

Heart Rate Monitoring Using NI MyDAQ

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Abstract: In this paper we use National Instruments Lab VIEW and myDAQ along with a simple circuitry to simulate the heart rate and acquire the data. The heart pumps blood through the body in pulses. The muscles of the heart contract and relax, pushing oxygenated blood through the body and allowing deoxygenated blood to return to the heart, to go on to the lungs. This does not mean that the body is not constantly filled with blood. In reality, it simply means that the arrival of fresh oxygenated blood through the body occurs in pulses that are timed to the heart's contraction, or heartbeat. Pulse can be felt at several pressure points in the body, where the pulsation of the artery is transmitted through bone and flesh to the top layer of skin. Certain areas, such as the, neck and chest allow the pulse to be felt most noticeably. The principle of variable blood flow dictates the operation of this project and other pulse sensors.

I.INTRODUCTION

Body tissue is able to absorb small amounts of light. Some of it is dispersed by organs, some is reflected back by the skin, and a very small amount passes through tissue. This is most noticeable in areas where the skin is thin and mildly transparent, such as finger tips and ear lobes [1].When oxygenated blood fills up capillaries, upon contraction of the heart, the capillary gets mildly larger. The opposite happens when deoxygenated blood returns to the heart. This variable size means that the amount of light absorbed by the tissue changes slightly [2].Most pulse sensors work by shining light through the skin of either the fingertip or earlobe, with a photodiode or light dependent resistor on the other side. If powerful enough, the sensor can detect the change in absorbed light, and produce a voltage that varies with each heartbeat.

In this paper we use this varying voltage to detect the peaks and display the heart rate using NI myDAQ.

II.PROPOSED METHOD

NI myDAQ is a low-cost portable data acquisition (DAQ) device that uses NI Lab VIEW-based software instruments, allowing students to measure and analyze real- world signals. NI myDAQ is ideal for exploring electronics and taking sensor measurements. Combined with NI Lab VIEW on the PC, students can analyze and process acquired signals and control simple processes anytime, anywhere [3].



Figure 1: NI myDAQ

NI myDAQ Hardware Overview:

NI myDAQ provides analog input (AI), analog output (AO), digital input and output (DIO), audio, power supplies, and digital multimeter (DMM) functions in a compact USB device.

The following figure shows the hardware connections of the NI myDAQ.

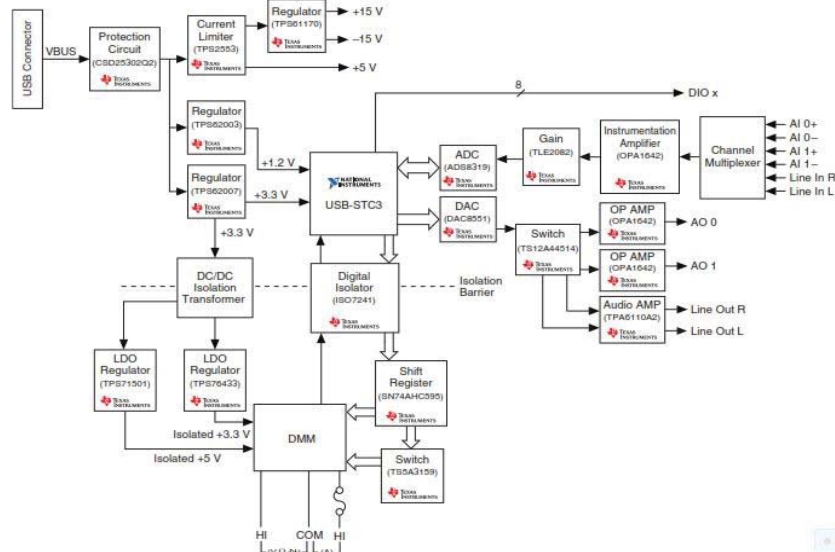


Figure 2: Hardware connections of NI myDAQ

Analog Input (AI):

In NI myDAQ, there are two analog input channels. The analog input channels can be configured either as general-purpose high-impedance differential voltage input or audio input. These inputs are multiplexed; which means that single analog-to-digital converter (ADC) is used to sample both channels.

