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Secure E-Voting System using Blockchain Technology

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Abstract: Implementing a safe and efficient electronic voting system that will maintain the fairness and privacy as well as simultaneously provide the transparency and flexibility of electronic systems has been a challenge since a long time. Digital system can be highly beneficial to senior citizens and especially for people living in the rural areas. But any system which is online can have a tendency to get hacked or disrupted. Even a single minute flaw has the potential to lead to large-scale vote tampering. Hence, we have proposed an electronic voting system which uses the blockchain technology and addresses some of the drawbacks of existing systems.

We evaluated the possibility of distributed ledger technology by establishing a blockchain-based application that boosts security while lowering the overall cost of administering a nationwide election. E-Voting refers to voting using electronic means and to take care of the votes given by the user and counting the votes accurately. An e-voting system must be secure, as it should not allow duplicated votes and be fully transparent, while protecting the privacy of the attendees. The disadvantages of traditional voting system are that there is no reliability of voting. No assurance that people gave the votes is not changed before they are counted on the system.

There is no transparency between the voter and the system. So, to overcome all these issues we are proposing to use block chain technology as a medium in the voting system. The objective of such a scheme would be to provide a decentralized architecture to run and support a voting scheme that is open, fair, and independently verifiable. In this, we propose a potential new e-voting protocol that utilizes the block chain as a transparent ballot box. Therefore, there would be more transparency between the user and the system. E-voting can be very helpful because everyone can easily access the election and uses his/her votes and declares his/her choice. People can share private hyperlinks to any created poll (as long as they know the link) and people who have the link can vote and one browser can only use one vote. The security here, in terms of voter authentication, duplicate votes and non-repudiation of votes, is very weak.

Keywords: Blockchain, Distributed System, Electronic Voting System, Candidates, Voters, e-Voting, I-Voting, etc.

I. INTRODUCTION

Voting is a method to make a collective decision or express an opinion among a group or a meeting or electorates Voting is usually following debates, discussions, and election campaigns. During voting, the person to be elected is the candidate of an election, and the person who casts a ballot for their chosen candidate is voter. Usually, the voter can vote in accordance with the list of candidate or vote for any other persons he/her prefers. Voting ballots must be unsigned and marked by the voters in private booths so that no one else can find out for whom a citizen is voting. Since the 17th century, voting has been the usual mechanism by which modern representative democracy has operated. Voting is also used in many other private organizations and groups, such as clubs, corporations, and voluntary associations

With the rapid development of the Internet and information technologies, many conventional offline services such as voting, mail, payment, are migrating to online ones. The online voting is known as electronic voting (e-voting). It is an electronic means for casting and counting votes. Users of e-voting are voters and election authorities. The voter can submit his/her or her votes electronically to the election authorities from any location via e-voting. The election authorities are responsible for collecting votes from voters. E-voting can save time and effort with high efficiency and flexibility, which is getting more and more attentions instead of traditional voting. With the development of Internet, e-voting became the important means of many organizations.

