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# Heartbeat Sensor using Arduino (Heart Rate Monitor)

NOVEMBER 4, 2017 BY RAVI — 74 COMMENTS

Heartbeat Sensor is an electronic device that is used to measure the heart rate i.e. speed of the heartbeat. Monitoring body temperature, heart rate and blood pressure are the basic things that we do in order to keep us healthy.

In order to measure the body temperature, we use thermometers and a sphygmomanometer to monitor the Arterial Pressure or Blood Pressure.

Heart Rate can be monitored in two ways: one way is to manually check the pulse either at wrists or neck and the other way is to use a Heartbeat Sensor.

In this project, we have designed a Heart Rate Monitor System using Arduino and Heartbeat Sensor. You can find the Principle of Heartbeat Sensor, working of the Heartbeat Sensor and Arduino based Heart Rate Monitoring System using a practical heartbeat Sensor.

Table of Contents

## Output Video

Heartbeat Sensor using Arduino (Heart Rate Monitor)

▶

## Introduction to Heartbeat Sensor

Monitoring heart rate is very important for athletes, patients as it determines the condition of the heart (just heart rate). There are many ways to measure heart rate and the most precise one is using an Electrocardiography

But the more easy way to monitor the heart rate is to use a Heartbeat Sensor. It comes in different shapes and sizes and allows an instant way to measure the heartbeat.

Heartbeat Sensors are available in Wrist Watches (Smart Watches), Smart Phones, chest straps, etc. The heartbeat is measured in beats per minute or bpm, which indicates the number of times the heart is contracting or expanding in a minute.

Clip to insert finger (contains IR LED & Photo Diode)
Control Circuit (based on LM358)
HEARTBEAT SENSOR
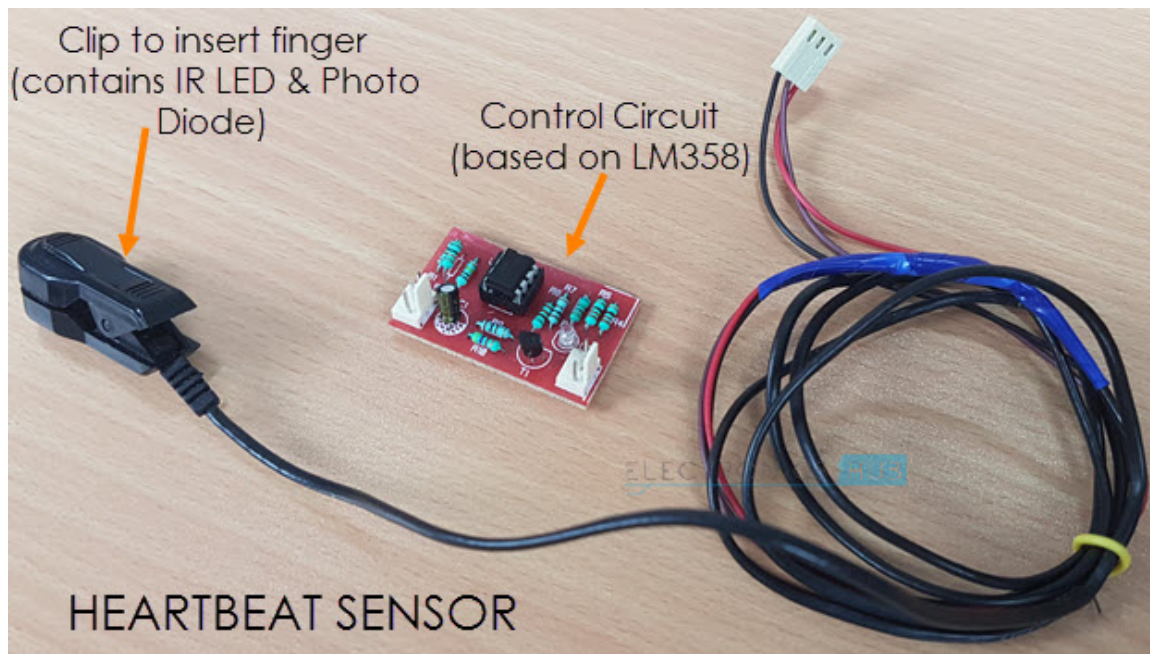
## Principle of Heartbeat Sensor

The principle behind the working of the Heartbeat Sensor is Photoplethysmograph. According to this principle, the changes in the volume of blood in an organ is measured by the changes in the intensity of the light passing through that organ.

Usually, the source of light in a heartbeat sensor would be an IR LED and the detector would be any Photo Detector like a Photo Diode, an LDR (Light Dependent Resistor) or a Photo Transistor.

