International Journal of Electronics Communication and Computer Engineering
Volume 4, Issue 2, ISSN (Online): 2249–071X, ISSN (Print): 2278–4209

Design Remote Power Control I/O Data Acquisition System and Control on Home Automation

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***Abstract* — In this paper we have designed a remote power control based on both an embedded board and on ZigBee communication. This design consists of two parts that regard as the essential two Control parts, the ZigBee control module and the server module. Where, The main objective of this article is show the control of electro-electronics devices using a PC software and a embedded system, sending and receiving remote data around one kilometer. The text shows the radiofrequency interface, the choice and programming of a microcontroller and the PC software that controls it and also provides a detailed description of the proposed system, from design to implementation, as well as the results of the demonstration experiment.**

***Keywords* – Embedded Board, ZigBee Board, Microcontroller ARM7 (LPC2148), Wireless Data Acquisition, Control of Electronic Devices.**

I. INTRODUCTION

From past many years, we hear people talking about a home that is intelligent, that understands what its user desires and accordingly fulfils their need. This concept is called a "smart house". It is a place that understands what its user want and respond accordingly. Just imagine how it would feel like, to live in a house that can understand your needs and your moods. Even before you reach home, it has the temperature that is maintained; lights adjusted, your favorite music playing on the player [1]. When you go out, it automatically turns off the lights, the heater and gas, and turns on the security alarms. Imagine how easy our life can be with these services. As more and more digital appliances colonize our home, managing them to form a home automation system is not only an option, but almost a necessity [2]. By automation, we mean organizing all the main systems in the house into one common system, thus making the tough job of handling them easy. Being an engineer, I have always been intrigued by the technologies that can make people's life easier. Home automation is one such emerging technology. Controlling and managing all the appliances in home from a remote place saves time and energy. I found ZigBee most interesting because of its low power consumption feature as power conservation is on everyone's agenda at this time and it is going to be even more important in times to come. "ZigBee is an IEEE 802.15.4 standard for data communications with business and consumer devices. It is designed around low-power consumption allowing batteries to essentially last forever. The ZigBee standard provides network, security, and application support services operating on top of the IEEE 802.15.4 [3]" ZigBee technology's development started in 1998, when engineers realized that the existing solutions like Wi-Fi and Bluetooth were deficient in fulfilling the demands that were anticipated in near future. Its main purpose was to provide a low power and low cost solution for wireless communications. A standard was developed by the IEEE in 2003, called 802.15 having the purpose of exploring a low data rate solution with large battery life and very low complexity.

- *ZigBee Vs other Technologies*

Today's market is full of technologies that aim the mid to high data rates for voice, PC LANs, video, etc. What is missing in all these technologies is the unique need for the sensors and control devices. Sensors and controls need very low energy consumption ability so as to have long battery lives even though high bandwidth is not required. ZigBee Alliance focuses on this part of the market and thus provides a standardized set of solutions for wireless communication for such devices. The main advantage of having a standard is that it provides a cost effective solution as compared to creating a new solution from scratch every time. There are a lot of other wireless technologies that are present in market for the whole sole purpose of remotely controlling and managing systems.

Table 1: Below shows a detailed comparison of various technologies

Feature	Wi-Fi	Bluetooth	Zegbee
Power profile / Battery life	Hours	Days	Years
Network size	32	7	64000
Frequency operation	2.4 and 5 GHz	2.4 GHz	868 MHz(Europe) 900-928 MHz (NA) 2.4 GHz(worldwide)
Complexity	Very complex	Complex	Simple
Range	50-100 m	10 m	70-300 m
Data rate	11 Mbps	1 Mbps	250 Kbps
Application Focus	Web , Email	Cable replacement	Monitor and Control
Success Metrics	Speed	Cost	Power , Cost

The ZigBee properties can be summarized as follows [2], [4]:

1. Simple and reliable
2. Very low cost and easy maintenance
3. Reliable communication

4. Low power requirements allowing a long battery life
5. Simple network configuration which allows devices to be added to existing networks with very little work.
6. Secure communication

It is clearly visible from the Table-1 that ZigBee is much better than Wi-Fi and Bluetooth technologies. The major attraction is the increased battery life. Whereas some technologies just give a life of 1-7 days, ZigBee shows a battery life of almost 1000 days.
This is because of its low power consumption capabilities.

