VI BASED HEMODYNAMIC MONITOR USING LABVIEW

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Abstract— To aid patients and physicians in healthcare, the system "VI BASED HEMODYNAMIC MONITOR" was developed. A typical heartbeat is referred to as an arrhythmia. It may be so brief that it has little effect on heart rate as a whole, yet it can make heart rate too slow or too high. It's possible that the heart can not pump enough when arrhythmias are severe or persist a long time. The patient could become exhausted or lose consciousness as a result of this. To identify arrhythmias, an electrocardiogram is frequently employed. In order to identify and categories the patient's anomalies and abnormalities, this system was designed to collect data from the patient's ECG, PPG, and BODY TEMPERATURE. The evaluation of systolic parameters generated from the calculation of hemodynamic index and ejection fraction is provided using a Virtual Instrumentation-based prototype. As a result, one can evaluate the patient's cardiovascular activity and body temperature based on the results. Additionally, this prototype will phone and send alert messages to the patient's guardian and monitoring doctor. The proposed prototype is non-intrusive, low cost, compact, and graphical user-friendly. It also incorporates integrated hardware and software.

Keywords— virtual instrumentation, systolic parameters, electrocardiograph, Photoplethysmogram, arrhythmia, LabVIEW

I.INTRODUCTION

The abbreviations for electrocardiogram and photoplethysmogram are ECG, EKG, and PPG, respectively. We occasionally encounter words like We occasionally hear words like "cardiovascular" and "cardiac."[1] Few of us truly comprehend what cardiovascular diseases are, despite the fact that we do take them at face value for the potentially harmful things that they represent. We all are familiar with terminology like "heart attack," "heart failure," "coronary artery disease," and "stroke," but few of us are aware that these conditions are all considered to be cardiovascular diseases. Cardiology is a field of medicine that focuses on issues with the heart and certain areas of the circulatory system.These VI-based prototypes, which were created to evaluate the patient's cardiovascular activity, have been featured in numerous academic papers and application-focused investigations.The design of such systems is described, starting with the types of sensors used, moving on to signal conditioning and data acquisition components, and finishing with a GUI user interface that makes use of intelligent signal processing techniques. New cardiovascular monitoring is being developed as a result of ongoing scientific research. by the fact that heart disorders are the world's biggest cause of mortality. According to the WHO (WORLD HEALTH ORGANIZATION), heart disease accounts for 17.9 million deaths worldwide, or 31% of all fatalities. The P, QRS, and T waves, which alternate in succession on an ECG, provide information about the electric impulse function of the heart. The characteristics aid in the accurate diagnosis of the majority of heart disorders. The P-QRS-T's segment amplitude and interval determine how well the heart works. The P-QRS-T waveform in an ECG signal represents one cardiac cycle.

1.1 ELECTROCARDIO GRAPH:

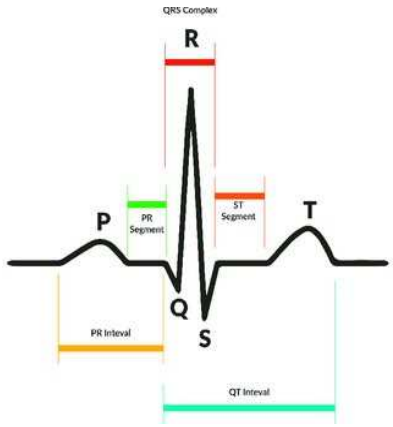
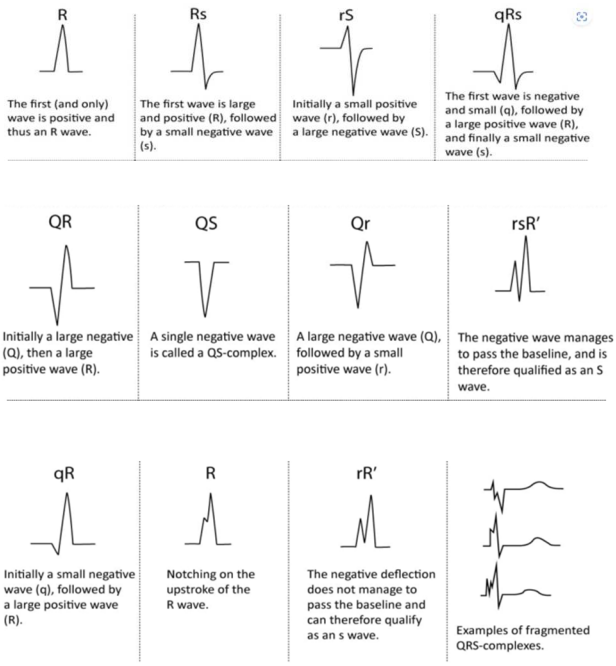


