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Utilizing 5G Mobile Connection as a Node in Layer 1 Proof of Authority Blockchain Used for Microtransaction

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***Abstract*—**The paper contributes to the feasibility of using a 5G mobile connection as a node for a Proof of Authority (PoA) blockchain, which is used for microtransactions at the same time. It uses the phone number identity of the users that are linked to the crypto wallet address. It also proposed a consensus protocol based on PoA blockchain; PoA is a permission blockchain where consensus is achieved through a set of designated authority rather than through mining, as is the case with a Proof of Work (PoW) blockchain. This report will first explain the concept of a PoA blockchain and how it works. It will then discuss the potential benefits and challenges of using a 5G mobile connection as a node in such a blockchain, and finally, the main open problem statement and proposed solutions with the requirements.

***Keywords*—**5G, mobile, connection, node, PoA, blockchain, microtransaction.

I. Introduction

THE concept of blockchain has been around for a while now. Still, it is only with the advent of Bitcoin and other cryptocurrencies that blockchain technology has begun to be understood and utilized by the masses [1]. In its simplest form, a blockchain is a digital ledger that records transactions securely in a tamper-proof manner. The potential applications of blockchain are vast, and one area that is gaining traction is the use of blockchain for microtransactions. Microtransactions are small financial transactions, typically conducted online and often used in video games or other digital platforms.

The problem with microtransactions is that they are often conducted using fiat currency, which can be subject to volatile swings in value. The value of a microtransaction can change dramatically between the time it is conducted and the time it is settled. Blockchain, with its built-in security and immutability, has the potential to solve this problem by allowing microtransactions to be conducted using cryptocurrencies. It would allow for near-instant settlements and eliminate the risk of value fluctuation. The problem in today blockchain is the high gas fee [2].

PoA blockchain is a type of crash fault tolerance consensus algorithm, which improves the efficiency of private and consortium blockchains. Unlike 5G, it does not have the longest chain or confirmation rule. New blocks are directly added to the chain with the unanimous approval of a group of trustworthy validators. Cryptographic puzzle solving is not a sport of the validators. As a result, executing this algorithm only requires a little amount of computing power. PoA relies on a set of N dependable nodes known as authority, each of which is identified by a unique ID or public key.

The transactions that are stored are verified by the stakeholders later. Certain attributes of the blockchain result in the benefit of different domains such as cryptocurrency, financial sectors, the Internet of Things, etc. The various attributes are decentralization, transparency, auditability, and cryptographic security, among many others. The data are stored securely in a blockchain. This report aims to explore the potential of using 5G mobile networks as a node in PoA blockchains that are used for microtransactions. PoA uses a consensus algorithm that gives certain nodes, called authority, the power to validate blocks and add them to the chain [3]. The network must authorize nodes in a PoA blockchain in order to participate in validation. This makes PoA blockchains more scalable than public blockchains, which anyone can join. Microtransactions are small financial transactions that occur online, often using cryptocurrency. They are used to purchase digital goods and services or to make small payments in lieu of traditional currency. Likewise, 5G is the fifth generation of mobile networks and is expected to be rolled out worldwide over the next few years. The 5G network is much faster than previous generations of mobile networks, up to 100 times faster than 4G. This increased speed and capacity will allow more data-intensive applications, such as streaming video and virtual reality, to be used on mobile devices.

II. State of the Art in PoA Blockchain

Data within a blockchain are stored chronologically and encrypted for added security. Hence, tampering or forging data is not possible. Blockchain technology uses distributed node consensus algorithms that make and update data and cause encryption for security access. There are many stages of blockchain development. The Embryo phase is the first phase or "Blockchain 1.0". Cryptocurrencies represent the embryo stage, among which Bitcoin is the most popular and good. The second phase of "Blockchain 2.0" contains the creation of smart contracts that are advanced and are available for achievable programs and commands. This expands the application area and scope of the blockchain [4]. The second phase of the blockchain is responsible for extending the blockchain application to

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different industries in such a way that the different blockchains collaborate with each other.

