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Survey on Power measurements Using EB Microcontrollers and zigbee transceivers

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Abstract

Design and development of astute monitoring and controlling system for household electrical appliances in authentic time is proposed. Incrementing power consumption is becoming an astronomically immense quandary. In this system, we propose an astute energy distribution system with a fine-tuned power utilization of every home set from Electricity Board (EB) office. Power distribution from EB is the major issue because of shortage in power generation from renewable and non-renewable resources. We design this, in order to reduce the frequent power cut off. Moreover monitoring and controlling of home appliances is developed either manually, remotely and with the avail of internet automatically. The main aim is to provide low cost and flexible operation. The goal is to develop an incipiently equipped well designed prototype for consumers in home to constrain the utilization of puissance. This avails users and power distribution centre to manage the potency in an efficient manner. Virtually applied in home and in EB unit with the avail of microcontrollers and zigbee transceivers. Internet provides the data efficaciously, in order to manage the puissance by controlling the home appliances.

Keywords:EB, Microcontrollers and zigbee transceivers.

1. Introduction

Wireless sensor network (WSN) facilely monitor assets or environment with reliable, battery-powered quantification nodes that offer industrial ratings and local analysis and control capabilities. Each wireless network can scale from tens to hundreds of nodes and seamlessly integrate with subsisting wired quantification and control systems. A wireless sensor network consists of three main components: nodes, gateways, and software. The spatially distributed quantification nodes interface with sensors to monitor assets or their environment. The acquired data wirelessly transmits to the gateway, which can operate independently or connect to a host system where you can amass, process, analyze, and present your quantification data utilizing software. Routers are a special type of quantification node that can be habituated to elongate WSN distance and reliability. The world passing the most immensely colossal quandary of potency.

Because the engenderment of potency is less than the injuctive authorization power of consumer side. In many countries the instrumentation in demand is growing at a more expeditious rate than transmission capacity and additionally the cost of providing power is additionally incrementing due to the higher coal prices and deficiency of fuel. Withal the reason of not getting the full power to consumers side is that the growing population of countries. To surmount the quandary of potency distribution this paper provides an overview of wireless sensor network by managing the equal power distribution by utilizing zigbee network sensor. A keenly intellective environment is a physical world that is interconnected through a perpetual network abundantly and invisibly with sensors, actuators and computational units, embedded seamlessly in the everyday objects of our lives. A perspicacious home is a residence in which computing and information technology apply to expect and respond to the occupants' needs and can be acclimated to enhance the everyday life at home. Potential applications for astute homes can be found in these categories: welfare, regalement, environment, safety, communication, and appliances. Automation is, where more things are being consummated every day automatically, customarily the fundamental tasks of turning on or off certain contrivances and beyond, either remotely or in close need to maintain as much control as we can over the automated processes. Automation lowers the human judgment to the lowest degree possible but does not consummately eliminate it. Depending on the location of its utilization, automation differs in its name as industrial automation, home automation etc. The rest of the paper is organized as follows: Section II discusses the subsisting system; Section III provides detailed implementation of the proprosed system; Section IV and V presents the block diagram and experimental results. Section VI has concluded and discussed about the future work.

2. Related Work

2.1 EXISTING SYSTEM:

In this section, we briefly discuss the subsisting works about astute home systems predicated on wireless communication technology. Sundry proposals are there to interconnect domestic appliances by wireless networks to monitor and control which are provided in [2], [3]. Withal, keenly intellective meter systems like [3]–[5] have been designed to categorical usages concretely cognate to geographical usages and are inhibited to categorical places. Different information and communication technologies integrating with astute meter contrivances have been roposed and tested at different flats in a residential area for optimal power utilization [6], [7], but individual controlling of the

contrivances are inhibited to concrete houses. There has been design and developments of astute meters soothsaying the utilization of puissance consumption [3]–[7]. However a low-cost, flexible, and robust system to perpetually monitor and control predicated on consumer requisites is at the early stages of development. In this, we have designed and implemented a ZigBee-predicated astute home energy management and control accommodation. We utilized 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 utilized in home and building environments [4]. The disadvantage are: the physical wiring from the meter to the house can still be an impediment for a facile implementation of this solution, concretely for tall or old buildings, due to cost and installation involution. Han et al. [9] proposed a Home Energy Management System (HEMS) utilizing the ZigBee technology to reduce the standby puissance.

