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PC BASED MONITORING OF HUMAN BIOLOGICAL SIGNALS USING LABVIEW

Dr. M. Shanmugavalli V[1]*, Mathangini M[2], Praveena M[3], Kaavya N R[4]

Professor, Department of Instrumentation and Control Engineering, Saranathan College of Engineering, India.[1]

Student, Department of Instrumentation and Control Engineering, Saranathan College of Engineering, India.[2]

Student, Department of Instrumentation and Control Engineering, Saranathan College of Engineering, India.[3]

Student, Department of Instrumentation and Control Engineering, Saranathan College of Engineering, India.[4]

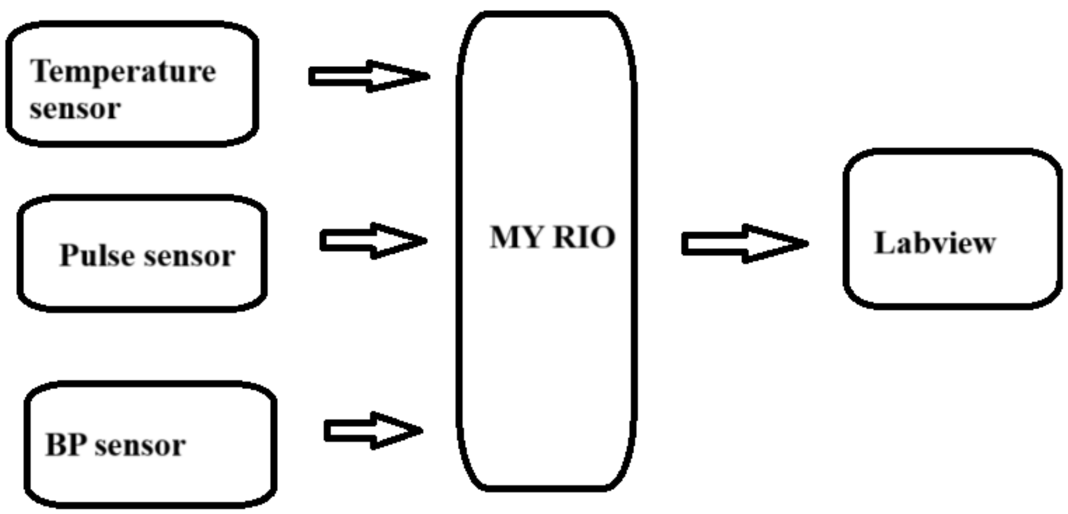
Abstract: PC-based monitoring of human biological signals using LabVIEW is an indirect method for measuring human biological parameters, which helps determine whether a person is in a normal or abnormal condition. Human body parameters such as body temperature, pulse rate, blood pressure, and respiration rate are commonly used to assess health. These parameters are measured from the external surface of the body, which characterizes the indirect method of measurement. Sensors like LM 35, XD 58C, and 6820 are used to measure temperature, pulse, and blood pressure signals. These signals are then interfaced with the LabVIEW simulator through myRIO. The obtained signals are compared with normal parameter values, and if any abnormalities are detected, the system provides an output indicating the issue.

Keywords: LabVIEW, myRIO, Temperature sensors, Pulse sensor, Pressure sensor, Pulse rate, Blood Pressure.

I. INTRODUCTION

Monitoring human biological signals is crucial in areas such as ICUs and operation theatres, where patients may have an immediate reaction to acute events. In the past, it was challenging to determine the abnormal condition of a patient, and it required a nurse to be present for each patient to monitor the signals continuously. To address this issue and reduce the need for many nurses in a hospital, an easy approach to monitoring human biological signals can be implemented using LabVIEW. LabVIEW is an easy-to-understand programming language that simplifies the process. By using LabVIEW, a program can be developed to determine whether a person's condition is normal or abnormal through the use of appropriate sensors.

II. BLOCK DIAGRAM



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III. HARDWARE DESCRIPTION

The hardware that has being used in this paper is that the temperature sensor(LM 35), the pulse sensor (XD58C AMPED), the blood pressure sensor (1620 pressure sensor) and myRIO. These sensors are connected in the bread board using circuit diagram. Myrio hardware set up is connected to the labview. jumper wire is used to connect the sensors to the myrio.

