REAL TIME ECG MONITORING SYSTEM USING ARDUINO AND LABVIEW

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ABSTRACT: Remote health monitoring system is an emerging topic which is being studied by many leading scientists. The paper focus on designing an Electrocardiogram using LabVIEW We have designed ECG machine using LabVIEW which can be used to monitor heart of the person and transmit data oncloud server using LabVIEWWeb Publishing Tools so that any person or doctor can access data even when doctor is in a remote location. A three lead monitoring system has been developed using ArduinoUNO and an ECG sensor AD8232 which gives sustainable result of heart monitoring. Through LabVIEW we can also store the data measured by ECG machine on cloud.

Keywords-LabVIEW Biomedical Toolkit, LabVIEWAdvance signal processing toolkit , ECG, ECG Feature Extraction.

1. INTRODUCTION

Remote heart monitoring is among the top researched topics which is being developed by using different software and technologies. One of the most emerging software in recent time is LabVIEW which gives us chance to design any hardware on computer and it reduces cost of production and space. We have also designed a ECG monitoring software using LabVIEW. We have used a 3 lead monitoring system. The three lead monitoring system has three lead one lead is attached to the left arm and the second lead is attached to the right arm and the third lead is attached to the left leg. We have used Arduino UNO and ECG AD232 sensor to design the remote heart monitoring software. The programming of Arduino is done by using Arduino software. The patient can use LabVIEW to upload data on the cloud server. It can be a very crucial for the heart patient whose heart requires continuous monitoring.

2. LITERATURE REVIEW

ECG is used to measure electrical activity which is generated due to the depolarization of heart muscles which travels in form of electrical wave through skin.During rest there is a negative charge in each heart muscles and it is known as membrane potential[1]. When Na+ and Ca++ are in fluxed the negative charge of muscles starts decreasing toward zero and this phenomenon is known as depolarization, it activates the mechanisms in the cell due to which cells contracts [2]. The progression of the depolarized wave is continuous in case of healthy heart and the wave is formed due to the cells present in the node called sinus node. This wave passes through the atrium then it goes through the atrioventricularnode and at the last it gets spread in the ventricles.

This causes the fall and rise of voltage which is detected by the electrodes pads placed on left or right position of heart and the output on the screenvaries[3-4].Good electrode pads are used to pick the signal because it is of very small voltage (microvolt, uV)[5]. A basic ECG setup contains as a minimum of 4 electrodes which are placed at the chest or at the 4 extremities according to standard nomenclatureRA = right arm; LA = left arm; RL = right leg; LL = left leg). There are different variations which are used for placing the electrode on body parts, for instance we can attach the electrodes to the forearms and legs[6]. ECG electrodes are normally moist sensors, requiring using a conductive gel to increase conductivity between pores and skin and electrodes[7].

2.1 THE ANALYSIS OF ELECTROCARDIOGRAM (ECG)

The ECG waveform consist of P,Q,R,S,T peaks. The accuracy of ECG relies upon on the QRS complex. The T and P waves also play the vital position in defining the accuracy of ECG signal. The top chamber of heart and atria is represented via the P waveform. TheQRS complex and T wave represent the excitation of ventricles or the lower chamber of heart[8].

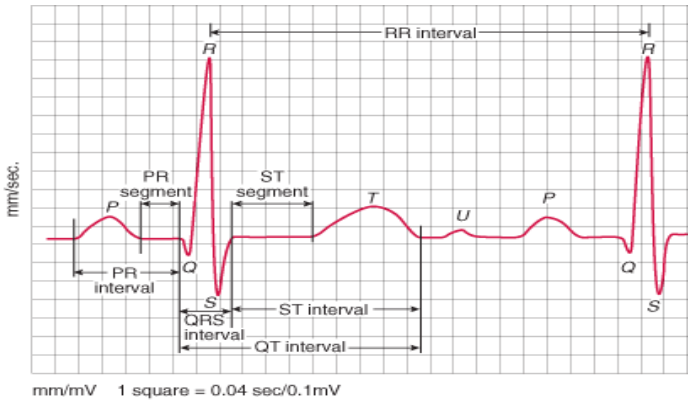


Figure 3 – The PQRST waveform of ECG signal[3]

Table 1: Reference values of normal person [4]

Parameter	Reference Value
Heart Rate	60-100 beats per minute (BPM)
P wave	Duration < 0.12 s; Amplitude < 0.25mV
P-R interval	Duration 0.12 - 0.20 s
QRS complex	Duration 0.04 –0.12s; Amplitude 0.5–1mV
Q-T interval	Duration 0.39-0.42 s

2.1.2CARDIAC DISEASES DETECTED BY ECG

- Tachycardia: When heart beat is greater than 100 in average adult. This situation is termedas Tachyardia.
- Bradycardia- When heart rate is beneath 60 beats in step with minute.
- Lengthy QT syndrome (LQTS): This case arises when ventricles of heart experience postpone of electric expansion and relaxation.

