International Journal of Engineering Research and Science & Technology

ISSN : 2319-5991
Vol. 1, No. 1
March 2015

National Conference on "Recent Prends in Communication & Information Technologies"NCRTCIT 2015

Organized by

Dept. of ECE, Indra Ganesan College of Engg., Trichy, Tamil Nadu, India.

www.ijerst.com

Email: editorijerst@gmail.com or editor@ijerst.com

Int. J. Engg. Res. & Sci. & Tech. 2015

International Journal of Engineering Research and Science & Technology

ISSN 2319-5991 www.ijerst.com
Special Issue, Vol. 1, No. 1, March 2015
National Conference on "Recent Prends in Communication & Information Technologies" NCRTCIT 2015

Research Paper

PATIENT HEALTH MONITORING SYSTEM BASED ON ZIGBEE

S Hemalatha[1]*, C P Geetha Priya[1] and S Sivapriya[1]

*Corresponding Author: S Hemalatha ✉ latha08hema@gmail.com

With the growing number of aging population and a significant portion of that suffering from diseases, it is necessary to remote the patient monitoring systems are expected to be widely used as Point-of-Care (PoC) applications in hospitals around the world. Therefore, amount of signal collected by Body Sensor Networks (BSNs) from patients will be transmitted to microcontroller.The basic parameters measured from the patients are blood pressure,heart beat,temperature,humidity. These are some of the necessary paramaters for any patients to diagnoise. It is utterly important that patient confidentiality is protected while data is being transmitted over the public network as well as when they are stored in hospital servers used by remote monitoring systems. In this paper, wireless technology used is ZIGBEE.By using this zigbee based technology the patient confidential information are send to the doctor's pc.In case of any emergency an alarm sound is produced so that the responsible person can treat the patients in case of an emergency.

Keywords: Body sensor network,Zigbee wireless technology,Microcontroller.

INTRODUCTION

The number of elderly patients is increasing dramatically due to the recent medical advancements. Accordingly, to reduce the medical labor cost, the use of remote healthcare monitoring systems and Point-of-Care (PoC) technologies have become popular. Moreover, Point-of-Care solutions can provide more reliability in emergency services as patient medical information(ex. for diagnosis)can be sent immediately to doctors and response or appropriate action can be taken without delay.one of the simple and economic technique uesd for this purpose is ZIGBEE. ZigBee is IEEE 802.15.4 – 2003 Wireless Personal Area Networks standard for wireless data transmission just like Wi-Fi and Bluetooth. The entire device (wireless device) is function to move the desired data to the next carrier in the communications path until the data is delivered to the target end-point.

In this a sensor is placed on patient waist,it contains all the four types of sensor together.It senses the necessary signal from the patient body.Then the output is given to the

[1] Indra Ganesan College of Engineering, Manikandam, Trichy-620012.

microcontroller,the microcontroller used here is PIC16F877A.The microcontroller done the necessary operation and send all the relevant details through zigbee.In order to operate the zigbee it should turn on both transmitter and receiver.Now by means of wireless techique all the patient confidential information is send through zigbee and it is displayed on the doctors pc.Suppose incase of any emergency and alaram is placed on the floor,so that the patient can be immediately diagonised.In this the patient result is maintained as confidential one because it is directly dispalyed on doctors pc alone and hence the doctors and other authorised person alone should see the patients reports.simillarly patient can also diagonised earlierly and the cost of diagonosis is also low.

BLOCK DIAGRAM

The block diagram involves both transmitter and receiver circuit.

Figure 1:Transmitter Circuit

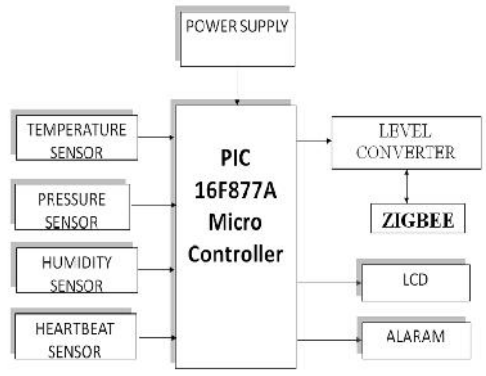
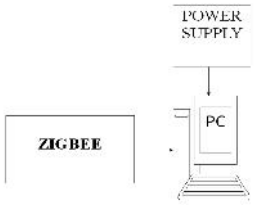


Figure 2:Receiver Circuit



The transmitter circuit consists of sensors, microcontroller, level convertor, zigbee, and alaram.