Pulse sensor:
The pulse sensor used in this paper is the XD58C (AMPED), which is designed to test heart rate sensors. It is suitable for students, artists, athletes, creators, and mobile terminal developers to create heart-related and interactive projects. The sensor can be worn on the finger or earlobe and features an open-source app that displays real-time heart rate data in graphical form. Essentially, the heart rate sensor integrates an optical amplifier and a noise elimination circuit, requiring a 3V or 5V power supply. The sensor specifications include a red color, FR4 material, a power supply of 3V-5V, a magnification of 330, and a wavelength of approximately 609 nm. The sensor's output is obtained by connecting it to myRIO for data processing.

Temperature sensor:
LM35 is a temperature measuring device having an analog output voltage proportional to the temperature. It provides output voltage in Centigrade (Celsius). It does not require any external calibration circuitry.The sensitivity of LM35 is 10 mV/degree Celsius. As temperature increases, output voltage also increases. It is a 3-terminal sensor used to measure surrounding temperature ranging from -55 °C to 150 °C. The output is linear, which means it is straightforward to convert the voltage output into a temperature reading. It typically operates with a supply voltage between **4V and 30V**, and it works with both single and dual power supplies.

Pressure sensor:
The sensor used in this paper is a 1620 tyre pressure sensor, which measures pressure in millivolt format. This value is then converted into an approximate mmHg value using LabVIEW coding. The pressure sensor is designed to meet the requirements outlined in the Association for the Advancement of Medical Instrumentation (AAMI) specification for blood pressure transducers. It consists of a pressure-sensing element mounted on a ceramic substrate, with thick-film resistors laser-trimmed for compensation and calibration.

A plastic cap is attached to the ceramic substrate, providing an easy method for attachment to the customer's assembly and offering protection for the sensing element.The sensor features include low cost, multiple configurations, top-side pressure entry, a solid-state piezoresistive sensor, and an integral dielectric gel barrier. The sensor is connected to a microcontroller and SMPS to ensure the voltage is at the correct level, enabling easy determination of the pressure.

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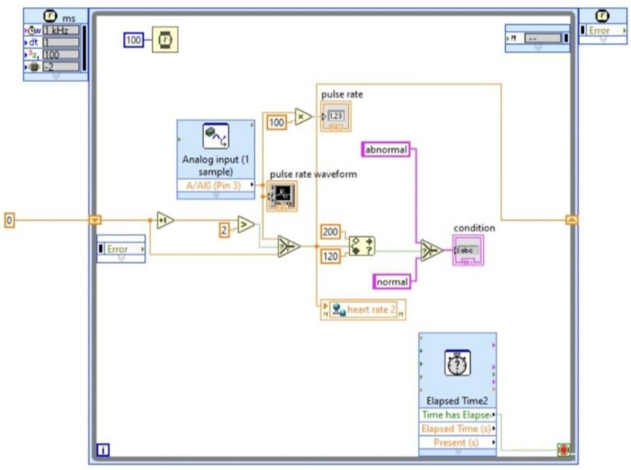
NI myRIO

NI myRIO (National Instruments myRIO) is a compact, portable, and high-performance embedded system designed for education, research, and industrial applications. It integrates real-time processing, I/O connectivity, and an intuitive development environment to create solutions for control, monitoring, and measurement systems. myRIO features an ARM-based real-time processor, providing the capability to process data and control systems in real-time. This is crucial for applications requiring immediate feedback or control, such as robotics, embedded control systems, and industrial automation. **Analog inputs** (16-bit resolution) and **digital I/O** make it suitable for applications involving sensors, motors, and actuators. It integrates seamlessly with **NI LabVIEW**, allowing users to program and interface with the myRIO system using graphical programming. This enables rapid development of systems without the need for low-level code writing.

IV. STIMULATION

The simulation for all the three sensor is being explained this paper to obtain the result in correct format. The correct format is that for temperature in oC, pulse in beats per minute and blood pressure in mmHg. The obtained result can also be checked whether the obtained output is in normal or in abnormal form is determines whether the Patient is in normal condition or in abnormal condition. The simulation for different types of sensor is being described in this paper.

