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Paper on Design of a Low Delay System to Monitor Multiple Household Parameters and Report over Zigbee Interface

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Abstract: Smart grid is a modified form of electrical grid where generation, transmission, distribution and customers are not only connected electrically but also through strong communication network with each other as well as with market, operation and service provider. For achieving good communication link among them, it is very necessary to find suitable protocol. In this paper, we discuss different hardware techniques for power monitoring, water monitoring, power management and remote power controlling at home and transmission side and also discuss the suitability of Zigbee for required communication link. Zigbee has major role in monitoring and direct load controlling for efficient power utilization. It covers enough area needed for communication and it works on low data rate of 20Kbps to 250Kbps with minimum power consumption. This paper describes the user friendly control home appliances, power on/off through the internet, PDA using Graphical User Interface (GUI) and through GSM cellular mobile phone.

I. INTRODUCTION

In many countries, communication based controlling and monitoring architecture is used in smart grid to save power. Communication network may be wired or wireless. Communication through wired interface is very intricate and hard to implement or install. Wireless interfaces are chosen because they are easy to organize and install.

Furthermore, Zigbee has some technical advantages over Bluetooth, Wi-Fi, infrared rays etc. Zigbee is a kind of low power-consuming communication technology for coverage area surrounded by 200m, with a data rate ranging from 20Kbps to 250Kbps, it is appropriate for use in home area networks, mainly for the remote control of electric home appliances.

standard	range	No of nodes	Data protection	Power use
Bluetooth	10m	8	16bit crc	High
Wi-fi	100m	32	32bit crc	High
zigbee	10-200m	More than25400	16bit crc	low

Table-1 comparisons of Bluetooth, wi-fi. Zigbee

In this paper, we discuss different options of hardware technique for power controlling and monitoring architecture. For Monitoring, hardware is based on current or voltage measuring circuits, Micro Controller Unit (MCU) relay and Zigbee Reduce Function Device (RFD). Current/voltage measuring circuit measures the I/V and sends the information to MCU. Micro Controller checks abnormality of power and send the information to the home server where database is maintained through Zigbee RFD. For controlling purpose, relay is added in power monitoring hardware. In case of emergency found by MCU, relay cuts the power supply to the electric home appliances after receiving the control command. Graphic User Interface (GUI) software is used as an interface between user and end devices. User can control all electric appliances through cell phone, computer or laptop

II. LITERATURE REVIEW

S. Gupta suggested in 2010 the Zigbee network is used to monitor the environment parameters of aquiculture water. Each sensor node of the network, which is composed of various sensors pH value, content of ammonia cal nitrogen etc. A GPRS module is used to complete data exchanging between remote monitoring center and the wireless sensor network. This system is an application in aquiculture field. The development of graphical user interface (GUI) for the monitoring purposes at the base monitoring station is another main component discussed in this paper. The GUI should be able to display the parameters being monitored continuously in real time. The developed GUI platform using VB is cost-effective and allows easy customization. The problem statement of proposed system will allow us measure the ph. between the range 1 to 14 only will allow us to control the system efficiently.

N. Batra suggested in 2013 the energy consumption, the energy consumption of household appliances given easy to collect information such as a single aggregate energy reading per month and static household characteristics.

But in this paper researchers approach only single data per month and can estimate the finer grained power signal.

In the existing work researchers have focused separately water measuring and energy measuring system. But our research work will be based on water , energy, gas monitoring as well as reduction of delay for the overall monitoring system in order to to get the most optimized results in terms of communication delay for the system.

III. PROPOSED METHODOLOGY

In this system we are using a zigbee technology; zigbee belongs to the class of wireless sensor networks. This device consists of hardware and software technique that means it consist as transmitter and receiver. Following figure shows that the block diagrm of our metering device.

