

Project Title: Sustainable and Resilient Automated E-Fulfilment Operations in the Era of Industrial 5.0

研究項目: 建立可持續和適應性強的電子訂單履行

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Abstract

The rapidly growing e-commerce sector has significantly transformed customer behaviour worldwide. In the European Union, the gross value of retail sales in April 2020 diminished by 17.9%, whereas sales via e-commerce orders increased by 30%. The burgeoning of e-commerce purchasing has highlighted the growing importance of e-commerce logistics. In the era of Industry 4.0, automated e-fulfilment centres are adopting technologies such as artificial intelligence (AI), Internet of things (IoT), and automated guided vehicles (AGVs) to enhance the capability and reliability of industries. In the modern business environment, apart from the use of technology, a more value-driven movement is a concern that drives the revolution of Industry 5.0.

This project aims to design a digital twin (DT) to jointly optimize sustainability and resilience in automated e-fulfilment centres. Specifically, solar power is employed as a source of renewable energy for an automated e-fulfilment centre. The proposed model contributes to infrastructure design recommendations by developing a DT that transforms the actual automated e-fulfilment centres to editable virtual automated e-fulfilment centres. Based on the DT, a simulated study is performed to determine the optimal renewable energy model to achieve self-reliance. With the optimal renewable energy model, operational resilience can be achieved by considering the interactions between different operational processes and renewable energy consumption. From the perspective of automated e-fulfilment centres, the proposed model presents a framework to transition from non-renewable energy to renewable energy. In addition, automated e-fulfilment centres can handle the rapidly changing supply chain environment by accomplishing resilient operations. With the aid of the proposed model, sustainable and resilient automated e-fulfilment centres can be realized, resulting in better economic competitiveness and environmental benefits.