CLOUD MANUFACTURING ARCHITECTURE BASED ON PUBLIC BLOCKCHAIN TECHNOLOGY

BS.Sathish kumar [1],S.Senthil kumar[2]

[1]*Dept of Computer Science, School of Arts and Science, Vinayaka Mission's Research Foundation, Chennai, India.*
Email : sathishbs999@gmail.com

[2]*Assistant Professor, Dept of Computer Science, School of Arts and Science, Vinayaka Mission's Research Foundation, Chennai, India.*
Email: senthil.cs@avit.ac.in

Abstract-

With Industry 4.0, IT infrastructure has started to be used more effectively in the manufacturing sector. Cyber physical systems, IoT, cloud manufacturing, big data are some of the technologies that make up the concept of Industry 4.0. These technologies have solved many problems in the manufacturing sector. One of these technologies, cloud manufacturing technology, has emerged with the idea of pay as you go. This technology has enabled manufacturing resources to be leased and shared on a global scale. However, it has problems arising from its central structure and the need for a reliable 3rd party. Reliability, security, continuity, scalability, data lock-in, single point failure, data manipulation are some of the main problems. Blockchain (BC) is a decentralized and distributed technology. The data stored on the BC network cannot be altered in any way. With these features, we believe that BC-supported cloud manufacturing systems can overcome the aforementioned problems and eliminates the need for a reliable 3rd party. Based on this belief, in this study the agreements and communication between the resource provider and the customer, which is one of the basic functions of cloud manufacturing platforms, are realized with a decentralized application using BC-based smart contracts (SCs). The designed application is called the decentralized cloud manufacturing application (DCMApp). DCMApp does not operate on a fully public BC network, it has a hybrid structure and uses the Ethereum network as a public BC network. These features make DCMApp different from other BC-based cloud manufacturing applications. DCMApp's hybrid structure has enabled more transparent, economic and safe manufacturing agreements. It is also possible to store agreements on the BC network at a low cost without installing any server infrastructure. The use of Ethereum network makes it almost impossible to manipulate agreements.

Keywords: IoT, Blockchain,Cloud, DCM.

I. INTRODUCTION

Cyber-physical-social System (CPSS) integrates the cyber, physical and social spaces together. One of the ultimate goals of CPSS is to make our lives more convenient and intelligent by providing prospective and personalized services for users. CPSS big data is complex and heterogeneous, and records all aspects of users' lives in the forms of image, audio, video and text. Generally, the collected or generated data in CPSS satisfies 4Vs (volume, variety, velocity, and veracity) of big data. CPSS big data is specified as the global historical data, the local real-time data and the extensive social data. Firstly, cloud computing in processing global historical data, which acts as a powerful paradigm for implementing the data-intensive applications, has an irreplaceable role; secondly, with the increasing computing capacity and communication capabilities of mobile terminal devices and sensors, fog-edge computing as an

important and effective supplement of cloud computing, has been widely used to process the local real time data.

Blockchain technology is a decentralized network for cloud manufacturing with a secured and distributed ledger that uses cryptography and smart contact for sharing services on the cloud between the providers and the end user. This network is secure, authenticated and verifiable based on the blockchain technology. Cloud manufacturing is based on cloud computing. Cloud computing highlights two features: ease of access and shared use of resources [10]. Cloud manufacturing, with these two feature of cloud computing, increases customers' accessibility to manufacturing resources and capabilities through the Internet .

II. RELATED WORKS

Cyber-physical-social systems for command and control [1]

The article provides a preliminary account of the operational process of command and control based on the cyber-physical-social system (CPSS) and a self-synchronization mechanism. The proposed CPSS for command and control incorporates the essential characteristics of operational mechanism and connects the physical network, cyberspace, mental space, and social network.

The emergence of intelligent enterprises[2]

When IEEE Intelligent Systems solicited ideas for a new department, cyber physical systems(CPS) received overwhelming support. Cyber-Physical-Social Systems is the new name for CPS. CPSS is the enabling platform technology that will lead us to an era of intelligent enterprises and industries. Internet use and cyberspace activities have created an overwhelming demand for the rapid development and application of CPSS. CPSS must be conducted with a multidisciplinary approach involving the physical, social, and cognitive sciences and that Al-based intelligent systems will be key to any successful construction and deployment.

