Design of Structural Health Monitoring Using Wireless Network

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Abstract: - This study aims the acquiring of the constant medical heart functions data of the patients by an implantable device and receiving such data at a center through the wireless network by some gateway. By the help of this desultory planning not only patient may have a better permissiveness but a real time monitoring can also be achieved. On the other hand, with the help of this suggested approach precautions can be taken in advance by the related staff and institutions. This project initially takes the cardiac and hypertension patients into consideration and aims examining the patients on time when an immediate treatment is needed. The system evaluates the values coming from the heart by storing them at a cellular station according to the standards of WHO. If the signals from the transmitter are not at a proper scale, the device warns the patient at once then the emergency staff. The signal parameters (threshold) can be given to the patient by the doctor. While doing it, the most important key aspects are; time, buzzer, sending the message, time of the message sent and the health graphics.

Key-Words: Biotelemetry, Zigbee Module, Wireless Network

1 Introduction

The technological improvements at health aim a better treatment during man's life which may result in a healthier society. The developed societies are taking the advantages of biotelemetry technology for a better treatment. Biotelemetry (or Medical Telemetry) involves the application of telemetry in the medical field to remotely monitor various vital signs of ambulatory patients [1].

First health monitoring system was designed as ECG systems early in the 20th century [2]. In due course of time as technology advanced, new portable devices were invented. Some new commercial wireless devices took their place as wireless technology has advanced [3]. New techniques developed on wireless technology are closely related with health telemetry as; ECG [4], oximetries [5] blood pressure devices [6]. Many of these devices are used as means of transportation via Bluetooth, wireless medical telemetry service (WMTS) or IEEE 802.11 [7].

The WiiSARD crew invented a pulse oximetry prototype by using a personal digital assistant (pda) equipped with IEEE 802.11 (Wi-Fi) [8]. SMART crew has developed an implant ECG system [9]. USARIEM and USAMMRC belonging to US Army have started the WPSM project and the GPS (Global Positioning System) [10].

Wearing a portable implant device at a clinic or a hospital enables the doctors and the nurses to monitor their patients constantly. Such technology also enables the clinic staff treat many of the patients efficiently. Specials may also mend their patients simultaneously when those especially suffering from heart attack or respiratory. Wireless receivers are taking the place of many wired telemetry systems when it comes to physical rehabilitation [11]-[16].

This study aims evaluating the values of the patients suffering from heart diseases by a simple detector and sending the values wirelessly to the centre.

2 Circuit Design

In this study, the buzzer beeps when the oxygen saturation (monitoring by a computer, serial port) in the patient's blood exceeds the stimulus threshold. At this stage Zigbee network sends a message through GSM and communication modules. During the study we have first acquired the oxygen saturation value by a pulse oximetry circuit. Pulse oximetry circuit consists of a receiver, a sensor, a filter and an amplifier circuit. The first received data is evaluated by CNY70 sensor.

The pressure value measuring the blood color is exposed to low filter and elevated by LM384 smart card as to be detected by PIC.

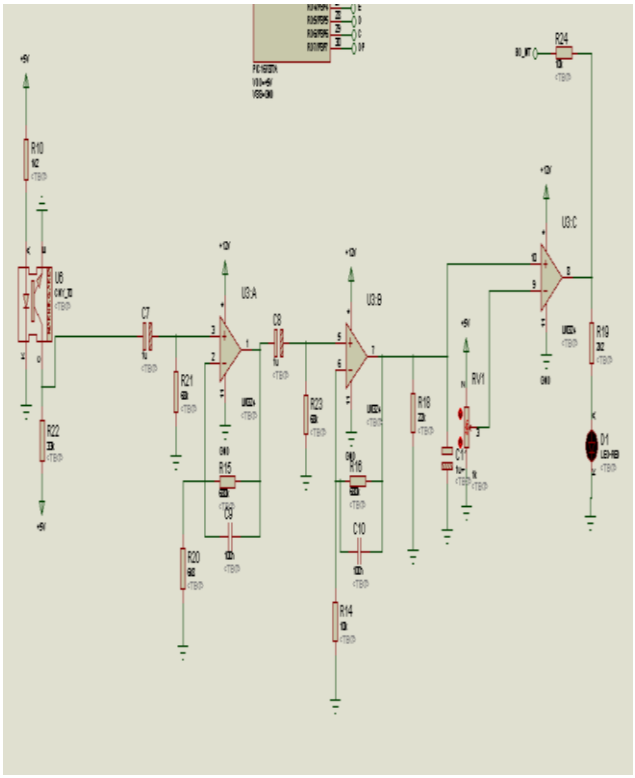

Fig. 1. The designed pulse oximetry circuit

The signals coming from CNY 70 and U3:a and U3:b are increased by LM 324 as seen in the Fig. 1. U3:c serves as the comparator . If the comparator signal is higher than that of set signals of RV1 then "+ output led" lights and the PIC receives synchronized 10 signals to display them on a monitor. The filter circuit consists of two low voltages working approx. at 2.5 Hz frequency which means that the max measured pulse is 150 bpm (2.5*60=150) The purpose of filtering is to stop the frequencies higher than expected frequency.

