HIGH SCHOOL EDITION
Journal of Student Research
Volume 13 Issue 1 (2024)

How can Alternative Applications of Blockchain Technology Create Opportunities for Improvement in Different Fields?

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ABSTRACT

Recent interest in cryptocurrency has fueled massive price increases and given rise to a host of new apps and software within the field of decentralized finance. This interest is definitely justified, since crypto offers several notable benefits over traditional currency. The underlying technology behind it, blockchain, was invented more than a decade ago for this purpose. Blockchain's decentralized nature offers security and efficiency, while its immutability increases the transparency of actions taken on it. As a result, it is appealing for a wide variety of industries, many of which are already taking advantage of its versatility to make improvements. They include: information storage - decentralized servers are more difficult to hack into, since there is not a single location, such as a company's servers, that a hacker can attack. Real estate - storing property deeds on the blockchain speeds up transactions and increases transparency. The current paper system is slow, and records are not easily accessible.

Internet of Things - passwords and other data can be stored on decentralized servers, where tampering with data is almost impossible. Digital identity verification - creating and using an identity on the blockchain can act as a digital watermark that can be assigned to any online transaction. Some companies are trying to reduce the risk of identity theft for consumers by creating a system that utilizes blockchain. Many other useful applications for blockchain technology exist, and the majority of them are relatively new and not fully developed yet. This paper examines those applications and how they function in detail, also comparing their effectiveness with non-blockchain systems.

Introduction

Recent interest in cryptocurrency has fueled massive price increases and given rise to a host of new apps and software within the field of decentralized finance. This interest is definitely justified, since crypto offers several notable benefits over traditional currency. The underlying technology behind it, blockchain, was invented more than a decade ago for this purpose. Blockchain's decentralized nature offers security and efficiency, while its immutability increases the transparency of actions taken on it. As a result, it is appealing for a wide variety of industries, many of which are already taking advantage of its versatility to make improvements. Many other useful applications for blockchain technology exist, and the majority of them are relatively new and not fully developed yet. This paper examines one specific application - information storage - and describes the use cases of this type of blockchain technology.

Overview of Blockchain Technology

A blockchain is a public and decentralized digital ledger that can record transactions. It was first created by Satoshi Nakamoto in 2008, and is a key part of the technology behind Bitcoin. Blockchain has several key features that set it apart from traditional methods of storing data.

First, it is decentralized, so there is no authority or third party that has complete control. Instead, storage is shared in a peer-to-peer network, where multiple different computers each have a copy of the ledger and receive data from each other instead of a central server. This unique technology allows transactions to process faster, because the work of performing a transaction is distributed over multiple computers. A peer-to-peer network also becomes increasingly efficient as it gets larger, since each computer contributes resources to it. This is in contrast to a traditional client-server network, in which a large number of requests would burden the central server and make it slower. In addition, because the ledger is distributed to every computer that is part of the network, records are both transparent and easily accessible.

Blockchain is immutable, meaning that records cannot be changed. Data is stored in 'blocks' that also contain information about the previously created block and a timestamp. All of the data is then encrypted by a hash function, which outputs some string of letters and numbers (called a hash). It links the blocks to form a chain where altering one of them 'breaks' it - the hash changes with the block's data, so the altered block's hash no longer fits with the others.

Blocks themselves are created with a consensus mechanism - this is a process in which all of the computers on the network agree to validate and add transactions to the public ledger. Blockchains can have different consensus mechanisms. For example, Bitcoin uses a mechanism called proof-of-work, which involves computational resources being used to solve a mathematical puzzle by rapidly generating random numbers. When computers put in work to solve these puzzles, it proves to the Bitcoin network that they are not bad actors and gives them the right to validate and add transactions to the ledger. Proof-of-work makes it extremely difficult for people to alter the blockchain for their own purposes, since a majority, or more than 50%, of the computational power on a network is needed to approve any transaction.

Smart contracts are programs stored on a blockchain that can run automatically when a transaction occurs. They can be made to perform virtually any task that a computer might be used for, from sending notifications, giving money to a certain party, or registering a vehicle. The versatility of blockchain technology is largely thanks to this capability. Smart contracts also add speed and accuracy to transactions, since they use computers to follow up immediately with any necessary processes.

Not only do blockchain features enable cryptocurrencies to provide benefits over normal money, but also those features have implications outside of the financial world. Uses of Blockchain technology include tracking assets through supply chains, facilitating real estate transactions, and sharing information securely. Bringing decentralization in to replace current systems can have benefits for a wide range of fields.

Information Storage Use Cases of Blockchain Technology

One specific area where there is tremendous application of this technology is the Information Storage sector. This section outlines several use cases of blockchain technology in this sector and provides real world explanations of how the technology is used.

When storing information on a blockchain, two types of methods exist - off-chain and on-chain. As its name implies, on-chain storage puts data directly on the blocks of a blockchain. Off-chain utilizes external storage to store data while using the blockchain only to store information about that data (the metadata). On-chain is generally more secure than off-chain, since putting everything on the blockchain means there is little to no risk of losing it. However, it is also more costly since blockchain is not efficient for storing large amounts of data. For this reason, most of the following applications of blockchain store at least some part of their data off-chain.

