Smart Factory Based on IoT Platform

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***Abstract*— Internet of Things (IoT) platform is applied to the enhancement in smart factories productions, operations and maintenance. IoT based on oneM2M technology in smart factories developed by interconnecting things (physical and virtual) and evolving interoperable information and communication. This paper describes the implementation work of sensing environment values in smart factory. In order to support data reliability and interoperability in smart factory environment, author uses IoT device based oneM2M standard platform. This implementation can contribute to the field of manufacturing to be able to deliver products and services in low cost and efficiently.**

Keywords— IoT, IoT Platform, Smart Factory, Smart Factories, oneM2M

I. INTRODUCTION

The use and development of the Internet of Thing (IoT) technology has continued to grow recently. IoT is a key technology for smart factories that will cause the market size to increase. From statistics [1] , this shows us the increase in the global size of smart factories from 2019 to 2024 which is estimated to be around 91.1 billion USD as show in Figure 1 below.

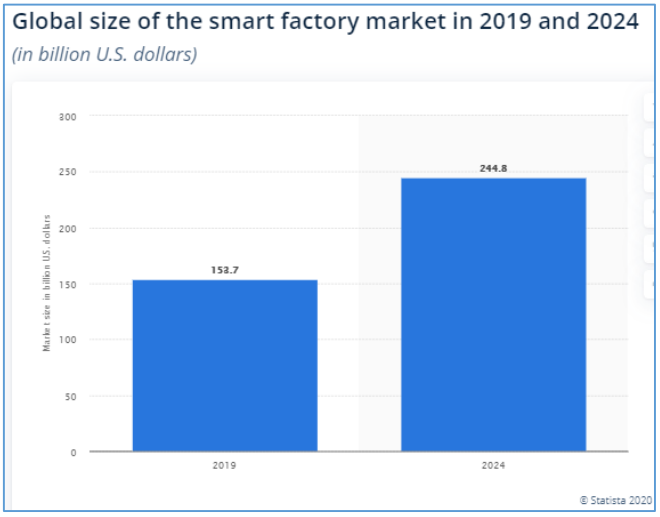

Figure 1 Global size of Smart Factory Market in 2019 and 2024

The increase in the size of the smart factory market implies that the use of IoT as the main technology is also increasing. With the use of these IoT and manufacturing-based services, the 4th industrial era is considered to be more increased in the decade.

Smart Manufacturing core systems are using the Internet of Things (IoT), big data processing, and artificial intelligence (AI), which is assessed as a component important in Industry 4.0. Smart factories have at least some important elements, namely modularity, interoperability, decentralization, virtualization, service orientation, and real-time capabilities [2].

The IoT platform utilizes wired and wireless connectivity, enabling smart factories to provide the ability to remotely monitor and manage processes and change production plans quickly, in real-time when needed. This is what can increase manufacturing output, reduce waste, speed up production, and improve the yield and quality of goods produced[3].

In addition to improving yields and quality of goods produced, IoT-based smart factories can also optimize processes at the global manufacturing level in the areas of performance, quality, cost, and resource management. This is driving the growth of the size of the smart factory market is also directly proportional to the size of the IoT market.

This paper describes a smart factory that runs the IoT Platform, related to the measurement of environmental values in the plant, such as temperature and humidity.

II. IOT PLATFORM BASED ON ONE2M2M ARCHITECTURE

In order to get reliability dan interoperability data in Smart Factory, authors have implemented the IoT based on oneM2M platforms. With oneM2M technology, we can get common service capabilities layer in terms of end-to-end platform.

Furthermore, M2M technology enables work by creating real-time responses on complex provider networks such as in

factory environment. Noticing of real-time control and command with vital technology will bring functions and gains to the process of optimization and automation in a supply chain. Therefore, in a standard technology oneM2M with real-time command and control, uses cases should be considered [4]. In addition, the requirements of the implementation of this technology need to be considered in accordance with existing protocol standards. IoT Platform which is using oneM2M standard can be seen Figure 2.