Analog Output (AO):

In NI myDAQ, there are two analog output channels. The output channels can be configured as either general-purpose voltage output or audio output. Both channels have a dedicated digital-to-analog converter (DAC), so they can update simultaneously.

Digital Input/output (DIO):

In NI myDAQ, there are eight DIO lines. Each line is a Programmable Function Interface (PFI), which means that configures as a general-purpose software-timed digital input or output, or it can act as a special function input or output for a digital counter.

Power Supplies:

There are three power supplies available for use on NI myDAQ. Analog components such as operational amplifiers and linear regulators are operated by +15V and -15V whereas digital components such as logic devices are operated by +5V and -5V.

Digital Multimeter (DMM):

The NI myDAQ DMM provides the functions for measuring voltage (DC and AC), current (DC and AC), resistance, and diode voltage drop. DMM measurements are software-timed, so update rates are affected by

the load on the computer and USB activity.

Making Signal Connections with NI myDAQ:

Setting up Your NI myDAQ Device:

The screw terminal connector must snap securely into place to ensure proper signal connection.

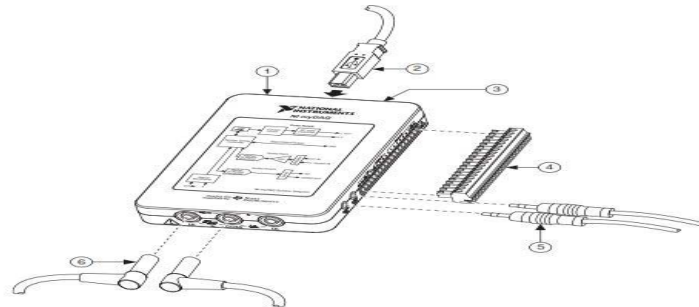


Figure 3: myDAQ Connection Diagram

Connecting Signals:

Figure shows the available audio, AI, AO, DIO, GND, and power signals accessed through the 3.5 mm audio jacks and screw terminal connections. Refer to table for descriptions of these signals [6].

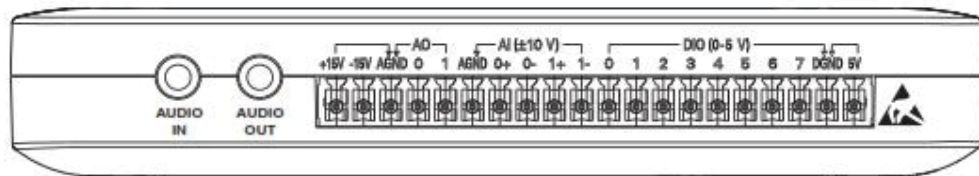


Figure 4: NI myDAQ 20-Position Screw terminal I/O Connector

Connections for DMM Measurements:

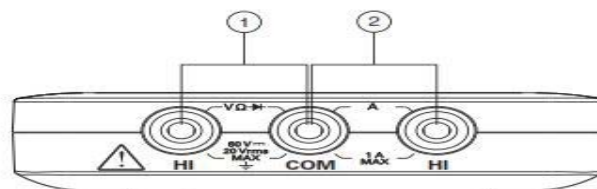


Figure 5: Connections for DMM Measurements

1. Connectors for Voltage/Resistance/Diode/Continuity
2. Connectors for Current

Digital I/O (DIO) and Counters/Timers:

There are eight, software-timed DIO lines on the NI myDAQ that can be individually configured for input or output. Additionally, lines DIO <0,4> can be configured for counter/timer functionality. The input—accessed through DIO 0, DIO 1, and DIO 2 signals configured as a counter which is used for counter, timer, pulse width measuring, and quadrature encoding applications.

III. RESULTS

The VI shown above is run using Lab VIEW 8.0 or later to get the desired outputs. The following figure shows the hardware circuitry connected to NI myDAQ.

