International Journal on Recent and Innovation Trends in Computing and Communication
ISSN: 2321-8169 Volume: 11 Issue: 8s
Article Received: *26 April 2023* ***Revised:*** *30 June 2023* ***Accepted:*** *17 August 2023*

Blockcloud: Merger of two Big Technologies Blockchain & Cloud Computing

Shalu J. Rajawat[1 a)], Manju Kaushik[1], and Surendra Kumar Yadav[2]
[1] Amity University Rajasthan, Jaipur, Rajasthan, India
[2] JECRC University, Jaipur, Rajasthan, India
[a)] Corresponding author: shalujrajawat@gmail.com

Abstract: A Blockchain is a continuous list - a structure like a file containing blocks connected by links, and the storage of blocks is done with the help of cryptography whereas Cloud computing is the need for computing resources, especially data storage (cloud storage) and computing power, without the direct control of users. Large cloud operations are often distributed across multiple locations, each with a data center. Both these technologies have their individual working and responsibilities and plays their roles very perfectly which makes them high demanding in today's world but if they both work together then it will upgrade the future of IT market because Blockchain makes a difference in cloud storage which keeps information secure and tamper-proof. Companies can be certain that their information is secure; erasing information from a computer does not erase information held on other blockchain arrange gadgets. In this way, information put away within the cloud utilizing blockchain innovation is secure and secure. In cloud computing, blockchain can make an organize of hubs that share data and handle vitality. This guarantees that companies don't require a central benefit supplier. Instep, they can depend on organized computers that are not controlled by a single company which is beneficial in all aspect. This paper showcase all benefits by merging these two big technologies Blockchain and Cloud computing and propose new term for this Merger as "BlockCloud".

Keywords: Blockchain, Cloud Computing, Reinventing cloud using Blockchain, Blockcloud, BlockCloud application areas, Adaptation challenges of Blockcloud

1. NTRODUCTION

The fast development of Blockchain technology is showing no signs of slowing down. inside the beyond few a long time, many things that regarded impossible have turned out to be fake, such as excessive transaction fees, double spending, internet fraud, retrieving misplaced records, and so on. however, now all this can be avoided with the assist of Blockchain era. Blockchain enables inside the verification and traceability of multistep transactions needing verification and traceability. It can offer relaxed transactions, lessen compliance costs,and a ccelerate information switch processing.

Blockchain generation can assist agreement management an d audit the beginning of a product. It additionally can be utilized in vote casting systems and coping with titles and deeds. Blockchain provides verification without intermediaries and secure (Encryption Algorithms). In blockchain data cannot be altered and deleted and consensus from all nodes. Blckchain provides Transaction recorded as per time-stamp and data blocks created for every successful transaction, only authorized users can view Transactions, it is completely follow Smart contracts.

Cloud is a model of computing in which servers, networks, garage, development equipment, and even packages (apps) are enabled via the net. Instead of organizations having to make predominant investments to shop for device, train group of workers, and provide ongoing preservation, a few or all of these desires are treated by means of a cloud provider. With a public cloud surroundings, users "plug into" the facts and programs through an internet connection giving anytime, anywhere get admission to. Cloud is a "Measured carrier". Cloud is often pay-as-you-move, where you most effective pay for what you use. Reflect on consideration on how an application company meters how plenty water, power, or gasoline is used and expenses based on consumption. The cloud is the identical. Service can be asked and provisioned quickly, without the need for manual setup and configuration. Cloud often makes use of the multi-tenancy version, this means a solitary application is shared among several customers. So, instead of growing a replica of the application for each person, numerous users, or "tenants" can configure the utility to their unique wishes. Cloud systems are elastic. An agency can scale its aid utilization tiers up or down quick and without problems as needs alternate.

