

N-iX introduces a robotic-based Digital Twin and Shadow solution for automotive battery assembly and diagnostics

Built with ROS 2 and MathWorks model-based tools, the solution enables scalable automation in battery assembly—without disrupting human-centric production line.

FLORIDA, FL, UNITED STATES, May 15, 2025 /EINPresswire.com/ -- [N-iX](#), a global software solutions and engineering company, has presented a Digital Twin/Shadow-based automation solution for electric vehicle (EV) battery manufacturing and diagnostics at the recent MATLAB and Simulink seminar. Built using ROS 2 (an open robotics middleware) and MathWorks model-based tools, this innovation is poised to transform how battery modules are assembled and tested — without disrupting existing human-centric production lines.

Reimagining EV Battery Production

Traditional battery assembly relies heavily on manual labor — slow, error-prone, and hard to scale. N-iX's new solution brings a human-robot collaborative system to life: a collaborative robot handles repetitive actions like pick-and-place, alignment, and probing. The engineer, meanwhile, performs dexterous tasks and critical final checks.

"We're transforming traditional battery assembly into a robotic-based collaborative process," said Artem Kharchenko, SVP, Head of Delivery Department at N-iX. "Digital Twin and Shadow

The N-iX logo, with "N" in orange and "iX" in dark grey.

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N-iX introduces Digital Twin/Shadow Solution

for Automotive Battery Assembly and Diagnostics

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solution empowers manufacturers to automate and scale processes safely, enabling intelligent diagnostics and real-time insights."

Real-Time Control with a Bidirectional Digital Twin

What makes the system exceptional is its integrated, bidirectional Digital Twin — a real-time, physics-based simulation of the robot, built with Simulink, Simscape Multibody, and Stateflow, and synchronized via ROS 2. This Digital Twin not only mirrors every joint, trajectory, and control signal of the physical robot, but also enables two-way communication between the physical and virtual systems:

1. From physical to digital: The engineer can guide the robot directly — for example, by physically moving it to demonstrate a trajectory — and those movements are captured and reflected in the simulation environment.
2. From digital to physical: The engineer can simulate, test, and refine robotic behaviors within the model, then apply those instructions in real time to the physical robot.

Intelligent Diagnostics with Digital Shadow

Alongside the robotic Digital Twin, N-iX developed a Digital Shadow for EV batteries — a data-driven replica that captures and visualizes battery state metrics such as temperature, voltage, and impedance. Based on these parameters, we calculate SoC, SoH, State of Risk, and more.

Learning and Safety Through AI and Machine Learning

The system applies AI and machine learning using two key data sources:

- Computer vision — enabling object recognition, alignment, and dynamic adjustments.
- Mechanical interaction data — capturing how the robot responds to contact with the physical environment, including interaction with the engineer.

These capabilities support two essential functions:

- Teaching the robot new tasks through demonstration and adaptive modeling
- Ensuring functional safety, with predictive logic to avoid unsafe movements in shared workspaces

"This is a working glimpse into how functional safety, robotics, and intelligence — powered by a model-based approach — can scale real-world manufacturing without breaking what already works," said Dmytro Humennyi, Ph.D., Engineering Manager at N-iX. "Together, the Digital Twin (robot) and Digital Shadow (battery), enhanced by AI-driven intelligence, allow manufacturers to scale automation safely and intelligently — while preserving transparency, traceability, and operator involvement."

About N-iX

N-iX is a global software solutions and engineering services company that helps the world's leading organizations turn challenges into lasting business value, improve operational efficiency, and drive revenue growth using modern technology. With over 2,200 professionals, N-iX offers expert solutions in cloud computing, data analytics, embedded software, IoT, AI, machine learning, and other tech domains.

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