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Implementation of Advanced Health Care System Using Wireless Technology

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Abstract:
In recent years, the world is facing a common problem that the number of elderly people is increasing. Hence, the problem of health -care for elderly people is very important. In recently, wireless sensor networks are used to structure health-care system in many researches. Wireless sensor networks application for physiological signals communication transmission has many technologies. Such as the Infrared, Bluetooth and ZigBee, etc. Because the angle limit problem of the infrared transmission, and the infrared have not be used for Physiological signal transmission. Although Bluetooth is better than ZigBee for transmission rate, but ZigBee has lower power consumption. Hence, ZigBee is generally used for 24 hours monitor of communication transmission systems. In this paper we implement the Health care system on FPGA with Zigbee enabled system.

Keywords: ***FPGA, Zigbee,***

Introduction:

The problem found in most hospitals is that the physician has to frequently visit the patient and asses his/her condition by measuring the parameters such as temperature, blood pressure, drip level etc. In case of emergencies, the nurse intimates the doctor through some means of communication like mobile phone.

A growing selection of innovative electronic monitoring devices is available, but meaningful communication and decision supports are also needed for both patients and clinicians [1]. Health care monitoring systems can help people by providing healthcare services such as medical monitoring, memory enhancement, medical data access, and communication with the healthcare. Continuous health monitoring with wearable or clothing-embedded transducers and implantable body sensor networks will increase detection of emergency conditions in at risk patients.

Not only the patient, but also their families will benefit from these. Nowadays, more and more urban residents living in the Community and the communities became ever larger. There is a medical center in a medium community in general which can provide some treatment to those common diseases. With the aging society in China, more and more elderly will live in urban community. Community health centers can also be a feature that is perfect for the elderly on a regular basis to provide some basic health care, such as measurement the blood pressure and heart rhythm once a month for the elderly, and keep record of the physical condition for them. Meanwhile, the elderly are also looking for this kind of health care, and hope to have a professional to make some reminders according to his own body status. Usually the medical center could allocate some medical staff to examine on-site for elderly regularly, but with increased number of older persons in the community, such on-site service is becoming increasingly costly.

Therefore, we want to design a family telemedicine system, will enable residents examine the health themselves in home with electronic Sphygmomanometers and other home medical tools, and coupled with simple operation, the original body

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health data could transmitted to the community medical center automatically. Replaced those staff but improve the efficiency of community medical center services.

PROPOSED SYSTEM

In this paper, we presented the wireless sensor networks (WSN) to observe the human physiological signals by ZigBee, which is provided with lower power consumption, small volume, high expansion, stylization and two-way transmission, etc. ZigBee is generally used for home care, digital home control, and industrial and security control. This paper developed a suite of home care sensor network system by ZigBee's characteristic, which is embedded sensors, such as the biosensor for observe heart rate and blood pressure. The biosensor transmits measured signals via ZigBee, and then sends to the remote wireless monitor for acquiring the observed human physiological signals. The remote wireless monitor is constructed of ZigBee and personal computer (PC). The measured signals send to the PC, which can be data collection. When the measured signals over the standard value, the personal computer sends Global System for Mobile Communication (GSM) short message to the manager. The manager can use the PC or personal digital assistant (PDA) to observe the observed human physiological signals in the remote place.

RFID technology has a big potential to become ubiquitous in the near future. Today it is already successfully used inv different applications like supply chain management to track pallets of items, in war field, military area, traffic management, animal tracking in farm, robot navigation etc. Tracking allows better coordination and control in these cases. Currently printing tags with organic materials seems to be a promising approach. Using printing tags, the cost-intensive assembly of the two main components, antenna and chip, can be eliminated. It also adds higher flexibility to production.

