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# 基于太阳能的柑桔园自动灌溉与土壤含水率监测系统研制

# Development of automatic irrigation and soil moisture monitoring system based on solar energy in citrus orchard

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中文关键词：灌溉,自动化,土壤水分,太阳能电池,自保持式电磁阀,锂电池,CAN总线,GSM网络

英文关键词:irrigation automation soil moisture solar cells self-keeping status radiotube Li-ion battery CAN bus GSM network

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中文摘要:

为实现柑桔园的节水节能自动灌溉与土壤含水率的监测，以太阳能为主要能源，用土壤水分传感器实时监测土壤含水率，利用CAN（controller area network）总线与GSM（global system for mobile communications）网络实现土壤含水率的远程监测。利用太阳能电池对锂电池充电，采用双锂电池结构，提高了系统供电稳定性，且将充电与放电过程完全分离，延长了锂电池寿命。土壤水分传感器每12 h测量一次土壤含水率，当其低于设定的阈值时，自动打开电磁阀进行灌溉，当高于设定值时停止灌溉。在666.7 m2内的土壤含水率数据利用CAN总线传输至主节点，各主节点通过短消息将数据发送至终端计算机。将桔园土壤含水率低于10%，高于20%作为系统开始自动灌溉和停止灌溉指标，且传感器距滴管外50 mm时，则水分输运到柑桔根系集中区域所需滴灌时间约为6.7 h。试验表明，系统运行稳定可靠，能实现柑桔园区的自动灌溉与土壤含水率的自动监测，对实现节水节能灌溉有较大的现实意义。

英文摘要:

In order to irrigate orange garden with the goal of automation, save water and power, solar energy was used to supply the power for the automatic irrigation and soil moisture monitoring system. Soil moisture sensor was used to real-time detect water content in soil. To monitor the soil moisture of the orange garden, controller area network (CAN) bus and global system for mobile communications (GSM) network were used to transmit the results. Solar cell was used to charge Li-ion battery. Two Li-ion batterys were used to separate the charging and discharging process, which enhanced the stability of power supply of the system. Soil moisture sensor worked one time per 12 hours. The determined value was lower than the setting value, the radiotube would be open automatically, in contrast, the radiotube would be closed. Data of water content in soil of 666.7 m2 area was transferred to the main node through CAN bus, which transmitted the data to terminal computer by short messages. Below 10% and above 20% of the water content in soil was taken as the beginning and end of irrigation, respectively. With the sensor placed out of the dropper pipe about 50 mm, the irrigation time was about 6.7 hours. The experiments showed that the system ran stably, and could implement automatic irrigation and monitoring soil water content of the orange garden, which was significant for realizing water and energy saving irrigation.

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