- *ZigBee Features and Communication*

ZigBee is a universal wireless language connecting radically dissimilar devices to work together and enhance everyday life. ZigBee standard is mainly for wireless sensor networks, like Bluetooth is for short distance communications and Wi-Fi is for internet. ZigBee Alliance provides a simple, low cost and low power wireless control standard for remote monitoring and controlling, based on IEEE standard 802.15.4. Some of the characteristics of IEEE 802.15.4 are as follows [4], [7]:

1. Simple Design and low cost
2. Low power, that means large battery life ranging from many months to years
3. Large number of devices
4. Data rates of 250 kbps, 40 kbps, and 20 kbps
5. Star topology, peer to peer possible
6. Extremely low duty-cycle (<0.1%)
7. CSMA-CA channel access
8. Optional Guaranteed Time Slot
9. Full handshake protocol for transfer reliability
10. Dual PHY (2.4GHz and 868/915 MHz)
11. Range: 10m (1-100m based on settings)

The scale of this IEEE standard is to define the physical layer (PHY) and the media access controller (MAC). It includes layers up to and including Link Layer Control. A graphical representation of the areas of responsibility between the IEEE standard, ZigBee
Alliance [5], [6]:

- *Applications of ZigBee Technology*

"Since its inception, the ZigBee Alliance has worked with a singular focus: create a much needed global wireless language capable of giving "voices" to the myriad of everyday devices which surround us as we go about our daily lives [8]." Some of the major applications of ZigBee are described below:

1. Home Automation and Control [1]
2. Medical/Patient Monitoring
3. Commercial Building Automation and Control [9]
4. Energy Management
5. Asset Tracking

II. MATERIAL AND METHOD

This project is to make a low power remote control model for controlling the on/off of the appliances using ZigBee communication. It consists of two parts: the ZigBee control module and the server module. The ZigBee control module contains several controllable outlets, the ZigBee receiving and transmission circuit and a microcontroller unit. One of the ZigBee modules is connected to the circuit and other one is connected to a master system (desktop, laptop). Master system gives the ON/OFF commands that are transmitted and received by ZigBee modules. A Microprocessor attached to kit takes the signals from ZigBee and hence control the appliances. As ZigBee offers a bidirectional communication, messages from micro processor can also be transmitted to the Master system. These short messages appear on PC window will make supervision to the devices in a remote fields. This whole model has been designed keeping home automation system in mind.

Fig.1. Control or master mode

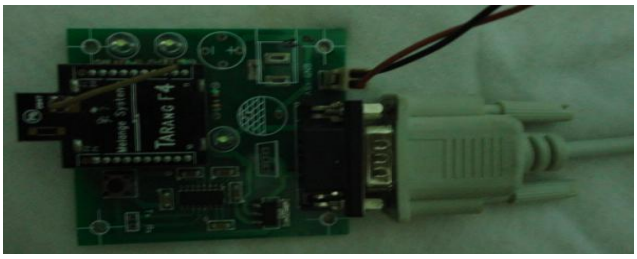

Fig.2. Server or slave mode

- *Lpc2148 Microcontroller*

The LPC2148 microcontrollers is based on a 32-bit ARM7TDMI-S CPU with real-time emulation and embedded trace support, that combine microcontrollers with embedded high-speed flash memory ranging from 32 kB to 512 kB. A 128-bit wide memory interface and unique accelerator architecture enable 32-bit code execution at the maximum clock rate. For critical code size applications, the alternative 16-bit Thumb mode reduces code by more than 30 % with minimal performance penalty. Due to their tiny size and low power consumption, LPC2141/42/44/46/48 are ideal for applications where miniaturization is a key requirement, such as access control and point-of-sale. Serial communications interfaces ranging from a USB 2.0 Full-speed device, multiple UARTs, SPI, SSP to I2C-bus and on-chip SRAM of 8 kB up to 40 kB, make these devices very well suited for communication gateways and protocol converters, soft modems, voice recognition and low end imaging, providing both large buffer size and high processing power. Various 32-bit timers, single or dual 10-bit ADCs, 10-bit DAC, PWM channels and 45 fast GPIO lines with up to nine edge or level sensitive external interrupt pins make these microcontrollers suitable for industrial control and medical systems [13] :

- *Zigbee Transmitter And Receiver*

It has following features [2], [6], [7]:

1. Input supply 5V to 12V
2. 254 Controlled Devices

3. 2.4 GHz Carrier Frequency
4. Very Low Power Consumption
5. RS232 UART interface available
6. Power LED indicator
7. Transfer rate of 250 Kbps
8. Compact size
9. Easy to use and install
10. Variable Packet Length is allowed
11. User Friendly GUI for setting up RF Module and Test Module

