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Survey on Smart Sensors for Power Management in Intelligent Buildings using WSN

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ABSTRACT: The design and development of a smart monitoring and controlling system for household electrical appliances in real time has been reported in this paper. The system principally monitors electrical parameters of household appliances such as voltage and current and subsequently calculates the power consumed. The novelty of this system is the implementation of the controlling. Mechanism of appliances in different ways. The developed system is a low-cost and flexible in operation and thus can save electricity expense of the consumers. The prototype has been extensively tested in real-life situations and experimental results are very encouraging.

KEYWORDS: Energy management, home automation, intelligent control system, wireless sensor network, Zig Bee.

I.INTRODUCTION

Wireless Sensor Networks (WSN) has been employed to collect data about physical phenomena in various applications such as habitat monitoring, and ocean monitoring, and surveillance As an emerging technology brought about rapid advances in modern wireless telecommunication, Internet of Things (IoT) has attracted a lot of attention and is expected to bring benefits to numerous application areas including industrial WSN systems, and healthcare systems manufacturing WSN systems are well-suited for long-term industrial environmental data acquisition for IoT representation . Sensor interface device is essential for detecting various kinds of sensor data of industrial WSN in IoT environments. It enables us to acquire sensor data. Thus, we can better understand the outside environment information. However, in order to meet the requirements of long-term industrial environmental data acquisition in the IoT, the acquisition interface device can collect multiple sensor data at the same time, so that more accurate and diverse data information can be collected from industrial WSN. With rapid development of IoT, major manufacturers are dedicated to the research of multi-sensor acquisition interface equipment.

There is a lot of data acquisition multiple interface equipment's with mature technologies on the market. But these interface devices are very specialized in working style, so they are not individually adaptable to the changing IoT environment. Meanwhile, these universal data acquisition interfaces are often restricted in physical properties of sensors (the connect number, sampling rate, and signal types). Now, micro control unit (MCU) is used as the core controller in mainstream data acquisition interface device. MCU has the advantage of low price and low power consumption, which makes it relatively easy to implement. But, it performs a task by way of interrupt, which makes these multi-sensor acquisition interfaces not really parallel in collecting multi-sensor data.

On the other hand, FPGA has unique hardware logic control, real-time performance, and synchronicity which enable it to achieve parallel acquisition of multi-sensor data and greatly improve real-time performance of the system. FPGA has currently becomes more popular than MCU in multi-sensor data acquisition in IoT environment. However, in IoT environment, different industrial WSNs involve a lot of complex and diverse sensors. At the same time,each sensor has its own requirements for readout and different users have their own applications that require different types of sensors .

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II.LITERATURE SURVEY

There are several proposals to interconnect various domestic appliances by wireless networks to monitor and control such as provided in [1], [2]. But the prototypes are verified using test bed scenarios. Also, smart meter systems like [2]–[4] have been designed to specific usages particularly related to geographical usages and are limited to specific places. Different information and communication technologies integrating with smart meter devices have been proposed and tested at different flats in a residential area for optimal power utilization [5], [6], but individual controlling of the devices are limited to specific houses. There has been design and developments of smart meters predicting the usage of power consumption [2]–[6]. However, a low-cost, flexible, and robust system to continuously monitor and control based on consumer requirements is at the early stages of development. In this study, we have designed and implemented a ZigBee-based intelligent home energy management and control service. We used the ZigBee (the IEEE 802.15.4 standard) technology for networking and communication, because it has low-power and low-cost characteristics, which enable it to be widely used in home and building environments [3]. Remote Sensor Networks (WSN) has wound up cardinal towards the execution of quick home, and they are ended up being a permitting development for helped living. WSNs are regarded fitting for circumstance in home circumstances for different applications. Remote Sensor Network has exceptionally propelled the imperativeness capable utilize. In WSN sensor center points, have confined imperativeness spending so this paper generally focus on harvesting of essentialness and power saving. It is more customary that nowadays a building presented with little power creators, for instance, sun arranged PV, Wind Turbine. There are challenges to check essentialness viability beginning from both free market movement and on the most capable technique to control cunningly the building imperativeness organization structure.

