International Journal for Modern Trends in Science and Technology, 9(01): 54-58, 2023

ISSN: 2455-3778 online
DOI: https://doi.org/10.46501/IJMTST0901009
Available online at: http://www.ijmtst.com/vol9issue01.html

Blockchain for Improved Water Resource Management

Garvit Chutani[1] | Saras Garg[1] | Tushar Arora[1] | Sakshi Jha[1]

Department of Computer Science and Engineering Maharaja Agrasen Institute of Technology

To Cite this Article
Garvit Chutani, Saras Garg, Tushar Arora and Sakshi Jha. Blockchain for Improved Water Resource Management. International Journal for Modern Trends in Science and Technology 2022, 9(01), pp. 54-58. https://doi.org/10.46501/IJMTST0901009

Article Info
Received: 20 December 2022; Accepted: 14 January 2023; Published: 23 January 2023.

ABSTRACT

One of the main issues over the ages has been the lack of water. The water supply networks are now being affected by the increased deployment of IOT technology and devices. The development of a trustworthy, auditable, and transparent traceable system like Blockchain is the product of creative research. Blockchain, a distributed ledger technology, introduces a fresh, creative strategy for the development of centralized, distrust-free systems. The use of blockchain technology eliminates corruption since it can keep track of every transaction. Blockchain has built-in capabilities for fault tolerance, immutability, transparency, and full transaction tracing for records that are saved, as well as for digital asset representation and transaction executions. The blockchain-based water management system described in this study is completely decentralized, with IoT devices collecting data as it is setup and adding it to the blockchain. We use the Ethereum blockchain to represent a supplier to consumer use case in our blockchain-based water management system. We also talk about the network's participants' duties in the water management system. Finally, we assessed the benefits of blockchain-based water management over existing ones and showed how it might benefit contemporary society.

KEYWORDS: Blockchain, Decentralization, IOT-Devices

1. INTRODUCTION

The water management systems now in use only monitor the quality of the water supply. They do not offer adequate auditability, transparency, and traceability characteristics. However, we improve water management system safety by integrating blockchain technology into the water delivery systems. The use of IoT devices with less expensive connected devices into water management systems with fine granularity is the focus of several research and development organisations. However, the bulk of solutions operate on a centralized cloud infrastructure that lacks transparency, auditability, and secrecy. In some water management systems, it's crucial to sustain reliability and confidence among all of the system's participants. The fact that a tamper-proof distributed ledger system does not rely on a centralized third party makes it a great solution. Centralized servers are not needed for distributed ledger technology. The distributed ledger's records are all predicated on a consensus being reached by

at least a majority of the network's peers. The blockchain-based solution would just need a reliable connection to the closest peer in terms of IoT installation, whereas other systems need communication to the main cloud. Hence Blockchain makes traceability visible from many angles and fields.

Almost 70% of the world's population will live in cities by 2050. A massive, centralized infrastructure may not be practical or wise in emerging markets, where more than 90% of this urban growth is anticipated to take place. whether as a result of financial restrictions, governance issues, or climate change. In these circumstances, decentralized solutions might be crucial in enhancing conventional methods and increasing access to sanitary facilities. Block chain for better management of water resources. Block chain technology has the potential to profoundly change how water resources are managed and exchanged by offering a secure, transparent, and distributed ledger to record transactions between parties.

First and foremost, utilizing this capability may give homes, business customers, water managers, and policy makers access to the same information on the quantity and quality of water and allow them to make more informed decisions. A consumer's decision to conserve or use water would be better informed with such openness. In general, it may assist prevent dishonest behavior in circumstances where local authorities may have an incentive to falsify or suppress information about water quality.

Block chain technology may potentially enable peer-to-peer water ride trade in a particular basin, enabling water users who have enough or are willing to share their surplus resources with neighbors to do so around-the-clock without depending on a centralized authority or mechanism. Imagine if farmers in the same water basin may decide to swap their allotment depending on the most recent weather information, crop increases, market patterns, and long-term climatic trends.

In this work, we describe a fully decentralized traceable blockchain-based water management system for the management of water supply chains. For blockchain-based water management systems, we employ a distributed ledger implementation based on ethereum. The solution ensures participant transparency because the data from IoT devices is directly kept in the blockchain. We distribute different network users among resources and consumers. Also shown are the prerequisites and necessity of distributed ledger implementations in water management systems.

STRUCTURE OF PAPER

The paper is organized as follows: In Section 1, the introduction of the paper is provided along with the structure, important terms, objectives and overall description. In Section 2 we discuss blockchain theory. In Section 3 we disucss the problem that we are currently facing and proposed solution for the same. Section 4 shares information about IOT (Internet Of Things) devices that collect, transmit and share data . Section 5 shows us the architecture and the flow control throughout the process. Section 6 tells us about the utilization of the project/device. Section 7 tells us about the future scope and concludes the paper with acknowledgement and references.

