A Review on the Integration of Blockchain and IoT

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Abstract

Blockchain innovation has been accelerated since the development of Bitcoin, the first and the biggest of the digital forms of money. Distributed ledger technology and blockchains are generating a lot of interest and spawning a lot of projects across a wide range of industries.The Internet of things (IoT) is a quickly developing innovation that improves people's association with one another and with their surroundings.It is also a key player behind the advancements in addition to many other fields. In order to meet their design requirements, IoT uses various types of sensors, smart meters,RFIDs, and actuators resulting in networks of growing size and complexity.This comes at the cost of raising scalability, security, authenticity, and reliability issues. This is where the blockchain fits and solves many IoT-related issues. Blockchain distinct features of transparency, traceability, reliability and security nominate it to play a vital role in tackling the problem in IoT networks and resolving their issues.This paper explains the main problems facing Iot-based systems and the role of blockchains in addressing them and also surveys the current work in the literature on researches discussing the integration of IoT with blockchain.

Keywords: Blockchain, Internet of Things (IoT), Challenges, Integration.

1 Introduction

Technology for data and communication is rapidly evolving [1]. The advancement of semiconductor devices and communication technologies has enabled a vast number of devices to communicate over the web/internet. These devices usually have sensors that can find information from the surrounding environment.The expression "Internet of Things" (IoT) was first presented by Kevin Ashton in 1999 [2]. IoT is the place where the physical and virtual universes meet.It is the major empowering agent of the carefully associated world where information gathered from gadgets and sensors are exchanged through the web to such an extent that items can be distantly observed and controlled without human intercession [2]. Blockchain, a type of distributed ledger technology, has been dubbed "the next big thing" by the popular press. In simple terms, a blockchain is a data structure that enables the creation and sharing of a tamper-proof digital record of transactions. It is very hard to change or remove blocks of information that are stored on the blockchain record [13]. The record consists of cryptographically connected blocks of transactions, which form a blockchain. It is very difficult to remove or alter information from blockchain ledger. The network authorises blocks using cryptographic methods. Each block also contains the hash value of the preceding block ("parent"), timestamps, and a noncerandom number, which is a unusual number used to validate the hash. A block can be added to the chain if the majority of the system's nodes agree on the authenticity of the transactions in it via consensus [6].

Currently, blockchain technology is categorized mainly into three categories: public blockchain, private blockchain, and consortium blockchain [5]. A private blockchain allows only those nodes from a certain organisation to join; it does not allow any nodes. It is also known as a integrated network since it is completely controlled by a one organisation. All records in a public blockchain are transparent to the whole public, and anybody may participate in the agreement cycle; hubs are not limited. In consortium blockchain, a gathering of preselected nodes can take part in an agreement cycle, consortium blockchain is made by a couple of associations is to some extent decentralized since just a few pieces of hubs would be chosen to decide the agreement.

2 Challenges in IoT System

It is well understood that IoT is based on the combination of numerous technologies such as communication and information technologies, sensors, and computing in addition to data analytic in collaboration to establish smart systems. The integration of such technologies results in increasing the complexity of IoT networks, especially for expanded ones. The surprising improvement of the IoT framework has opened innovative possibilities in different fields. In any case, the IoT actually has a few issues that stand like a divider notwithstanding the guaranteed spreading of IoT objects.The lack of trust and assurance is one of these concerns. The present IoT centralised approach employs a centralised third-party agency with complete control over data collecting and processing from different IoT items, with no constraints on how the information obtained is utilised. As a result, the central authority functions as a gemstone box for IoT users, which is a persuading circumstance for the majority of IoT device owners. The detailed challenges of IoT system is described in the Table 1.Blockchain is a capable to provide solution to the problem facing by IoT. Since, currently IoT system is large scale centralized system in which large number of devices interact through servers performing different tasks such as data storing, analyzing and authenticating.Table 1

3 Additional Blockchain Factors to Consider

Additional considerations must be considered when selecting whether to use a blockchain, and it must be determined if these aspects restrict one's capacity to apply a blockchain or a certain category of blockchain:

Visibility of data: Permission-ed type of blockchain systems will or will not make blockchain data available to the general public. Data is allowed to access to the node within the network.The blockchain may be seen and contributed to by anybody with access to a permissionless blockchain network. This raises a number of concerns that must be addressed. Is it necessary for everyone to have access to the application's data? Is it possible that having public data is harmful?