Fig.3. ZigBee module

- *RS 232 (Serial Port)*

Recommended Standard – 232 is The (RS232) used for establishing a serial communication between a Microcontroller of embedded system and the peripherals. Data is sent bit by bit on a physical channel. The data sent can be of variable length, though transmitter and receiver use the same number of bits. It uses 4 types of Bits for transfer: start bit, stop bit, parity bits and data bit. The data transfer takes place at a fixed, predefined frequency, known as baud rate. Both the transmitter and receiver work on same bit frequency. After receiving the first bit, the receiver calculates the moments at which other data bits arrive. Voltage levels at those instances are checked by receiver [10], [12], [13].

- *Relay*

Solid state contactor relay is a solid state contactor is a very heavy-duty solid state relay, including the necessary heat sink, used for switching electric heaters, small electric motors and lighting loads; where frequent on/off cycles are required. There are no moving parts to wear out and there is no contact bounce due to vibration. They are activated by AC control signals or DC control signals, like; from Programmable logic controller (PLCs), PCs, Transistor-transistor logic (TTL) sources, or other microprocessor controls [12].

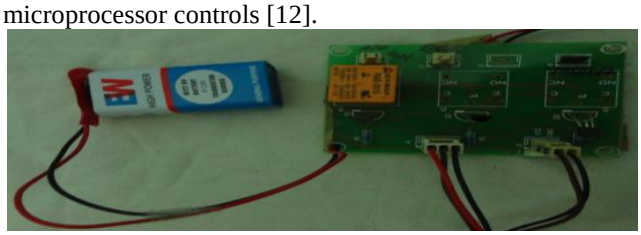

Fig.4. Relay

- *LCD*

Liquid Crystal Display also called as LCD is very helpful in providing user interface as well as for debugging purpose. A liquid crystal display (LCD) is a flat panel display that uses the light modulating properties of liquid crystals (LCs). LCD Modules can present textual information to user [12], [13].

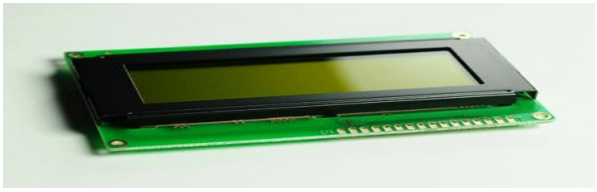

Fig.5. LCD

III. Interfacing Work and Circuit Descriptions

Interfacing ZigBee module with LPC2148 board for used for controlling application through UART0. The data communication is done in by using the ZigBee module through MAX232 IC into the SBUF register of LPC2148 microcontroller (refer serial interfacing with LPC2148). The serial data from the Zigbee receiver is taken by using the Serial Interrupt of the controller. +5V and ground is connected to provide power to the module. While TX and RX pin is connected for communication [13]. Interfacing LCD module with LPC2148 In 4-bit mode the data is sent in nibbles, first we send the higher nibble and then the lower nibble. To enable the 4-bit mode of LCD, we need to follow special sequence of initialization that tells the LCD controller that user has selected 4-bit mode of operation [12]. The sensors interface is very simple; sensors are connected to the I2C interface. Note that the jumpers on J25 (see reset and I2C-E2PROM part) must be mounted to connect the I2C interface with the LPC2148. The addresses of the sensors are 0X90 [13]. Interface the Relay to microcontroller. There are 2 input channels. Each input is connected to the triggering coil of the respective relay. There are 2 output channels that each correspond to an input. When the input is activated, the relay turns on and the '+' output is connected to +5v. When the relay is off, the '+' output is connected to Ground. The '-' output is permanently wired to Ground [12]. Interface the Buzzer to microcontroller. A piezoelectric element may be driven by an oscillating electronic circuit or other audio signal source, driven with a piezoelectric audio amplifier. Sounds commonly used to indicate that a button has been pressed are a click, a ring or a beep. When the input port pin from microcontroller is changed, the sound wave is changed in Buzzer [12]. When communicating with various micro processors one needs to convert the RS232 levels down to lower levels, typically 3.3 or 5.0 Volts. Here is a cheap and simple way to do that. Serial RS-232 (V.24) communication works with voltages -15V to +15V for high and low. On the other hand, TTL logic operates between 0V and +5V. Modern low power consumption logic operates in the range of 0V and +3.3V or even lower. Thus the RS-232 signal levels are far too high TTL electronics, and the negative RS-232 voltage for high can't be handled at all by computer logic. To receive serial data from an RS-232 interface the voltage has to be reduced. Also the low and high voltage level has to be inverted. This level converter uses a Max232 and five capacitors. The max232 is quite cheap (less than 5 dollars) or if you're lucky you can get a free sample from Maxim. The MAX232 from Maxim