International Journal on Recent and Innovation Trends in Computing and Communication
ISSN: 2321-8169 Volume: 11 Issue: 8s
Article Received: *26 April 2023* ***Revised:*** *30 June 2023* ***Accepted:*** *17 August 2023*

2. REVIEW OF LITERATURE

[1] In their study titled Secure Blockchain Banking Cloud with Error Recovery Processes discussed a way to make the biometric gadget safer with the aid of utilizing cloud computing, as well as a way to enhance its performance so that criminals cannot get entry to your records. Biometric authentication is a viable solution for cloud offerings. we are able to discover the way to construct a cryptographic technique inside a blockchain to overcome those issues. Blockchain era will improve information security by utilising cryptographic keys. The machine additionally manages error recovery, which results in the failing cloud instance being immediately identified and corrected.

[2] in their study titled Integration of Blockchain and Cloud computing authors have examined how blockchain era can be leveraged in cloud computing, mentioned the benefits of the usage of cloud-based blockchain services, and explored the modern-day traits in this subject, paying near attention to its development, blessings, and packages. Numerous blockchain programs within the supply chain, finance, healthcare, and so on, had been explored. Then it involves some precious conclusions with few unanswered questions that require greater inquiry. This assessment article gives a wide foundation for researchers inquisitive about cloud facts security and records control the usage of blockchain era.

[3] in their study titled A novel multi-objective service composition architecture for Blockchain-based cloud manufacturing proposes a novel multi-goal provider composition structure for blockchain-primarily based CMfg (MOSC-BBCM). First, a blockchain-chained garage structure is designed for the real manufacturing cloud carrier constraint and scale dynamic changes, that can completely use the historic service information. Second, to lessen the squandered computing sources in the PoW. Finally, an incentive mechanism primarily based on the environment selection technique is proposed, that may avoid the fork trouble at the same time as distributing on a labor basis.

[4] in their study titled IOT and Blockchain-Based Cloud Model for Secure Data Transmission for Smart City is blanketed about two sorts of safety are as compared on this examine. The modern-day gadget-based intrusion detection gadget is damaged down into greater special categories primarily based on detection generation, records supply, architecture, and operating technique. Those classes are as follows: it is pointed out how IoT security will grow in the destiny and the way to recognize its intrusion detection device too. on this paper, a cloud-primarily based blockchain protection version has been supplied for relaxed records transmission over IoT.

[5] in their study titled The Intelligent Information Integrity Model to Ensure the Database Protection Using Blockchain in Cloud Networking because of this any modifications or adjustments to the data could be detected and addressed. moreover, blockchain generation provides a permanent and immutable record of transactions, making it hard for records to be tampered with or corrupted. in addition to its security blessings, blockchain technology also gives scalability, efficiency, and cost savings. Blockchain-based totally databases are plenty greater green than conventional databases, as they require fewer sources and are able to technique a larger volume of transactions. furthermore, considering that blockchain generation is decentralized, it is able to paintings across multiple devices and networks, bearing in mind a more efficient and value-powerful solution.

[6] in their study titled Blockchain Assisted Cloud Storage proposed a framework for Electronic Health Records which able to remedy the issues of facts silos and supply unchangeable, at ease transactions within the healthcare sector. To remedy the troubles of interoperability and privacy of Electronic Health Records, blockchain-based decentralised on-line ledgers have already been proposed and applied, the primary technical trouble is to keep scientific data in their numerous formats off-chain whilst supplying relaxed get right of entry to control to them on-chain. the second issue is presenting an good enough description of who owns what statistics and the way that information is shared during instances of scientific emergency. Accessibility remains a problem, but, as formal verification of smart contracts takes a long time relative to processing huge batches of transactions.

[7] in their study titled Blockchain and Cloud-based Technology in Automotive Supply Chain include Cloud-primarily based Blockchain services to a more extent. It has been determined that the adoption of blockchain and cloud technology improves supply chain sustainability and coordinates amongst exclusive gadgets in deliver chain. It offers car tracking, theft prevention, coverage scrutiny need to be targeted greater because the car sector in India is inclined to the Blockchain generation closer to the backward linkages up the supply chain opposed to the forward linkages downward. The cloud integration inside the blockchain network do enhances the performance & utilities inside the car region, it needs to be extra sophisticated and benefit industry-huge acceptance.

