Short Communication

Blockchain-Empowered Digital Twins Collaboration for Smart Manufacturing

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The concept of using "Twins" originates from NASA's Apollo program (National Aeronautics and Space Administration), where at least two identical spacecrafts were built to reflect the conditions of the spacecraft during a mission in outer space [1]. Multiple digital twins are deployed to represent the up-to-date industrial data of the physical assets in operation, including asset status within manufacturing. These digital twins collaborate by sharing and exchanging information among entities and sharing tasks to act accordingly [2,3].

When it comes to adopting digital twin collaboration, the manufacturing sector has a crucial benefit, including communication, sensing, and power, which have been utilized to process massive volumes of information to overcome the issues such as downtime. All the generated data of the manufacturing process are represented in the virtualized digital twins, from temperature monitoring within a device and equipment to deliver the product to the end-user. Then, these digital twins collaborate and use their operational data to feed the learning system to predict the potential risks in the manufacturing process.

However, many challenges still exist to adopt digital twins collaboration in the manufacturing sector, including interoperability, authentication, distributed machine learning, distributed decision making.

The combination of blockchain and digital twins technologies have significant advantages to address the challenges mentioned above. Considering the capabilities of the blockchain technology within the design phase of digital twins will empower the privacy, security, transparency, and traceability of the set of digital twins that are being collaborated and interacting. In particular, blockchain technology is beneficial for digital twins collaboration to 1) maintain the trust among network peers, which digital twins represent. 2) allow traceability across the entire digital twins' network, 3) provide insightful consensus-based decision-making process, and 4) deliver efficient and reliable solutions by utilizing the decentralization feature of blockchain technology. However, there are still many challenges requiring further investigation to identify the requirements of empowering blockchain and digital twins collaboration to add progressive value to make the manufacturing systems smarter.

Acknowledgements

Bibliography

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