

Heart Beat Sensor Using Arduino

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Abstract- Technological innovations in the field of disease prevention and maintenance of patient health have enabled the evolution of fields such as monitoring systems. Heart rate is a very vital health parameter that is directly related to the soundness of the human cardiovascular system. Heart rate is the number of times the heart beats per minute, reflects different physiological conditions such as biological workload, stress at work and concentration on tasks and the active state of the autonomic nervous system. It is able to be measured either by way of the ECG waveform or via sensing the heart beat - the rhythmic expansion and contraction of an artery as blood is pressured through it by way of the ordinary contractions of the coronary heart. . This paper describes a technique of measuring the heart price via a fingertip and Arduino . It is primarily based on the predominant of photoplethysmography (PPG) which is non-invasive approach of measuring the variation in blood quantity in tissue using a mild source and detector. while the heart is thrashing, it's far surely pumping blood for the duration of the body, and that makes the blood volume in the finger artery to exchange too. This fluctuation of blood may be detected through an optical sensing mechanism positioned across the fingertip. The signal may be amplified and is sent to arduino with the assist of serial port communication. With the help of processing software program coronary heart fee monitoring and counting is completed.

Keywords- Heart rate sensor, Heart rate measurement, photophelthysmography (PPG), IR LED,. Arduino Software

I. INTRODUCTION

In this present scenario, it is not possible for a doctor to observe a patient's heart rate per minute and body temperature all the time. So I decided this project to make useful for everyone in this society. Again a doctor far away from the patient need to know heart rate and body temperature for initial treatment . An embedded system which can measure the heart rate and store the data for the doctor to know the condition of the patient can help for this purpose. The area of work of this project is based on Electronics Communication and Computer science. As Arduino can sense the environment by receiving input from a variety of sensors and can affect its surroundings by controlling lights, motors, and other actuators so Arduino is a main part of this project.

Electro-cardiogram (ECG) is one in every of often used approach for measuring the coronary heart rate. However it's far an luxurious device. Low-cost gadgets inside the form of wrist watches are also available for the instant dimension of the coronary heart rate. Such devices can give accurate measurements however their value is usually in extra of several hundred bucks, making them uneconomical. So this heart rate monitor with a temperature sensor is definitely a useful instrument in knowing the pulse and the temperature of the patient.

II. LITERATURE SURVEY

Determining the new algorithms and insights to construct a frame work for sensing body temperature is main focus of this paper. Automation is one of the considerable developments in the new innovations. It is best technique to execute in the fields of medical i.e. observing the patient condition. In this paper oxygen levels are controlled precisely by utilizing fuzzy logic. Here the beat rate and the ECG qualities are chosen the pressure variation of the oxygen [1].

Heart Rate Variability (HRV) is a measure of variation in the time interval between consecutive heart beats. HRV analysis is highly sensitive for risks linked with Cardiovascular disease, Diabetic Mellitus etc. In this paper, the authors propose a low-cost and easy to use Remote HRV Monitoring System based on the Internet of Things (IoT) technology for borderline Hypertensive patients [2].

The main objective of this paper is to design and develop a system that remotely monitors the heart rate and to play music depending on the tune of heartbeat to compliment exercise regimes. A pulse sensor circuit is designed to obtain the heart beats per minute (bpm). The output of the sensor is sent to the Arduino Ethernet shield's web server [3].

The main objective of this paper is to use GSM module for this project since the telecom network is widely spread within rural & urban area of the India. This system is used to monitor physical parameter like heart beat and send the measured data directly to a doctor through SMS. System consists of an IR base heart beat sensor, Arduino Uno & GSM module. [4].

This literature of analyzed the use of stethoscope. This project was developed to monitor and display heartbeat sound using wireless digital stethoscope. The condenser microphone is used as a sensor to capture the low sensitivity of heart sound signal. ZigBee Pro Series 1 wireless module is used to send the heart beat signal wirelessly in 100 meters range. [5].

Analysis explained about Arduino chip module that had expandability function to the smart handheld device. This device has the great characteristic which is a light and small size that equipped with heart rate (HR) sensor in this embedded chip Arduino module and then capable to communicate with the integration of wireless Bluetooth transmission. By using this module, people be able to care and do real-time monitor in their daily health even though they are an as disabled situation [6].

This work presents a smart health monitoring system that uses biomedical sensors to check patient's condition and uses internet to inform the concerned. The biomedical sensors here are connected to Arduino UNO controller to read the data which is in turn interfaced to an LCD display/serial monitor to see the output. [7][8].