PoA is an algorithm that is used with blockchains and is responsible for delivering fast transactions through a consensus mechanism that is based on identity as a stake. VeChain, Reltime and Xodex are the most notable platforms of PoA. The approved accounts in PoA-based networks corroborate the transactions and blocks. These are known as validators. The validators run the software and allow them to put the transactions in blocks [5]. This process is automated, and there is no requirement for the validators to monitor the computers.

III. Problem Statement

Microtransactions usually take the form of purchasing in-game items with real-world currency. These items can be purely cosmetic, such as new skins or outfits, or they can offer a gameplay advantage, such as a faster means of travel or improved weapons. Microtransactions have become increasingly commonplace in games over the past decade, and their use has been controversial.

There are several reasons why microtransactions can be problematic. Firstly, they can create an uneven playing field, where those willing or able to spend more money have a distinct advantage over those who are not [6]. There is also a lack of trust between users and authority. This is because no centralized authority controls the network [7]. The users must rely on consensus mechanisms to ensure that transactions are valid and correct. However, these mechanisms are not perfect and can sometimes fail. This can lead to double spending and other problems. Finally, blockchain networks are often slow and expensive to use. This is because they are reliant on peer-to-peer networking and consensus mechanisms. This can make them difficult to scale and use for real-world applications.

The PoA blockchain is a new type of blockchain that seeks to solve these problems. The PoA blockchain is a permissioned network that uses a PoA consensus mechanism. This means that only certain users ("validators") are allowed to add blocks to the chain. Validators are chosen by the community and must have their identity verified by a trusted third party. This verification process ensures that validators are who they say they are and helps to prevent Sybil attacks.

The PoA consensus mechanism is more efficient than other mechanisms, such as PoW. This is because it does not require users to compete against each other to add blocks to the chain. Instead, they must agree on which validator to add to the next block. This can lead to faster transaction speeds and lower costs.

