# Patient Pulse Rate Monitoring System Using LabVIEW

**A. R. Krishnan, S. Jayanth and R. Janani**

**Abstract** In this article, the authors have attempted to design a LabVIEW-based health monitoring system, which measures the human body temperature and continuous pulse monitoring with the help of ECG electrodes. The LabVIEW helps to create a user-friendly GUI which can graphically show the continuous pulse or heartbeat rate. This system is suitable where the doctor will monitor the patient's condition without being present physically. This system also helps the doctor by producing medical test and previous records of the patient when the doctor is present physically. This system uses various sensors, like, temperature sensor, heartbeat rate, and ECG electrodes. This system allows the doctor to diagnose the patient's condition and allows the doctor to suggest suitable treatment. The sensors are interfaced in LabVIEW to provide a graphical user interface-based monitoring systems.

**Keywords** ECG electrodes · Body mass index · Temperature sensor · Health monitoring · LabVIEW

## Abbreviation

| | |
|---|---|
| ECG | Electrocardiogram |
| PMS | Pulse monitoring system |
| DAQ | Data acquisition |
| VI | Virtual Instruments |
| GUI | Graphical user interface |
| BPM | Beats per minute |

A. R. Krishnan · S. Jayanth · R. Janani (✉)
Sri Chandrasekharendra Saraswathi Viswa Mahavidyalaya, Enathur, Kanchipuram, India
e-mail: janani.rajaraman@kanchiuniv.ac.in



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## 1 Introduction

In a developing country like India, the major concern in the field of medical sciences are lack of proper diagnosis and treatment facilities especially in remote villages, this is because of the doctor-to-patient ratio is very less. The main advantage of the presented system in this article is this method does not require the doctor all the time. Because of the vast development in the area of Biomedical Instrumentation, such monitoring system is made. In this method, the system measures the patient ECG, respiration, heart rate, and temperature of the body using sensors. The graphical user interface system developed with the help of LabVIEW will measure the biosignals from the patient health and display it on the screen. The details of the patient will be recorded individually and stored in the separate database [1].

Section 2 gives a brief summary LabVIEW Environment; Sect. 3 describes on ECG measurement and its components. The block diagram of the presented system is in Sect. 4. Results are discussed in Sect. 5, followed by conclusion.

## 2 LabVIEW Environment

Laboratory Virtual Instrument Engineering Workbench is a graphical programming language used as analysis software system in various fields of engineering such as biomedical, image processing, control engineering, and wireless technologies. LabVIEW uses G language to create programs called Virtual Instruments which is in the form of block diagram and front panel thereby eliminating a lot of the syntactical errors produced in the other text-based programming. Each VI consists of user interface like knobs, push buttons as input control numerical, and graphical indicators as outputs, and all these inputs and outputs are grouped under front panel controls. Inputs can be digital data or real-time interface data. All these controls in front panel will have its corresponding terminals in the block diagram. The block diagram has lower level, built-in VI functions. The blocks can be connected using wires to indicate the dataflow [2].

## 3 ECG Biosignals in LabVIEW

LabVIEW with its processing abilities will provide the user robust and efficient environment for resolving ECG signal processing. ECG is a pictorial representation of the heartbeat. It is primary way to deduct the pulse and functionality of heart. A human heart consists of four chambers, two auricles and two ventricles. The heart sends the oxygenated blood to the other parts of the body by ventricles and it receives the deoxygenated blood from the other parts of the body by auricles. An ECG pulse as shown in Fig. 1 is representing the functionality of this auricles and ventricles. The portion (PQ) from the waveform represents the action of arteries, and portion (QRS) represents the function of ventricles. The (ST) portion of the waveform shows the normalization of the heartbeat [3] (Table 1).

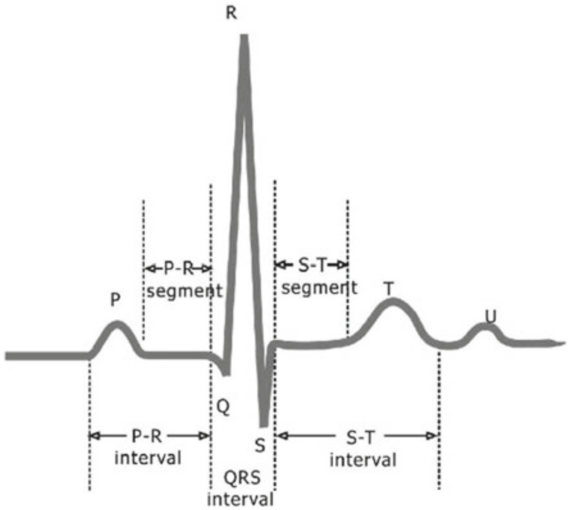


**Fig. 1** ECG waveform

**Table 1** Normal ECG waveform

| Parameters | Range |
|---|---|
| P-portion | ≤0.11 s |
| PR interval | min 0.12 s–max 0.21 s |
| QRS portion | ≤0.12 s |
| QRS peak voltage | 2.5–5 mv |
| QT interval | 0.40–0.44 s |

## *3.1 Temperature Measurement*

Temperature of the body should be continuously monitored for a patient in an ICU. This individual body temperature depends on the ager, infection, and activity level, state of consciousness and emotional state. It should be maintained within the range by thermos regulation. The normal body temperature of the human is 37 °C or 98.6°. The temperature sensor used here is LM35, and it measures the temperature of the patient continuously [4] (Fig. 2).

