REAL TIME PORTABLE WIRELESS ECG MONITORING SYSTEM

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In the paper, design and implementation of Real Time wireless ECG Monitoring system is a portable, wireless ZigBee based to acquire, amplify, real time transmit over the air a single lead ECG and to a remote base station (e.g. PC, laptop).

INTRODUCTION

Wireless technology is ability to generate interactive healthcare utilizing modern technology and telecommunication. In telemetry system is useful for absent of directly contact between the patient and doctor-physician. The wireless device employ for the efficient remote monitoring system, using for real time, continuous and accurately information of patient heart condition.

The electrocardiogram (ECG) is important role in the prevention, diagnosis the abnormality of patients and rescue of heart disease. The development of a remote monitoring system for ECG signals, the deployment of packet data services over telecommunication network with new applications.

BAN (body area network) where a certain number of sensors are acquire full range of biological signal and transmit them to remote base station for processing. Using wireless connection as medium, number of issue must be considered; ease of security, network generation, data throughput, data loss and power consumption.

Zigbee is Radio. Generally radio module to use for transmission and loaded on their batteries in terms of absorbs current form, continuous monitoring data and Trans receiver work. Battery life is most important for wireless transmission. In respect of this new efficient wireless zigbee protocol has been implemented. Which is consume only approximately 1mw power consumption as much possible, getting excellent compromise between data throughput, covering the wireless range and data receiving robustness. So, Zigbee is most prominent wireless protocol for health care application. That's why real time ECG data monitoring using this zigbee module interface with PC and ECG data.

1. SYSTEM WORK FLOW

The system divided in to the three parts. The first is the ecg acquisition part, the second part is the wireless transmission of the data to the patient's computer using ZigBee or ZigBee transmission, and the third part is data acquisition, viewing and restore.

A. ECG analog signal acquisition

The Analog signal portion has been simple, in order minimized space board. The raw signal- noisy ecg signal is acquire through disposable electrodes, attached to cables through a couple of standard clips. That signal applied to the

![ECG acquisition and Amplification](image)

Filtering

![Wireless Transmission](image)

Reception

![Visualization Monitoring Data](image)

Processing and Storing

Fig.1 System work Flow

Filter circuit and then to wireless module for transmission.

B. Wireless Transmission/Reception

Wireless module based on IEEE 802.15.4 used for transmission and receiving the signal. ECG front end circuit connected with wireless module as remote base station.
Receiver module is interface with PC at Base station.

II. SYSTEM HARDWARE AND IMPLEMENTATION WORK

Analog signal, ECG form measurement data from the sensor (electrodes) are transmitted wirelessly using low cost module (Zigbee-802.15.4) radio equipment. At the receiver side same type of radio module for receiving the wireless signal which was transmitted by the transmitter module at ECG taken from the body using transducer (electrodes). Then forwarded to com port of PC for further processing of ECG signal.

![Real time ECG monitoring Block](image)

**A. Design of ECG Acquisition System:**
ECG signal acquired from the electrodes (Clamp or chest electrodes). This signal amplified using amplifier, which gain of 1000 and filter with cut off frequency 150hz. This block has ECG amplifier AC front end circuit. Instrumentation amplifier is using opamp for ECG amplification.

Further signal given to Low pass amplification and notch filter for noise removing process. After getting this ecg analog signal interface with Zigbee transmitter module for the purpose of transmission in wireless nature.

In the figure shows that, Electrodes attached(interface) with body for working as transducer to convert the heart nerves generated signal in to bio potential analog signal with environmental effect of noise. Basic view in fig.3.

![ECG Actuation System](image)

![Design of Bio Potential Pre-Amplifier](image)

Practically electrodes (transducer) are places on the body using lead III configuration. Electrode converts the body bio potential signal into electrical signal, which is amplified by the bio potential Instrumentation pre amplifier.

Bio potential amplifier is using for the amplification of the body ECG signal. An instrumentation amplifier is a precision differential voltage gain device that is optimized for operation in environment hostile to precision measurement basic differential amplifier makes instrumentation amplifier [7]. It basically consists of three op-amp amplifier and seven resistors.

Bio potential Instrumentation Amplifier offers the following advantages for its application in the biomedical field [7].

- Extremely high input impedance
- Low bias and offset currents
- Less performance deterioration if source impedance changes
- Possibility of independence reference levels for source and amplifier
- Very high cmmr
- Low power consumption
- High slew rate

![Design of Low Pass Filter](image)

A low-pass filter is a filter that passes low-frequency signals but attenuates (reduces the amplitude of) signals with frequencies higher than the cutoff frequency. The actual amount of attenuation for each frequency varies from filter to filter.

Bio potential amplifier output (0.5 to 1 mv) applied to the low pass filter for the higher frequency noise. Figure 5 shows the rc low pass filter, which filter the bio potential signal.
Amplified and Filtered output gives to Zigbee module. Zigbee module has ADC for the conversion of analog data to digital. This data will be packetizing and send by Zigbee module (RF transceiver). Which is describe in next.

**B. Receiver Module:**

The receiving section is composed of Zigbee module connected to PC through USB explorer. This system is support the point to point network configuration. This base module will receive wirelessly data stream coming from the transmitter zigbee module section. PC ports are read data and visualize the real time ECG signal on the screen.

Incoming data are handled in computer using Matlab software to read data packets and find data bytes which contain measurement information. These are utilized to plot a graph and/or display such parameters as ECG.

**III. ZIGBEE WIRELESS MODULE**

IEEE 802.15.4 is a radio transmission standard intended for wireless low data rate transmissions over small distances. The standard is based on the OSI protocol model, which is widely used as a reference for layered protocols. The standard defines only the two lowest layers; namely, the physical and MAC layers. On top of these, the ZigBee Alliance has developed the so-called ZigBee specification, containing network and application layers. Together, the standard and specification form an application generally referred to as ZigBee. The name ZigBee is said to come from domestic honey bee which uses a zig zag type of dance to communicate important information to other member’s. ZigBee is provided with lower consumption, small volume, high expansion, stylization and two way transmissions etc. The ZigBee protocol is implemented on top of IEEE 802.15.4 radio communication.

**IV. EXPERIMENTS AND RESULT**

Number of experiments performed with ECG front end circuit which described earlier, to get ECG signal in form of analog signal as well as noisy part also. Fig. 9 shows that ecg signal with noisy part.

After the performing the number of experiments with DSO and filtering and getting the ECG signal.
Transmitted data are in form of packets (with frames) converted via ADC inbuilt in zigbee module (digit int Xb-24 10EC).

CONCLUSION AND FUTURE WORK

Zigbee protocol is most prominent flexible, robust and low power consumption for the ECG health care data. Module also supports the various topologies.

The number of problems occurred during the zigbee interface with ECG front end circuit, other zigbee USB explorer radio disconnected. Also digi module needs to download new firmware and take the result at base station. This problem reduced by first to change gain of initial ECG circuit and performed then zigbee support that data.

For continuous monitoring of ECG data at receiver side it should be stored. So, memory aspect number of signal occupied memory. To reduce occupied space using compressed techniques as seqency based algorithm Walsh Hardnarm code for the ECG data compressed and stored.

REFERENCES