There are four types of sensors used in this circuit.The temperature sensor are used to sense the temperature of the patients.The normal temperarure of human is 37c.Here the temperature sensor used is LM35.LM35 is a precision ic temperature sensors with its output propotional to temperature.the sensor circuitary is sealed so that it is not subjected to oxidation and any other process.With LM35 the temperature can measure more accurately than thermistor.It is also possess low self heating and doesnot cause more than 0.1c temperature raise in air.The operating range is from-55c to 150c

Heart rate is the number of heartbeats per unit of time and is usually expressed in beats per minute (bpm). In adults, a normal heart beats about 60 to 100 times a minute during resting condition. The resting heart rate is directly related to the health and fitness of a person and hence is important to know. You can measure heart rate at any spot on the body where you can feel a pulse with your fingers. The most common places are wrist and neck. You can count the number of pulses within a certain interval (say 15 sec), and easily determine the heart rate in bpm.

The Heart Beat Sensor provides a simple way to study the heart's function. This sensor monitors the flow of blood through Finger. As the heart forces blood through the blood vessels in the Finger, the amount of blood in the Finger changes with time. The sensor shines a light lobe (small High Bright LED) through the ear and measures the light that is transmitted to LDR. The signal is amplified, inverted and filtered, in the Circuit

Heart rate ear clip kit contain a ear clip and a receiver module. The heart rate measure kit can be used to monitor heart rate of patient and athlete. The result can be displayed on a screen via the serial port and can be saved for analysis. The entire system has a high sensitivity, low power consumption and is very portable.

Humidity is the presence of water in air. The amount of water vapor in air can affect human comfort as well as many manufacturing processes in industries. The presence of water vapor also influences various physical, chemical, and biological

Processess.hence it is necessary to monitor the humidity of the patients. This humidity can be measured by means of humidity sensors. Temperature of the patients is also measured by means of temperature sensors.

PIC16F877A-I/P Microcontroller, 40 DIP, 20 MHz

High-Performance, Enhanced PIC Flash Microcontroller in 40-pin PDIP

The PIC16F877A CMOS FLASH-based 8-bit microcontroller is upward compatible with the PIC16C5x, PIC12Cxxx and PIC16C7x devices. It features 200 ns instruction execution, 256 bytes of EEPROM data memory, self programming, an ICD, 2 Comparators, 8 channels of 10-bit Analog-to-Digital (A/D) converter, 2 capture/compare/ PWM functions, a synchronous serial port that can be configured as either 3-wire SPI or 2-wire I2C bus, a USART, and a Parallel Slave Port.

Microchip PIC16F877A Microcontroller Features

High-Performance RISC CPU

- Lead-free; RoHS-compliant
- Operating speed: 20 MHz, 200 ns instruction cycle
- Operating voltage: 4.0-5.5V
- Industrial temperature range (-40° to +85°C)
- 15 Interrupt Sources
- 35 single-word instructions
- All single-cycle instructions except for program branches (two-cycle)

Special Microcontroller Features

- Flash Memory: 14.3 Kbytes (8192 words)
- Data SRAM: 368 bytes
- Data EEPROM: 256 bytes
- Self-reprogrammable under software control
- In-Circuit Serial Programming via two pins (5V)
- Watchdog Timer with on-chip RC oscillator
- Programmable code protection
- Power-saving Sleep mode
- Selectable oscillator options
- In-Circuit Debug via two pins

Peripheral Features

- 33 I/O pins; 5 I/O ports
- Timer0: 8-bit timer/counter with 8-bit prescaler
- Timer1: 16-bit timer/counter with prescaler
  - Can be incremented during Sleep via external crystal/clock
- Timer2: 8-bit timer/counter with 8-bit period register, prescaler and postscaler
- Two Capture, Compare, PWM modules
  - 16-bit Capture input; max resolution 12.5 ns
  - 16-bit Compare; max resolution 200 ns
  - 10-bit PWM