The system consists of an automatic standby cutoff outlet, a ZigBee hub and a server. The potency outlet with a ZigBee module cuts off the ac power when the energy consumption of the contrivance connected to the puissance outlet is below a fine-tuned value. The central hub accumulates information from the potency channels and controls these power channels through the ZigBee module. The central hub sends the present state information to a server and then a utilizer can monitor or control the present energy utilization utilizing the HEMS utilizer interface. This facility may engender some uneasiness for the users. For example, if the users may want low intensity of light, for some situation but the system will cut the puissance off leading to tenebrosity. Gill et al. [10] projected a ZigBee-predicated home automation system. This system consists of a home network unit and a gateway. The core part of the development is the interoperability of different networks in the home environment. Less paramountcy is given to the home automation. Pan et al. [11] recommended a WSN-predicated keenly intellective light control system for indoor environments, such as a home for a reduction in energy consumption.

In this paper, wireless sensors are responsible for quantifying current illuminations and the lights are controlled by applying the model of user‟s actions and profiles. The above mentioned home monitoring and controlling systems have circumscriptions with reverence to home automation such as: 1) energy consumption control mechanism is circumscribed to only certain contrivances like light illuminations, whereas several household appliances can be controlled; 2) energy control

is predicated on fine-tuned threshold power consumption, which may not be applicable to different consumers; 3) controlling the home appliances through network management functions, in practice inhabitant requisites may vary according to their demeanor but not with network characteristics. A low-cost, flexible, and authentic-time astute power management system, which can facilely integrate and operate with the home monitoring systems such as [12]is presented. The system is designed to monitor the sultriness of polyhouse environment. On-demand meter reading and remote troubleshooting sanction utilities to provide better and more timely consumer support. Utilities have more at hand about outages and renovations, and are able to consumers with good information about when power will be renovated. During emergencies, utilities can engender "partial outages" in non-exempt buildings to ascertain the puissance remains available where it is most needed. Partial outages are more economically efficient than full rotating outages, because the effects are inhibited to the reduction of a single discretionary accommodation such as air conditioning rather than the elimination of all accommodations. Additionally power factor amendment can result in an abundance of puissance preserving for industrial sector. Power demand and utilization, sanctioning utilities and consumers kindred to do their component to ascertain perpetuated and affordable supply of essential accommodations.

2.2 PROPOSED SYSTEM

A.Wireless Sensing and Intelligent Buildings

Present day keenly intellective buildings are highly adaptable to transmuting environmental conditions. They have automated systems, including wireless sensor monitoring, to facilitate energy efficient, comfortable and cost efficacious environments by optimising structure, systems, accommodations, building management and their interrelationships. In the context of the future „Internet of Things", Astute Building Management Systems can be considered part of a much more sizably voluminous information system. This system is utilized by facilities managers in buildings to manage energy use and energy procurement and to maintain buildings systems. It is predicated on the infrastructure of the subsisting Intranets and the Internet, and ergo utilises the same standards as other IT contrivances. Within this context reductions in the cost and reliability of WSNs are transforming building automation, by making the maintenance of energy efficient salubrious productive work spaces in buildings increasingly cost efficacious.

Wireless sensing in commercial and office buildings has lead to a more preponderant vigilance of the condition of buildings and their

systems: As it provides information indispensable for those in charge of building operation and maintenance to apperceive limits and non-functioning equipment and systems and prioritise building maintenance tasks etc. predicated on costs and other paramount factors. The main benefits of this are:

- An increased lifespan for equipment/electric appliances;
- An improved building environment for occupants;
- Economies of scale gained from monitoring, tracking and responding to the status of multiple uilding assets from centralised or regional locations;
- The ability to detect impending faults and therefore minimise energy usage associated with facility assets and increase reliability while reducing costs;
- Lower energy and operating costs leading to an advantageous return on investment. For example energy management systems based on WSNs can save an average of 10 % in overall building energy consumption and the energy savings can be as high as 30% depending on occupancy.

B. Recent advances

The WSNs utilized in keenly intellective building management systems consist of variants of sensor nodes quantifying parameters such as temperature, sultriness, light, asphyxiating gases/smoke, occupancy, and energy consumption. In integration, the systems may include actuators, gateways, servers and communication and application software on different calibers as well as different home appliances. A substantial amount of research has been conducted fixating on different aspects of WSN for building management and control.

C. ZigBee Wireless Sensor Network

The gateway functions both as a server storing network data and a connection point between the network nodes, the LAN and the external server. It has the coordinator role in the ZigBee network. A Web utilizer interface running on the gateway enables the utilizer to establish and manage the gateway and the WSN. Several battery-driven wireless sensor nodes with internal sensors to quantify temperature, light and sultriness are deployed in the network. These nodes are able to compose mesh networks and can operate within an indoor range of about 40 metres. They function as end-contrivances in the ZigBee WSN.