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already taking advantage of its versatility to make improvements. Many other useful applications for blockchain technology exist, and the majority of them are relatively new and not fully developed yet. This paper examines one specific application - information storage - and describes the use cases of this type of blockchain technology.

Encryption

Today, all kinds of information are stored digitally in the cloud. This typically means that people pay companies to store their data in a server, where it can be accessed remotely through the Internet. Another way to store information is through the blockchain, where multiple copies of data are stored on different decentralized servers instead of those of one company's. Even if a copy of the data becomes inaccessible for some reason, other copies would still exist; therefore, the risk of losing any of it is greatly decreased. Also, centralized data storage inherently allows a central entity to see or change data. These risks do not exist on a blockchain because it is immutable and protected by encryption.

Blockchain company Sia has developed an information storage system that relies on this concept. It allows customers to store data on a blockchain by paying a fee. Since a decentralized network requires multiple computers, it relies on third-party hosts to store information. When a customer uploads files to Sia, the data is encrypted, split up into pieces, and stored with multiple different hosts to improve its security. Hosts are rewarded with Sia's cryptocurrency Siacoin for providing storage space, and are incentivized not to lose customer data by money that they put up as collateral. As a result, Sia's system can provide a highly viable alternative to traditional cloud storage systems.

Internet of Things

The Internet of Things (IoT) refers to "the network of physical objects—'things'—that are embedded with sensors, software, and other technologies for the purpose of connecting and exchanging data with other devices and systems". Examples of IoT networks are found in everyday life, such as home security systems that involve cameras, alarms, and smoke detectors. Modern cars can be another instance of an IoT network, as they involve multiple sensors and, sometimes, onboard computers that can connect to the Internet. A common need of such networks, though, is the capability to store data from sensors. Most systems use centralized cloud storage, but blockchain is an alternative that can provide significant advantages. Its immutability means that data from sensors cannot be tampered with, which would be important in settings where security is a concern. Also, its decentralized nature means that it is immune to potential cyberattacks that centralized servers would be more vulnerable to.

Helium is a company that is making use of blockchain to power IoT. While traditional IoT devices rely on a regional server, Helium has created a decentralized network of servers that runs with the help of independent operators, called "The People's Network". These third-party operators are supported by fees paid by users of the network. A significant benefit of Helium's network is that almost anyone with a computer can be a host, meaning that more servers would be distributed over more distance. Users of IoT devices would then benefit from increased network speed and reliability, adding on to the inherent benefits of blockchain technology.

Healthcare

Hospital databases store large amounts of sensitive patient data and other important information. Currently, these databases are rather vulnerable to being shut down, with a 38% increase in cyberattacks on the healthcare industry during the last year. Another pressing issue in the healthcare industry is access to information across different databases. It is often the case today that transferring patient data from one hospital to another involves complicated and risk-prone processes. Avaneer Health is a company that targets these issues with blockchain technology in an effort to improve transparency for information storage in hospitals. The company has created its own decentralized network that healthcare organizations can connect to in order to receive and transfer data securely. According to their website,

the Avaneer network will streamline healthcare administration and save time by maintaining up-to-date records on the blockchain, while making sure that data is not compromised by keeping it in separate pieces across databases.

Potential Roadblocks and Considerations for using Information Storage with Blockchain Technology

While countless promising applications of blockchain technology exist, it is likely that not all of them will be able to offer enough value to replace their traditional counterparts. For all of its benefits, blockchain has significant drawbacks as well. Depending on where it is used, it may be that these disadvantages make it less viable than existing systems. This section discusses several reasons why some applications of blockchain may need further development before they are able to make improvements in their respective fields.

Scalability

A P2P network requires many nodes (computers) to be part of it for it to work effectively. In the case of the first such network—file sharing service Napster—millions of people joined with their personal computers because they wanted to download songs using Napster . However, such an incentive doesn't exist in every case. A company or organization without one, that is looking to store large amounts of data on a blockchain, might find acquiring a large number of computers difficult or impractical.

Energy Efficiency

As discussed in the introduction of this paper, a blockchain requires a consensus mechanism to run. Many blockchains use the same mechanism as Bitcoin does, proof-of-work (PoW). However, PoW is very energy-intensive, as miners on the network must continuously expend computing power in order to verify transactions. Several other consensus mechanisms have their own drawbacks as well, so finding the right one to use could be a challenge for anyone looking to implement a blockchain system.

Conclusion

There are several alternative applications of blockchain technology in the information storage sector. Blockchain technology can provide a secure and decentralized framework for information management, as well as enabling more efficient and transparent information exchange. Specifically, Sia, Helium, and XYZ demonstrate the potential for blockchain technology to revolutionize the way we store and manage information.

However, it is important to acknowledge that blockchain technology is not a solution to all problems. There are several drawbacks to using blockchain technology that must be considered, and may require additional research to overcome. Despite these challenges, the potential benefits are undeniable. As it continues to evolve and mature, it is likely that we will see an increasing number of use cases and applications emerging.

In conclusion, blockchain technology has opened up a world of possibilities for alternative applications in the information storage sector. As people continue to explore its potential, it is important to carefully consider the benefits and limitations of technology, as well as the unique requirements of different use cases.

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