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The Real Time Wireless Sensor Network for Heart Beat Monitoring using Zigbee Module

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Abstract - In this system using the features and technology of wireless sensor networks such as distributed and self-organization to build Heartbeat monitoring system, which can monitor the Heartbeat of human in real time. This system applies RF communication protocol and uses the 2.4 GHZ Zigbee as RF transceiver. It has the characteristics of low power consumption, low cost, flexible structure and accurate measurement, and it can achieve the long- distance Heartbeat monitoring of human in real time. The wireless Heartbeat sensor node senses and transmits the variations in the human Heartbeat to the central computing unit within the range. The central computing unit receives the data and stores it in the file and plotting the variations simultaneously. The results are displayed in matlab. The system achieve heartbeat within the distance of 100 meters approximately and are successful to remove all wired logic for monitoring. this paper proposes a solution to upgrade existing health monitoring systems in hospitals by providing remote monitoring capability.

Keywords - wsn, microcontroller, atmega, zigbee, biomedical, sensor node, MATLAB.

1. INTRODUCTION

This system is designed for using biomedical areas. In this system we use HEARTBEAT SENSOR to measure heartbeat. This system is totally depends on WSN (wireless sensor network). In this network we are displaying the transmitted data in the central computing. We also use some others sensors instead of heartbeat sensor (eg: Statroscope, ekg). Wireless Sensor Networks are found to be useful when we talk about the surveillance. It may be surveillance for military application, home appliances, seismic applications, monitoring the wild life, structures monitoring, environment monitoring etc. The advantage of wireless sensor network is that we can use them with ease in the environment where wired system cannot be used or if used we have to be very cautious for example in medical treatment. The sensor nodes can also be deployed to monitor patients and assist disabled .Some other commercial applications Include managing inventory, monitoring the product quality, and monitoring disaster areas. The Wireless sensor network is a new research field. It can be used in some special situation for signal collection, processing and transmitting. Zigbee is a new Wireless sensor network technology characteristic of less distance and low speed. It is a new wireless network protocol stack of IEEE 802.15.4.Zig Bee-style networks began to be conceived about 1998, when many installers realized that both Wi-Fi and Bluetooth were going to be unsuitable for many applications. In particular, many engineers saw a need for self-organizing ad-hoc digital radio networks. In this paper section I, describes the introduction , section II, a proposed work ,section-III gives Hardware used, section IV the softwares used and finally the paper is concluded with conclusions and future work in section V.

2. PROPOSED WORK

In transmitter circuit the Heat Beat is measured by LED and LDR, then it is applied to the microcontroller. The Microcontroller maintains the records of the measured readings. It compares the measured heart beat with the normal readings and checks it is with in the normal range or not. If it is normal, then it keeps record of the same and there readings in SMS (Short Messaging Service) form to the specified mobile number. The time specified for sending message is given by the user Develop a remote heart beat monitoring system using wireless technology . Currently most hospitals use ECG (Electrocardiography) for monitoring heart rate but do not have remote monitoring system. This paper proposes a solution to upgrade existing health monitoring systems in hospitals by providing remote monitoring capability.

To interface the heart beat sensor with ATmega 32 microcontroller is used. ATMega 32 is a AVR core 8 bit microcontroller. This microcontroller is working on 16MHz crystal oscillator frequency. This controller works on 5V DC.. We use biomedical sensor in this paper. In wireless sensors network ,Power management is the main point for any system, & with the help of this system we manage our system power, & for other modules external power for eg. We use 9volt external battery for heartbeat monitoring system.