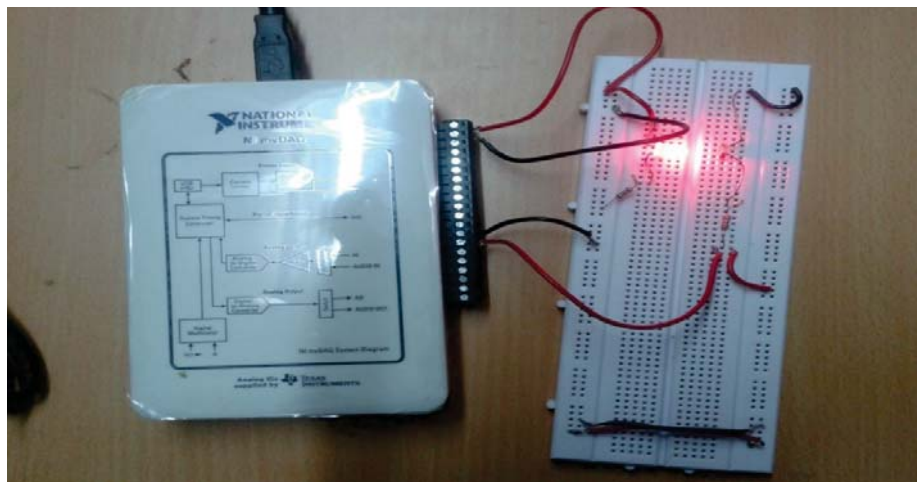


Figure 6: NI myDAQ connected by Hardware Circuitry

The below figure shows the screen shot of the front panel indicating the heart rate in beats per minute.

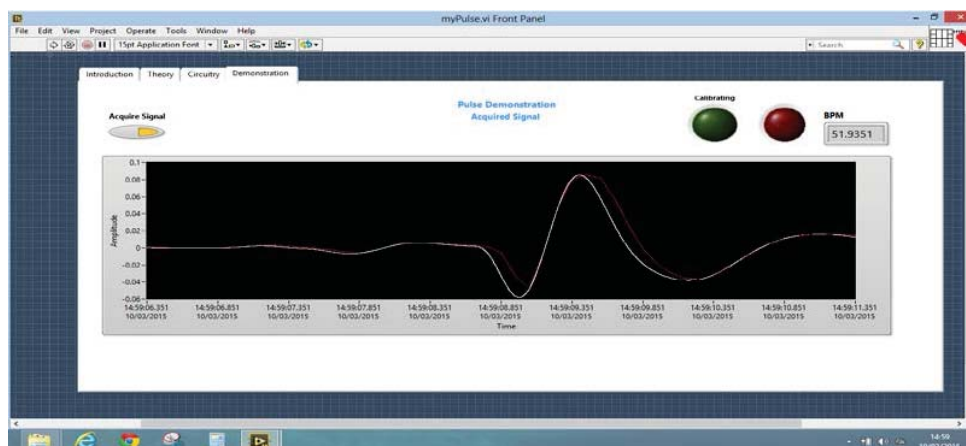


Figure 7: Screen shot of the front panel indicating heart rate

The following table shows the readings obtained from NI myDAQ.

S.no.	Beats Per Minute (BPM)
1	51.957
2	51.9351
3	59.671
4	55.692
5	53.624
Avg	54.5758

Table 1: output values

Hence from the above table it is deduced that the average beats per minute acquired from NI myDAQ heart rate monitor is 54.5758 BPM. These results are validated against the Vernier heart rate sensor using NI ELVIS- II board for checking the accuracy.

IV.CONCLUSION

A Low Cost Portable *Heart beat monitor using* Infrared sensor is a Bio-medical product been used as a sensor to measure the *heart rate* and *NI-myDAQ* to convert the Analog output signal to Digital signal. The heart rate monitor demonstrates how valuable LabVIEW can be on a daily basis of a person's live. LabVIEW have many uses and help us publicize deeper and enrich our curiosity to develop new and innovative thoughts. In this paper we use National Instruments LabVIEW and myDAQ along with a simple circuitry to simulate the heart rate and acquire the data.

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