International Journal of Electronics Communication and Computer Engineering
Volume 4, Issue 2, ISSN (Online): 2249–071X, ISSN (Print): 2278–4209

was the first IC which in one package contains the necessary drivers and receivers to adapt the RS-232 signal voltage levels to TTL logic. It became popular, because it just needs one voltage (+5V or +3.3V) and generates the necessary RS-232 voltage levels. Rs232 is 9 pin db connector, only three pins of these are used i.e. 2, 3, 5. The transmit pin (pin 3) of Rs232 is connected to pin 13 of MAX232 and receive pin (pin 2) is connected to pin 14 of MAX232, but pin 5 is connected to ground. MAX232 is connected to the microcontroller as shown in the figure above 11, 12 pin are connected to the 10 and 11 pin i.e. transmit and receive pin of microcontroller or to zegbee [13].

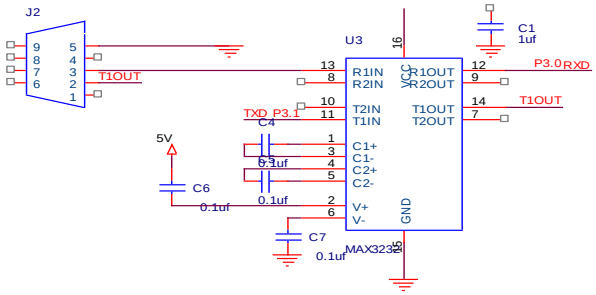

Fig.6. RS232 Interfaced to Max 232

IV. Circuit Description and Working or System Design Target

Whole model is divided into two parts: ZigBee control module and a server module. The first part of our own model is ZigBee control module which is connected to the ARM7 processor. Where ZigBee control module consists of three circuits as input respectively an fire circuit which is connected to the processor, it becomes active when it senses in a near fire at his position as well as temperature circuit is connected to the processor, which becomes active when it senses at every step of room hotness. Also, an LDR circuit is connected to the processor, which becomes active when a strong light falls on it. Furthermore ZigBee control module consists of three circuits as output respectively (devices and relay) circuit which fan symbolize to device1 and bulb symbolize to device2 where these two device used as a load , where both device1 and device2 (fan, bulb) are connected to processor through the relay where the relay has efficiency control on two devices by latching and open its coil according to processor signal .LCD circuit is connected to the processor directly which used to appear the output detail as a short texts sequentially for every input circuits and the main advantage for LCD in ZigBee control module circuit for let to any worker to see and check the output situations in a remote room without going to control room. Anyway the last circuit in ZigBee control module is alarm (buzzer) circuit which is connected to processor to give alarm just when the fire sensor has been activated it would give alarm voice for 15 second to warn all the people over there. Moreover ZigBee control module has a Zegbee module for transfer and it has power supply to feed on ARM7 processor and Zegbee module. The second part of our model, our own design is Server module, which consists of MAX 232, serial port as well as ZEGBEE module. The server module (desktop, laptop) is connected to a ZigBee module through an Rs232 to serial cable. First part of this project is to start the communication; server module sends the on/off control signals for the loads. As there are both bulb and fan used as load, signal specific for each device is sent. This signal is transferred to the ZigBee module connected to the server. This ZigBee acts as a transmitter at this case now, and sends the data to the other ZigBee module, that is connected to the processor. This ZigBee acts as a receiver and receives the data. It transfers the data to the processor, which, in turn gives the signals to the relays for the on or off of a particular device. These two devices react according to the signal received. We gave programming for control signal of these two devices, where pressing 1 on laptop or desktop keyboard fan off, whereas pressing 2 for fan on, pressing 3 bulb off and pressing 4 bulb on. Second part of this project is acquisition data or the supervision rather. LDR detects the light falling on it and temperature sensor discovers the surrounding heating that nearer to it and fire sensor find out the flame or smoke that around to it. where we give a programming to LDR and temperature sensor to calculate or sense the state by three steps, it is low, normal and high as well as giving programming to fire sensor to sense the state by two steps, it is dictated and not dictated then they send the signal to the microprocessor as pulses depending on device steps. The processor calculates treatments by counting the pulse. It then changes the value from hex format to decimal form and the sends the value to server module. This time, the ZigBee connected to processor acts as a transmitter and the one connected to server module acts as receiver. The value is received by the server module and is displayed on the monitor as short texts. These values help us to keep a check on the total device situations and thus aids in devices conservation. The whole model is created to represent a home automation system. The advantage of this model is that it is a low power wireless system. Another advantage is that it is quite cheap because of the low cost of ZigBee. This model shows us the advantages of using a ZigBee module for automation purposes.
As shown in block diagram below:

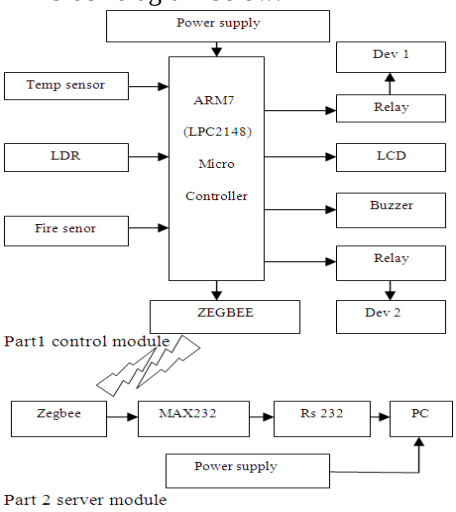

Fig.7. Block diagram

International Journal of Electronics Communication and Computer Engineering
Volume 4, Issue 2, ISSN (Online): 2249–071X, ISSN (Print): 2278–4209

V. Total Circuit Internal Working Explanation and Function of the System

This project consists of a microcontroller which is communicated through Zigbee technology through IC MAX232.The controller we are using is LPC2148 microcontroller which is used to transmit and receive the data. Temperature sensor is used to find the temperature, LDR is used to find the light intensity and fire sensor is used to find out the smoke in atmosphere. All these sensors are connected to micro controller. The controller takes the data from these sensors and transmits through Zigbee Transmitter. The input devices are sensors which are interfaced to the controller through ADC. Where; the microcontroller acquires analog data from these sensors and converts it into digital format. The ADC here we are using is a 10-bit ADC. This controller contains two ADC's totally it can support 14 analog inputs. The maximum converted output can be 10-bit data. This ADC has independent clock frequency generator so this frequency can be generated by a formula as shown below.

CLKDIV = (PCLK/Adclk) – 1

The clock frequency required for ADC is 4.5MHZ frequency it takes 11clocks to convert analog value to 10-bit digital value. The time taken for conversion is 2.44usecs.

1. A/D control register is used select which channel sensor conversion to be taken place by using SEL bits, frequency required for A/D conversion is loaded in CLKDIV, number of bits required for conversion is done by selecting CLKS bit, to start conversion of analog data to digital data can be done by selecting START bits by placing 001 value at that bits.
2. To check for conversion completed or not this can be done by checking DONE bit in A/D data register. When DONE bit is one the result of binary converted data will be placed in RESULT which is of 10-bits size.
3. Based on converted analog sensor connected to channel corresponding DONE bit will activated in A/D status register. Like this each and every sensor converted data will be placed in their corresponding channel data register and hence converted data is send to controller.

The digital data is transferred to the wireless Zegbee modem, which modulates digital data to wireless signal and transmits it. At the receiver side the transmitted wireless data is received by Zigbee receiver. The receiver gives the data to PC through Max232. The voltage levels of micro controller and PC are different. To produce compatibility between controller and PC Max232 IC is used. MAX-232 is an IC which is used to convert the logic level generated by controller into required voltages. So the information is from wireless zegbee modem is first transferred to MAX-232 and then to PC through the serial port. From PC devices are controlled by sending data through zigbee. Other side zigbee receives data and checks for received message based on message it receives it automatically turns on/off devices through relay so that the starting and control of the bulb and fan connected to the microcontroller port is controlled from PC remotely.

VI. Software Development of the System

Microcontrollers can be programmed using the assembly language (or) using the high – level language such as C, BASIC. In our own present system, the software is developed in Embedded 'C' using Micro vision Keil (IDE). The IDE allows the user to built projects; add source code files to the projects, set compiler options for the projects, compile projects into executable program files. The executable files are then loaded into the target microcontroller by using flash magic. The compiler uses preprocessor commands and a data base of microcontroller information to guide the generation of the software associated with on–chip peripherals.... [11].

