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Patient Health Record System using Blockchain Technology

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Abstract: ***The integration of blockchain technology into patient health records (PHRs) presents a transformative solution for healthcare systems worldwide. This abstract outlines the key benefits and objectives of utilizing blockchain in EHR systems. Blockchain ensures data securityand privacy through cryptographictechniques, offering patients greater control over their health information. It establishes a tamper-proof, auditable ledger, guaranteeing data integrityandimmutability. Moreover, smart contractsstreamlineadministrativeprocesses,reducingcosts and errors. Consent management tools allow patients to control data access, ensuring compliance with regulations like HIPAA and GDPR.***

Thisinnovationfostersinteroperabilityamonghealthcareproviders,facilitatingseamless data sharing and improving care coordination. It empowers healthcare researchandanalytics, securely sharing data while preserving privacy. Standardized data formats enhancecompatibilityamong different PHR systems.

Theblockchain'sscalabilityanddisasterrecoverycapabilitiesensuredataavailabilityandsystemresilience.Byreducingadministrativeoverheadandmedicalerrors,itcontributesto costreductionand improved resource allocation.

Integrating blockchaininto EHRsaddresses data security,interoperability,and patient control while reducing costsand enhancing healthcare quality— apromisingadvancementforthehealthcareindustry.

However,theimplementationofblockchain-basedsystemsmustconsiderregulatorycompliance,data privacy,and scalability challenge stoachieve widespread adoption andintegration within existing healthcare infrastructures.

I. LITERATUREREVIEW

A. Introduction

Thehealthcareindustryfacesnumerouschallenges, includingdatainteroperability, security, privacy, and efficiency. Blockchain technology, with its inherent properties of immutability, transparency, and decentralization, has emerged asa promising solution to addressthese issues.This literaturereviewaims to synthesize existing research on theapplication of blockchain technology in healthcare, focusing on its potential benefits, challenges, and future directions.

B. Core Concepts and Applications:

1) DataInteroperabilityandExchange:

- Traditionalhealthcaresystemsoftensufferfrom fragmenteddatasilos, hinderingseamless informationexchange.Blockchain-basedsolutions, asexploredbyYaga etal.(2019),offer a distributed ledger to facilitate secure and interoperable data sharing among healthcare providers, patients, and researchers.
- Research by Ekblaw et al. (2016) on MedRec demonstrates how blockchain can manage patient recordsandaccess permissions, enhancing data portability and patient control.
- Studies like those by Zhang et al. (2018) highlight the use of blockchain for building federated learning systems that improve data interoperability while preserving patient privacy.

2) Data Security and Privacy:

- Thesensitivenatureof healthcaredata necessitatesrobust securitymeasures. Blockchain's cryptographic techniques and distributed architecture enhance data integrity and prevent unauthorized access.
- Kshetri (2018) emphasizes the role of blockchain in securing medical data against cyberattacks and ensuring data provenance.
- Research byRoehrs etal.(2019)investigates theuseofblockchain forimplementing fine- grained access control policiesand protecting patient privacy.

- Blockchain'sability to create an immutableaudittrailisextremelyuseful fortracking data access and changes, adding another layer of security.

3) *Supply Chain Management:*
- Blockchaincanimprovethetraceabilityandtransparencyofpharmaceuticalsupplychains, combating counterfeit drugs and ensuring medication safety.
- ResearchbyBenchoufiandRida(2017)explorestheapplicationofblockchainfortracking and verifying drug provenance, reducing the risk of counterfeit medications.
- This traceability provided by blockchain can be applied to medical devices as well, ensuring proper tracking and maintenance.

4) *Clinical Trials and Research:*
- Blockchain can streamline clinical trial management by improving data integrity, patient recruitment, and consent management.
- StudiesbyKuoetal.(2017)suggestthatblockchaincanenhancethetransparencyand efficiency of clinical trials, leadingto faster and morereliableresearch outcomes.
- Smartcontractsbuiltuponblockchaintechnologycanautomatetheprocessofpaying participants, and verifying results.

5) *Patient Empowerment and Personalized Medicine:*
- Blockchain empowers patients to own and control their health data, facilitating personalizedmedicine and patient-centric care.
- ResearchbyDagheretal.(2018)discussesthepotentialofblockchainforenablingpatient- controlled health data management and personalized healthcare services.
- Thiscontrolcanleadtobetterpatientengagement,andbetterpatientoutcomes.

C. *Challenges and Limitations:*

1) *ScalabilityandPerformance:*
- Blockchainnetworksmayfacescalabilitychallengeswhenhandlinglargevolumesof healthcare data and transactions.
- Research by Casino et al. (2019) discusses the performance limitations of blockchain and explores potential solutions for improving scalability.

2) *RegulatoryandLegalIssues:*
- Theadoptionofblockchaininhealthcareraisescomplexregulatoryandlegalissues, including data privacy, liability, andinteroperability standards.
- Studies by Swan (2015) highlight the need for clear regulatory frameworks to govern the use of blockchain in healthcare.

3) *InteroperabilityandStandardization:*
- Achieving interoperability among different blockchainplatforms and existing healthcare systems remains a significant challenge.
- Thereisa needtocreateunifiedstandardsthatallblockchainbasedhealthcaresystems can follow.

4) *Implementation Costs and Complexity:*
- Implementingblockchainsolutionscanbeexpensive andcomplex, requiringsignificant investments in infrastructure and expertise.
- Thetransitionfromlegacysystemstoblockchainbasedsystemscanbe difficult.

5) *Data Governance:*
- Defining clear data governance models that address data ownership, access control, and data sharing is crucial for the successful adoption of blockchain in healthcare.

D. *Future Directions:*

1) *Integration with AI and IoT:*
- Combiningblockchainwithartificialintelligence(AI)andtheInternet ofThings(IoT)can enable advanced healthcare applications, such as predictive analytics and remote patient monitoring.

- Thisintegrationcanleadtomoreefficientandpersonalizedhealthcaresolutions.

2) *Development of Interoperability Standards:*
- Efforts are needed to develop standardized protocols and frameworks that facilitate interoperability among different blockchain platformsand healthcare systems.
- Developingthesestandardswillallowforwideradoption.

3) *FocusonPatient-CentricSolutions:*
- Future research should prioritize the development of patient-centric blockchain solutions that empower individualsto manage their health data and participate intheir care.
- Puttingthepatientincontroloftheirowndataisparamount.

4) *Exploration of Hybrid Blockchain Models:*
- Hybrid blockchain models, which combine the benefitsof publicand private blockchains, may offer a more suitable approach for healthcare applications.
- Thesemodelscanprovideabalancebetweensecurityandaccessibility.

5) *Increased Research into Security and Privacy:*
- Continuedresearchintoimprovingthesecurityandprivacyofblockchainbasedhealthcare systems is vital.

E. Conclusion

Blockchain technology holds significant potential to transform the healthcare industry by addressing critical challenges related to data interoperability, security, and efficiency. However, overcoming the existing limitations and addressing regulatory concerns are crucial for realizing its full potential. Future research should focuson developinginteroperable, scalable, andpatient-centricblockchain solutionsthat enhance healthcare delivery and improve patient outcomes.

II. INTRODUCTION

Blockchainis a decentralisedand public digital ledger that recordstransactions on many computers so that norecord involved can bealtered retroactively without altering any blocksafterwards.Blockchain is verifiedandlinkedt othepreceding‘block, ’forminga longchain.Afterall, Blockchainisthenameofthe record.Asany transaction isregistered and checked publicly,Blockchain providesa good deal of accountability.When entered, no one can modify all the information written in the Blockchain. It serves to demonstrate that the data isactual and unchanged. In Blockchain, data are maintained on networks instead of a central database, improving stabilityand showingits proneness to be hacked.Blockchain offersa fantastic forum todevelop and compete withtraditional companies for modernand creative business models [[1],[2],[3]].

Blockchainhelpsmarketerstomaintainanoverviewoftheproductsusedinmedicine.Healthand pharmaceuticalswill get rid of counterfeit medicationsusing Blockchaintechnologies, enabling tracingofallthesemedicines. Ithelpsdiscoverthecause offalsification. Blockchaincanguaranteethe confidentialityofpatientrecords;when medicalhistoryisdeveloped, Blockchaincanalsostoreit, and thisrecordcannotbemodified.Thisdecentralisednetworkisused withall commodityhardwareinthe hospital.Researchers allow computing estimates for therapies, medicines,and remedies of diverse illnesses and disorders using the resources saved by these devices [4,5].

Blockchainis a distributed ledger network thatadds and never deletes or modifiesrecords withouta common consensus.ABlockchain hash's value depends on a cryptographic hash that connectsnewly addedinformation block records with each data block.The distributed Blockchainledger architecture ensures that data is not processed inany centralised venue, making itaccessibleand accountabletoall networkusers.Thisdecentralised systemavoidsasingleattack ,strengtheningandsecuringthesystem. It facilitates better control of health recordsand patient care by minimisingtwicethe amount of medical practiceandmonitoring,savingbothpractitionersandpatientstimeandresources.Thepatient will watch where their information goesand achieve it by keeping health records on a blockchain [6,7].

Scholars can use thistechnology to analysea massive volume ofunveiledknowledgeabouta particular groupofindividuals.

It helpsfor theadvancement ofprecisionmedicinetobeprovidedappropriatelyfor longitudinal research. WeuseBlockchain for healthcare inreal-time withthe help oftheInternet of Things(IoT)and wearable'sdevicesto storeand update valuable patient data such asblood pressureand sugar level.It helps doctors track patients whoare vulnerable to highrisk and, ifan emergency occurs, adviseandalerttheircareersandfamilies.Blockchainhasadecentralisedstructurethatallowsitsafelyto hack and avoids compromisingany single copy of the records [8,9].This report addresses the following research questions:

- RQ1:TostudyBlockchaintechnologyanditssignificantneedsinhealthcare;
- RQ2:toidentifycapabilitiesofBlockchaintechnologytosupportthehealthcarecultureglobally;
- RQ3:toidentifyanddiscussenablersofBlockchaintechnologyforrevivinghealthcareservices;
- RQ4:toidentifythe‘UnifiedWork-FlowProcess'ofBlockchaintechnologyrealizationin providing healthcare amenities;
- RQ5:toidentifyanddiscusssignificantapplicationsofBlockchainforhealthcare.

A. Blockchain

Blockchainisadecentralisednodenetworkthatstoresthedata.Itisanexcellenttechnologyforprotectingconfidentialdatawithinthesystem.Thistechnologyhelpstoexchangecriticaldataandkeeps it secureand confidential. It isa perfect toolto hold all the related documents in onelocation and securely.Blockchainalsospeedsupsearchesforapplicantsthatfulfilspecifictrialcriteriausingasingle patient database.TheBlockchain can be describedas a decentralised peer-to-peer (P2P) network of personal computers called nodes, which maintains, stores,and records historical or transaction data [[10], [11], [12]]. It allows a reliable collaborationasthe informationis storedand exchanged byall network membersandkeeps a constanttrack of past and current experiences.This technology can integrate disparate networksto provide insights into the importance ofindividual treatment. Thus,Blockchain can well berecognised for immutability and safety.Blocks, nodes,and minersarethethree mainideasinBlockchain.Blockchaindoesnotsaveanyofitsdataina singlelocation.Instead,a network of computers copies and spreads the Blockchain. Every computer on the webupdatesitsBlockchainto reflectanewblocktotheBlockchain.

PatientHealthRecords(PHRs)playapivotalroleinmodernhealthcare,offeringadigitalrepositoryforpatientdata.However,concernsregardingdatasecurity,interoperability,andprivacypersist.Blockchaintechnologyemergesasatransformativesolution,introducingadecentralizedandtamper-resistantledger to revolutionize EHR systems.

Blockchain'sinherent characteristics address critical challenges in healthcare data management.

By distributingdataacrossanetworkofnodes,itensurestransparencyandpreventsunauthorizedalterations. This tamper-proof feature enhances data integrity, fostering trustamong stakeholdersin the healthcare ecosystem.

Thedecentralizednatureofblockchaincontributestoimprovedinteroperability.Traditionally,healthcare recordsare fragmented across various systems, hindering seamless data exchange. Blockchain's distributedledger enablesa unified, standardized formataccessible to authorized entities, facilitating efficient information sharing and enhancing care coordination.

Moreover, blockchain ensures patient privacythrough cryptographic techniques. Patientsretain control over their data, granting permission for specific individualsor entitiesto accessit.Thisgranular control alignswiththeprinciplesofpatient-centeredcareandcomplieswithstringentdataprotectionregulations.

Smart contracts, programmable scripts on the blockchain, automateand enforce predefinedrules, streamliningadministrativeprocesses.Thisnotonlyreducesoperationalcostsbutalsominimizeserrors and fraud, enhancing overall system efficiency.