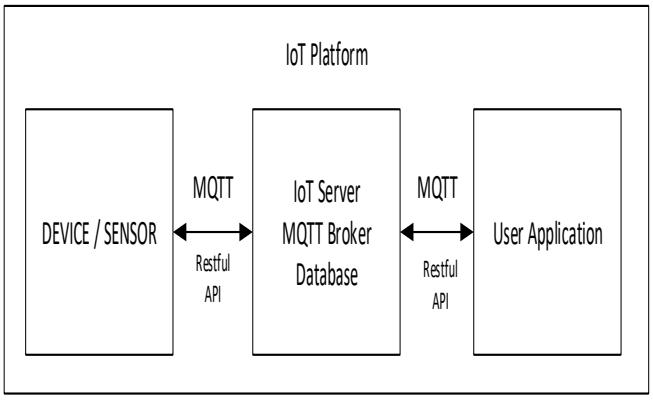

Figure 2. IoT Platform Design and Architecture

In Figure 2 above, we can see that MQTT is playing main role in the IoT Platform. Message Telemetry Transport Queue (MQTT) is messaging protocols based on publication/subscription schemes [5].

Message queue telemetry transport (MQTT) is used as a lightweight application layer protocol for IoT devices. MQTT is a protocol that has a type of "publish" and "subscribe" where the sender of the message can send information to customers through an intermediary server called a broker.

Each message published has one topic, which clients can use to subscribe to a broker. In the MQTT protocol standard, because only one broker is defined in a system, this broker can be a single PoF (point of failure). To introduce several brokers in a system as a solution to increase system availability. The network architecture in the MQTT protocol must be cloud-based because this system has only one broker.

III. Implementation

In order to monitoring factory environment, authors were using industrial sensor as source of data. The sensor data was able to be collected by developing the script code using programming at the IoT side. After running the script, the output which contains Temperature and Humidity were sent automatically to the table under MySQL database in a real-time mode simultaneously.

In order to get real-time monitoring, author uses application in server side which the data retrieved from MySQL database. By using real-time mode, we can predict the value of particle concentration in the future using AI algorithm.

The result of real-time monitoring implementation can be seen in Figure 3.

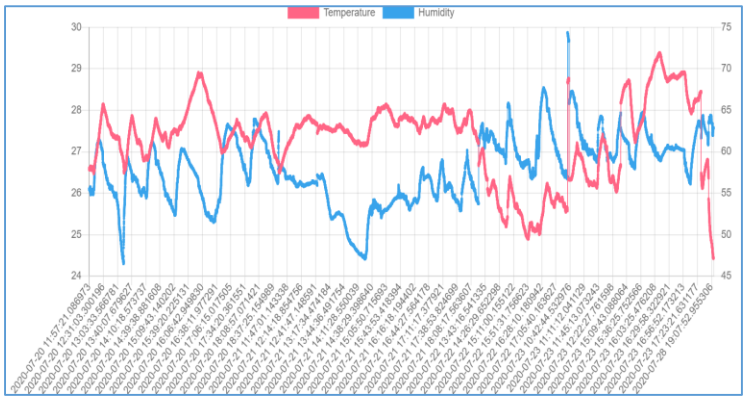

Figure 3. Result Implementation. Real-time data monitoring Sensor Temperature and Humidity

IV. Conclusion

This paper presents the implementation of data sensing using IoT platform to provide data reliability and interoperability based on real-time monitoring. This implementation can be used as the solution strategy for Smart Factory to improve their factory maintenance efficiency. This paper also describes how to collect the data from the industrial sensor devices which using IoT Platform, so the real industry will be able to use this research output. Sustainable improvement needed to this implementation in order to give the result of prediction, more precisely and accurately.

Acknowledgment

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References

[1] Statista, "'Global size of the smart factory market in 2019 and 2024,'" *Online*. https://www.statista.com/statistics/872289/worldwide-smart-factory-market-size/.

[2] M. M. Mabkhot, A. M. Al-Ahmari, B. Salah, and H. Alkhalefah, "Requirements of the smart factory system: A survey and perspective," *Machines*, vol. 6, no. 2, 2018, doi: 10.3390/MACHINES6020023.

[3] Thalesgroup, "Smart manufacturing and the IoT are driving the Industry 4.0 revolution," *2019*. https://www.thalesgroup.com/en/markets/digital-identity-and-security/iot/inspired/smart-manufacturing.

[4] I. D. Enablement, "Etsi tr 118 518," vol. 1, pp. 1–58, 2020.

[5] R. Kawaguchi and M. Bandai, "Edge Based MQTT Broker Architecture for Geographical IoT Applications," in *2020 International Conference on Information Networking (ICOIN)*, 2020, pp. 232–235, doi: 10.1109/ICOIN48656.2020.9016528.