Records of Transaction : Some Blockchain system allow to available the public history of digital transaction available, from origin to all transaction. This factor may be advantageous for certain solutions but not for others.

Table 1 Blockchain deals with IoT challenges

Challenges	How Blockchain Resolve this Challenges
Failure at a single point	Blockchain technology enables distributed and independent interaction between system nodes, eliminating the need for a central server to oversee and manage interaction and operation between them. As a result, if one node goes down or fails, the entire network remains unaffected, overcoming the central piece of failure problem associated with the monolithic iot ecosystem.
Privacy	In blockchain system, cryptography is used which ensure that only authorized participants can use and perform data transaction.
Security	Blockchain provides significantly higher security by leveraging cryptography or the public key infrastructure, which provides more protection against numerous threats. Blocks are connected using a hash algorithm to dorm a chain where each block contains the hash of the last block embedded in its header. If any hackers want to alter the information of any block, they need to evaluate the hash along with the hashes of all successive block which is almost impossible task. Any adjustment to data is only permitted with the permission of the majority of network contributors, ensuring data integrity [11].
Cost	Blockchain is a decentralized and distrubted structure where a third agency or third-party is not necessary to supervise user communications So, no need to spend money on for installing a server with high software [13].
Scalability	Since the number of IoT devices are increasingly day by day so, the centralised paradigm is incapable of scaling and operating efficiently. The distributed and decentralized nature of the blockchain will manage the increase in IoT devices in an efficient way.
Flexibility	Through a variety of open source, Blockchain creates a flexible ecosystem for IoT devices of all kinds.
Susceptibility to Manipulation	In blockchain, manipulation, alteration, or update is only permitted with the permission of all participating parties. The blockchain system stops the manipulation or change of information to ensure data integrity.

Input of false data: Because a blockchain is a distributed ledger, some individuals may contribute fraudulent data to imitate data from legitimate sources (such as sensor data).The validation of information that enters a blockchain platform is challenging to automate. Wherever practical, smart contract application may include extra validattion to assist verify data.

Compliance: A system's usage of blockchain technology does not exclude it from adhering to all applicable rules and regulations. For example, there are several compliance issues relating to legislation and rules relating to PII or GDPR that state that some data should not be stored on the blockchain.

4 Literature Review

Using blockchain technology in conjunction with IoT is one of the most well-known topics that has drew the attention of a number of academics looking for ways to solve the challenges associated with centralised IoT design. According to recent research, blockchain technology is the best option for dealing with privacy and security issues in the IoT system. For instance, Zibin Zheng [5] presented an overview of blockchian architecture, technical challenges of blockchain like scalability, privacy leakage, energy consumption. Also, proposed how this scalability challenge of Blockchain is removed by storage optimization of blockchain and redesigning blockchain. Privacy leakage can be preserve by the public key and private key. The advantages and difficulties of combining blockchain with IoT system were also covered in this article. Nir Kshetri discussed whether blockchain is strengthening the internet of things(IoT), the answer of this question is "maybe", because [13] Blockchain overcome all the challenges of IOT - Cost and capacity constraint, Susceptibility to manipulation, Inadequate architecture, Downtime and service unavailability on cloud servers. Kiktenko [12] The proposed approach for constructing an IoT device blockchain comprises determining the type of IoT device, as well as the use cases and applications that will be implemented, the design of storage, security concerns, and the requisite blockchain characteristics. Gao, Zhimin—& Xu [3] Proposed a concept of Block-id which can be used for identity management, an unique system for managing people's identities that makes use of biometric authentication and trusted computing technologies. IoT gadgets are mostly used to deal with our everyday concerns and to work with our lives by detecting and collecting various types of data about our actual surroundings, which is then utilised to create new digital administrations. The Internet of Things has made massive development on a global basis, with billions of instruments sold and utilised globally to date across a variety of different markets [4].

5 Conclusion

Blockchain and IoT are two fantastic technologies, and combining them would produce excellent results in every imaginable sector. The paper discusses the development of the technologies, their integration, and their applications. The challenges IoT is dealing with centralized structure and blockchain role in resolving IoT issues. It presents the description of both IoT and Blockchain. This paper surveyed the work on IoT-blockchian integration and describe a summary of their work.

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