3. MATERIALS AND METHODS

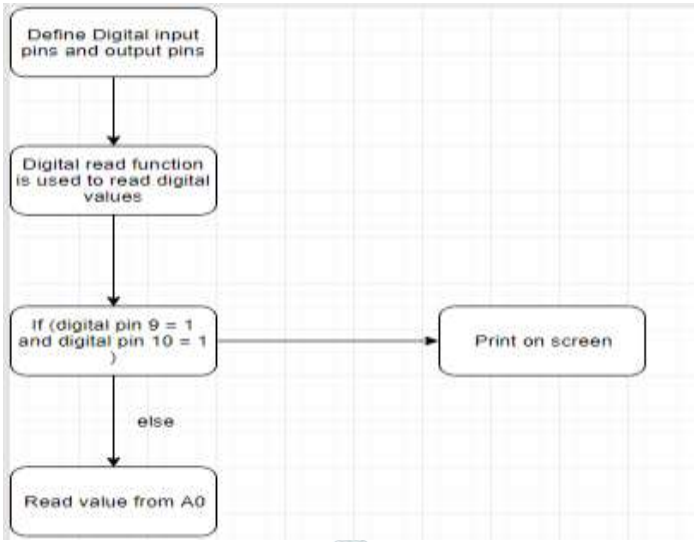
3.1 SOFTWARE

LabVIEW: LabVIEW is software which is developed by National Instruments. LabVIEW consist of two different screens and the first one is known as block panel and second one is known as the front panel. Block panel is used to layout the application with the help of in-built controls and function and the front panel shows the output. With the help of LabVIEW one can layout any hardware. It is used for data acquisition, signal processing(analysis) and hardware control.

Codes which are of graphical type are programmed on the block panel in LabVIEW. Block panel consist of terminals which are basically controls and indicators.Structures and function can be found on function palette andthey can be positioned on the block panel. Wires are used to connect two nodes.A virtual instrument can be used as a program, where front panel act as an interface between machine and the front panel is used to define the input and output of particular node.

Arduino-Arduino software program (IDE) is used to write the code and upload on the board which is used tointerface Arduino with different utilities like MATLAB and LabVIEW. The common language used to write and add code is java language despite the fact that you could use C and C++.

Following program was used to program Arduino UNO in our project.



HARDWARE

1. ArduinoUNO- It is a microcontroller board based on the ATmega328 (datasheet). There are 14 pinswhich are used for input and output (from these 14 pins 6 pins are for output of PWM), 6 pins are for inputs which are of analog type, there is resonator which is of ceramic type and is of 16MHz frequency. The board consist of a USB port, an electric jack, header which is for ICSP, and there is button for reset.

2**.** ECG module AD8232 heart ECG monitoring sensor module Kit.

METHODOLOGY

To extract the ECG signal we used an ECG sensor AD8232 and anArduinoUNO for interfacing with the LabVIEW. The Arduinois used to take values from body with the help of ECG sensor AD8232 and in LabVIEW high pass filter was used to remove noise from the signal so that we can get a clear signal without noise. After that a waveform function is used to indicate the output. An error handling function is also used to handle the error so that the program doesn't stop when error occurs.

