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Design Of Wireless Home Care Medical Monitoring System Using Zigbee Technology

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Abstract

The project provides the design of a Medical Monitoring Terminal use C8051F021 MCU and CC2420 RF chip based upon the Zigbee technology. The Monitoring Terminal used to detect the patient's real-time body temperature, heart rate and their physiological information, and transmit them to the control center.The control centre then monitor the patient condition and control them by giving description to patient session. Then these descriptions are displayed in display session. And they are sending to near by pharmacy via gsm.

Keywords- Zigbee; Wireless sensor network node; monitoring System;

I. INTRODUCTION

In recent years, with the miniaturization of biomedical Sensors, the fast development and popularization of information processing and wireless data transmission technology, the wireless Medical Monitoring System has became a research topic. By utilizing the wireless technique to transmit information between medical sensor and monitoring control centre, the patient's relaxation is enlarged, and also the efficiency of the modern management of hospitals is also improved. Besides, the problem of the lack of unremitted real-time care for every patient, which is caused due to the lack of health care members, is also solved and therefore, the portable wireless medical monitoring products will become popular in the future market.

II. HARDWARE DESIGN OF MEDICAL MONITORING TERMINAL

A. Terminal Hardware Architecture

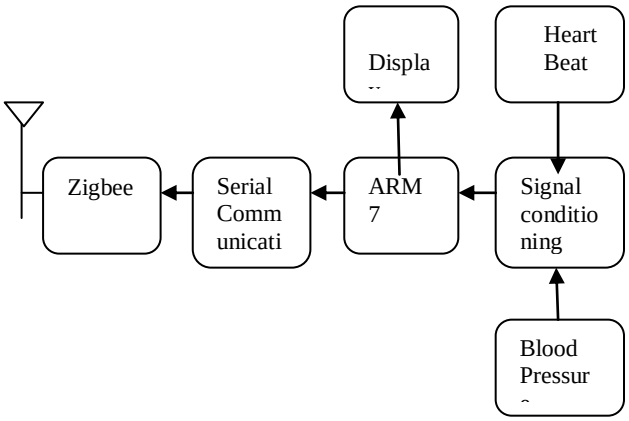
The wireless medical monitoring system is the design of wireless monitoring terminal, and the system software. The monitoring terminal basically consists of three units: the sensor unit, the control unit, and communication unit. The sensor module is used for

getting the medical information from outside and those data's are converted to digital signals. Those data's are converted to digital signals. The control unit is often compared to the brain of monitoring terminal, which is in the position of coordinating the task of different units, controlling the sensors, processing data, and executing the communication protocols. The wireless communication unit mainly deals with the transmission of information. Nowadays, there are so many wireless communication protocols for transmitting the information's. But the main task of a monitoring terminal is to realize the transmission of signals--- such as heart rate, body temperature, and blood pressure. Moreover, because the monitoring terminal is worn on patient's body, which needs to be charged by battery, it puts a high demand on the reducing of power dissipation of wireless transmission module. Having taken these factors into consideration, zigbee technology is chosen in this paper as the wireless communication protocol. ZigBee technology is a recently developed with short-range, low-rate, low-power wireless communication technology. It has a powerful capability and flexible methods of network forming, large network capacity, high security, and has low power consumption; it also uses the free wireless spectrum. Therefore, ZigBee technology is suitable for wireless medical monitoring system. CC2420 is used as a communication unit in this paper Texas Instruments' first RF transceiver chip that is suitable for ZigBee products and it is mainly designed for power reduction. CC2420 operates in 2.4GHz frequency band, and direct sequence spread spectrum baseband method is used, whose chip-rate and effective data transfer rate can reach as high as 2MChips/s and 250kb/s respectively.

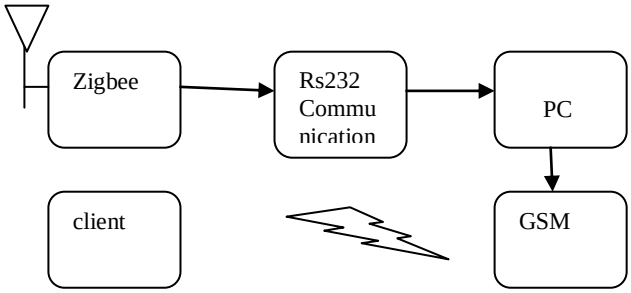
The control chip used in this is a Silicon LAB's C8051F021. C8051F021 belongs to C8051F series, a fully integrated mixed-signal micro-controller. It has a high-speed 51 core, 64K bytes of FLASH memory, and hardware implementation of the SPI Interface.

