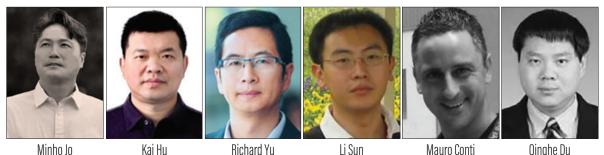
## **GUEST EDITORIAL**

## PRIVATE BLOCKCHAIN IN INDUSTRIAL IOT



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his special issue is devoted to sharing state-of-the-art research on private blockchain in industrial IoT (Internet of Things). A blockchain is a decentralized and distributed ledger with a chain network of blocks recording historical transactions. A transaction is a record of action. A transaction inside the block will be of: sensing/saving data, assembling parts, depositing money, processing a business deal, ordering/delivering a product part, notarizing a paperwork, and so on. Blockchains are categorized into two types, public blockchain and private blockchain. Private blockchains have been more in the spotlight in industry recently because they are much faster, cheaper, and privacy-oriented compared to the public blockchain. We expect that private blockchains will be much more widely implemented soon. This is our main motivation for preparing this special issue.

Public blockchains are literally just "public." Anyone can read, write, and join a public chain network while private blockchains are permissioned and one or multiple nodes control and restrict access of members to the chain network. The openness of public blockchain is a disadvantage. Some well known examples of public blockchains are Bitcoin, Ethereum, and Ripple, while several well known examples of private blokchains are Hyperledger Fabric and R3 Corda. Public blockchains consume a tremendous amount of energy, time and money because of the mining to achieve consensus. On the other hand, the consensus algorithm of the private blockchain is simple, which provides advantages of much faster computing time, cheaper cost, and greater scalability. Private and public blockchains have few similarities and consequently private blockchain is totally opposite of public blockchain. Private blockchain has been successfully applied in industrial Internet of Things (IoT) because of its advantages and industrial characteristics. Most industrial IoT organizations are exclusive and private (namely, less public) as well as money-oriented and time-oriented, and thus private blokchains are well suited for industrial IoT.

However, private blockchains have many challenging technological problems for various industrial IoT applications which we should attack, for example, the scalability problem, efficient consensus mechanism, robust smart contract, secure access control, replica management, interoperability and compatibility with public blockchains, deployment and feasibility in emerging networks such as VANET, edge/fog computing networks, and software-defined networking, and more.

The article "A Many-Objective Optimization Model of Industrial Internet of Things Based on Private Blockchain" by B. Cao et al. presents an improved algorithm based on Two\_Arch2 to maximize the scalability and decentralization while reducing the latency and cost of the private blockchain, which is well fitted for industrial IoT. In Two Arch2, two archives, convergence (CA) and diversity (DA), evolve independently. CA can reach the Pareto front rapidly, while DA keeps the diversity of the population. However, Two-Arch2 has a disadvantage of preferring the solutions in the boundary area. In order to overcome the disadvantage, the authors replaced this existing strategy with the non-dominated ranking strategy and the maximum extension distance (MED) indicator while updating the population in CA. By using the PBFT (Practical Byzantine Fault Tolerance) consensus mechanism, their proposed algorithm has shown that it can maximize the scalability of the private blockchain as well as the cost, decentralization, and latency according to the experimental results.

The article "Blockchain and AI-Based Natural Gas Industrial IoT System: Architecture and Design Issues" by Y. Miao et al. proposes an architecture for a private blockchain for the purpose of distributing natural gas supply with trusted gas transactions. The authors designed a forward natural gas IoT architecture based on blockchain and AI, consisting of a side-chain of natural gas block based on data dimension, and a backbone of natural gas block based on value dimension, in order to address the defects of a centralized energy supply architecture. The side-chain of natural gas block aims at avoiding tampering with data in the process of generation, transmission, and recording. In the proposed private blockchain architecture, AI is used for data mining such as natural gas load prediction which is applied for energy pricing. The proposed private blockchain architecture for natural gas transactions has proven its effectiveness through experimental simulation.

The article "Private-Blockchain-Based Industrial IoT for Material and Product Tracking in Smart Manufacturing" by M. Assaqty et al. is a tutorial for implementing a private blockchain in the manufacturing industry. The authors have shown that a private blockchain is successfully used in smart manufacturing in order to bridge the needs for trusted product and material tracking information exchange between parties in smart manufacturing. Private blockchain based

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industrial IoT has not been widely applied in the manufacturing industry so far, especially for material and product tracking. This paper illustrates a design of private blockchain based industrial IoT in the form of a model and architecture that is expected to help the manufacturing industry in implementation. The authors define user roles of the manufacturing industry for a private blockchain and introduce implementation strategies. For better understanding of the implementation, they have carried out a simulation by using the Hyperledger Fabric framework, which is the most popular private blockchain platform in industry.

## BIOGRAPHIES

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