Despiteitspromises,challengeslikescalabilityandregulatoryframeworksneedconsideration.However, ongoing research and industry collaborationsareaddressing these concerns, paving the way for widespread adoption.

Integrating blockchaininto electronic health records presents a paradigm shift in healthcare data management.The technology's decentralized, secure, and interoperable nature hasthe potential to revolutionizepatientcare,ensuringdataintegrity,privacy,andefficiency.Asthehealthcareindustry embracesdigitaltransformation,blockchainstandsasabeaconforamoresecureandinterconnected future.

III. OBJECTIVES

Using blockchain technology for patient health records (PHRs) can offer several advantages, including enhanced security, interoperability, and patient control over their data.

The objectives of implementing electronic health records using blockchain typically include:

1) *Data Security and Privacy:*
- Ensure the highest level of data security by using cryptographic techniques to protect patient health information from unauthorized access and breaches.
- Empower patients with greater control over their health data, allowing them to grant orrevoke access as needed.

2) *Interoperability:*
- Create a standardized and interoperable platform that allows forseamless data sharing among healthcare providers, reducing redundancy and improving care coordination.

3) *Data Integrity and Immutability:*
- Utilize blockchain's distributed ledger technology to create a tamper-proofand auditable record ofall EHR transactions, ensuring the integrity of patient data.

4) *ReducedAdministrativeOverhead:*
- Streamlineadministrativeprocesses, suchasinsuranceclaimsandbilling,byautomatingthemthrough smart contracts on the blockchain, reducing costs and errors.

5) *ConsentManagement:*
- Developarobustconsent management systemthatallowspatientstospecifywhocanaccesstheirdata and for what purposes, ensuring compliance with data protectionregulationslike GDPRandHIPAA.

6) *AuditabilityandCompliance:*
- FacilitateeasyauditingofEHRtransactionsforregulatorycompliance,research,andquality improvement purposes.

7) *ResearchandAnalytics:*
- Enablesecureandprivacy-preservingdatasharingformedicalresearchandanalytics,fostering innovation and improving healthcare outcomes.

8) *DataStandardization:*
- Establish standardized data formatsandterminologiesto ensure consistencyandcompatibilityamong different EHR systems and providers.

9) *Scalability:*
- Design the blockchain network to accommodate the growing volume of EHR data and transactions while maintaining performance and efficiency.

10) *DisasterRecoveryandRedundancy:*
- Implement distributed storage and redundancy to ensure data availability, even in the event of hardwarefailures or natural disasters.

11) *PatientEmpowerment:*
- EducatepatientsabouttheirrightsandresponsibilitiesregardingtheirEHRs,includinghowtomanage and control their data effectively.

12) *EducationandTraining:*
- Providetrainingandeducationfor healthcareprofessionalsandpatientstouseblockchain-basedEHR systems effectively and securely.

Implementing electronic health records using blockchain technology is a complex undertaking that requires careful planning, collaboration, and adherence to regulatory requirements.

The objectives align with improving patient care, data security,and healthcare system efficiency.

Blockchain is a distributed database with decentralised, traceable, non-tamperable, secure and reliable features. It integrates P2P (Peer-to-Peer) protocol, digital encryption technology, consensus mechanism, smart contract and other technologies together. Abandoning the maintenance mode of the traditional central node and adopting the method of mutual maintenance by multiple users to realise the information supervision among multiple parties, thereby ensuring the credibility and integrity of the data. The blockchain platform can be divided into public chain, private chain and alliance chain. All nodes in the public chain can join or withdraw freely;the private chain strictly limitsthe qualification ofparticipating nodes;thealliance chain isjointly managed by severalparticipatinginstitutions.Bitcoin wasproposedby Nakamoto in 2008, which is the most successful case of digital currency, and is also the most typical application ofblockchain. In addition, the blockchain has expanded itsunique application value in many aspects and has shown its potential to reshape society.

As a representative of distributed databases, blockchain stores all user transaction information on the blockchain, which has high requirements for the security performance of blockchain. Blockchain is a decentralised peer-to-peer network. Nodes do not need to trust each other and there is no central node. Therefore, transactions on the blockchain also need to ensure the security of transaction information on unsecured channels and to maintain the integrity of transactions. It can be seen that cryptography technology occupiesthe most central position in theblockchain. In blockchain, cryptography technology is mainly used to protect user privacy and transaction information, and ensure data consistency, etc.[2] This paper briefly introduces the cryptographic techniques such as hash algorithm, asymmetric encryption algorithm and digital signature, also elaborates the blockchain infrastructure, the blockchain structure, bitcoin address, digital currency trading and other technologies of blockchain, and also explains how cryptographytechnology protects privacy andtransaction maintenance in the blockchain in detail.

IV. BLOCKCHAIN INFRASTRUCTURE

According to Melanie Swan, founder of the Blockchain Science Institute, blockchain technology has experiencedtwophases,thefirstoneistheblockchain1.0 phaseofmulti-technologyportfolio innovation represented by Bitcoin, the second one is the blockchain 2.0 phase represented by Ethereum, which is transferred by digital assets. Typical applications of blockchain technology mainly include Bitcoin, Ethereum,HyperLedgers, etc.Althoughtheimplementationsaredifferent,therearemanycommonalities in the overall architecture.As shown inTable 1, the blockchain platform can be divided into five levels: network layer, consensuslayer, data layer, contract layer and applicationlayer.

Thedatalayermainlyusestheblockdatastructuretoensuretheintegrityofdatastorage.Eachnodein the network encapsulates the data transactions received over a period oftime intoa time-stamped data block and links the block to the current longest main blockchain for storage. This layer involves the main techniques of block storage, chain structure, hashalgorithm, Merkle tree,time stampand so on.

The consensus layer mainly includes a consensus mechanism, which enables each node to reach a consensus onthevalidityofblockdatainthedecentralizedsystem.TheconsensusmechanismmainlyhasPoW,PoS, PBFT and SBFT. The smart contract that is mainly included in the contract layer is the basis of the blockchainprogrammablefeature.Thecomputerizedprogramthat canautomaticallyexecutethecontract terms is stored in the blockchain in the form ofcode and data sets. Smart contracts, driven by time or events, are executed by blockchain nodes in a distributed manner. All relevant terms are coded, automatically settled, and triggeredby signatures or otherexternal datamessages. The network layerincludes various data transmission protocols and verification mechanisms. The blockchain is a typical P2P network. All nodes are connected through a planar topology and have no central nodes.Any two nodes can be freely traded,andany node can join or leave the network at any time.The P2Pprotocol in the blockchain is mainly usedforinformationtransmissionbetweennodes.TheapplicationlayermainlyincludesBitcoin,Ethereum and Hyperledger and so on. Bitcoin is mainly for digital currency transactions. Ethereum adds decentralized applicationsbasedondigitalcurrency.Hyperledgerdoesnotsupportdigitalcurrencytransactions,mainly enterprise-level blockchain applications.

V. HASHANDBLOCK STRUCTURE

Thehashalgorithmisa functionthat mapsa sequenceof messages ofanylengthtoa shorter fixed-length value, and is characterized by susceptibility, unidirectionality, collision resistance, and high sensitivity.

Hash is usually used to ensure data integrity, that is, to verify the data has been illegally tampered with. Whenthedatatestedchanges,itshashvaluealsochangescorrespondingly.
Therefore,evenifthedataisin anunsafeenvironment,the integrityofthe datacan be detected based on the hashvalue ofthe data.
SHAisatypeofcryptographichashfunctionissuedbytheNationalInstituteofStandardsandTechnology (NIST) with thegeneral characteristics of a cryptographic hash function.
The SHA256 algorithm is a class of the SHA-2 algorithm cluster, which generates a 256-bit message digest. The algorithm's calculation process includes two stages: message preprocessing and main loop. In the messagepreprocessingstage,binarybitfillingandmessagelengthfillingareperformedontheinformation of any length, and the filled message is divided into several 512-bit message blocks. In the main loop phase, eachmessageblockisprocessedbyacompressionfunction.Theinputofthecurrentcompressionfunction is the output ofthe previous compression function, and the output ofthe last compression function is the hash value of the original message.
RIEPEMD, a summary of the RACE original integrity check message, is a hash function algorithm developedby the COSI research team of the University in Leuven, Belgium. RIPEMD-160 is the most common version of RIPEMD[5].As the SHA series functions, the first step of the algorithm is message complement, and the complement method is identical to the SHA series algorithm. The core of the processing algorithm is the compression function, which is a loop, where each loop consists of 16 step functions. Using differentoriginal logic functionsin each loop,theprocessing ofthealgorithmisdivided intotwo different cases, withfive of the two original logicfunctions running in reverse order.After all 512- bit packet processing is completed, the resulting 160-bit outputis the hash value ofthe original message.
For blockchain, hash functions can be used to perform block and transaction integrity verification. In the blockchain, the hash value of the information of the previous block is stored in the header of each block, andanyusercan comparethecalculatedhashvalue withthe storedhashvalue.Inturn,theintegrityofthe informationofthepreviousblockisdetected. Similarly, thehashfunctioncanbeusedtogeneratepublic- private key pairs.
The hash pointer isa data structure that contains, inaddition totheusualpointers, some data information andpasswordhashesassociatedwiththeinformation.Anormalpointerisusedtoretrieveinformation,and a hash pointer is used to verify that the information has been tampered. The blockchain is a list of hash pointers, each of which is connected byusinga hash value. It is verified according to the hash value whether the data contained inthe block is changed, thereby ensuringtheintegrity of the block information.

A. *Types of blockchains*

1) Public blockchain:A blockchain that anyone in the world can read, can send transactions to and expect to see them included if they are valid.This means anyone can become part of the network and par-ticipate in the consensusprocess making them permissionless.There isno way to censor transactionsonthenetworknor changetransactionsretrospectively.Thecontentoftheblockchain can be trusted to be correct. Public blockchainsare, however, very inefficient. The more com- putingpower is required to support trust. So, an attacker would need to acquire 51% of the network's computing power to changean entryin the blockchain. (e.g., Bitcoin, Ethereum, ZCash).
2) Consortium blockchain: Itisa blockchain wherea pre-selected set ofnodescontrolthe consensus process.
3) Privateblockchain: A blockchainwhere access permissions aremore lightly controlled, where rights to modify or evenread the blockchain statearerestricted to a fewusers, where onlyknown nodes are allowed to partici- pate in the network. Ideally, it is internal for an organization. The writes permissionsarekept centralizedto oneorganization.Privateblockchainreduces counterpartyrisk by enabling the exchange of data without theintermediation of third parties.
4) PermissionedBlockchain: Itisa blockchainwhere wecanallowspe-cificactionstobeperformed only by specific addresses.The participants in the network can restrict who can participate in the consensus mecha- nism and who can create a smart contract and give the authority for some participants to provide the validation of blocks of transactions. A control access layer into the blockchain nodes is used. However, raise their ques- tions, Who has the authority to grant permission?Apermission blockchain may make its owners feel more secure, giving the database rigorous secu- rity and privacy capabilities but can be seen as violating the idea of blockchain becauseonlysomeparticipantshavemorecontrol, whichmeanstheycanmakechangeswhetheror not other network participants agree.

VI. DIGITAL CONTENT PROTECTION

Inordertopreservetheprivacyfortraceableencryptioninblockchain,Wuetal.proposedasystemin which authenticityand non-repudiation of digital contentis guaranteed.

The problem tackled by authors isthe secretkey ofthe user, which when shared with other entities doesnot hold the specific information of the user.In case the sharedkey is corrupted or abused, it makesit difficult toanalyze the source of the secret key. Moreover, leakage of confidentialinformation inaccess controlis a bottleneck for existing systems. Therefore, authors haveintegrated the privacy protectionalgorithm suchas attribute based encryption(ABE) to securethe secret keys. However, the decryption mechanism does not show improved efficiency.

Management ofdigital datarightsisa fundamental requirementtoachieveprotectionof digital data. Existingtechniquesfordatarightslacktransparency,decentralization,andtrust.Inresponsetoabove mentioned problems, Zhang and Zhao proposed blockchain-based decentralized solutions.

Information regarding the use of digital content, suchastransaction andlicense information is transparent to everyone. Smart contract is designed for the automaticassignment oflicense. In this mechanism,theownercansetthepricesfor sellingthelicensetoothercustomers.However,peersof the network haveto possess high computational power to perform keyacquisition.

