



# Building Digital Twins of Cyber Physical Systems With Metaverse for Industry 5.0 and Beyond

Jagatheesaperumal and Rahouti, 2022

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# Introduction

"the digital twin paradigm can serve as a synchronization enabler of the digital space with the physical world (or vice versa)"

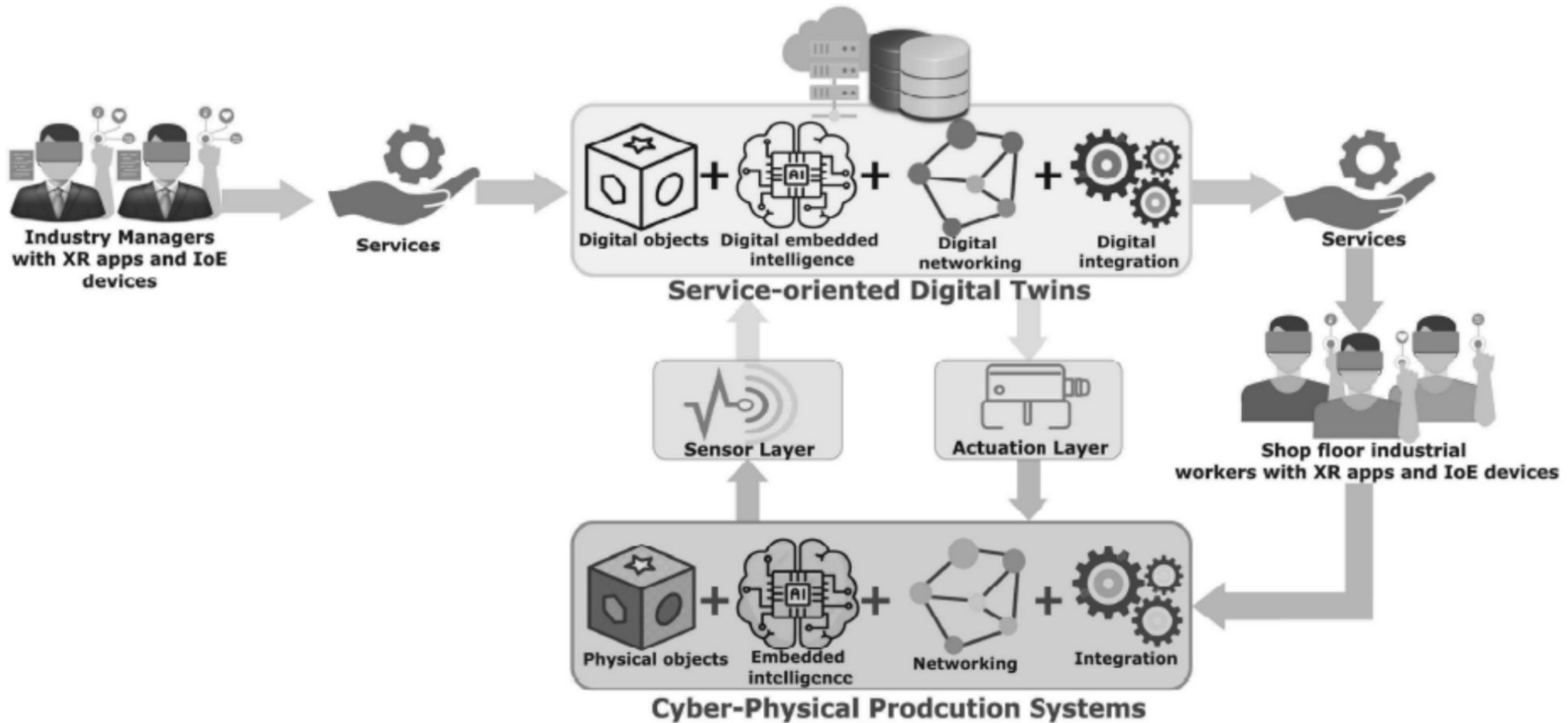
"transform the smart factories into virtual metafactories that enable them to test cases in the metaverse."

"integration of the virtual/digital and physical worlds ensures efficient monitoring of assets, failure anticipation, and optimization plan development."

# Challenges

- digital twin integration with metaverse-supported frameworks
- digital cloning in smart industries
- virtual interactions with digital clones

*\* Challenges are not limited to this ones*



**FIGURE 1.** Metaverse-based service-oriented digital-twin model for Industry 5.0.

# Characteristics

- Connectivity
- Homogenization
- Digital traces
- Re-programmability
- Modularity

# Applications

- Manufacturing
- Automotive industry
- Logistics and supply chain
- Urban planning
- Healthcare

# The evolution of CPS architectures toward digital cloning technology

- 3C architecture
- 5C architecture
- Self-adaptive architecture
- Fog computing
- Reference Architecture Model (RAMI 4.0)
- Industrial Internet Reference Architecture (IIRA)

# Recommendations for Industry 5.0 and Beyond

1. Explore for BestFit VR/AR Gadgets, XR Apps, and IoE Devices
2. Embrace the Supporting Technologies as Building Blocks of Industry 5.0
3. Setup Immersive Framework for Remote Analysis and Control
4. Establish Social Interactions Among the Workforce, Supply Chain, and Consumers



# Open Challenges

- integration with metaverse-enabled frameworks
- immersive virtual interactions with the digital clones
- remote access for monitoring and controlling
- enforce immersive virtual remote access policies
- assessment of the feedback from the digital clones
- issues related to privacy and security of customers
- scalability concerns of blockchain solutions
- ensure human well-being in face of autonomous and intelligent systems (A/IS)

# Conclusion

"the metaverse will become a significant platform for Industry 5.0 operations and beyond to plan activities, manufacturing, assembling, supply chain, marketing, and other relationships with stakeholders"

"They allow the smart industries to conduct innovative alterations in the digital clones for new product development and embrace novel marketing strategies for their products."

# Bibliografia

Jagatheesaperumal, Senthil Kumar, e Mohamed Rahouti. 2022. “Building Digital Twins of Cyber Physical Systems With Metaverse for Industry 5.0 and Beyond”. IT Professional 24 (6): 34–40.

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# FIM

Obrigado pela sua atenção