With these two i.e. a light source and a detector, we can arrange them in two ways: A Transmissive Sensor and a Reflective Sensor.

In a Transmissive Sensor, the light source and the detector are place facing each other and the finger of the person must be placed in between the transmitter and receiver.

Reflective Sensor, on the other hand, has the light source and the detector adjacent to each other and the finger of the person must be placed in front of the sensor.

Here are few simple Arduino Projects: **10 SIMPLE ARDUINO PROJECTS FOR BEGINNERS.**

## Working of Heartbeat Sensor

A simple Heartbeat Sensor consists of a sensor and a control circuit. The sensor part of the Heartbeat Sensor consists of an IR LED and a Photo Diode placed in a clip.

The Control Circuit consists of an Op-Amp IC and few other components that help in connecting the signal to a Microcontroller. The working of the Heartbeat Sensor can be understood better if we take a look at its circuit diagram.
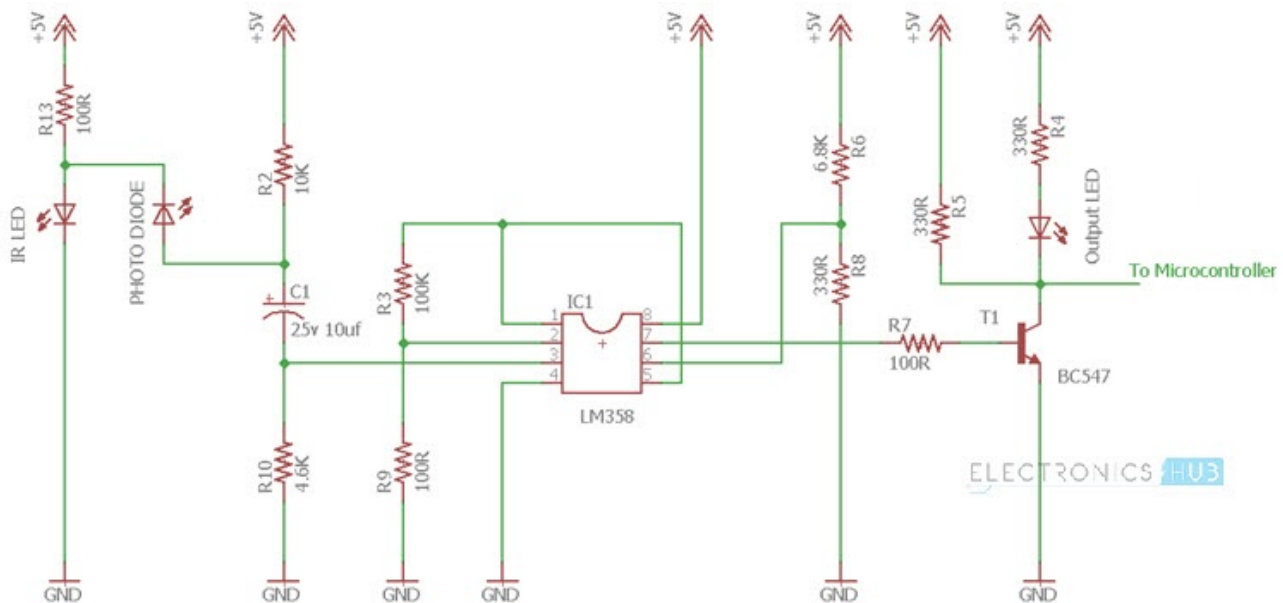


The above circuit shows the finger type heartbeat sensor, which works by detecting the pulses. Every heartbeat will alter the amount of blood in the finger and the light from the IR LED passing through the finger and thus detected by the Photo Diode will also vary.

The output of the photo diode is given to the non – inverting input of the first op – amp through a capacitor, which blocks the DC Components of the signal. The first op – amp cats as a non – inverting amplifier with an amplification factor of 1001.

The output of the first op – amp is given as one of the inputs to the second op – amp, which acts as a comparator. The output of the second op – amp triggers a transistor, from which, the signal is given to a Microcontroller like Arduino.

The Op – amp used in this circuit is LM358. It has two op – amps on the same chip. Also, the transistor used is a BC547. An LED, which is connected to transistor, will blink when the pulse is detected.