III.METHODOLOGY

The system has been designed for measurement of electrical parameters of household appliances. Important functions to the system are the ease of modelling, setup, and use. From the consumer point of view, electrical power consumption of various appliances in a house along with supply voltage and current is the key parameter. Fig. 1 shows the functional description of the developed system to monitor electrical parameters and control appliances based on the consumer requirements. The measurement of electrical parameters of home appliances is done by interfacing with fabricated sensing modules.The details of the design and development of the sensing modules are provided in the following sections. The output signals from the sensors are integrated and connected to XBee module for transmitting electrical parameters data wirelessly. The XBee modules are interfaced with various sensing devices and interconnected in the form of mesh topology to have reliable data reception at a centralized ZigBee coordinator.

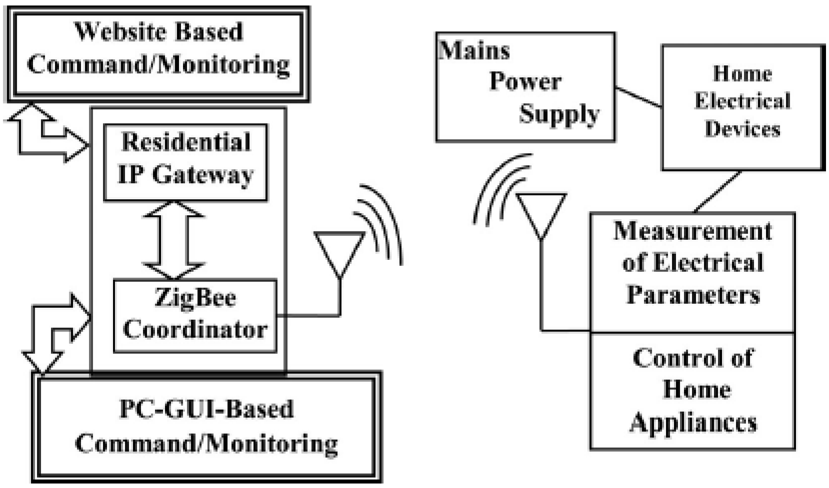

Fig.1:Block diagram of system

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The maximum distance between the adjacent ZigBee nodes is less than 10 m, and through hopping technique of the mesh topology, reliable sensor fusion data has been performed. The ZigBeecoordinator has been connected through the USB cable of the host computer, which stores the data into a database of computer system. The collected sensor fusion data have been sent to an internet residential gateway for remote monitoring and controlling the home environment.

A.Measurement of Electrical Parameters

1) Voltage Measurement: The voltage transformer used in our paper is the 44 127 voltage step-down transformer man ufactured by MYRRA [23]. The striking features include two bobbins compartments including self-extinguishing plastics and very light weight (100 g). The step-down voltage transformer is used to convert input supply of 230–240 V to 10 VRMS ac signal. The actual voltage is thus obtained as follows:

Vact = m1 × Vmeasured voltage (1)

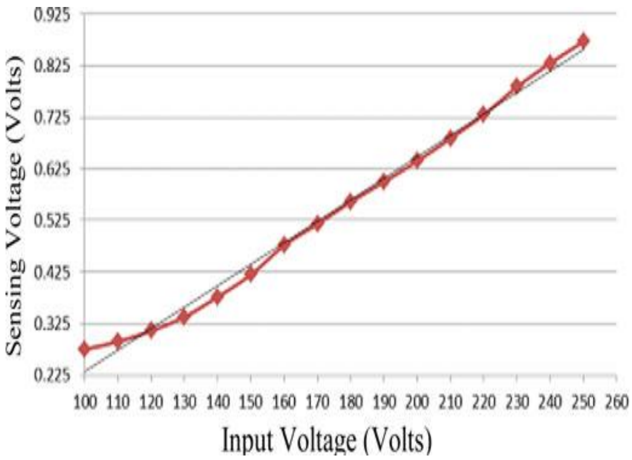

Fig.2:Scaling factor (m1) of voltage signal

wherem1 is the scaling factor obtained from Fig. 4, Vact is the actual voltage, and Vmeasured voltage is the measured sensing voltage.

2) Current Measurement: For sensing current, we used ASM010 current transformer manufactured by TalemaThe main features of this sensor include fully encapsulated PCB mounting and compact size.

