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Patient Monitoring System for Cardiovascular patient with body temperature using Lab VIEW

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Abstract:- A "managed care model" has been realized to permit both a continuous patient check without hospitalization. Here the main focus is on designing hardware and software architecture for people who stay alone at home and suffering from heart diseases and developing a hardware which will sense the heart rate and temperature of the patient. These ECG and temperature has been automatically processed by "LAB VIEW" through a multi parametric approach based on time & frequency domain study. Advanced characteristics have been utilised by this monitoring prototype and different technologies such as data acquisition, elaboration, and online transmission have been integrated knowledge management. In this way it is possible not only data real time visualization and collection but also Continuous patient management useful to improve patient life quality.

Keywords:- ECG, Lab view mail, Patient Monitoring Signal processing, Temperature

I. INTRODUCTION

To reduce both time and hospitalization costs, this patient monitoring system plays an important roles [1].Cardiovascular diseases are leading cause of health globally and it is estimated to remain in the number one position. Heart attack or stroke caused 76% of these death[5].ECG monitoring can used to forecast possible coming heart problems[3].The system would constantly monitor important body parameters like body temperature and heart beat[2] and the data transmitted to the Email id of doctor. In such case the patient will get a quick medical help and also would save time and energy of the doctor who neither would have to be with them all the time and the doctor always know the condition of his patient continuously [2,4].This project design make use of PIC Microcontroller (PIC16F877A) for interfacing to various hardware interfaces like ECG module and temperature sensor [1, 2].Technology today is swing it's heights in all the areas, especially in the area of embedded system. By using this system wireless data can be received by pc interfaced card using Bluetooth through serial port and it can be monitor on pc in "LABVIEW" frontend with report generation. For frontend design we are using "LABVIEW" software because through this it is easy to develop without writing any character based long program. The programming which is used in "LABVIEW" is "G" (graphical) programming. So it is very easy to develop and creating it's setup for any platform in comparison to others.

Fig.1: Complete circuit to read heart beat and temperature

II. METHODS

A. Subjects

There are two types of subjects are included in this study. One is the healthy subject and another one is hypertensive subject after doing 10 min exercises.

B. ECG Measurement Instrument

The heart rate is measured by using an inflatable hand cuff. The device is consisted three main parts: external hardwires (such as cuff, motor, valve and LCD), analogue circuit and microcontroller.

Fig.2: Heart beat measurement module

The analogue circuit converts the pressure value inside the cuff in to readable and usable analogue waveforms .the MCU samples the waveforms and performs A/D conversion so that further calculations can be made. The MCU also controls the operation of the devices such as the button and LCD display. Since it is a portable device so it allows the user to take it anywhere and perform a measurement wherever the subject wants.

C. Heart rate monitored

To perform a heart rate measurement we use a method called oscillometric method. The air will be pumped in to the cuff to be around 20mmHg above average systolic pressure (about 120 mm Hg for an average).After the air will be slowly released from the cuff causing the pressure in the cuff to decrease. As the cuff is slowly deflected, we will measuring the tiny oscillation in the air pressure of the arm cuff this oscillation is produce through heart and we can say this is nothing but heart pulse.

D. Body temperature

Body temperature can vary with other factors such as drinking hot or cold water or sitting in a cold room. The normal core body temperature of a healthy adult human being is stated to be 98.4 degree Fahrenheit or 32.0 degree Celsius. The body temperature here sensed by a digital temperature sensor that is DS1621. This temperature sensor measures temperature from -55 degree c to 125 degree c in 0.5 degree c increments. Fahrenheit equivalent is -67 degree f to 25degree f in 95 degree f increments.

E. Data acquisition

The core of the acquisition board used to collect data is a microchip PIC16F877A microcontroller for interfacing various hardware data interfaces like ECG module and temperature sensor.
By using this system wireless data can be received by pc interfaced card using Bluetooth through serial port and it can be monitor on pc in LABVIEW front-end with report generation.

F. Body Temperature and ECG Signal processing by using LABVIEW

The program developed in LABVIEW has been designed to analyze ECG signal and body temperature. As a first step, the body temperature which was measured by using temperature sensor that is we can see in lab view front panel and ECG signal was measured by ECG module was stored in a file format as to extract relevant clinical parameters of the signal, then it has been applied to a multi parametric approach to extract information about HRV.

1): ECG Feature Extraction

The classification of ECG patterns is based on features that are used to describe the ECG. This parameterization must provide the necessary differentiation between the different pattern types and must be such that features are clinically meaningful. In this work the noisy input ECG signal filtered by using band pass filter in lab view program and the 'PQRST' signal is formed which shows the heart rate mean, QRS amplitude mean, QRS time mean, RR interval mean, QT interval mean, heart rate standard, QRS amplitude standard, QRS time std, RR interval std and QT interval standard.