III SYSTEM ARCHITECTURE

The wireless sensor networks (WSN) will observe the human physiological signals by means of ZigBee, which is provided with low power consumption, high expansion, stylization and two-way transmission, etc. ZigBee is generally used for military applications, home care, home application control, and industrial and security control. This paper is mainly developed for home care sensor network system by ZigBee's characteristic, which is sensors are embedded, such as the biosensor for observe heart rate and blood pressure. The biosensor transmits the measured signals via ZigBee, and then the signals are sends to the remote wireless monitor for acquiring the observed human physiological signals. The remote wireless monitor is construction of ZigBee and personal computer (PC). The measured signals send to the PC can be data collection. After that the personal computer sends Global System for Mobile Communication (GSM) short message to the manager. The manager can use the Personal computers or personal digital assistant (PDA) to observe the human physiological signals in the remote place.



Block diagram for patient session



Block Diagram for control session

A. Processing Section.

Processing section plays a main role. The collected details are processed here and then it is transmitted through Zigbee to the monitoring section for further analysis.

ZIGBEE is a wireless technology developed for open global standard to address for needs of low-cost, low-power, wireless sensor networks. The standard IEEE 802.15.4 physical radio specification and operates in worldwide for the frequencies: 2.400-2.484GHz, 902-928MHz and 868.0-868.6MHz.The 802.15.4 specification was developed at the Institute of Electrical and Electronics Engineers (IEEE). The needs of low-cost, battery-operated devices are approached by the specifications, which is a packet based radio protocol. The protocol allows devices to be intercommunicating and the powers are charged for years instead of hour's .The protocol that l carries all the benefits of the IEEE802.15.4 with some added networking functionality.

ZigBee PRO uses Stochastic addressing to assign addresses using probability analysis to simplify network formation. In networks, tree cluster approach is used so that it will lead to the address table 'churning' when a new node joins the network, something those creats problems in large networks. Nodes do not need a new address when joining a network, when using stochastic addressing. In the some case of a collision the stack will provides a conflict resolution system using the unique IEEE address assigned to each node. Another benefit is that the entire 16 bit address space

is available to all nodes at any point in the network. This address space is constant even if the network undergoes change such as nodes joining or leaving or a change in the RF environment.

ZigBee PRO networks have the ability to aggregate routes through the use of 'many to one' routing. This allows each device to share the same routing path reducing broadcast and network traffic and greatly improves the efficiency and stability of the network routing table.