BLOCK DIAGRAM

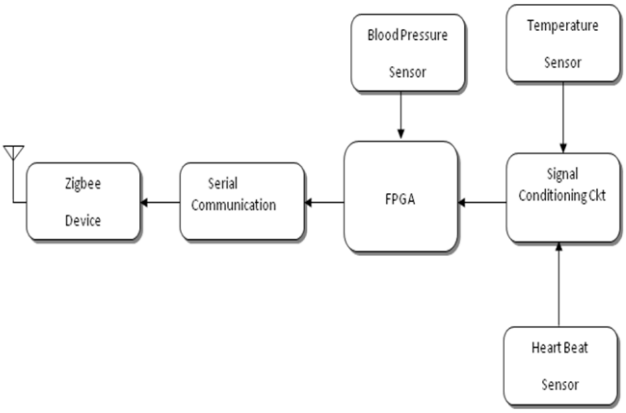

Fig1: Block Diagram

CONTROL SECTION

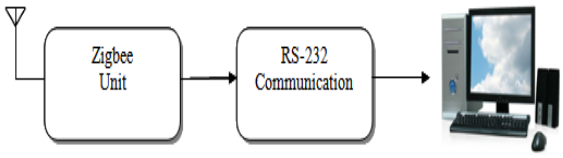

Fig2: Control Section

PERSON SECTION

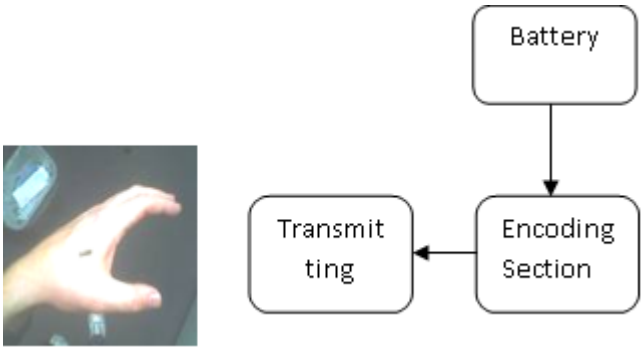

Fig3: Person Section

Explanation:

At the patient section we connect the Blood Pressure sensor Heart Beat and temperature sensor which were used for monitor the patient. These sensors are interfaced to the FPGA which will communicate with the monitor section by wireless communication device zigbee. Whenever the sensor was sensed then FPGA will be transmit the wireless information to the Monitor section.

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Patient Information can be known by the Individual RF signal that was attached to the each patient.
Patient will have a RFID and FPGA was interfaced with the RF receiver to know which person data was showing on the monitor section can be known.

Modules Explanation:

In this health care monitoring system we are using two sensors
1. Heart Beat Sensor
2. Temperature Sensor

Temperature Sensor:

Temperature Sensor - The LM35

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature.

Features

Calibrated directly in ° Celsius (Centigrade) Linear + 10.0 mV/°C scale factor 0.5°C accuracy guaranteeable (at +25°C) Rated for full −55° to +150°C range Suitable for remote applications Low cost due to wafer-level trimming Operates from4 to 30 volts Less than 60 µA current drain Low self-heating, 0.08°C in still air Nonlinearity only ±1⁄4°C typical Low impedance output, 0.1 □□for 1 mA load

Why Use LM35s To Measure Temperature?

You can measure temperature more accurately than a using a thermostat.
The sensor circuitry is sealed and not subject to oxidation, etc.
The LM35 generates a higher output voltage than thermocouples and may not require that the output voltage be amplified.

Fig4: Temparature Sensor

Heart beat measurement

The skin may be illuminated with visible (red) or infrared LEDs using transmitted or reflected light for detection. The very small changes in reflectivity or in transmittance caused by the varying blood content of human tissue are almost invisible. Various noise sources may produce disturbance signals with amplitudes equal or even higher than the amplitude of the pulse signal. Valid pulse measurement therefore requires extensive preprocessing of the raw signal.

The setup described here uses a red LED for transmitted light illumination and a pin Photodiode as detector. With only slight changes in the preamplifier circuit the same hard- and software could be used with other illumination and detection concepts. The detectors photo current (AC Part) is converted to voltage and amplified by an inexpensive operational amplifier (LM358). A PIC16F877 microcontroller converts the analog signal with 10 bits resolution to a digital signal. An average is calculated from 250 readings taken over a 20 milliseconds period (This equals one period of the european power line frequency of 50 Hz).

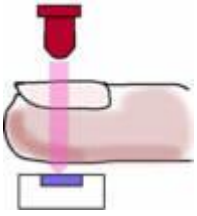

Fig4:Heart beat sensor

Zigbee Module:

The XBee/ XBee-PRO RF Modules are designed to operate within the ZigBee protocol and support the unique needs of low-cost, low-power wireless sensor networks. The modules require minimal power and provide reliable delivery of data between remote devices. The modules operate within the ISM 2.4 GHz frequency band and are compatible with the following:

- XBee RS-232 Adapter
- XBee RS-232 PH (Power Harvester) Adapter
- XBee RS-485 Adapter
- XBee Analog I/O Adapter

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- XBee Digital I/O Adapter
- XBee Sensor Adapter
- XBee USB Adapter
- XStick
- Connect Port X Gateways
- XBee Wall Router.

The XBee/XBee-PRO ZB firmware release can be installed on XBee modules. This firmware is compatible with the ZigBee 2007 specification, while the ZNet 2.5 firmware is based on Ember's proprietary "designed for ZigBee" mesh stack (EmberZNet 2.5). ZB and ZNet 2.5 firmware are similar in nature, but not over-the-air compatible. Devices running ZNet 2.5 firmware cannot talk to devices running the ZB firmware.

