

A Survey of Blockchain and Its Applications

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Abstract—Blockchain is one of the technologies which appeared in the last decade and brought a lot of promise with it. Much researches are being conducted actively to explore the full capabilities of Blockchain. Some believe that Blockchain is key for a decentralized society. Especially, we are considering blockchain as the security scheme to protect the privacies of the objects to be augmented in intelligent mobile augmented reality (IMAR) project. To do that, this paper describe an overview of an blockchain.

Keywords—Blockchain, Artificial Intelligence, Internet of Things, IoT, Decentralization

I. INTRODUCTION

The Blockchain is one of the technologies which appeared in the last decade and brought a lot of promise with it. Work is still being done to explore the full capabilities of Blockchain and where it can be used. Some believe that Blockchain is the key for a decentralized society. Our current ecosystem is completely centralized, meaning the power to make decisions is in the hands of a few [1]. For example our entire financial system is controlled by government authorized banks and in organizations decisions are made only by a few members of the board. Even giants like Google and Facebook, used by billions of users everyday decide what they want us to see.

Whereas a decentralized is with any authority, the power is distributed among all the members of the network [1]. Bitcoin is an example where there is no need of a bank or any middleman for the transactions because all the transactions are visible to all the parties and blockchain keeps the history as well which allows anyone in the network to trace back any transaction to its origin. This paper will discuss What is Blockchain and some areas where it is being implemented.

II. BLOCKCHAIN

A. Definition

Nowadays, blockchain is regarded as cryptocurrencies like bitcoin, ripple etc. but in reality, application of Blockchain are not at all limited to finance. As defined above blockchain is a decentralized digital ledger, and ledgers are used to the keep record of important stuff, financial or otherwise. Now imagine a ledger that cannot be stolen, corrupted or influenced by anyone, it can change our economy and our business structure as we know it [2].

B. Blockchain Structure

Simply put, blockchain can be imagined as a chain of blocks (Nodes) that are connected to each other. The transactions are stored throughout the network. Whenever a new transaction is or there is a change in any transaction, It has to be verified. The verification is via consensus between the nodes, there are different methods to achieve consensus. Information in Blockchain cannot be added or modified until the consensus is reached which makes it fraud-proof [2].

Framework of Blockchain can be divided into three layers namely Network Layer, Data Layer and Application Layer, for understanding sake. The Network Layer enables the Blockchain to connect and interact with the surroundings and the users. It also makes the entire system decentralized using peer-to-peer network and IP protocols. One of the most important task, consensus is achieved in this layer. Data layer is what makes the blocks in Blockchain. All the data and algorithms and other mechanisms like digital signature, Merkle tree and hash pointers are defined here. These algorithms and data structures help in making the Blockchain transparent and decentralized. The Application layer represents different application that can use Blockchain and its features like smart contracts and cryptocurrency for their purpose [2].

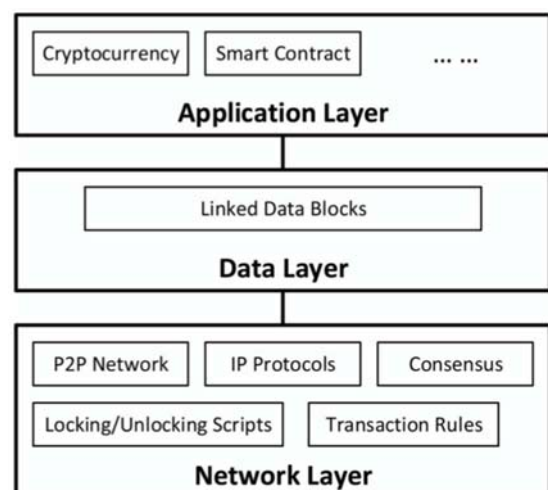


Figure.1. Framework of Blockchain

III. APPLICATIONS OF BLOCKCHAIN

Since the emergence of Blockchain, a lot of research is being done to explore what more can we do with this amazing technology. Applications of Blockchain are still being discovered, a few of those will be discussed here.

A. Financial Application of Blockchain

The first and largest use of Blockchain is in finance. It all started with bitcoin where blockchain was used to keep a record of the financial transaction, eliminating the middleman. Since bitcoin, different Blockchain technologies have given birth to different cryptocurrencies so much so there are hundreds of cryptocurrencies are being traded in the world right now [3]. Figure 2 shows us a bitcoin Blockchain. Whenever a new transaction is made it is broadcasted across the network. Miners record these transactions and after the verification, the transaction is cryptographically sealed and becomes a block. Now this block is attached with the previous block by hashing [4].

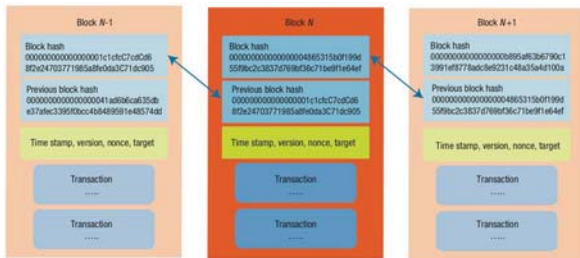


Fig.2. Bitcoin Blockchain

B. Smart Contracts

Exactly like the name says, Blockchain with smart contracts can eliminate the need for lawyers and intermediaries. Smart contracts will be available to all the parties and any change in the contract must be done after reaching Consensus. Smart contracts can be helpful in business as well as private dealing [2].

C. Blockchain and Internet of things

The Internet is a big part of everyone's life now, sometimes we don't even know how much connected everything is. All the devices like smart watches, smart fridges, cameras and your mobile phone etc. are connected to the internet. Internet of things(IoT) is basically a web of smart sensors and devise that is connected to the internet and are sharing information with each other to make our lives easier. There is no denying that IoTs has made our environment smarter for us, but they also make us vulnerable too. Imagine you live in a smart home, where every this connected and all the devices are tracking and watching you, to help but all your data are on the internet, which is not secure [5].

Blockchain as a decentralized and temper proof is very attractive for the Internet of things(IoTs) industry. The number of nodes in IoT is increasing day by day and so is the data that are being gathered. The security of data has always

been an issue, Blockchain can help secure and manage this data.

Fig.3 lists some challenges faced by IoT that can be potentially fixed by Blockchain features.

Challenge	Explanation	Potential blockchain solution
Costs and capacity constraints	It is a challenge to handle exponential growth in IoT devices: by 2020, a network capacity at least 1,000 times the level of 2016 will be needed.	No need for a centralized entity: devices can communicate securely, exchange value with each other, and execute actions automatically through smart contracts.
Deficient architecture	Each block of IoT architecture acts as a bottleneck or point of failure and disrupts the entire network; vulnerability to distributed denial-of-service attacks, hacking, data theft, and remote hijacking also exists.	Secure messaging between devices: the validity of a device's identity is verified, and transactions are signed and verified cryptographically to ensure that only a message's originator could have sent it.
Cloud server downtime and unavailability of services	Cloud servers are sometimes down due to cyberattacks, software bugs, power, cooling, or other problems.	No single point of failure: records are on many computers and devices that hold identical information.
Susceptibility to manipulation	Information is likely to be manipulated and put to inappropriate uses.	Decentralized access and immutability: malicious actions can be detected and prevented. Devices are interlocked: if one device's blockchain updates are breached, the system rejects it.

Fig.3 Blockchain based solutions for IoT

D. Blockchain in Developing countries

Blockchain can help eliminate or at least decrease the corruption in developing countries. It can help make all the transactions transparent and available to the public which in turn makes it hard for records to be modified. The transparency will make the system trustworthy and rights of the people will be protected [6].

E. Communication

Blockchain offers security and cannot be corrupted. These features have a major role in securing our communication and networks. Personal or individual communication aside, imagine what Blockchain can do for sensitive government institutes like army, police and Intelligence Agencies.

F. Medical Data

Medical Industry is very much interested in Blockchain technology to secure and track medical data collected from the patient. Medical data is extremely important, and any mistake or modification can lead to extreme results. With Blockchain data can be publicly available for use without the fear of mutation [2].

G. Blockchain and Artificial Intelligence

Blockchain and Artificial Intelligence (AI) are leading the innovations today. Both are making crazy strides in different domains. The recent breakthrough in Machine Learning (ML), particularly in the field of Deep Learning (DL) are being used for prediction, classification, Natural Language Processing and Image recognition etc.

It suffices to say that both AI and Blockchain have their strengths, but they also have some weaknesses. Blockchain faces issues like scalability, efficiency and security and the concerns regarding AI are the creation of fake news, privacy issues and monopolization of AI by giants. AI and Blockchain can help each other over their weaknesses.

Blockchain can provide decentralized platforms for AI like data, computing power and make the decisions of AI more transparent as data in Blockchain is public and contains all the records, thus making AI less intimidating [7].

In turn AI can help in the design and operation of Blockchain for scalability and can also automate and optimize the Blockchain for better performance. And Since data on the Blockchain is public, AI can help in the protection of user confidentiality and privacy [7].

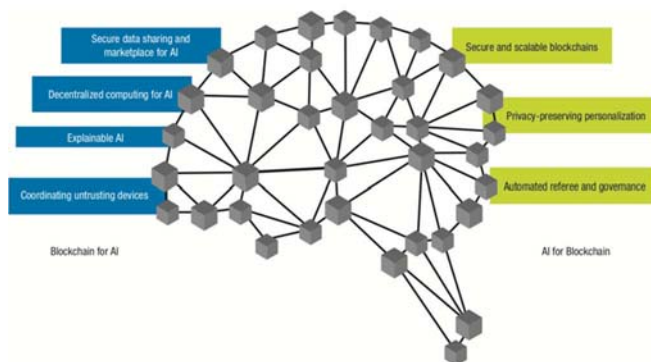


Fig.4 Blockchain and AI

IV. CONCERNS ABOUT BLOCKCHAIN

Even though Blockchain has a lot to offer and can help a lot of technologies by adding some value, there are still some concerns about it. It is a new technology and the more researchers explore it new and different sides of Blockchain are showing up. The major concerns about Blockchain are listed below [2].

Concerns	Explanation
Security	<p>Majority Attack: Majority attacks can be performed when controlling more than 50 % of miners in the blockchain. In this case, the entire process of writing blocks to the chain can be hijacked, and potentially erroneous blocks can be introduced</p> <p>Selfish Mining: In selfish mining, the attacker (miner) puts mined blocks in a private branch instead of broadcasting them. The private branch is then revealed to the public only when it is longer than the public chain. Once revealed, the longer private chain will replace the current public chain, increasing the mining rewards to the attacker to the detriment of the miners from the original public chain.</p>

Anonymity and Privacy	Blockchain allows its users to make transactions anonymously. Nonetheless, because the transactions are public, there may still be traceable clues that can reveal the identity and private information of users
Abuse of Blockchain	The use of cryptographically secure systems provides security for both benign and criminal users alike

V. CONCLUSION

The paper discusses what is Blockchain and how this technology is being implemented and integrated with other technologies to strengthen different sectors. A lot of research is still needed to explore the full protentional of Blockchain and its possible applications.

VI. ACKNOWLEDGMENT

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