Fig. 1: QRS COMPLEX

[5]From the extracted ECG graph, we can obtain QRS complex (fig. 1)where we can further use these data for more classification and analysis like – an QRS complex consist of Q, R, S, wave. There may be leads and may not be visible. The wave which represents the ventricular depolarization is said to be QRS complex.



Fif. 2: These are some naming of the QRS-complex.

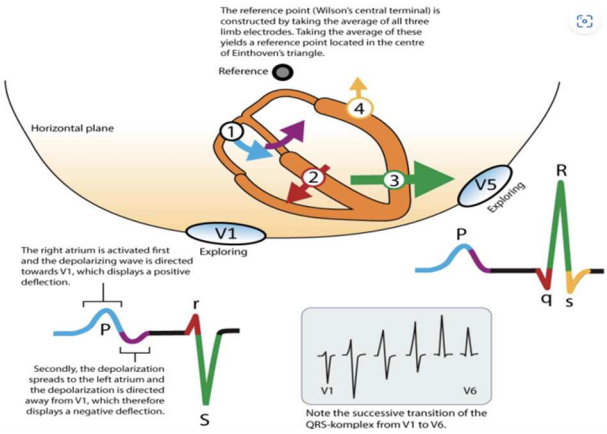


FIG 3: working function on how the ECG graph is extracted.

A.Photoplethysmogram:

PPG is an obtained optically known as plethysmogram (Fig. 4) which is often used to detect the volume of the blood which changes in the bed of micro vascular tissue. The change in volume caused by the pressure pulse is deducted by the skin with light from the LED.

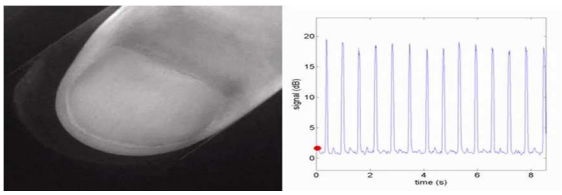


Fig.4. Plethysmogram

II BLOCK DIAGRAM AND DISCRIPTION

A.*Block diagram*

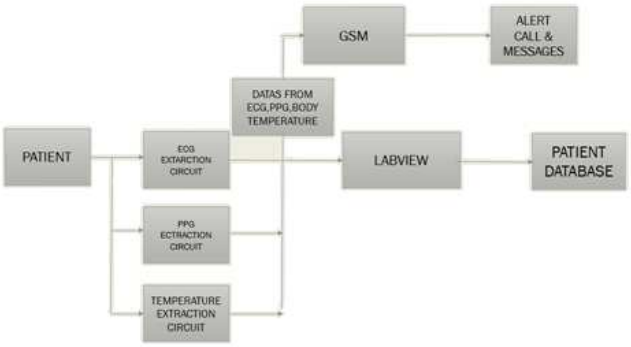


Fig. 5 Block diagram

Data collected data from the patient like ECG, PPG and temperature. The extracted data is processed to two different systems first one is we could able to see the extracted data in LabVIEW, Arduino ide, firebase (database). In the other system the data is analyzed and processed accordingly to the patients age, condition, etc, the analyzed data is given to GSM module where it helps to receive and transfer data, also used it as " an alert Message and call system" to the gradient and doctor .