This device is designed using sensors to measure the parameters non-invasively. The results obtained are stored in the designed app, over a period of time. The patient details with the readings of the different parameters is transferred to the cloud. After each measurement, the results are compared with the threshold for each parameter. If the results are not as desired, then a summary with confirmed symptoms is displayed in the app. This summary can be uploaded on the cloud for consulting a remote doctor [9].

This paper proposes an android-based elderly support system as an alternative way for existing care homes or health care centers. This project can be divided into two parts; development of android application and hardware implementation. [10].

III. PROPOSED METHOD

In this section the whole process is going to be analyzed. Analysis can be classified into three fields:

1. System Description
 - Electrical Method
 - Optical Method
2. Circuit Description
3. ARDUINO Hardware

A. SYSTEM DESCRIPTION :

Current technology includes optical and electrical video display units. The electric approach provides a cumbersome strap round one's chest. The optical method does no longer require the strap and may be used more comfortably than the electrical method. There are numerous constraints in generating a heart monitor. First, the technology used to measure the pulse has to be determined. A cost efficient way of measuring the pulse is the combination of a led and picture-sensor.

3.1 Electrical Method :

The chest strap of a heart charge screen makes use of electrodes to display the electric volts that occur while your heart beats. The receiver detects this records from the electrodes through radio signal from the chest strap. The receiver, then, makes use of this data to decide your coronary heart rate.

3.2 Optical Method :

Optical method exploits the reality that tiny subcutaneous blood vessels (capillaries) in any patch of pores and skin (fingertip, ear lobe, and many others.) provided with a good blood supply, alternately enlarge and agreement in time with the pulse. An regular infrared LED/phototransistor pair can feel this rhythmic exchange as small however detectable versions in skin comparison.

B. Circuit Description

The overall circuit has been constructed in 3 steps: External biasing circuit, First degree signal conditioning circuit, and 2nd stage sign conditioning circuit. In this paper the circuit has been integrated with an Arduino board and processing software program.

3.3 Signal Conditioning Circuit

The reflected IR signal detected by the photo diode is fed to a signal conditioning circuit that filters the unwanted signals and boost the desired pulse signal. The circuit diagrams below shows the IR LED (D1) and the photo diode (D2) along with the signal conditioning circuit made of two stage operational amplifiers.

