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An integral and flexible wireless power monitoring system

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Abstract. This paper describes the main and fundamental aspects of a power monitoring system, with good adaptation possibilities that ease its use in both PV power production plants and home or building electrical grids.
It makes a smart metering solution which integrates several acquisition modules for electrical energy production and consumption monitoring, analysis and control management. The system is flexible in its configuration, easy to install and maintain and allows data transmission to a remote server by Ethernet, Wifi or GPRS/GSM or to a local server through a simple USB cable.

Key words

Wireless, monitoring, Smart metering

1. Introduction

In the past few years wireless sensor networks (WSN) have evolved considerably. The aim of these networks is to provide solutions which are low cost but reliable acquiring data from the environment in real time and ensuring loss free transmission to their final destination. WSN are especially well suited to acquiring data in power plants where production is distributed over a large area. If we compare wired and wireless infrastructures we can see that a wireless connection has a lower installation and physical maintenance cost, it can be used for integral data acquisition, transporting heterogeneous data from power production, consumption or smart metering on the same network. A WSN also has a lower development cost, as it is a generic system that can be used for many applications. Implementation is specific for each plant, varying the following parameters: type and number of nodes, distribution of nodes in the plant and distance to the central node.
An example of existing systems is Siemens PV plant monitoring solution [1]. This system monitors the performance and yield of the plant. Our system presents the following advantages: Measures not only power generated but also power consumption of the plant itself, what is very useful in small plants and home plants; It is wireless, what reduces installation and maintenance costs and can be used with a variety of sensing modules to adapt to the needs of different installations. This modularity eases its use in different applications, such as energy audits, as in [2] with the added advantage of being an integral measuring system. It also adds in flexibility, as the sink node can send information to the database through a number of different networks, such as Ethernet, Wifi, USB or GPRS/GSM.
This paper presents the system developed. Section 2 describes system topology and nodes already designed. Section 3 some functional aspects of the network and section 4 presents conclusions and future work.

2. System description

Topology:

As figure 1 shows, the monitoring system is made of two subsystems: The measurements acquisition system and the data analysis system.

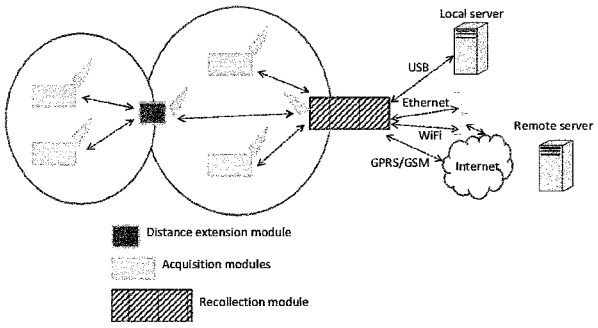

Figure 1: Wireless network and database topology

The measurements acquisition system is composed of wireless nodes. These measurement nodes can be powered by batteries or solar cells. The network topology is a star, where all acquired data are centralized in a sink node committed to generating a bridge between the acquisition system and the analysis system. The network can be set to different frequencies, but currently is operating at 868.3 MHz (In Europe), it uses a GFSK modulation and a bit rate of 38.4 Kbps, medium access is CCA (Clear Channel Assessment). The architecture of the nodes is modular, with a basic core component in all nodes. Measurement nodes are instrumented according to the type of acquisition to be performed. They can be in one of four types: