夏 于,孙忠富,杜克明,胡 新.基于物联网的小麦苗情诊断管理系统设计与实现[J].农业工程学报,2013,29(5):117-124

基于物联网的小麦苗情诊断管理系统设计与实现

Design and realization of IOT-based diagnosis and management system for wheat production

投稿时间： 2012-10-25 最后修改时间： 2013-02-02

中文关键词：管理信息系统,决策支持系统,无线传感器网络,远程诊断,物联网,小麦苗情

英文关键词:management information systems decision support systems wireless sensor network remote diagnosis internet of things wheat growth condition

基金项目:农业部公益性行业科研专项（200903010）；“十二五”国家科技支撑计划（2011BAD32B03）；中央级公益性科研院所基本科研业务费（BSRF201302）

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中文摘要:

为提高小麦生产调控管理水平，该文设计并实现了基于物联网技术的小麦苗情远程诊断管理系统。系统采用浏览器/服务器模式（Browser/Server），通过远程监控节（站点）动态数据计算，并进一步融合小麦生理生态特性和作物气象灾害指标分析，可对小麦生产过程和主要气象灾害进行精准监测、快速诊断，做出综合分析结果和产管理调优方案，并以文字描述、现场图片与视频、数据表格多种方式输出，用户可通过LED电子显示屏、计算机及智能移动终端等多种设备，便捷快速获得多源数据共享和决策支持服务。该系统目前已经在中国主要小麦产区陆续开展示范应用，结果表明在提高小麦苗情的精准监测和智能管理等方面，具有较好的应用前景。

英文摘要:

Wheat is one of the most important grain crops in China. Its long growth cycle and wide distribution makes it easily susceptible to a variety of stresses and disasters. In order promote the management and control capability of wheat production through strengthening diagnosis and prediction of wheat growth status, a remote monitoring and diagnosis system was designed and realized based on the Internet of Things (IOT).On the basis of the accumulated results of early period research and layout both in software and hardwar crucial data (including HD image and video) related to wheat growth and meteorological disasters were acquired quickly and steadily by technical integration of heterogeneous networks, such as wireless sensor network (ZigBee) and LAN (Wi-Fi), mobile communication (GPRS/3G), Internet or VPN, etc. Simultaneously on the server side, the system can provide decision supporting services for making a final intelligent diagnosis of wheat growth status and disasters with a combination of network database, statistical algorithm, computer control and inference engine etc., according to the monitoring data and characteristics of the crops and meteorological condition.The monitoring system was developed under the construction of Browser/Server mode with C# language on .NET, and further designed with a 3-tier application framework, which included data layer, data access layer, layer and the presentation layer respectively for data acquisition, data process, and data storage. By such optimal methods, advantages of the system are ensured in keeping exce object-oriented functions, better compatibility and suitable systematic standardization in follow-up development.The system consists of six modules individually designed for dat acquisition, knowledge specification and normalization, intelligent diagnosis and analysis, user management, assistant help for system management and application. These modul mainly responsible for receiving dynamic data from remote sites, knowledge specification and normalization, and definition of the diagnosis indexes for crop and meteorological disasters, etc. By the utility of monitoring data combined with crop and meteorological index specifications, the system may give precision and rapid diagnosis of the condition an probability for both wheat growth and main meteorological disasters, which includes drought and waterlogging, low temperature, and dry and hot wind. In order for precision diagnosis of wheat growth and development, four grades are classified according to the crucial factors below: numbers of leaves on main stem, numbers of stems and tillers per pl and numbers of secondary roots and tillers. Those parameters are obtained from field experiments or knowledge and experiences from different agricultural experts.The results of t diagnosis and decision supporting services can be output in multiple forms, like MS word document, different type of curves and figures, as well as data sheets depending on the user’s option. With the integration of web services and socket techniques, users can easily get the multi-source data resources and information services via the platforms, such mobile terminals, LED screens, flat pad, personal computers, etc. Demonstration and actual application of the system has been successively carried out in the main wheat producti regions of China, and the results show a quite significant prospect for remote intelligent management and precision monitoring diversification of meteorological disasters by the integration of IOT technology.

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