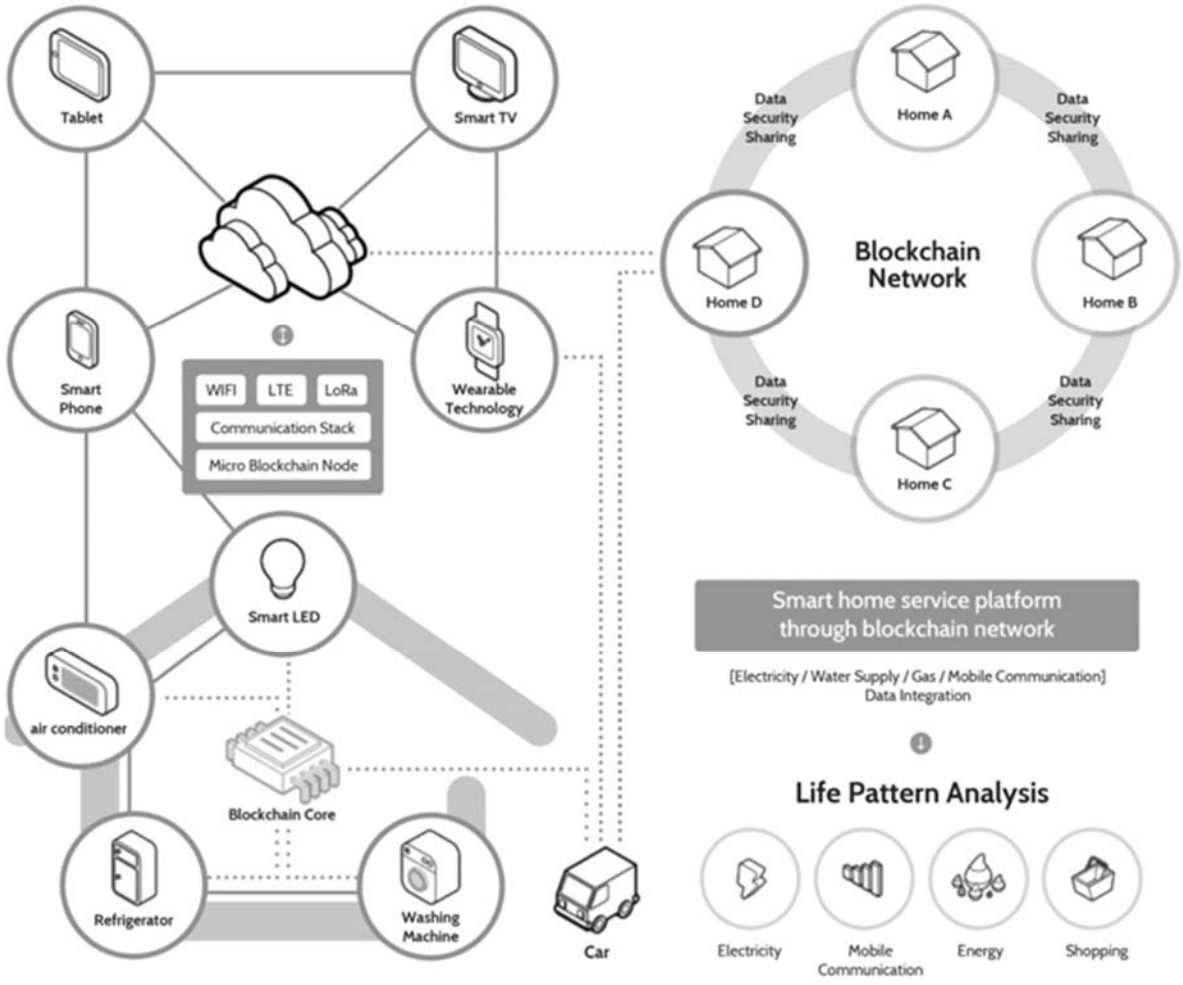

Fig. 1 Where the Microtransaction is ahead

The PoA blockchain has several other features that make it attractive to businesses and governments. For example, the PoA blockchain can be used to create "private" or "permissioned" blockchains [8]. Only certain users are allowed access to the network. It can be useful for companies who want to use blockchain technology but do not want to make their data public.

The PoA blockchain is still in its early stages, and a number of challenges need to be addressed. For example, it is not clear how the network will be governed. There also needs to be more research into the security of the PoA consensus mechanism. However, the PoA blockchain has the potential to solve many of the problems that have been holding back blockchain technology.

PoA is not without its own weaknesses. Recently, a group of researchers from Cornell University published a paper detailing how they were able to successfully carry out a Sybil attack on a PoA-based blockchain [9].

Blockchain microtransactions have a number of advantages over traditional microtransactions:

- Because blockchain transactions are irreversible, there is no need for a third party to hold or process payments. This reduces the fees associated with microtransactions, as there is no need to pay for an intermediary.
- Blockchain microtransactions are nearly instant, meaning users can receive their goods or services immediately after payment. This is a major advantage over traditional microtransactions, which can often take days or weeks to process.
- Blockchain microtransactions are scalable, meaning service providers with large user bases can use them without running into scalability issues.

Despite these advantages, blockchain microtransactions are not without their challenges:

- Because blockchain microtransactions are irreversible, service providers must be sure they can trust the user making the payment. This is a major challenge, as it is often difficult to verify the identity of a user on the blockchain.
- Blockchain microtransactions are still in their infancy, and there is a lack of infrastructure and support for them. This means that service providers must be willing to invest time and resources into developing their blockchain-based microtransaction systems.
- Because blockchain microtransactions are pseudonymous, service providers must be careful to protect their users' privacy.