OBJECTIVES

The water management systems now in use only monitor the quality of the water supply. However, we improve water management system safety by integrating blockchain technology into the water delivery systems. The use of IoT devices with less expensive connected devices into water management systems with fine granularity is the focus of several researches and development organisations. This project aims to address some of the problems in current systems by greatly minimizing the human intervention in the process and thus reducing costs and errors. The aim is to ease the task of both the buyer and the seller.

2. BLOCKCHAIN THEORY

2.1 Need for blockchain

There are some conditions that a water management system should meet.

- The main objective of any water management system is to conserve water. So adequate water supply tracing must be kept up.
- The information that IoT devices and other participants add to the records should be tamper- proof.
- No single organization or central authority should manage the system.
- Depending on their positions, the participants should only have limited access to the system.
- No member of the system, from the producer to the consumer, should be able to introduce fraud into the network.
- Records of water safety and quality must be safe and unchangeable.
- A transparent report on the customer's usage is required

2.2 Decentralization

P2P networks are made up of several nodes and lack a central device or management structure. All nodes in the network having maintenance capabilities are necessary for network maintenance. Nodes are treated equally. A consensus algorithm is used by blockchain technology to timely share data with the node server. The normal operation of the entire system is unaffected when some nodes are attacked, their data are altered, or they are purposefully eliminated.

2.3 Traceability

The blockchain stores data in time-stamped blocks, and each transaction is cryptographically linked to two neighboring blocks to ensure that every transaction can be tracked. Each transaction can be tracked and its timing is recorded thanks to the features of the blockchain. Any node can query any block of information in the blockchain, and the comprehensive recording and searchability of the completed transaction information significantly increases the interaction's transparency. The data are open, transparent, and cannot be altered, and all transaction records are verifiable at every node. These qualities promote trust and produce dependable cooperation.

3. PROBLEM AND PROPOSAL

In today's world, water quality is a major concern because it can lead to health problems. Unfortunately, there is no current technology that allows us to get real-time updates on the quality of the water that we use in our homes or other places. As a result, people may unknowingly consume contaminated water and become sick with diseases such as cholera, diarrhea, dysentery, hepatitis A, and typhoid. To address this issue, it is important to ensure that the water we use is properly treated and tested for contaminants to prevent these types of health problems.

The proposed project combines Internet of Things (IoT) and blockchain technology to create a decentralized platform that meets the needs of all users, including organizations, governments, and individuals. This project aims to provide safe drinking water to every household by regularly monitoring the quality of the water. The platform combines IoT technology with blockchain to create a decentralized system that can be accessed by all users, ensuring that everyone has access to accurate and up-to-date information about the quality of their water. By monitoring the water quality on a regular basis, the platform aims to prevent the spread of waterborne diseases and protect public health.

In addition to addressing current issues, the proposed project also focuses on the future by considering the potential involvement of multiple third-party organizations in the water supply chain. To provide a secure platform for distribution, the project aims to utilize blockchain technology. By implementing blockchain, the project can eliminate corruption through its ability to maintain accurate records of every transaction. Blockchain offers several inherent properties that make it well-suited for this purpose, including fault tolerance, immutability, transparency, and full traceability of stored transactions and digital assets. These properties make blockchain an ideal choice for ensuring the integrity and security of the water supply chain.

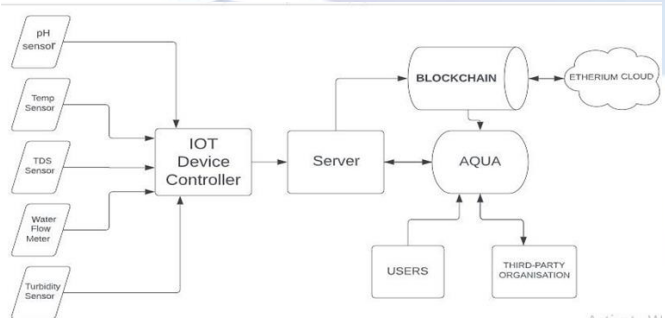
4. ROLE OF IOT

The Internet of Things (IoT) refers to the interconnectedness of physical devices and objects that are equipped with sensors and other technologies that allow them to collect, transmit, and share data over the internet. These devices can range from everyday objects like smart thermostats and security cameras, to more specialized equipment like industrial sensors and medical devices.

In the context of a water quality monitoring project, IoT devices such as temperature sensors, pH sensors, TDS sensors, water flow meters, and turbidity sensors can be used to collect data about various water quality parameters. This data can then be transmitted over the internet to a central system or database, where it can be analyzed and used to identify trends and patterns, or to trigger alerts or notifications if certain thresholds are exceeded.