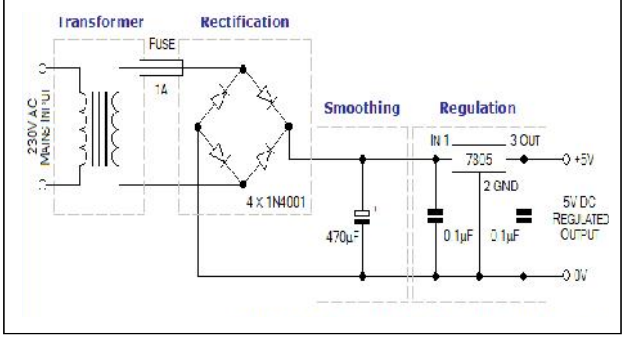
- Synchronous Serial Port with two modes:
  - SPI Master
  - I2C Master and Slave
- USART/SCI with 9-bit address detection
- Parallel Slave Port (PSP)
  - 8 bits wide with external RD, WR and CS controls
- Brown-out detection circuitry for Brown-Out Reset

Analog Features

- 10-bit, 8-channel A/D Converter
- Brown-Out Reset
- Analog Comparator module
  - 2 analog comparators
  - Programmable on-chip voltage reference module.

The power supply are used to provide nessary voltage to the sensors and microcontrollers.It provide constant voltage of 12v to all the components. It contains stepdown transformer, rectifier, capacitors and voltage regulators.The voltage regulators only allocates or regulates the necessary voltage to the corresponding equipments.

Figure 4: A Simple 5V DC Regulated Power System



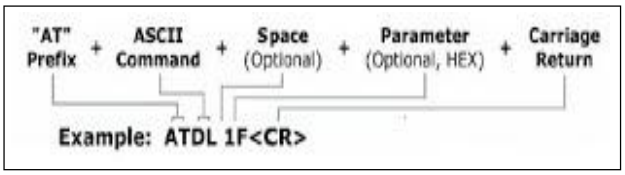
In this the stepdown transformer are used to step down the required voltage then the rectification process is done.the output of rectification process is dc voltage and it is nw given to the voltage regulator for regulating purpose.

ZigBee is a standard for wireless data transmission just like Wi-Fi and Bluetooth. The entire device (wireless device) is function to move the desired data to the next carrier in the communications path until the data is delivered to the target end-point.MaxStream is a well-known manufacturer of components for wireless communication. ZigBee is one of the MaxStream products. There are two versions of ZigBee that are available from MaxStream which are XBee and XBee PRO. Both versions are functionally identical and pin compatible. The only difference is the transmit power, which is 1mW maximum for XBee and 63mW maximum for XBee PRO. ZigBee's mission is to cut the traditional wires between sensors, wired slaves devices, and the microcontrollers and microprocessors they serve.

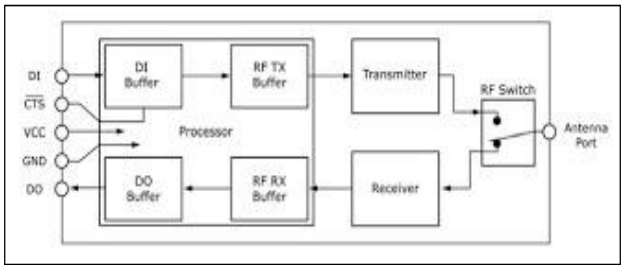
ZigBee is available in three difference antenna: Integrated into the chip. In this case the radiated energy is practically non-directional

With an antenna connector for attaching an external antenna.

With an integrated vertical (whip) antenna. ZigBee can be interfaced quite easily via a standard serial port, such is commonly found in the microcontrollers (UART) or the COM port of a PC (RS232), at maximum rate baud of 115, 200. The XBee is powered from a 3.3v supply instead of 5v supply like most digital circuits.



The commands are actually just ASCII codes (character strings). You send commands to the XBee the same way as data, and there is a bit of software that tells the two apart. This works as follows. Before send a command, you have to put the XBee in the 'wait for command' state. To do so, you send it a string of three + characters (hex 2B), or literally '+++'. After this, the XBee expects to receive a command in Hayes format, which always starts with 'AT' (which stands for 'attention') in ASCII code, followed immediately by the actual command and any command parameters that may be necessary. The command string is terminated by a Carriage Return (CR) character. Figure above shows an example of all this. The XBee module executes the command and then reports whether the command was processed successfully. If everything went the way it should, the XBee returns 'OK', while otherwise you will receive an error string from the module.