Using consortium blockchain concept in microtransaction model for better service levels, data privacy, and security. Blockchain technology can help to restore trust in online services by providing a decentralized and tamper-proof platform for storing data and transactions. The consortium blockchain is a type of blockchain jointly managed by a group of organizations rather than a single entity. This type of blockchain is well suited for businesses that need to share data and transactions but do not want to publicize this information. Businesses can improve their service levels by using a consortium blockchain while still maintaining control over their data. In addition, consortium blockchains can provide better data privacy and security than traditional centralized databases.

IV. Stand-Alone Server Node to Mobile Node

The 5G mobile connection can be used as a node in the PoA blockchain. The 5G network provides high speed and low latency, which is essential for blockchain applications. In addition, using 5G will allow for more transactions to be processed per second, making it ideal for microtransactions. The use of 5G will also help to improve the security of the blockchain as it will allow for more data to be stored on the network. This will make it more difficult for hackers to access the data and tamper with it.

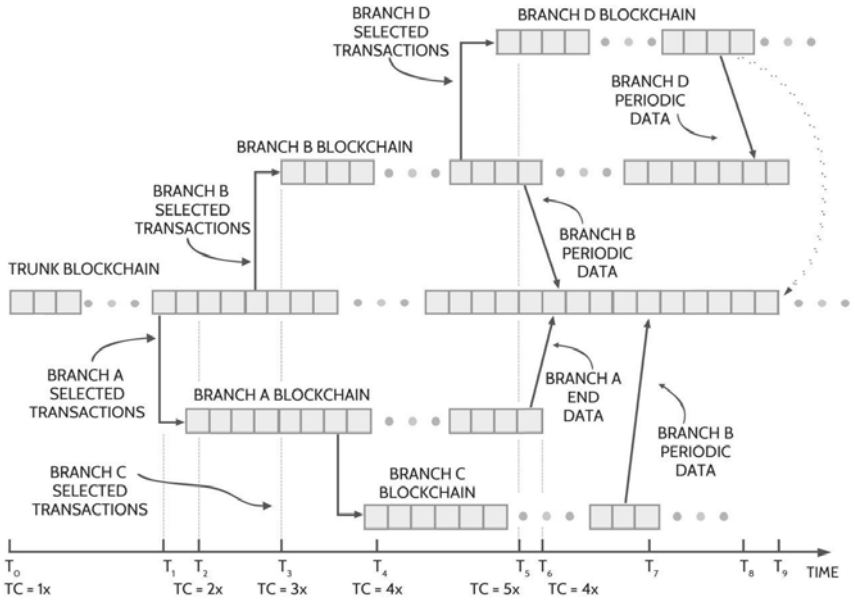

Fig. 2 Multi-Tenant PoA solution used for Mobile Node

The PoA consensus algorithm is well suited for use with 5G mobile connection nodes as it does not require a large amount of energy to run. This is important as 5G mobile connection nodes are likely to be powered by batteries. Using 5G will also help reduce the cost of running a blockchain as it will allow for more transactions to be processed per second. In addition, using 5G will help improve the security of the blockchain as it will allow for more data to be stored on the network. This will make it more difficult for hackers to access and tamper with the data.

The PoA blockchain is designed to be more scalable and faster than other blockchains. The PoA blockchain can be used for a variety of applications, including micropayments.

There is a growing interest in using blockchain technology in the public sector. The PoA blockchain is well suited for use in the public sector due to its scalability and speed. PoA can be used for a variety of applications in the public sector, including micropayments. Research on the use of blockchain technology in the public sector is still in its early stages, but there is a lot of potentials for the PoA blockchain to be used for a variety of applications.

There are several benefits of using the PoA blockchain for micropayments in the public sector. First, the PoA blockchain is very fast and can handle a large number of transactions per second. This is important for micropayments, which are often small payments that need to be processed quickly. Second, the PoA blockchain is very scalable and can handle many users. This is important for the public sector, which often has many users. Third, the PoA blockchain is very secure and has a strong consensus algorithm. This is important for the public sector, which often deals with sensitive data.