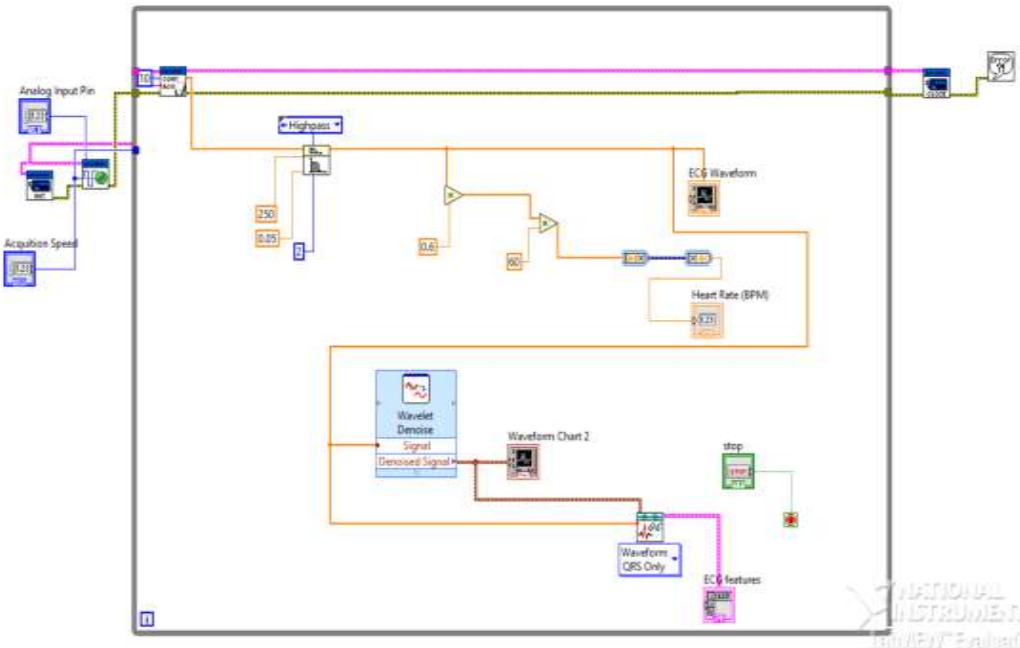
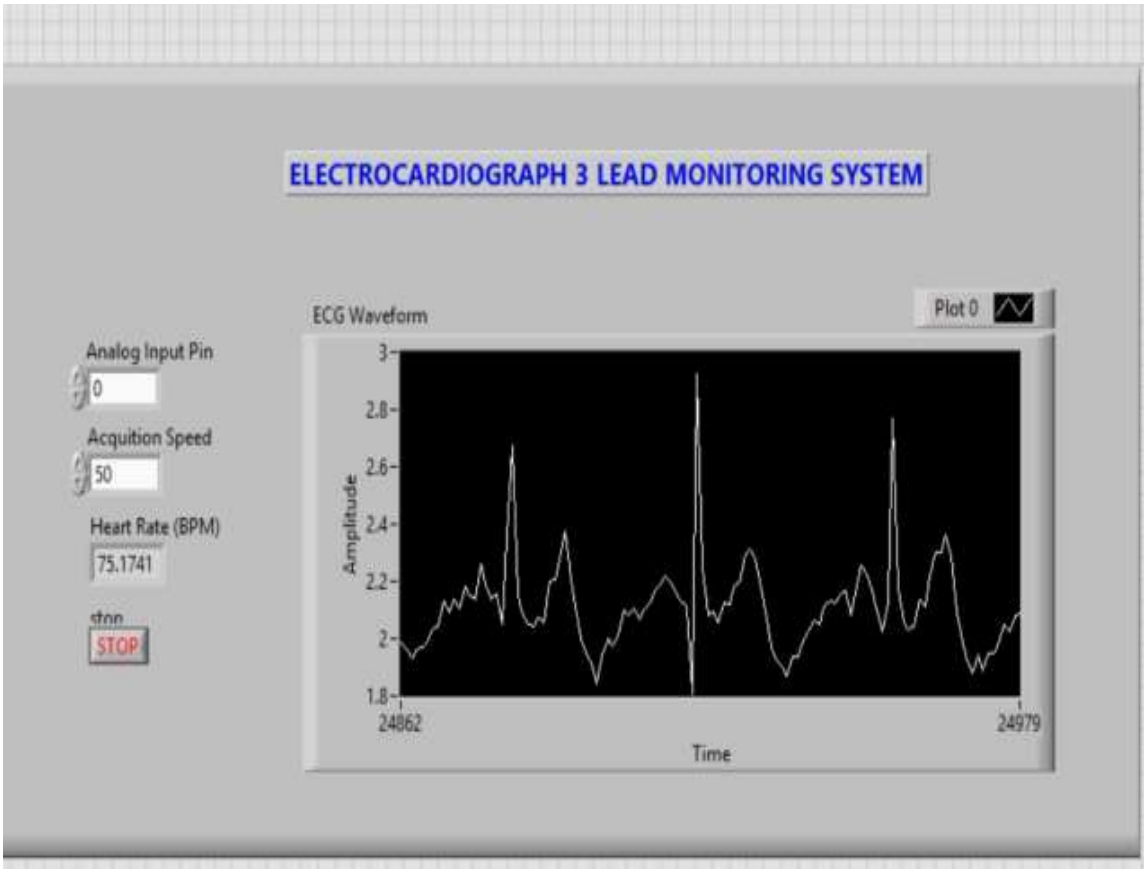


