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DIGITAL TWIN-BASED APPLICATIONS FOR ASSEMBLY PRODUCTION LINES OF GLOBAL AUTOMOTIVE PART SUPPLIERS

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ABSTRACT

Nowadays, several manufacturing companies design, engineer, and produce their products through a globally distributed supply chain. In an increasingly complex and uncertain automotive manufacturing environment, it is essential to effectively manage distributed global supply chains to enhance the efficiency and responsiveness. Accordingly, These manufacturers make great efforts to efficiently operate manufacturing systems using smart manufacturing(SM) technology. However, it is difficult to collect real-time information and support rapid decision-making from distributed manufacturing sites with existing independent applications. To solve these problems, this study propose a digital twin(DT)-based application using real-time manufacturing data which collected from manufacturing site. In addition, the proposed application was verified through a case study.

1 INTRODUCTION

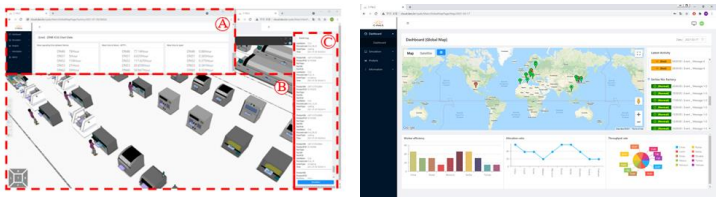
The automotive industry is a representative assembly industry that receives multiple parts from several part suppliers and produces final products (Jung 2001). The supply chain of the automotive industry is expanding geographically due to the increasing globalization and the pressure to reduction of production costs. In addition, consumer preferences become more individualized, production systems have been changing to build to-order model (Lee., *et al*. 2019). To solve these problems, smart manufacturing(SM) are necessary and the key technologies of SM are cyber-physical system(CPS) and digital twin(DT) (Kagermann *et al*. 2013). In this study, we propose a DT-based application for implements SM and CPS of global automotive Supplier.

2 DIGITAL TWIN-BASED APPLICATION IN CPS PLATFORM

CPS-based platform is designed based on various standards to overcome the heterogeneous environment of distributed manufacturing sites and provides services by integrating the information for SM. The DT-based application consists of a DT library, a configuration module, a simulation engine, and a DT interface. For the successful application of DT, the description of physical assets through a information model is important. The information model was reprocessed based on National Institute of Standards and Technology's Core Manufacturing Simulation Data. It contains various elements composing the manufacturing site.

3 CASE STUDY

To verify the effectiveness, we applied the DT-based applications to the factory of global automotive parts manufacturers in South Korea. Figure 1 shows that the CPS platform and DT application are interlinked, and the simulation is performed (Choi 2021). A part A shows the KPI values derived by the simulation results. And a part B shows that a simulation screen with real-time data sent from the platform. A part C shows that the data collected from the manufacturing site is delivered through the CPS platform.



(a) (b)

Figure 1: (a) Snapshot of DT Application and CPS Platform; (b) The Web Dashboard of CPS Platform.

4 CONCLUSION

In the case of traditional simulation modeling, data must be collected and analyzed continuously, which is more inefficient than DT interlinked with manufacturing site in real-time. In addition, while traditional modeling often involves workers' labor, DT model has the advantage of being able to predict KPI quickly by automating tasks.

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