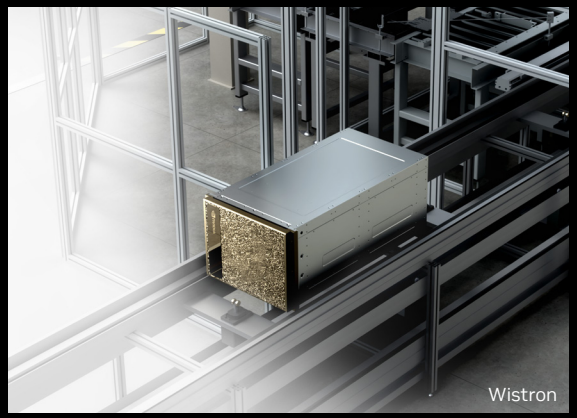
Ebook

Exploring Digital Twins: Key Insights From Five Industry Leaders

Siemens, HD Hyundai


Wistron

Amazon Robotics

Introduction

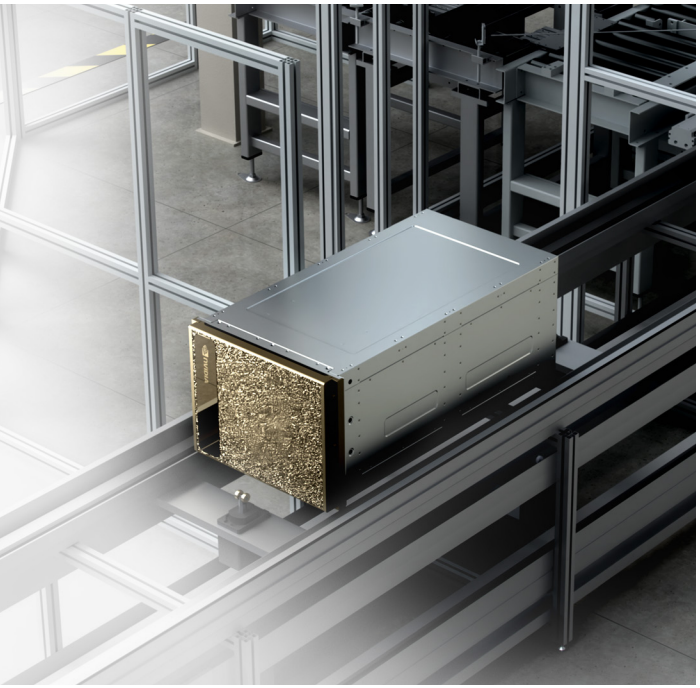
The world's heavy industries are undergoing a profound transformation driven by industrial digitalization. As they look to become more software-defined, companies in these industries are embracing digital twins to unlock new levels of efficiency, productivity, and competitiveness.

Digital twins are physically accurate virtual replicas of assets, processes, or environments. The latest advancements in open standards, computer vision and graphics, and accelerated computing make a new class of digital twins possible—live, connected, perfectly synchronized, and with true-to-reality physics, materials, lighting, rendering, and behavior. Once built, these digital twins become the birthplace of robotics systems and virtual training grounds for AI. They help ensure that intelligent equipment embedded with advanced perception, reasoning, and recommendation capabilities can engage with our physical world and make recommendations and autonomous decisions based on the laws of physics.

To unlock their industrial digitalization ambitions, developers are leveraging **Universal Scene Description (OpenUSD)** and the **NVIDIA Omniverse™** platform to build advanced digital twin solutions that bring **data interoperability**, **collaboration**, and **physically based visualization** to their users.

In this ebook, we'll explore five real-world developer use cases and share insights and resources to help you develop your own digital twin solutions.

01. Wistron Increases Planning Efficiency and Accelerates Time to Production



Wistron

Digital twins significantly streamline facility planning and reduce the time required to bring them online. Planning teams can virtually test new layouts and processes to improve current operations. They can also verify that the built structure matches their digital plans, avoiding costly change orders late in development.

Wistron, one of the world's largest suppliers of information and communications products, utilizes digital twins to enhance their manufacturing operations. By integrating multi-CAD and process simulation data into a unified digital twin, Wistron teams test and optimize layouts in a physically accurate digital environment. The digital twin increases worker efficiency by 51% during planning and construction. Using digital twins, Wistron drastically cuts the time needed to bring new factories online. Instead of taking five months, it can now be done in just two and a half months.

> "The digital twin helps with rapidly testing new layouts to accommodate new processes and improve operations in the existing space."
>
> **John Lu**, Plant Manager, Wistron

By connecting their digital twin to live IoT data from machines on the production line, real-time monitoring of operations becomes possible, further improving efficiency and enabling teams to reduce end-to-end cycle times by 50% and defect rates by 40%.

See how **Wistron** developers built their digital twin platform and learn more from their **developer spotlight**.

02: Delta Electronics Redefines Production Lines and Industrial Inspection

Delta Electronics, a global leader in power and thermal management technologies, uses digital twins to enhance their production lines and industrial inspection processes.

The process of creating a digital twin begins with aggregating and visualizing 3D data. Delta teams use multiple software tools, including Autodesk 3ds Max, FlexSim, and Visual Components to model and simulate their production line.

By building solutions on Omniverse and OpenUSD, Delta developers connect their various applications and data together via a unified data pipeline.

Once their digital twin was built, utilizing the NVIDIA Isaac Sim simulation platform enabled Delta's teams to generate synthetic data for training their computer vision models and simulate the performance of their inspection cameras. With this new workflow, they now train their AI models 100 times faster and achieve 90% object model detection accuracy.

The use of digital twins and synthetic data has proven to be a cost-effective and efficient solution for Delta Electronics in their pursuit of smart manufacturing and sustainable production.