Focusondigitalrightsmanagementusingblockchaintoavoidtheuseofsensitivedigitalcontentfor illegal purposes. For such concerns,a solution is proposed which is calledDRMchain(DIGITAL RIGHTSMANAGEMENT).This solution ensures the usage of digital contentin theright way by authenticatedusers.Two separateblockchainsaredesigned:oneistostoretheoriginal contentwith itsciphersummary,andtheotherstoresthesciphersummaryofprotecteddigitalcontent.DRMchain providesthetraceabilityrecord of a violationand highlevel trusted protection. From the proposed solution, protection of digital content, secureauthorization of users, anduse of multi signatures for usagecontrolisachieved.However,theuseofEthereumcoinscouldbeanewresearchdirection for protection of digital content.

Data sharing is a crucial step to gain maximum benefit from the strengths of research. A lot of data sharingmechanismsareproposedanddiscussedinliterature.Thereisnosufficientworkavailablethat focuses on the incentive mechanism to promote data sharing. To cover these limitations, authors conductedareviewonmedicalandhealthdata touncover theincentive mechanisms withthe pre-and post-resultsafterempiricalanalysis.Accordingtoasurvey,asingleincentiveistestedformedicaland health data to analyse the rate of data sharing. Therefore, it is concluded that more incentive based research needs to be performed to encourage data sharing.

VII. THE SIGNIFICANCE OF SECURITY FOR BLOCKCHAIN

Beforewediverightintounderstandingtheroleofcryptographyinblockchain,letusreflectbrieflyon the blockchain itself. It basically refers to a distributed database that offers the features of decentralization, security, traceability, reliability, and immutability. Blockchain takes away the need for traditional approaches for maintaining central nodes and introduces the new approach for mutual maintenance of nodes by multiple users.

As a result, it can entrust information supervision to multiple parties and ensure desired levels of credibility and data integrity. Another important aspect pertaining to blockchain refers to the three distincttypesofblockchainplatforms.Thetypesofblockchain platformsincludepublicchain,private chain,andalliance chain. Allthenodesina publicchaincould easily participateorwithdrawfromthe blockchain according to their preferences.

On the other hand, private blockchains impose specific conditions to determine the eligibility of the participating nodes.Thealliancechain operatesunderthejoint management ofdifferent participating organizations. Over the years, blockchain has been largely associated with the financial industry. However, it has showcased the promising potential for adding value to different sectors alongside reshaping the fundamental tenets of our society.

So, what is the relationship between blockchain and cryptography? The blockchain serves as a representative of distributed databases by storing all the transaction information of users on the blockchain. Therefore,itis reasonabletoidentify aprofoundly higherdemandforsecurityperformance in the blockchain.

Since blockchain operates with a decentralised, peer-to-peer network model, there is no single node, and nodesdon'thavetotrust oneanother. So, blockchain mustalso ensureappropriatesafeguards for transaction information on unsecured channels while maintaining transaction integrity. Therefore, cryptography becomes an essential requirement for blockchain to safeguard user transaction information and privacy alongside ensuring data consistency.

VIII. DISTRIBUTED LEDGER

Adistributedledgerisadirectoryordatabasethat'sstoredacrossvariouscomputers(akanodes).All nodes possessan exact copy oftheledger. When new information isadded, the nodes conduct an automatic vote to verify the authenticity of the update. Whenthe majority of nodesagree(aka gain consensus), the systemupdates itselfaccordingly (ie. Adoptingthenew informationinto allcopiesoftheledger,orrejectingit).Distributedledgersrun without a central authority, revolutionizing the way we think of democracy.

Thetechnologyisabletoreducethe"costoftrust"(akatheamountofmoneyyou needtopayforvarious services that authenticate transactions). Because transactionsaretransparent, the ledgersare distributed across several computersand encrypted to ensure protection,tampering with data is almostimpossible without detection.

Thismeansthatdistributedledgerscanoptimizevariousbusinesstaskswhilesavingyoumoneyyou'd otherwise spend on fees for your lawyers.

You're probably thinkingthat these sounds exactly the sameas blockchaintechnology. Not so. Rememberbiologyclass?That'swhereyou'veprobablyheardthephrase"Allbugsareinsects,butnot all insects are bugs." Same goes here.

Blockchainsanddistributedledgershaveavery similarrelationshipto eachother.Blockchainsareatype of distributedledger technology where data is structured into blocks. When new data isadded, new blocksare created, forminga chain of blocks(hencethe name). As with distributed ledgers in general, cryptography provides security for the system.

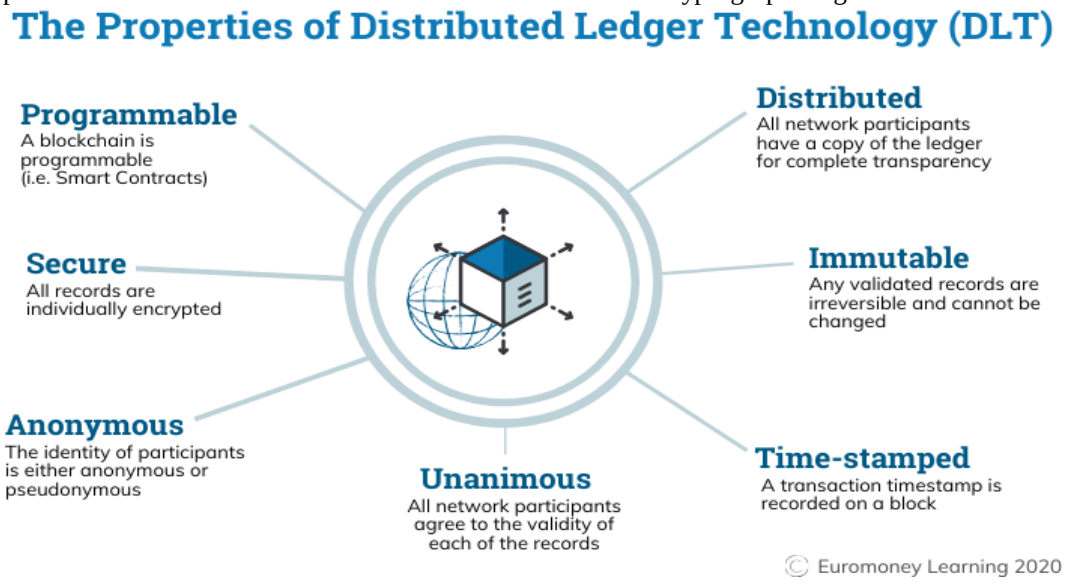
Thisistheonlysignificantdifferencebetweenthetwophenomena.Becauseofthespecificstructuringof data, blockchains are sometimes considered moreadvancedand more expensive, hence their use in financial transactions.

Thereasonthesetermsareusedsynonymouslyisbecauseblockchainsarethemostwidelyusediteration ofthelarger, umbrella technologyknownas the distributed ledger. For our purposes, we'regoingtouse themorewidelyknowntermtoavoidconfusion,andbecausewewill mostlybereferringtothefinancial use-cases of these technologies. In this space, blockchain reigns.

Blockchainisasystemofrecordinginformationinawaythatmakesitdifficultorimpossibletochange, hack, or cheat the system.

Ablockchainisessentiallyadigitalledger oftransactionsthat isduplicatedanddistributedacrossthe entire network of computer systems on the blockchain. Each block inthe chain containsa number of transactions,andeverytimea newtransactionoccursontheblockchain,arecordofthattransactionis addedto every participant's ledger. The decentralised database managed by multiple participantsis known as Distributed Ledger Technology (DLT).

BlockchainisatypeofDLTinwhichtransactionsarerecordedwithanimmutablecryptographicsignature called a hash.



Thismeansifoneblockinonechainwaschanged,itwouldbeimmediatelyapparentithadbeentampered with. If hackers wanted to corrupt a blockchain system, they would have to change every block in the chain, across all of the distributed versions of the chain.

A. Aglobal Public Network

Blockchaintechnologyisshowingthatwecanconnectfinancialinfrastructuresothatnomatterwhereyou arein the world, systems and forms of value can interoperate with each other.

Stellar, a global, public blockchain that is built for interoperability and to further financial access and inclusion, has a network of more than 20 anchors around the world who are integral parts of connecting global financial systems.Theseanchorsare regulated financial institutions, money service businesses, or fintech companies that issue 1:1 backed fiat tokens (also known as stablecoins) and/or provide a fiat on/off- ramp. The goal is to open markets to new remittance and payments corridors, like between Europe and Nigeria, Africa's largest Sub-Saharan remittance market.

Forexample,CowrieIntegratedSystems,afinancialtechnologycompanywithheadquartersintheUnited KingdomandofficesinNigeria, providesvalue-added services over electronicpayment networks. Given recentguidanceoutoftheCentralBankofNigeria,Cowriedesignedapaymentchanneltoleverage USDC, one of the world's leading digital dollar stablecoins, as a bridge currency to help businesses reduce the friction of sending payments to and from Europe.

Working withTempo, an electronic payment institution based in France and the issuer of EURT, a euro stablecoin also pegged 1:1 to fiat reserves, they are developing a bi-directional channel for customersto redeemandtradethese tokensrightaway.Thisresultedin savings interms of costsand timeand showed thepowerofconnectingglobalfinancialsystemssotheyareeasilyinteroperable,efficient,affordable,and most importantly, accessible.

Openness,innovationandinteroperabilityOncewerecognizethattheblockchainfuturewe've allbeendreamingaboutisactuallyhere,right now,we have to ask ourselves whether we are creating long-term solutions

Opennetworksallowinnovationfromthemanyratherthanthefew.Opennetworksensurethatanyonecan build upon, improve and challenge the technology and push the market to consider the next idea. Open networks promise interoperability and allow for continual ideation and progression. If we were to start building this technology in a silo, on closed networks that can't work together, we would risk putting ourselvesrightbackwherewestarted.Byworkingtogetherintheopentoconnecttraditionalfinancialrails with digital ones, we can reap the benefitsand work through shared challenges.

IX. MAKING BLOCK CHAINMAIN STREAM

Confidenceinthistechnology,especiallyfordigitalcurrencies,isgrowingacrosstheboard.Governments are accelerating theirworkon Central Bank Digital Currencies. Businesses are building and investing, with thevast majorityofglobalexecutivessurveyedby Deloittelastyearsayingtheybelievedigitalassetswill be important to their industries within the next three years.

But the benefits of innovation, especially in the financial sector, cannot be gained at the expense of additional risk to consumers. Central banksand regulators, entrusted with the duty to protect consumers, draft and enforce regulations guided by that lofty responsibility. But, as the Tempo-Cowrie example demonstrates, deployed correctly, blockchain technology can be leveraged to benefit consumers without sacrificing oversight, accountability or regulation.

This is why it is all the more important for us to demonstrate to stakeholders what a difference this technologycanmakefor consumers,citizensandbusinesses,boostinglocalandnational economies -and howthetechnologycanbesubjecttoregulatoryoversight.Thisiswhyitiscriticalfortheprivatesectorto engagewithgovernmentstoensurethatnewregulationsbalancetheneedfornewandimprovedfinancial rails with the need to guard against innovations that empower illicit actors. The desire to get this right is shared byall stakeholders andit's by workingtogether that we willachievethat balance.

Blockchain is real and actionable today, ready to tackle not only cross-border payments but many of the mostmeaningful,impactfulfinancialusecasesforcitizens,consumers,governmentsandbusinesses.Now, with a concerted public-private partnership, we can take it mainstream.

Cryptocurrencies:TheBeginningofBlockchain'sTechnologicalRiseBlockchain's most well-known use (and maybe most controversial) is in cryptocurrencies. Cryptocurrenciesaredigitalcurrencies(ortokens),likeBitcoin, EthereumorLitecoin,that canbeusedto buy goods and services. Just like a digital form of cash, crypto can be used to buy everything from your lunch to your next home. Unlike cash, crypto uses blockchain to act as both a public ledger and an enhanced cryptographic security system, so onlinetransactions are always recorded and secured.

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HOW DOES CRYPTO CURRENCY WORK?

Cryptocurrencies are digital currencies that use blockchain technology to record and secure every transaction.

A cryptocurrency (for example, Bitcoin) can be used as a digital form of cash to pay for everything from everyday items to larger purchases like cars and homes. It can be bought using one of several digital wallets or trading platforms, then digitally transferred upon purchase of an item, with the blockchainrecordingthetransactionand thenewowner. Theappealofcryptocurrenciesisthateverything is recorded in a public ledger and secured using cryptography, making an irrefutable, timestamped and secure record of every payment.

