resources. The minimum fitness score is set to the default of 85, on a scale from 0 to 100, with 0 as the minimum and 100 as the maximum. This parameter should be changed depending on the results. If the result is far from the expected score, it should be increased. However, if it is taking too long to generate a schedule, the score should be decreased.

The voting system is projected to provide secure, reliable, and transparent voting. It is built on a blockchain platform, which ensures that every vote is saved in a tamper-proof manner. The voting system consists of several components:

1. Voter Registration: To participate in the voting process, users need to register and authenticate themselves using a secure and user-friendly interface. This component includes identity verification and digital signatures to ensure the authenticity of each voter.
2. Block Creation: The block creation component is responsible for creating the block and ensuring that it contains all the necessary information required for the voting process. This includes candidate lists, referendums, and voting rules.
3. Voting: The voting component is responsible for ensuring that each vote is recorded and stored in the blockchain securely and transparently. The component ensures that the vote is valid and that the voter has not voted twice.
4. Vote Counting: The vote counting component is responsible for tallying the votes and declaring the winner. This component ensures that the vote count is accurate, transparent, and tamper-proof.

To perform this, the system makes use of a customized blockchain, which eliminates the requirement for institutions to pay fees to publish on blockchains such as Ethereum or Bitcoin. The system may be built as Docker [22] images that are deployed with Kubernetes [23] to produce numerous instances per server on as many servers as the institution requires, making it cost-effective. Kubernetes is critical to ensure that the system is always highly available and responsive. Nonetheless, the system’s deployment component may be tailored to the institution’s present system. The system validates itself via proof of work, which is more expensive on the computer but a safer alternative for tiny blockchains. There is no requirement for staking or the use of a coin or token with proof of work validation.

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 | Monthly Peer Reviewed & Referred Journal |

|| Volume 12, Issue 4, April 2024 ||

| DOI: 10.15680/IJIRCCE.2024.1204063 |

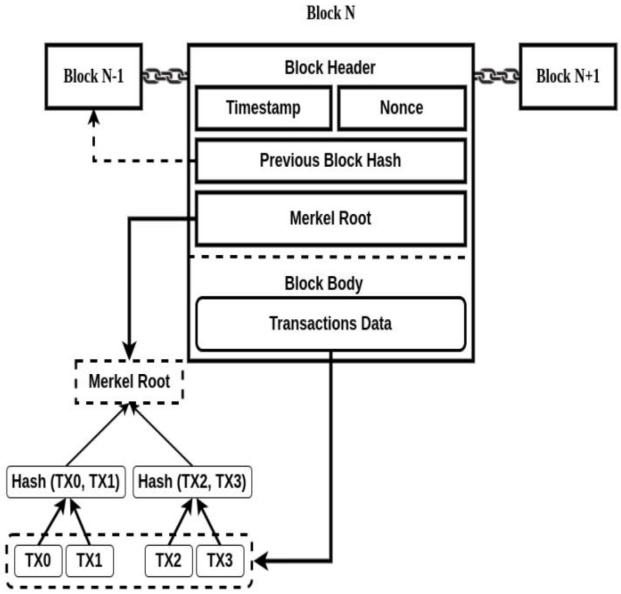


Fig 2: Work Flow

The online interface for establishing and editing polls allows the pool's developer to assign a height to each person's vote, which is essential in administration board polls where each person's vote has a varied amount of importance. Its height can be described as the proportion of the institution that the individual owns, such as in an administrative pool. To ensure transparency, the system offers anonymous voting, where no one knows who owns the wallets, but everyone can see where each wallet voted. Additionally, the blockchain is encrypted to guarantee that data are safe and that only authorized parties have access to data.

IV. RESULT ANALYSIS

In the context of a university that needs to generate schedules for all courses at the beginning of the semester, various restrictions need to be analyzed and considered. A problem with the traditional approach is that when this scheduler has been created, it is really difficult to consider every professor's restriction, and even worse is when those restrictions collide with others' limitations (e.g., room capacity, lecture overlap). Our system proposes a genetic algorithm to generate possible schedule solutions. We will try every smart combination of the classes, respecting the restriction, until we find a schedule that fits perfectly with the restriction. However, that is not always the case because of overlap restrictions; it is sometimes impossible to respect all the restrictions, more specifically the soft restrictions. Here we introduce the second part of our system, the blockchain voting system, which will select a specified amount of schedules to send to vote. The professors may choose, through a poll, the schedule that they prefer. All those votes will be stored in a blockchain to secure all the fairness and transparency that a poll should have.

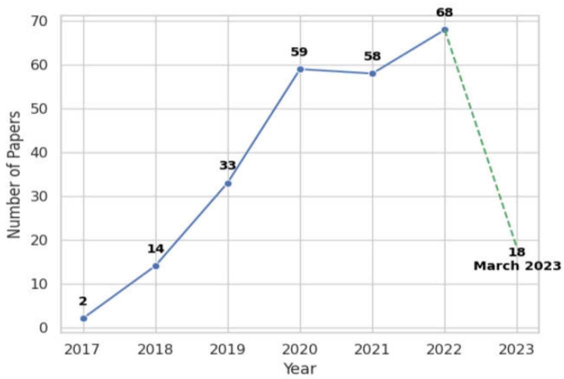


Fig 3: Result Analysis

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 | Monthly Peer Reviewed & Referred Journal |

|| Volume 12, Issue 4, April 2024 ||

| DOI: 10.15680/IJIRCCE.2024.1204063 |

Back to the beginning, the first step is to register all the restrictions that the university has. These restrictions may include the number and capacity of classrooms, the specifications of each classroom (e.g., the presence of projectors or computers), the availability of professors, and other relevant factors. Once these requirements have been identified and registered in the system, a JSON file will be created with this format.