3. REINVENTING CLOUD USING BLOCKCHAIN

Cloud computing is a familiar technology as it has existed for decades. However people are still suffering to triumph over some demanding situations of cloud computing like information security, facts management, interoperability, and

International Journal on Recent and Innovation Trends in Computing and Communication
ISSN: 2321-8169 Volume: 11 Issue: 8s
Article Received: *26 April 2023* ***Revised:*** *30 June 2023* ***Accepted:*** *17 August 2023*

so on. Blockchain era is an emerging era widely recognized for its security and authenticity, which are the principle characteristics which are making the arena flip to its side. By means of integrating blockchain with cloud computing, there might be many blessings in usability, consider, safety, scalability, facts management, and plenty of different advantages [8]. Excessive overall performance computing and I/O is needed to control the security processing requirements of Blockchain. Public clouds assist you to allocate as many instances as you like from a public cloud issuer, and this elastic technique to scaling and de-scaling to assist a relaxed translation is ideal for a Blockchain transaction. The pervasiveness of public cloud computing approach that the node of a Blockchain gadget can be supported outside of the enterprise by using a neutral third party, the public cloud provider. Additionally, which means access is simply as clean from a small business as a large one, because you're handiest buying the infrastructure through utilization. This makes the prices of moving to Blockchain cheap, and accordingly eliminates budgetary limitations to entry. Get right of entry to Blockchain enabled programs and facts are largely identification and function-primarily based. The use of public cloud has grown to be the proving floor for identity- and get admission to-based management methods, together with those provided by way of Microsoft, Google and AWS. Those offerings are already native on those cloud providers; you don't have to integrate them manually. The usage of in depth transaction logging, with each distributed and I/O-in depth influences, is ideal for cloud computing. Logging operations can be spun off on new system times and storage times without impacting the center application. These are released, used to guide the Blockchain tactics and then de-provisioned [9]. Re-inventing cloud using Blockchain advantages:

1. Gassed up computing
2. Multiple Instances
3. Elastic Approach
4. Access→ Identity & Role-Based
5. Greater Pellucidity
6. Increased Proficiency
7. Improved Traceability

4. BLOCKCLOUD

The merger of blockchain with cloud computing is an exciting new vicinity of studies that might dramatically alter how groups handle their facts now and within the future. The mixture of blockchain and cloud computing opens up hitherto not possible use cases, which includes digital identity, Electronic Health Records, decentralised banking, and supply chain management. Scalability, interoperability, security, regulatory compliance, and technological complexity are all issues that rise up due to this merging of systems and must be addressed. The study stresses the want for forethought and funding of each infrastructure and talent for a success rollout of blockchain-based totally cloud solutions. In sum, there's superb ability for groups to evolve to the fast and unpredictable changes inside the modern commercial enterprise landscape via the aggregate of blockchain and cloud computing [10].

Figure 1: Decentralized banking transactions application using Blockcloud Technology [11]

