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Portable Heartbeat Rate Monitoring System by Using LabVIEW

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Abstract

In this paper, we present a prototype for heart rate monitoring. Heart rate monitoring technology can be achieved using the LabVIEW platform. This proposed system deploys integrated devices to monitor individuals in periodic periods via wireless technology. As Biological factors are the only factors that can determine whether an individual is in normal health conditions. The first stage of the proposed system includes monitoring the heart rate, where the heart condition is the most vital sign, to determine the health status of individuals suffering from stress, and thus, converting abnormal states to fully verify the heart signal as the second stage signal.

Keywords: Heartbeat Rate Monitoring, Health Status

1. INTRODUCTION

The death rate in the world has been increasing recently due to cardiovascular and other chronic diseases. Cardiovascular diseases are certain kind of disorders that damage the heart, veins, and arteries. Heart related cardiovascular diseases are like heart attack, stroke, and heart failure. On the other hand, blood vessels related cardiovascular diseases are like coronary

artery disease, which are known as vascular diseases.World Health Organization (WHO) showed that cardiovascular diseases are the most reason for death in the world [1].

In the United States, cardiovascular diseases remain the first reason for the death of patients [2].

Moreover, statistics in Europe, which are based on data from different health institutes such as the European Health Network, showed that in average 2 million deaths duo to cardiovascular disease yearly. Using Heart Rate Monitor is not only limited to healthcare monitors in the hospital or for the elderly.

But, it can be used in sport fields as well. The Heart Rate Monitor will help monitor athletes during both performance and rest periods to maximize the training benefits [3].

The real-time monitoring of individuals suffering from heart problems, particularly patients with cardiovascular diseases, is a significant task [4].

Real-time monitoring of people can help reduce the necessity of direct monitoring by the human in the field and guarantee the monitoring of patients at urgent medical conditions without using substantial and expensive health management.

Thus, the embedded monitoring system development is very vital. Also, it is promising to implement real-time monitoring system by incorporating the electrocardiogram (ECG) signal detection and its processing on the same board [5].

Direct heartbeat detection and real-time heart rate monitoring are the main concerns in modern medical care. Different studies have revealed that many of the cardiovascular diseases could be well recognized, managed, and avoided by real-time monitoring and analysis of electrocardiogram signals [6].

Therefore, the real-time monitoring of body signals like (ECG) signals would open a new general model for the evaluation of cardiovascular disease, which would help control and avoid the disease. Technology developments in different fields like communication networks, signals, and data processing could help improve the performance of real-time monitoring which would provide a new smart, active medical care [7].

Nowadays, smart systems based on electronic devices have attracted people's attention in many fields. Accordingly, designing a new smart system is not related to the used software only. it would be related to the hardware implementation as well to decrease the power consumption and the final system size. Hardware implementation using various new electronic devices has become the best tool for developing medical care systems. These developed systems can handle complex functions because of their certain purpose devices, cost effective, and flexibility [8].

2. BLOCK DIAGRAM

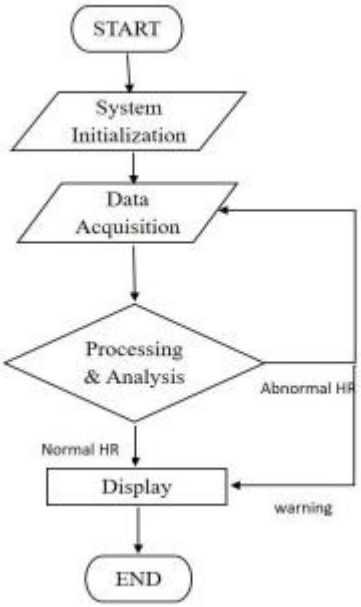

Figure 1 Block diagram of the system

3. SOFTWARE DESCRIPTION

3.1 LABVIEW:

LabVIEW is systems engineering software for applications that require test, measurement, and control with rapid access to hardware and data insights.

The LabVIEW programming environment simplifies hardware integration for engineering applications so that you have a consistent way to acquire data from NI and third-party hardware. LabVIEW reduces the complexity of programming, so you can focus on your unique engineering problem.

LabVIEW enables you to immediately visualize results with built-in, drag-and-drop engineering user interface creation and integrated data viewers. To turn your acquired data into real business results, you can develop algorithms for data analysis and advanced control with included math and signal processing IP or reuse your own libraries from a variety of tools. To ensure compatibility with other engineering tools, LabVIEW can interoperate with, and reuse libraries from, other software and open source languages.