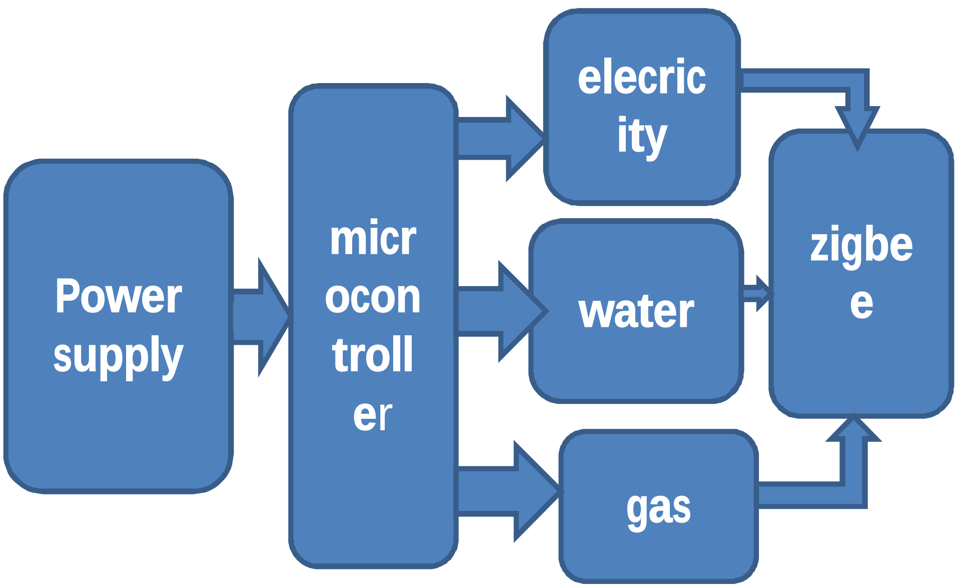

Fig . Transmitter

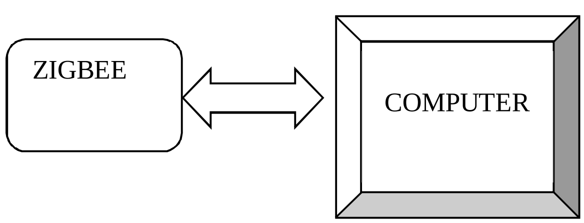

Fig. Receiver

The overall structure of reconfigurable smart sensor interface consists of CPLD chip (XC2C256 chip), crystals and peripheral circuit, communication circuit for turning USB to serial port (PL2303HXC chips and peripheral circuits), power supply of 1.8 and3.3V (LM1117chip, voltage regulator and filter circuit), an SRAM memory (TC55V400 chip), high-speed 8-channel ADC

(ADS7870 chip and peripheral circuit), LED indicator light, an analog extended interface, and three digital extended interfaces. Every extended interface among them can connect eight independent sensors, namely, the reconfigurable smart sensor interface device can access eight analog signals and 24 digital signals. Fig. shows the CPLD hardware block diagrams. The hardware system can also send and receive data besides the basic sensor data acquisition. It can send data to the control center via USB serial port or Zigbee wireless module. Zigbee wireless communication module can be connected with the board through the mini-USB interface or the extensible GPIO interface on the device. It can be used as wireless data transceiver node when the main controller receives trial or executive instructions [39]. After the data control center finishes further processing for the received data, it needs to feedback related actions to sensor interface device. Data communication function can also control the running status of corresponding peripheral device.

IV. WEB APPLICATION

Graphical user interface software was developed for real time monitoring and programming of irrigation based on soil moisture and temperature data. The software application permits the user to visualize graphically the data from each WSU online using any device with Internet Besides the soil-moisture and temperature graphs; the web application displays the total water consumption and the kind of the IA. The web application also enabled the user direct programming of scheduled irrigation schemes and adjusting the trigger values in the WIU according to the crop species and season management. All the information is stored in a database. The web application for monitoring and programming was coded in C# language of Microsoft Visual Studio 2010. The database was implemented in SQL Server 2005.

V. USER RESPONSIVE CONTROL SYSTEM

Zigbee based Smart meters are part of AMI which give all information about power to customer like showing peak hours time, current running price, and real time power consumption by electric home appliances. It involves user to control power load at his end. This system provides reliable control system to user through different ways.

A. Control by Internet

In the software for remote controlling is install in PC or laptop and connect to internet. The network formation of connecting remote control by internet is a host-client structure. This remote control software sets IP address and ports and sends request to Power Monitoring System (PMS), creates a link between user and PMS. when PMS detects a power abnormality, warning message hurl to user through email by means of Mail Transfer Protocol (MTP). In [2], under the proposed system, functional schedules are implemented on java Virtual Machine(VM). When user want to switch on/off an electric home appliance from a web interface, response time is less than one sec.