## Circuit of Arduino based Heart Rate Monitor using Heartbeat Sensor

The following image shows the circuit diagram of the Arduino based Heart Rate Monitor using Heartbeat Sensor. The sensor has a clip to insert the finger and has three pins coming out of it

for connecting VCC, GND and the Data.
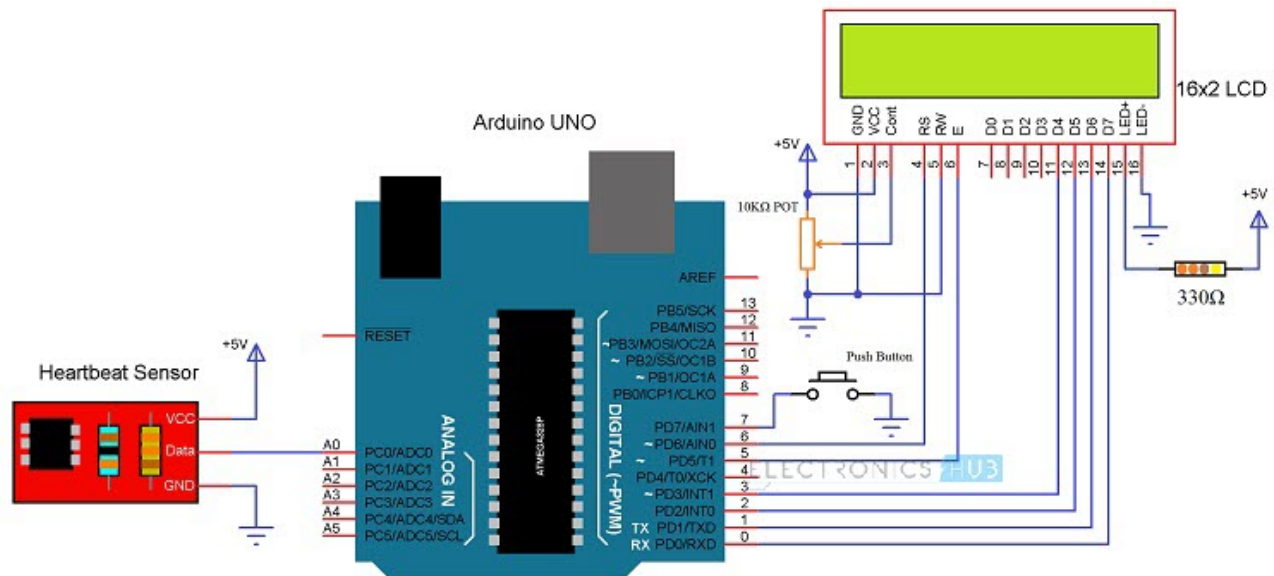


## Components Required

- Arduino UNO x 1
- 16 x 2 LCD Display x 1
- 10KΩ Potentiometer
- 330Ω Resistor (Optional – for LCD backlight)
- Push Button
- Heartbeat Sensor Module with Probe (finger based)
- Mini Breadboard
- Connecting Wires

## Circuit Design of Interfacing Heartbeat Sensor with Arduino

The circuit design of Arduino based Heartrate monitor system using Heart beat Sensor is very simple. First, in order to display the heartbeat readings in bpm, we have to connect a 16×2 LCD Display to the Arduino UNO.

The 4 data pins of the LCD Module (D4, D5, D6 and D7) are connected to Pins 1, 1, 1 and 1 of the Arduino UNO. Also, a 10KΩ Potentiometer is connected to Pin 3 of LCD (contrast adjust pin). The RS and E (Pins 3 and 5) of the LCD are connected to Pins 1 and 1 of the Arduino UNO.

