A Novel Method for Pulse Detection using a Resonator

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Abstract— Pulse rate is usually checked to estimate overall health and fitness level of the heart. For the most part, the heart rate should be monitored continuously for the patients with heart problems for instance bradycardia or tachycardia. So for continuous monitoring of pulse rate is achieved through photoplethysmography (PPG) which has a drawback of surrounding lights interference. The proposed technique uses a wrist pulse sensor with a resonator which transmit RF signal to the major artery. The RF signal gets reflected from the walls of the radial artery which is sensed by the resonator Antennae. This system shows better results when compared to PPG.

Key words: Bradycardia, PPG, radial artery, RF Resonator, wrist pulse

I. INTRODUCTION

Now-a-days many non-invasive communication sensors are implemented and are been in practice. It is also used for sports and regular health care checkup, case in point Heart beat and respiration rate had been taken.

There are non-invasive and regular heart pulse possession schemes on tips of fingers or wrist without the use of nodes. As an illustration the BP sensors for wrist radial artery have been introduced [1,2].In addition to wrist pulse sensors using optical IR signals or red light has been developed based on the fact that it is absorbed by hemoglobin and the reflected light gets saturated to attain the rate of oxygen [3,4]. This is actually known as PPG signal. When it is placed on the wrist the surrounding light gets interrupted. So as to avoid such situation RF sensors are used as it has the capability to attain the physical movement without contact to the object. Till today the sensors are focused mostly on detection of heart beat signal near to the chest [5]-[7]. As the pulse movement of the radial artery is very small the heart movement has to be detected using the wrist artery.

II. SYSTEM DESIGN

A. Block Diagram:

This project consists of patient section and monitoring section. The patient section includes Pulse sensor, power supply, microcontroller, ZigBee module, serial port and a buzzer. The monitoring section consists of ZigBee receiver and a LCD screen.

Fig.1. shows the basic block diagram of the system. (a) shows Patient Section and (b) shows Monitoring Section.

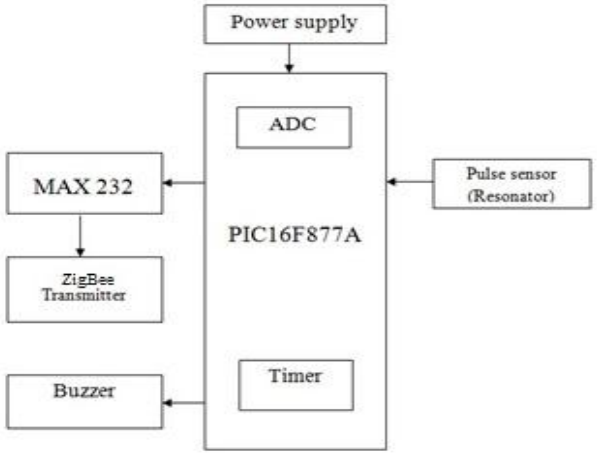

Fig. 1: (a) Patient Section

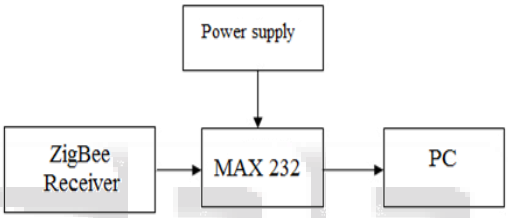

Fig. 1: (b) Monitoring Section

Pulse Sensor senses Pulse rate and sends the signals to the ADC of the Microcontroller which digitizes the signals and averages the signals per minute. The Microcontroller sends the signal to PC through ZigBee transmitter. The buzzer alerts if the transmission is complete. The output is displayed on the PC using Visual Basic software.

B. Pulse Sensor:

The pulse sensor used here is a resonator which is tied to the wrist of the patient. This sensor works based on the principle electromechanical piezoelectricity and resonance. This sensor can produce resonance up to 16MHz.the input to the sensor is given through an electronic oscillator circuit this produces oscillating signal of 16MHz frequency. This oscillating signal is given to the controller for processing.

C. Microcontroller:

PIC16F877A is used as the controller here. It has inbuilt 8-bit ADC. The controller receives the oscillating signal from the resonator and it digitizes and averages the signal at particular samples per minute. The sampled signal is given to the ZigBee to be transferred to the host system.

D. ZigBee:

The transmission in this system is achieved through ZigBee Protocol. ZigBee of frequency 2.2 GHz has been used in this system. ZigBee transmitter is embedded in the wrist strap whereas receiver is attached with the PC available at the Monitoring section.

E. MAX232:

The MAX232 is a serial port that is used here for connecting the controller with ZigBee. The data is transferred through MAX232 from the controller to the ZigBee without any loss.

III. SOFTWARE DESCRIPTION

The host system is programmed with Visual Basic (VB) software and the signal received by the ZigBee receiver is given to the PC. The digital output from the receiver is displayed as analog waveform with the help of VB software. The normal and abnormal waveforms are analyzed manually.

IV. EXPERIMENTAL RESULTS

The system was tested with three patients at different physical conditions. The pulse output obtained was clinically meaningful with greater accuracy. The accuracy analysis is represented using a bar chart.

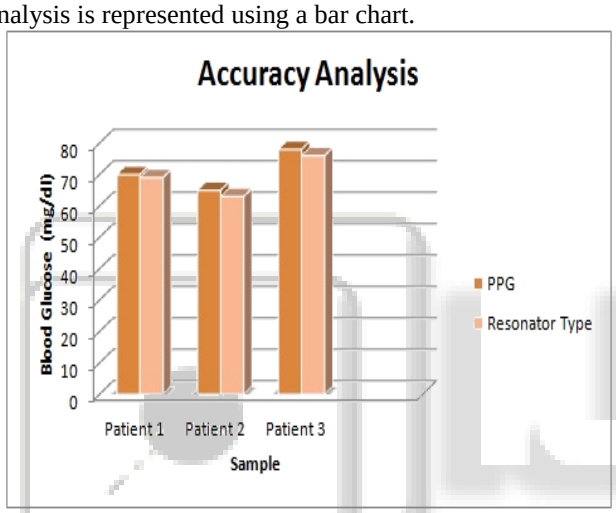

Fig. 2: Accuracy Analysis Chart

V. CONCLUSION

This paper has demonstrated an efficient and alternative technique for pulse detection. The resonator has the capability to detect low frequency pulses too. With some modification this system can be used to transmit patient pulse to physicians at a farthest distance.

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