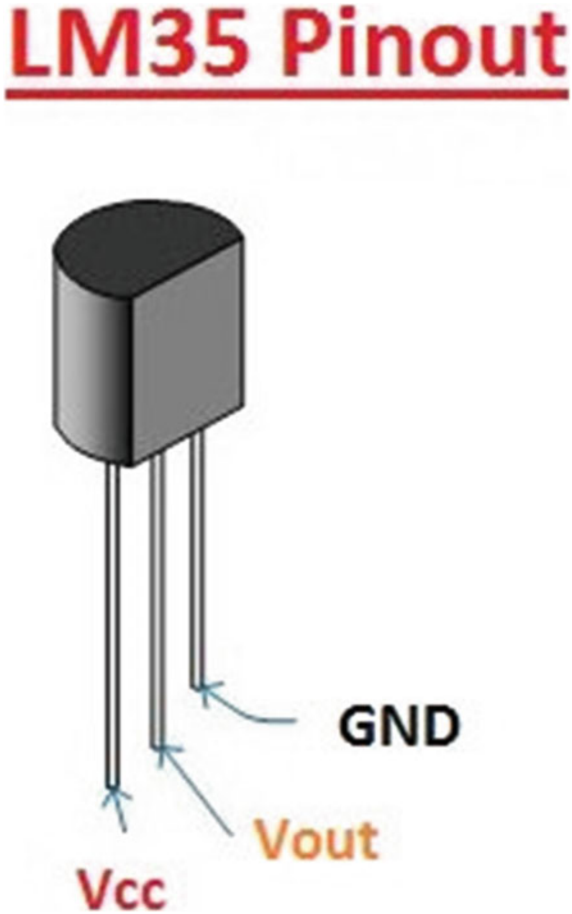


**Fig. 2** Temperature sensor

## 4 Block Diagram of Patient Monitoring System

The functional block diagram of the patient monitoring system (PMS) is shown in Fig. 3. The major components are the temperature sensor, ECG electrodes, and National Instruments DAQ card. The temperature of the patient is measured and given to the LabVIEW interface through DAQ system in LabVIEW.

The biosignals from the patient health is also measured and given to the LabVIEW biosignal simulator, which generates the ECG waveform and this can be viewed by waveform monitor; ECG feature extractor module imports the ECG signal from a DAQ device and integrates robust extraction algorithms to detect ECG features, such

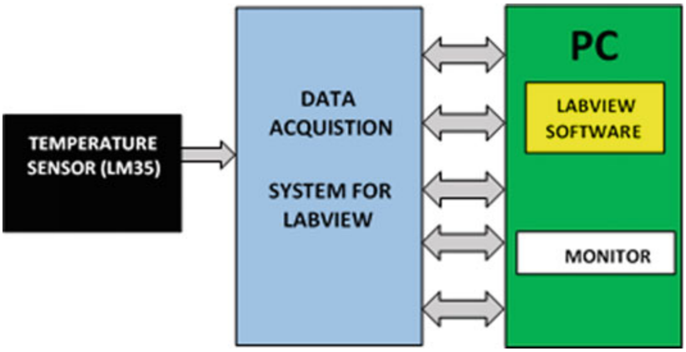


**Fig. 3** Block diagram of PMS

as QRS complex, P interval, and T wave, and this also transfers the RR interval data to heart rate variability analysis application. This module also allows the user to take a printout form of patient ECG [5].

## 5 Results and Discussion

Figure 4 and Figure 5 shows the biosignal measure and the feature extractor, respectively. Figure 6 shows the real-time implementation of monitoring the patient's body temperature. The values of body parameters can be saved in spreadsheet file for future reference as shown in LabVIEW block diagram Fig. 7.