II. RELATED WORK

1) Gupta A, Patel J, Gupta M, Gupta H. [1] System presented in the Issues and Effectiveness of Blockchain Technology on Digital Voting that block chain is a technology that enables moving digital coins or assets from one individual to other individual. Blockchain concept can be understand with the concept of linked list in Data Structure, because its next key address are stored in previous key and they are linked with each other.
   Methodology:- It was first conceptualized in 2008 which implemented in the successive year as a core component of the digital currency bitcoin, which works as a public ledger of all transactions. Digital voting through block chain technology has some issues and effectiveness but our concern is to focus that how much system makes this technique more effective. Here, our main focus is that how system can implement this technique in our daily life. Our country India is deeply interested for future use and lots of efforts are being done to overcome the security issues as early as possible.
2) Hardwick, Freya Sheer, Raja NaeemAkram, and Konstantinos Markantonakis. [3] E-Voting with Blockchain: An E-Voting Protocol with Decentralization and Voter Privacy that a potential solution to the lack of interest in voting amongst the young tech savvy population. For e-voting to become more open, transparent, and independently auditable, a potential solution would be base it on block chain technology. This paper explores the potential of the block chain technology and its usefulness in the e-voting scheme. An e-voting scheme, which is then implemented.
   Methodology:- The implementation and related performance measurements are given in the paper along with the challenges presented by the block chain platform to develop a complex application like e-voting. The paper highlights some shortcomings and presents two potential paths forward to improve the underlying platform (block chain technology) to support e-voting and other similar applications. Blockchain technology has a lot of promise; how system fevers, in its current state it might not reach its full potential. There needs to be concerted effort in the core block chain technology research to improve is features and support for complex applications that can execute within the block chain network.
3) Meter, Christian. [4] System presents the Design of Distributed Voting Systems. Electronic voting systems attempt to be as easy to use and secure as ideal traditional elections and attempt to eliminate the human errors described.
   Methodology: - This is hard to achieve, because electronic voting systems need a strong encryption to guarantee security, integrity and anonymity of the vote. This must be ensured and still result in a user-friendly application, which is often hard to achieve. But to assume that traditional elections are completely secure and correct is also questionable, as system already so, this is a good opportunity to think about reinventing elections with the help of computers and cryptography.
4) Panja, Somnath, and Bimal Kumar Roy. [5] System presented in the secure end-to-end verifiable e-voting system using zero knowledge based blockchain that present a cryptographic technique for an authenticated, end-to-end verifiable and secret ballot election. Voters should receive assurance that their vote is cast as intended, recorded as cast and tallied as recorded. The election system as a whole should ensure that voter coercion is unlikely, even when voters are willing to be influenced. Currently, almost all verifiable e-voting systems require trusted authorities to perform the tallying process. An exception is the DRE-i and DRE-ip system. The DRE-ip system removes the requirement of tallying authorities by encrypting ballot in such a way that the election tally can be publicly verified without decrypting cast ballots. However, the DRE-ip system necessitates a secure bulletin board (BB) for storing the encrypted ballot as without it the integrity of the system may be lost and the result can be compromised without detection during the audit phase.
   Methodology: - System has modified the DRE-ip system so that if any recorded ballot is tempered by an adversary before the tallying phase, it will be detected during the tallying phase. In addition, system has described a method using zero knowledge based public blockchain to store these ballots so that it remains tamper proof. To the best of our knowledge, it is the first end-to end verifiable Direct-recording electronic (DRE) based e-voting system using blockchain. In our case, system assumes that the bulletin board is insecure and an adversary as read and write access to the bulletin board. System have also added a secure biometric with government provided identity card based authentication mechanism for voter authentication. System is able to encrypt ballot in such a way that the election tally can be publicly verified without decrypting cast ballots maintaining end-to-end verifiability and without requiring the secure bulletin board.

III. EXISTING SYSTEM

The existing voting system typically involves a physical polling place where registered voters go to cast their ballot on election day. Voters present identification, verify their registration, and receive a paper ballot or use an electronic voting machine to make their selections.

Once completed, the ballot is either deposited in a ballot box or recorded electronically. After the polls close, the ballots are counted by election officials and results are reported. This system has been in place for many years and has been used successfully in many countries, but there are ongoing debates about its security, accessibility, and accuracy.

IV. PROPOSED METHODOLOGY

This system highlights the implementation of e-voting using blockchain for such a proposal from a practical point view in both development/ deployment and usage contexts. Concluding this work is a potential roadmap for blockchain technology to be able to support complex applications. Building an electronic voting system that satisfies the legal requirements of legislators has been a challenge for a long time. Distributed ledger technologies are an exciting technological advancement in the information technology world. Blockchain technologies offer an infinite range of applications benefiting from sharing economies. This paper aims to evaluate the application of blockchain as service to implement distributed electronic voting systems. The proposed system focuses on the use of blockchain technology for various E-Voting Applications. The system architecture diagram is depicted in Fig.1.