VII. Results and Discussion

In the present existing method manual presence must be there to monitor the sensed data at place. To monitor every time we need to go there and note down the readings which is a time taking process. This is the main disadvantage of this method, furthermore, As usual; we are using TV remote to control the devices inside industrial places or in homes which can control the devices in the line of sight only as well as it also consume more power like using batteries. Moreover industrial places will not present in a small area it covers very vast area so it very difficult to take remote control device to each and every place to control the devices, as well as the essential problems in all industrial places which oblige the worker to use on one TV remote control for one device only . The proposed method is Data Acquisition Systems, as the name implies, it is products and/or processes used to collect information to document (or) to analyze some phenomenon. The purpose of the data acquisition system is generally the analysis of the sensed and measured data at the remote location in the industry and process it and transmitting to the control room consisting of PC. We can overcome the disadvantage of the existing method by the concept controlling the devices remotely using PC and Zigbee wireless communication. We can also control the entire devices in industry like Refrigerators, Funs, motors, machines and AC etc by sitting in front of the PC. Input will be given from the PC. We can also control Power Supply and appliances within the all the rooms in a building using this technique. We can also extend this concept for controlling the power supply for the devices at the remote locations in industrial places or in homes. The system uses a compact circuitry built around LPC2148 (ARM7) Programs are developed in Embedded C. Flash magic software is used for loading or damping programs into Microcontroller and Keil software is used for checking the code or debugging as well as converting the code to hex decimal for damping code into main microcontroller. This project "Microcontroller Based Wireless Data Acquisition system" is designed to monitor and control the devices through wireless technology, which are located at remote areas where it is difficult for the user to go and take the data. Also the added advantage in using wireless technology is, it reduces a lot of

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connections, also eliminates chance of electrical noise. Apart from various general microcontrollers available in the market, this project is implemented with ARM7 (LPC2148) because it has various on – chip peripherals as well as consumes less power. Because of the on – chip peripherals, additional circuitry required will be reduced to a greater extent. The present project acquires data only from three different physical devices; it can be extended for various other devices also. This project is implemented with zegbee technique; the same design cannot be implemented with IR, Bluetooth, etc….. Latest wireless technologies are somewhat limited in bandwidth and range which sometimes offsets its inherent benefits. Once the application code is downloaded into the flash program memory of the ARM7 (LPC2148) using device programmer of Micro vision Keil (IDE) firstly and flash magic software as well then the system works independent of PC. It monitors the temperature, fire status and light intensity in remote fields continuously, and then sends the temperature, fire status and light intensity data to the Hyper Terminal window of PC using wireless Zegbee Communication. The temperature, fire status and light intensity data is displayed on PC as shown in Figure below.

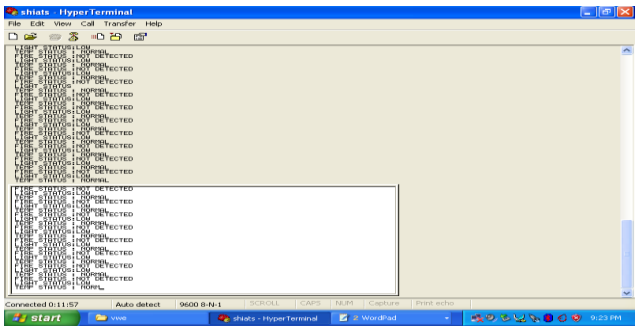

Fig.8. Hyper Terminal (Result Window)

Appropriate control signals for these operations are sent to the target system from PC through wireless zegbee Communication also since it is bidirectional. Where any user wants to activate output devices control signal, he should hyper terminal properties and activate ASCII setup (Echo typed characters locally) as shown in Figure below

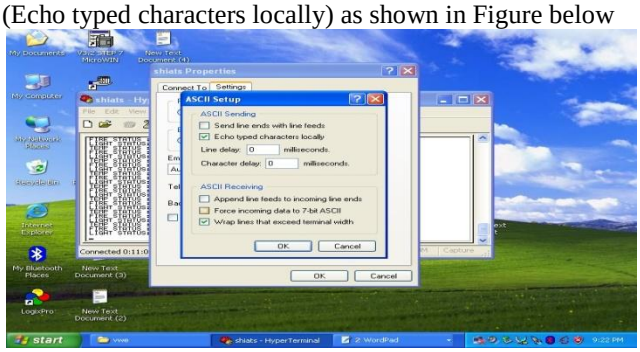

Fig.9. PC's Hyper Terminal (ASCLL Setup)