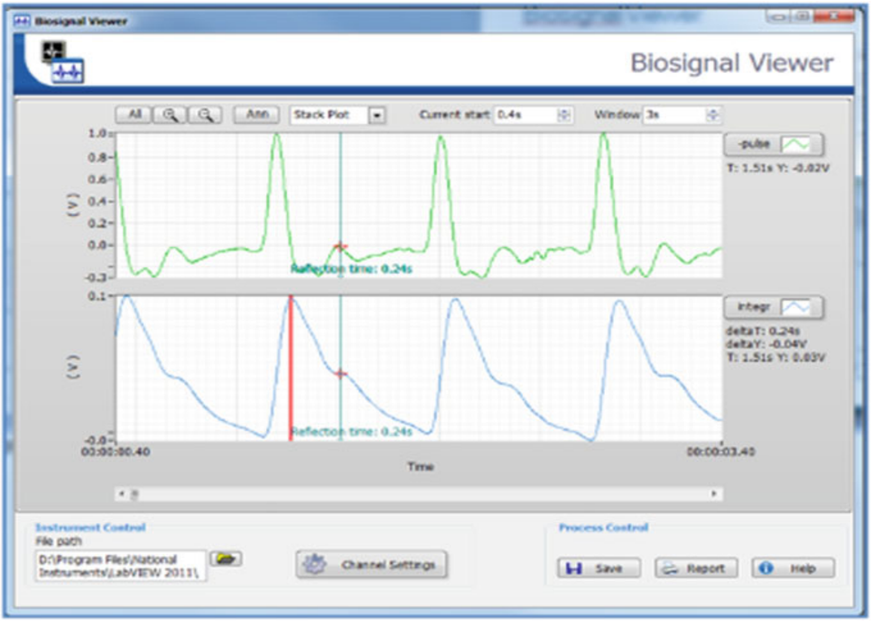


**Fig. 4** Biosignal viewer

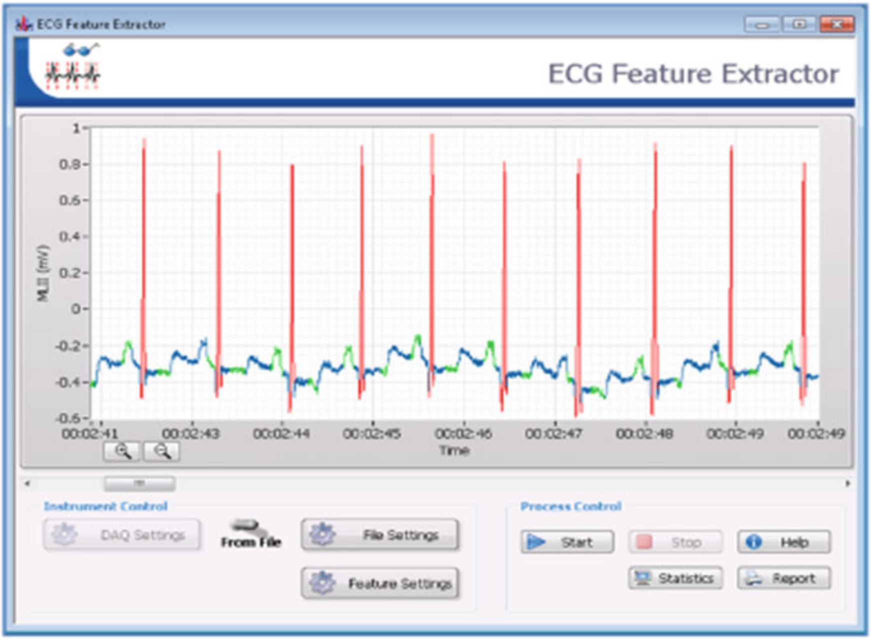


**Fig. 5** ECG feature extractor


**Fig. 6** Real-time experimental set-up for temperature monitoring

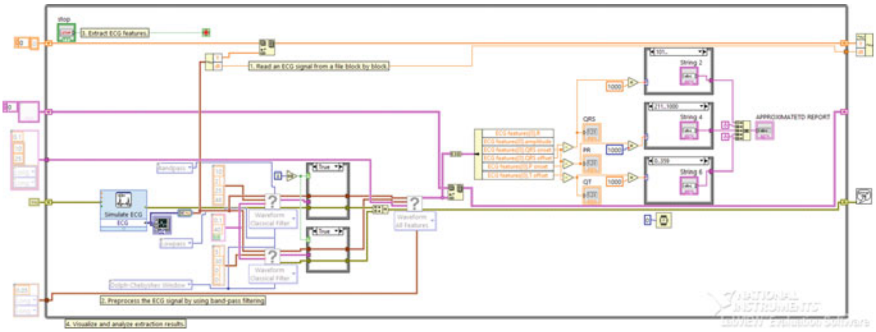


**Fig. 7** Block diagram of ECG feature extraction in LabVIEW

## 6 Conclusion

The presented system when employed in all the medical centers will be a great impact as well as this will be much useful in the village sector where the ratio of doctor to the patient is less. This method have less cost and can be employed in rural and urban areas. In this article, LabVIEW platform provides an efficient environment and keeps track of patient's body temperature, ECG, and pulse rate in real time.

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