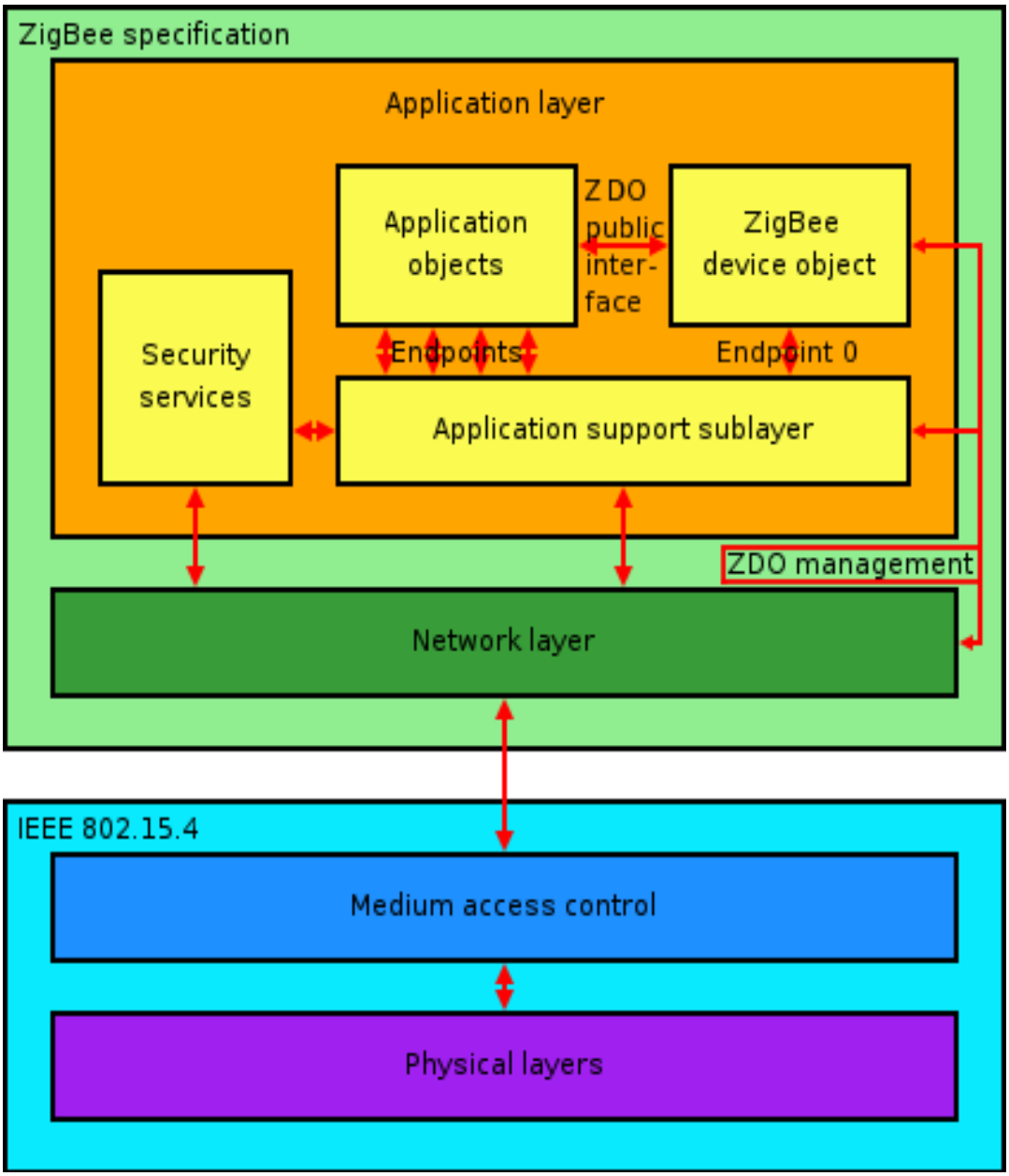


Fig.3 IEEE 802.15.4/ZigBee Architecture

The RS-232 serial communication protocol is a standard protocol used for serial communication. It is the protocol used by the MicroStamp11 when it communicates with a host PC. The different components in a serial link are the UART, the serial channel, and the interface logic. An interface chip called universal asynchronous receiver/transmitter or UART is used for implementing serial data transmission. The UART is placed between the host computer and serial channel. The serial channel is the collection of wires in which the bits of data's are transmitted. The output from the UART is a standard TTL/CMOS logic level of having 0 or 5 volts. In order to improve the bandwidth, removing noise, and increase range, this TTL logical level is converted to RS-232 logic level to volts before being sent out on the serial channel.

A frame is a complete and non divisible packet of bits. A frame includes both information (e.g., data and characters) and overhead (e.g., start bit, error checking and stop bits). In RS-232, the frame consists of 1 start bit, 7 or 8 data bits and stop bits. A timing diagram for RS-232 frame consisting of 1 start bit, 7 data bits, 1 parity bits and 2 stop bits

IV SIMULTION RESULTS

It's possible to do the simulation of this project using Visual Basic simulator. Visual Basic is Easy to learn Programming language. With Visual Basic you can develop Windows based applications and also games. Visual Basic is easy to learn than other language (like Visual C++), and yet it is a powerful programming language. Visual Basic is more useful for application developing than for Games developing. You may choose other language (like C++), that would be much more harder to program. The features of VB are Visual Basic event driven meaning code remains idle until called upon to respond to some event like button pressing, menu selection, Full set of objects - you 'draw' the application. Response to mouse and keyboard actions, Clipboard and printer access, Full array of mathematical, string handling and graphic functions. Can handle fixed and dynamic variable and control arrays.

