



BLOCKCHAIN IN GOVERNMENT SERVICES

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ABSTRACT

Blockchain, a Distributed Ledger Technology, is a disruptive and revolutionary technology that enables transacting data in a decentralized structure without the need for trusted central authorities. Many industries have taken steps to unleash the potential of blockchain technology, including the government sector, and early adopters are exploring the use of blockchain as one of the critical capabilities needed to create new business models and to radically transform government services and functions. However, despite this interest in adopting Blockchain technology, there is a lack of Blockchain frameworks or reference models/architecture that address government services in literature. In this paper, we propose a novel blockchain model that can be adopted by governments to establish a government-led blockchain ecosystem for government services. The blockchain model is proposed based on the outcomes of our analysis of the permissioned blockchain platform, and analysis of the blockchain powered housing rentals use case that is being implemented by the Dubai Government. The proposed blockchain model outcomes include a blockchain governance structure, participants and roles definition, and network architecture design which explains the deployment options and components. We also explain the model lifecycle and blockchain services, and we shed light on the security and performance of the model. The study also includes exploring many blockchain use cases used by governments through proofs of concept or prototypes. Our analysis of Hyperledger Fabric design features shows the platform's relevance to government services and use cases.

Keywords: Blockchain Government services, Hyperledger fabric

[1] INTRODUCTION

Blockchain technology is a Distributed Ledger Technology (DLT) that is attracting interest in many industries due to its ability to transform and create new business models, overcome existing challenges, increase efficiency, and optimize. Blockchain enables direct and nonreversible transactions and it has the potential to improve many applications and allow for the implementation of others that were considered impractical in the past. Blockchain technology provides decentralized data management in a trustless, transparent, and immutable manner.

Bitcoin was the first practical application of blockchain, and it was first introduced in a white paper published in 2008. Since then, blockchain has gained the attention of various industries, such as the financial and public sectors, and has created opportunities for innovation through new applications. For instance, by 2021, the Dubai Government is aiming to become paperless by adopting blockchain technology for all transactions. The main strategic objectives of blockchain technology for Dubai Government services are increasing government efficiency, creating new specialized sectors (industry creation), and achieving global leadership.

Despite the interest of government entities in leveraging blockchain technology to enable government services, there are few studies conducted that specifically focus on blockchain technology architecture for government services. In this, the authors presented the results of a systematic literature review on blockchain architectures applied to government services. The number of articles selected for this study was small (33 articles) due to the limited academic studies on this subject. This indicates the opportunity for further research on this subject. The authors concluded that there is a need to consider the challenges in creating a more effective blockchain architecture for governments.

The remainder of this paper is organized as follows: first, we discuss background information about blockchain technology. Section three is about the related work including details about the blockchain technology use cases for various government agencies. The fourth section explains the research methodology, and then we present an analysis conducted on the Hyperledger Fabric platform. We present the Dubai blockchain housing rental case study in section six. The proposed government blockchain model is presented in the seventh section and finally, we conclude the paper's outcomes and discuss future work.

[2] BACKGROUND STUDY

Blockchain technology implementations are of two types: permissionless and permissioned blockchain. [1] Bitcoin is a good example of a permissionless blockchain, also known as a public blockchain. In a permissionless blockchain, access is open to any participant willing to transact through the network. The public blockchain network is not owned by an

entity, and any participant is allowed to be part of it. Participants can create and validate transactions and hold an identical copy of the complete ledger. [2] In the public blockchain, or the permissionless ledger, permissions and access rights are not enforced for participation.

Permissioned blockchain access is not open to any participant, and the network is owned by one or more owners. Furthermore, the participants of permissioned ledgers are known and can be trusted. This simplicity results in less time being required for operations, offering more flexibility and increasing efficiency compared to the public permissionless blockchain.

