

电力载波在电器设备监控中的应用

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[摘要] 以低压电力线作为传输媒质, 以电力载波技术为基础, 通过电力载波信号来监控电器设备的运行状态, 达到维护电器设备的目的。基于电力载波技术的智能管理系统可以很好地维护管理大型医疗设备, 从而节约财力物力、提高经济效益。

[关键词] 单片机; 电力载波; 监控

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电力载波通讯是电力系统特有的通信方式, 其指利用现有电力线, 通过载波方式将模拟或数字信号进行高速传输, 其最大特点是不需要重新架设网络, 只要有电线, 就能进行数据传递。笔者应用低压电力线作为传输媒质, 结合单片机控制和网络等技术实现了设备在线监控与精确定位, 从而可以很好地维护管理大型医疗设备, 达到了节约财力物力、提高经济效益的目的。

1 电器设备监控原理

1.1 电力载波系统

电器设备监控系统主要由电力载波通信、数据采集和网络数据库管理等模块组成。该监控系统通过电力载波解决数据通信问题, 三相电力线之间采用专用网桥^[1], 以解决三相之间和跨变压器数据通信问题, 低压电力线载波通信的系统原理如图 1 所示。数据采集模块解决设备状态检测, 网络数据库管理完成信息监控和调度管理等。

数据由主通信设备发出, 经通信接口模块, 存入微控制器处理中的一段缓冲区内, 再经编码处理后进行通信调制, 最后耦合到电力线上。

在电力线的另一端, 数据经解耦后从电力线上接收下来再解调到微控制器中, 最后经通信接口到从通信设备中。在整个系统中, 微控制器是系统的核心, 其负责整个系统中各任务的协调与调度。电力线接口主要起耦合、隔离、滤波与保护的功能。

低压电力线上存在信号衰减大、时变性大、噪声影响大等问题, 这些问题导致误码率升高, 通信质量严重下降。除了选择好的通信器件来提高通信质量、降低误码率外, 另外可采用一些纠错能力强的编译码方案。在兼顾运算能力与控制性能的基础上, 选用飞利浦公司 ARM 内核的 LPC2132 单片机, LPC2132 是基于一个支持实时仿真和嵌入式跟踪的 32/16 位 ARM7TDMI-SCPU 的微控制器, 并带有 64 KB 的嵌入的高速 Flash 存储器。128 位宽度的存储器接口和独特的加速结构使 32 位代码能够在最大时

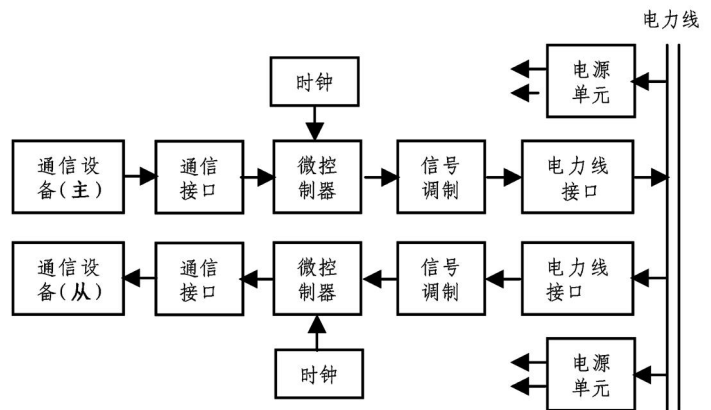


图 1 电力载波系统通信原理图

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钟速率下运行。该系统选择 SGSTHOMSON 公司的 ST7538 芯片，具有半双工、同步/异步 FSK（调频）调制解调器功能^[2]。ST7538 内部集成了发送和接收数据的所有功能，通过串行通信，可以方便地与微处理器相连接。内部具有电压自动控制和电流自动控制，只要通过耦合变压器等少量外部器件即可连接到电力网中。ST7538 用于 FSK 信号的传输与接收；同时也是一个滤波系统，能可靠地过滤掉 220V/50Hz 的电力信号、噪声信号和浪涌信号^[3]。

