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Editorial

Introduction to the special section on blockchain technologies for industrial Internet of Things (SI-bciot)

1. Introduction

In the Industrial Internet of Things (IIoT) era, we have billions of Internet-connected devices (also referred to as 'things'), which range from unmanned/autonomous vehicles (e.g., unmanned aerial vehicle – UAV) to domestic robots to traffic sensors. There are a number of research and operational challenges associated with IIoT deployment, such as security and privacy. In an IIoT setup, cloud servers may also be utilized to store and process data from IIoT devices; thus ensuring the security of such data (both in-transit and at-rest) is crucial. It can, however, be challenging for data owners to ensure a fine-grained control over the access and use of their private, sometimes sensitive, data, particularly in a centralized IIoT service architecture. This is demonstrated in the survey presented by Khan et al. [1] included in this special section.

Blockchain can potentially be used to mitigate existing limitations, for example, in the facilitation of a novel decentralization architecture for IIoT. The use of blockchain in IIoT security and privacy is an emerging area, and one that has great potential; hence, the focus of this special section. This is also demonstrated by Dai et al. [2] and Khan et al. [3] in this special section, who surveyed the literature on the use of blockchain for cloud exchange in security, privacy, reputation systems and transaction management, and the application of Blockchain in IoT domain.

Twenty two papers were submitted to this special section. In the next three sections, we introduce the remaining seven accepted papers.

2. Cryptography-based approaches

Li et al. [4] proposed a fair searchable symmetric encryption (SSE) scheme based on blockchain, which is designed to guarantee fairness for both involved parties. That is, if the user is not honest, (s)he cannot obtain the right results from the server, and at the same time the server cannot get any information related to the plaintexts during this search process. In the event that the server is not honest, there are mechanism in place to penalize the dishonest server.

Hyla et al. [5] presented their scheme, which allows the user to achieve signature validity without using timestamps from some trusted third-party. Specifically, after inserting data into a blockchain, a user can store a signed document in his/her storage without the need to perform any further maintenance action. The round-based blockchain time-stamping scheme is also designed to be scalable, in the sense that the constant number of bytes embedded into a blockchain is independent from the number of input documents. The scheme allows the user to prove that a document exists not only before a certain date, but also after a certain date. In addition, the scheme achieves non-repudiation and allows for verification of signature validity using a chain model and under some conditions using a modified shell model.

Khan et al. [6] presented their proposed system, designed to enable users to summarize a video based on human and objects as parameters. Cryptographic hashes are then used in combination with blockchain, where hashes are generated from summarized video blocks, signed and transmitted via blockchain. Cumulus blockchain technique is utilized to ensure video integrity. Their proposed system also allows remote users to obtain tamper-proof summarized video of their business sites or any sensitive premises on their smartphones.

3. Machine learning-based approach

Cryptocurrency price prediction could also be facilitated using machine learning as demonstrated by Poongodi et al. [7], who used two machine learning methods, namely: linear regression (LR) and support vector machine (SVM). They also

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used filters of different weight coefficients, and evaluation findings suggested that the SVM method has a higher accuracy (96.06%) than the LR method (85.46%). Furthermore, the authors showed that the accuracy score of their proposed model can be up to 99% if features are added to the SVM method.

4. Security and privacy solutions

Song et al. [8] revisited the security challenges associated with the three layers of a typical Internet of Things (IoT) architecture (i.e., perception layer, network layer and application layer) and proposed a high-level Blockchain-based security management scheme for different IoT devices in the full life cycle.

An Android-based intelligent smart watering system (SWS) was presented by Imran Bajwa et al. [9]. The proposed system relies on a set of accessible and economical sensors that capture real-time data of plants and environment conditions. In their approach, blockchain is used to facilitate scalability, privacy, and reliability in the proposed IoT base smart system. Specifically, the users and devices can monitor and interact remotely with the plants using the Android SWS application.

Azad et al. [10] proposed a blockchain-based solution and framework for document sharing and version control. The proposal facilitates multiuser collaboration and tracks changes in a trusted, secure, and decentralized manner, without relying on a centralized trusted entity or third-party. This solution is based on utilizing Ethereum smart contracts to govern and regulate the document version control functions among the creators and developers of the document and its validators. The authors developed the smart contracts using Solidity language, and their functionalities evaluated using the Remix IDE. The code was also made publicly available on Github.

5. Final thoughts

In conclusion, the papers included in this special section have contributed to different aspects of the blockchain literature, and hopefully benefit the readers interested in the potential application of blockchain.

We would like to express our appreciation to the Editor-in-Chief and the editorial staff for their support in making this special section possible. The special section would not have been possible without the support of the authors and reviewers.

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