A. Simulation for Pulse Rate:



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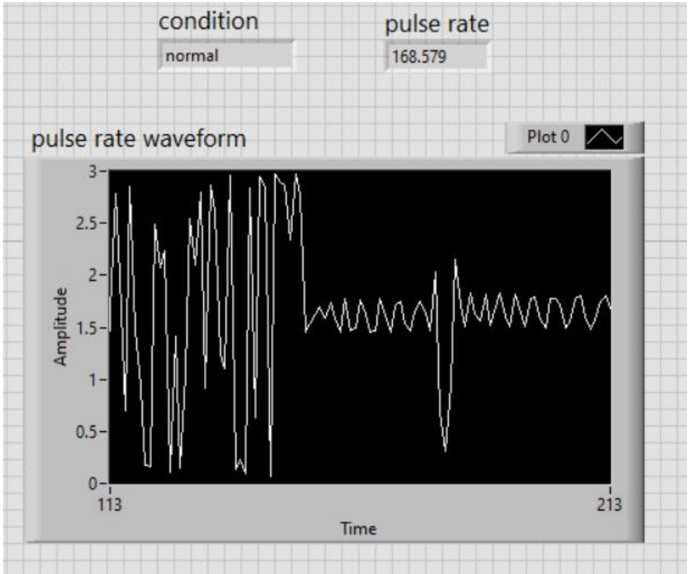
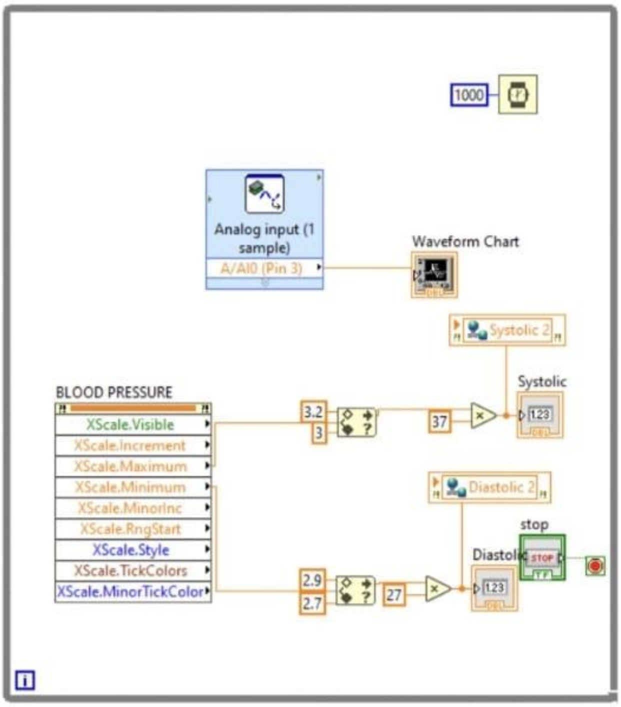
The simulation for pulse rate in order to obtain the output in beats per minute. The elapsed time is being used to stop the pulse within one minute. The pulse is normally determined in one minute to know the pulse rate being obtained. The normal pulse range is of about 60-80 beats per minute. The pulse range will be obtained in beats per minute. The output will be in the form of in which obtained in front panel.

Execution of Pulse Rate:



The pulse rate being noted down in the front panel. The normal and abnormal range is also detected. A numerical valu-+e of "168.579" is displayed as the current pulse rate. This is a relatively high pulse rate for an adult at rest, which typically ranges between 60 and 100 beats per minute. The central element is a time-series plot labeled "pulse rate waveform". The x-axis represents "Time," ranging from approximately 113 to 213 units .The y-axis represents "Amplitude," ranging from 0 to 3.