3.2 : SIMULATION DIAGRAM OF HEARTBEAT RATE MONITORING SYSTEM USING LABVIEW:

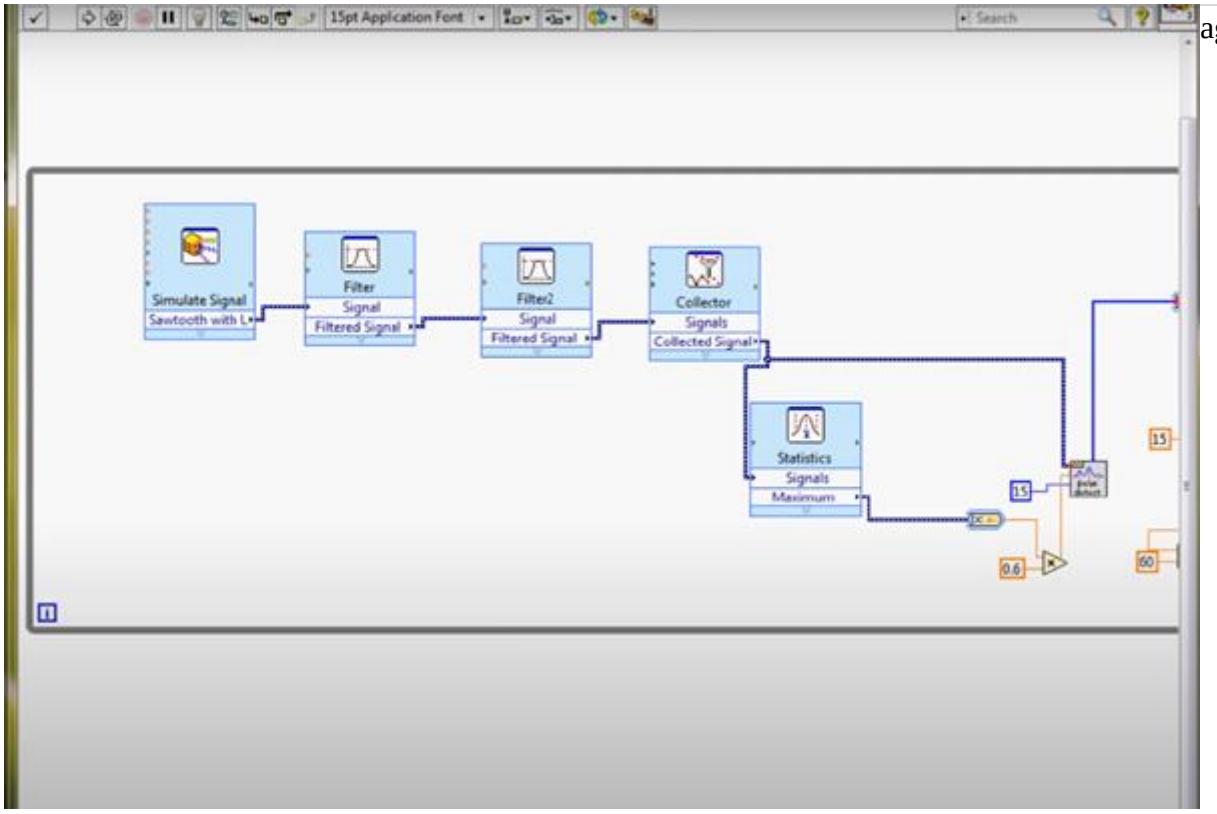

Fig 3.2.1 SIMULATION DIAGRAM OF HEARTBEAT RATE MONITORING

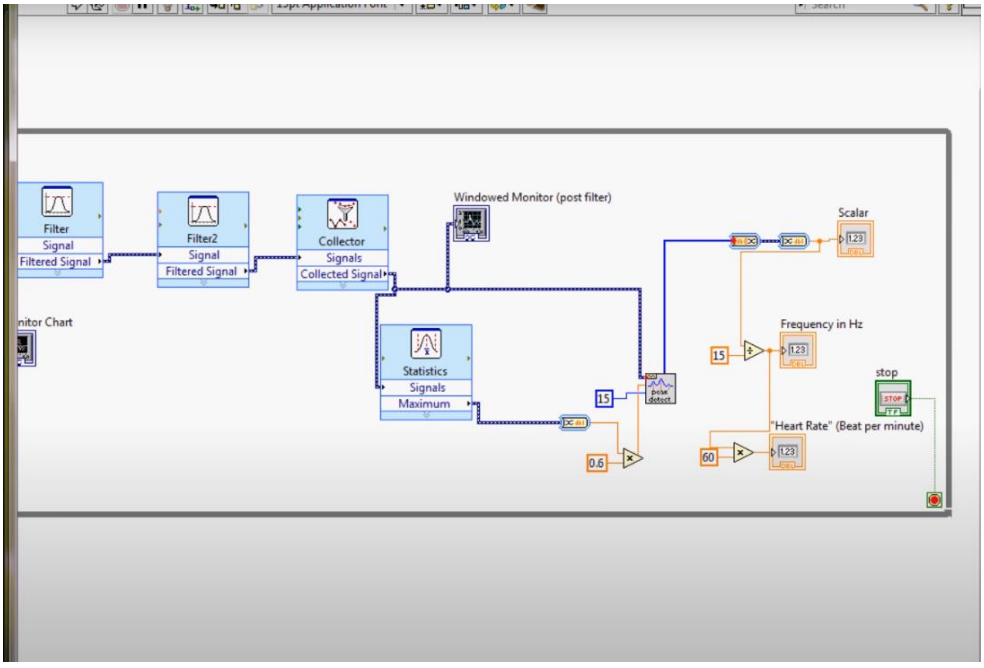

Fig 3.2.2 SIMULATION DIAGRAM OF HEARTBEAT RATE MONITORING 2

4. RESULT

LabVIEW was used to collect data and display the analysis results of the heartbeat rate. Moreover, LabVIEW provides the ability to save the obtained results for future records. Heartbeat signal is frequently employed to distinguish heart and cardiac functions . The implemented system using LabVIEW was used for data acquisition and data saving the input channel. One of the advantages of using this system is its ability to be extended by adding more athletes or channels at the same time. Moreover, it has the ability to read data during collecting signals which could be beneficial for real time applications and visualization . The received analog signals were converted to digital data via the analog-to-digital convertor. After that, digital signal processing was deployed to produce high SNR to improve the system performance.

