A WIRELESS ECG MODULE FOR PATIENT MONITORING NETWORK

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ABSTRACT: The current paper presents low-power analog integrated circuits (ICs) for wireless electrocardiogram (ECG) detection in personal health monitoring. Considering the power-efficient communication in the body sensor network (BSN), the required low-power analog ICs are developed for a healthcare system through miniaturization and system integration. The proposed system comprises the design and implementation with three subsystems, namely, the ECG acquisition node,the protocol for standard IEEE 802.15.4 ZigBee system, and the radio frequency (RF) transmitter circuits. A preamplifier, a low-pass filter, and a successive-approximation analog-to-digital converter (SA-ADC) are integrated to detect an ECG signal. For high integration, the ZigBee protocol is adopted for wireless communication. To transmit the ECG signal through wireless communication, a quadrature voltage-controlled oscillator and a 2.4 GHz low-IF transmitter with a power amplifier and up-conversion mixer are also developed. In the receiver, a 2.4 GHz fully integrated CMOS radio-frequency front-end with a low-noise amplifier, and a quadrature mixer is proposed. The low-power wireless bio-signal acquisition SoC (WBSA-SoC) has been implemented in TSMC 0.18-μm standard CMOS process. The measurement results on the human body reveal that the ECG signals can be acquired effectively by the proposedSoc.

*Keywords:*Microcontroller, Zigbee, RF Transceiver, Ethernet, Personal Computer.

I. INTRODUCTION

Rapid economic and industrial development leads to increased intensity in daily life, which brings people negative sentiments, such as nervousness, anxiety, and disturbance . These emotions along with changes of quickly lifestyle result that chronic cardiovascular (CV) diseases become the major adult illnesses instead of infectious diseases, therefore, the evolution of degenerative diseases resulted in the medical cost increased rapidly. In recent years, the telemedicine information system becomes more and more essential, especially the intelligent system is employed to not only supply a better healthcare monitoring but to save the medicine cost . Mainstream investigation has leaned toward the development of biomedical devices. Furthermore, almost all observation positions of human health (e.g., ECG, EEG, Blood, and Pressure) can be monitored by the related bio-microsystem device as shown in Fig. 1. A wide range of biomedical devices and systems being integrated on a chip have been developed rapidly. Moreover, telemedicine information system with interactive and intelligent features has become increasingly important to provide the high quality healthcare monitoring .

According to the BSN, home telecare monitoring allows patients to examine themselves using bio-signal acquisition nodes (BANs) . The reader can collect the bio-signal on a bio-information node (BIN) and submit personal data to the healthcare center through the local sensor network.

II. The 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. They use the same basic technology, except that arbitrary images are made up of a large number of small pixels, while other displays have larger elements.
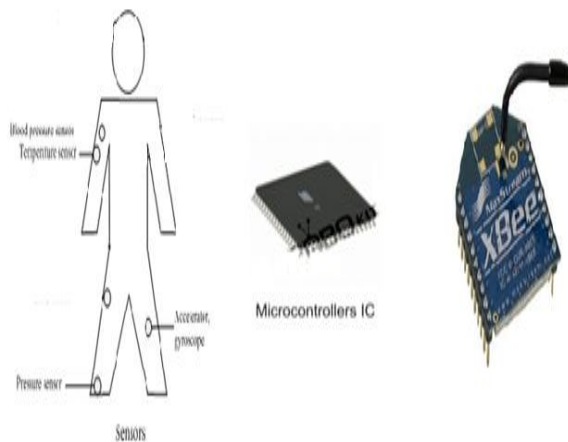
I. Design of Proposed Hardware System
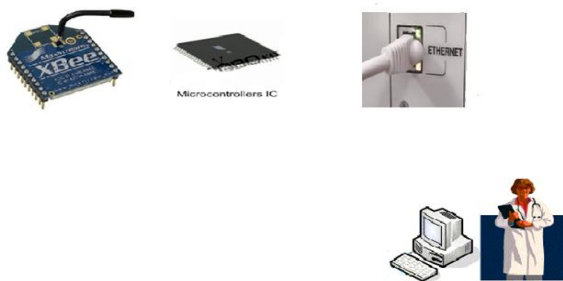