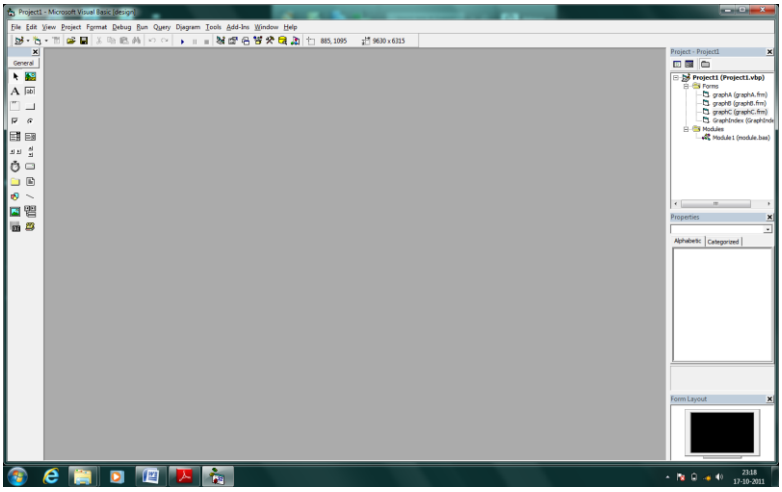


Fig: program window

This is the graphical display window where we can monitor the ECG, Temperature and blood pressure.

Fig: Graphical Display

An ECG waveform display

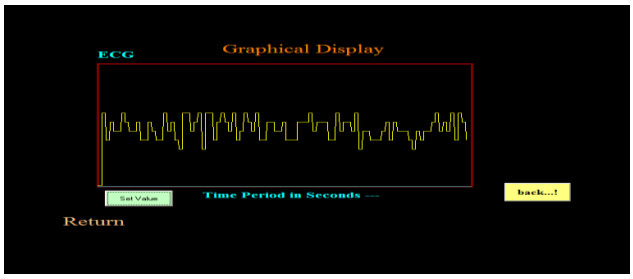


Fig: ECG Graph

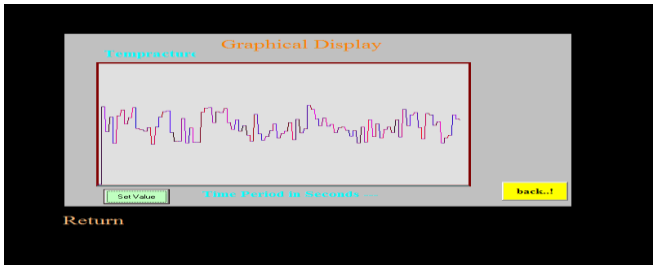


Fig: Temperature Graph

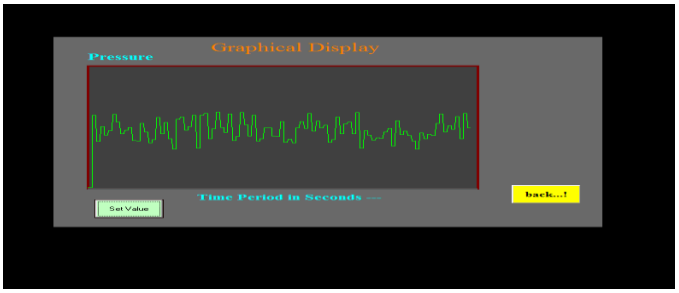


Fig: Blood Pressure Graph

V. CONCLUSION

Tests find that this system can successfully set up the Zigbee star network. The monitoring terminal can precisely check the heart rate and body temperature of patients, and send them to coordinator and then surveillance centre through wireless network. The error of the monitored body temperature, heart rate, and other information is very slight, which satisfies practical usage, and meets the demand of the design. By extending other sensor module, it could realize the monitoring of more psychological parameters and reliable transmission. Since this system only realized the detecting and transmission of heart rate and body temperature, and the detection accuracy is not enough. The next step focuses on how to improve the detection accuracy, how to realize more reliable transmission of data, and to extend more sensor module, so as to conduct further research on the monitoring of more psychological parameters. At the same time, due to the

Limitation of the master chip, the power dissipation of routers and terminal device is not low enough. More work should be done concerning this aspect to further reduce the power dissipation and lower the cost.

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