The JSON is formatted as follows: first, the name of the constraint; second, the values the constraint can have. For example, the hour constraints, where their values mean the hours during which it is possible to have classes. The meaning changes from constraint to constraint and from context to context. A more simple constraint is represented as an array with values; we can have more complex constraints such as a constraint that depends on another constraint. For example, the class entity, for one class to happen, requires the teacher that is going to teach that class to be available at the time of the class itself.

V. CONCLUSION

This study followed the PRISMA protocol, resulting in a selection of 252 papers. Five research questions centered on benefits, challenges, impacts, and open future research, as well as technology aspects, guided this study. To provide context, we supplemented this study of the literature with a comprehensive definition of voting system types as a framework, but also technology definitions, also extracted from the literature, in order to make the concerns better understood from an implementation perspective. The results show that blockchain technology has the potential to successfully implement e-voting systems. Transparency and auditability are seen as undisputed benefits. Security and privacy are, as would be expected for voting processes, the central properties. Here, the potential is seen in blockchain technology over other platform technologies, but whereas some specific aspects are acknowledged, both remain serious open problems, which their top rankings in the frequency lists for challenges and future directions show. An undisputed limitation of blockchains is their lack of scalability, which is the most serious non-security concern. Beyond core platform concerns, usability, verifiability, accessibility, reliability, and acceptability are properties of concern that in the wider voting systems implementation require more attention. Where evident from the studies considered, we supplemented these observations with concrete solution techniques.

REFERENCES

1. Page, M.J.; McKenzie, J.E.; Bossuyt, P.M.; Boutron, I.; Hoffmann, T.C.; Mulrow, C.D.; Shamseer, L.; Tetzlaff, J.M.; Akl, E.A.; Brennan, S.E.; et al. The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *Int. J. Surg.* **2021**, *88*, 105906. [**Google Scholar**] [**CrossRef**] [**PubMed**]
2. Voting Technology. Available online: **https://electionlab.mit.edu/research/voting-technology** (accessed on 22 April 2023).
3. Krimmer, R.; Volkamer, M. Bits or Paper? Comparing Remote Electronic Voting to Postal Voting. In Proceedings of the EGOV (Workshops and Posters), Copenhagen, Denmark, 22–26 August 2005; Citeseer: State College, PA, USA, 2005; pp. 225–232. [**Google Scholar**]
4. Jones, D.W. The evaluation of voting technology. In *Secure Electronic Voting*; Springer: New York, NY, USA, 2003; pp. 3–16. [**Google Scholar**]
5. Fischer, E.A.; Coleman, K.J. *The Direct Recording Electronic Voting Machine (DRE) Controversy: FAQs and Misperceptions*; Congressional Research Service, Library of Congress: Washington, DC, USA, 2007.
6. Electoral Technology. Available online: **https://aceproject.org/ace-en/topics/et/eta/default** (accessed on 19 March 2023).
7. Verified Voting–The Verifier. Available online: **https://verifiedvoting.org/verifier/#mode/navigate/map/ppEquip/mapType/normal/year/2024** (accessed on 19 March 2023).
8. Oostveen, A.-M.; van den Besselaar, P. E-voting and media effects, an exploratory study. In Proceedings of the Conference on New Media, Technology and Everyday Life in Europe, Amsterdam, The Netherlands, 18–19 September 2003. [**Google Scholar**]
9. Buchstein, H. Online democracy, is it viable? Is it desirable? Internet voting and normative democratic theory. In *Electronic Voting and Democracy: A Comparative Analysis*; Palgrave Macmillan UK: London, UK, 2004; pp. 39–58. [**Google Scholar**]
10. Akbari, E.; Wu, Q.; Zhao, W.; Arabnia, H.R.; Yang, M.Q. From blockchain to internet-based voting. In Proceedings of the 2017 International Conference on Computational Science and Computational Intelligence (CSCI), Las Vegas, NV, USA, 14–16 December 2017; IEEE: Piscataway, NJ, USA, 2017; pp. 218–221. [**Google Scholar**]

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 | Monthly Peer Reviewed & Referred Journal |

|| Volume 12, Issue 4, April 2024 ||

| DOI: 10.15680/IJIRCCE.2024.1204063 |

11. Kshetri, N.; Voas, J. Blockchain-enabled e-voting. *IEEE Softw.* **2018**, *35*, 95–99. [**Google Scholar**] [**CrossRef**]
12. Tanwar, S.; Gupta, N.; Kumar, P.; Hu, Y.-C. Implementation of blockchain-based e-voting system. *Multimed. Tools Appl.* **2023**, 1–32. [**Google Scholar**] [**CrossRef**]
13. Gritzalis, D.A. Principles and requirements for a secure e-voting system. *Comput. Secur.* **2002**, *21*, 539–556. [**Google Scholar**] [**CrossRef**]
14. Anane, R.; Freeland, R.; Theodoropoulos, G. E-voting requirements and implementation. In Proceedings of the the 9th IEEE International Conference on E-Commerce Technology and the 4th IEEE International Conference on Enterprise Computing, E-Commerce and E-Services (CEC-EEE 2007), Tokyo, Japan, 23–26 July 2007; IEEE: Piscataway, NJ, USA, 2007; pp. 382–392. [**Google Scholar**]
15. Volkamer, M. *Evaluation of Electronic Voting: Requirements and Evaluation Procedures to Support Responsible Election Authorities*, 1st ed.; Springer Science & Business Media: Berlin, Germany, 2009; Volume 30. [**Google Scholar**]

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

INNO SPACE SJIF Scientific Journal Impact Factor

doi crossref

निस्केयर NISCAIR

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING