

Comparison Study of In-House Developed and Proprietary Digital Twin and Simulation Platforms

Bachelor-Thesis

For this work, different digital twin development and simulation platforms should be explored and compared with in-house developed solutions in the context of industrial robotics, investigating their strengths and weaknesses, and the potential and use-cases of each option.

Motivation

In the currently evolving field of industrial automation, 3D robot simulation environments are becoming indispensable tools. They not only streamline the development and integration of automated systems but also enable concepts like digital twins.

A wide array of simulation platforms is available today, ranging from proprietary solutions like NVIDIA Omniverse and CoppeliaSim to customizable open-source alternatives, e.g. via frameworks like ROS (Robot Operating System) and cross-platform graphics engines. These platforms differ significantly in terms of capabilities, complexity, and cost. While commercial tools often offer polished, feature-rich environments, they create a dependency for engineers on proprietary licences and their dynamic costs. Open-source solutions provide the flexibility to tailor simulations to specific needs, without creating any specific dependency. However, this flexibility comes at the cost of increased development time and technical overhead.

Given this diverse landscape, engineers and developers face a critical question: which simulation platform is best suited for a given application? This question highlights the need to explore and compare the strengths and trade-offs of various environments.

Goals

This thesis aims to create a detailed and comprehensive comparison study between in-house developed simulation environment and commercial solutions. For this goal, diverse use-cases should be designed and aimed at benchmarking different requirements and desired goals, common in the automation engineering. The comparison should evaluate and score the proposals under specific metrics that highlight their strengths and trade-offs.

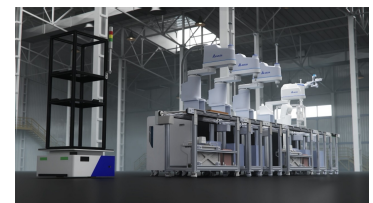


Figure 1: NVIDIA Omniverse Simulation with Delta Electronics Robots.

Credits:

www.nvidia.com/omniverse

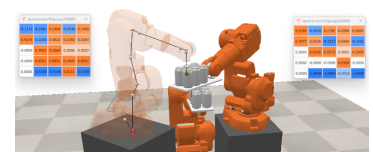


Figure 2: CoppeliaSim Simulation.

Credits:

manual.coppeliarobotics.com



Betreuer

Xavier Bustamante, M. Sc.
Geb. 30.33, Raum 208
Tel.: 0721/608-43238
xavier.bustamante@kit.edu

Thesis: Bachelor

Datum der Ausschreibung: 03.07.2025

Tags: Digital Twin, Robotics, Simulation, NVIDIA Omniverse, CoppeliaSim

Interests and Prior Knowledge

- 🏠 Interest in digital twins and information models
- 🤖 Interest in robotic industrial processes
- >_ Ideally programming skills in Python and/or C++
- >_ Experience with platforms like NVIDIA Omniverse is beneficial
- 🧑 Basic knowledge in robotics beneficial



Betreuer

Xavier Bustamante, M. Sc.
Geb. 30.33, Raum 208
Tel.: 0721/608-43238
xavier.bustamante@kit.edu

Thesis: Bachelor

Datum der Ausschreibung: 03.07.2025

Tags: *Digital Twin, Robotics, Simulation, NVIDIA Omniverse, CoppeliaSim*