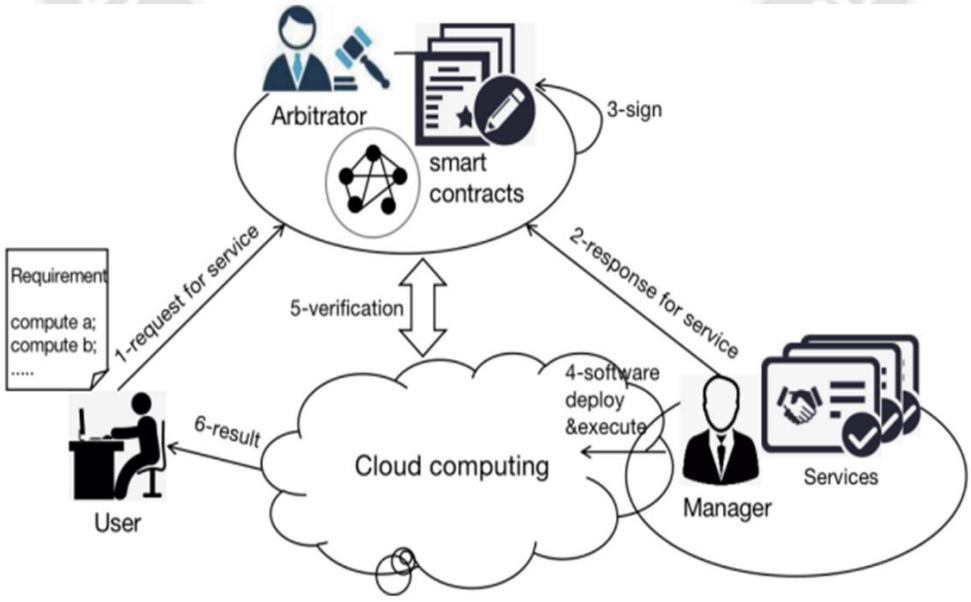


Figure 2: Electronic Health records Application using Blockcloud Technology [12]

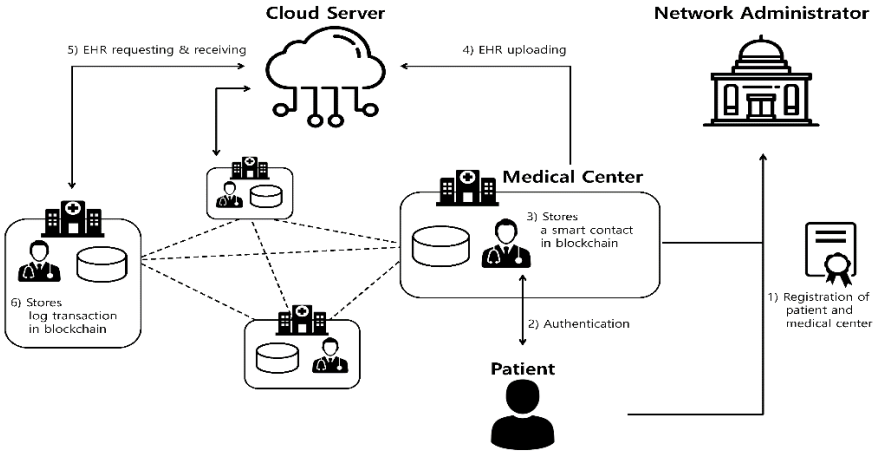


Figure 3: Supply Chain application using Blockcloud Technology [13]

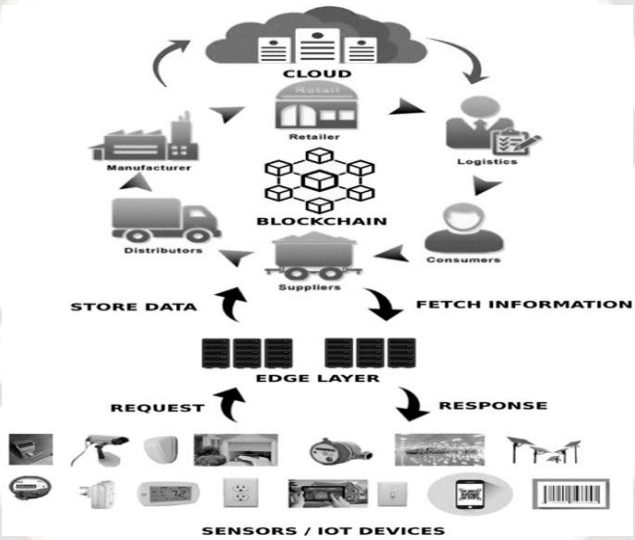
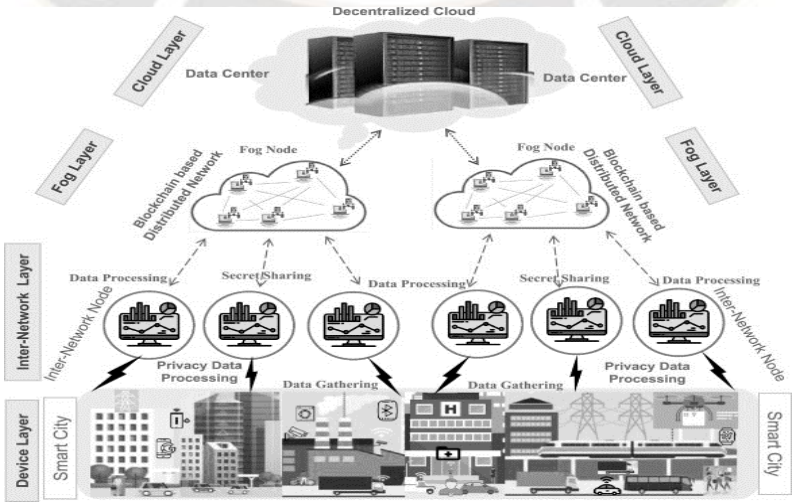