There are two more amplifiers other than the low voltages which are used for increasing the weak signals coming from CNY70.

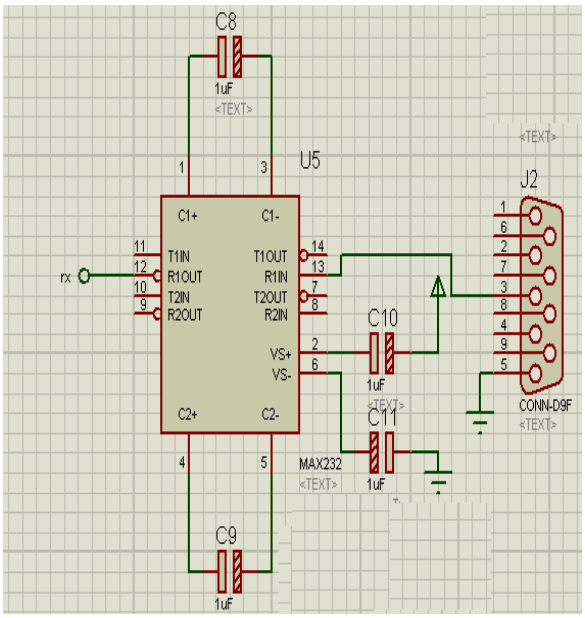

Fig. 2. PIC serial port communication circuit

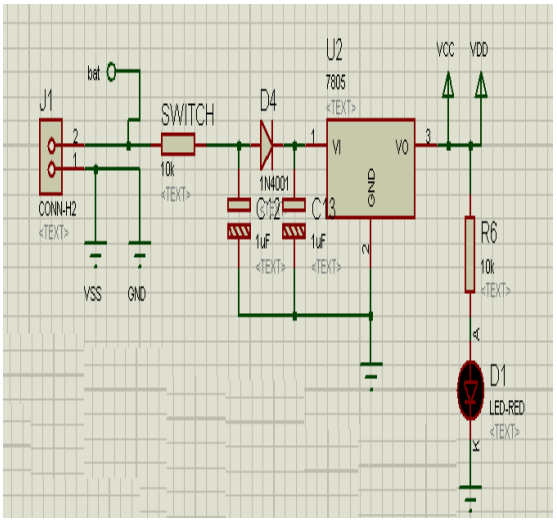

Fig. 3. Designed regulator circuit

The PIC threshold value circuit is as seen above. Max 232 integrate has been used and 12th leg has been tied up with PIC rx. The regulator generating 9-12 volt to PIC LCD can also be seen at the table above; (Fig. 3). The on/off switch is also placed here. LM 7805 has been used to regulate and LCD R1 and R2 are used to set LCD settings.