Fig.3.The Block Diagram of ECG

The output is shown in fig 4 and to obtain clearer signal we used a WA denoise function which is available in advance signal processing toolkit. ASP is used to filter signal and to attain clearer signal. A subVI known as peak detector is also used to measure the peak amplitude of signal.



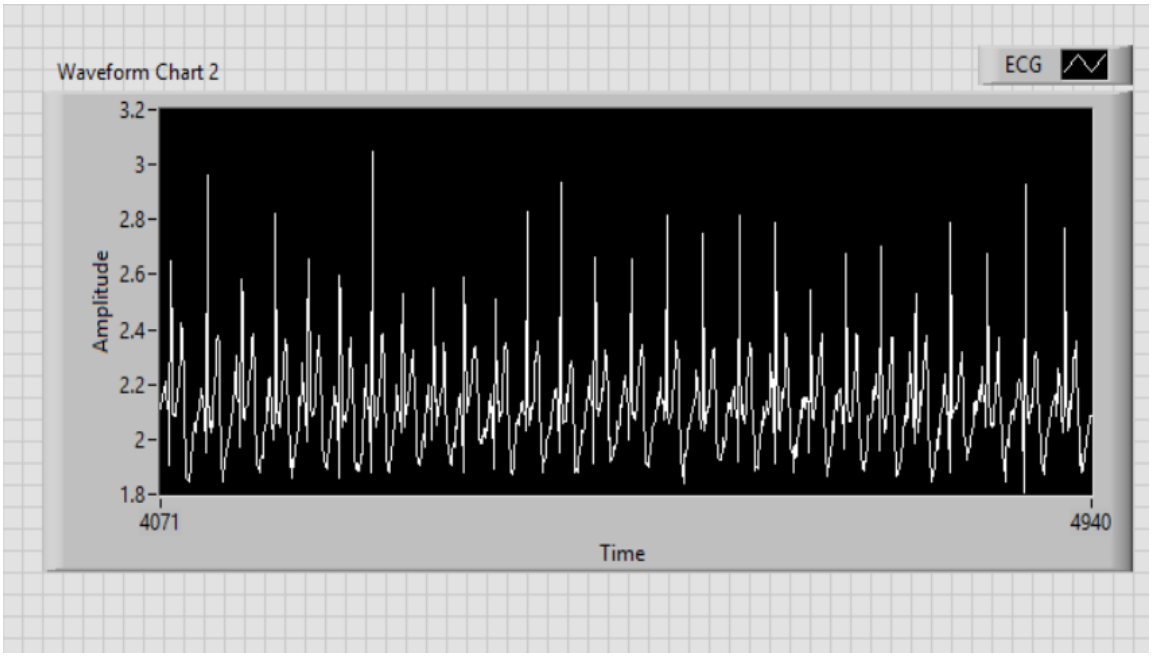
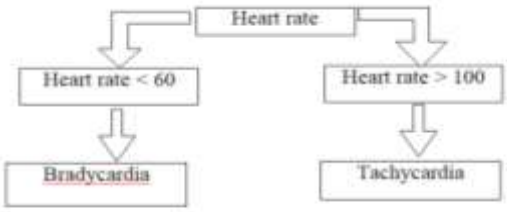


Fig 4 De-noise signal

To detect the heart abnormalities like Bradycardyia and Tachycardia following algorithm is used.



CONCLUSION

Real time analysis of ECG signals using LabVIEW aim at acquiring ECG signal and analysing the signal parameters using Labview. This work focuses on acquisition and analysis of ECG signal, identification of different diseases. LabVIEW can also be used to maintain database of patients. This will help cardiologists and health care system in diagnosis of different diseases. This will reduce cost and size.

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