Figure 4: Smart city application using Blockcloud Technology [14]



International Journal on Recent and Innovation Trends in Computing and Communication
ISSN: 2321-8169 Volume: 11 Issue: 8s
***Article Received:** 26 April 2023 **Revised:** 30 June 2023 **Accepted:** 17 August 2023*

In order to enhance the security and effectiveness of statistics sharing, the fairness of facts distribution, and defend the earnings of facts proprietor in a multi-cloud surroundings. All figures basically contained four parts: cloud users, the data service agent (a third-party agency), the blockchain community, and data owners. The customers dispatched records sharing request through the service agent, and received the corresponding statistics carrier after identification authentication and permission evaluation on blockchain. All information manipulation behaviors have been recorded in the blockchain community [15].

Figure 5: Blockcloud application areas usecases

Cloud computing safety additionally advantage from combining blockchain technology and the cloud computing idea. Scalability and thorough evaluation are improved via the use of the cloud platform. Blockchain technology make the cloud computing paradigm more at ease and trustworthy. Cloud computing has the computer strength and storage capacity to address the demands of the blockchain [16].

5. ADAPTATION CHALLENGES FOR BLOCKCLOUD

In this section we highlight the challenges that restrict the widespread adoption of Blockcloud. We realize that there's still a long manner to head before Blockchain era may be implemented to cloud facts storage. To satisfy the requirements wished to integrate Blockchain into cloud computing, it is crucial to cope with the challenges of authentication, scalability, network protection, records integrity, verifiable computation, and low latency [17].

1. **Cloud information accessing control challenge:** Using Blockchain to provide access manage to facts stored within the cloud can create a capacity loophole (pseudo-anonymity), where the flow of transactions may be tracked to attain the real identification of cloud customers or different applicable facts due to the general public nature of the Blockchain community. It is very important to confirm protected access management to switch participant access to information stored in the cloud.
2. **Consensus optimization in cloud storage challenge**: Even though Blockchain era has great ability for handling get entry to control requests in a cloud surroundings, it could also reason latency issues because of the usage of consensus protocols. The goal is to construct consensus systems to improve the performance of the get entry to management machine and at ease storage inside the cloud to be able to store money and time and control competitors while ensuring scalability, execution, and a better stage of identity, confidentiality, and safety.
3. **Restricted Interoperability**: Many companies are doing Enterprise Transaction through Blockchain but It would be hard for an enterprise using Hyperledger Fabric to coincide with its companion using Corda services without having compatibility concerns. Blockchain platform services have begun to discourse this problem. Hyperledger and Enterprise Ethereum Association, these two Blockchain platforms for defining standards to allow interoperability. But in this regard more work still need to be completed for adopting and enabling enterprise Blockchains [18].
4. **Monitoring Issues**: Enterprise blockchain technology is motionless in its early stages, with a small number of initial projects being completed. This makes it tough for lawmakers to set forth adequate rules and regulations for dealing with organization blockchain networks. For a giant majority of organisations, these networks can be allotted internationally, making it a complicated method for governments to establish jurisdiction. Given the network's complexity, once a bootleg transaction has took place, authorities may additionally locate it tough to trace it down and perceive the legal obligations of the parties concerned.
5. **Scalability venture**: According to [19], scalability remains Blockchain's largest project. due to the growing variety of cloud users, several transactions are increasing daily within the Blockchain, which affords extra scalability issues in phrases of improving overload competencies. rapid elasticity, one of the principal traits of cloud