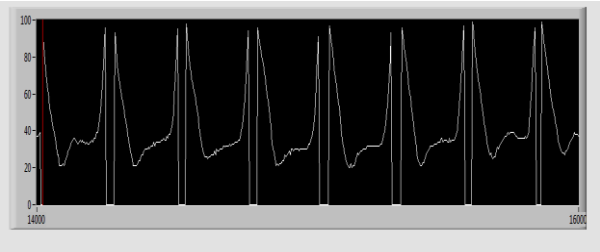

Figure 3.Input ECG signal with noise

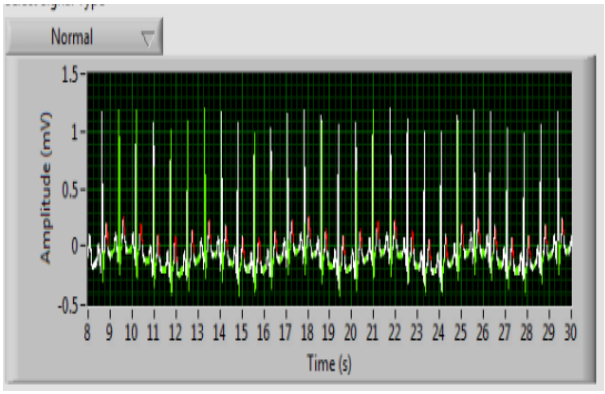

Fig.4: PQRST signal ECG parameters estimation

Once the 'PQRST' signal obtained it permits to process automatically HRV on time domain and frequency domain by a multi parametric approach. It has been obtained RR mean, RR standard, HR mean.HR standard, NN50, pNN50 (percentage of differences between adjacent RR interval exceeding 50msec), RMSSD (the root mean square of the sum of the squares of differences between adjacent RR intervals).

G. Temperature and ECG process transmission and storage

Once the clinical parameter ranges were defined, by pressing the Report button shown in fig.5 (at right side) all the processing results were stored in an Excel file and immediately these data are send to the E-MAIL ID of physician which was previously stored in front panel mail box shown in fig.6.The system has been projected stored 30 sec ECG signal, temperature and other clinical parameters in Excel file format as shown in fig.5.

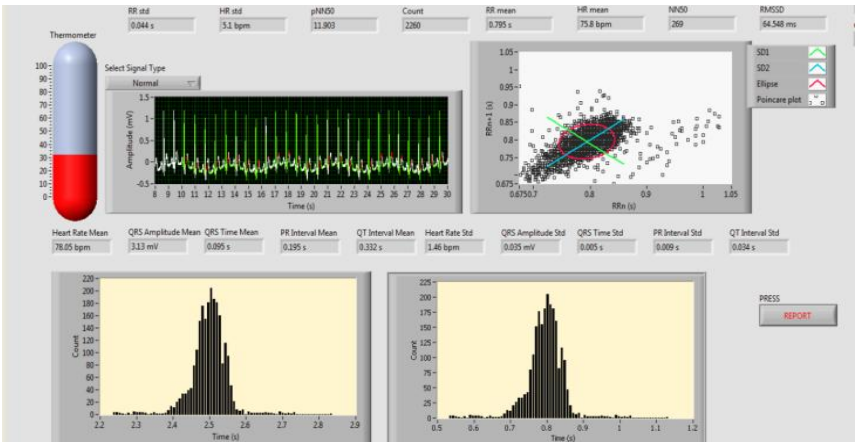

Fig.5: Results in Excel file format

In fig 5, the thermometer present in left side of the excel file that shows the body temperature. After processing of input ECG signal the "PQRST" signal is formed that is shown in this fig. The left side shows the histogram of input ECG signal and the right side shows the reference histogram by which we can compare the recent histogram with the reference histogram. In the top the Poincare plot present that is the plot of recent input signal.

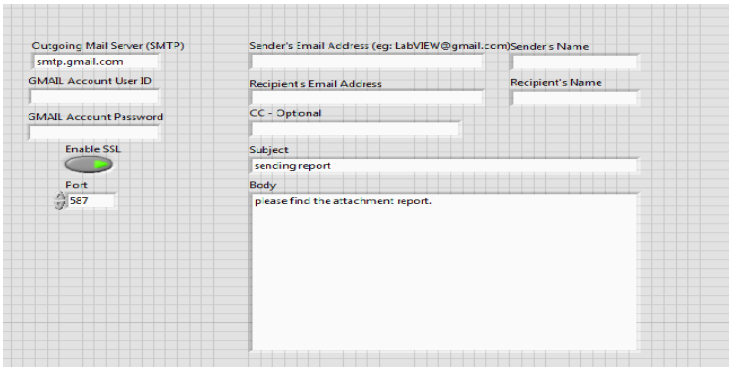

Fig.6: Lab VIEW front panel mail

III. RESULTS

The knowledge-based system realizes a complete and automatic description as concerned HRV pattern of patient after 10minute exercise training. The RR interval histograms of a normal subject and of a hypertensive one are shown in figure.7.The ECG analysis of hypertensive subjects has been useful to underline their electrical instability showing the differences of the adjacent RR lengths.

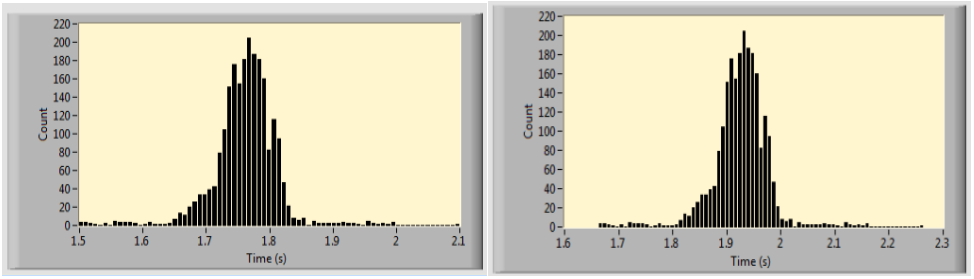

Fig.7: Example of histogram of 30sec RR series belonged to an hypertensive subject and to a normal one is computed

IV. CONCLUSION

This system not only process the biomedical data but also send this important data to the mail id of doctor by which the patient as well as his doctor continuously know the situation of his health. By which the patient receives the medical attention in the nick of time before it is too late.

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