A wireless link is always half-duplex. It can transmit or receive with a single antenna, but not both at the same time. However, your application can transmit and receive at the same time (full-duplex mode) via a serial link to the UART at your end of the interface. Data is presented to the XBee module through its DIN pin, and it must be in the asynchronous serial format, which consists of a start bit, 8 data bits, and a stop bit. Because the input data goes directly into the input of a UART within the XBee module, no bit inversions are necessary within the asynchronous serial data stream. All of the required timing and parity checking is automatically taken care of by the XBee's UART. This is made possible by two software buffers. The principle is revealed in figure above. As you would expect, the XBee module produces a received data asynchronous serial data stream for the host on its DOUT pin. So, all you need is a simple three wire (DIN, DOUT, and ground) serial connection to put ZigBee to work with the XBee and XBee-Pro modules.

There is a transmit buffer and a receive buffer, and each buffer provides a temporary parking place for 100 bytes. Data can arrive from both directions at the same time – the data to be transmitted coming from the UART, and the data received by the antenna from the RF link. When the antenna is receiving data, it cannot transmit data at the same time. For this reason, the data to be transmitted is parked in the transmit buffer for a while, and the received data is stacked up in the receive buffer.

As soon as the data stream from the RF end stops, the XBee module switches the antenna from receive to transmit and empties the transmit buffer by sending its content out on the ether. At the same time, the UART empties the receive buffer by sending the data in it to your application. An application with a large amount of data to send can easily overload the transmit buffer. MaxStream provides a 'full' alarm to deal with this problem. As soon as the application has filled all but the last 17 bytes of the transmit buffer (which means 83 bytes are waiting to be transmitted), pin 12 goes high to signal to the system that it has to stop filling the buffer for a while. Pin 12 goes low again after the content of the transmit buffer has been reduced to 66 bytes. This can be regarded as a sort of software hysteresis.

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on. A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data.The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD. Click to learn more about internal structure of a LCD.

OPERATION AND OUTPUTS

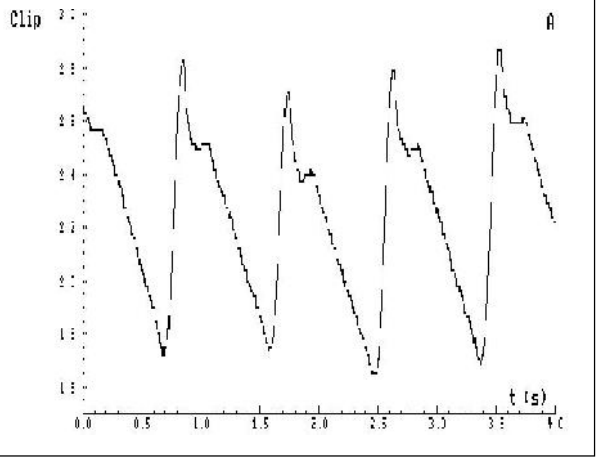
All the 4 sensors are designed together in the same sensor and it should be placed on the patient wrist.There must be wired connection between sensor and microcontroller.now the sensor senses the biological signal from the patient body,the sensed signal is given to the microcontroller for furthur processing.Generally the biological signal are analog signal,in microcontroller that is converted into digital form by analog to digital converter.after that processing of signal is done in microcontroller.Now the processed signal is ready it is send by means of zigbee.zigbee connection should be turn on,on both tramsmitter and receiver and side.So that the processed data is transmitted by means of zigbee.The receiver is doctors pc,all the important details of the patients are dispalyed on doctors pc.

This has an adavantage that the patient medical information is more confidental,because it is directly dispalyed on doctors pc and there is no way of doing any illegal activities.Hence it is advantageous.

In case any emergency,if the patient condition is not well,then immediate action will be taken to safeguard the patient.for that an alaram is provided on each floors doctors room as well as in nurse room. If any of the parameter like temperature, humidity, heart beat, blood flow is either too large or too small means the alaram sound is produced, in case the doctor is not available means the primary treatment is given by the nurse,then they informed about that to the doctor.similarly the lcd display is also placed on nurse room for constant viewing of patient health details.

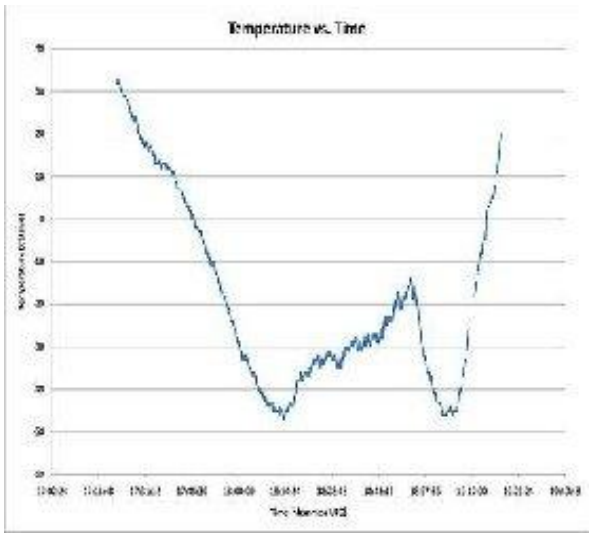
Figure 3 shows that the blood flowing through the Finger rises at the start of the heartbeat. This

