Driving crane performance **through data**

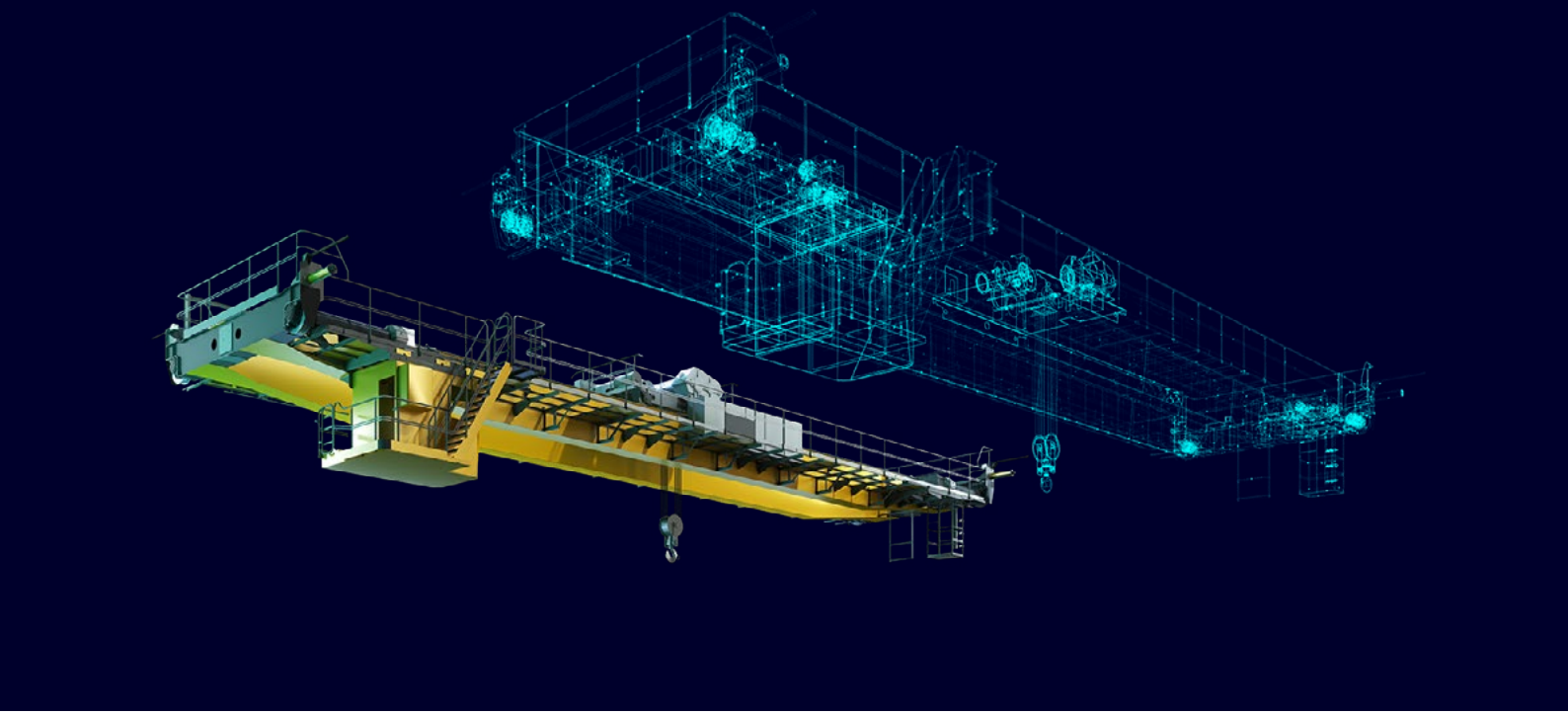
SIEMENS

Cranes have become an integral part of industrial automated production networks and need to operate at optimum productivity, reliability, and availability to ensure overall plant performance. With data-driven services and solutions, both crane manufacturers and operators can not only reduce engineering times and project risks but also optimize crane operation, efficiency, and safety.

Cranes have evolved significantly: What used to be a relatively simple piece of equipment, operated via push buttons and joysticks, has now become an essential part of production processes. As a result, cranes must be able not just to transport goods but to interact with the production environment where they are installed and exchange data with a multitude of systems, both on the shop floor and on the MES and ERP levels. To meet the growing requirements for productivity, availability, reliability, and safety, cranes increasingly rely on automation systems for operation. Cranes are equipped with automation modules like sway control, collision prevention, and optical character recognition (OCR) systems. They can run semi- or fully autonomously and can even be operated remotely from a central control room.

Increasing efficiency during engineering

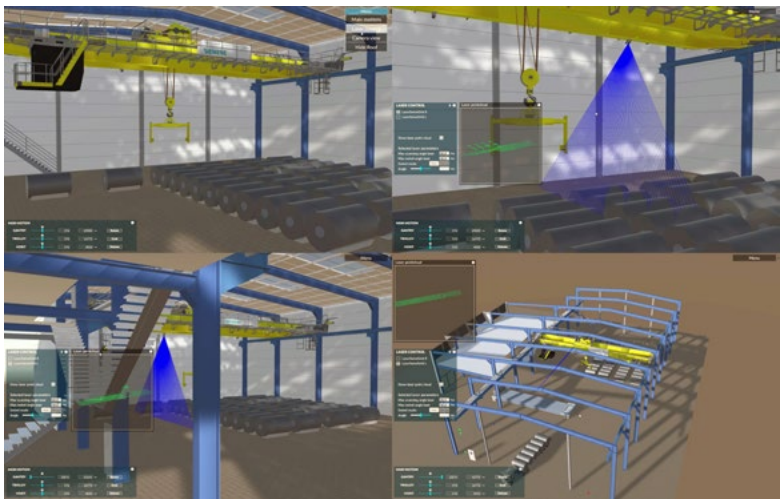
Cranes are no longer simply distinguished by mechanical design and load but are customized to include various automation modules to allow for semi- or fully autonomous operation. Systems to improve safety, communication interfaces, and motion sensors make designing and engineering cranes increasingly complex. At the same time, suppliers must offer cost-effective modular solutions and meet short time-to-market requirements. Being able to deliver a crane that meets all requirements in a short time and with minimum expense is critical in the market. One way to address these challenges is to utilize data-driven processes and tools. Digital twinning allows for a 3D simulation of the future crane to demonstrate its behavior during the specification phase. This way, automation modules for the



specific application are fine-tuned to meet requirements.

This simulated crane can also be integrated with a simulation of the production environment to verify motion paths, compare crane performance with production KPIs, and even check specific requirements such as the field of vision for cameras on the crane. This is especially important for remote operation concepts where several cranes are controlled from a single operator desk. In these applications, operators must rely on the visual information provided by the crane for operation and control. Any errors in early stages of design can incur added costs and create risks to production and personal safety.

During engineering, creating a digital twin that integrates the mechanical, electrical, and automation design of the crane will greatly facilitate testing and verifying crane behavior and safety. Various operation scenarios and critical equipment states can be simulated. It is possible to verify that scanners will reliably detect and avoid a collision with static production elements or with other pieces of equipment. Advanced simulation environments such as Simit support tracking paths of motion, help identify weaknesses in the design, and avoid costly rollbacks or modifications.



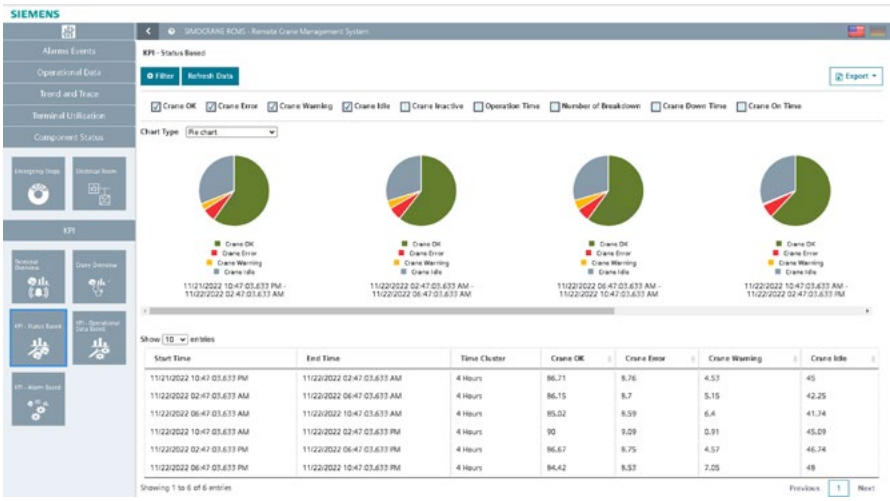
Camera positions and field of views can be adapted and optimized on a digital twin

Increasing efficiency during commissioning

The crane can be fully created as a digital model. The physical crane is built on a pretested and optimized design. As the crane is being built parallel to commissioning, this helps to cut installation time and cost. All electrical and automation systems are pretested and precommissioned, so the on-site installation and commissioning can be performed with minimum effort. The digital twin also gives more options to provide support from multiple engineers remotely, which improves response time and further reduces project duration. The digital twin also provides an ideal environment for operator training even before the crane is installed and commissioned. With a training simulator, exceptional scenarios can be created without occupying the real crane, thus eliminating risks. This way, the crane will be not just fully operational right after handover but also fully productive, as operators will be more capable of handling the systems.