The use of 5G mobile connection nodes in the PoA blockchain can help to improve the efficiency of the blockchain and reduce its environmental impact. The use of 5G will also help to improve the security of the blockchain as it will allow for more data to be stored on the network. This will make it more difficult for hackers to access the data and tamper with it.

The explosion of mobile data and the ever-growing demand for higher bandwidth has necessitated the development of a new generation of wireless technology known as 5G. This next generation of wireless will provide significantly higher speeds and capacity while also reducing latency. One key factor that will enable these advances is using a much larger frequency range, including millimeter wave (mmWave) frequencies. These high frequencies have been underutilized in the past due to their propagation characteristics, which limit their range and make them more susceptible to interference and obstacles.

Another key factor that will enable the advances in 5G is the use of massive MIMO (Multiple Input, Multiple Output) [10]. Massive MIMO is a technology that uses many antennas at the base station to provide spatial multiplexing, improving spectral efficiency and reducing interference.

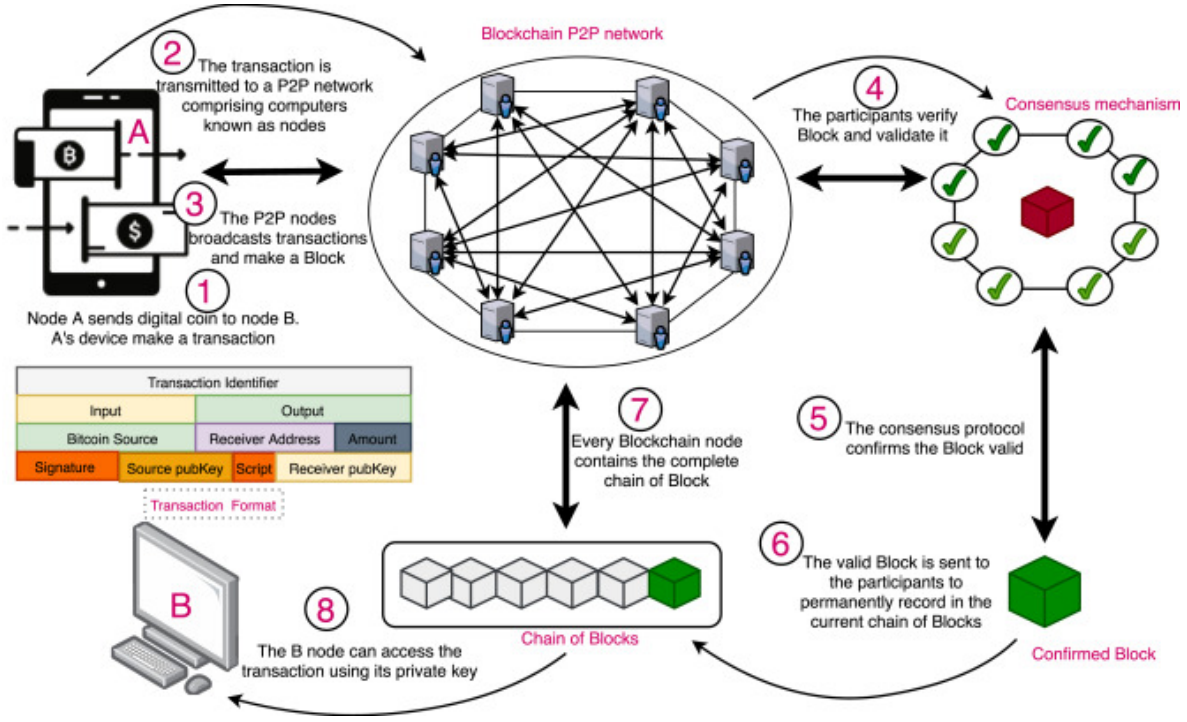

Fig. 3 Blockchain P2P network

While 5G will bring man y benefits, one significant challenge is deploying the necessary infrastructure. The high frequencies used by 5G have a limited range, which means that a denser network of small cells will be required [11]. Additionally, the use of massive MIMO will require more base stations than in previous generations of wireless technology. One potential solution to this challenge is the use of blockchain technology. Blockchain is a distributed database that can be used to store data in a decentralized manner. This could potentially be used to store information related to 5G base stations and their