1.2 电器设备智能管理终端

该系统的主要功能包括：**实时数据采集**（设备状态参数检测与信号传输）。将传感器采集的数据进行 A/D 转换后，保存在微控制器 MCU 中，数据经过网络传输，最终传送至监管中心 PC 的操作平台。计算机将数据存入数据库，并进一步判断该设备是否处于安全范围内，若超过规定阈值则自动报警；**设备实时跟踪、精确定位与动态显示**。系统将接收到的信息定时传送至远端监管中心 PC 中，监控中心可以监测到设备的使用地点、运行起止时间等数据，从而确保设备的安全使用；**设备调度及统计管理**。通过操作平台软件可以实时查询、打印当前及某时间段设备状态、开机时间，活动轨迹及分布情况。查询各个设备所在具体位置并根据需要迅速进行人员及设备的调配。同时，利用保存在 PC 机中的数据也可实现对重要设备的开机率汇总统计以便于管理人员对该设备做出效益分析与更新替换等功能；**报警功能**。当遇到紧急情况如设备故障、特殊参数超限等，可向监管中心报警；**网络信息管理与信息发布**。实现信息发布和远程管理，管理者在使用权限范围内都能实现对系统信息浏览、分析和控制。

在大型医疗电器设备中安装着一个数据终端传输设备（Remote Terminal Unit，RTU），数据接收或传送准确和完整性是决定系统功能实现的关键。通常 RTU 嵌入被控设备内，其功能是当被控设备工作时，被控设备电气参数、使用地点及使用人信息由 RTU 通过设备的用电网络传输到管理中心，管理中心合法性验证和故障检测后向 RTU 发出合法、非法及状态（正常、非正常）信息，RTU 根据管理中心信息以及用户初始设置条件执行停机或报警操作。RTU 包括单片机、载波、控制报警系统。该 RTU 功能原理图如图 2 所示。

为了实现该系统，需要具备以下条件：**定位**。射频天线覆盖域，要求在半径为 8m 的区域范围内信号接收良好。**能在线监测用电设备的工作状态**，其主要参数如下：电流为 0~100A，误差 1%（根据设备用电容量可调整）；电压为 0~400V，误差 1%（大型医疗设备传输参数根据需要选定）。

2 电器设备监控系统实现

根据电器设备监控原理实现了一套电器设备监控系统，其框架结构如图 3 所示。

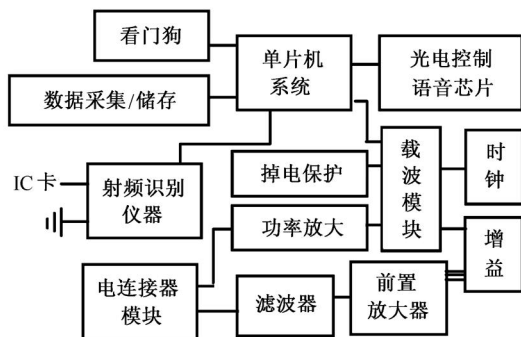


图 2 电器设备智能管理终端原理图

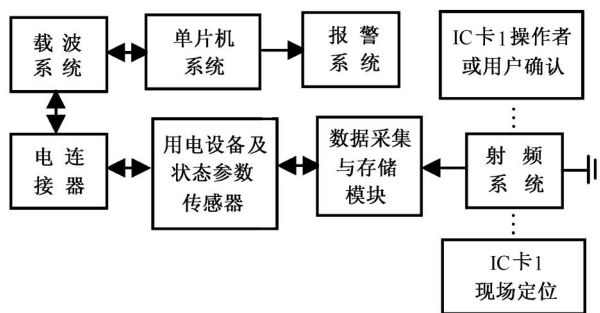


图 3 电器设备监控系统框架图

IC 卡端口接收监控设备的数据，射频系统获取射频信号，所有这些数据都是电器设备使用环境的数据，其通过射频系统传输到数据采集与存储模块，而后再将这些数据通过电力线中的电力载波信号传输到单片机系统中，如果发现使用中设备有不正常的状态则由单片机系统发出报警。

- 1) 单片机系统 由单片机及嵌入软件、数据采集及存储及报警、以及看门狗电路组成，通过软件

设置及电路连接对相关功能模块实施管理,完成与管理中心数据交换及对用电设备的智能控制。

2) 电力载波系统 电力载波系统功能主要通过公用电网传输或接收单片机或管理中心数据。其主要由载波芯片、带通滤波器、前置放大、功率放大、时钟等模块组成。

3) 电连接器部分 其功能是保证设备开启与载波信息同步和实现电器设备管理跟踪仪认证控制。用语音提示检测射频信号 IC1 和 IC2 (IC1 是用电设备现场的某一固定位置编码,检测范围小于 10m; IC2 是使用者或用户持有卡,检测范围小于 0.06m),同时将用电设备电器参数(电压、电流、开启时间等)数据打包由载波系统通过电联接点项管理中心传送,并接收管理中心数据,然后决定使用设备是否合法,并发出语音及声光提示。