Dynamic social structure of things: A contextual approach in CPSS[3]

The emergence of cyber-physical-social systems (CPSS) and context-aware technologies has helped boost a growing interest in building frameworks for adaptive smart services that hide heterogeneity in the infrastructure and support services by seamlessly integrating the cyber, physical, and social worlds. However, this entails an enormous amount of computational and networking contextual complexity. Here, the proposed smart services framework in CPSS (called Dynamic Social Structure of Things, or DSSoT) boosts sociality and narrows down the contextual complexity based on situational awareness. DSSoT monitors spatiotemporal situations and, depending on users' individual goals and other social aspects, induces and structures relevant social objects and smart services in a temporal network of interactions. An application using DSSoT, called Airport Dynamic Social, provides a proof of concept.

III. SYSTEM DESIGN

The customer reviews the offers made by all source providers. The customer may accept one of the offers or reject all offers and request new offers. If the customer accepts, JC will now complete the entire offer process. The fee offered by the customer is recorded in the SC. Thus, both the customer and the source provider are secured. The customer pays the fee with the existing Ethereum in the wallet. After the customer makes the payment to JC and gives the job confirmation, JC's status now changes to "Job Assigned". When the resource owner completes the job, he sends the order to the customer and the document number obtained according to the delivery method is saved to JC. The job status is now saved to JC as "Sent" and a counter is started. This counter will be used for automatic confirmation mechanism.

DISADVANTAGES

They can use this global account address when accessing target data in different domains. Therefore, BacCPSS can solve the problem of difficult identity management for users.

Since the whole authorization access process is recorded through the blockchain, there are two problems in this scheme. One is that it will take time to protect privacy, so we can find more lightweight and suitable methods to protect privacy for mobile terminal devices.

It is difficult for users to manage their identities. The number of domains has increased dramatically with the development of CPSS. Users accessing different domains need to register different accounts, which greatly increase difficulties of them in identity management.

The proposed model is evaluated under two headings in terms of applicability and reliability. In terms of applicability, there are some limitations on how the model can be configured on a public BC network, unlike other distributed cloud manufacturing applications. In terms of reliability, evaluations about how the elimination of intermediaries contributed and how it can provide a trust environment were expressed. The pricing policy may vary by company. Some companies charge periodic fees, while others receive commissions per transaction. In the architecture proposed here, the fees paid are paid as the rental fees of the computers operating on the network. From an individual perspective, the proposed model is more economical than the private and consortium networks for the reasons mentioned above. The total cost spent on the network varies according to the purpose and scale of the application.

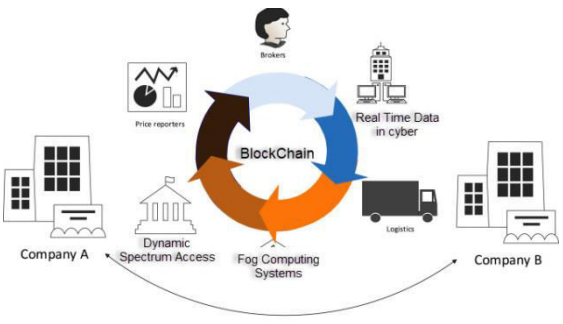

Fig.1. Overall architecture of Proposed System

IV. IMPLEMENTATION

Smart contracts

SCs are permanently registered to the system as an application instance when deployed to a BC network. A new application instance is created for each instance created from the same SC code. A SC code contains variables and functions. In this application, when using SCs, it is discussed whether to store all jobs in a single SC or to create a new SC instance from the same SC code for each job. Both options will make the system work. However, if we compare these two methods, it can be understood why it would be more appropriate to create a new SC instance for each job.

Cyber-physical systems

TECHNOLOGICAL developments in manufacturing systems have changed the competitive factors in the sector. Before 1970s, cost, which is one of these factors, one the most important factor, whereas quality gained importance after the 70s. By 1990s, service and environmental factors gained importance and in the 21st century, information became the most important factor. The information is the foundation of the 4th industrial revolution, namely, Industry 4.0. The term Industry 4.0 collectively refers to a wide range of current concepts, including cyber-physical systems (CPS), internet of things (IoT), simulation, cloud computing, big data and advanced analysis techniques, service-oriented technologies, virtualisation and so on.