International Journal on Recent and Innovation Trends in Computing and Communication
ISSN: 2321-8169 Volume: 11 Issue: 8s
Article Received: *26 April 2023* ***Revised:*** *30 June 2023* ***Accepted:*** *17 August 2023*

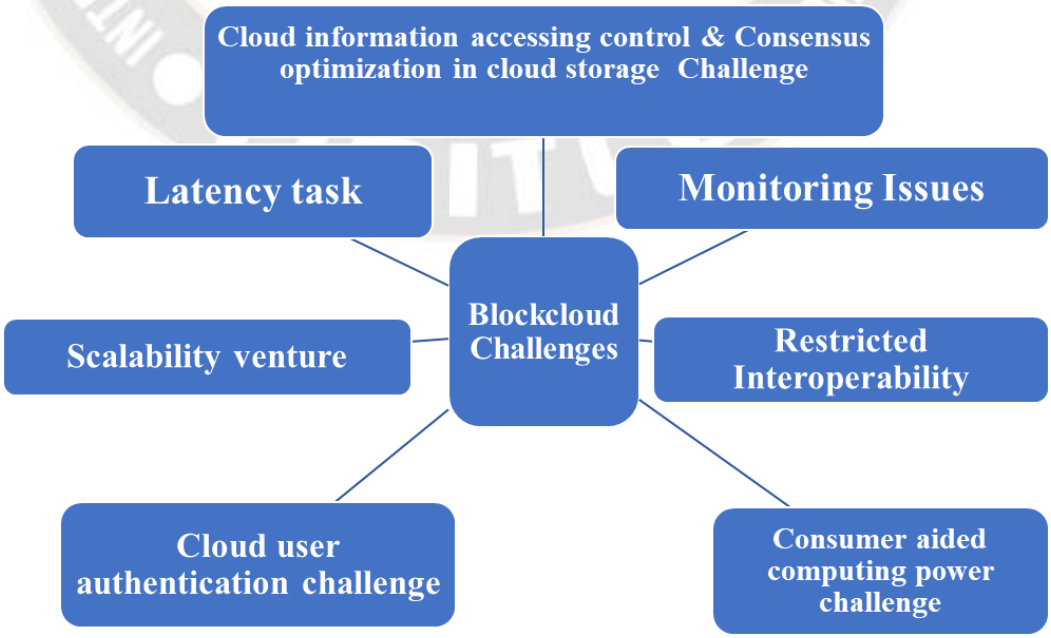
computing, calls for immediately. Scalability of resources, and consequently Blockchain is not likely to paintings optimally with cloud computing. Many small transactions may be not on time as miners select transactions with better transaction fees. but, this type of issue should result in expanded computing requirements for the entire Blockchain machine. So it's miles crucial to restoration the scalability difficulty [20].

6. Consumer aided computing power challenge: Blockchain statistics for cloud user devices is normally computationally restrained, which inhibits the adoption of cryptographic strategies [21]. The various overall performance and safety troubles is that a large portion of Blockchains deploys public essential cryptosystems based totally on uneven algorithms like ECC, which complicates the overall manner of choosing suitable cryptographic methods. However, it's miles worth discovering strength-efficient quantum safety strategies to hold information protection. Moreover, the way to layout an efficient facts structure that helps dynamic facts operations is a critical studies topic in Blockchain-based totally information storage schemes.

7. Cloud user authentication challenge: In traditional centralized cloud systems, user identification records is managed by way of a third-party authority, therefore, user verification, authorization, and responsibility also are implemented and guaranteed by a centralized authority. With a decentralized Blockchain community, identities participating and dealing with flexibly can also face substantial demanding situations. In a Blockchain network, anyone can connect to the community and users can reap an address without supplying their actual identification and practice it for any identification authentication. on account that customers do not provide their true identification to engage with the cloud software and other users, this will increase the ability for impersonation [22].