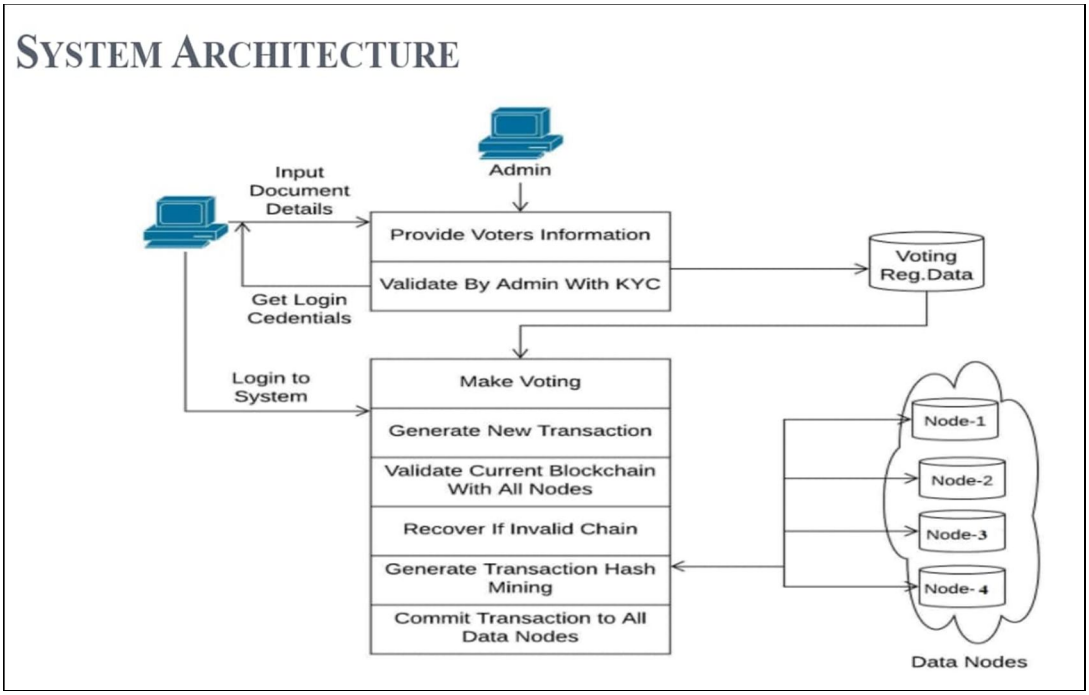


Fig.1-Architecture Diagram

We propose an e-voting scheme based on blockchain technology that meets the fundamental e-voting properties whilst, at the same time, provides a degree of decentralization and places as much control of the process in the hands of the voters as was deemed possible. We carried out the below objectives of proposed system: -

1) To design and implement an e-voting system using block chain technology.
2) We integrate the blockchain paradigm into e-voting procedure and come up with a feasible and general e-voting protocol.
3) Implement a system which provides a secure and flexible voting mechanism, satisfies almost all of the main requirements for an e-voting system and weakens the power of the election organizer.

E-voting is more preferable because e-voting is available for everyone who has a computer or a mobile phone, every single administrative decision can be made by people and members or at least people's opinion will be more public and more accessible by politicians and managers. This will eventually lead humanity to the true direct democracy. It's important for us since elections can easily be corrupted or manipulated especially in small towns, and even in bigger cities located in corrupt countries. Plus, large-scale traditional elections are very expensive in the long term, especially if there are hundreds of geographically distributed vote centers and millions of voters. Also, the voters (mainly for members of organizations) might be on vacation, on a business trip or far away for any other reason, which will make impossible for that particular voter to attend the election and may lower the overall attendance. E-voting will be able solve these problems, if implemented carefully.