To date, there are roughly 6,700 cryptocurrenciesin the world that have a total market cap around $1.6 trillion, with Bitcoin holding a majority of the value.These tokens have become incredibly popular over thelast fewyears,withone Bitcoinequaling$60,000.Hereare someofthe mainreasonswhyeveryoneis suddenly taking notice of cryptocurrencies:

1) Blockchain's security makestheft much harder since each cryptocurrency has its own irrefutable identifiable number that is attached to one owner.
2) Cryptoreduces the need for individualized currenciesand central banks-With blockchain, crypto can be sent to anywhere and anyone in the world without the need for currency exchanging or without interference from central banks.
3) Cryptocurrenciescanmakesomepeoplerich-Speculatorshavebeendrivingupthepriceofcrypto, especially Bitcoin, helping some early adopters to become billionaires. Whether this isactually a positive has yet to be seen, as some retractors believe that speculators do not have the long-term benefits of crypto in mind.
4) More and more large corporations are coming around to the idea of a blockchain-based digital currency for payments. In February 2021,Tesla famously announcedthat it would invest $1.5 billion into Bitcoin and accept it as payment for their cars.

Of course, thereare many legitimateargumentsagainst blockchain-based digital currencies. First, crypto isn't a veryregulated market. Many governmentswere quick tojump into crypto, but fewhavea staunch set of codified laws regarding it.Additionally, crypto is incredibly volatile due to those aforementioned speculators. In2016,Bitcoin was priced around$450 per token. It then jumped toabout $16,000 a token in 2018, dipped to around $3,100, then has since increased to more than $60,000. Lack of stability has caused some people to get very rich, while a majority have still lost thousands.

Whether or not digital currencies are the future remains to be seen. For now, it seems as if blockchain's meteoric rise is more starting to take root in reality than pure hype. Though it's still making headway in this entirely-new, highly-exploratory field, blockchainisalso showing promise beyond Bitcoin.

BLOCKCHAINREVOLUTION

A. Beyond Bitcoin: Ethereum Blockchain

Originally created as the ultra-transparent ledger system for Bitcoin to operate on, blockchain has long been associatedwithcryptocurrency,butthetechnology'stransparencyandsecurityhasseengrowingadoption ina number ofareas, much ofwhich can be traced back to the development ofthe Ethereum blockchain.

Inlate2013, Russian-CanadiandeveloperVitalikButerinpublishedawhitepaperthatproposedaplatform combiningtraditional blockchain functionality with one key difference: the execution of computer code. Thus, the Ethereum Projectwas born.

Ethereum blockchain lets developerscreatesophisticated programs thatcan communicate with one another on the blockchain.

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Tokens Ethereum programmers can create tokens to represent any kind of digital asset, track its ownership and execute its functionality according to a set of programming instructions.

Tokens can be music files, contracts, concert tickets or even a patient's medical records. Most recently, Non-FungibleTokens (NFTs)have become all the rage. NFTs are unique blockchain-based tokens that store digital media (like a video, music orart). EachNFT hasthe abilityto verify authenticity, past historyand soleownership ofthepieceofdigital media. NFTshavebecome wildly popularbecausethey offera new waveofdigitalcreatorsthe abilitytobuyandsell theircreations, whilegetting proper creditandafairshare of profits.

Newfound uses for blockchain have broadened the potential of the ledger technology to permeate other sectors like media, government and identity security. Thousands of companies are currently researching and developing productsand ecosystems that run entirely on the burgeoning technology.

Blockchain is challenging the current status quo of innovation by letting companies experiment with groundbreaking technology like peer-to-peer energy distribution or decentralized forms for news media. Much like the definition of blockchain, the uses for the ledger system will only evolve as technology evolves.

HowDoesBlockchainWork?

Thenameblockchainishardlyaccidental:Thedigitalledgerisoftendescribedasa “chain”that’smadeup ofindividual“blocks”ofdata. As freshdata isperiodicallyaddedtothenetwork,a new“block” iscreated and attached to the “chain.” This involves all nodesupdating their version of the blockchain ledger to be identical.

How these new blocksare created is key to why blockchain is consideredhighly secure.Amajority of nodes mustverifyand confirmthelegitimacyofthenewdata beforea newblock canbeaddedtotheledger.For acryptocurrency, theymightinvolveensuring thatnewtransactionsinablockwerenotfraudulent,orthatcoinshadnotbeenspentmorethanonce.Thisisdifferentfromastandalonedata baseorspreadsheet,where one person can make changes without oversight.

“Once there is consensus, the block is added to the chain and the underlying transactions are recorded in the distributedledger,” says C. Neil Gray, partner inthe fintech practiceareas at Duane Morris LLP. “Blocks aresecurelylinkedtogether, formingasecuredigitalchainfromthebeginningoftheledgertothepresent.”

Transactions are typically secured using cryptography, meaning the nodes need to solve complex mathematical equations to process a transaction.

“As a reward for their efforts in validating changes to the shared data, nodes are typically rewarded with new amounts of the blockchain’s native currency—e.g., new bitcoin on the bitcoin blockchain,” says Sarah Shtylman, fintech and blockchain counsel with Perkins Coie.

B. Public Blockchains vs PrivateBlockchains

Therearebothpublicandprivateblockchains. Inapublicblockchain, anyone can participate meaning they canread, writeorauditthedata on theblockchain. Notably,itisvery difficulttoalter transactionslogged in a public blockchain as no single authority controls the nodes.

A private blockchain, meanwhile, is controlled by an organisation or group. Only it can decide who is invitedtothe system plusit hastheauthorityto go back andalter the blockchain.This private blockchain processis more similar to an in-house data storage system except spread over multiple nodes to increase security.

HowIsBlockchain Used?

Blockchaintechnologyisusedformanydifferentpurposes,fromprovidingfinancialservicesto administering voting systems.

C. Crypto currency

The most common use of blockchain today isas the backbone of cryptocurrencies, like Bitcoin or Ethereum. When peoplebuy, exchange or spend cryptocurrency, thetransactionsarerecorded on a blockchain.The more peopleuse cryptocurrency, the more widespread blockchain couldbecome.

“Becausecryptocurrenciesarevolatile,theyarenotyetusedmuchtopurchasegoodsandservices.Butthat is changing as PayPal, Square and other money service businesses make digital asset services broadly availabletovendorsandretailcustomers, ”notesPatrickDaugherty,seniorpartnerofFoley&Lardnerand lead of the firm’s blockchain task force.

1) Banking

Beyond cryptocurrency, blockchain isbeingused to processtransactionsin fiat currency, like dollarsand euros. This could be faster than sending money through a bank or other financial institution as the transactions can be verified more quicklyand processed outside of normal business hours.

2) Asset Transfers

Blockchaincanalsobeusedtorecordandtransfertheownership of differentassets.Thisiscurrentlyvery popular with digitalassets like NFTs,a representation of ownership of digitalartand videos.

However, blockchain could also be used to process the ownership of real-life assets, like the deed to real estate and vehicles. The two sides of a party would first use the blockchain to verify that one owns the propertyand the other has the money to buy; thentheycould complete andrecord thesale on the blockchain.

Usingthisprocess,theycouldtransferthepropertydeedwithoutmanuallysubmittingpaperworktoupdate thelocal county's government records; it would be instantaneouslyupdated in the blockchain.

3) SmartContracts

Another blockchain innovation are self-executing contracts commonly called "smart contracts." These digital contracts are enacted automatically once conditions are met. For instance, a payment for a good might bereleased instantly once the buyerand seller have met all specified parameters for a deal.

"Weseegreatpotentialintheareaofsmartcontracts—usingblockchaintechnologyandcodedinstructions toautomatelegalcontracts,"saysGray."Aproperlycodedsmartlegalcontractonadistributedledger can minimize, or preferably eliminate, the need for outside third partiesto verify performance."

4) SupplyChainMonitoring

Supply chainsinvolve massiveamountsofinformation, especiallyasgoodsgo fromonepartofthe world totheother. Withtraditionaldatastoragemethods,itcanbehardtotracethesourceofproblems,likewhich vendor poor-quality goods came from. Storingthisinformation on blockchain would makeit easier to go backandmonitorthesupply chain, suchas withIBM'sFoodTrust, which uses blockchaintechnologyto track food from its harvest to its consumption.

5) Voting

Expertsarelookinginto waystoapply blockchaintopreventfraudin voting.In theory,blockchainvoting would allow people to submit votes that couldn't be tampered with as well as would remove the need to have people manually collect and verify paper ballots.

Advantages of Blockchain Higher Accuracy of Transactions

Becauseablockchaintransactionmustbeverifiedbymultiplenodes,thiscanreduceerror.Ifonenodehas amistakeinthedatabase,theotherswouldseeit'sdifferentandcatchtheerror.

In contrast,ina traditional database,ifsomeone makesa mistake, it may be morelikelytogothrough.In addition, everyassetis individuallyidentifiedand tracked on the blockchainledger, so there is no chance of double spending it (likea person overdrawingtheir bank account,thereby spending moneytwice).

No Need for Intermediaries

Using blockchain, two parties in a transaction can confirm and complete something without working througha third party.This savestimeas wellas the cost ofpaying for an intermediary like a bank.

"Ithastheabilitytobringgreaterefficiencytoalldigitalcommerce,toincreasefinancialempowermentto the unbanked or underbanked populations of the world and to power a new generation of internet applications as a result," says Shtylman.

Extra Security

Theoretically, a decentralised network, like blockchain, makes it nearlyimpossible for someone to make fraudulent transactions. To enter in forged transactions, they would need to hack every node and change everyledger.Whilethisisn't necessarilyimpossible,manycryptocurrencyblockchain systemsuseproof-of-stake or proof-of-work transaction verification methods that make it difficult, as well as not in participants' best interests, to add fraudulent transactions.

More Efficient Transfers

Since blockchains operate 24/7, people can make more efficient financial and asset transfers, especially internationally. They don't need to wait days for a bank or a government agency to manually confirm everything.

X. DISADVANTAGES OF BLOCKCHAIN

A. LimitonTransactionsperSecond

Given that blockchaindependsonalargernetwork toapprovetransactions, there'salimit to howquickly it can move. For example, Bitcoin can only process 4.6 transactions per second versus 1,700 per second with Visa. In addition, increasing numbers of transactions can create network speed issues. Until this improves, scalability is a challenge.

B. HighEnergyCosts

Having all the nodes working to verify transactions takes significantly more electricity than a single database or spreadsheet. Not only does this make blockchain-based transactions more expensive, but it also creates a large carbon burden on the environment.

Because ofthis, some industryleadersarebeginningtomoveaway fromcertain blockchaintechnologies, likeBitcoin: For instance, Elon Muskrecently saidTesla would stopacceptingBitcoinpartly because he was concerned about the damage to the environment.

C. RiskofAssetLoss

Somedigitalassetsaresecuredusingacryptographickey,likecryptocurrencyinablockchainwallet.You need to carefully guard this key.

"If the owner of a digital asset loses the private cryptographic key that gives them access to their asset, currently thereis no way to recover it—theasset is gonepermanently," saysGray. Becausethesystemis decentralized, you can't call a central authority, like your bank, toask toregainaccess.

D. PotentialforIllegalActivity

Blockchain's decentralization adds more privacy and confidentiality, which unfortunately makes it appealingtocriminals.It'shardertotrackillicittransactionsonblockchainthanthroughbanktransactions that are tied to a name.

HowtoInvestinBlockchain

You can't actually invest in blockchain itself, since it's merely a system for storing and processing transactions. However, you caninvest inassets and companies using thistechnology.

"The easiest way is to purchase cryptocurrencies, like Bitcoin, Ethereum and other tokens that run on a blockchain," says Gray.

Another optionistoinvestinblockchaincompaniesusingthistechnology. For example, Santander Bank isexperimentingwithblockchain-basedfinancialproducts,andifyouwereinterestedingainingexposure to blockchain technologyin your portfolio, you might buyits stock.

For a more diversified approach, you could buy into an exchange-traded fund (ETF) that invests in blockchain assets and companies, like the Amplify Transformational Data Sharing ETF (BLOK), which puts at least 80% of its assets in blockchain companies.

E. The Bottom Line

Despite its promise, blockchain remains something of a niche technology. Gray sees the potential for blockchain being used in more situations but it depends on future government policies. "It remainsto be seen whenandifregulatorslikeSEC willtakeaction.Onethingisevident—thegoalwillbetoprotect markets and investors," he says.

Shtylmanlikensblockchaintotheearlystagesoftheinternet. "Ittookabout15yearsofhavingtheinternet beforewesawthefirstversionofGoogleand over20 forFacebook.It'shardto predict whereblockchain technology will beinanother10 or15 years, but muchliketheinternet,it will significantly transformthe ways wetransact and interact with each other in the future."

Hurdles remain, especially with the transaction limits and energy costs, but for investors who see the potential ofthetechnology, blockchain-basedinvestments may bea bet worthtaking.

enhanceoursocialandeconomicsystems.

AblockchainisbuiltbyrunningsoftwareandlinkingseveralTheBlockchainandtheFutureofTransactionsBlockchaintechnologyistransformative,andisexpectedtohaveamassiveeconomicimpactsimilartothe one the Internet has had in the past few decades.

