An electronic green thumb

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If sensors are supposed to communicate with each other to compare the measured data and to secure them, then, in the future, a network of distributed sensor nodes will aid in that: the network ensures a problem-free communication between the sensors. For example, they can be used to reliably monitor the watering of plants. At the 'embedded world' trade fair, taking place from 2/28 - 3/1 in Nuremberg (Germany), the researchers are showcasing a technological demonstration.

A green thumb is required where plants are to grow abundantly – that also applies to watering them in dry areas. If they are watered too much, then the soil becomes saline; if the plants receive too little moisture, they let their leaves droop and, in the worst case, they wither. In the future, sensors in the soil, a central unit and an associated app will supplement the green thumb: one look at the smart phone and the farmer will know what moisture content the soil has. Which plants need water, which do not? If the plants get too dry, the farmer is alerted by SMS; the same applies if there is too much water flowing onto the fields.

Watering is one of the potential applications for the new technology developed by the researchers at the Fraunhofer Institute for Telecommunications HHI in Berlin. “The basis is a central unit that connects all types of sensors securely and reliably with each other”, says Jens Krüger, scientist at the HHI. This unit records the data of all sensors and forwards them to an Internet browser or an app on an Android smart phone, where the user can call them up and enter limit values – in the case of the watering system they might be humidity values. If these threshold values are under or over, he will receive an SMS on his mobile

phone. “We use existing technology and customize it so the user can access it”, says Krüger. This means: The sensors that the researchers connect to this central unit via sensor nodes are commercially available – what is new is the platform, via which they communicate with each other, and the language, or rather, the protocol that they use for their communication.

The special part: the sensors need not be installed in a complex manner, they contact the central unit automatically. The required sensors simply need to be inserted and away we go. “The system we developed gets to know the sensors automatically. To achieve this, we developed our own protocol that the sensors and the base unit use to communicate”, says Krüger. Another benefit: the central unit does work similar to a computer, but it has an embedded system with micro-controls and an operating system and therefore is far more energy-efficient: it uses only two watts. In comparison, a PC would use roughly 150 Watts.

A demonstrator comprising the central unit and several sensor nodes already exists. Currently, the sensors are connected via cable, in the future, however, they will radio their data wirelessly to the unit. If some of the sensors are no longer within radio range, they will first send their measurement results to other sensors that are closer to the central unit and which will transmit the signals to the unit. To illustrate the capabilities, the researchers connected to the demonstrator sensors that measure humidity, temperature and leakage. The system also works for any other type of sensor, such as noise sensors. For instance, they might also be used to protect critical infrastructures such as water mains, main electric lines of the electrical grid or railway lines and alert to thieves trying to steal the copper. In these cases, the sensor would detect, for example, noises made by digging. If one sensor detects such a respective noise, it connects via radio to the other sensors and compares the results. The system calculates the exact spot the digging takes place with the help of the data that is recorded by neighboring sensors. The system will emit

an alarm if there is an electricity cable or a water main.

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