locations. By storing this information on a blockchain, mobile operators could quickly and easily deploy 5G infrastructure. Another potential application of blockchain technology is the use of smart contracts. Smart contracts are computer programs that can automatically execute transactions when certain conditions are met [12]. This could be used to automate the process of leasing infrastructure from landowners or other parties.

New security solutions will also be required for 5G due to the increased use of high-speed data and millimetre wave frequencies. One potential solution is the use of quantum cryptography. Quantum cryptography is a type of cryptography that uses the principles of quantum mechanics to secure communications. This could be used to secure the data transmissions between 5G base stations and devices.

In a federated learning setting, where data are distributed across a network of devices, this advantage is even more pronounced. By using blockchain, 5G networks can ensure that data remains private and secure, even when it is distributed across a network. This makes federated learning an attractive option for 5G networks, which are expected to be highly distributed.

In addition, blockchain can provide a way to ensure that data are not tampered with or lost. When data are stored on a blockchain, it is immutable and can be easily verified. This means that data stored on a blockchain are more secure than data stored on a centralized server.

V. Proposed Solution

Blockchain can help to prevent double-spending attacks by providing a public record of all transactions that have taken place [12]. This means that it would be easy to see if someone has tried to spend the same currency twice, and the transaction can be rejected.

It is possible to use a blockchain to create a model that can help to prevent double-spending attacks. This model would work by having a central authority that validates all transactions. This authority would keep a record of all transactions that have taken place and check each new transaction against this record. If the authority sees that the same currency has been spent twice, then it can reject the transaction.

While this model would require a central authority, it would help to prevent double-spending attacks and could be used in conjunction with other security measures, such as cryptographic signatures.

The PoA blockchain is an excellent choice for microtransaction applications because of its high scalability and low cost. The main advantage of the PoA blockchain over other blockchain platforms is its ability to handle a large number of transactions with minimal fees. In addition, the PoA blockchain is able to confirm transactions quickly and securely. This makes it an ideal choice for applications that require fast and secure transaction processing.

The use of the PoA blockchain for microtransactions has a number of benefits. First, it is a very scalable platform that can handle a large number of transactions with minimal fees. Second, it is able to confirm transactions quickly and securely. This makes it an ideal choice for applications that require fast and secure transaction processing. Finally, the microtransactions that can be processed on the PoA blockchain are much smaller in value than those that can be processed on other blockchain platforms. This is because the PoA blockchain uses a PoA consensus algorithm instead of a Proof of Work or Proof of Stake algorithm. The PoA algorithm is more efficient and requires less computational power to confirm transactions. As a result, the PoA blockchain is able to confirm transactions far more quickly than other blockchain platforms.

The 5G mobile connection can be used as a node in the PoA blockchain, which can be used for microtransactions. It will provide secure, low-cost, and high-speed transaction settlement infrastructure. This will enable a new class of applications, such as micropayments, instant payments, and high-frequency trading. In the PoA blockchain, each node is assigned a specific task, such as validating transactions or maintaining the ledger. The nodes are connected to each other and share the same copy of the ledger. When a transaction is made, it is broadcast to all the nodes in the network. The nodes then validate the transaction and add it to the ledger. Once a transaction is added to the ledger, it cannot be changed or reversed.

VI. Requirements

The advent of 5G technology presents a unique opportunity for deploying blockchain nodes on mobile devices. The 5G network offers high speeds and low latency, which is ideal for running a node on a mobile device. In addition, 5G provides support for multiple simultaneous connections, making it possible to connect to multiple blockchain networks at the same time. This opens up the possibility of using a mobile device as a node in a PoA blockchain.