B. Description

ECG Circuit: The output of this circuit is analog. This signal is processed for future analysis.

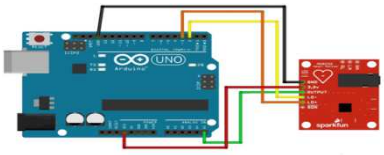


Fig.6. ECG Circuit

Photoplethysmography(PPG) circuit: The output of this circuit is analog. We can obtain graph and BPM from this output.

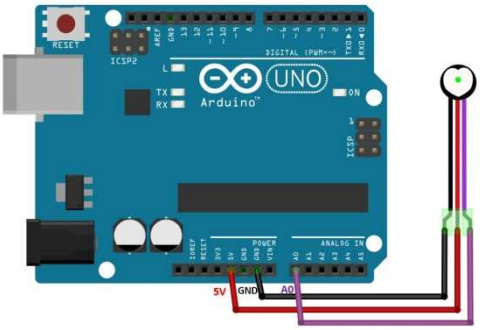


Fig.7. PPG Circuit

MODULE FOR ALERTING THE PATIENT CONDITION:

A GSM module with a serial interface is the SIM800L. It has the ability to make and take phone calls as well as send and receive text messages. It has the ability to receive FM signals and connect to the internet. The serial UART interface can also be used to connect a microcontroller to the SIM800L.

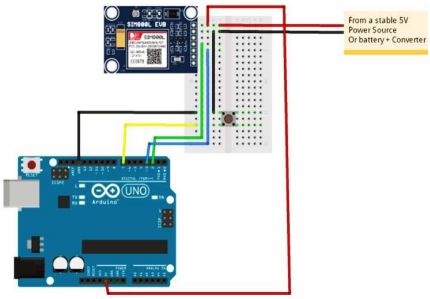


Fig.8 GSM Module

III RESULT AND DISCUSSION

In the ECG extraction circuit, filters, amplifiers and sensing electrodes are used. The data is provided by the patient to whom the electrodes are affixed. The ECG monitoring system to which this sensor is connected has three electrodes, one on each wrist of the right hand, left hand, and left leg. The end user's GSM module receives the ECG data and processes it using LabVIEW before filtering it to ascertain the patient's status. The ECG extraction circuit used for data collection also converts the signal from analogue to digital.

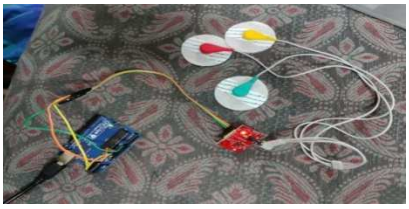


Fig.9 ECG Extraction Circuit

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The data is then analyzed using LabVIEW, such as signal processing and end automated data that can acquire signals, amplify the signals. The acquired signal is used to design front end hardware that aids in converting the captured data into a format that can be processed by LabVIEW, to calculate (BPM)beats per minute and identify cardiac arrhythmia. The signal is filtered in LabVIEW to create an accurate PQRST wave, which is then used to determine the heart rate (measured in beats per minute) using the value of the RR interval.

PPG extraction:

In the world of health-related gadgets, the pulse sensor is one of the most important sensors, and it has many different types. If we wish to measure beats per minute with a heartbeat sensor or pulse sensor, this is the simplest basic sensor to start with. As a result, both the offline and internet markets offer it at a low price. Comparatively speaking to other modules on the market, this sensor is relatively small. But for the small purpose, its size has no impact on how well it works or how efficiently it performs. A straightforward circuit is used to measure blood volume by detecting light reflections caused by blood moving through blood arteries. The single pin, known as the out pin, is used to deliver the sensor's output. It uses pulse signals to communicate with the microcontroller. The sensor operates on the incredibly straightforward idea of light reflection. The method is known as the photoplethysmogram. The play of algorithms used to process data from the sensor makes up the remaining portion. The photoplethysmogram principle dictates that the light used for reflection is often RED/GREEN optics. These two lights, along with the one I suggested above, are used in all other heartbeat sensors. The received light is transformed into a voltage signal pulse that is either supplied directly or indirectly through an Op-Amp to low logic level microcontrollers.