Iact = m2 × Vmeasured voltage for current (2)

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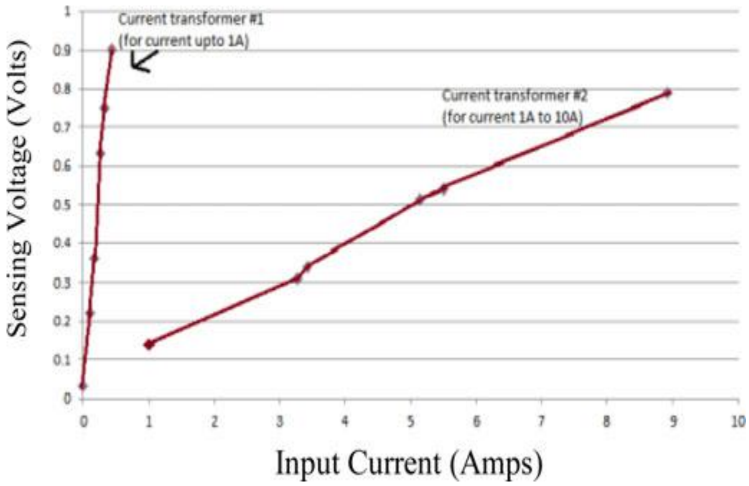

Fig.3:Scalingfactor (m2) of current signal.

wherem2 is the scaling factor , different values ofm2 to be used for different current transformers. Iact is the actual current; Vmeasured voltage for current is the measured sensing voltage for current.

3) Power Measurement: In order to calculate power of a single-phase ac circuit, the product of root mean square (RMS) voltage and RMS current must be multiplied by the power factor as given in (3). Power factor is the cosine of the phase angle of voltage and current waveforms

$$Pact = Vrms\times Irms\times Pf \quad (3)$$

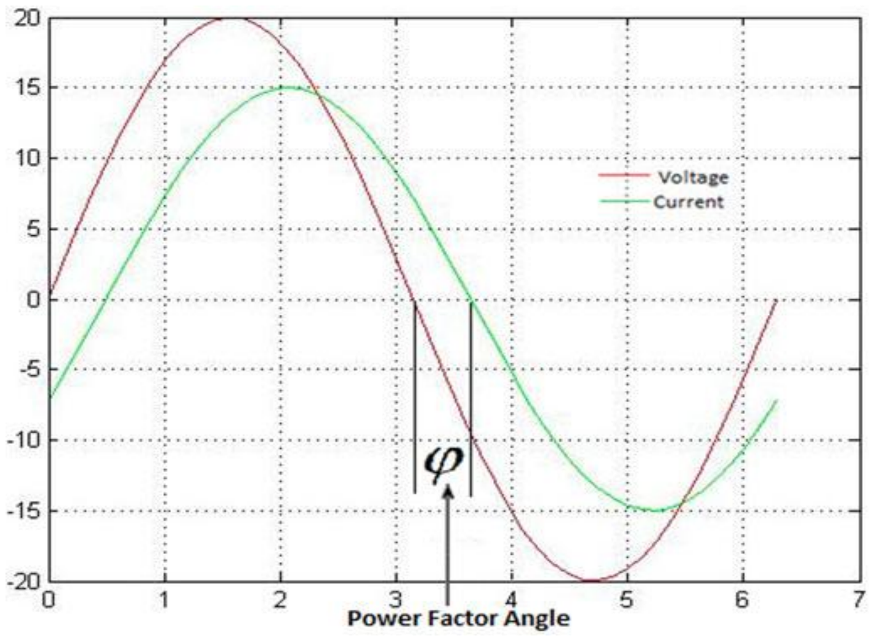

Fig.4:Representation of power factor.

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Where Pact is the actual power, Vrms and Irms are the RMS values of voltage and current, respectively, and Pf is the power factor.

IV.CONCLUSION

From the consideration of all the above points we conclude that, the design and development of a smart monitoring and controlling system for household electrical appliances in real time has been reported in this paper. The system principally monitors electrical parameters of household appliances such as voltage and current and subsequently calculates the power consumed. The novelty of this system is the implementation of the controlling. Mechanism of appliances in different ways. The developed system is a low-cost and flexible in operation and thus can save electricity expense of the consumers. The prototype has been extensively tested in real-life situations and experimental results are very encouraging.

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