Big data keeps complex production running smoothly

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Industrial plants are complex structures, and anyone who wants to monitor them must monitor the data from a wide variety of process variables. The Fraunhofer Institute of Optronics, System Technologies and Image Exploitation is developing tools for evaluating the data quickly. Credit: © Daimler AG

Industrial plants must function effectively. Remedying production downtimes and breakdowns is an expensive and time-consuming business. That is why companies collect data to evaluate how their facilities are doing. At the Hannover Messe Digital Factory, from Apr.

7-11, the Fraunhofer Institute for Optronics, System Technologies, and Image Exploitation will show how operators can analyze these huge amounts of data and use it as an early warning system when problems threaten.

Large amounts of data are produced when industrial companies monitor their facilities. Sensors check temperature, pressure, power, or energy use data. "If you're scanning to the nearest second, it's easy to rack up several terabytes of information in under a week," says Dr. Olaf Sauer from the automation business unit at the IOSB. But often there is a lack of suitable methods to evaluate the information. "Today's operators use only about seven percent of this data for maintenance or protection from breakdowns," adds Sauer. At the Hannover Messe Digital Factory, IOSB developers from Karlsruhe and Lemgo will present ways to leverage this untapped potential. Their systems can process the collected data in a way that increases plant availability significantly while reducing energy consumption.

The scientists from Karlsruhe focus on continuous processes in the chemical or pharmaceutical industries. "At the Fraunhofer Application Center Industrial Automation IOSB-INA in Lemgo, we have developed solutions, we can use to easily monitor complex manufacturing technology and hybrid systems," explains Prof. Oliver Niggemann, deputy head of IOSB INA in Lemgo. Together, the methods are suitable for all kinds of capital-intensive industrial facilities that need to run for long periods of time. "Even wind farms could be monitored this way," says Sauer.

The researchers use smart data mining methods to calculate the optimum operational steps for each production process. This reference model is then compared to data from current operations in order to quickly identify and precisely locate any discrepancies before thoroughly eliminating them. There is no need for detailed separate modeling of

complex plant structures. Special data storage systems record the information in real time and send it over the network to a database. Next, software normalizes the data, makes it comparable, and establishes relationships. The results are then presented in a clear way – for instance in the form of a three-dimensional map. "Mountains" and "valleys" depict the individual process phases; any disruptions or anomalies can be quickly identified. "Our tool has been used successfully in industry for some time now," says Niggemann. "The toolbox proKNOWS for instance currently is tested in two projects with industry partners." The scientists from Karlsruhe and Lemgo also use it to monitor and analyze facilities' energy demand. This information makes it possible not only to judge the state of the facilities but also to reduce their power consumption by way of appropriate adjustments to the controls. "This is something we've already demonstrated with conveyor drive technology," says Sauer.

A step towards Industry 4.0: Condition Monitoring

"Condition monitoring" is the name production experts give this use of modern ICT systems to monitor industrial facilities so as to prevent breakdowns. Most industrial companies today use technology of this sort, but in many cases they monitor only individual components and not the entire facility – even though that is what they should be doing. This is especially true for continuous manufacturing processes, where creeping change can suddenly cause a breakdown unless operators have their eye on all the variables. One example could be a pipeline blockage as a result of a gradual build-up of liquid or viscous material deposits on the pipe's inner walls. It is also rare for people to work up a reference model directly from collected data in the way the IOSB tools do. An additional challenge is that today's monitoring systems generally run on a standalone basis and are not part of the production ICT system. "But industry has recognized that it needs to catch up, and there is clearly a trend toward integrating them into manufacturing execution systems

(MES). We're still a long way away from the vision of Industry 4.0, in which smart machines automatically report of their own accord when they need maintenance or spare parts. But our methods bring us one step closer to reach that goal," says Sauer.

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