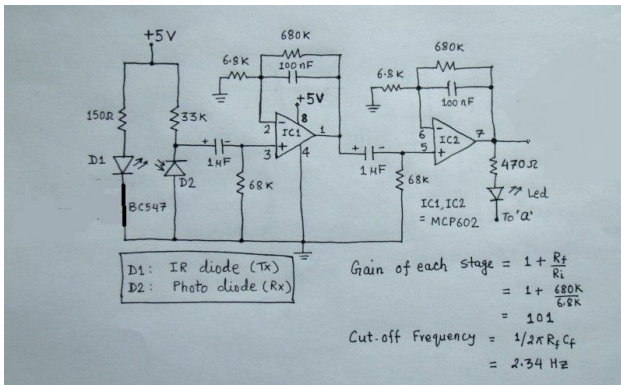


Fig1.Circuit diagram of sensor

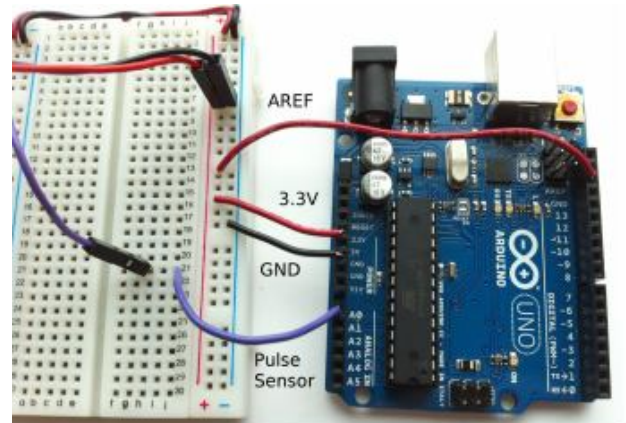


Fig 3 Pulse Sensor with Arduino

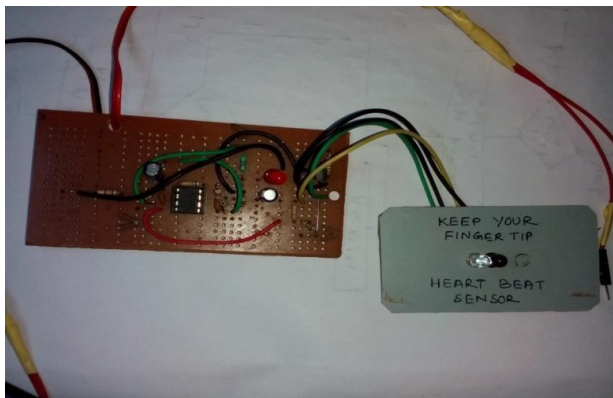


Fig 2 .PCB connection of IR sensor

Features:

Microcontroller	ATmega328
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Digital I/O Pins	14 (of which 6 provide PWM output)
Analog Input Pins	6
SRAM	2 KB (ATmega328)
EEPROM	1 KB (ATmega328)
DC Current per I/O Pin	40 mA

3.4. IR Transmitter

An infrared emitter is an LED crafted from gallium arsenide, which emits near-infrared energy at approximately 880nm. The infrared phototransistor acts as a transistor with the base voltage determined by using the quantity of mild hitting the transistor. therefore it acts as a variable contemporary source. more quantity of IR mild reason extra currents to go with the flow via the collector-emitter leads.

3.5 Infrared Detector

Phototransistors additionally encompass a photodiode with internal gain. A phototransistor is in essence not anything extra than a bipolar transistor that is encased in a obvious case in order that light can reach the bottom-collector junction.

C. ARDUINO Hardware

The Arduino Uno can be powered through the USB connection or with an external strength deliver. The powersource is chosen automatically . The Arduino Uno is a microcontroller board primarily based at the ATmega328.

4. Programming

```
//Arduino ppg Signal
#include <firFilter.h>
firFilter Filter;
int value;
int filtered;
void setup()
{
  Serial.begin(7200);
  Filter.begin();
}
void loop()
{
  value = analogRead(A0);
  filtered= Filter.run(value); /* Serial.print("In: ");
  Serial.print(value);
  Serial.print(" - Out: ");*/
  Serial.println(filtered);
  delay(2);
}
```

}

IV. PROCESSING SOFTWARE

Processing is a programming language, improvement surroundings, and on-line community. Considering 2001, Processing has promoted software program literacy within the visual arts and visual literacy within technology to start with created to serve as a softwareprogram sketchbook and to educate pc programming basics within a visual context, processing advanced into a development device for experts.

4.1 Real Time Monitoring for Heart-rate



Fig4. PPG waveform and heart rate displayed on computer screen



Fig 5. ppg waveform

5.2 Counting the PPG Signal

The PC application first reads 600 consecutive samples sent by Arduino. Since the sampling rate was 5ms, it takes 3 sec to read the 6000 samples. The DC component (minima of 600 samples) is subtracted out from the samples. Next, the range of the samples is computed. If the range is less than 50 counts, the received PPG waveform is very weak, and is considered to be a noise. This could happen when no PPG

signal is detected through fingertip (sensor is faulty or disconnected) or the gain of the amplifier on Easy Pulse board is set very low. The gain can be increased through potentiometer P1 on the Easy Pulse board. If the range of ADC samples is greater than 50, it is considered as a valid PPG signal and is displayed on the PC screen.

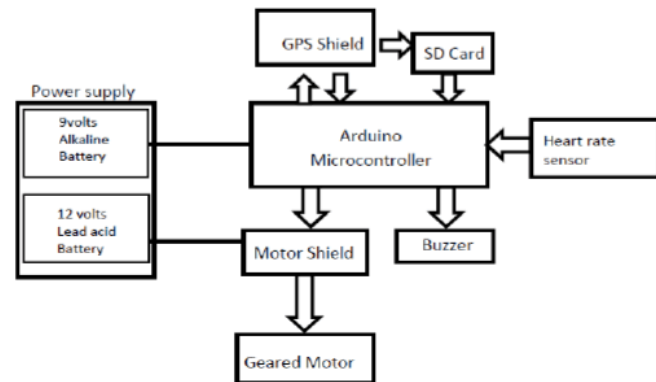


Fig: 6 Block Diagram of Heart Monitoring System

The heart beat rate can be computed by knowing the time period of the PPG waveform. For this, we identify three consecutive peaks in the waveform based on where the slope of the curve changes from positive to negative, and the magnitude of the signal is greater than 80% of the maxima of all the samples. Since two consecutive samples are 5ms apart, time difference between any two peaks can be easily computed from their indices (or sequence numbers). Two heart rates are computed from the three consecutive PPG peaks and their average value is displayed as an instantaneous heart rate