A blockchain system can be considered as a virtually incorruptible cryptographic database where critical voting information could be recorded. The system is maintained by a network of computers that is accessible to anyone running the software. Blockchain operates as a pseudo-anonymous system that has still privacy issue since all transactions are exposed to the public, even though it is tamper-proof in the sense of data-integrity. The access control of heterogeneous patients' voting records across multiple vote institutions and devices needed to be carefully designed. Blockchain itself is not designed as the large-scale storage system. In the context vote, a decentralized storage solution would greatly complement the weakness of blockchain in the perspective. The blockchain network as a decentralized system is more resilient in that there is no single-point attack or failure compare to centralized systems. However, since the entire bitcoin transactions are public and everybody has access, there already exist analytics tools that identify the participants in the network based on the transaction history. With popularity analytics, similarity or closeness among topics within large volume of data can be detected. Groups of items or topics can be system generated using closeness relationship formulation.

V. RESULTS ANALYSIS

A secure e-voting system using blockchain technology is a proposed method of electronic voting that utilizes blockchain's distributed ledger technology to ensure the integrity and security of the voting process. The use of blockchain provides a decentralized and transparent platform that enables voters to cast their votes securely without the need for a central authority or intermediary. The following table provides an overview of some of the potential benefits and challenges of implementing a secure e-voting system using blockchain technology:

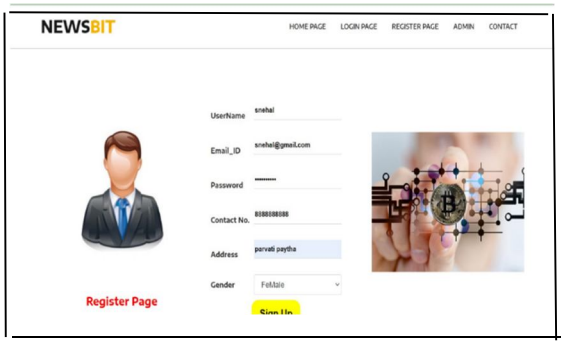
Benefits	Challenges
Improved transparency and accountability	Limited adoption and implementation
Enhanced security and data integrity	Technical complexities and scalability
Reduced costs and increased efficiency	Privacy concerns and voter anonymity
Real-time tracking and reporting of results	Potential for hacking and cyber attacks

While the concept of a secure e-voting system using blockchain technology holds promise, there are still several challenges that need to be addressed before it can be widely adopted as a viable alternative to traditional voting systems.

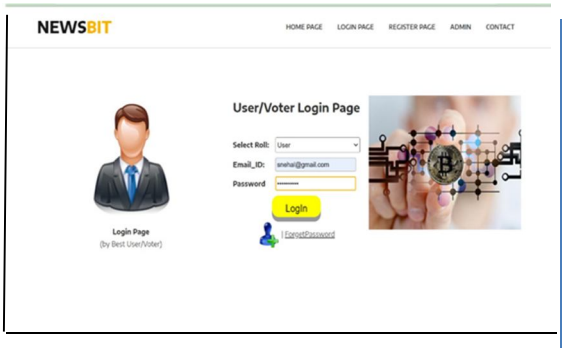
Factor	Impact on Accuracy
Blockchain Consensus Mechanism	Can impact the speed and level of trust in the e-voting system
Security Measures	Can impact the authenticity and integrity of the votes
Voter Verification	Can impact the accuracy of the identity verification process
Transparency	A more transparent system can help ensure the accuracy of the results
System Maintenance	Regular maintenance and updates can help ensure the accuracy and security of the system

Blockchain technology can be used to create a secure and transparent e-voting system by ensuring that every vote is recorded on an immutable and decentralized ledger. This makes it virtually impossible for anyone to manipulate the voting results. Additionally, by using cryptography, the identities of the voters can be kept anonymous, further ensuring the security and privacy of the voting process