Figure 3: A Sample Measurement Taken with the Heartbeat Sensor



is caused by the contraction of the ventricles forcing blood into the arteries. Soon after the first peak a second, smaller peak is observed. This is caused by the shutting of the heart valve, at the end of the active phase, which raises the pressure in the arteries and the earlobe.

Figure 4: Sample Measurement Taken with Temperature Sensors



CONCLUSION

In this paper we prposed a very simple and ecomic method of measuring the patient health parameters by means of zigbee based wireless technology.A simple and compact sensor is placed on patient and it senses and process the signal and nw by means of wireless technology it sends to the doctors pc.Here the patient confidental information is maintained securely and immediate action will be taken.

REFERENCES

1. Bonner R and Nossal R (1981), "Model for laser Doppler measurements ofblood flow in tissue", *Appl. Opt.*, Vol. 20, pp. 2097–2107.
2. Higurashi E, Sawada R and Ito T (2003), "An integrated laser blood flowmeter", *J. Lightw. Technol.*, Vol. 21, pp. 591–595.
3. Hu F, Jiang M, Wagner M and Dong D (2007), "Privacy-preserving telecardiology sensor networks: toward a low-cost portable wireless hardware/software codesign", *IEEE Transactions on Information Technologyin Biomedicine,* Vol. 11, No. 6, pp. 619–627.
4. Ibaida A, Khalil I and Sufi F (2010), "Cardiac abnormalities detection fromcompressed ECG in wireless telemonitoring using principal componentsanalysis (PCA)", in *5th International Conference on Intelligent Sensors,Sensor Networks and Information Processing (ISSNIP), 2009*, IEEE, 2010, pp. 207–212.
5. Itao K (2007), "Wearable sensor network connecting artifacts, nature and human being", in *Proc. IEEE Sensors Conf.*, Atlanta, USA, pp. 1120–1123.
6. Kimura Y, Goma M, Onoe A, Higurashi E and Sawada R (2008), "Integratedlaser Doppler blood flowmeter designed to enable wafar-level packaging", *IEEE Trans. Biomed. Eng.*, Vol. 57, No. 8, pp. 2026–2033.
7. Kimura Y, Onoe A, Higurashi E and Sawada R (2010), "Low-power consumption integrated laser Doppler blood flowmeter with a built-in siliconmicrolens", in *Proc. Int. Conf. Opt. MEMS Nanophoton.*, Freiburg, Germany, August, pp. 13–14.
8. Lee W and Lee C (2008), "A cryptographic key management solution forhipaa privacy/ security regulations", *IEEE Transactions on*

Information Technology in Biomedicine, Vol. 12, No. 1, pp. 34–41.

9. Lin Y, Jan I, Ko P, Chen Y, Wong J and Jan G (2004), "A wirelessPDA-based physiological monitoring system for patient transport", *IEEE Transactions on information technology in biomedicine*, Vol. 8, No. 4, pp. 439–447.
10. Lopez G, Shuzo M and Yamada I (2011), "New healthcare society supported by wearable sensors and information mappling based services", *Int. J. Netw. Virtual Org.*, Vol. 9, pp. 233–247.
11. Lymberis A (2007), "Advanced wearable health systems and applications—Research and development efforts in the European union", *IEEE Eng. Med. Biol. Mag.*, Vol. 26, No. 3, pp. 29–33.
12. Serov A N, Nieland J, Oosterbaan S, deMul F F M, van Kranenburg H, H H P Th. Bekman and Steenbergen W (2006), "Integrated optoelectronic-probe including a vertical cavity surface emitting laser for laser Dopplerperfusion monitorin", *IEEE Trans. Biomed. Eng.*, Vol. 53, No. 10, pp. 2067–2074.

International Journal of Engineering Research and Science & Technology
Hyderabad, INDIA. Ph: +91-09441351700, 09059645577
E-mail: editorijlerst@gmail.com or editor@ijerst.com
Website: www.ijerst.com