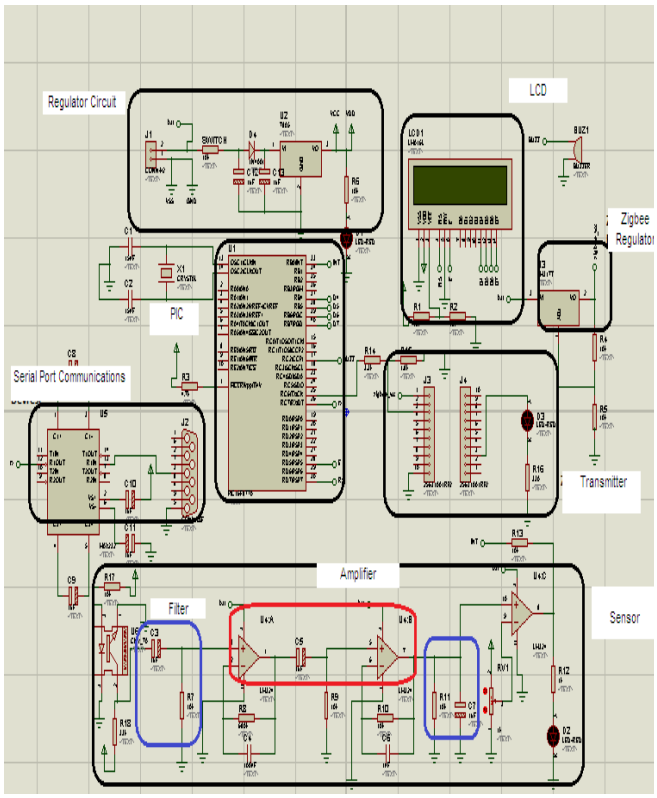

Fig. 4. Connection units of the designed circuit

Having had the simulation results, the same values have been received while working on the board. In order to make the circuit portable a printed circuit has been used. We have transferred our circuit from Proteus 7.7 simulation programmed ISIS to ARES to prepare the circuits' PCB.

3 XBEE Module Configuration

XCTU has been used for the configuration. "Read" button has been clicked to see the configuration. DH and DL tabs were clicked to enter the address values, "Write" tab has been clicked to save the changes on Zigbee module. XCTU programme and Zigbee both have sender and receiver antennas. Configured Zigbee modules are set as "blue" as the sender and "red" as the receiver. So, the pulse values are received between Zigbees and collected on a computer through a wireless system. The processed data has been sent by C# software.

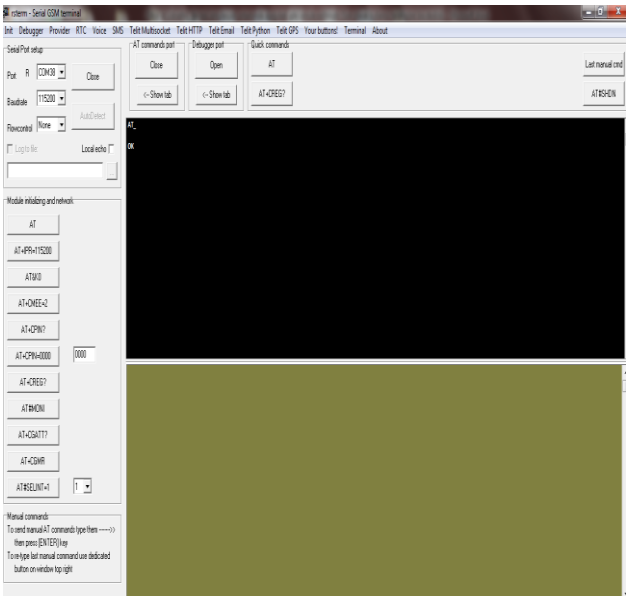

Fig. 5. AT commend applications

The code directory RS_TERM5 is connected to a modem from the computer by AT commends. The code directory has been changed to accelerate the modem speed as seen in picture 4. Primarily the AT commend is used to check the connection settings between the modem and the computer then the AT+CMGF=1 string message command has been added on the programme. A sample massage has been sent to AT+CMGS= +90532XXXXXXX.

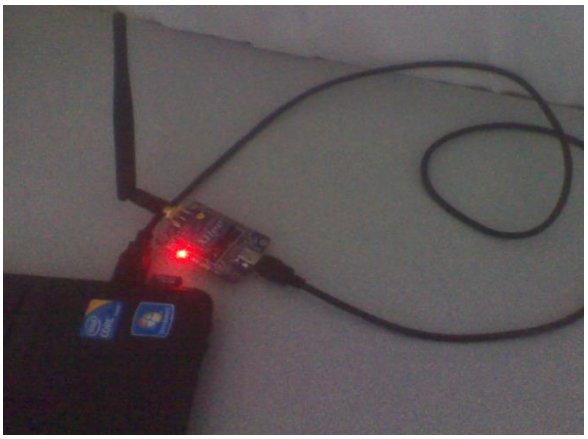

Fig. 6. The data transferred to computer with Zigbee

Fig. 7. The data transmission module with GSM

4 Conclusions

This study has evaluated the heart functions of the patients by the help of a simple portable device. The second phase carrying those signals through a wireless network has enabled the patients to move freely and the real time remote monitoring. The system has also informs the related staff when the threshold bares the limit which was set by the doctor. Nevertheless, Zigbee and GSM modules are likely to create new sector areas. Besides, it is certain that the today's biomedical devices are inevitable to develop more technological biomedical devices, this system has been generated in order to be used at houses and hospitals The signal parameters (threshold) can be given to the patient by a doctor, the buzzer alert, time, buzzer, sending the message, time of the message sent and the health graphics are all to be saved which makes the system even more special.

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