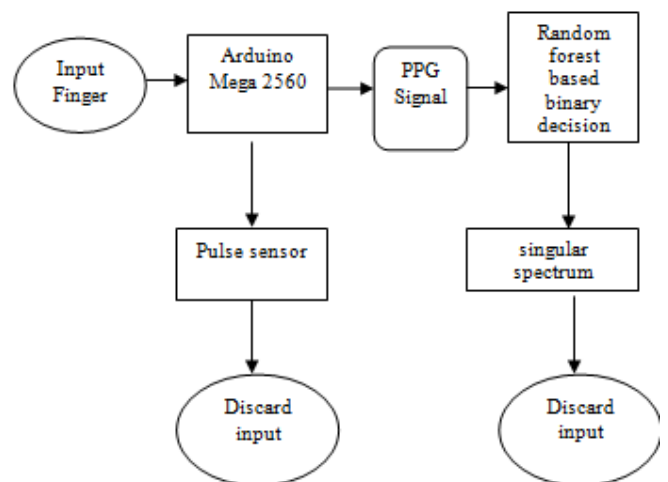


Fig. 5: Stages of heart beat sensing

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All stages have been shown through the help of flow chart . This paper totally focuses on heart beat sensor and the main part is arduino .The main feature is to create awareness among people for health checup.

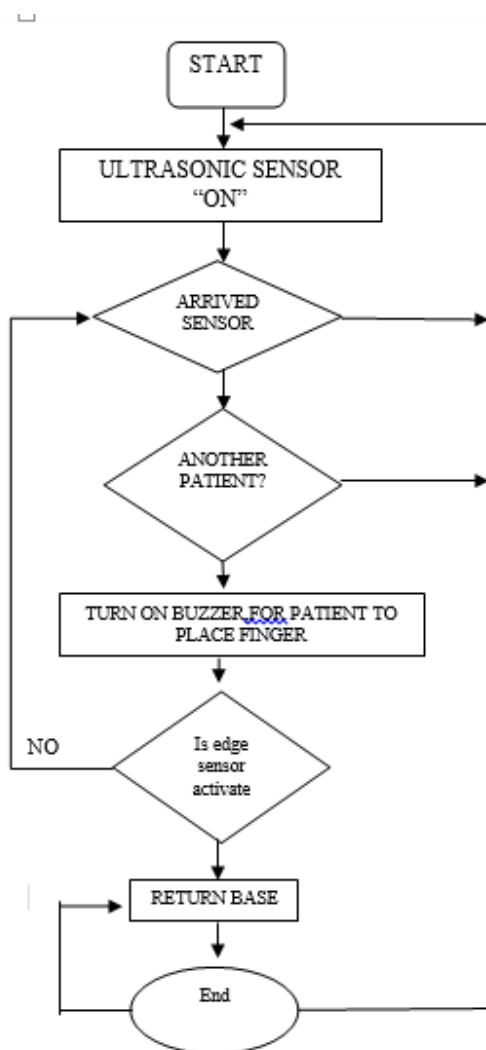


Fig 7: Flow chart of heart beat monitoring system

V. CONCLUSION

In this paper, detection of heart beat sensor using Arduino is presented. Biomedical engineering (BME) combines the layout and problem solving ability of engineering with scientific and biological sciences to improve patient’s health care and the first-class of lifestyles of individuals. Cardiovascular disorder is one of the fundamental causes of untimely deaths in world, coronary heart beat readings are by means of a ways the handiest viable diagnostic tool that might promote early detection of cardiac events via the use of this we will measure ones heart rate through fingertip.This paper focuses on the coronary heart charge monitoring and alert which is able to monitor the coronary heart beat situation of affected person . It is far portable and cost effective. It is very efficient gadget and very smooth to handle and for this reason presents first-rate flexibility and serves as a high-quality improvement over other conventional monitoring and alert structures

VI. FUTURE WORK

The current version of the Processing application displays the near-real-time PPG waveform and heart rate but does not record anything. There is a lot of room for improvements.

- Logging heart rate measurements and PPG samples along with the time-stamp information available from the PC
- Beeping sound alarm for heart rates below or above threshold
- Heart rate trend over time, etc.

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