B. Control by PDA with GUI

In PDA is connected to power monitoring module for controlling and monitoring electric home machines. GUI is used in control area to create interface between user and electronic devices. By making use of GUI, user can access condition of electric home appliances, time reaction and energy utilization made by electric power outlets. GUI provides effortless control of power status of electric home machines. User can set each switch as on/off by sending command. The remote control system offers to supervise and manage power condition of electric home appliances.

C. Controls by GSM Cellular Mobile Phone

consumer can examine and organize electric home machines using GSM cellular mobile phone. User sends control command message through GSM cellular mobile phone to PMS. After receiving control command PMS allows user to control if sending command format match with system. User can be capable for supervise and organize power condition of electric home appliances anytime and anywhere using GSM cellular mobile. PMS can also send warning message to consumer after finding unusual status of power.

To fulfill this requirement, the following recommendations are proposed for MIZBAN design.

1) Every ZBGW should not serve more than 150 energy meters and the maximum hop count of the backbone network should be limited to no more than fourteen.

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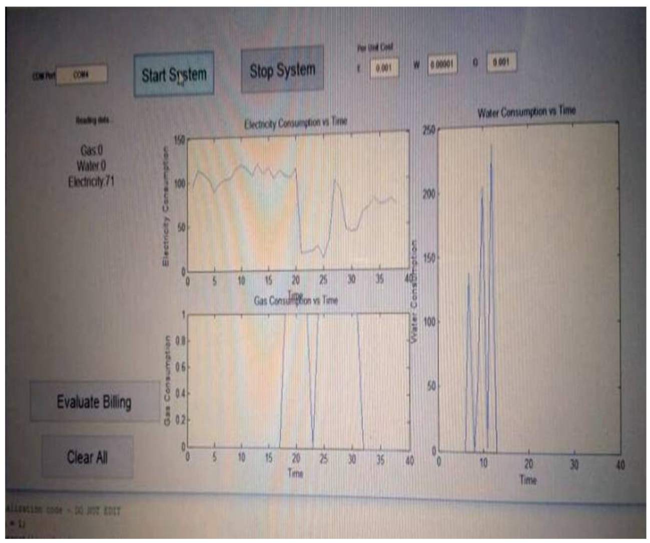
2) Z-BGW should NOT be located at the meter room of the ground floor in order to maximize the number of served floors. For example, Z-BGW should locate at the meter room of the 15th floor if the maximum hop count is 14 and the Zig Bee signal can only propagate single floor under these assumptions, a Z-BGW can serve 30floors.
3) A single-interface MIZBAN is recommended for a building with no more than 40 energy meters and at the same time no more than three hops for the backbone network.
4) A tri-interface MIZBAN is recommended for a building with 41–90 energy meters and with a maximum hop count of the backbone network no more than eight.
5) A Quadra-interface ZigBee device is recommended for a building with more than 90 energy meter and no more than 14 hops for the backbone network.
6) AZ-IHD and a Zig Bee router that are within coverage but located on different floors should be attached to different interfaces.
7) A Z-IHD should be connected to the MIZBAN meter terminal by not more than three hops in the coverage

VI. RESULT



A. Calculation of Total Consumed Water Flow, Light , Gas

“$FLG# “is decode in time t
F denotes flow of water
L denotes light
G denotes gas
Lets ,
on time t1—f1,l1,g1
On t2– f2,l2,g2
tn– fn,ln,gn
Total flow=∑f1-fn=TF
Total light=∑l1-ln=TL
Total gas=∑g1-gn=TG
Wc=water consumed/time=TF/time
Lc=light consumed/time=TL/time
Gc=gas consumed/time=TG/time
Water bill=Wc*unit consumed of water
Light bill=Lc*unit consued of light
Gas bill=Gc*unit consumed of light

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VII. CONCLUSION AND FUTURE WORK

In this paper, we discussed power and water utilization, organizing and controlling architecture for saving purpose. We also discussed the role of Zigbee in transmission line monitoring, real time meter reading and direct load controlling of electric home appliances. This paper also describes the user friendly control home appliances for power on/off through internet, PDA using GUI and through GSM cellular mobile phone

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