4) 报警系统 该包括语音系统和光电系统,其功能是实现电器设备管理跟踪仪在没有得到认证的情况下的自动报警和控制。

3 结 语

在电器设备监控系统中,通过电力载波技术监控电器设备,以完成设备跟踪管理与用电设备现场的状态跟踪和现场定位,同时将用电设备电器参数(电压、电流、开启时间等)数据打包由载波系统通过电联接点向管理中心传送,并接收管理中心数据决定使用设备是否合法,并发出语音及声光提示。通过在某医院使用医疗电器设备监控系统的情况表明,该系统能实现真正意义的设备动态监控、管理和调度,节约了大型医疗设备使用维护的成本。因此,通过电力载波技术监控电器设备的方法具有可行性,值得向社会推广。

[参考文献]

- [1] Song Wenguang. The Research of One Self-Adapt Wireless Sensor Network Rate Flow Control [A]. NSWCTC 2009 Table of Contents Volume- 2 [C]. WuHan: HuaZhong University of Science and Technology, 2009. 267 ~ 269.
- [2] 詹圣红. 电力线载波技术在设施监测系统中的应用 [D]. 上海: 上海交通大学, 2008.
- [3] Song Wenguang, Jiang Qionqin. The Tactics Analysis about Early Phase Ends of the Partial Distortion Search [A]. WGEC2008 [C]. JingZhou: YangtzeUniversity, 2008. 324 ~ 327.

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2 现场实践

某海洋石油平台注水缓冲罐的容积为 20m ×10m ×8m,在该容器底部方向均匀布置 3 排 2 虹吸排污管,并与外接 2 排放管相连,在每排虹吸排污管上安装 2 个 2 法兰,利用法兰面作为虹吸排污管的有效支撑,同时利用法兰面的高度来保持虹吸排污管与容器底部的距离差,并在每排虹吸排污管上每隔 30cm 开挖一个直径 4mm 面对容器底部的虹吸孔。

该海洋石油平台注水缓冲罐于 2008 年初完成改造,每星期通过排放管手动排放一次,到目前为止,非常顺利地完成其生产过程,杜绝了该注水缓冲罐改造前每季度停产清洗一次的现象。

3 结论与建议

利用虹吸现象,将虹吸孔控制范围内的杂质通过虹吸排污管排放出容器,从而达到不停产清洗就能将容器底部杂质清洗干净的目的。通过改造后的海洋石油平台注水缓冲罐的生产作业表明,虹吸排污管排污方式减少了现场作业量和作业风险,保证了油田现场生产作业的顺利进行,因而具有很高的推广价值。

[参考文献]

- [1] 王英,谢晓晴,李海英. 流体力学实验 [M]. 武汉: 中南大学出版社, 2005.
- [2] 欧阳玉霞,董继先. 新型悬臂式虹吸管 [J]. 国际造纸, 2006, 25 (2): 53 ~ 55.

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source management system is an important component of the forestry information developed rapidly , Net Framework2.0 framework and ArcGIS provide the methods and techniques to achieve the system framework based on plug-in technology , no need to re-build the system in the case , to achieve the dynamic loading of the plug-in , other management providing data as a solution for the realization of forestry information system is important.

Key words : Forest resources management system ; plug-in technology ; Framework2.0

271 **EWEBs-Based Large-scale ERP Systems Integration Solutions Research on Application of Virtualization**

ZHANG Jian (Yangtze University, Jingzhou 434023)

Abstract : Application of virtualization platforms EWEBs is mainly through the deployment of EWEBs cluster to its application of virtualization capabilities to the enterprise portal for end-users. Under any conditions it is so safe ,efficient ,fast ,easy remote access to enterprise resources ,Author wants to use the virtualization platform through EWEBs Kingdee K/3 ERP system for C/S mode ,the client B/S release for the propose of achieving low-cost mobile office services.

Key words : ERP ;EWEBs ;Virtualization

298 **Application of Excel Data Validity**

ZHOU Xiannshan, ZHU Guangyao (Yangtze University, Jingzhou 434023)

Abstract : The Excel data entry is a very dull , tedious and error-prone task. Based on some examples , the article explores the application of Excel data validity in the achievement of the selective entry in the drop-down list. It is suggested that the data are verified by means of the pre-set condition to prevent the appearance of invalid data. Thus the Excel data are easy entry and accurate.