Learn more about how developers at **Delta Electronics** are redefining production lines and industrial inspection with digital twins and synthetic data.

Delta Electronics

> "When apps connect to our tools developed on Omniverse, our files and data can be synced simultaneously, so team members can see updates in the USD Stage and collaborate in real time. "USD enables seamless collaboration with each team member, so we can design a production line faster and more efficiently than before."
>
> **Ares Chen**, PSBG General Manager, Delta Electronics

03: Siemens Brings Physically Based Visualization and Generative AI to Product Lifecycle Management

Siemens, HD Hyundai

Design and engineering teams typically rely on physical prototypes and in-person meetings to complete their large-scale projects. But this approach is often prone to costly errors and delays in time to market.

By unifying complex project data, digital twins provide insights to all stakeholders, allowing them to visualize complex engineering data at scale, collaborate in real time, and reduce workflow inefficiencies.

Siemens, a leading technology company for automation, digitalization and sustainability, is enabling their customers to take advantage of large-scale, physics-based digital twins by connecting NVIDIA Omniverse and OpenUSD with its Xcelerator portfolio, starting with Teamcenter X, the industry-leading cloud-based product lifecycle management (PLM) software.

Using NVIDIA Omniverse and Teamcenter X, engineering teams can create more immersive and photorealistic physics-based digital twins, which help streamline design and engineering workflows and provide stakeholders with a deeper insight and understanding of their products' real-world appearance.

Learn more about how **Siemens** is bringing generative AI and digital twins to industrial design and manufacturing.

> "Every enterprise has a wealth of different information in different formats. With OpenUSD, we can bring it all together and that will unlock a lot of value for enterprises. Before, when there would be a set of problems—like simulating a factory floor at scale—we had to take the problem, and make it smaller and smaller until we could solve it. But now, with Omniverse, we're in these whole worlds where we can solve the big problems right away."
>
> **Joe Bohman**, Executive Vice President, PLM Products, Siemens

04. Amazon Robotics Accelerates the Training and Deployment of Robotics

Robotics developers and engineers use digital twins to train autonomous robots in a controlled environment before real-world implementation.

Amazon Robotics engineers develop tools on Omniverse and OpenUSD to automate and optimize their autonomous warehouses through digital twin simulations. By utilizing the NVIDIA Isaac Sim platform, Amazon Robotics enhances the capabilities of its advanced autonomous mobile robot, Proteus. This enables the online retail giant to fulfill a large volume of orders efficiently while minimizing costs.

Large scale, physics-based simulations were crucial in enhancing the performance of Proteus' neural network, which relies on fiducial markers for location detection.

With Omniverse and Isaac Sim, Amazon Robotics engineers were able to generate large photoreal synthetic datasets that improved marker detection success rates from 88.6% to 98%. The use of synthetic data generated using Omniverse Replicator in their workflow also sped up development time from months to days.

> "To train autonomous robots and perception systems to be safe and operating around humans, you need accuracy. So our engineers and scientists used to train on collected, annotated real-world data. But with the realism available today for synthetic data, teams found they weren't able to improve beyond a certain point without augmenting with synthetic data. We now have synthetic data of high enough quality that it can augment the real-world data."
>
> **Christine Osik**, System Operations and Simulation, Amazon Robotics

Learn more about how **Amazon Robotics** is using digital twins of its warehouses to train robotics systems.

Amazon Robotics

05. Pegatron Transforms Factory Operations and Training of Perception AI Models

Pegatron

Companies are increasingly using AI-powered computer vision systems to elevate quality control and inspection, ensuring their products meet the highest standards.

Developers at Pegatron, a leading electronics manufacturer, leveraged NVIDIA AI, Omniverse, and OpenUSD to build digital twin solutions that provide a real-time view of complex factory data to their planning teams and suppliers. Pegatron teams use digital twins to optimize factory layouts and train perception AI models.

The team uses the NVIDIA Isaac Sim platform to simulate and optimize their fleet of mobile robots and pick-and-place robotic arms in the factory. Automated optical inspection (AOI) points are deployed along production lines to reduce cost and increase line throughput. By using NVIDIA Metropolis, Pegatron teams can quickly develop and deploy cloud-native, highly accurate AOI workflows across their production lines.

The combination of NVIDIA AI and Omniverse technologies enables Pegatron' developers to equip their teams with real-time insights and predictive analytics, ensuring they can make data-driven decisions and continuously improve their manufacturing operations.

> "With software-defined factories built on NVIDIA AI and Omniverse, manufacturers can super-accelerate factory bring up and minimize change orders. This allows our teams to continuously optimize operations and maximize production line throughput, while reducing costs."
>
> **Andrew Hsiao**, Associate Vice President, AI Development Division, Pegatron

Learn more about **Pegatron** and how they're digitalizing with AI smart factories through their **developer spotlight**.

Resources to Get Started

> Learn how **leading companies across industries** are driving innovations with digital twins.

> Learn more about **Universal Scene Description** (OpenUSD).

> Register for a **self-paced course** on how to build digital twins.

> Explore **factory digital twin reference architectures**.

> **Contact Us** to discuss how NVIDIA solutions and our growing partner ecosystem can help you get started with digital twins and unlock their vast potential for your organization.

Get Started With Our Partners

See the ecosystem of developers that are integrating OpenUSD and Omniverse technologies into their software, solution, and services portfolios.

Ansys cadence DASSAULT SYSTEMES HEXAGON kinetic vision

Microsoft Azure NavVis PATCH MANAGER infrastructure management software Rockwell Automation SIEMENS softserve

Ready to Get Started?

Learn more about how companies are using digital twins:
www.nvidia.com/en-us/omniverse/solutions/digital-twins/

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