Studies in Computational Intelligence 1068

Thi Dieu Linh Nguyen
Joan Lu *Editors*

Machine Learning and Mechanics Based Soft Computing Applications

Springer

Machine Learning and Mechanics Based Soft Computing Applications pp 241–258Cite as

Digital Twins of Robotic Systems: Increasing Capability for Industrial Applications

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- Chapter
- First Online: 28 February 2023

Part of the Studies in Computational Intelligence book series (SCI,volume 1068)

Abstract

Digital twin is one of the emerging areas of research and technology development and the enabling technologies of Smart Manufacturing and Industry 4.0. This study aims to develop and demonstrate a proof-of-concept prototype with a case study of the digital twin of a robotic system. The system has two main elements: the virtual element and the physical or the real element. The virtual element of system has been built based on the Unity platform, which is a cross-platform game engine developed by Unity Software Inc., and the physical element was built with the use of two servomotors and the NVIDIA® Jetson Nano™ Developer Kit. The virtual and the physical elements are connected and communicated via using the TCP socket protocol suite. A digital twin model of the ABB IRB 120 robot was successfully developed and demonstrated. The collected data include the joint angle position values of the physical and virtual models, and they are stored both locally and in the cloud for the future system development, which can be used as for minimizing the errors between the physical and virtual models of digital twins of robotic systems. The successfully developed digital twin model can be considered as the cost-effective solutions for demonstrating and evaluating potential applications of digital twins in industrial practices as well as in higher educations and research.

Keywords

- **IoT**
- **Coffee disease**
- **Coffee farm**
- **Environmental factor**

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Appendices

Fig. 6

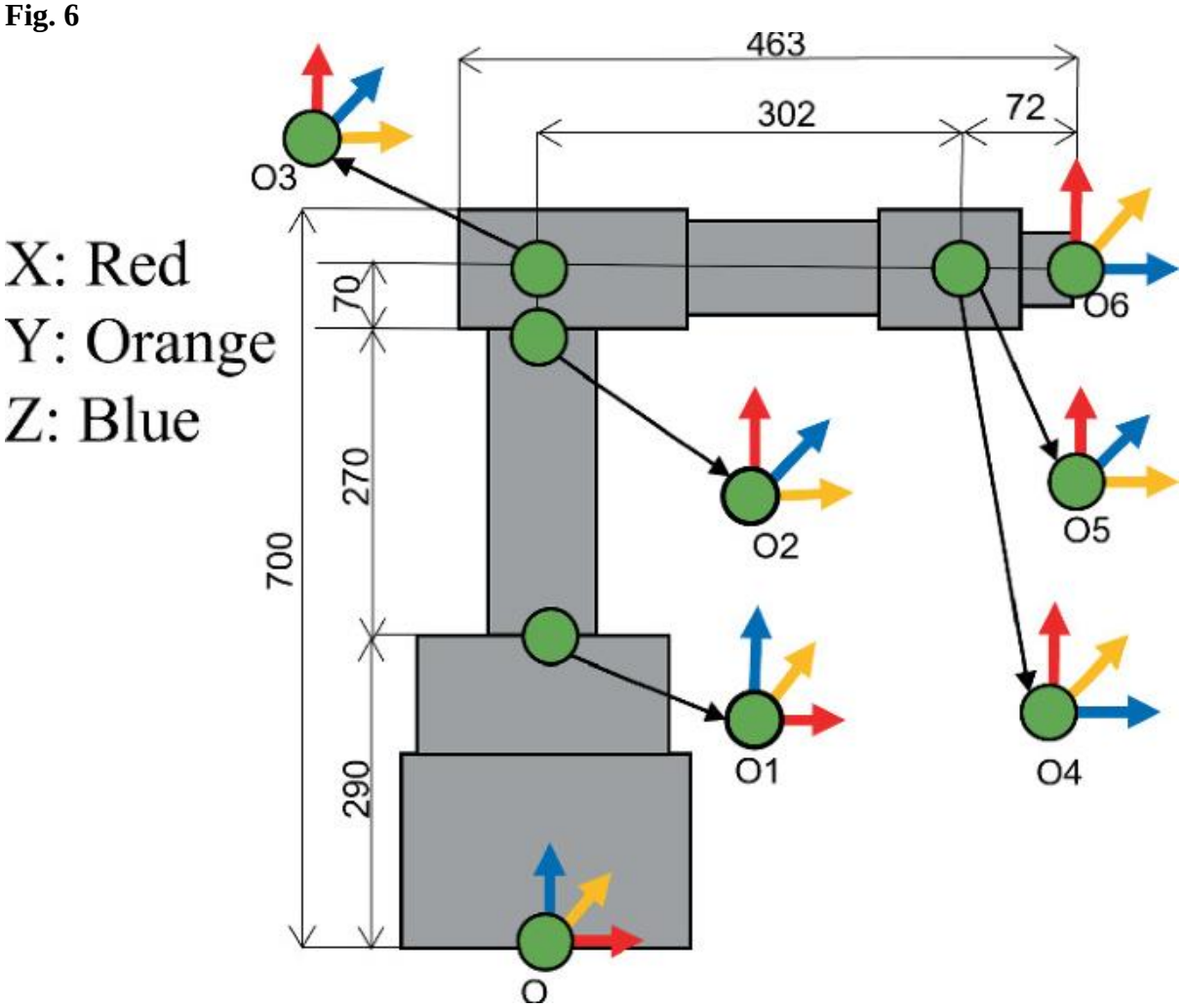
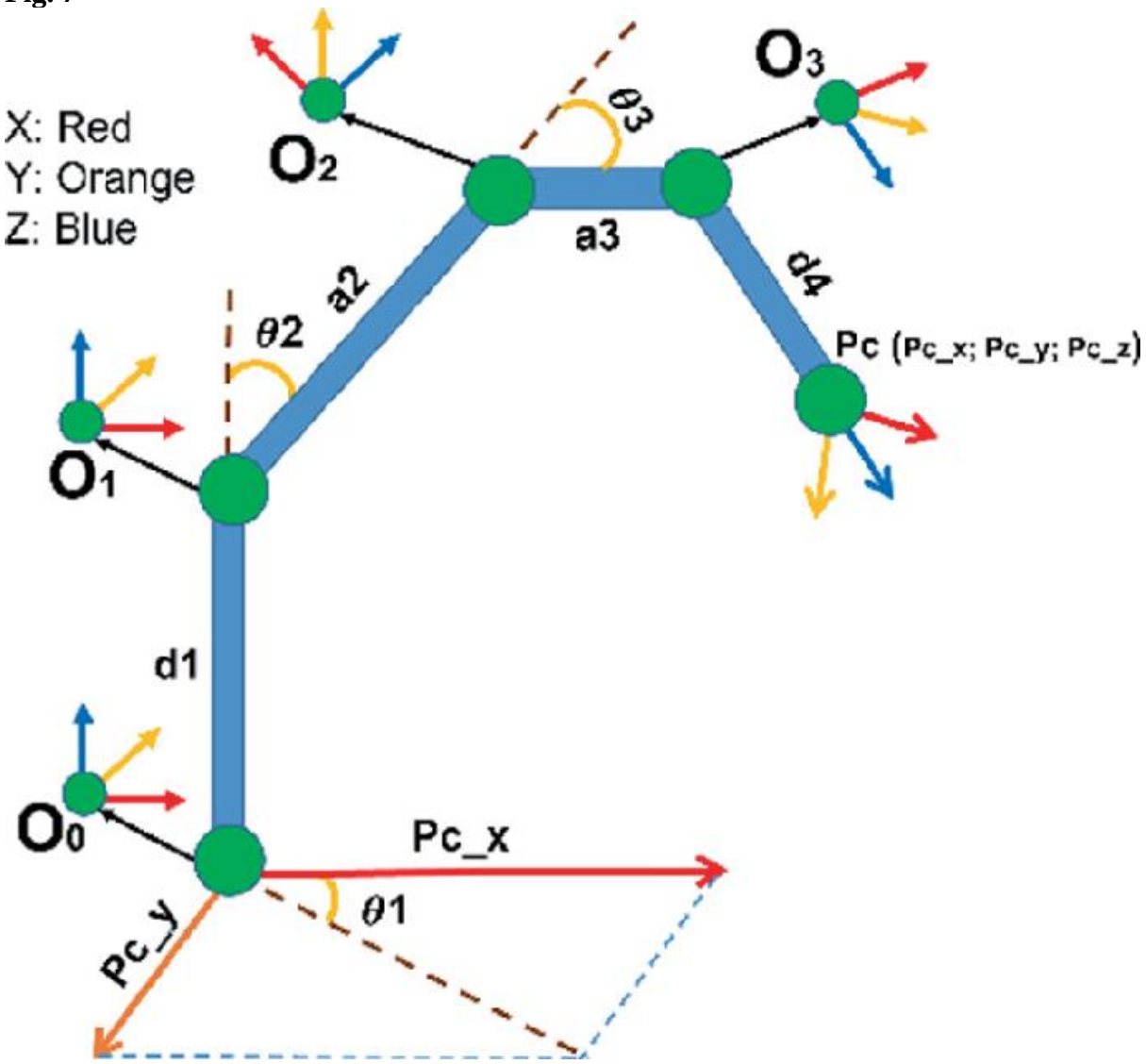


Fig. 7



About this chapter

Cite this chapter

Anh, T.T. *et al.* (2023). Digital Twins of Robotic Systems: Increasing Capability for Industrial Applications. In: Nguyen, T.D.L., Lu, J. (eds) Machine Learning and Mechanics Based Soft Computing Applications. Studies in Computational Intelligence, vol 1068. Springer, Singapore. https://doi.org/10.1007/978-981-19-6450-3_23

- DOIhttps://doi.org/10.1007/978-981-19-6450-3_23
- Published28 February 2023
- Publisher NameSpringer, Singapore
- Print ISBN978-981-19-6449-7
- Online ISBN978-981-19-6450-3
- eBook PackagesComputer ScienceComputer Science (R0)