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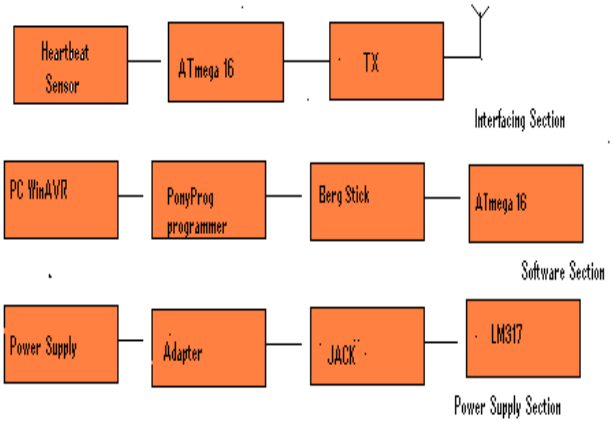

Fig. 2 Block diagram of transmitter section

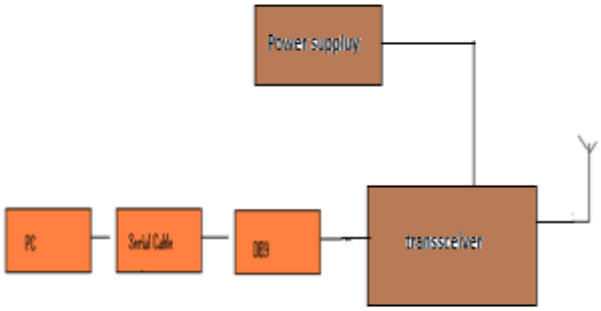

Fig. 3 Block diagram of receiving section

3. HARDWARE IMPLEMENTATIONS

A. HEART BEAT SENSOR

This block is used to sense the heart beat with the help of an LED and an LDR. A continuous light from the LED should fall on the LDR and the finger of the patient is to be placed in between the LED and LDR. Heart beat sensor is designed to give digital output of heat beat when a finger is placed on it. When the heart beat detector is working, the beat LED flashes in unison with each heart beat. This digital output can be connected to microcontroller directly to measure the Beats Per Minute (BPM) rate. It works on the principle of light modulation by blood flow through finger at each pulse.

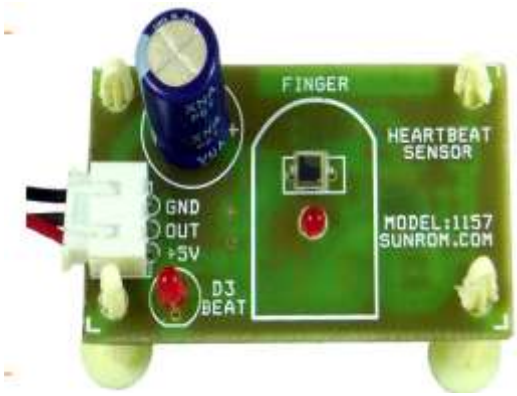

Fig. 4 View of heart beat sensor

Fig 5. Using heart beat sensor

Features of heart beat sensor

Heat beat indication by LED Instant output digital signal for directly connecting to microcontroller,compact size,works on +5v dc supply ,Connect regulated DC power supply of 5 Volts. Black wire is Ground, Next middle wire is Brown which is output and Red wire is positive supply. These wires are also marked on PCB .to test sensor we only need power the sensor by connect two wires +5V and GND. we can leave the output wire as it is. When Beat LED is off the output is at 0V.Put finger on the marked position, and we can view the beat LED blinking on each heartbeat.The output is active high for each beat and can be given directly to microcontroller for Interfacing applications.

The sensor consists of a super bright red LED and light detector. The LED needs to be super bright as the maximum light must pass spread in finger and detected by detector. Now, when the heart pumps a pulse of blood through the blood vessels, the finger becomes slightly more opaque and so less light reached the detector. With each heart pulse the detector signal varies. This variation is converted to electrical pulse. This signal is amplified and triggered through an amplifier which outputs +5V logic level signal. The output signal is also indicated by a LED which blinks on each heart beat.

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B. MASTER NODE (SINK)

The function of master system is to gather the data process and display it if required by the application. The master node implemented in the present work has the following component to carry out its functions:

- Personnel Computer
- Xbee Transceiver Module
- MAX232 Driver/ Receiver
- DB9 Connector

The master system design is easy as compared to the slave node. The idea of not using a microcontroller at master system is that PC can be used as a processor in place of microcontroller. Besides it will be helpful to data collected at master node. Fig.6 shows the block diagram for Master system.