Cloud manufacturing

Combining recently emerged technologies with advanced manufacturing models and information technologies, Cloud Manufacturing is a new manufacturing paradigm that meets the needs of manufacturing systems. A number of significant researchers have been made to develop cloud manufacturing technologies, design the system architectures, and define cloud manufacturing and key characteristics. Cloud manufacturing is based on cloud computing. Cloud computing highlights two features: ease of access and shared use of resources. Cloud manufacturing, with these two feature of cloud computing, increases customers' accessibility to manufacturing resources and capabilities through the Internet.

Blockchain technology

These features of cloud manufacturing make it inefficient in scalability, interoperability, reliability, security, data confidentiality, efficiency, continuity and flexibility. It is possible to use blockchain (BC) technology to solve many of these problems. BC technology offers an innovative approach to decentralized and fully distributed mechanism in industries and businesses. The BC technology basically can be considered as an immutable distributed ledger. BC is a technology that comes to the fore with guaranteeing the reliability of the data it stores. The BC technology has the following powerful characteristic.

V. RESULTS

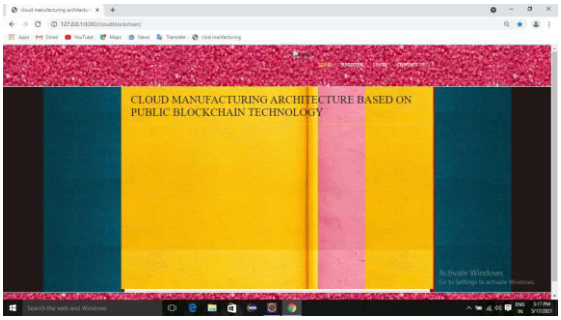

Fig.2. Home page

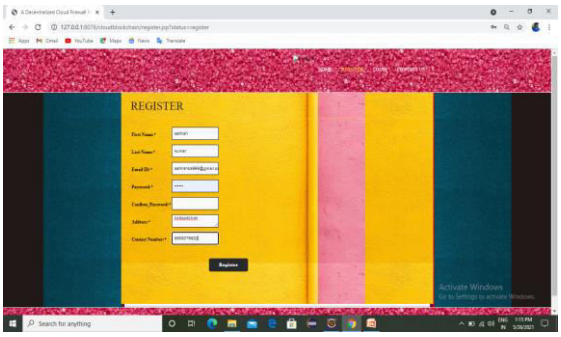

Fig.3. Register page

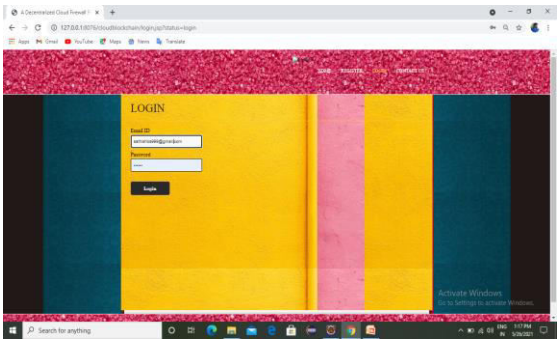

Fig.4. Login page

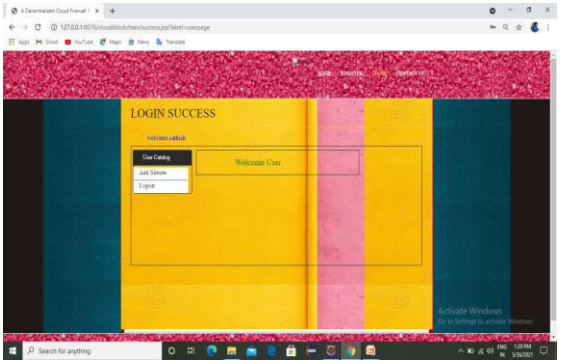

Fig.5. Add website

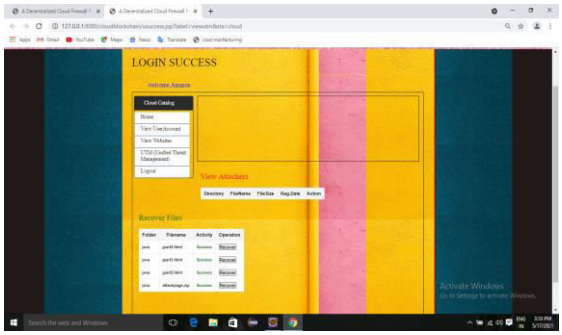

Fig.6. View attackers

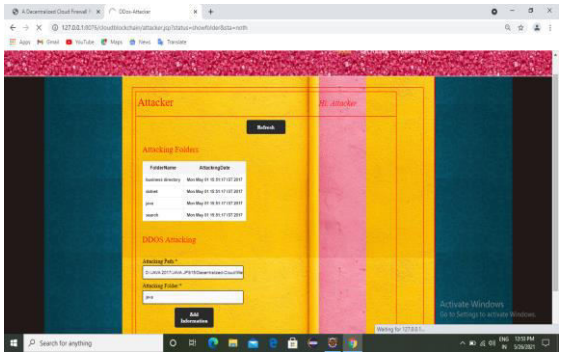

Fig.7. Attacking folder

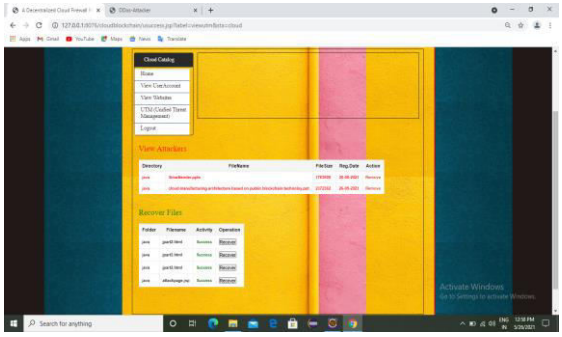

Fig.8. Recover files

VI . CONCLUSION

It is an important research direction to solve the security of access control in CPSS big data by utilizing the features of blockchain. This paper proposes a blockchain-based access control scheme called BacCPSS for privacy preserve in CPSS big data. Given the nature of CPSS big data, we redefined the rights in access and used lighter weight encryption algorithms to ensure privacy. In BacCPSS, all access control transactions are encrypted and issued by the domain management server, such