Key words : data validity ; Excel ; selective entry ; data verification

301 **Design of A Multi-channel High-precision Data Acquisition System Based on USB2.0**

FENG Zhong, WANG Dianhong, ZHAO Juan (China University of Geosciences (Wuhan), Wuhan 430074)

Abstract : This paper researches on a multi-channel data acquisition system based on USB2.0. In the hardware , the STM32F103RB is used as its microcontroller and chose CY7C68013 manufactured by Cypress corporation USB chip. ADS1271 produced by Ti corporation is used as its A/D chip. On this base , Labview8.20 which is a kind of graphical programming language to complete the application design is chosen. This system 's highest sampling rate can reach 80 KSPS , it achieves a 18Bit resolution of the 4-channel real-time data collection and can meet the most needs of vast applications.

Key words : data acquisition ; USB2.0 ; STM32F103RB ; labview8.20

304 **l_2-l_1 Control for the Network Control Systems Based on LMI**

WANG Zhigang (Daqing Petroleum Institute, Daqing 163318)

Abstract : For a class of network control system (NCS) with varying-delays , Based a discrete model of the NCS and according to Lyapunov stability theory and linear matrix inequality (LMI) technique , the l_2-l_1 performance criterion is proposed without external disturbances where closed-loop system is asymptotically stable with design state feedback controller. Finally a numerical example shows the effectiveness of the proposed method.

Key words : Networked control system (NCS) ; varying-delays ; l_2-l_1 control

312 **The Power Line Communication Used in the electrical equipment Monitoring**

JIANG Qiongqin, LI Yingjun (Yangtze University, Jingzhou 434023)

DING Weirbo (Western Drilling Karamay Logging Engineering Company Information Center, Karamay 834000)

Abstract : The low-voltage power line is used as a transmission medium , a power line carrier technology is proposed , the power line carrier signals are used to monitor the operational status of electrical equipment to protect electrical equipment. It is large-scale medical equipment to the great significance. We can be well managed to use these large-scale medical equipment through the intelligent management system. So this can be cost savings. It can improve economic efficiency.

Key words : SCM ; power line communication ; monitor

324 Application of New Network Reference Station of RTK

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WANG Jin-ling (Hubei Water Resources Technical College, Wuhan 430212)

Abstract : Currently , under complicated conditions , conventional RTK technology in the surveyed area often encounters the problems such as operating within a short distance , mobile stations frequently losing its lock , base station setting up too many times , which lead to operating inefficiency , thus it can not give full play to RTK technology features. Network base station technology is the further extension of GPS-RTK technology , which transmits the reference station data to the mobile station by means of the communication through Internet access. Network communications are used to greatly extend the operational radius of the RTK , expand the scope of its operations , and further improve the positioning accuracy and reliability. By taking the example of Shiman Freeway measurements , this paper proves the superiority of network base station technology from the project process to the accuracy of data analysis , and opens up new avenues for linear measurements of projects.

Key words : land-surveying ; RTK ; network base station

346 Focus on the Technical Movement 's Normative for Physical Education Specialty Majors

WANG Qing-bo , CAI Wei-li (Zhangzhou Normal University, Zhangzhou 363000)

Abstract : Learning sports technology should usually pay attention to the normative and effective , as the high-level athletes , they must focus on the effective of technical movement , and for general physical education specialty majors , the normative of technical movement is more important. The article discusses about it , and gives some advices about how to learn a correct and normative technical movement.

Key words : Physical Education specialty ; technical movement ; normative ; effective

363 Development of Peasant PE in the Construction of New Rural Theory

WEI Zhi-ying (Hunan Institute of Humanities and Science, Loudi 417000)

Abstract : Peasant 's sports is a "bottle neck" constraining National spots , in construction of a socialist New Rural theory , by using the way of literature , this paper puts forward the corresponding suggestion to improve peasant PE "supported by government" , "peasants participating as the main body" , "led to the elite" , "to multiple sources of funding for protection" , "rural school sports as a breakthrough" . This study aims in the development of peasant sports improves the healthy level of peasants and promotes health , scientific and civilized way of life to the promotion of new rural construction.

Key words : construction of new rural ; peasant PE ; development

388 Virtual Studio System and Advantages of Application In University Teaching

YANG Jiang-ping (Karshgar Teachers College, Karshi 844000)

Abstract : Based on the computer technical in graph and image and the Key of traditional studio , virtual studio is developed. At present , some universities have purchased the Virtual Studio System. At universities , the teachers and research fellow focus on the teaching study based on Virtual Studio System. The article introduces the component and work principle of Virtual Studio System , explains Virtual Studio's advantages in educational application at universities , discusses the problems on educational application at universities.

Key words : Virtual Studio System ; educational application ; advantage

Translated & Edited by SU Kai-ke (苏开科)