ENERGY MANAGEMENT USING ZIGBEE AND WIFI

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Abstract: *The goal of the research presented in this paper is to investigate the reliability of ZigBee-based wireless sensor networks in transforming existing power systems into future smart grids. The performance of the communication network for a specific propagation environment, channel modulation, and frequency band is investigated. The high-power interrupting disturbances generated from harsh normal and abnormal operating conditions in a power system environment are investigated. Laboratory- simulated switching transient events have been generated under different conditions. The interruption limits due to the radio-frequency signals generated during high-power switching transients are defined for ZigBee coordinator and device units.*

Key Words: *Microcontroller, LDR, ZIGBEE, WIFI.*

I. INTRODUCTION

Adiverse set of applications for sensor networks has already emerged for use in a number of fields, including energy, machine malfunctions, medicine, agriculture, the environment, motion tracking, and many others. The delivery of the IEEE 802.15.4 standard for physical and medium-access control (MAC) layers and the development of a ZigBee standard for network and application layers have paved the way for the broad acceptance of sensor devices in a wide variety of applications. Increasing the efficiency of energy delivery, enhancing the reliability of the power system, and mitigating the adverse impact of conventional fuel plants on the environment can all be achieved through increases in the intelligence level of power systems. Intelligent power networks are expected to incorporate millions of sensors, all connected through an advanced, two-way communication and data-acquisition system in order to provide real-time monitoring, diagnosis, and control. IEEE 802.11 (Wi-Fi), IEEE 802.15.1 (Bluetooth), IEEE 802.15.3 (UWB), and IEEE 802.15.4 (ZigBee) are possible candidates for integrating sensors with wireless technologies in order to provide reliable data and to transform existing power systems into smart grids. ZigBee offers a self-forming, self-healing, secure wireless communication protocol enabled by a mesh topology supported by a low data rate, low cost, and low power consumption. These attractive features make ZigBee a good candidate for application in a smart-grid environment. The U.S. Department of Energy (DOE) expects that the widespread deployment of wireless sensor networks (WSNs) in industry could improve overall production efficiency by 11%to 18%
The goal of the research presented in this paper was to investigate the reliability of a ZigBee-based WSN when it is incorporated into a smart grid. In addition to examining the data size and real-time requirements of power systems, the study also explored the effect of HPD on ZigBee networks due to switching transients. The results of this research will set the

basis for and define the limits of deploying Zigbee WSNs in power systems.

II. Hardware System

Micro controller: This section forms the control unit of the whole project. This section basically consists of a Microcontroller with its associated circuitry like Crystal with capacitors, Reset circuitry, Pull up resistors (if needed) and so on. The Microcontroller forms the heart of the project because it controls the devices being interfaced and communicates with the devices according to the program being written.

ARM7TDMI: ARM is the abbreviation of Advanced RISC Machines, it is the name of a class of processors, and is the name of a kind technology too. The RISC instruction set, and related decode mechanism are much simpler than those of Complex Instruction Set Computer (CISC) designs.

Liquid-crystal display (**LCD**) is a flat panel display, electronic visual display that uses the light modulation properties of liquid crystals. Liquid crystals do not emit light directly. LCDs are available to display arbitrary images or fixed images which can be displayed or hidden, such as preset words, digits, and 7-segment displays as in a digital clock.

In this paper we are proposed a automatic control system to overcome the above mentioned situations. Here we are using LPC2148 (ARM7) micro processor, LCD display, Voltage sensor, Current sensor, Energy meter, Zigbee communication, Relays, AC power supply, Loads and PC. Whenever there is over load or any disturbances in mains supply then the voltage sensors can measure the changes in the voltage and send the data to the LPC2148 (ARM7) microprocessor, it processes the data and sends to Zigbee communication unit. The Zigbee unit transfers the data to the Wi-Fi. In the mobile we have a control program based on the received data. The control program controls the power unit by using relays and microprocessor.

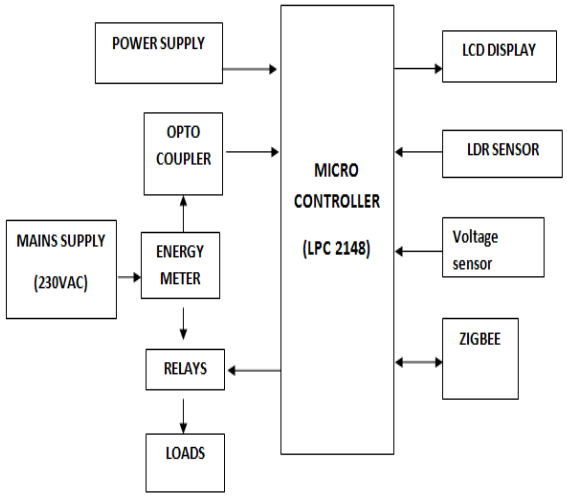

Fig.1. Field Section Block diagram

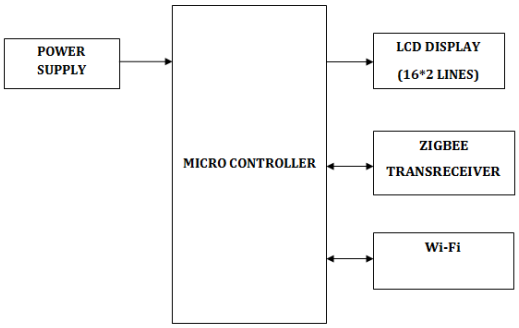

Fig 2. Monitoring Section

III. METHODOLOGY

LDR:

LDRs or Light Dependent Resistors are very useful especially in light/dark sensor circuits. Normally the

resistance of an LDR is very high, sometimes as high as 1000 000 ohms, but when they are illuminated with light resistance drops dramatically. The image shows that when the torch is turned on, the resistance of the LDR falls, allowing current to pass through it. In a light sensor circuit, When the light level is low the resistance of the LDR is high. This prevents current from flowing to the base of the transistors. Consequently the LED does not light. However, when light shines onto the LDR its resistance falls and current flows into the base of the first transistor and then the second transistor. The LED lights on.