as FeS, SdS, Cloud, and so on. Experiments have proved that this scheme is feasible and effective, and secure to implement access control for CPSS big data. Since the whole authorization access process is recorded through the blockchain, there are two problems in this scheme.

REFERENCES

[1] Z. Liu, D. Yang, D. Wen, et al. Cyber-physical-social systems for command and control[J]. IEEE Intelligent Systems, 2011, 26(4): 92-96.

[2] F. Y. Wang. The emergence of intelligent enterprises: From CPS to CPSS[J]. IEEE Intelligent Systems, 2010, 25(4): 85-88.

[3] D. Hussein, S. Park, S. N. Han, et al. Dynamic social structure of things: A contextual approach in CPSS[J]. IEEE Internet Computing, 2015, 19(3): 12-20.

[4] X.Wang, L. T. Yang, Y.Wang, et al. ADTT: A Highly-Efficient Distributed Tensor-Train Decomposition Method for IIoT Big Data[J]. IEEE Transactions on Industrial Informatics, DOI: 10.1109/TII.2020.2967768, 2020.

[5] X. Zhou, W. Liang, S. Huang and M. Fu. Social Recommendation with Large-Scale Group Decision Making for Cyber-Enabled Online Service[J]. IEEE Transactions on Computational Social Systems, vol. 6, no. 5, pp. 1073-1082, Oct. 2019. DOI: 10.1109/TCSS.2019.2932288

[6] X. Wang, L. T. Yang, Y. Wang, et al. A distributed tensor-train decomposition method for cyber-physical-social services[J]. ACM Transactions on Cyber-Physical Systems, 2019, 3(4): 1-15.

[7] X. Zhou, W. Liang, K. Wang and S. Shimizu. Multi-Modality Behavioral Influence Analysis for Personalized Recommendations in Health Social Media Environment[J]. IEEE Transactions on Computational Social Systems, vol. 6, no. 5, pp. 888-897, Oct. 2019. DOI: 10.1109/TCSS.2019.2918285

[8] H. Li, K. Ota, M. Dong, et al. Mobile crowd sensing in software defined opportunistic networks[J]. IEEE Communications Magazine, 2017, 55(6): 140-145.

[9] X. Wang, L. T. Yang, J. Feng, et al. A tensor-based big service framework for enhanced living environments[J]. IEEE Cloud Computing, 2016, 3(6): 36-43.

[10] K. C. Okafor. Dynamic reliability modeling of cyber-physical edge computing network[J]. International Journal of Computers and Applications, 2019: 1-11.