Blockchain technology has many promises due to its decentralized structure. [3] The cost of blockchain operations is relatively lower and it works with high efficiency, as it cannot be affected by outages. The blockchain does not include a single point of failure due to its decentralized structure, which facilitates durability, reliability, and longevity. [4] Other promises of blockchain technology are the immutability, integrity, and transparency of the ledger. This is because the ledger is shared with all nodes of the blockchain network, and changes in the network are transparent to all parties. In addition, blockchain enables disintermediation and trustless exchange between users, which helps to eliminate counterparty risks and provides process integrity. Therefore, blockchain empowers users by putting them in control of all their data and information, so that the user can grant access to a third party to those data that are relevant for processing the user request. [5] The data stored in the blockchain ledger are considered high-quality, consistent, accurate, and complete.

Blockchain technology has key features regardless of the implementation and use case or its application. The distributed ledger is one of the key features of blockchain technology. [6] The distributed ledger is maintained by the network participants, and new validated transactions are added to all copies of the ledgers to maintain identical copies. Another key feature of blockchain technology is the use of cryptography and digital signatures, which blockchains rely on to maintain the immutability of blockchain-disrupted ledgers. [7] Cryptographic methods are used in the blockchain network to establish identity, provide authenticity, and allow relevant access. Moreover, identical copies of the disrupted ledger are maintained across the participants of the network using consensus mechanisms. [8] These consensus mechanisms define the procedure for validating transactions by the network participants. Consensus enables participants to perform transactions in a peer-to-peer model without the need for a centralized third party. [9] Smart contracts are executable software installed and instantiated on the blockchain and executed when predefined rules are met.

The applicability of blockchain technology use cases is not restricted to specific industries. Various promising use cases have been identified from the literature and platform documentation. [10] These use cases are related to many industries, such as finance, crowdfunding, asset management, construction, data storage, sharing economy, prediction medical services, supply chain management, and education. rental market ecosystem.

[3] RELATED WORK

One problem with implementing blockchain in government services is the issue of scalability. While blockchain technology offers transparency, security, and immutability, it also poses challenges when it comes to handling large volumes of transactions. As more government services and processes are digitized and incorporated into blockchain networks, the scalability of these networks becomes crucial.

The current blockchain protocols, such as Bitcoin and Ethereum, have limitations in terms of the number of transactions they can process per second. This limitation becomes a bottleneck when trying to scale blockchain solutions to handle the vast number of transactions involved in government services, such as processing payments, verifying identities, or recording property ownership.

Furthermore, as more nodes join the network and the amount of data stored on the blockchain increases, it becomes increasingly challenging to maintain the decentralized nature of the network while ensuring high performance and efficiency.

Addressing the scalability issue requires significant research and development efforts to design and implement scalable blockchain solutions tailored to the specific requirements of government services. This may involve exploring alternative consensus mechanisms, optimizing network protocols, or utilizing off-chain scaling solutions such as side chains or state channels.

Overall, scalability remains a significant challenge that must be addressed to realize the full potential of blockchain technology in government services. Without scalable solutions, blockchain implementations may struggle to meet the demands of modern government operations, hindering their widespread adoption and effectiveness.

[4] CONCLUSION AND FUTURE WORK

In conclusion, blockchain promises innovative decentralized methods that become a significant trust enabler and potential critical capability enabling the digital transformation and optimization of government services. Blockchain transforms government operations to inspire new service delivery models for governments. Although governments have shown interest in adopting blockchain technology, the actual implementation and use cases of blockchain for government services are still emerging and immature.

This paper explored current blockchain use cases in government sectors and a case study of the blockchain housing rental project that is being implemented by the Dubai Government. This case study showed the potential benefits of blockchain technology in optimizing and enhancing the process and its potential impact on the whole real estate market. In addition,

the analysis of Hyperledger Fabric design features confirmed the platform usability for government services use cases. The analysis of Hyperledger Fabric actors, roles, components, data structure, and the processes illustrated in sequence diagrams resulted in deriving a government blockchain model. The proposed model presented a flexible model for establishing, governing and operating government-led blockchain implementation enabling government services. For future work, the proposed government blockchain model should be applied to other governments with different operating models for improvements.

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