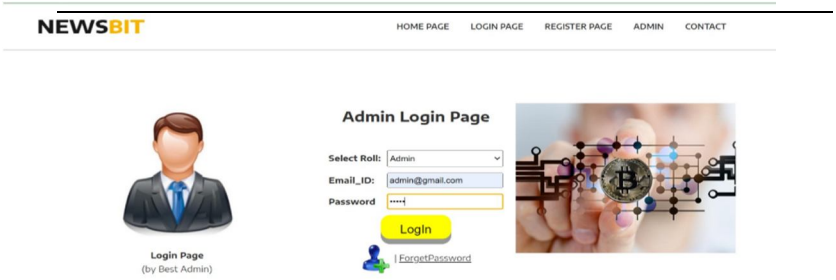
User Registration Page



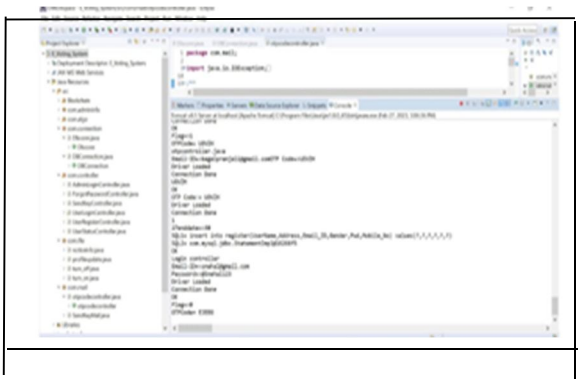
User Login Page



Admin Login



OTP Generation



Admin

Id:	Candidate Name	Voting Card_No	PanCard_No	AdharCard_No	Party Name	View
1	jay	WWA1520123	ABCS1456	1234567890	BJP	View
2	amit	ABC4567891	ABCS1456	1234567890	NCP	View
3	om	ABC4567891	ABCS1456	1234567890	Congress	View
5	Rajesh	ABC1234567	XYZA123	1234569871	MNS	View
6	Vijay	ABC4567891	ABCS1456	1234569871	AAP	View

In the admin module, we use the hash generation algorithm and the hash will be generated for the given string. Before executing any transaction, we use peer to peer verification to validate the data. If any chain is invalid then it will recover or update the current server blockchain. Mining algorithm is used for checking the hash generated for the query till the valid hash is generated.

View Profile & Voting Result

Candidate_Name	Candidate Party_Name	CountVoter
jay	BJP	1
amit	NCP	5
Rajesh	MNS	1
Vijay	AAP	1
Winner is:	**amit**	

Show Hash Values of Blockchain

ID	Candidate Name	Party Name	Block Data
6	Vijay	AAP	0000045fa9ce4d3cd4486ab588f88e05a2c67801e1ff4af01836c5bb36eb9b65

VI. CONCLUSION & FUTURE SCOPE

Conclusion From the design and implementation of the e-voting system based on the Blockchain can be drawn including: The e-voting system based on the Blockchain can work well. This e-voting system is able to validate the voter's identity well and prevent repeating the election. This e-voting system can store data safely and reliably. By using this electoral system, the voting process will be much faster and safer. The voting process and the calculation of the number of votes will be faster because the voting process is done in real-time. There are many research directions in applying Blockchain technology to the voting industry due to the complexity of this domain and the need for more robust and effective information technology systems. From the more technical aspect, much research is needed to pinpoint the most practical design process in creating an interoperable ecosystem using the Blockchain technology while balancing critical security and confidentiality concerns in healthcare. Whether to create a decentralized application leveraging an existing Blockchain, additional research on secure and efficient software practice for applying the Blockchain technology in voting is also needed to educate software engineers and domain experts on the potential and also limitations of this new technology. Likewise, validation and testing approaches to gauge the efficacy of Blockchain-based voting architectures compared to existing systems are also important (e.g., via performance metrics related to time and cost of computations or assessment metrics related to its feasibility).