B. Simulation of Blood Pressure:



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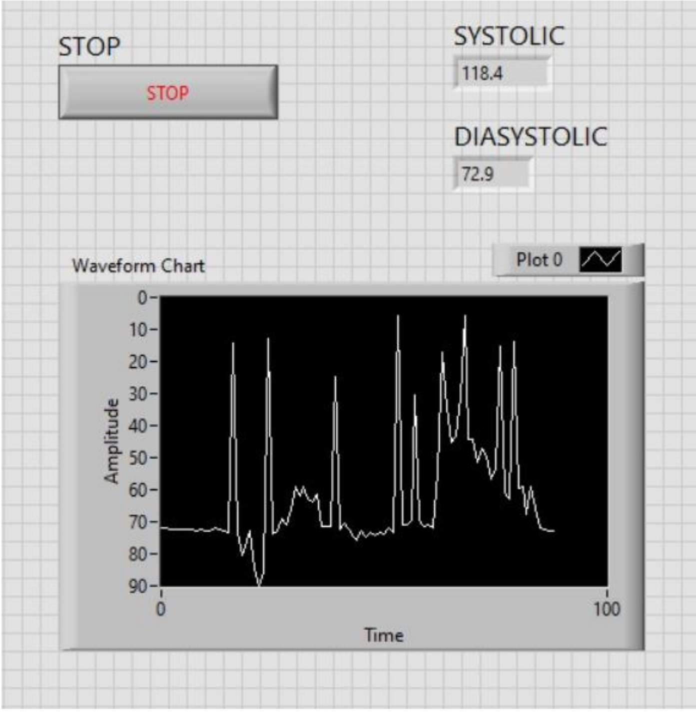
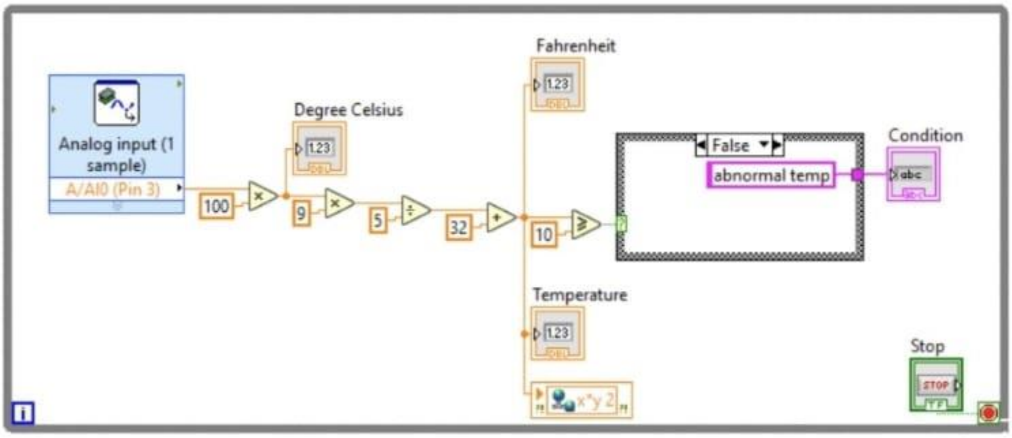
The blood pressure should be obtained in the form of mmHg. But the output will be in the form of millivolt in which it should be converted into mmHg format where the LabVIEW is being programmed to obtain directly into mmHg format. This shows the implementation for blood pressure. By running the program the output will be obtained in systolic as well as in diastolic state. The normal and abnormal of the person can also been determined using this program. It reads an analog input, processes it to extract systolic and diastolic values, and displays these values numerically ("Systolic" and "Diastolic"). There's also a "Waveform Chart" to visualize the raw or processed blood pressure signal over time. The "stop" button allows the user to halt the data acquisition.

Execution of Blood Pressure:



A numerical indicator labeled "SYSTOLIC" displays the value "118.4". This represents the systolic blood pressure measurement. Systolic pressure is the maximum pressure exerted be the heart when it contracts and pumps blood. A numerical indicator labeled "DIASYSTOLIC" displays the value "72.9". This represents the diastolic blood pressure measurement. Diastolic pressure is the minimum pressure in the arteries when the heart relaxes between beats. The output being obtained for the blood pressure in terms of systolic and diastolic is obtained. As the blood pressure is being noted in 20 to 50 seconds an automatic stop is not being connected only manual stop is being used. The normal range of systolic and diastolic state is being of 120/80mmHg. The range is also being noted down.

