



Wireless soil moisture sensor networks for environmental monitoring and irrigation

Christof Hübner (1), Rachel Cardell-Oliver (2), Rolf Becker (3), Klaus Spohrer (4), Kai Jotter (1), and Tino Wagenknecht (1)

(1) Institute for Industrial Data Processing and Communication, University of Applied Sciences Mannheim, Mannheim, Germany (c.huebner@hs-mannheim.de), (2) School of Computer Science and Software Engineering, The University of Western Australia, Perth, Australia (rachel@csse.uwa.edu.au), (3) Rhine-Waal University of Applied Sciences, Kleve, Germany (rolf@bfam.org), (4) Institute for Agricultural Engineering, University of Hohenheim, Stuttgart, Germany (k.spohrer@uni-hohenheim.de)

Dependable spatial-temporal soil parameter data is required for informed decision making in precision farming and hydrological applications. Wireless sensor networks are seen as a key technology to satisfy these demands. Hence, research and development focus is on reliable outdoor applications. This comprises sensor design improvement, more robust communication protocols, less power consumption as well as better deployment strategies and tools. Field trials were performed to investigate and iteratively improve wireless sensor networks in the above-mentioned areas. They accounted for different climate conditions, soil types and salinity, irrigation practices, solar power availability and also for different radio spectrum use which affects the reliability of the wireless links. E.g. 868 MHz and 2.4 GHz wireless nodes were compared in the field with regard to range. Furthermore a low-cost soil moisture sensor was developed to allow for large-scale field experiments. It is based on the measurement of the high frequency dielectric properties of the soil. Two agricultural sites were equipped with 80 sensors and 20 wireless nodes each. The soil moisture data is collected in regular intervals, aggregated in a base station and visualized through a web-based geographical information system. The complete system and results of field experiments are presented.