A number of remotely controlled ZigBee contrivances with relays are utilized as switches to power external equipment, such as table fans, desk lamps, etc. These contrivances, which act as routers in the WSN, are plugged into power points. They are additionally utilized as meters

for quantifying the voltage, current, frequency, power consumption and load of the annexed equipment.

3. Implementation

3.1 BLOCK DIAGRAM

The system has been designed for quantification of electrical parameters of household appliances. The quantification of electrical parameters of home appliances is done by interfacing with sensing modules. 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 sundry sensing contrivances and interconnected in the form of mesh topology to have reliable data reception at a centralized ZigBee coordinator. 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 ZigBee coordinator has been connected through the USB cable of the host computer to store the data into a database of computer system. The block diagram of the system is shown in Fig.1 and Fig.2. The accumulated sensor fusion data have been sent to a cyberspace residential gateway for remote monitoring and controlling the home environment. By analyzing the potency from the system, energy consumption can be controlled. The appliances are controlled either automatically or manually. The keenly intellective power metering circuit is connected to mains 240 V/50 Hz supply.

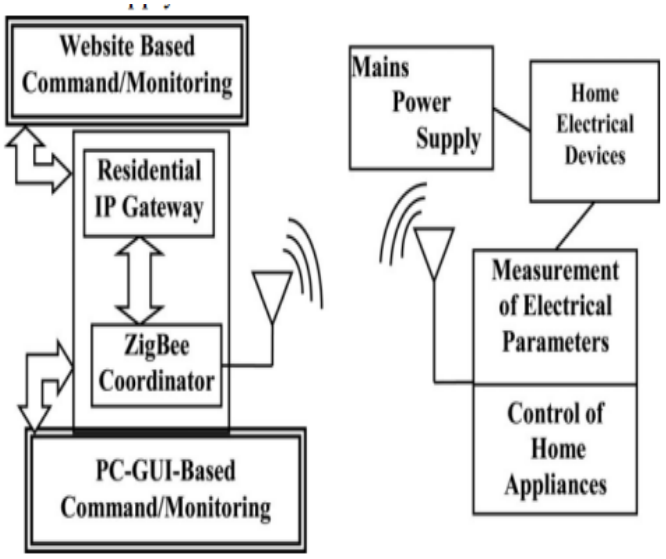

Fig 1. Block diagram of the system.

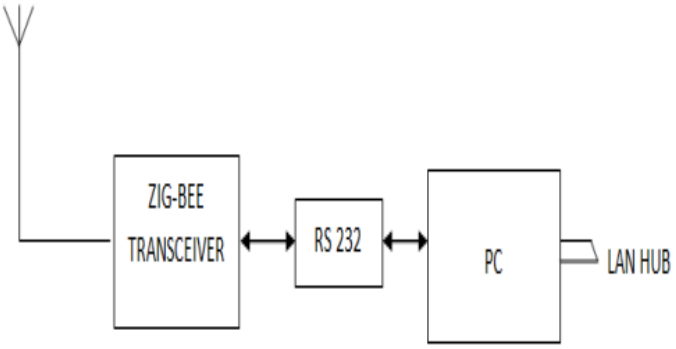

Fig 2. Control unit.

The home automation system is a key for energy conservation that can be equipped in mundane buildings. Nowa-days the injuctive authorization for home automation systems in homes and offices are invariably incrementing. These systems directly work on the household appliances to provide effortless operation and

control of the contrivances. In this paper we have presented the concept of astute home automation to reduce the energy consumption and wastage utilizing advanced graphical software called LabVIEW. It provides the programming implements to code power system applications more facilely, which preserves programming time. With the development of low cost electronic components home automation migrated from being an industrial application to home automation.

A. Zigbee Overview

There are three categories of nodes in a ZigBee system.They are Coordinator, Router and Enddevices.

1) Coordinator: It is responsible for initiating the networkand selecting the network parameters such as radio frequencychannel, unique network identifier and setting otheroperational parameters. It can also store the informationabout network, security keys.

2) Router: Router acts as intermediate nodes, relaying datafrom other devices. Router can connect to an already existentnetwork, also able to accept connections from other devicesand be some kind of re-transmitters to the network. Networkmay be extended through the use of ZigBee routers.

3) End Devices: End Device can be low-power /battery powereddevices. They can collect various information fromsensors and switches. They have sufficient functionality totalk to their parents (either the coordinator or a router) andcannot relay data from other devices.

B. Control of Home Appliances

1) Automatic control: Based on the electricity tariffconditions, the appliance can be regulated with the help ofsmart software. This enables the user to have more costsaving by auto switch off the appliances during theelectricity peak hours. The electricity tariff is procured fromthe website of the electricity supply company and is updatedat regular intervals.