8. Latency task: In recent times, clinical structures are more and more using cloud computing to save their data. If an affected person desires to connect with the cloud, transaction latency represents the time it takes for a Blockchain to manner a transaction with the cloud. Because all Blockchain structures require some time to set up confirmed transactions and consensus, this could irritate the mixing of Blockchains into healthcare packages, which should reply to moves and facts received concurrently. Addressing community latency [23] calls for that researchers can make sure that proposed or tested designs enhance their overall performance and performance to house the growing extent of transactions that can be projected with the additional implementation Blockchain structures [24].

Figure 6: Blockcloud main challenges



6. CONCLUSION

The paper turned into when cloud computing is mixed with blockchain technology, the primary troubles of protection and privateness are solved. Blockchain additionally contributes to more transparency through establishing a decentralized and dispensed believe shape. Statistics deletion from one pc does now not dispose of information stored on different blockchain network devices. Hence, there may be no chance of records loss or change. The statistics on a blockchain is immutable. It permits precise documentation of data intake, together with in which, when, and how it's far applied and who is the use of it. Blockchains are regulated by way of codes, eliminating the want for third party regulations and making them a more cozy choice. Blockchain is transforming industries which includes healthcare, agriculture, finance, and banking. Cloud computing has become crucial in modern corporate world that extra reliance and accompanying risks is probably risky. The security, compliance, and centralized design of the cloud may also pose a tremendous enterprise hazard. On the other hand, Blockchain appreciably influences storage, transactions, and business operations.

As an end result, merging Blockchain with the cloud will increase safety and decentralization while enhancing authorization, privateness, and efficiency. Industries will grow with the help of Blockcloud as per the current scenario.

7. FUTURE WORK

Future work in the era of considerable evaluate of the literature on cloud Blockchain services and packages, we endorse many viable destiny directions diagnosed to stimulate research in this promising vicinity, therefore, it's miles obvious from the discussion that a strong Blockchain framework for the cloud encompasses any challenges to remember when integrating and deploying it. We believe that the main effects of this survey will provide theoretical guide and realistic advice to researchers and Blockcloud customers.

REFERENCES

[1] Manoj, K. S. (2023, February). Secure Blockchain Banking Cloud with Error Recovery Processes. In 2023 3rd International Conference on Innovative Practices in Technology and Management (ICIPTM) (pp. 1-6). IEEE.

[2] Tarannum, W., & Abidin, S. (2023, March). Integration of Blockchain and Cloud Computing: A Review. In 2023 10th International Conference on Computing for Sustainable Global Development (INDIACom) (pp. 1623-1628). IEEE.

[3] Tong, J., Zhao, B., & An, Y. (2023). A novel multi-objective service composition architecture for blockchain-based cloud manufacturing. Journal of Computational Design and Engineering, 10(1), 185-203.

[4] Al-Farhani, L. H., Alqahtani, Y., Alshehri, H. A., Martin, R. J., Lalar, S., & Jain, R. (2023). IOT and Blockchain-Based Cloud Model for Secure Data Transmission for Smart City. Security and Communication Networks, 2023.

[5] KN, R. P. (2023, April). The Intelligent Information Integrity Model to Ensure the Database Protection Using Blockchain in Cloud Networking. In 2023 International Conference on Distributed Computing and Electrical Circuits and Electronics (ICDCECE) (pp. 1-7). IEEE.

[6] Sandeepkumar, E. V., & Suresh, A. (2023, January). Blockchain Assisted Cloud Storage For Electronic Health Records. In 2023 International Conference on Computer Communication and Informatics (ICCCI) (pp. 1-6). IEEE.

[7] Yasmin, S., & Devi, G. S. (2023, January). Blockchain and Cloud-based Technology in Automotive Supply Chain. In 2023 5th International Conference on Smart Systems and Inventive Technology (ICSSIT) (pp. 771-775). IEEE.