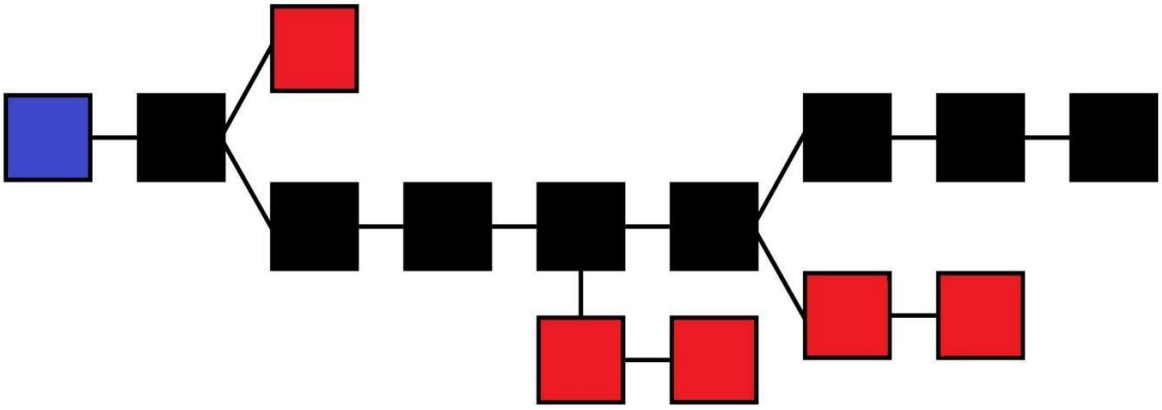
Since blockchaintechnology isatthe heart of Bitcoinand other virtual currencies,it can at the veryleast be expected to power even more consequential mediums of exchange in the future. However, virtual currencies are merely the first use case of blockchain technology.

F. Blockchain Fundamentals

The blockchain is an open and distributed ledger. It uses an append-only data structure, meaning new transactions and data can be added on to a blockchain, but past data cannot be erased. This results in a verifiable and permanent recordof dataand transactionsbetween twoor more parties. Thishas thepotential toincreasetransparency andaccountability, andpositively nodestogether.Ablockchainisnot one global entity— thereare several blockchains.Imaginea network ofconnected computersinsideahighly secure office,whichareconnectedtoeachother,butnottotheinternet.Ablockchainissimilartothis:itcanhave numerous connected nodes, but remain totally separate and unique from other blockchains. Institutions and banks can build internal blockchains with their own features for various organisational purposes.

Aconsensus mechanismanda reward systemarerequired to maintainthe integrityand functionality of a blockchain.IntheBitcoinblockchain,consensusisachievedby‘mining’,andtherewardsystemisa protocol awarding aminersome amountof Bitcoin upon successfully mining a block.Mining is undertaken by powerful computers solving complex mathematical puzzles.

Once a transaction verified, and accepted as true by the entire network, miners start working on the next block. Thus, a blockchainkeeps growing (linking each new block to the one before it).



Themainchain(black)consistsofthelongestseriesofblocksfromthegenesisblock(blue)tothecurrent block. Orphan blocks (red) exist outside of the main chain.

ImplicationsforTransactions

Blockchain technology will disrupt the way we write and enforce contracts, execute transactions and maintain records.

Keepingrecords of transactionsis a core functionof all businesses.Theserecordsare meantto track past performanceand help with forecastingand planning for the future. Most organizations’recordstakealot of time and effort to create, and often the creation and storage processes are prone to errors. Currently, transactionscanbeexecutedimmediately,but settlement cantakeanywherefromseveral hourstoseveral days. For example, someoneselling stockina corporationona stock exchange can sell immediately, but settlement can takea fewdays. Similarly, a deal to purchasea house or car can be negotiated and signed quickly, but the registration process (verifying and registering the change in property ownership) often takes days andmayinvolve lawyers andgovernmentemployees. Ineachof these examples,eachpartymaintains its own ledger, and cannot accessthe ledgers ofthe other partiesinvolved.

Ontheblockchain,theprocessoftransactionverificationandrecordingisimmediateandpermanent.The ledger is distributedacross several nodes, meaningthe data isreplicatedand storedinstantaneously on each nodeacrossthe system. When a transaction isrecordedinthe blockchain, details ofthetransaction suchas price, asset,and ownership,arerecorded, verifiedand settled within secondsacrossall nodes.A verified change registered onany oneledger isalso simultaneouslyregistered on all other copies of the ledger. Since eachtransaction istransparentlyand permanently recorded acrossall ledgers, open for anyone to see, there is no need for third-party verification.

From Virtual Currenciesto Enterprise Use

TheblockchainunderlyingBitcoiniscurrentlythelargestandbestknownblockchain.

Ethereum is a separate blockchain: while it supports the Ether currency, it also acts as a distributed computingplatformthatfeaturessmartcontractfunctionality.Therefore,despitehaving avirtualcurrency element, it has many more usesthan Bitcoin. For example, companiesin various industriesraising funds through ICOs use Ethereum for their projects.

TheHyperledgerProject,bytheLinuxFoundation,aimstobringtogetheranumberofindependentefforts to develop open protocols and standardsin blockchaintechnology for enterpriseuse.

Hyperledgerisaprojectwithseveralopensourceblockchainsandrelatedtoolstosupportthecollaborative development of blockchain — based distributed ledgers.

XI. BENEFITS OF BLOCKCHAIN

Theblockchainisnothingshortofagame-changingtechnologyforanyonewhochoosestouseandmaster it. Let's discuss the benefits of blockchain-

1) Transparency – Blockchain makes transaction histories more transparent than they ever were. Because it is a type of a distributed ledger, all nodes in the network share a copy of the documentation.The data on a blockchain ledger is easily accessible for everyone to view. If a transaction history changes, everyone in the network can see the change and the updated record. Therefore, all information about currency exchange isavailable to everyone.
2) Security–Blockchainisbetterthananyotherrecord-keepingsystemwhenitcomestosecurity,by allstandards.Thesharedocumentationoftransactionscanonlybeupdatedand/or modified with consensus on a blockchain network. Only if everyone or a majority of nodes agree to update a record, the information is edited. Moreover, when a transaction is approved, it is encrypted and connectedwiththeprevioustransaction.Therefore,noonepersonorpartyhasthepotentialtoalter a record. Blockchain is decentralized, and so, no one reserves the right to update records by their free will. Any industry that has a critical need to protect sensitive data such as governments, healthcare, financial services, etc., canuse blockchainto enforce stringent security.
3) Efficiency – With traditional, paperwork processes, completing a transaction is exhausting as it needsthird-partymediationandispronetohumanerrors.Blockchaincanstreamlineanddiscipline these legacy methods and remove the risk of mistakes, making trading more efficient and faster. Sincethereisonly one ledger, partiesdon't haveto maintain multiple documents,a factthatleads to much less clutter.And, when everyone hasaccessto the sameinformation, establishing trust is easier.Withoutany need forintermediaries, settlementscan be made smooth and effortless,too.
4) Traceability–Incomplex supplychains,itishardtotraceproductsback totheirorigins.But, with blockchain, the exchanges of goods are recorded, so you get an audit trail to learn where a particular asset came from.You also get to know every stop the product made on itsjourney & thislevel of traceability of products can help verify the authenticity and prevent frauds.
5) Auditability – Another aspect of the point mentioned above isauditability.As each transaction is recordedforitscompletelifetimeinblockchain,thereisanaudittrailthatalreadyexists foryouto see and check the authenticity of your asset.
6) Cost reduction – As blockchain eliminates the need for third-parties and middlemen, it saves enormouscostsforbusinesses.Giventhatyoucantrustthetradingpartner, youdon't needanyone elsetoestablishtherulesandpoliciesofexchange.Thecostandeffortspentondocumentationand its revisionsare also saved as everyone gets to view a single immutable version oftheledger.

Forlongterm

Blockchaintechnologyisstillinanearly,formativestage,andcryptocurrenciesareonlyitsfirstmajoruse case.

Beyondcryptocurrency,blockchaintechnologywillchangehowwetransact,andhowwerecordand verify transactions. This will revolutionize contracts and reduce friction in the exchange of assets. Over the next few decades, blockchain technology will percolate through our organizations and institutions, and shapehowwetransactwithoneanother.

JustastheInternetcontinuestopoweremergenttechnologies,we can expect to see new use cases of blockchain technology acrossall industries.

Advantages of Blockchain Technology

Therearemanyadvantagestousingblockchaintechnologycomparedtoothertraditionaltechnologies.

- With blockchain, your business process will be better protected with the help of a high level of security

- Thehackingthreatsagainstyourbusinesswillalsobereducedtoagreaterextent.
- As blockchain offers a decentralised platform, there is no need to pay for centralised entities or intermediaries'services.
- Enterpriseblockchaintechnologyenablesorganisationstousedifferentlevelsofaccessibility.
- Organisationscandofastertransactionswiththehelpofblockchain**.**
- Accountreconciliationcanbeautomated.
- Thetransactionsdonearetransparentandhence,easytotrack. Benefits of Blockchain In Energy Sector

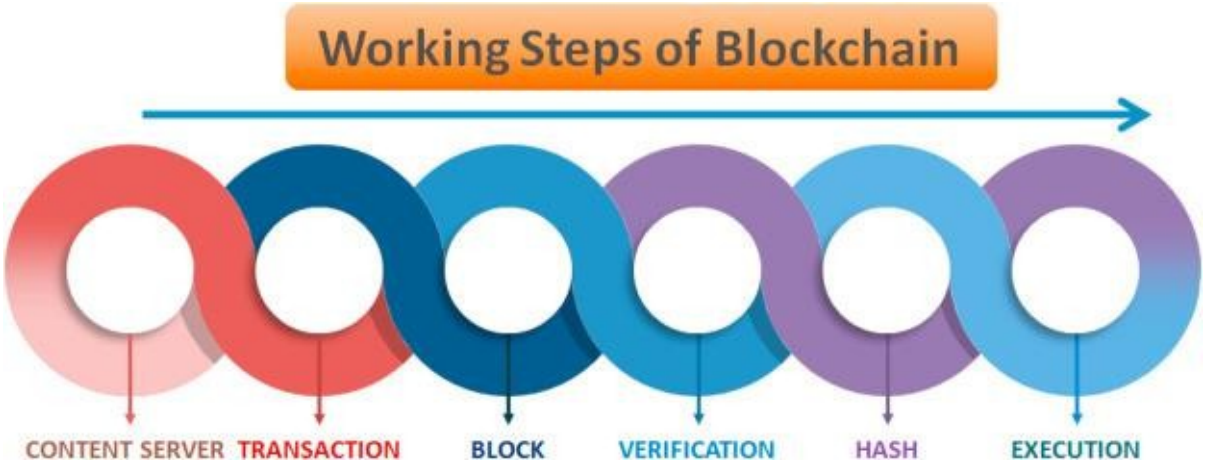
Energydistribution,allocation,andproductionhavealwaysbeenanimportant sector forgovernmentsout there. Withoutproperenergymanagement, itbecomes hardforanygovernment toprovidevaluablegrowth toits economy.Private playersalsoplaya crucialroleand canbenefit fromtheblockchain.Belowarethe benefitsthat the energy sector receives with the use of blockchain.

- Environmental Sustainability: Blockchain helps make the energy sector more environmentally sustainable.Ithelpsovercomelegacyenergysectorefficiencyissuesandprovidesanetworkwhere it is possibleto produce, store, and distribute energy more efficiently.
- Reduced Costs: The costs associated are reduced when it comes to infrastructure and operational aspects of the energy sector.
- ImprovedTransparency:Theuseofadistributedledgersimprovestransparency.