The preset resistor can be turned up or down to increase or decrease resistance, in this way it can make the circuit more or less sensitive.

ZIGBEE Technology:

ZIGBEE is a new wireless technology guided by the IEEE 802.15.4 Personal Area Networks standard. It is primarily designed for the wide ranging automation applications and to replace the existing non-standard technologies. It currently operates in the 868MHz band at a data rate of 20Kbps in Europe, 914MHz band at 40Kbps in the USA, and the 2.4GHz ISM bands Worldwide at a maximum data-rate of 250Kbps.The ZIGBEE specification is a combination of Home RF Late and the 802.15.4 specification. The specification operates in the 2.4GHz (ISM) radio band - the same band as 802.11b standard, Bluetooth, microwaves and some other devices. It is capable of connecting 255 devices per network.

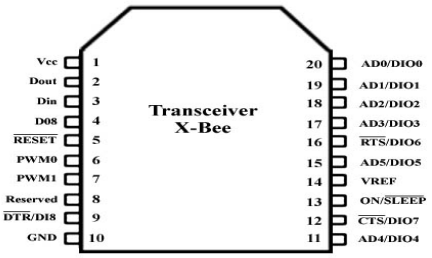

Fig 3: Pin diagram of X-Bee Transceiver

The specification supports data transmission rates of up to 250 Kbps at a range of up to 30 meters. ZIGBEE's technology is slower than 802.11b (11 Mbps) and Bluetooth (1 Mbps) but it consumes significantly less power. 802.15.4 (ZIGBEE) is a new standard uniquely designed for low rate wireless personal area networks. It targets low data rate, low power consumption and low cost wireless networking, and its goal is to provide a physical-layer and MAC-layer standard for such networks.

Wireless networks provide advantages in deployment, cost, size and distributed intelligence when compared with wired networks. This technology allows users to set up a network quickly, and allows them to set up networks where it is impossible or inconvenient to wire cables. Wireless networks are more cost-efficient than wired networks in general. Bluetooth (802.15.1) was the first well-known wireless standard facing low data rate applications. The effort of Bluetooth to cover more applications and provide quality of service has led to its deviation from the design goal of simplicity, which makes it expensive and inappropriate for some simple applications requiring low cost and low power consumption. These are the kind of applications this new standard is focused on. It's relevant to compare here Bluetooth and ZIGBEE, as they are sometimes

seen as competitors, to show their differences and to clarify for which applications suits each of them. The data transfer capabilities are much higher in Bluetooth, which is capable of transmitting audio, graphics and pictures over small networks, and also appropriate for file transfers. ZIGBEE, on the other hand, is better suited for transmitting smaller packets over large networks; mostly static networks with many, infrequently used devices, like home automation, toys, remote controls, etc. While the performance of a Bluetooth network drops when more than 8 devices are present, ZIGBEE networks can handle 65000+ devices.

WIFI:

VSD03 is the new third-generation embedded Uart Wifi modules studied by VSDTECH. Uart-Wif is an embedded module based on the Uart serial,according with the WiFi wireless WLAN standards, It accords with IEEE802.11 protocol stack and TCP / IP protocol stack，and it enables the data conversion between the user serial and the wireless network module. through the Uart-Wifi module, the traditional serial devices can easily access to the wireless network. The module supports quick networking by specifying channel number. In the usual course of wireless networking, devices would first scan automatically on the current channel, in order to search for the network(or Ad hoc) built by the target AP. This module provides working channel configuration, when the channel of the target network is known, users can specify the working channel directly, the networking time will be reduced from 2 seconds to about 300 milliseconds, then quick networking is achieved.

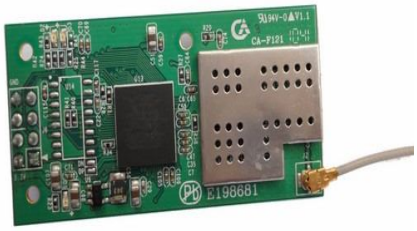

Fig 4: WIFI Module

IV. CONCLUSION

This paper has investigated the reliability of ZigBee-based wireless sensor networks under severe interruption conditions that occur in an electric power distribution system. The effects of impulsive transients were examined using controllable real laboratory data. High power impulsive transients create a problem related to the quality of the operation of the wireless sensors, as indicated by the tests conducted in this study. The oscillatory spikes that appear at the inception of the application of the impulse cause communication interference in the three frequency bands (868–2450 MHz) of ZigBee units, which might result in the loss or delay of data packets. High impulsive transients may cause breakdown failure of a communication link, which requires the resetting of the ZigBee system. This study reveals that ZigBee wireless sensors are adequate for monitoring low data rates in real time, can be integrated with data loggers and sensitive CTs/VTs in order to manage high-sampling-rate data. This can offer an excellent tool for incorporating additional intelligence into conventional distribution systems in the area of asset management where data

of high sampling to be collected and real-time application is not essential.

V. REFERENCES

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