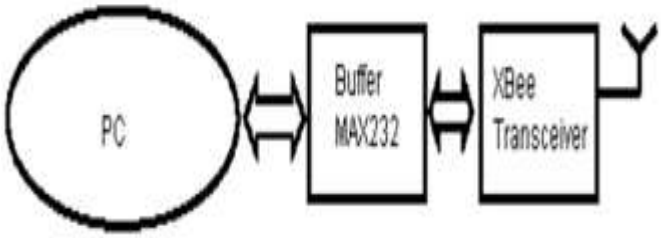

Fig. 6: Block diagram of master system

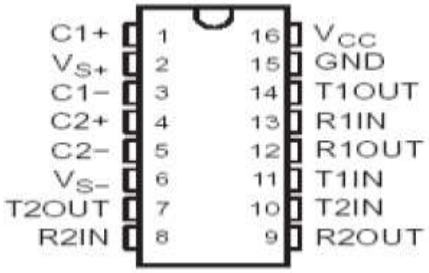

Fig.7 MAX 232 pin diagram

In order to set the computer side up with the XBee module, serial communications needs to be setup. MAX232 and DB9 connector has been used to set up a serial communication between the PC and Xbee. The MAX232 is a line drivers/ receiver, which is intended for all EIA/ TIA-232E and V.28/ V.24 communications interfaces. It has a double charge pump voltage doubler and a +10V to –10V voltage inverter. The voltages outputs are used to generate the RS-232 .Serial cable has been used to connect the MAX232 to PC. Serial cable has male/ female DB9 connector .Pins 13 and 14 on the MAX232 have been connected to pin 3 and pin 2 respectively at DB9 port in order to transfer information to a computer. Pin 11 on the MAX232 chip connects to the Tx pin-2 on the XBee device while pin 12 connects to an Rx pin-3 The voltage supply of 5 V for MAX232 can be achieved through the schematic circuit.

In relation to the XBee module, the DIN pin is where data will come in from the computer while the DOUT pin is where information can be transferred back over to the computer once received from another XBee module. The XBee module can only input voltage levels between 2.8V and 3.4V, therefore if a 5V MAX232 chip is used, arrangements will need to be made in order to adjust the levels so as not to burn out the module.

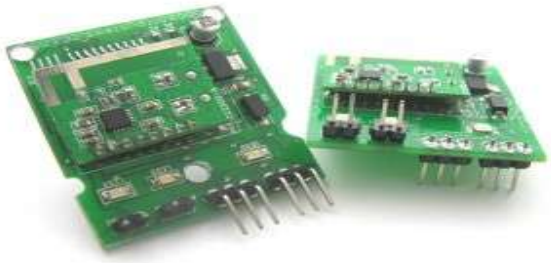

Fig 8: CC 2500-2.4GHz ZIGBEE

Fig. 9 connection of ZIGBEE with DB9 connector

C. INTERFACING SENSOR (DS1620)

The interfacing of sensor with Atmega16 is done using the 3-Wire communication through 3-wire communication protocol. The application calls a method to read a value, which starts the conversion and then returns. As soon as sensor gets a query for data it starts conversion and sends it to XBee transceiver through processing unit (microcontroller).

D. 2 X 16 PARALLEL LCD

The 2 X16 Parallel LCD is an 8 bit or 4 bit parallel interfaced LCD. This unit allows the user to display text, numerical data and custom created characters. The LCD uses the HD44780 series LCD driver from Hitachi or equivalent controller. The LCD is connected to a female 14-pin connector for easy interface with the BS2p24/40 Demo Board (#45187) and the Professional Development Board (#28138).Though the device has the ribbon cable and 14-pin connector it may also be hooked up manually .