Output devices control such as starting of fan and stopping fan or staring of bulb and stopping of bulb can be achieved from PC in Interrupt mode, but the last output device buzzer will work for 15 seconds properly directly when the fire sensor have any instruction for the fire . This is done by any user when press 1, 2, 3 and 4 on keyboard of the PC no more it like; When you press 2 on keyboard of the PC, the fan will start working and it also displays on hyper terminal of the PC as shown in Figure below

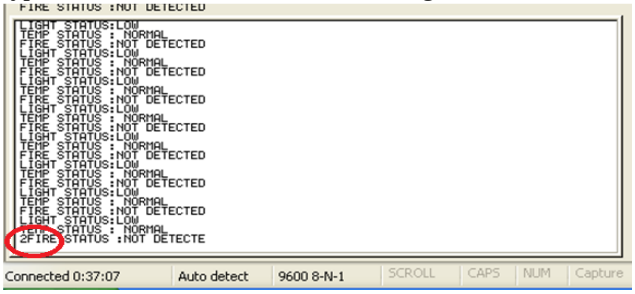

Fig.10. PC's Hyper Terminal (insert command 2)

When you press 1 on keyboard of the PC, the fan will stop working and it also displays on hyper terminal of the PC as shown in Figure below

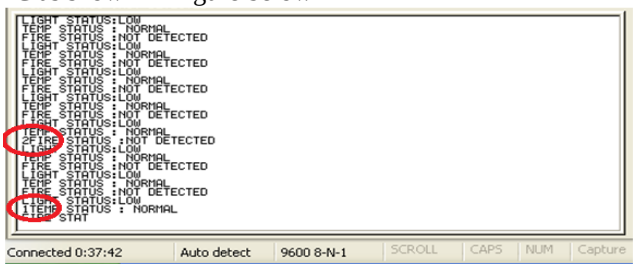

Fig.11. Hyper Terminal (insert command 1)

When you press 4 on keyboard of the PC, the bulb will stop working and it also displays on hyper terminal of the PC as shown in Figure below

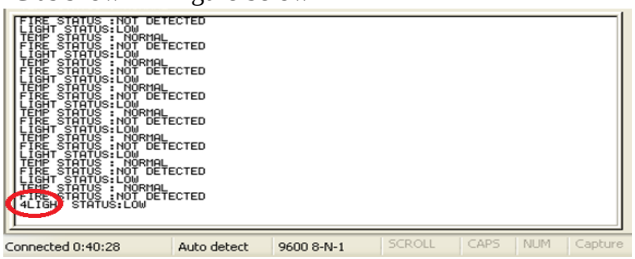

Fig.12. PC's Hyper Terminal (insert command 4)

When you press 3 on keyboard of the PC, the bulb will stop working and it also displays on hyper terminal of the PC as shown in Figure below

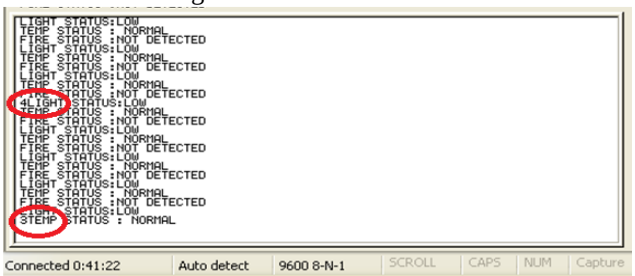

Fig.13. PC's Hyper Terminal (insert command 3)

Another advantage for our own system is saving the previous sent data and sent commands on other words, the user can use the saving time in hyper terminal of PC inquire about previous situations and the user can regard this benefit as a sheet statistical as shown in Figure below.

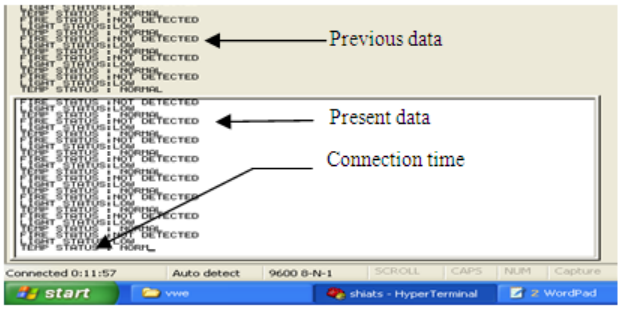

Fig.14. PC's Hyper Terminal (connection time)

Tests of this project were run on wireless communication in a radius of one hundred meters, using the Zegbee antenna pattern that came with the transceivers and control devices has been carried out According to what has been proposed. According to the manufacturer, is possible with the use of external antennas, positioned at two meters from the ground and in an open field, industrial , commercial , home , Depending on the user's needs, it will choose the appropriate transmitter for increasing the radius of wireless communication. Demonstrations of our own design communication until one hundred meters approximately are succeeded sufficiently. Finally the main advantages used to reduce the energy wastage, low cost, easy to design and to use.

