

PRESS RELEASE

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Smart Screw Connection – Fraunhofer CCIT presents wireless, self-powered monitoring solution

Nuremberg, Germany: Loose screws at important connection points are a considerable safety risk. The Research Center IoT-COMMs – part of the Fraunhofer Cluster of Excellence Cognitive Internet Technologies CCIT – has developed a smart screw connection that enables wireless, self-powered monitoring. A thin-film sensor measures force effects on the screw connection as well as changes in the ambient temperature at the installation site. The screw regularly transmits load data via the standardized mioty® wireless protocol for monitoring purposes. The aim is to implement a self-powered approach to the permanent long-term monitoring of structures such as bridges, scaffolding and wind power plants. The solution will be presented for at the SPS Connect.

Screws can loosen themselves even if sufficient preload force has been applied. In the case of load-bearing elements that are exposed to strong mechanical or thermal loads, this means safe operation can then no longer be guaranteed. In bridges, scaffolding or fairground rides, for example, the consequences can be fatal. Depending on the application, a drop in the preload force of a screw connection can endanger the operational safety of a whole plant or bring an entire production facility to a standstill. With the smart screw connection developed at the Research Center IoT-COMMs, such a drop would be noticed in time. The smart screw connection permanently monitors even hard-to-reach spots and areas.

Sensor reports loose screws

Using the thin-film sensor system based on the DiaForce® layer developed by the Fraunhofer Institute for Surface Engineering and Thin Films IST, it is possible to determine the tightening force of the screw connection and the temperature at the installation site. The sensor structures register pressure effects and temperature changes because these alter their electrical resistance. A change in pressure signifies that the screw has come loose. Measuring the ambient temperature is important because if it is too high it can affect the sensor data.

Wireless, secure data transmission with mioty®

Using mioty® wireless transmission technology developed by the Fraunhofer Institute for Integrated Circuits IIS, the sensor system regularly transmits readings to a cloud-

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connected monitoring entity. Thanks to mioty® LPWAN technology, the data can be sent with high transmission security over a range of several kilometers. In addition, before assembly the screws are configured in the FunkeyBox tamper-proof programming unit, developed by the Fraunhofer Institute for Applied and Integrated Security AISEC. Each screw receives its own key, which encrypts their sensor data and thus protects against attacks during transmission to the base station or the backend.

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Special plus: Energy harvesting guarantees independent power supply

Thanks to energy harvesting technology developed by Fraunhofer IIS, the screw connection does not require an external power supply. Inside the screw connection is a thermogenerator that generates electrical power from the smallest heating effects at the screw's connection, which makes sensor operations energy-independent and self-powered. Alternatively, the sensor and transmitter can be powered by a solar cell or battery.

This solution is being developed within the Fraunhofer Research Center IoT-COMMs in collaboration with Fraunhofer IIS, Fraunhofer IST and Fraunhofer AISEC. FloTCOMMs is part of the Fraunhofer-Gesellschaft's Cluster Initiative CCIT (Cluster of Excellence Cognitive Internet Technologies).

More information at:

Fraunhofer CCIT

<https://www.cit.fraunhofer.de/en/research-center/iot-comms/smart-screw-connection.html>

SPS - information for visitors

https://sps.mesago.com/nuernberg/en/sps_connect/visitor-information.html

The Fraunhofer-Gesellschaft, headquartered in Germany, is the world's leading applied research organization. Its research activities are conducted by 74 institutes and research units at locations throughout Germany. The Fraunhofer-Gesellschaft employs a staff of 28,000, who work with an annual research budget totaling more than 2.8 billion euros.

The **Fraunhofer Institute for Integrated Circuits IIS**, headquartered in Erlangen, Germany, conducts world-class research on microelectronic and IT system solutions and services. Today, it is the largest institute of the Fraunhofer-Gesellschaft. Research at Fraunhofer IIS revolves around two guiding topics:

In the area of **"Audio and Media Technologies"**, the institute has been shaping the digitalization of media for more than 30 years now.

Fraunhofer IIS was instrumental in the development of mp3 and AAC and played a significant role in the digitalization of the cinema. Current developments are opening up whole new sound worlds and are being used in virtual reality, automotive sound systems, mobile telephony, streaming and broadcasting.

In the context of **"cognitive sensor technologies"**, the institute researches technologies for sensor technology, data transmission technology, data analysis methods and the exploitation of data as part of data-driven services and their accompanying business models. This adds a cognitive component to the function of the conventional "smart" sensor.

More than 1100 employees conduct contract research for industry, the service sector and public authorities. Founded in 1985 in Erlangen, Fraunhofer IIS has now 14 locations in 11 cities: Erlangen (headquarters), Nuremberg, Fürth, Dresden, further in Bamberg, Waischenfeld, Coburg, Würzburg, Ilmenau, Deggendorf and Passau. The budget of 169.9 million euros is mainly financed by projects. 26 percent of the budget is subsidized by federal and state funds.

Detailed information on: www.iis.fraunhofer.de/en