C. **Simulation for Temperature:**



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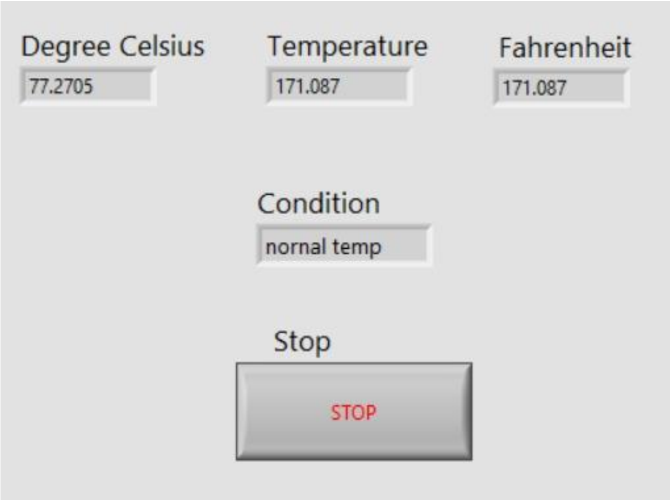
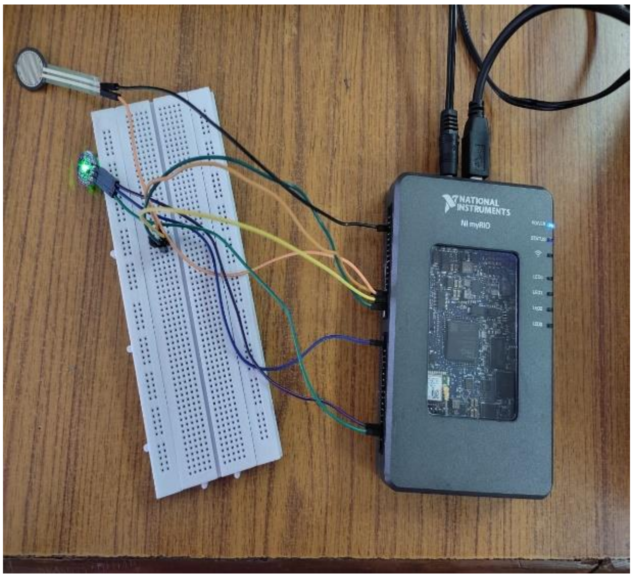
The above shown in fig 6 is the implementation for temperature. The temperature sensor is being used in which LM 35 which it is being interfaced with the myRIO. The myRIO is being connected and LabVIEW program is being done to obtain the millivolt form into oC and Fahrenheit form. The normal range of temperature of human body is of about 37oC and Fahrenheit of 98.6f. The obtained output will be shown in the Front panel of the LabVIEW. The formula node is being used in order to convert the millivolt into oC.

Execution of Temperature:



A numerical indicator displays the temperature as "77.2705" degrees Celsius. Another numerical indicator shows the temperature as "171.087". The label "Temperature" is somewhat ambiguous without a specified unit, but given the other readings, it's highly likely this is also displaying the temperature, perhaps a raw sensor reading or an intermediate value. A numerical indicator displays the temperature as "171.087" degrees Fahrenheit. Notice that the Fahrenheit value is numerically different from the Celsius value, which is expected due to the different scales. A button labeled "STOP" is present. This button likely allows the user to halt the temperature monitoring process or the execution of the program.

V. HARDWARE SETUP



VI. CONCLUSION

Human biological signals are efficiently acquired from sensors and meticulously recorded utilizing a custom-designed LabVIEW program. This intuitive platform facilitates the real-time observation and annotation of physiological data, clearly distinguishing between normal and abnormal conditions.

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This approach to human signal monitoring offers a streamlined and accessible method for patient surveillance. Specifically, the myRIO hardware platform serves as the interface for signal acquisition, enabling a straightforward and robust pathway for obtaining crucial physiological information. The LabVIEW-based system then processes and presents this data, allowing for immediate identification and logging of both typical and atypical human physiological states, thereby providing a valuable tool for preliminary health assessment and continuous monitoring.

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