One of the key benefits of using IoT in water quality monitoring is that it allows for real-time data collection and analysis, which can help to identify and address problems more quickly. Additionally, because the data is transmitted over the internet, it can be accessed from anywhere, which makes it easier to share and collaborate on water quality data with others. Finally, by using blockchain technology to store and transmit the data, it can be more secure and less vulnerable to tampering, which can help to ensure the integrity of the data

5. ARCHITECTURE



By using IoT devices to monitor the flow of water through the pipeline, it is possible to detect when there are unusual spikes or drops in flow, which could indicate a leak. This information can then be used to repair the leak and prevent further water loss.

Similarly, if there is a problem with the distribution of water through tanker trucks or other vehicles, IoT devices can help to identify the cause of the problem and allow the government to take corrective action. Additionally, by using blockchain technology to store and transmit the data, the government can ensure that the data is secure and cannot be tampered with, which can help to ensure the integrity of the data and the reliability of the water supply.

6. UTILIZATION

Water distribution is typically managed by government agencies or utilities, and it is important to monitor the water supply to ensure that it is being delivered efficiently and effectively. By using IoT devices to collect data on water flow and usage, government agencies and utilities can gain valuable insights into the distribution and consumption of water, and use this information to identify and address any problems or inefficiencies in the system.

For example, if there are leaks in the water pipeline, this can result in significant water loss.

7. CONCLUSION

Water is a vital resource for all living things on Earth. In today's world, where water scarcity is a major concern, it is important to have a good water management system in place. A blockchain-based water management system can help to create a transparent and tamper-proof system that ensures customer satisfaction and works effectively in a trustless environment. By defining roles and responsibilities, the burden on any single authority can be reduced. The integration of distributed ledger technology and IoT devices makes the water management system smarter and more efficient than traditional systems. From an economic perspective, the cost of using Ethereum can be reduced by implementing a private blockchain network. However, there are some limitations to writing smart contracts, as they must be written in the same language throughout the

system. Ethereum's implementation offers a CPU-intensive environment, which is important for ensuring the effectiveness of the system. Overall, a blockchain- based water management system has the potential to be a valuable asset for modernsociety.

Conflict of interest statement

Authors declare that they do not have any conflict of interest.

REFERENCES

[1] Bordel, B., Martin, D., Alcarria, R., and Robles, T. (2019). "A Blockchain-Based Water Control System for the Automatic Management of Irrigation Communities," in 2019 IEEE International Conference on Consumer Electronics (ICCE) (IEEE), 1–2. doi:10.1109/ICCE.2019.8661940

[2] S. Nakamoto, "Bitcoin: A peer-to-peer electronic cash system," 2008.

[3] Chohan, U. W. (2019). Blockchain and Environmental Sustainability: Case of IBM's Blockchain Water Management. Notes on the 21st Century (CBRI). doi:10.2139/ssrn.3334154

[4] https://www.newamerica.org/fellows/reports/anthology-working-papers-new-americas-us-india-fellows/thedevelopment-of-smart-water-markets-usingblockchain-technology-aditya-k-kaushik/

[5] Della Valle, F., and Oliver, M. (2021). Blockchain- based Information Management for Supply Chain Data-Platforms. Appl. Sci. 11 (17), 8161. doi:10.3390/app11178161

[6] Swan, M. (2015). Blockchain: Blueprint for a new economy. " O'Reilly Media, Inc."

[7] Dogo, E. M., Salami, A. F., Nwulu, N. I., and Aigbavboa, C. O. (2019). "Blockchain and Internet of Things-Based Technologies for Intelligent Water Management System," in Artificial Intelligence in IoT. Editor F. Al-Turjman (Springer publishing), 129– 150. doi:10.1007/978-3-030-04110-6_7

[8] Borja BORDEL, Diego MARTIN, Ramón ALCARRIA and Tomás ROBLES, "A Blockchain-based Water Control System for the Automatic Management of Irrigation Communities."

[9] Hakak, S., Khan, W. Z., Gilkar, G. A., Haider, N., Imran, M., and Alkatheiri, M. S. (2020). Industrial Wastewater Management Using Blockchain Technology: Architecture, Requirements, and Future Directions. IEEE Internet Things M. 3 (2), 38–43. doi:10.1109/IOTM.0001.1900092

[10] Sreerag Iyer, Snehal Thakur, Mihirraj Dixit, Rajneesh Katkam, Ashish Agrawal, Faruk Kazi,"Blockchain and Anomaly Detection based Monitoring System for Enforcing Wastewater Reuse",IEEE – 45670

[11] Hasan, H. R., and Salah, K. (2018). Proof of Delivery of Digital Assets Using Blockchain and Smart Contracts. IEEE Access 6, 65439–65448. doi:10.1109/ACCESS.2018.2876971

[12] NIBI MAOURIYAN , A.G.ACHUDH KRISHNA, AQUACHAIN -WaterSupply-Chain management usingDistributed Ledger Technology", 3rd International Conference on Computing and Communication Technologies ICCCT 2019