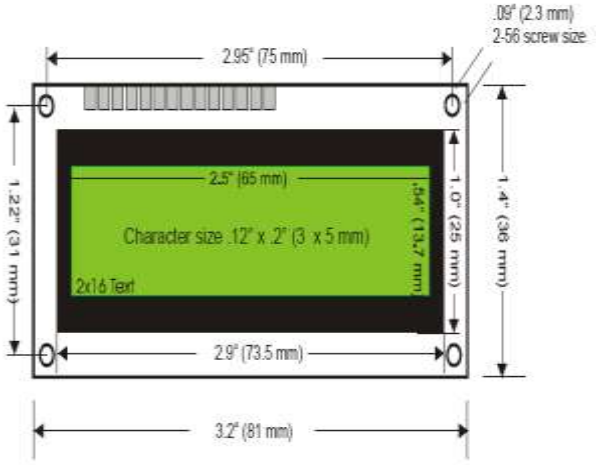

Fig. 12 LCD

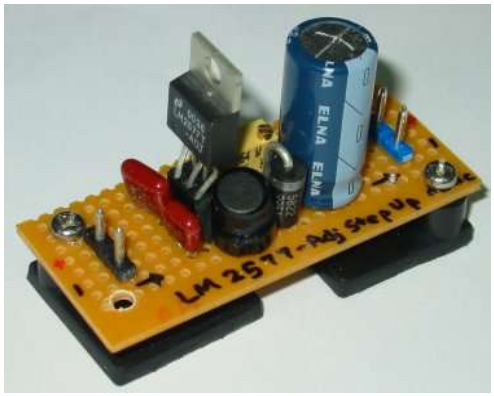

Fig. 10: power supply

E. Power supply

In alternating current the electron flow is alternate, i.e. the electron flow increases to maximum in one direction, decreases back to zero. It then increases in the other direction and then decreases to zero again. Direct current flows in one direction only. Rectifier converts alternating current to flow in one direction only. When the anode of the diode is positive with respect to its cathode, it is forward biased, allowing current to flow. But when its anode is negative with respect to the cathode, it is reverse biased and does not allow current to flow. This unidirectional property of the diode is useful for rectification.

F. ATMEGA16 (MICROCONTROLLER)

The ATmega16 is a low-power CMOS 8-bit microcontroller based on the AVR RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega16 achieves throughputs approaching 1 MIPS per MHz, allowing the system designed to optimize power consumption versus processing speed. of In-System Self-programmable Flash program memory, 512 Bytes EEPROM– 1 Kbyte Internal SRAM.

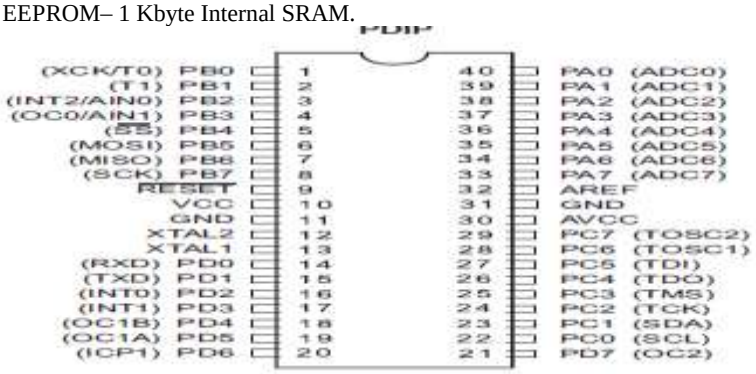

Fig. 1: Pin diagram of ATmega 32

4. SOFTWARE IMPLEMENTATION IN SYSTEM

If the system performs all the required tasks and behaves as expected the software development phase is over. If not, the whole procedure will have to be repeated again. One of the difficulties of programming microcontrollers is the limited amount of resources the programmer has to deal with. In PCs resources such as RAM and processing speed are basically limitless when compared to microcontrollers. In contrast to a PC, the code on microcontrollers should be as low on resources as possible. In summary, the physical realization of sensor node through hardware implementation is made and a firmware has been discussed to make the integrated devices to interact with each other. the sensor nodes has been evaluated in terms of their size, power, cost etc. The firmware developed can also been discussed in terms of the code size. Further the implemented system is compared with the existing technologies such as Mica Mote. Processing unit, Sensing unit, and Transceiver unit are commercially available in the form of IC's. Frequently the power requirements of the designed system are met through the use of Batteries. Though the battery alone may not be sufficient to carry out a smooth functioning of the system, hence power voltage regulators may be added to the circuit. In the present work, initially adapters were used when system was evolving through different stages to reduce the cost and complexity of the system and finally after testing the system the battery will replace the power adapters. Power voltage regulators IC's have been used to achieve the specified voltage supply to different units within the designed system.