2) Manual control: An on/off switch is provided to directly intercede with the device. This feature enables the user to have more flexibility by having manual control on the appliance usage without following automatic control. Also, with the help of the software developed for monitoring and controlling user interface, user can control the device for its appropriate use. This feature has the higher priority to bypass the automatic control.

3) Remote control: The smart power monitoring andcontrolling software system has the feature of interactingwith the appliances remotely through internet (website). Thisenables user to have flexible control mechanism remotelythrough a secured internet web connection. This sometimesis a huge help to the user who has the habit of keeping theappliances ON while away from house. The user can

monitorthe condition of all appliances and do the needful.

Residential IP Gateway: Transmission Over IPIn order to transmit real-time sensed data over the internetfrom the collected computer system, the ZigBee packetinformation is to be transformed to the Internet ProtocolVersion 6(IPv6). The key element in the data transformationfrom Zig-Bee packet is the address translation. This wasimplemented at the application gateway, a program fordetermining the source or destination address of a packet thatencapsulates a ZigBee packets‟ payload. The corresponding application gateway program performsthe address transformation mechanism for ZigBee to addressnon-ZigBee nodes. ZigBee is based upon the IEEE 802.14.5protocol, which uses a 64-bit address for each node on apersonal area network (PAN) and 16 bits to identify the PANID. IPv6 uses 128 bits to address a node on the network, ofwhich 48 bits represent the network, 16 bits represent thelocal network (PAN ID), and 64 bits represent the host id(sensor node). Therefore, the node address for the IEEE802.15.4 can be placed in an IPv6 address, and the PAN IDcan be used to identify the ZigBee network in an IPv6address.

4. Experimental Results

Fig 3: System with initial Architecture diagram.

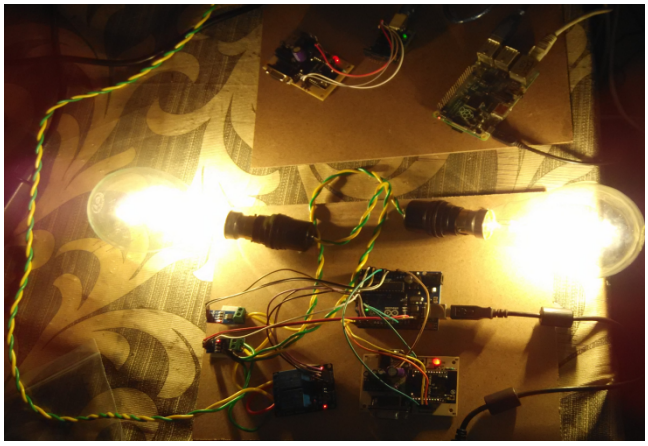

Fig 4: System with Power passing when on lights.

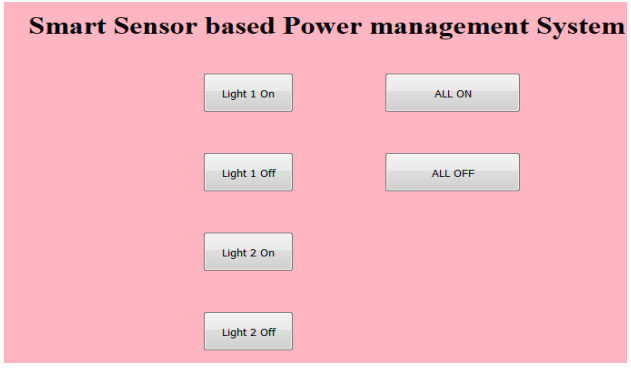

Fig 5: System with Light Channels in web App.

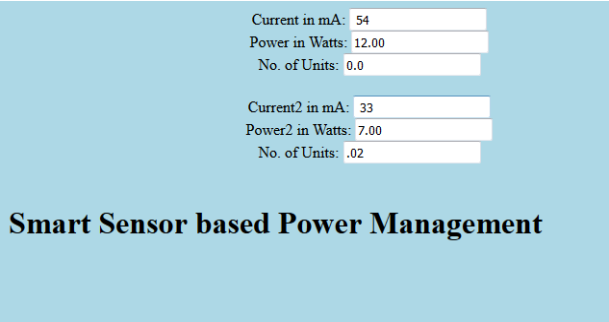

Fig 6: all Devices on power measurements.

5. Conclusion

Keenly intellective monitoring and controlling system for household electrical appliances in authentic time is designed. Thus the potency consumption is minimized by providing periodic alert and managing the potency consumption predicated on the utilization of the customer automatically.The advantages are as follows: no cabling required, facile inclusion of consequential data emanating from other meters similarly equipped with centre to manage the potency in an efficient manner. As a component of future work, prototype has to be designed for implementation of potency management.

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