

A Proposal of a Standardized Architecture of Manufacturing Data Trading platform

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Abstract—The dominant perspective is that it is difficult to apply artificial intelligence (AI) technology to the manufacturing industry through the development of a general-purpose AI solution. It is due to in the particularities of manufacturing and manufacturing data. In order for AI technology to be applied well to in the manufacturing industry site, it is essential to be able to use real data from the field. Therefore, we aimed to propose an intuitively modified standard architecture of a blockchain-based trading platform to activate the trading of manufacturing data. It will be possible to that the data trading could be made transparent and with guaranteed integrity by recording and managing trading information on the blockchain and it is expected to develop technologies that are compatible with unspecified platforms.

Keywords—manufacturing, data, trading, smart contract

I. INTRODUCTION

One of the world's leading experts in the field of artificial intelligence was pointed out that a few machine learning models can serve a billion users in the consumer software space, but it may need to build 10,000 customized AI models to 10,000 manufacturing companies [1]. Also, the prevailing opinion is that there are few situations in which a 'Swiss Army knife' can be used in the manufacturing industry. The cause of this can be found in the characteristics of the manufacturing industry itself, as follows: first, the size of the data sets in manufacturing companies is smaller compared to projects carried out in IT companies, customizing costs are high depending on the fields, and there is a large gap between proof of concept(PoC) and actual field application [2].

Also, manufacturing data has sensitivity as it contains each company's manufacturing know-how and trading secrets, and has legal context regarding prevention of unfair competition, unlike general data [3][4]. Its make manufacturing companies that agree on the necessity of introducing and utilizing AI are negative about providing their real site data to outside companies even if the purpose is to learn data essential for developing AI technology.

Therefore, a fundamental technology in order to synergy between the manufacturing industry and AI technology is required to record the process and content of mutual consultation on various matters e.g., that manufacturing companies are required to limit access to data when exchanging manufacturing data, how to process data after using it, etc., and prevent technically unilateral forgery, alteration, or modification of this.

Smart contracts and transaction platforms in IoT domain were newly extracted in the latter half of the analysis period that compared and analyzed which published academic research papers and articles over a certain period related to blockchain topics to predict emerging in blockchain industrial [5]. We had proposed a draft for the standardized structure [6]. It was explained the draft standardized architecture focused on its functionality, thus it was unintuitive. And we supplemented a new standardized structure, based on the previous version.

This study aims to proposes a modified architecture required for a standardized blockchain-based trading platform of manufacturing data that could record, store, and manage the trading contracts, contract terms, and data access rights when required for exchanging manufacturing data between manufacturing companies and AI service solution development companies on an unspecified data platform without unilateral falsification, alteration, or modification. Thereby, we expected that promote manufacturing data transactions and establishing the foundation for a virtuous cycle industrial ecosystem centered on data.

II. PROPOSED PLATFORM SYSTEM

The purpose of this blockchain-based manufacturing data trading platform that we proposed is to mediate transaction between entities that possess manufacturing data and entities that wish to develop AI solutions using manufacturing data by securing transparency, integrity, traceability, and irreversibility of transaction contracts.

The architecture we propose consists of Manufacturing Data Supplier, Manufacturing Data Consumer, Manufacturing Data Trading Platform, and Off-Chain Storage(Fig. 1).

A. Manufacturing Data Supplier and Manufacturing Data Consumer

1) *Manufacturing Data Supplier*: A Manufacturing Data Supplier is an self that holds the manufacturing data to be traded and performs procedures related to the trading contract on this platform, and provides the manufacturing data to be traded to an Off-Chain Storage.

2) *Manufacturing Data Consumer*: A Manufacturing Data Consumer is an self that make to use the manufacturing data to be traded and also performs a procedures related to the trading contract on this platform and receives the manufacturing data from an Off-Chain Storage.

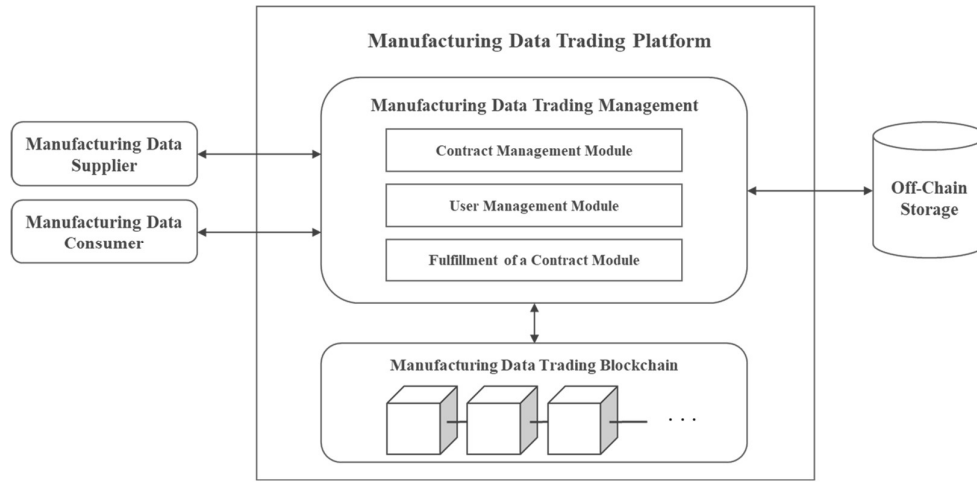


Fig. 1. Architecture of Blockchain based Manufacturing Data Trading Platform

B. Manufacturing Data Trading Platform

The manufacturing data trading platform consists of a Manufacturing Data Trading Management and a Manufacturing Data Trading Blockchain. And a method of communication among the manufacturing data trading platform, Manufacturing Data Supplier, Manufacturing Data Consumer, and Off-Chain Storage uses TLS(Transport Layer Security).

1) *Manufacturing Data Trading Management*: It handles contract management, user management, and contract execution management in order to conclude contracts between Manufacturing Data Suppliers and Manufacturing Data Consumers. This platform is composed of a) Contract Management Module, b) User Management Module, and c) Fulfillment of a Contract Module as follows.

a) *Contract Management Module*: It provides functions which composed of registering contracts, modifying and deleting contracts, and signing contracts.

b) *User Management Module*: It consists of functions for authenticating the identities of contracting parties in contracts which concluded on the manufacturing data trading platform and managing electronic signatures had used in contracts.

c) *Fulfillment of a Contract Module*: It functions that for sharing and managing the traded manufacturing data based on contracts concluded on the manufacturing data trading platform. This includes that the registration of traded data, downloading, access controlling, validating, encrypting, and data searching.

2) *Manufacturing Data Trading Blockchain*: It records trading contracts, related-information, and information of the traded data providing and downloading.

C. Off-Chain Storage

An Off-Chain Storage encrypts and stores the be traded manufacturing data required to be provided under a trading. Access to manufacturing data stored in Off-Chain Storage is restricted to contracting parties only, it is possible to protect and efficiently manage huge volumes of manufacturing data.

III. CONCLUSION

This study had proposed a modified standard architecture for a trading platform of manufacturing data. It records and manages that details(e.g., method of providing data, data use, data use period, data disposal method after use, etc.) of contracts mutually agreed upon between contracting parties, such as manufacturers and AI solution developers, and traded data providing and downloading a blockchain. And this complements natural language-based contracts including terms and conditions commonly used in usually, which ensuring the transparency and integrity. That is expected to facilitate manufacturing data trading as a means of fostering synergy between the manufacturing and AI industries.

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