Fig.1.Block diagram (TRANSMITTERSECTION)

Fig.2.Block diagram (RECEIVER SECTION)

An interactive intelligent healthcare and monitoring system (IIHMS) including body sensor network (BSN) and local sensor network has been presented. The wireless bio-signal acquisition for BSN application is applied to acquire the real human body data via ZigBee network communication. The high integration TX-Baseband processor with zigBee protocol. In addition, an ARM-based

receiver platform with an RF receiver, an analog to digital mixed mode board, ARM-based displayer to demonstrate values. The patient is in any place our system is sent to the Measurement data to server. We proposed system is less delay and low noise. The existing system is used in only hospital not in out of hospital. In our proposed system it is of low power operating system.

IV.Board Hardware Resources Features
Zigbee

Zigbee modules feature a UART interface, which allows any microcontroller or microprocessor to immediately use the services of the Zigbee protocol. All a Zigbee hardware designer has to do in this ase is ensure that the host's serial port logic levels are compatible with the XBee's 2.8- to 3.4-V logic levels. The logic level conversion can be performed using either a standard RS-232 IC or logic level translators such as the 74LVTH125 when the host is directly connected to the XBee UART. The below table gives the pin description of transceiver. Data is presented to the X-Bee 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 X-Bee 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 X-Bee's UART

Ethernet: Networking is playing vital role in current IT era where data distribution and access is critically important. As the use of communication between two or more entities increases the networking technologies need to be improved and refurbished over time. Similarly the transmission media, the heart of a network, has been changed with the time improving on the previous one. If you know a little bit about networking you surely have heard the term Ethernet which is currently the dominant network technology. Wide spread of the Ethernet technology made most of the offices, universities and buildings use the technology for establishment of local area networks (LANs).

To understand what actually Ethernet is, we need to know about IEEE first which is a short of Institute of Electrical and Electronics Engineers. IEEE is a part of International Organization for Standardization (ISO) whose standard IEEE 802.3 is defined for Local Area Network. The standard 802.3 commonly known as ETHERNT defines the communication standards for how data is transferred from one network device to another in a local area network. Since the limit for Ethernet cable is few hundred meters Ethernet is commonly deployed for networks lying in a single building to connect devices with close proximity. The same standard for Ethernet enables manufactures from around the earth to manufacture Ethernet products in accordance with the ISO standards that are feasible for all computing devices worldwide

PC :

Keyboards on an OEM basis to leading global PC manufacturers for use in desktop and notebook PCs and also supplies for retail keyboard OEMs.

- Internal Sourcing of almost all of main Parts

Almost all components - frame, key switches and membrane sheet - other than connecters and cord are manufactured in-house, giving Minebea an un-matched advantage in terms of quality, supply capabilities, cost-competitiveness and speed of delivery.Especially, these products capitalize on Minebea's ultra-precision machining technology of components.

- Efficient Production System

Plant in China which supplys the global market employs the Minebea's vertically integrated manufacturing system, whereby all process, from machining components to final assembly are conducted in-house.

CONCLUSION

An interactive intelligent healthcare and monitoring system (IIHMS) including body sensor network (BSN) and local sensor network has been presented. The wireless bio-signal acquisition SoC (WBSA-SoC) for BSN application is applied to acquire the real human body ECG signal via IEEE 802.15.4 ZigBee network communication. The high integration WBSA-SoC including an ECG acquisition node, a TX-Baseband processor with ZigBee protocol, a mix-mode interface, and an RF transmitter have been designed

and implemented in TSMC 0.18-μm standard CMOS process. In addition, an ARM-based receiver platform with an RF receiver, an analog to digital mixed mode board, an Offset-QPSK digital demodulation with FPGA and ARM-based displayer to demonstrate the ECG waveform. According to the real ECG measurement results, the ECG can be acquired by the proposed WBSA-SoC.

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