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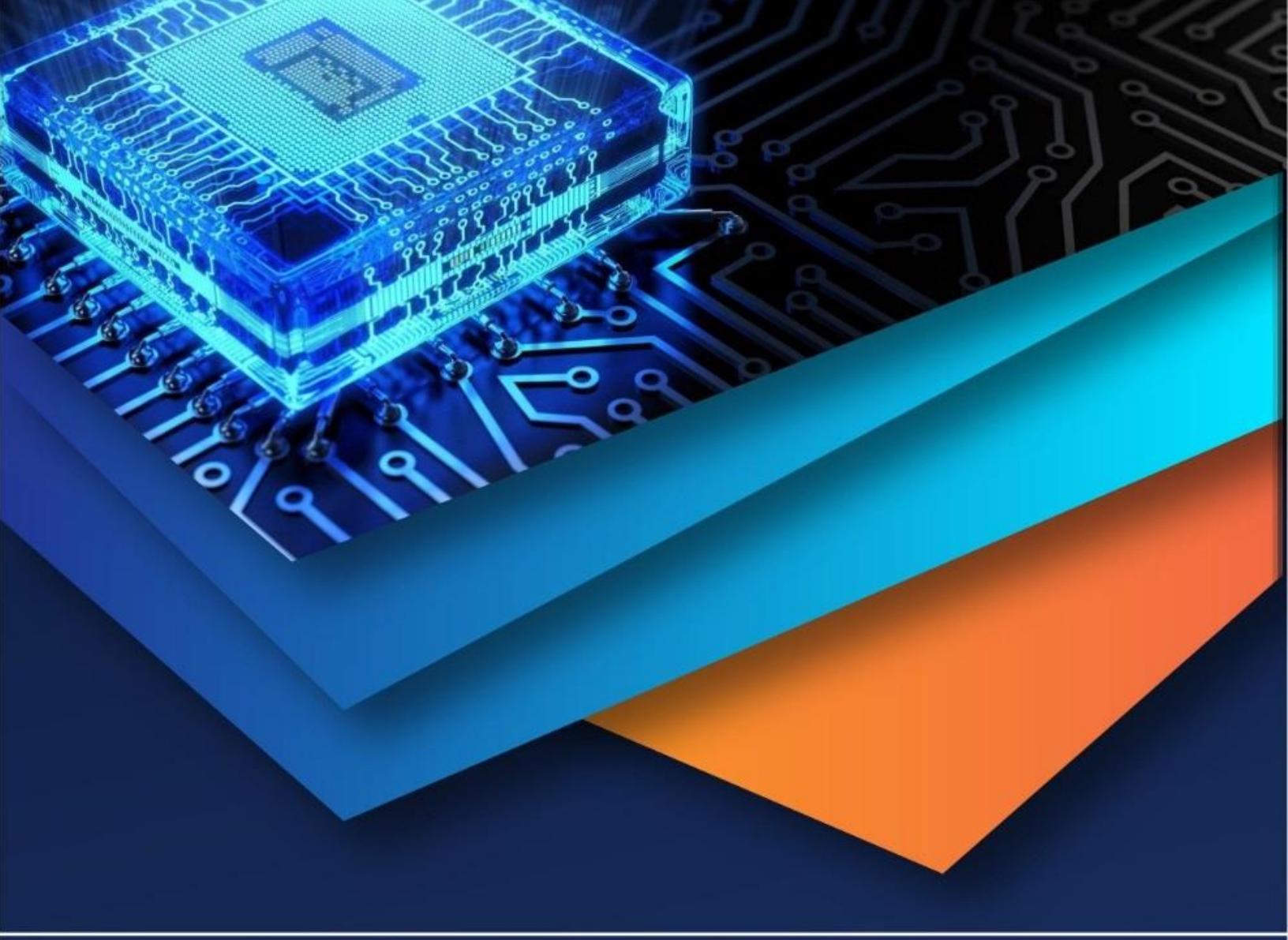

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