

Design of an ARM-Based Power Meter Having WIFI Wireless Communication Module

Li Li, Xiaoguang Hu

School of Automation Science and Electrical Engineering
Beihang University
Beijing China
lilihe@buaa.edu.cn

Weicun Zhang

Department of Automation
University of Science and Technology Beijing
Beijing, China
weicunzhang@263.net

Abstract—AMR (Automatic Meter Reading) and PQ (power quality) management based on kinds of network technologies has become a trend. However, because of the high construction and maintenance costs with the existing meter reading technology, the applicability to different residential buildings and different network infrastructure should be improved. It is greatly significant to research new kind of power meter and the meter reading technology, which can accelerate the evolution of the Next Generation Network and facilitate people's lives. Now wireless broadband network develops rapidly. Generally WiFi is considered the commensurate scheme to resolve "the last 100 meters access problem", and WiMAX is regarded as the perfect scheme to resolve "the last 1000 meters access problem". At present, many cities in many countries are building or will build Wireless Metropolitan Area Networks. By WiFi and WiMAX, it provides the new connection ways to the AMR system. This paper presents an AMR system scheme using WiFi technology and an ARM-based PMWCM (Power Meter with WiFi Communication Module) scheme. On the basis of the schemes, this paper designs the PMWCM hardware system and software system. The ARM-based hardware system is consisted of processor core board and peripheral board, and the software program is based on embedded Linux. This paper also proposes the functions of wireless communication module and design detail and discuss the security of the communications.

Index Terms—Power meter, AMR, WiFi, WiMAX, ARM

I. INTRODUCTION

With the rapid development of science and technology, it is possible to read and manage power meter data of residents by network remotely. The traditional manual Meter-Reading was not suitable any longer. On the one hand, it spends much human and material resource and brings about additional problems such as the security of entering house. On the other hand, the power management department can not collect the real-time data electricity being used. And with the power price reform, in order to make account rapidly, the power management department also needs more power parameters such as power requirement, time-sharing power quantity and burden curve. AMR (Automatic Meter Reading) can meet above demands. So, remote AMR and management through kinds of network technologies has become a trend now.

At present, most AMR system are generally based on such media as RF (Radio Frequency) [1-3], PLC (power line carrier communication) [4-6], GPRS (General Packet Radio Service)

[7-8], HFC (Hybrid Fiber-Coaxial) [9], and so on, to transfer data between power meter and manage center. All the above communication media have merits, but also have some shortcomings, such as short transmission distance, high transmission cost, difficult maintenance and unsafe data transmission. The shortcomings of PLC are that its communication signals can not go through the transformer directly and the low-voltage power line carrier is vulnerable to be impacted by the environment. It is real-time, wireless and extensive to use GPRS meter reading, but the cost of current GPRS module and the communications-cost are high. Until the cost reduces to the extent that ordinary people can accept, it can not be used widely. Reading power meter by wire is costly too. For in some part it's hard to make net-line beyond the wall and make hole in the wall and in later period the maintenance cost is also high in network connection and security. In order to solve these problems, we can consider applying Wireless communication system WiFi (Wireless Fidelity), which is popularly used in the world, to transmit power data.

Now, Wireless broadband network develops rapidly. The WiFi [10-11] needs no wire and use the 2.4GHz frequency, which can be used needing no application in advance, so it is generally considered the ideal scheme to resolve "the last 100 meters connection". The network by WiFi can compose LAN (Local Area Network), and it is free to the user to communicate within LAN. So WiFi greatly reduces the construction and maintenance costs of AMR system. Further more, the WiFi LAN can connect to remote manage center by many ways, such as FTTH (Fiber to the Home), wire and the wireless. So power meter and AMR by WiFi is a preferable scheme to resolve the power data collection and the PQ (power quality) management.

Metropolitans like New York, Beijing and Shanghai are building Wireless Metropolitan Area Networks with WiFi and WiMAX. The Wireless Metropolitan Area Networks provide a new connection method to the meter reading. With the existing wire-broadband connection ways, meter reading by WiFi will certainly has a good market prospects.

II. READING POWER METER BY WIFI

WiFi belongs to the short-range wireless technology which is used in offices and buildings. This technology is based on the IEEE 802.11 of wireless communications technology. It can work in the bandwidth near the 2.4 GHz which do not need any permission for use. Its currently communications standards is IEEE 802.11a, IEEE 802.11b, IEEE 802.11g and IEEE

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Table of Contents Design Of An Arm Based Power Meter Having Wifi Wireless

1. Understanding the eBook Design Of An Arm Based Power Meter Having Wifi Wireless
 - The Rise of Digital Reading Design Of An Arm Based Power Meter Having Wifi Wireless
 - Advantages of eBooks Over Traditional Books
2. Identifying Design Of An Arm Based Power Meter Having Wifi Wireless
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Design Of An Arm Based Power Meter Having Wifi Wireless
 - User-Friendly Interface
4. Exploring eBook Recommendations from Design Of An Arm Based Power Meter Having Wifi Wireless

- Personalized Recommendations
- Design Of An Arm Based Power Meter Having Wifi Wireless User Reviews and Ratings
- Design Of An Arm Based Power Meter Having Wifi Wireless and Bestseller Lists
- 5. Accessing Design Of An Arm Based Power Meter Having Wifi Wireless Free and Paid eBooks
 - Design Of An Arm Based Power Meter Having Wifi Wireless Public Domain eBooks
 - Design Of An Arm Based Power Meter Having Wifi Wireless eBook Subscription Services
 - Design Of An Arm Based Power Meter Having Wifi Wireless Budget-Friendly Options
- 6. Navigating Design Of An Arm Based Power Meter Having Wifi Wireless eBook Formats
 - ePub, PDF, MOBI, and More
 - Design Of An Arm Based Power Meter Having Wifi Wireless Compatibility with Devices
 - Design Of An Arm Based Power Meter Having Wifi Wireless Enhanced eBook Features
- 7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Design Of An Arm Based Power Meter Having Wifi Wireless
 - Highlighting and Note-Taking Design Of An Arm Based Power Meter Having Wifi Wireless
 - Interactive Elements Design Of An Arm Based Power Meter Having Wifi Wireless
- 8. Staying Engaged with Design Of An Arm Based Power Meter Having Wifi Wireless
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Design Of An Arm Based Power Meter Having Wifi Wireless
- 9. Balancing eBooks and Physical Books Design Of An Arm Based Power Meter Having Wifi Wireless
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Design Of An Arm Based Power Meter Having Wifi Wireless
- 10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
- 11. Cultivating a Reading Routine Design Of An Arm Based Power Meter Having Wifi Wireless
 - Setting Reading Goals Design Of An Arm Based Power Meter Having Wifi Wireless
 - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of Design Of An Arm Based Power Meter Having Wifi Wireless

- Fact-Checking eBook Content of Design Of An Arm Based Power Meter Having Wifi Wireless
- Distinguishing Credible Sources

13. Promoting Lifelong Learning

- Utilizing eBooks for Skill Development
- Exploring Educational eBooks

14. Embracing eBook Trends

- Integration of Multimedia Elements
- Interactive and Gamified eBooks

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