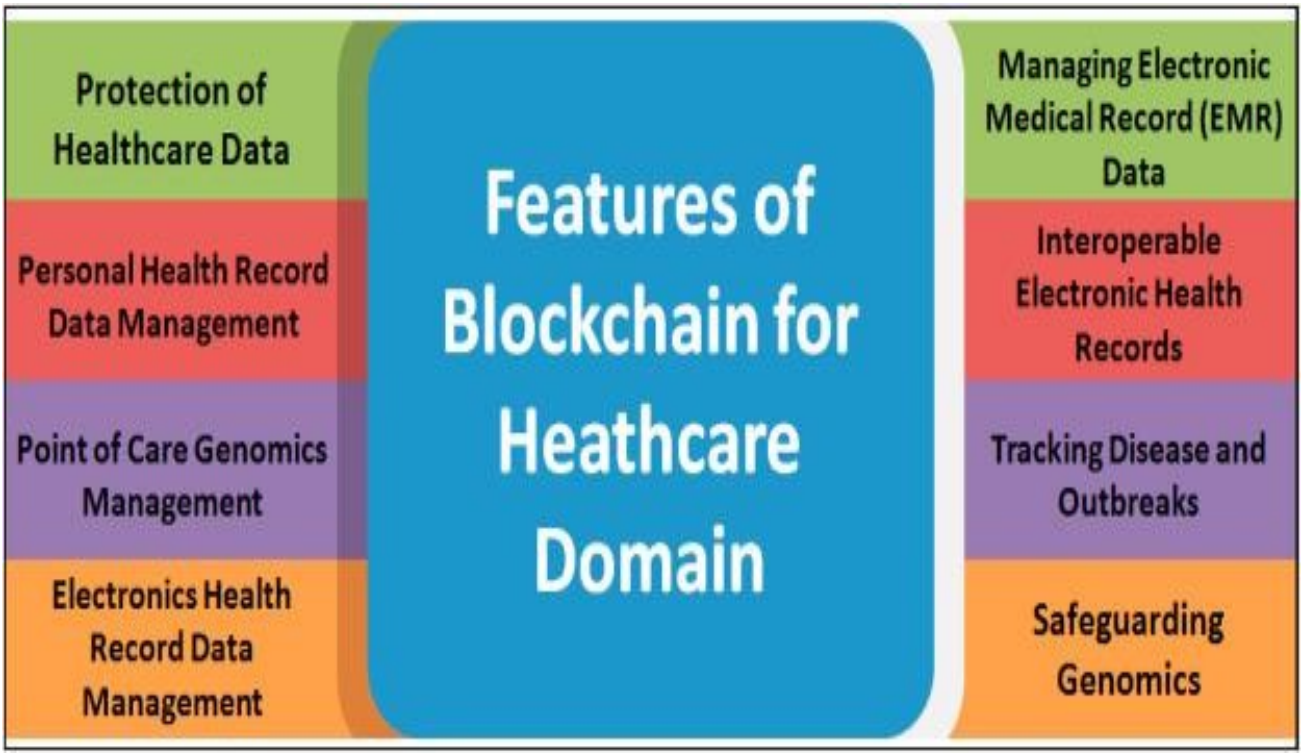
BenefitsofBlockchainInRealEstate

Thereal estatesector'sconditionhasnot been so good forthepast fewyears.That'spartlybecauseofthe ever-increasing priceand how frustrating it hasbecometo buy a property. Blockchain hasbrought a new fresh outlook on how the real estate sector operates. The benefits of blockchain in real estate include the following –

- Tokenization: With blockchain, it will become possible to tokenize actions. This means that properties can be rented outfor a certain periodusing pre-defined code. Tokensalso makeit possible to add any business logic, including the ability to protect against fraud.
- Proper Tenant and Investor Identity: Digital identities can help both investor and tenant to create digital identities that are easy to verify and work with. The KYC/AML procedures will become more streamlined with the use of proper identity management. Lastly, documentation becomes easier and more shareable.
- Property Sale: Property sales can be automated with smart contracts. It enables legal agreements that are traceable and executable if a certain condition is met.
- Real-TimeAccounting:Withblockchain,itispossibletodoreal-timeaccounting Benefits of Blockchain In Trade Finance
- Trade finance benefited immensely from the blockchain. It required some form of reform to solve the problems itis currently facing.The benefits of blockchain in trade financeincludethe following.
- DataIntegrity:Withblockchain,thetradefinancesectorimproveswhenitcomestodataintegrity, authenticity, and proper asset provenance.
- StreamlinedProcess:Automationalso becamea normduetoblockchaindAppandsmart contract capabilities.Itimprovedoverallprocessefficiency,includingtheabilitytodoreal-timesettlement. The processalso became error free dueto the non-involvement of intermediaries.
- Programmable: With blockchain, organizations can now code multiple aspects of the business, including data privacy, governance, identity management, and so on.
- Market Reactivity: Using digital security also means that trade finance organizations can make changes when the need arises. In simple words, it offers customization.
- Cost Reduction: Using an automated network means cost reduction, including transactional, operational, and infrastructural.



CapacitiesofblockchaintechnologyforhealthcaredomainThe Blockchain makes the entire prescription process transparent, from manufacturing to pharmacy shelves.Congestion,freightdirection,andspeedmayallbetrackedusingIoTandBlockchain.Itoffersthechancetoscheduleacquisition sefficientlytoprevent disruptionsandshortagesinclinics, pharmacies,and other medical facilities with a given medication. The deployment of digital frameworks built on Blockchain wouldhelpensurethatthelogisticsdataavoid uncontrolledadjustments.Itincreasestrustandpreventsthe illicit handling of records, payments, and medication themselves by various people interested in purchasing drugs. The technology can effectively improve the condition of patients while at a competitive cost retaining the funds. It eliminates all obstacles and barriers in multi-level authentication . Because Blockchain can preserve an incorruptible, decentralised, and transparent log of all patient data, it is ripe for security applications. Furthermore, while Blockchain is visible, it is also private, hiding any individual's identity behind complicatedand securealgorithmsthat can preservethe sensitivity of medical data.Thanks tothe technology's decentralised structure, patients, doctors, and healthcare providers can all share the same information swiftly and safely.



XII. BACKGROUND OF THE STUDY

Apatientmovingfromonestatetoanother,orvisitingmultiplespecialists.Currently,theirmedicalrecords are often fragmented across different healthcare providers using incompatible systems. This leads to delays, potential errors,andrepeatedtests.Blockchain'sabilityto createashared,immutableledger could enable seamless and secure data exchange, ensuringa complete patient history isaccessible when needed.

1) During disaster relief efforts, where temporary medical facilities are set up, accessing patient records quicklyiscrucial.Blockchaincouldprovideasecureanddecentralizedwaytosharecriticalhealth information, even in environments with limited infrastructure.

ResearchPaperStudyInsights:

2) "Blockchain for Health Data and Beyond: CurrentApplications, Challenges, and Future Trends" (Yaga et al., 2019):

- This paper highlights the potential of blockchain to address the challenges of data interoperability, security, and patient-centricityin healthcare. It emphasizes the need for a decentralizedandsecureplatformtomanagepatienthealthrecords,citingthelimitationsof existing centralized systems.
- The paper addresses the security concerns surrounding the current health record systems, and points to the cryptographic nature of block chain as a strong solutionto this problem.

3) "AReviewontheApplicationofBlockchaininHealthcare"(Ekblawetal.,2016):

- This study explorestheuse of blockchain for managing electronic health records(EHRs), emphasizing the need for secure andauditable data sharingamong healthcare providers.
- It points out that blockchain could help solve the problem of data ownership, by allowing patients to control who has access to their data.

Main AIM:

The main aim of developing a blockchain-based patient health record system is to create a secure, interoperable,andpatient-centricplatformthatrevolutionizeshealthcaredatamanagement.Thisinvolves:

- Enhancing Data Security and Privacy: Utilizing blockchain's cryptographic features to protect sensitive patient information from unauthorized access and tampering.
- Improving Interoperability: Enabling seamless and secure data exchange between disparate healthcare providersand systems, eliminating data silos and fragmentation.
- Empowering Patients: Givingindividuals greater control over their healthrecords, allowingthem to manageaccess permissionsand share their data withauthorized parties.
- Ensuring Data Integrity andImmutability: Leveraging blockchain'simmutableledger to maintain theaccuracy andreliability of patient healthrecords, reducing the risk of errorsand fraud.
- Streamlining Healthcare Processes: Optimizing workflows and reducing administrative burdens through efficient data sharing and secure transactions.
- FacilitatingResearch andDataAnalytics:Providingasecureand auditableplatformfor researchers to access and analyze anonymized patient data, advancing medical knowledge and improving public health.

Theadvantagesoftheproposedsystem:

A blockchain-based patient health record system offers several key advantages over traditional, centralized systems:

- EnhancedSecurity:
  - Blockchain'scryptographicfeaturesanddecentralizednaturemakeit significantly more resistant to hacking and data breaches.
  - Dataisdistributedacrossmultiple nodes,makingitdifficultforasingle pointoffailure to compromise the entire system.
- ImprovedInteroperability:
  - Blockchaincanfacilitateseamlessandsecuredataexchangebetweendifferent healthcare providers andsystems, regardless of their underlying technology.
  - Thiseliminatesdatasilosandpromotesamoreholisticviewofpatienthealth.

- PatientEmpowerment:
  - Patientsgaingreatercontrolovertheirhealthrecords, allowingthemtomanage access permissions and share their data with authorized parties.
  - Thisfosterspatientengagementandpromotessharеddecision-making.
- DataIntegrityandImmutability:
  - Blockchain'simmutableledgerensuresthathealthrecordsareaccurateandtamper-proof.
  - Thisreducestheriskoferrorsandfraud,enhancingthereliabilityofpatientdata.
- IncreasedTransparencyandAuditability:
  - Alltransactionsanddatachangesarerecordedontheblockchain,creatingatransparentand auditable trail.
  - Thisenhancesaccountabilityandfacilitatesregulatorycompliance.
- ReducedAdministrativeCosts:
  - Automated datasharing and secure transactions canstreamline administrative processes, reducing paperwork and operational costs.
- FacilitationofResearch:
  - Secureandanonymizeddatasharingcanfacilitatemedicalresearch.
  - Thiscanleadtoadvancementsinmedicaltechnologyandtreatments.
- MitigationofMedicalIdentityTheft:
  - The useofcryptography and permissioned accesscansignificantlydecrease theriskof medical identity theft.

Requirementsoftheproject
SoftwareRequirements:
IDE:VisualstudioCode,Atomorsublimetext Browser : chrome
HardwareRequirements:
RAM: 4GB min ROM:256GBmin
Programming:
FrontEnd:HTML&CSS Back End : Python

Process/Implementation:

- WewillWriteBlockchainCode
- Willuselibrarieslikeimporthashlib,random,SHA256,datetime.
- InstallFlaskandotherdependencies
- Thenwewillcreateflaskapplication(app.py)and willcreateanewfilenamedapp.pyintheproject folder.

Followingcode:

```
fromflaskimportFlask,render_template,request from hashlib import sha256
fromdatetimeimportdatetime import random
app=Flask(name)
#listtostoreblockchain blockchain = []
#Patientrecordclass classPatientRecord:
definit(self,name,uid,age,medical_history): self.timestamp = datetime.now()
self.name=name self.age = age self.uid = uid
self.medical_history = medical_historyself.previous_hash = None
self.hash=self.calculate_hash()

defcalculate_hash(self):
hash_data = str(self.timestamp) + self.name + str(self.uid) + str(self.age) + self.medical_historyreturn
sha256(hash_data.encode()).hexdigest()

def calculate_previous_hash(self): if len(blockchain) > 0:
```

```
previous_record=blockchain[-1]
returnprevious_record.hash
else:
returnNone

# to add new record to blockchain @app.route('/add_record', methods=['POST']) def add_record():
name = request.form['name'] age = request.form['age']
medical_history = request.form['medical_history'] uid = request.form['uid']

# Createanewpatientrecord
record=PatientRecord(name,uid,age,medical_history)


# Adding the patient record to the blockchain record.previous_hash = record.calculate_previous_hash()
blockchain.append(record)

returnf'Recordaddedtoblockchainsuccessfully.YourUserID-{uid}'


# getting patient record from blockchain @app.route('/get_record', methods=['GET']) def get_record():
uid = request.args.get('uid') for block in blockchain:
ifblock.uid==uid:
        return render_template('record.html', record=block) return 'Record not found.'

#displayingwholeblockchain

@app.route('/view_blockchain', methods=['GET']) def view_blockchain():
returnrender_template('blockchain.html',blockchain=blockchain)

@app.route('/get_patient_history', methods=['GET']) def get_patient_history():
pass
@app.route('/get_history', methods=['GET']) def get_history():
uid = request.args.get('uid') history = list()
forblockinblockchain: if block.uid == uid:
    history.append(block) else:
continue
iflen(history)>=1:
    return render_template('patient_records.html', all_records=history)else:
return'Recordnotfound.'

#returninglandingpage @app.route('/')
defindex():
returnrender_template('index.html')
ifname_____=='main':

app.run(debug=True)
```