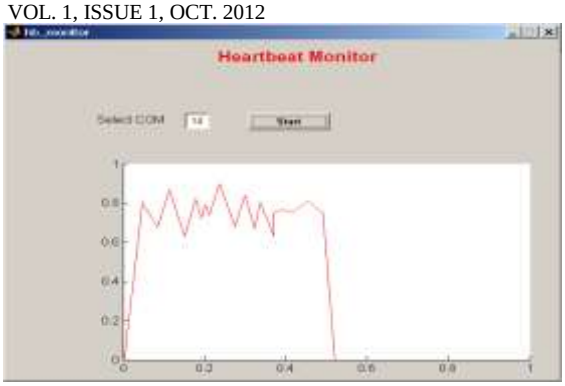

Fig.12: Output in MATLAB (GUI)

Fig. 13 View of designed system

The system achieved heartbeat within the distance of 30m approx. and are successful to remove all wired logic for monitoring.

CONCLUSION & FUTURE SCOPE

We have proposed a low-cost solution to enhance the remote monitoring capability of existing health care system. We conducted a feasibility study of using ZigBee network based heart rate monitoring system. It is secure, robust and low-power consuming. It can operate on multiple channels so as to avoid interference with other wireless devices or other equipments in the hospital.EEG, ECG and other health parameters can also be monitored. Continuous monitoring and future diagnosis can be performed via the same system (TELEMEDICINE). More than a single patient at different places can be monitored using single system.

REFERENCES

[1] Eli S. Leland, Elaine M. Lai, Paul K. Wright, "A Self Powered Wireless Sensor for indoor environmental monitoring".
[2] NingXu et al,"A wireless sensor network for structural monitoring, ACM SenSys, 2004.
[3] http://www.cs.virginia.edu/~control/medical/subsystems.html, Medical Application.
[4] Christopher Sadler et al,"Hardware Design experiences in Zebranet", ACM SenSys, 2004.
[5] Ian F. Akyildiz, WeilianSu,Yogesh Sankarasubramaniam, ErdalCayirci, "A Survey on Sensor Networks", Georgia Institute of Technology.
[6] Sanjay Singh, Rajesh Singh and Su kumar Ray chaudhari, "Design Of Nodes In Wireless Sensor Network Using Rf Module ", International journal Association of advancement in combinatorial Sciences, Ref.: ITAS-2-4/10, Dec. 15, 2010.
[7] Sanjay Singh, Rajesh Singh Vivek Kaundal ,"Automatic Meter Reading in wsn using 2.4Ghz tranceiver with MATLAB data Logger", "International Transactions in Mathematical Sciences and Computer (ITMSC)" (ISSN-0974-7273) .
[8] Rajesh Singh, Akanksha, Shashank Mishra, Ankit Joshi " Wireless Personal Area Network Node Design and Simulaton of Alcohol Sensor using Zigbee Transceiver Module", International Journal of Engineering Research and Applications (IJERA), Vol. 2, Issue 3, May-Jun 2012, pp.133-138.
[9] SINGH R, MISHRA S, JOSHI P, "Wireless pressure monitoring in wireless sensor network using 2.4 GHz transceiver module", ICCCT 2011, IEEE conference on computer and communication technology " at MNNIT Allahabad ISBN: 978-1-4577-1385-9, Page no 225-229.
[10] Rajesh Singh, Vivek Kaundal, Arpit Jain, "Wireless Personal Area Network Design and Simulation to locate Accidental Information using 2.4 Ghz Transceiver Module", International Journal of Engineering Science & Advanced Technology, ISSN: 2250–3676, Volume-2, Issue-2, 297 – 300.
[11] Rajesh Singh, Vinod Kumar, Pankaj Joshi, "WPAN node design for Gathering Real Time Data through V1.9b terminal using 2.4 GHz Transceiver Module", International Journal of Electronics and Computer Science Engineering, ISSN- 2277-1956.