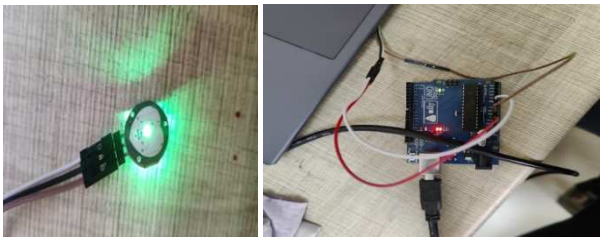

Fig.10 PPG Extraction circuit

Temprature: Creating the circuit for extraction for temperature. Before beginning the project, disconnect the Arduino's USB cable. The flat side of the LM35 must face you when it is positioned anywhere horizontally on your breadboard. After that, join the three wires to the sensor's three pins. The wire on the left will connect to the Arduino's 5v (+5 volts) supply. The analogue output will be on the

center wire. The right-hand wire will connect to the Arduino's GND pin. Open the serial monitor while the code is uploaded and temperature readings are displayed. Verify the serial monitor is set to 9600 bauds

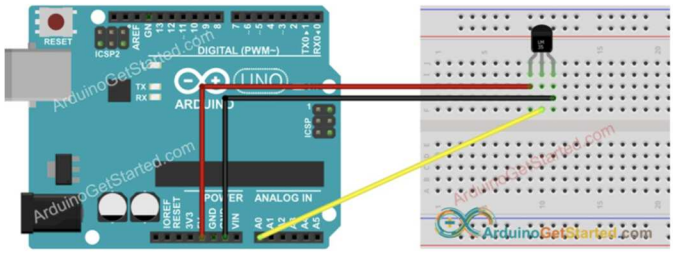

Fig.11 Body temperature circuit

Module SIM800 GSM: The SIM800I GPRS/ GSM module is a tiny GSM modem that can be used in numerous Internet of Things (IoT) projects. Almost all tasks that a typical cell phone can perform, including as making phone calls, sending SMS messages, connecting to the Internet via GPRS, and much more, may be carried out with this module.And to top it all off, the module works almost everywhere in the world because it supports quad-band GSM/GPRS networks. The silcon chip, which powers GSM mobile phones, is its brains. This module can work between 3.4 and 4.4 volts. Since the arduino board only has 3.3 and 5 volts, we must use a LiPo battery or dc-to-dc converter to supply power. It is therefore a smart choice for embedding in projects with limited space.

Fig.12. GSM Discription

Fig.13. ECG Lead placement

MEN						
AGE	18 -25	26 -35	36 -45	46 - 55	56 -65	65+
ATHLETE	49-55	49-54	50-56	50-57	51-56	50-55
EXCEL'T	56-61	55-61	57-62	58-63	57-61	56-61
GOOD	62-65	62-65	63-66	64-67	62-67	62-65
ABOVE AV	66-69	66-70	67-70	68-71	68-71	66-69
AVERAGE	70-73	71-74	71-75	72-76	72-75	70-73
BELOW AV	74-81	75-81	76-82	77-83	76-81	74-79
POOR	82+	82+	83+	84+	82+	80+

WOMEN						
AGE	18 -25	26 -35	36 -45	46 - 55	56 -65	65+
ATHLETE	54-60	54-59	54-59	54-60	54-59	54-59
EXCEL'T	61-65	60-64	60-64	61-65	60-64	60-64
GOOD	66-69	65-68	65-69	66-69	65-68	65-68
ABOVE AV	70-73	69-72	70-73	70-73	69-73	69-72
AVERAGE	74-78	73-76	74-78	74-77	74-77	73-76
BELOW AV	79-84	77-82	79-84	78-83	78-83	77-84
POOR	85+	83+	85+	84+	84+	84+

