Wireless window guards

WINDOW CONTACTS REGISTER WHETHER WINDOWS ARE OPEN OR SHUT. HOWEVER, THESE SENSORS ARE GENERALLY WIRED. IN COOPERATION WITH PARTNERS IN INDUSTRY, SCIENTISTS HAVE NOW DEVELOPED A NEW SYSTEM WHICH MANAGES WITHOUT CABLES OR BATTERIES. THE ENVIRONMENT IS THE SOURCE OF ENERGY – LIGHT AND AMBIENT HEAT

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The HallinOne®-Sensor from Fraunhofer Institute for Integrated Circuits (IIS)

+ There's a bad weather front on the way and the rain is just about to fall. Anyone who is out and about and forgot to close the windows or overlooked a room despite having checked the house can get a nasty (and wet) surprise on arriving home. However, it doesn't have to be this way and situations like this can now be avoided in future thanks to a new sensor system. The sensor, which is placed in the window frame, detects whether a window is open, locked, tilted or closed and forwards the information to a basis station at the entrance door. When you leave the house you can see at a glance if any windows have been left open. Remote enquiries are also possible with this system so that you can even monitor your windows using a Smartphone. Researchers at the Fraunhofer Institute for Integrated Circuits (IIS) in Erlangen and Nuremberg have developed the product in close cooperation with Seuffer GmbH & Co. KG, a Calw-based company and with whom they have been working for more than ten years.

Intelligent window control is based on the HallinOne®-Sensor from IIS – a three axis magnetic field measurement that is already being fitted as standard in washing machines to determine the location and position of the washing drum. "We adapted our technology for use in windows. The fingernail-sized sensor embedded in the inner frame recognizes the position of both window and handles by measuring the changes and movement in the angles of magnets on the edge of the lower window frame. If the window is locked for example, the magnet shifts to the right," explains IIS engineer Klaus-Dieter Taschka. "The sensor even recognizes if the window is just ajar, but appears closed. No other system can manage that." What is more, the system is tamper-proof and so can be used as protection against burglary: the sensor registers automatically if the magnet is physically removed.

Wireless radio transmission

The radio unit is also installed in the frame and consists of a microcontroller and sensor nodes. It uses the IIS Technology for extremely energy-efficient wireless data transmission to a base station. This can be a PC, a mobile phone, a tablet or room controller. "The wireless s-net® Sensor network is a Multi Hop Network in which data is exchanged both between the individual sensor nodes and the master node at the base," Taschka explains. The radio range between the nodes – in other words from window to window – is about 20 to 30 m. The system's Multi Hop capability means a large area can be covered making it suitable for use in companies. Installed in an office building, it can provide information to the security staff saving inspection rounds through all the offices.

Another distinctive feature of the window guard is the fact that the device functions without cables or batteries and draws all the energy needed from the environment. Experts term the technology Energy Harvesting where energy is won from everyday sources such as air currents and vibrations or – as in this case – light and ambient heat.

Thermo generators embedded in the window frame transform the heat into electricity. In addition, solar cells on the outer window provide energy for the 3D Sensor. "Our tests confirmed that this even worked on north-facing windows," says Andreas Buchholz, Head of Research and Development at Seuffer.

However, the system is of course only suitable for daily use if all the sensors work perfectly. To ensure that this is the case, every chip is fitted with a coil which creates a magnetic field when an electrical signal is applied. An emitted signal indicates the sensor is intact.

"The window monitor is the result of the lively exchange of ideas we've maintained for many years with the Fraunhofer researchers," says Buchholz. The window including sensor, magnet, radio unit and solar cells is currently available as a prototype and will be ready to go into mass production by the end of the year. The system will be manufactured by Seuffer which also developed the electronics and built the housing. +++