Showcase

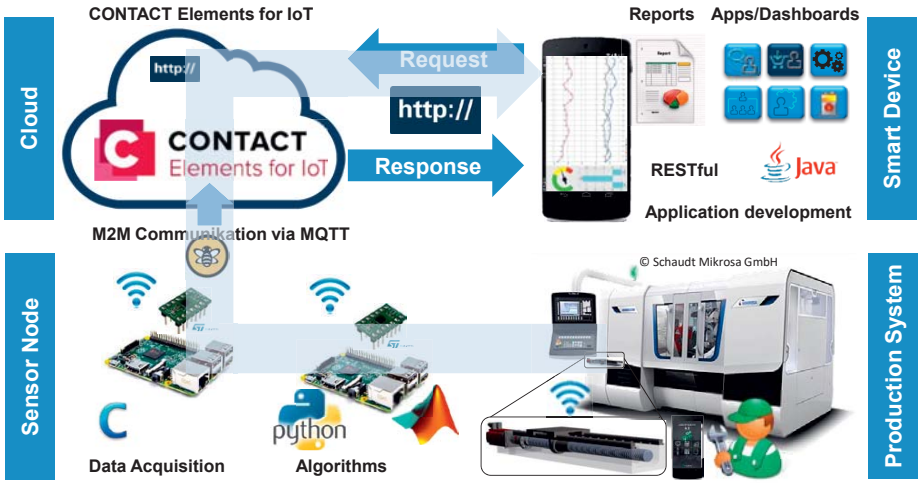
Lifecycle Monitoring with the Digital Twin

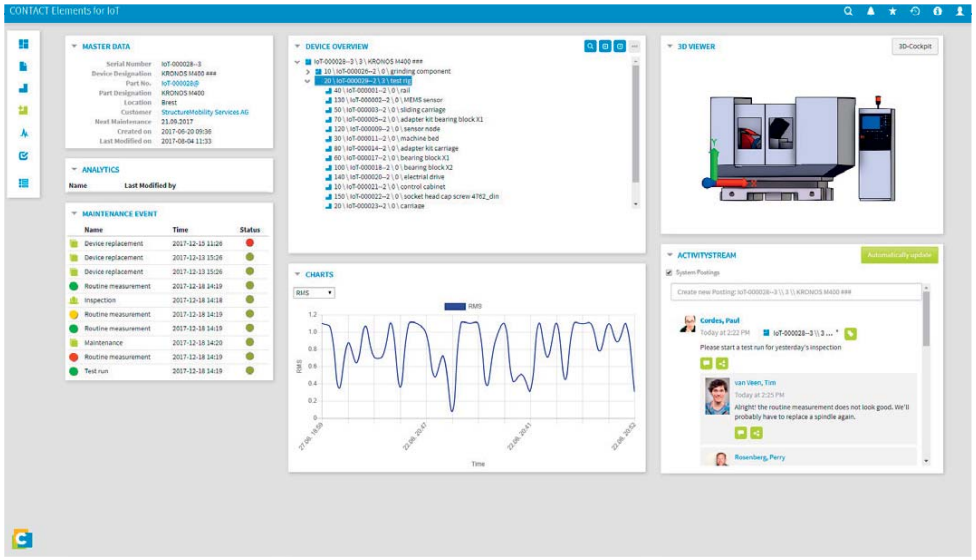
Together with CONTACT Software, Fraunhofer IPK developed a showcase that demonstrates the potential of IoT-based services for industrial production. The showcase can be seen in the Industrie 4.0 Lab of the Berlin Center for Digital Transformation. Condition monitoring of a machine tool for specific operating parameters enables the operator or manufacturer to practice prognostic maintenance.

Usually, the digital twin of a production line displays the virtual map of the actual physical production line or selects components of this line. At the core of such digital twins are cyber-physical production systems (CPPS). These intelligent systems contain sensors and actuators. They evaluate data and communicate with other systems via integrated micro controllers. Digital twins play a role in practically all phases in the lifecycle of production facilities. In the product emergence phase (PEP), digital twins safeguard manufacturing processes before the physical product actually exists. The process works with the design and engineering data from the design data management system. In the final stage of this process, the product exists in virtual reality. The useful life span of the production facility is an equally exciting application of digital twins. In this phase, digital twins depict live manufacturing processes. Aside from PEP data, digital twins also collect sensor data, internal control data (e. g. from the condition monitoring system) and maintenance and repair data. These data are linked in the cloud. This service provides the user with up-to-date information on current and past configurations and on the integrity of the facility.

The equipment manufacturer uses this information in the data-driven business model offering added value to the customer beyond providing the equipment for the production process. Companies advertise such offers as »pay per x« services. The customer no longer buys the product itself but only the desired added value, which the equipment provides. For example, monitoring the production equipment and analyzing the recorded data may uncover a hidden problem in the digital twin, thus allowing the operator to take preventive measures. The shorter down times increase the technical availability of the equipment. Moreover, the insights gained will serve as »feedback to design« for future developments.

System structure and information flow in the CONTACT showcase





Screenshot of the test bench scenario in the new CONTACT Elements Platform 15.2 (© CONTACT Software)

Fraunhofer IPK together with CONTACT Software, a PDM/PLM provider from Bremen, used an agile approach to developing a showcase. This showcase now serves as the demonstration model for the partner's new offer »CONTACT Elements for IoT« to producers of industrial products. For this project, the engineers re-purposed an existing machine tool-based axle test bench into a cyber-physical production system. With its simple sensors and one-circuit board computers, the system now measures the wear condition of the feed axis and sends the data to the IoT application. The sensors and circuit boards started their useful life in the automotive and consumer equipment sections.

Once the system detects a critical wear status, the system triggers a service call and transmits via cloud supporting information to the service technician on-site. The technician uses his/her mobile device to log on to the platform. First, he/she sends the QR code to identify the equipment. Then he/she aligns the existing configuration with the one sent by the system. The technician will replace the defective equipment components, if both configurations are identical. There are two more steps. A self-test confirms the flawless functioning and the system registers the installed new part as change in the system configuration. Finally, the new equipment status is stored in the cloud platform. This keeps the entire history of the equipment in the long-term computer memory of the system. Analyses using machine learning methods and other methods allow the development of further innovative business models based on the stored data for the digital twin. ■

Your contact
Claudio Geisert
Phone: +49 30 39006-133
claudio.geisert@ipk.fraunhofer.de
Dr.-Ing. Patrick Müller
Phone: +49 5823 9550707
patrick.mueller@contact-software.com