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自动农业气象观测系统功能与设计

Function and Designing of Automatic Observing System for Agro meteorology

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摘要:

根据现代农业气象业务需求, 提出了可视化、实时性、远程控制的自动农业气象观测系统技术思路、设计原则, 并设计了系统的硬件和软件架构及自动化观测的实现方法。该系统具有作物生长、农田气象要素观测及环境监控功能, 可实现作物发育期、株高、盖度等的自动观测, 还可实现农田主要农业气象灾害实时监测。该文利用三维空间模拟技术初步确定了CCD(charge coupled device)传感器的技术指标; 提出利用图像判别技术, 结合作物生长特征及农业气象指标, 实现作物发育期自动判别; 利用摄影测量学技术, 采用动态跟踪法实现作物株高自动化观测; 提出了作物盖度的计算方法和通过研究作物盖度与密度、叶面积指数的关系, 解决作物种植密度和叶面积指数自动观测的技术思路。该系统模仿人工观测原理, 将图像处理和摄影测量学等技术引入农业气象自动观测中, 基本上可以满足农业气象观测的主要任务的实时性、可视化和自动化需求。

关键词: [农业气象](#) [自动观测](#) [图像处理](#) [摄影测量学](#)

Abstract:

Based on the proposed technique thought and designing principles, the hardware component parts and software function is designed for automatic observing system of agro meteorology(named AOSA), which is visual and real time and can be controlled remotely according to the requirement of modern agro meteorological operation. The AOSA is made of the automatic observing system of crop growing and meteorological observing as well as environment monitoring in the field. It includes temperature and humidity sensors for different heights, and solar radiation, photosynthetically active radiation, infrared temperature, rain, wind sensors above crop, and soil humidity and soil temperature sensors for different depths in soil. It can realize automatic observation of crop growing phases, crop height, crop cover, and main agro meteorological disasters by means of crop meteorological observing and soil moisture data. There are many observing elements in agro meteorology observation task, but the urgently needed elements and crop types in operational observation are solved in AOSA. The automatic observing techniques are introduced systematically. The technological specification of crop growing sensor is the foundation of AOSA research and development, which (resolutions of CCD sensors and installing height) have influences on accuracy of the crop automatic distinguishing. The results show that CCD sensor height and focus for short stalked plant is not below 3 m and 16 mm respectively and CCD sensor height and focus for tall stalked plant is not below 5 m and 21 mm respectively to observe an area of 5 m² properly. The automatic distinguishing technique of crop development phases is realized by means of picture differentiating technique, considering crop growing and meteorological index. Crop observation is complicated, so different development phases have different algorithms of automatic observing. Observing method of crop height is developed by photography and dynamic tracking technique. The method of plant cover calculating is given out per hour, and automatic observing of crop density and leaf area will be solved through researching out the relationship between them. The AOSA will preliminarily realize visual, real time and automatic observing of main agro meteorology observation through image processing and photogrammetry techniques.

Keywords: [agro meteorology](#) [automatic observing](#) [image processing](#) [photogrammetry](#)

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