A PoA blockchain is a type of consensus mechanism that allows for trustless and permissionless transactions. This makes it well-suited for use cases such as microtransactions. In a PoA blockchain, each node has a “stake” in the network, which is used to determine their level of authority. The higher the stake, the more authority a node has.

A 5G mobile device could be used as a node in a PoA blockchain by staking its connection to the network. The connection could be used to validate transactions and add them to the blockchain. In addition, the node could also be used to relay transactions to other nodes in the network. This would allow for a decentralized and trustless network that is not reliant on any central authority.

The use of a 5G mobile device as a node in a PoA blockchain has potential benefits for both users and businesses. For users, it would provide a way to participate in the blockchain without having to invest in hardware or software. In addition, it would allow users to access the blockchain from anywhere in the world. For businesses, it would provide a way to reach new customers and markets. In addition, it would allow businesses to reduce their dependence on central authority.

The use of 5G mobile devices as nodes in PoA blockchains is a promising new technology that could have a major impact on the way we use and interact with blockchain networks.

There are several potential benefits of using a 5G mobile device as a node in a PoA blockchain. First, it would provide a way for users to participate in the blockchain without having to invest in hardware or software. Second, it would allow users to access the blockchain from anywhere in the world. Third, it would allow businesses to reach new customers and markets. Fourth, it would allow businesses to reduce their dependence on central authority.

Some of the challenges associated with using a 5G mobile device as a node in a PoA blockchain include the need for a high level of understanding among users, the potential for network congestion, and the possibility of theft or loss of the device.

Overall, the use of a 5G mobile device as a node in a PoA blockchain is a promising new technology with potential benefits for both users and businesses. However, there are some challenges that need to be addressed before this technology can be fully realized.

In order to connect a 5G mobile connection as a node in a PoA blockchain, a few requirements and challenges must be met. First, the 5G network must have high speed and low latency in order to support the transaction processing that is required for blockchain. Second, the node must be able to remain online and operational at all times, as any downtime could result in missed or invalid blocks. Third, the node must have a high degree of security to protect against attacks. Finally, the node must be able to process transactions quickly and efficiently in order to keep up with the rest of the network. While these challenges must be met in order to create a 5G-based node in a PoA blockchain, doing so could provide many benefits. First, it would allow for near-instantaneous transaction processing times. Second, it would greatly reduce the amount of energy required to run the network. Third, it would allow for a more decentralized and distributed network. Ultimately, utilizing a 5G mobile connection as a node in a PoA blockchain could provide many benefits and help to make the network more efficient and secure.

VII. Conclusion

Globalization and digitalization have led to many challenges in the present, and they will lead to many more obstacles in the future. Hence, one needs to start adapting to the increasing cutting-edge and up-to-date tools and technologies. Blockchain technology is a revolutionizing arena in the daily life of people. There are many benefits of using blockchain, and there is a state-of-the-art PoA blockchain implemented in many fields. However, blockchain has faced many challenges, like integration and coexistence with rules and regulations.

This report has investigated the feasibility of using a 5G mobile connection as a node in a PoA blockchain used for microtransactions. It was found that there are a number of potential benefits to using a 5G mobile connection in this way, including the fact that 5G mobile connections are much faster than traditional broadband connections and thus would be able to process transactions much quicker. Additionally, the use of a 5G mobile connection would also allow more security than older generations of mobile networks. However, there are also a number of challenges associated with using a 5G mobile connection as a node in a PoA blockchain, including the fact that 5G mobile networks are not yet widely available, and thus, there would be a limited number of nodes in the network. Additionally, 5G mobile connections are also much more expensive than traditional broadband connections, which could make it cost-prohibitive for some users. Nonetheless, the use of a 5G mobile connection as a node in a PoA blockchain has the potential to offer a number of benefits and should be further investigated.

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