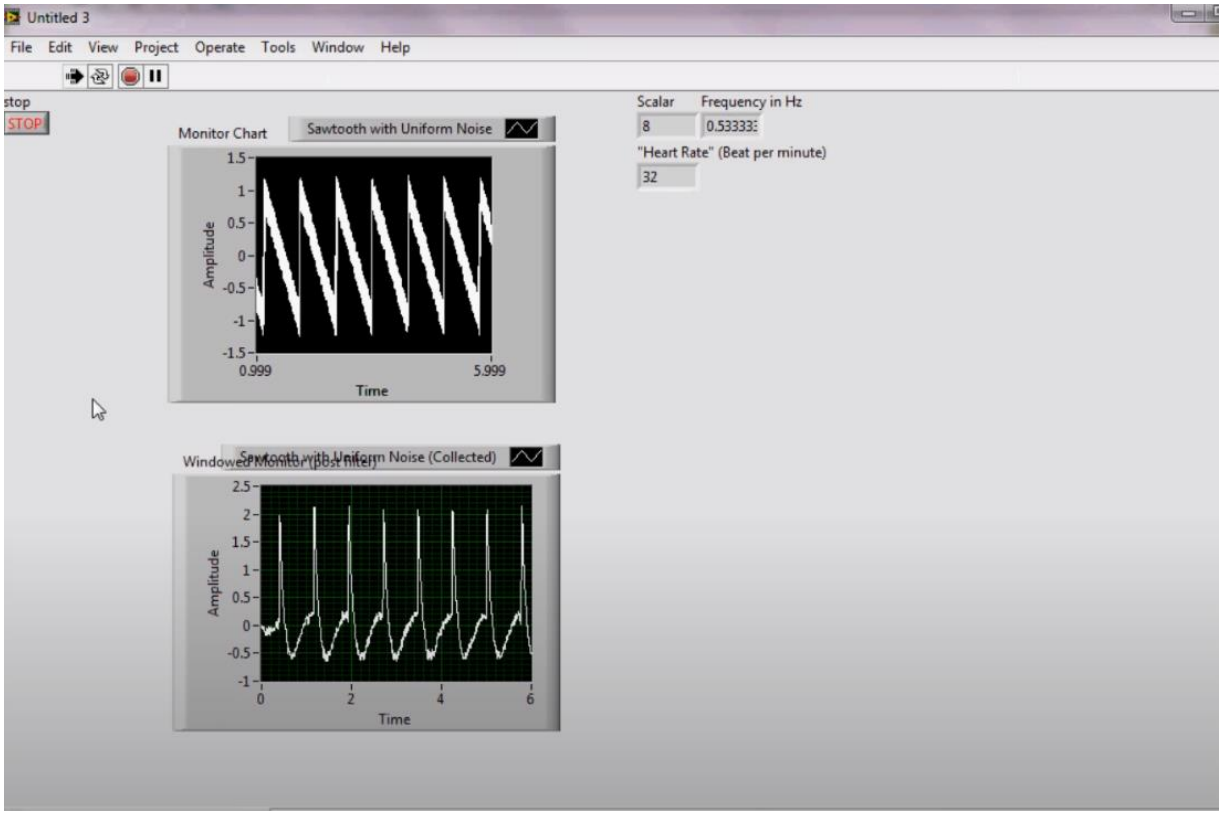

Fig 4.1.1 Real-time output in LabView

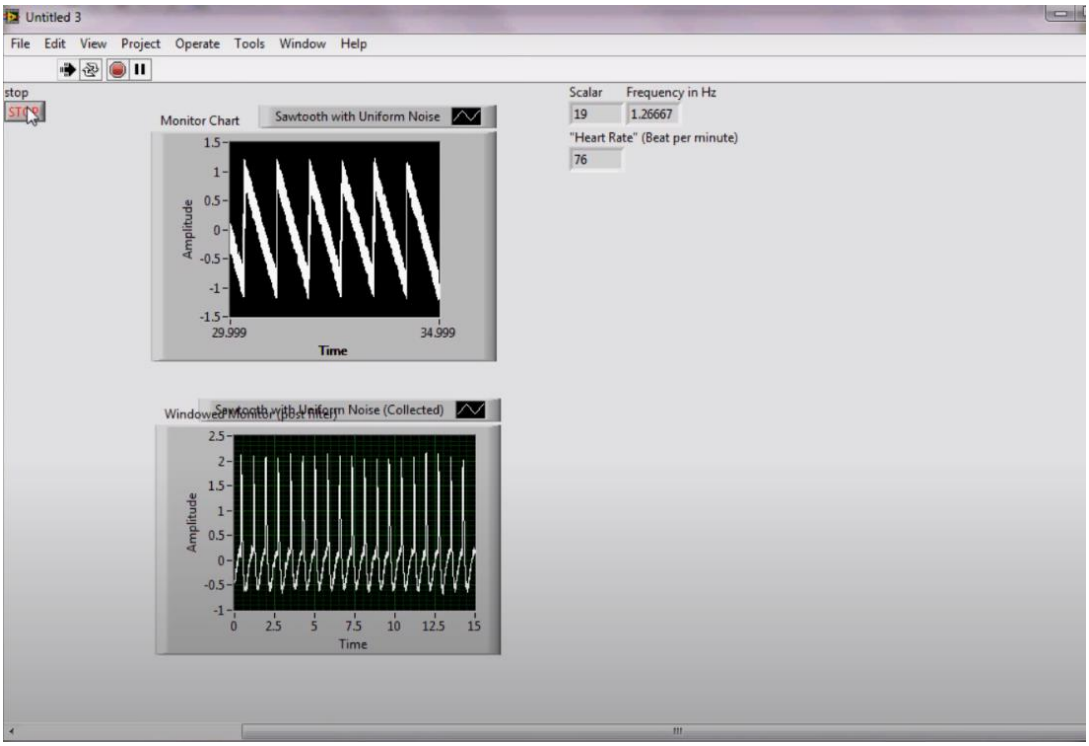

Fig 4.1.2 Real-time output in LabView for various values

Fig 4.1.3 Real-time output in LabView for various body conditions

5. CONCLUSION

In this paper, a real-time wireless heart rate sensor network has been proposed and successfully implemented with the support of the LabVIEW environment . The system allows many individuals to be monitored remotely and simultaneously.This proposed system can remotely monitor many athletes in the field during the training sessions and the real competitions in an efficient way at the same time. The proposed portable heartbeat rate monitoring system is easy and effortless to use with simple working conditions and very small error percentage. In addition, this low-cost proposed system shows good performance in terms of high-speed response and high accuracy compared to the commercially available heart rate monitoring systems that could be useful in medical applications.

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