VIII. Conclusion

The most important conclusion to be drawn from the project is the potential power saving it offers over several other existing technologies for home automation. The use of ZigBee technology reduces the power consumption, thus increasing the life of batteries to almost one year, as compared to some of the other technologies, that lasts for just few days or months. Also, it reduces the total cost of implementation of automation, as the cost of ZigBee is far less than that of other technologies. For purposes of prototype was made a small application fully functional only for demonstration ability and capability and ease of implementation of the project throughout its extension. This project makes people sit and realize the enormous potential of home automation system. It presents to the world, a huge range of possibilities that can be exploited to make our life as comfortable as possible, and with minimum efforts. One can control the on/off of all the lights, fans and refrigerators etc in whole house, while sitting in at any place. Apart from making our homes more comfortable, home automation also provides us a way to monitor the power situations for remote devices by reminders or short texts that has been appeared on widow of a PC. It shows every situation for all remote sensors as soon as you sit in your own office and it allows us to keep track of power for each hour, each day, each month or year. This helps people in making wise decisions about the power utilization. It is a huge thing, as reducing power consumption is on everyone's agenda. While working on the Master's project, I got the opportunity to learn and work on various new things which I was not able to do before. It helped me to broaden my skill set. I learned the embedded C programming language used to code the processor. I also got a chance to work on real hardware, to design one according to the block diagram. Finally the project "Design Remote Power Control I/O Data Acquisition System and Control on Home Automation" has been successfully designed and tested. It has been developed by integrating features of all the hardware components used. Presence of every module has been reasoned out and placed carefully thus contributing to the best working of the unit. Secondly, using highly advanced IC's and with the help of growing technology the project has been successfully implemented.

Acknowledgment

I would take this opportunity to convey my sincere thanks to all of you as well as Iwould like to thank Dr. A. K. Bharadwaj Professor and Head department of electrical and electronic engineering who is my first reader. i would also like to thank Er. Surya Prakash graduate coordinator, for his valuable suggestions and support throughout the span of the project. though he is very busy, he agreed to be my second reader and gave me valuable suggestions for report writing.

References

[1] ZigBee Alliance, *"ZigBee™ Vision for the Home"*, November 2006, pp. 1-6.

[2] Ying-Wen Bai and Chi-huang Hung, *"Remote Power On/Off Control and Current Measurement for Home Electric Outlets based on a Low-Power Embedded Board and Zigbee Communication"*, IEEE International Symposium on Consumer Electronics, 2008, pp. 1.

[3] Riaz Ahamed, *"The Role of ZigBee Technology in Future Data Communication System"*, 2005, pp. 129-135.

[4] John Kooker, "*Bluetooth, ZigBee, and Wibree: A Comparison of WPAN Technologies*", November 20, 2008, pp. 1-3..

[5] Atmel Corporation, *"IEEE 802.15.4 MAC*", User guide, November 2006, pp.6-18.

[6] LAN-MAN Standards Committee of the IEEE Computer Society, "*Wireless Medium Access Control (MAC) and Physical Layer (PHY) Specifications for Low-Rate Wireless Personal Area Networks (LR-WPANs)"*, IEEE, 2003, CH. 4.

[7] Dusan Stevanovic, *"Zigbee / IEEE 802.15.4 Standard*", June 2007, pp. 3-48

[8] ZigBee Alliance, *"ZigBee Wireless Sensor Applications for Health, Wellness and Fitness"*, March 2009, pp. 4-11.

[9] ZigBee Alliance, *"ZigBee Enables Smart Buildings of the Future Today*", April 2007, pp. 2-6.

[10] Atmel Corporation, *"8-bit Microcontroller with 8K Bytes Flash – AT89C52*", April 1999. pp. 5-14

[11] S.K.Sivastava, and Deepali Sivastava " *C in Depth"* University of Delhi, Indian, second edition, 2011, pp. 1-504.

[12] Muhammad Ali Mazidi , Janice Gillispie Mazidi and Rolin D. Mckinlay , " *The 8051 microcontroller and embedded systems using assembly and C"* , united state , second edition , persons , 2012 , pp. 29-441.

[13] Datasheets and the user manuals of LPC2148, pp. 1-37.

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