Key Features:

High Performance, Low Cost

- Indoor/Urban: up to 300' (100 m)
- Outdoor line-of-sight: up to 1 mile (1.6 km)
- Transmit Power Output: 100 mW (20 dBm) EIRP
- Receiver Sensitivity: -102 dBmRF Data rate: 250,000 bps.

Advanced Networking & Security

- Retries and Acknowledgements
- DSSS (Direct Sequence Spread Spectrum)
- Each direct sequence channel has over 65,000 unique network addresses available
- Point-to-point topology
- point-to-multipoint topology
- Self-routing, self-healing and fault-tolerant
- mesh networking

Low Power

- TX Current: 295 mA (@3.3 V)
- RX Current: 45 mA (@3.3 V)
- Power-down Current: < 1 µA @ 25oC

Easy-to-Use

- No configuration necessary for out-of box
- RF communications
- AT and API Command Modes for configuring module parameters
- Small form factor
- Extensive command set
- Free X-CTU Software (Testing and configuration software)

Mounting Considerations

The XBee modules were designed to mount into a receptacle (socket) and therefore do not require any soldering when mounting it to a board. The XBee-PRO Development Kits contain RS- 232 and USB interface boards which use two 20-pin receptacles to receive modules. Figure 4.7.2 XBee-PRO Module Mounting to an RS-232 Interface Board.

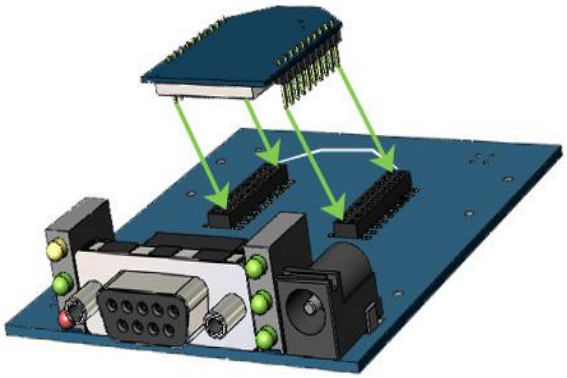

Figure5: Zigbee Module

Figure Zigbee Module Mounting to an RS232 Interface Board.

The receptacles used on Digi development boards are manufactured by Century Interconnect. Several other manufacturers provide comparable mounting solutions; however, Digi currently uses the following receptacles:

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- Through-hole single-row receptacles - Samtec P/N: MMS-110-01-L-SV (or equivalent)
- Surface-mount double-row receptacles Century Interconnect P/N: CPRMSL20-D-0-1
- Surface-mount single-row receptacles - Samtec P/N: SMM-110-02-SM-S

Patient Section:

The data from patient section is received to the monitoring section by RF communication. This RF communication consists of two types.

1. RF Transmitter
2. RF Receiver

RF Transmitter:

The TWS-434 extremely small, and are excellent for applications requiring short-range RF remote controls. The TWS-434 modules do not incorporate internal encoding. If simple control or status signals such as button presses or switch closures want to send, consider using an encoder and decoder IC set that takes care of all encoding, error checking, and decoding functions. The transmitter output is up to 8mW at 433.92MHz with a range of approximately 400 foot (open area) outdoors. Indoors, the range is approximately 200 foot, and will go through most walls. The TWS-434 transmitter accepts both linear and digital inputs can operate from 1.5 to 12 Volts-DC, and makes building a miniature hand-held RF transmitter very easy

RF receiver:

RWS-434: The receiver also operates at 433.92MHz, and has a sensitivity of 3uV. The WS-434 receiver operates from 4.5 to 5.5 volts-DC, and has both linear and digital outputs. A 0 volt to Vcc data output is available on pins. This output is normally used to drive a digital decoder IC or a microprocessor which is performing the data decoding. The receiver's output will only transition when valid data is present. In instances, when no carrier is present the output will remain low. The RWS-434 modules do not incorporate internal decoding. If you want to receive Simple control or status signals such as button presses or switch closes, you can use the encoder and decoder IC set described above. Decoders with momentary and latched outputs are available.

Conclusion:

This paper illustrates an approach of how to design and implement an ARM-based embedded system, which is simple, stable, very easy to use at home for the elderly persons in a community and also very convenient to all of the community residents. The system has a good scalability. The residents can access the community server to check themselves' health information without others software but a computer with IE. Doctors can review a patient's former health information via internet too when they diagnose the patient. As a result, this system would have a widely use in future.

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