



XVIIth World Congress of the International Commission of Agricultural and Biosystems Engineering (CIGR)

Hosted by the Canadian Society for Bioengineering (CSBE/SCGAB)
Québec City, Canada June 13-17, 2010



RESEARCH ON WSN DESIGN AND FORMATION FOR DROUGHT MONITORING IN A TEA PLANTATION

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CSBE100679 – Presented at Section VII: Information Systems Conference

ABSTRACT A wireless sensor network is a self-organizing network used to collect information from complicated geographical conditions. A wireless sensor network was designed and deployed in a tea plantation with the purpose of drought monitoring. The sensing nodes that were designed were composed of an ATmega128L micro-processor, a CC2420 transmit-receive module, an interface module and a solar cell based power supply. The TinyOS as well as the devices drivers were transplanted into the nodes. A WSNs gateway layout scheme based on ARM was demonstrated, which involves ARM920T micro controller S3C2410X as the kernel of the hardware platform, the storage system peripheral circuits, serial communication interface, Ethernet interface, serial-port extension unit and standard interface unit to be used for further linkage of other data transmission method. The networking experiments were conducted in a laboratory with Mesh Routing Protocol to determine the network performance under the scale of 5 nodes, 10 nodes, 15 nodes and 20 nodes. The performance of QOS (Quality of Service), including Packet Loss Rate (PLR), Retransfer ratio, and the Communication Link Quality, declined with network scale extentions. Simultaneously, the topology formation time, the topology stabilization time and the topology reconstruction time was prolonged. The entrance of a new node did little effects on routing performance of a steady-going WSN. Both random and deterministic deployments, diamond shaped deployment was chosen, of nodes were implemented in the tea plantation to be compared and analyzed. Meanwhile, soil water content and ambient temperature were measured. We fixed the nodes at an altitude of at least 1m over tea plants, thus the communication range increased from 30m to 90m. Tests showed that PLR goes up when data transmission interval varied from 10s, 20s, 30s, to 40s, and that PLR values in deterministic situation are lower than those in random case.

Keywords: Wireless sensor network, WSN design, node deployment, network performance, topology formation