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能量自给的果园信息采集无线传感器网络节点设计

Design of energy self-sufficient wireless sensor network node for orchard information acquisition

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英文关键词: [wireless sensor networks](#) [solar energy](#) [information acquisition](#) [energy self-sufficient](#) [low power consumption](#) [orchard](#)

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中文摘要:

针对果园中所存在的无线通信障碍与电池更换困难问题, 该文设计了一款适合果园信息采集的无线传感器网络(wireless sensor network, WSN)节点。节点以MSP430F149为核心, nRF905射频芯片及其外围电路作为无线通信模块, CN3058和HT6292智能充电芯片及其外围电路作为太阳能充电模块, 电机驱动芯片ULN2003及水平、垂直电机作为太阳追踪模块, DHT22空气温湿度传感器和TDR-3土壤含水量传感器及其外围电路作为传感器模块, 并以该硬件平台编写了通信协议、应用程序和时间同步算法。分析、测试了节点的功耗、通信距离以及太阳能充电时间, 在空旷地带有效通信距离达到202 m; 主电路电池由3 V充电至3.6 V所需时间为580 min, 传感器电路电池由5.6 V充电至7.2 V所需时间为283 min; 在无太阳能充电且节点系统工作周期为30 min情况下, 主电路生命周期理论值为497 d, 传感器电路生命周期理论值为147 d。组网试验结果表明: 网络丢包率小于1.5%, 能够满足果园信息采集以及能量自给的应用要求。

英文摘要:

A type of wireless sensor network (WSN) node suitable for orchard information acquisition was designed to solve the existing problems as wireless communication obstruction and battery replacement difficulties.. The node uses a MSP430F149 as the processing core, a nRF905 RF chip and its peripheral circuits were used as wireless communication module, power management chips CN3058 and HT6292 as well as their peripheral circuits were used as the solar charging module, motor driver chip uln2003 and vertical、horizontal motors were used as the solar tracing module, DHT22 air temperature and humidity sensor and TDR-3 soil moisture sensor and their peripheral circuits were used as the sensing module. The communication protocol, application program and time synchronization algorithm were designed based on the hardware platform. Power consumption, communication distance and charging time of one node were tested and analyzed, the maximum effective communication distance of the designed nodes reached 202 m in unoccupied regions. In the test of charging time, 580 minutes were needed for charging one lithium battery from 3V to 3.6 V, and 283 minutes were needed for charging two tandem lithium batteries from 5.6 V to 8.4 V. With no solar charging and a working cycle of 30 min, the theoretical life cycles of the main circuit and sensor circuit is 497 d and 147 d, respectively. A WSN was established for measuring temperature, humidity and soil water content in a citrus orchard, the experimental results indicated that the network packet loss rate is 1.5%.

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