Press release

Predictive maintenance set to play a growing role in industrial applications

Engineers repurpose bat detector to spot defects in production equipment

Alpnach, 31 January 2022 – CSEM teamed up with four companies in central Switzerland – Aurovis AG, KNF Flodos AG, maxon motor AG and Schurter AG – to develop an inspection system that can spot and predict defects in production equipment. Their technology combines artificial intelligence with a sound sensor initially designed to detect bats flying near wind turbines. (SEE PICTURES HERE)

Wear and tear on production equipment can manifest in a variety of ways – pressure leaks, friction, overheating or unusual vibrations, for instance. These can be signs of defects which, if not repaired in time, can cause major disruptions to production lines. The challenge for plant operators is to spot these defects, but without having to shut down the equipment or the entire plant.

To help resolve this problem, CSEM teamed up with Aurovis, KNF Flodos, maxon and Schurter to develop an autonomous predictive-maintenance system that can inspect production equipment as it operates and flag potential failures before they happen. The system sends out instant alerts if it detects any sort of anomaly.

After over two years of joint R&D, the project team has now unveiled its device. It consists of high-precision sensor technology coupled with an easy-to-use software program.

The software was developed using existing production-plant data collected by instruments such as cameras, control systems, and temperature and pressure sensors. The engineers used these data to

train machine-learning algorithms to recognize abnormal and potentially dangerous disturbances in the way production equipment operates.

CSEM contributed its expertise in this area, including its [Vision Automation Robotics Designer (VISARD)](#) application, which allowed the engineers to analyze existing data and develop their versatile AI-based program. To use the new inspection system, a plant operator just needs to run the program for a few hours at the plant to collect data, with the equipment running normally.

"The longer the program runs on a production line, the more data are collected and the better our AI algorithms work," says Mario Russi, a senior R&D engineer in robotics and machine learning at CSEM.

The four companies involved in the project bring their respective expertise: Aurovis is specialized in robotics and image-processing systems; KNF Flodos supplies diaphragm pumps; maxon has developed a range of drive systems; and Schurter AG provides electronic components. These firms supplied the engineers with key parts including a robotic arm, a conveyor belt, pumps, control systems and motors. For instance, the project team installed a fully automated pick-and-place robot at CSEM to test their system. By running their algorithms on the robot, the engineers were able to continuously improve them. Now the algorithms form the core of a reliable, efficient system ready to be deployed on an industrial scale.

From wind turbines to production plants

But the new system contains other innovations, too. Because plant operators aren't always able or allowed to use existing sensors to collect data on production equipment, the project team came up with an original workaround: they repurposed a sound sensor originally designed to detect bats. These sensors are installed near wind turbines to detect the ultrasonic signals emitted by bats. If a sensor picks up such a signal, it triggers a series of algorithms that halt the turbine so as to avoid injuring the animal. Lucern-based Elekon AG supplied the sensors for this project, which can detect frequencies up to 150 kHz; for comparison, the human ear can detect frequencies up to only 20 kHz.

During tests on the robotic arm, the sound sensors were able to identify up to 80% of equipment anomalies, with no other signals to go by. "A lot of information can be gleaned from the noise a machine makes," says Russi. "It's like when a mechanic listens to your car's engine to figure out what's wrong. By paying close attention to the noise coming out of plant equipment, we can pick up on potential hazards like leaks, problems with rotation, or glitches in its camera. That's why our sound-sensor method works so well – it's easy to set up and can be used in association with other types of sensors."

The next step will be to pilot test the new inspection system under real-world conditions. "Approaches like ours will be increasingly common as we transition to Industry 4.0," says Russi. "This kind of technology will improve the reliability of entire production lines considerably and help manufacturers stay competitive."

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