.Create HTML Templates Create a templates folder: Createafoldernamedtemplatesinyourprojectfolder. Create index.html:

```
<!DOCTYPEhtml>
<html>
```

```
  <head>
  <title>PatientManagementSystem</title>
<style>body{
  background-color: #ac8e8e; font-family: Arial, sans-serif;
  }


  h1{
  text-align:center; margin-top:50px;
  }

  form{
  margin:0auto;
  width:50%;
  background-color: rgb(124, 174, 45); padding: 20px;
  border-radius:10px;
  box-shadow:0px0px20pxrgba(87,52,201,0.2);
  }


  label{

  font-weight:bold;
  }

input[type=text], input[type=number], textarea{ width: 100%;
  padding:10px;
  border:1pxsolid#713030; border-radius: 4px;
  box-sizing: border-box; margin-top: 5px; margin-bottom: 10px; resize: vertical;
  }

input[type=submit] { background-color: #7e6f33; color: white;
  padding:10px20px; border: none;
  border-radius:4px; cursor: pointer;
  }

input[type=submit]:hover{ background-color: #7b293d;
  }

input[type=submit]:focus{ outline: none;
  }
  </style>
  </head>
  <body>
  <h1>Patienthealthrecordusingblockchain</h1>
                        <center><img                src="https://encrypted-tbn0.gstatic.com/images?q=tbn:ANd9GcR2DZ-
  2k2w9JmuMLmMAwwAwYY1QadA-kEhLMg&s">
  </center>
  <formmethod="POST"action="/add_record">
  <labelfor="name">Name:</label>
```

<inputtype="text"id="name"name="name">
<***labelfor="age">Age:</label***>
<***inputtype="number"id="age"name="age"><br***>
<***labelfor="medical_history">MedicalHistory:</label***>
<***textareaid="medical_history"name="medical_history"></textarea><br***>
<***labelfor="uid">USERIDENTITY:</label***>
<***inputtype="number"id="uid"name="uid"><br***>
<***inputtype="submit"value="AddRecord"***>
<***/form***>

<formmethod="GET"action="/get_history">
<labelfor="name">USERIDENTITY:</label>
<inputtype="text"id="uid"name="uid">
<inputtype="submit"value="GetRecord">
</form>

<formmethod="GET"action="/view_blockchain">
<inputtype="submit"value="ViewallBlockchain">
</form>
</body>
</html>

1) Createrecord.html

```
<!DOCTYPEhtml>
<html>
<head>
<title>PatientRecord</title>
</head>
<body>
<h1>PatientRecord</h1>
<p>Name:{{record.name}}</p>
<p>Age:{{record.age}}</p>
<p>MedicalHistory:{{record.medical_history}}</p>
<p>Timestamp:{{record.timestamp}}</p>
<p>Hash:{{record.hash}}</p>
<p>PreviousHash:{{record.previous_hash}}</p>
</body>
</html>
```

2) Createblockchain.html

```
<!DOCTYPEhtml>
<html>
<head>
<title>BlockchainViewer</title>
<style>body{
font-family: Arial, sans-serif; background-color: #b8b66a;
}

h1{
text-align:center; font-size: 36px; margin-top:50px;
```

```
  }

table {margin:auto;
  border-collapse: collapse; width: 80%;
  margin-top: 50px; margin-bottom: 50px;
  }

  th{
  background-color: #6e5391; color: white;
  padding: 10px; text-align:center;
  font-weight:normal;
  }

  td{
  padding: 10px; text-align:center;
  border-bottom:1pxsolid#ddd;
  }

tr:nth-child(even) { background-color: #5f9e7a;
  }

  tr:hover{
  background-color:#a6ab5d;
  }
  </style>
  </head>
  <body>
  <h1>BlockchainViewer</h1>
  <table>
  <tr>
  <th>Timestamp</th>
  <th>Name</th>
  <th>Age</th>
  <th>UID</th>
  <th>MedicalHistory</th>
  <th>Hash</th>
  <th>PreviousHash</th>
  </tr>
  {%forblockinblockchain%}
  <tr>
  <td>{{block.timestamp}}</td>
  <td>{{block.name}}</td>
  <td>{{block.age}}</td>
  <td>{{block.uid}}</td>
  <td>{{block.medical_history}}</td>
  <td>{{block.hash}}</td>
  <td>{{block.previous_hash}}</td>
  </tr>

  {%endfor%}
```

```
</table>
</body>
</html>
```

3) Createpatient_records.html

```
<!DOCTYPEhtml>
<html>
<head>
<metacharset="utf-8">
<title>PatientManagementSystemusingBlockchain</title>
<style>body{
font-family: Arial, sans-serif; background-color: #509b5b; margin: 0;
padding:0;
}
h1{
color: #837eb4; text-align:center; margin: 1rem 0;
}
table{
border-collapse: collapse; width: 100%;
max-width:800px; margin: 0 auto;
background-color:#adb583;
box-shadow:0px0px10pxrgba(0,0,0,0.1);
}
th, td{
text-align: left; padding:0.5rem;
}
th{
background-color: #333; color: #fff;
font-weight:bold;
}
tr:nth-child(even) { background-color: #a3b285;
}
tr:hover{
background-color:#acb078;

}
p{
text-align:center; margin: 1rem 0;
}
</style>
</head>
<body>
<h1>RecordsforPatient:{{all_records[0].name}}</h1>
{%ifall_records%}
<table>
<tr>
<th>Index</th>
<th>Name</th>
<th>Age</th>
<th>MedicalHistory</th>
<th>Timestamp</th>
```

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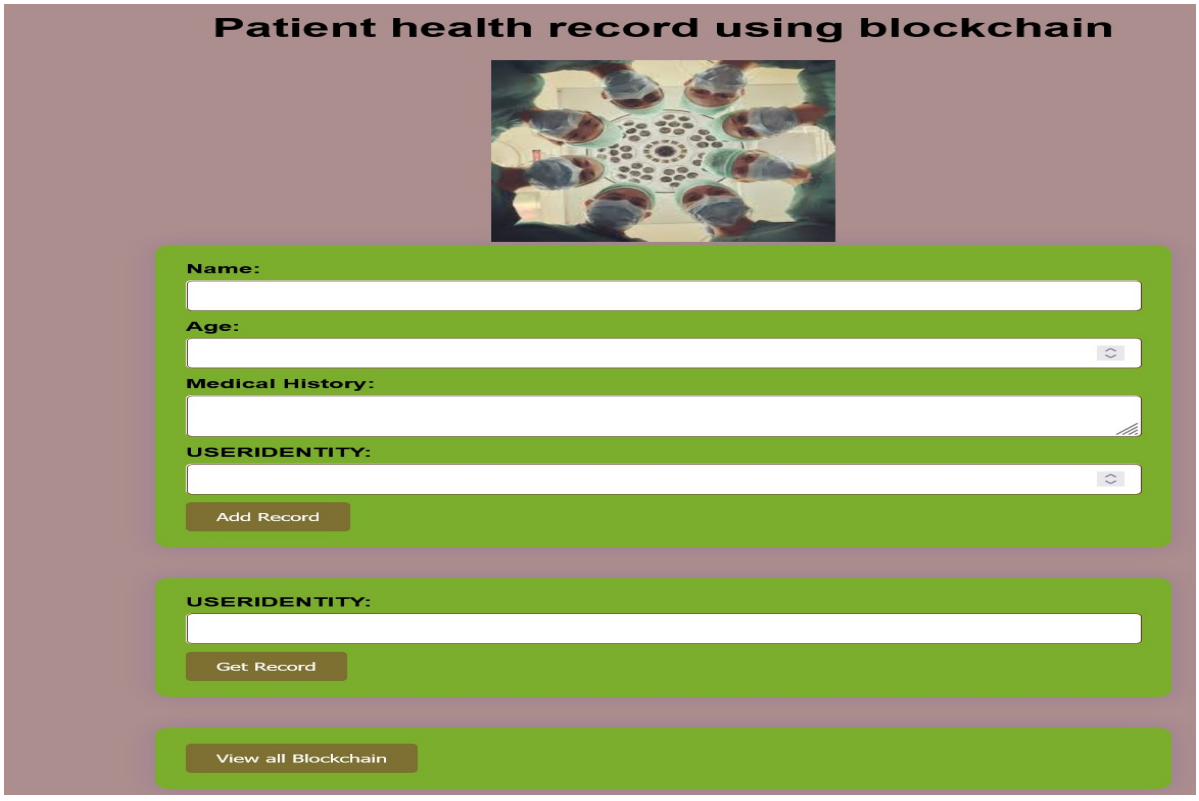
```
<th>Hash</th>
</tr>
{%forblockinall_records%}
<tr>
<td>{{loop.index}}</td>
<td>{{block.name}}</td>
<td>{{block.age}}</td>
<td>{{block.medical_history}}</td>
<td>{{block.timestamp}}</td>
<td>{{block.hash}}</td>
</tr>
{%endfor%}
</table>
{%else%}
<p>Norecordsfoundforthispatient.</p>
{%endif%}
</body>
        </html>RuntheApplication
```

4) IntheVSCodeterminal,run:pythonapp.py

5) Openyourwebbrowser Explanation:

- TheFlaskapphandlesroutinganddataprocessing.
- ThePatientRecordclassrepresentsablockintheblockchain.
- Thecalculate_hashmethodgeneratesaSHA256hashforeachrecord.
- Thecalculate_previous_hashmethodlinksblockstogether.
- TheHTMLtemplatesprovidetheuserinterface.
- Thegethistoryfunctionallowstheusertoviewalltheblocksassociatedwitha singleUID.

Output :MainPage:

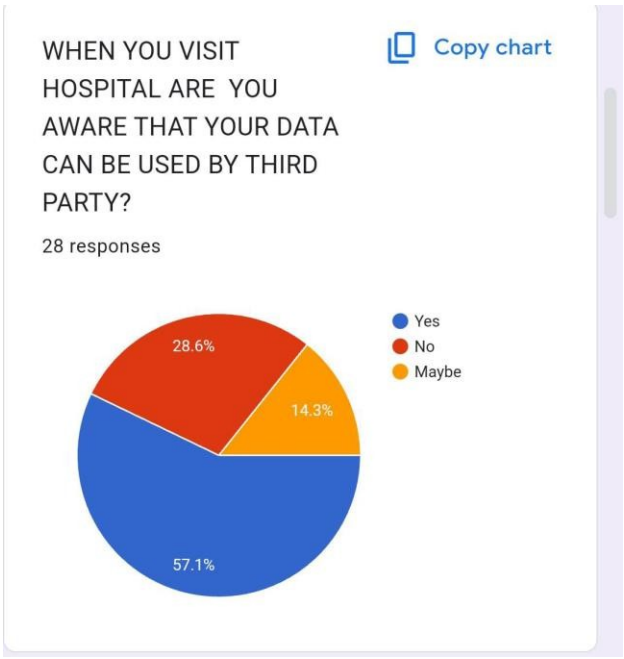


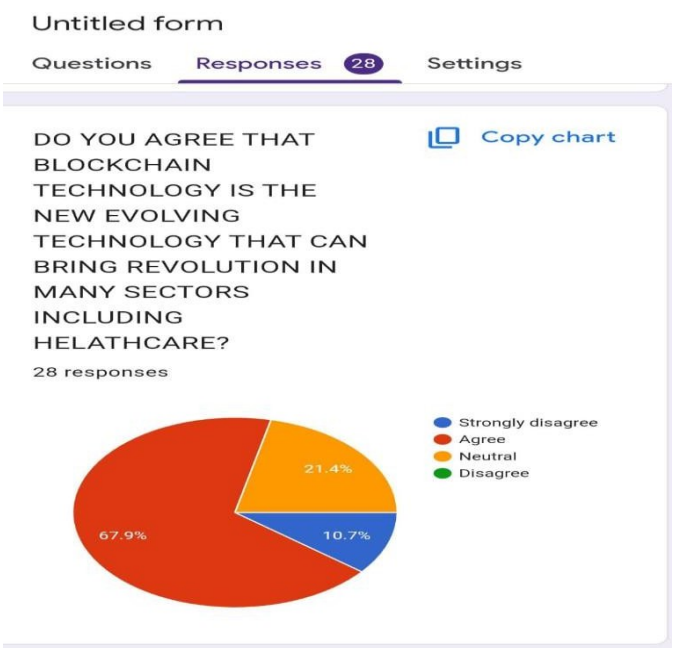
RESULTPAGE:

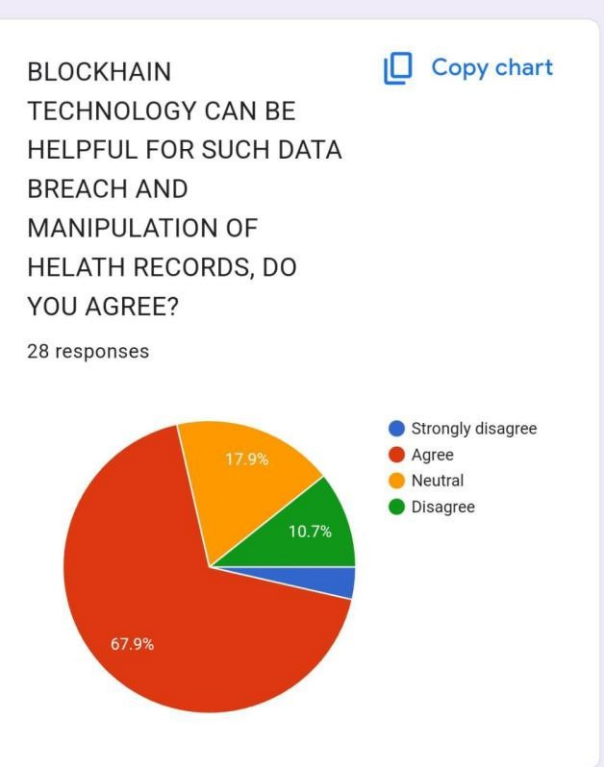
Blockchain Viewer

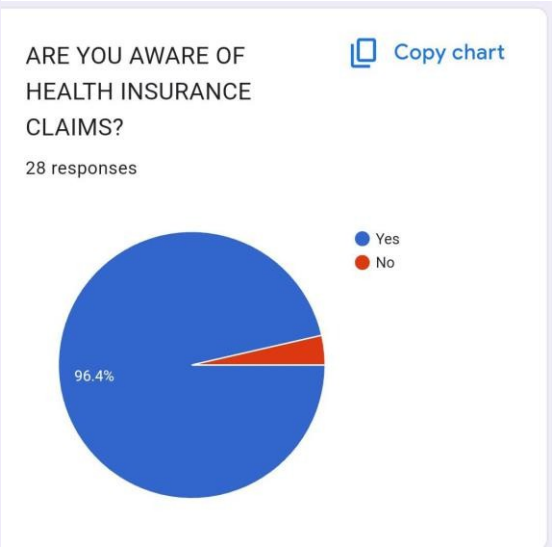
Timestamp	Name	Age	UID	Medical History	Hash	Previous Hash
2025-04-05 12:51:58.230028	NANDITA	30	78231	PCOD	94b7d76917cdbd51af63c640a3b70c881763fca7b29f406cc8b56702ab567391	None
2025-04-05 12:53:33.546315	DIKSHA	29	89632	COUGH AND RUNNING NOSE	c3b18ec81fa23bbe4e0ca2f903c6b00149cd3eb41ecd72b576d284c08de10378	94b7d76917cdbd51af63c640a3b70c881763fca7b29f406cc8b56702ab567391
2025-04-05 12:57:02.109226	ANJALI	28	47283	BACK PAIN AND GAS	024d9487b6c33f44759cc28ecc86d6970031be109d801260b8223d4f8b1fb319	c3b18ec81fa23bbe4e0ca2f903c6b00149cd3eb41ecd72b576d284c08de10378
2025-04-05 13:01:35.288356	SUSHMITA SINGH	28	21345	HIGH BP	d5851c706091187c452d0c6526754f15af9325360db4a6df3bfb7d12a96dde95	024d9487b6c33f44759cc28ecc86d6970031be109d801260b8223d4f8b1fb319

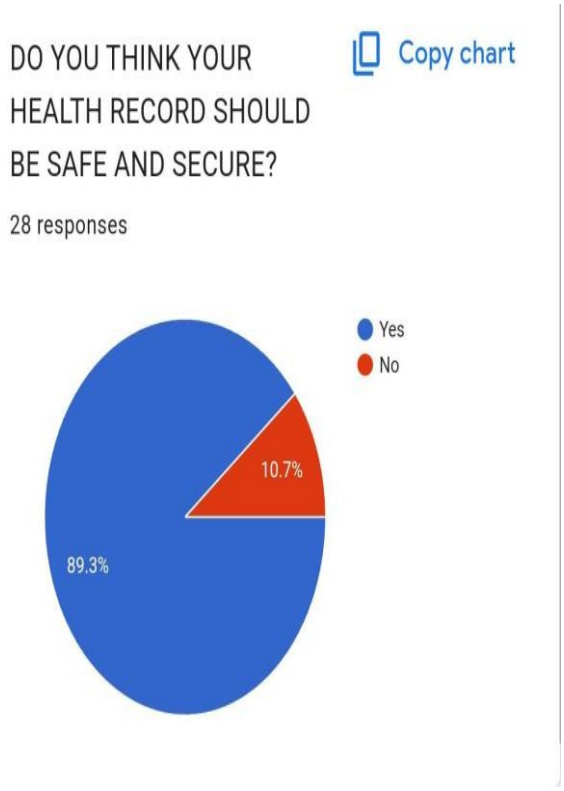
GOOGLEFORMRESPONSESCHARTS:

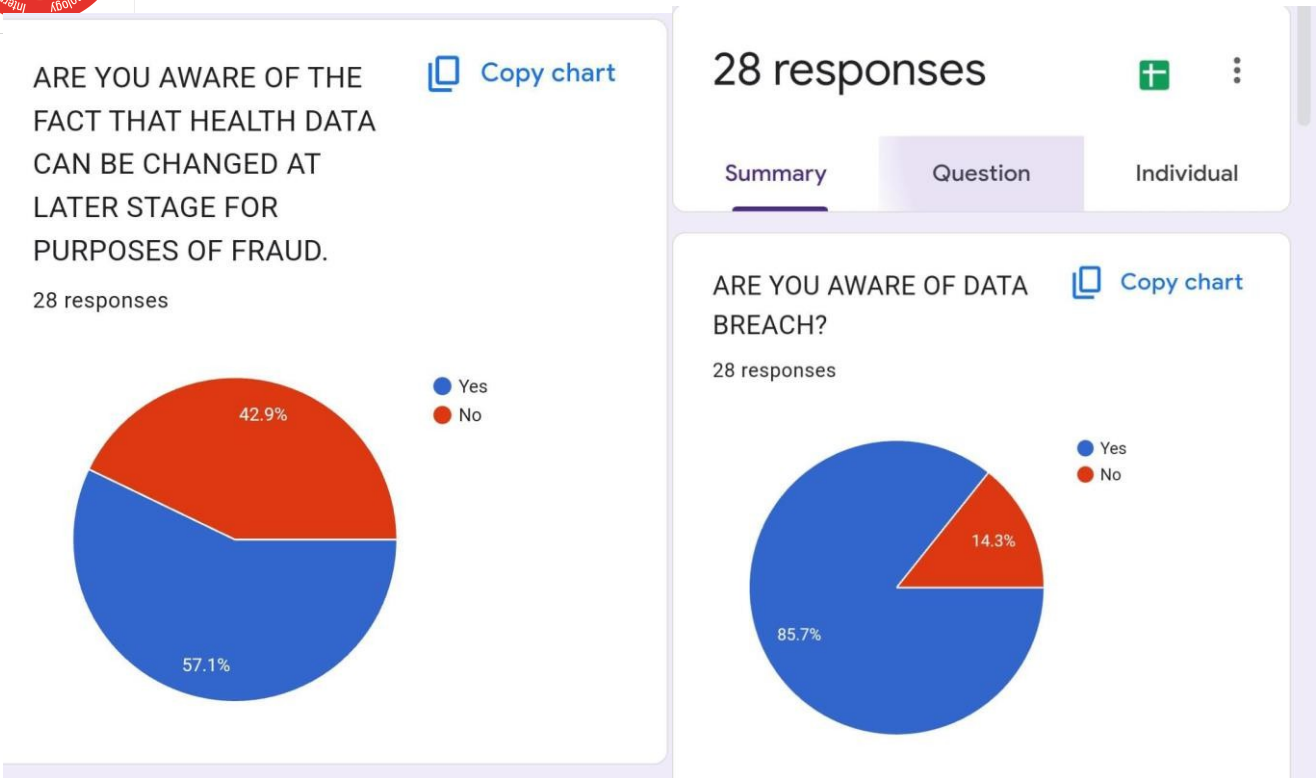





BLOCKHAIN TECHNOLOGY CAN BE HELPFUL FOR SUCH DATA BREACH AND MANIPULATION OF HELATH RECORDS, DO YOU AGREE?
Copy chart
28 responses
Strongly disagree
Agree
Neutral
Disagree
17.9%
10.7%
67.9%


ARE YOU AWARE OF HEALTH INSURANCE CLAIMS?
Copy chart
28 responses
Yes
No
96.4%


DO YOU THINK YOUR HEALTH RECORD SHOULD BE SAFE AND SECURE?
Copy chart
28 responses
Yes
No
10.7%
89.3%



XIII. CONCLUSION

The purpose of these literature reviews was to collect information on how an information system helped themanagement ofPatientHealthRecords.Basedonthereviews,itwasfoundoutthatweb-basedPatient Health Records systems provide convenience, efficiency and security to the system users and hospitals compared to the manual systems.

Mainwork isthatI've createdallthearchitecture fora blockchain, froma setofstatetransitionrulestoa method for creating blocks, to mechanisms for checking the validity of transactions, blocks, and the full chain.Thisisanewanduniquewaytodevelopasystemforsecuringhealthdata.ThirdParties,Attacksor any system will take a lot of time to crack this system. We can say it is tough to break the hash and information will be stored with security. It will help the whole human for medical health records Data through blockchain technology.

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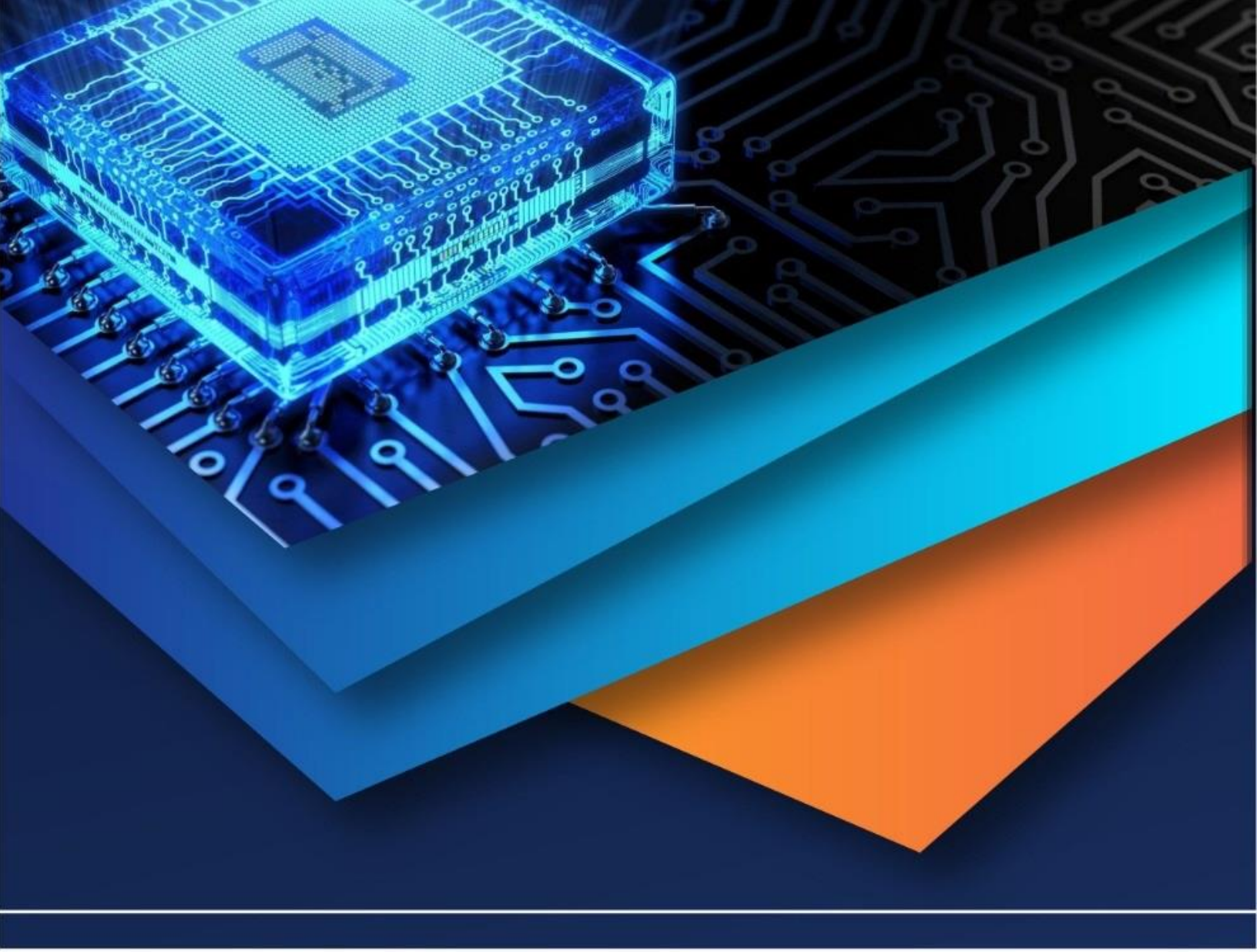

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