[8] Murthy, C. V. B., Shri, M. L., Kadry, S., & Lim, S. (2020). Blockchain based cloud computing: Architecture and research challenges. IEEE access, 8, 205190-205205.

[9] Sengar, H., & Joshi, S. (2020). CYBER RISK MITIGATION IN CLOUD COMPUTING ENVIRONMENTS USING BLOCKCHAIN TECHNOLOGY. PalArch's Journal of Archaeology of Egypt/Egyptology, 17(6), 4648-4655.

[10] Rashmi, M., William, P., Yogeesh, N., & Girija, D. K. (2023, May). Blockchain-Based Cloud Storage Using Secure and Decentralised Solution. In International Conference on Data Analytics and Insights (pp. 269-279). Singapore: Springer Nature Singapore.

[11] Li, W., Wu, J., Cao, J., Chen, N., Zhang, Q., & Buyya, R. (2021). Blockchain-based trust management in cloud computing systems: a taxonomy, review and future directions. Journal of Cloud Computing, 10(1), 1-34.

[12] Kim, M., Yu, S., Lee, J., Park, Y., & Park, Y. (2020). Design of secure protocol for cloud-assisted electronic health record system using blockchain. Sensors, 20(10), 2913.

[13] Jain, A., & Jat, D. S. (2022). Supply Chain Management Using Blockchain, IoT and Edge Computing Technology. In Innovative Supply Chain Management via Digitalization and Artificial Intelligence (pp. 87-98).

Singapore: Springer Singapore.

[14] Cha, J., Singh, S. K., Kim, T. W., & Park, J. H. (2021). Blockchain-empowered cloud architecture based on secret sharing for smart city. Journal of Information Security and Applications, 57, 102686.

[15] Agapito, G., & Cannataro, M. (2023). An Overview on the Challenges and Limitations Using Cloud Computing in Healthcare Corporations. Big Data and Cognitive Computing, 7(2), 68.

[16] Habib, G., Sharma, S., Ibrahim, S., Ahmad, I., Qureshi, S., & Ishfaq, M. (2022). Blockchain technology: benefits, challenges, applications, and integration of blockchain technology with cloud computing. Future Internet, 14(11), 341.

[17] Ghanmi, H., Hajlaoui, N., Touati, H., Hadded, M., & Muhlethaler, P. (2023). Blockchain-Cloud Integration: Comprehensive Survey and Open Research Issues.

[18] Khanna, A., Sah, A., Bolshev, V., Burgio, A., Panchenko, V., & Jasiński, M. (2022). Blockchain–cloud integration: A survey. Sensors, 22(14), 5238.

[19] Jabbar, R., Dhib, E., Said, A. B., Krichen, M., Fetais, N., Zaidan, E., & Barkaoui, K. (2022). Blockchain technology for intelligent transportation systems: A systematic literature review. IEEE Access, 10, 20995-21031.

[20] Tikkakoski, T. (2023). Facilitating Management and Usage of Health-Related Data through Smart Contracts and Blockchains.

[21] Gunanidhi, G. S., & Krishnaveni, R. (2022, February). Improved security blockchain for IoT based healthcare monitoring system. In 2022 Second International Conference on Artificial Intelligence and Smart Energy (ICAIS) (pp. 1244-1247). IEEE.

[22] Banaeian Far, S., & Hosseini Bamakan, S. M. (2023). NFT-based identity management in metaverses: challenges and opportunities. SN Applied Sciences, 5(10), 260.

[23] Chen Yingwen, Meng Linghang, Zhou Huan, & Xue Guangtao. (2021). A blockchain-based medical data sharing mechanism with attribute-based access control and privacy protection. Wireless Communications and Mobile Computing, 2021:1–12.

[24] Deshwal, A., & Miglani, S. (2022). 15 Enhancement of the Healthcare Sector and the Medical Cyber-Physical System with the Help of Blockchain Technology. Cyber-Physical Systems: A Comprehensive Guide, 15-42.