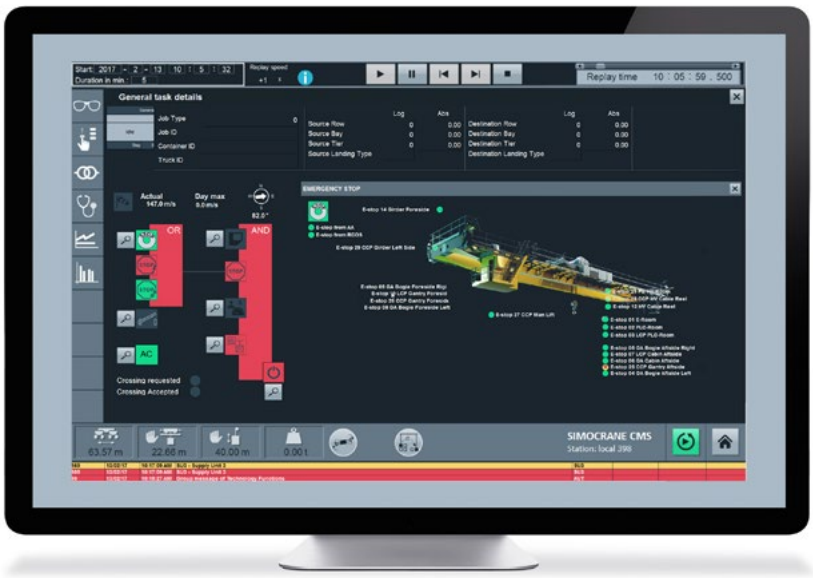
Increasing efficiency during operation

Even after commissioning, simulation and data-driven tools can support efficient crane operation. Automation systems, sensors, and drive systems can provide a wealth of data that can be readily exploited to optimize performance and streamline service and maintenance. For example, a typical crane has more than 2,000 data points that provide information on crane motion, position, and status. Sensors track vibration and temperature changes in crane components. Furthermore, the automation systems provide details on KPIs, including events, alarms, and fault messages.



A centralized crane management system (CCMS) collects data from all cranes in operation and enables benchmarking of fleet and crane performance

The crane data can provide valuable insights into current crane performance that can be used for condition-based monitoring and maintenance. For example, the Simocrane Crane Management System provides dashboards to present real-time data and various KPIs from the crane. It also enables reporting and data analysis to optimize operation and maintenance. Users can extract and analyze process value and message archives to identify patterns. In case of failures, the replay function can play back the events to support troubleshooting and to help identify root causes.



The replay function plays back analog and binary signals of events

Through simulation with a digital twin, crane design can be optimized in an early stage

On the next level, the data provided by the crane can also be used for advanced data-driven services such as AI-based predictive maintenance. Such solutions are already applied in many industries and applications. For example, the Analyze MyDrives app from Siemens uses machine learning and AI algorithms to identify anomalies in drive-train behavior as well as their causes. The system gives alerts in time to take preventive action and avoid unplanned downtime.

From single crane to fleet management and optimization

When data from different cranes are available and comparable, operators can then integrate all their cranes into one centralized crane management system to analyze and optimize the entire fleet. This enables benchmarking of cranes to identify bottlenecks, help optimize crane performance and availability, analyze energy consumption, and reduce maintenance requirements. Moreover, advanced crane management systems can counsel operators in unusual situations, provide guidance for troubleshooting, and assist in operating and managing different types of cranes and operations—all based on current crane data. The automation, drive, and sensor systems installed in cranes today already provide much of the data required for these services, so it is time to use them.

A new era of integration

Semi- or fully autonomous cranes have become indispensable. Automation and digitalization give unmatched advantages in meeting safety, sustainability, and performance targets. The standardized approach of state-of-the-art automation modules allows for state-of-the-future scalability in which you can further enhance existing cranes or easily integrate new ones in your processes. In operation, open communication interfaces between models, systems, and cranes combined with condition monitoring solutions enable advance data analytics of entire fleets. Beyond optimizing your cranes fleet, automation and digitalization increase the potential to improve overall plant productivity, since cranes are—and need to be—integral with factory processes and its ecosystem.

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