Table 14 BPM chart

LABVIEW Result

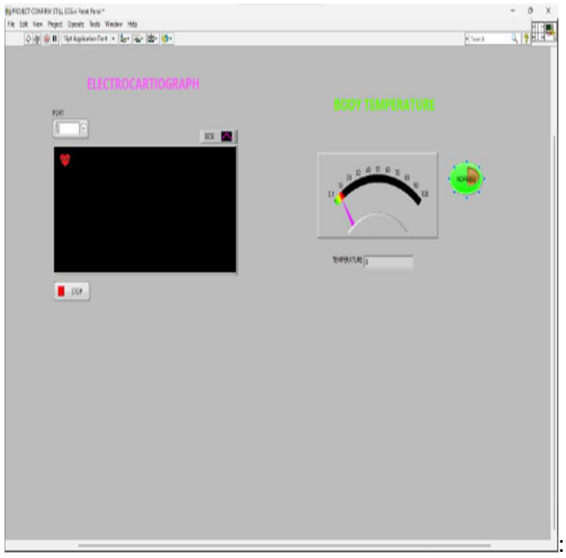

Fig 15. Front panel

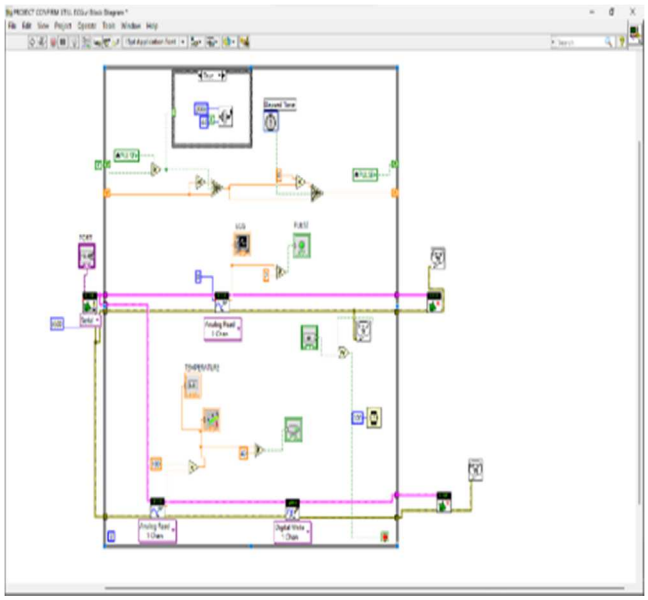

Fig 15. Block diagram

-GRAPH OF PPG SIGNAL

IV.Conclusion

The software built in LabVIEW and Arduino IDE for continuously monitoring ECG, PPG, body temperature, and beats per minute (BPM) data has been detailed in this study, along with hardware implementations utilising commercially available devices. The ECG , PPG, temperature, and the regularity and rate of heartbeats are all intended to be collected and analysed by this system.It focuses on database maintenance using LabVIEW, the acquisition and analysis of hemodynamic measurements, and the detection of cardiac arrhythmia. Cardiologists and healthcare systems will benefit from this system's assistance in diagnosing various arrhythmia kinds.The proposed system runs on a local level. The ability to execute code remotely and offline using LabVIEW and the Arduino IDE, or to publish results online using Firebase, is a potential future development. In context of the first cardiac analysis and alarm system performed a general medical setting, we must carefully evaluate how valuable such characteristics are. The apparatus has been improved to include a second plethysmography sensor linked to a temperature sensor. The heart hand and heart foot pulse - waves frequency and amplitude will be used to examine peripheral arterial circulation characteristics. His method involves evaluating the patient to determine if the presence of a disease is likely or not. Testing the technology on patients with concomitant cardiovascular diseases under hospital conditions will also contribute to future validation. This will provide additional proof that the system has been implemented correctly.

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