

RESEARCH NEWS

March 2017 || Page 1 | 3

CeBIT 2017: The washroom of the future

Wireless sensor systems prevent soap etc. topped up

Washrooms are among the highest-maintenance rooms in companies. A new Fraunhofer technology now monitors soap, cotton towel and toilet paper dispensers fully automatically, and notifies the cleaning staff when levels are running low. At the core of the "CWS Washroom Information Service" are sensors and some ingenious wireless technology.

"The cotton towels are running out in washroom 17 on the third floor, in washroom 21 on the fourth floor the soap is almost empty, and in 26 there is almost no toilet paper left." Armed with this kind of information in advance, cleaning staff will be able to plan their rounds far more effectively in the future. No small thing, given that washrooms are among the highest-maintenance rooms in buildings. As well as having to be cleaned, their soap, hand-towels and toilet paper have to be replenished regularly. The Fraunhofer Institute for Integrated Circuits IIS has now designed a highly efficient solution to this problem. Together with the full-service provider CWS-boco International GmbH, Fraunhofer IIS has created the "CWS Washroom Information Service" system, which significantly reduces washroom maintenance requirements. In charge of the project is Prof. Thomas Wieland, head of the Fraunhofer Application Center for Wireless Sensor Systems in Coburg. In addition to the sensor technology, the Fraunhofer scientists also contribute a wireless system for transmitting the data. CWS-boco is responsible for the design of the various container and dispenser systems.

The basis of the "CWS Washroom Information Service" (WIS) are the sensors. They are battery powered and monitor the fill levels of soap dispensers, cotton towel rolls and toilet paper. The measurement method employed depends on the task. For instance, in the case of the soap dispenser, an optical sensor keeps an eye on the fill level, and the sensor module gathers the data from the meter in the soap dispenser that records every portion dispensed. Optical systems are also used for toilet paper, while a portion meter monitors the usage of the cotton towel dispenser.

The wireless network configures itself

The data collected by these means is then sent through a complex wireless transmission system. First, the dispenser information is transmitted to the nearest "Washroom Control Unit" (WCU) via energy-saving Bluetooth 4.0 LE (Low Energy). Each WCU is a collection point and communication node. They are distributed around the entire building and networked with each other. This is where the s-net® wireless technology

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developed by Fraunhofer IIS comes into play, by enabling the wireless network to configure itself. Each WCU in the network decides autonomously what device it sends the data to. "If a given module is out of order or cannot be reached for other reasons, the WCU sends its data to another module," Fraunhofer expert Wieland explains. This means the wireless network compensates automatically for a defective device or any disturbances in the transmission path. Once all the data has been collected, the final WCU in the transmission chain sends the entire data package – again via s-net® – to a gateway, which is generally attached to the outside of the building.

From there, the information is then forwarded via the cellular network to CWS-boco's server. A visual user interface displays the information for each individual washroom operator. The shift supervisor can then print out the washroom information as a shift plan or send it to the cleaning staff's tablets. Another option would be to have a display at the entrance to the washrooms that shows what the washroom requires.

Field trial starting 2017

With the development phase of the "CWS Washroom Information Service" now more or less completed, a progressive field trial with a pilot customer is beginning in the first quarter of 2017. CWS-boco will market the system, one of the biggest benefits of which is its flexibility. "We can integrate new devices with their own sensor systems. Pretty much any product can be fitted with sensors and integrated into the system, from soap dispensers to toilet paper holders and waste bins," says Jens Einsiedler, Head of Business Digitalisation at CWS-boco International GmbH.

And the Fraunhofer researchers aren't only thinking about washroom services. Sensor-based s-net® technology makes many applications possible. "The system is ideal for any situation where sensor data has to be gathered and transmitted," Wieland explains. Thanks to its ability to organize itself, the energy-saving s-net® is extremely reliable. But not only that, its transmission frequency of 868 MHz has excellent propagation characteristics, so it can penetrate walls with ease. That is particularly useful in complex buildings.

Wireless sensor networks featuring this or other transmission technologies are a particularly effective way for the agricultural sector to monitor crop land. In cities, sensor networks can keep track of the water quality in rivers. Sensors can keep tabs on the stability of bridges and other constructions, and even in the field of health care this technology opens up new opportunities. For instance, the sensors could be integrated into textiles to monitor a patient's movements during physiotherapy.

Further applications are also an option in the field of Industrie 4.0. Wireless sensors are ideal for supervising production plants and monitoring the status of machines or workpieces. On this basis, the system delivers all the data required to manage the

process in question. Meanwhile, Wieland and his team are also currently working on a more down-to-earth but no less useful project: monitoring the fill levels of the waste bins in the pedestrian zone in the city of Reutlingen.

RESEARCH NEWS

March 2017 || Page 3 | 3



Checking dispensers with a tablet computer in a networked washroom. © CWS-boco International GmbH | Picture in color and printing quality: www.fraunhofer.de/en/press



Hand-towel, soap and toilet paper dispensers transmit their fill levels. © CWS-boco International GmbH | Picture in color and printing quality: www.fraunhofer.de/en/press