Next, connect the output of the Heartbeat Sensor Module to the Analog Input Pin (Pin 1) of Arduino.
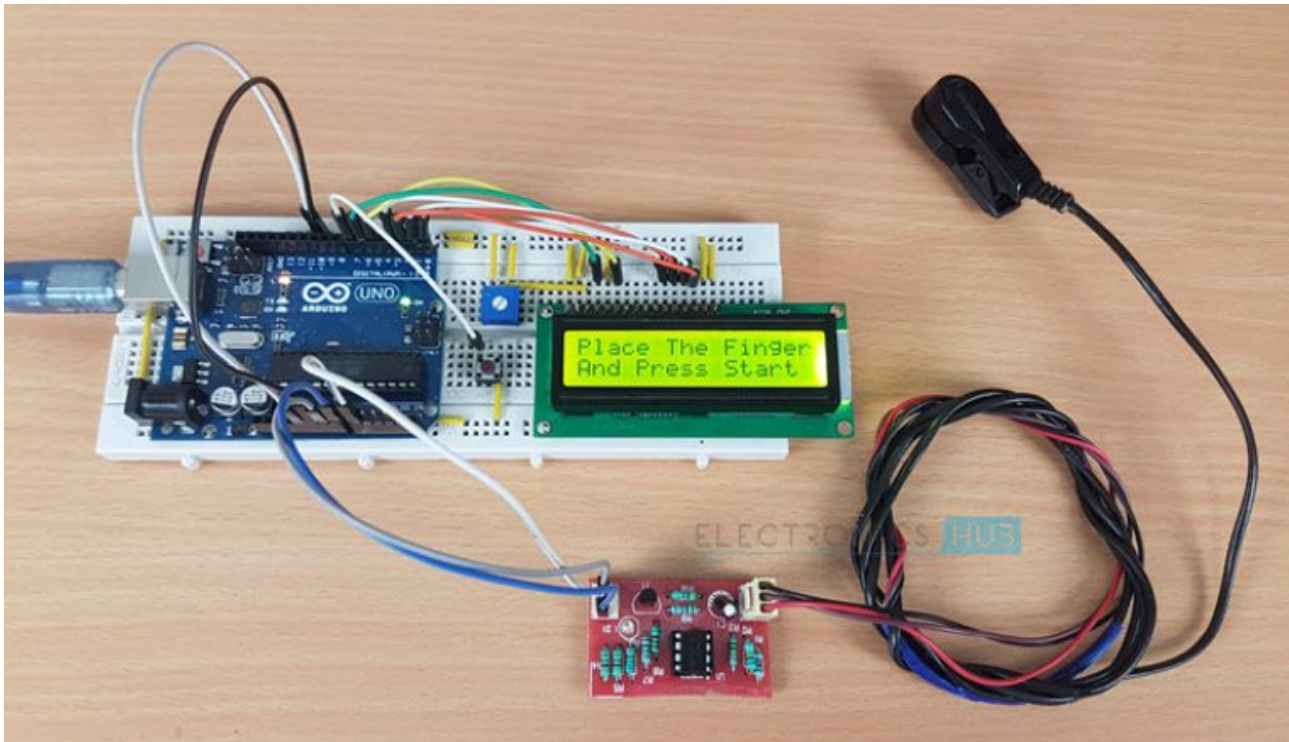
## Working of the Circuit

Upload the code to Arduino UNO and Power on the system. The Arduino asks us to place our finger in the sensor and press the switch.

Place any finger (except the Thumb) in the sensor clip and push the switch (button). Based on the data from the sensor, Arduino calculates the heart rate and displays the heartbeat in bpm.

While the sensor is collecting the data, sit down and relax and do not shake the wire as it might result in a faulty values.

After the result is displayed on the LCD, if you want to perform another test, just push the rest button on the Arduino and start the procedure once again.

## CODE

```
1    #include <LiquidCrystal.h>
2    LiquidCrystal lcd(6, 5, 3, 2, 1, 0);
3    int data=A0;
4    int start=7;
5    int count=0;
6    unsigned long temp=0;
7
8    byte customChar1[8] = {0b00000,0b00000,0b00011,0b00111,0b01111,0b01111,0b01111,0b01111};
9    byte customChar2[8] = {0b00000,0b11000,0b11100,0b11110,0b11111,0b11111,0b11111,0b11111};
```

```
10    byte customChar3[8] = {0b00000,0b00011,0b00111,0b01111,0b11111,0b11111,0b11111,0b11111};
11    byte customChar4[8] = {0b00000,0b10000,0b11000,0b11100,0b11110,0b11110,0b11110,0b11110};
12    byte customChar5[8] = {0b00111,0b00011,0b00001,0b00000,0b00000,0b00000,0b00000,0b00000};
13    byte customChar6[8] = {0b11111,0b11111,0b11111,0b11111,0b01111,0b00111,0b00011,0b00001};
14    byte customChar7[8] = {0b11111,0b11111,0b11111,0b11111,0b11110,0b11100,0b11000,0b10000};
15    byte customChar8[8] = {0b11100,0b11000,0b10000,0b00000,0b00000,0b00000,0b00000,0b00000};
16    void setup()
17    {
18    lcd.begin(16, 2);
19    lcd.createChar(1, customChar1);
20    lcd.createChar(2, customChar2);
21    lcd.createChar(3, customChar3);
22    lcd.createChar(4, customChar4);
23    lcd.createChar(5, customChar5);
24    lcd.createChar(6, customChar6);
25    lcd.createChar(7, customChar7);
26    lcd.createChar(8, customChar8);
27
28    pinMode(data,INPUT);
29    pinMode(start,INPUT_PULLUP);
30    }
31
32    void loop()
33    {
34     lcd.setCursor(0, 0);
35     lcd.print("Place The Finger");
36     lcd.setCursor(0, 1);
37     lcd.print("And Press Start");
38
39      while(digitalRead(start)>0);
40
41       lcd.clear();
42       temp=millis();
43
44       while(millis()<(temp+10000))
45       {
46          if(analogRead(data)<100)
47           {
48             count=count+1;
49
50             lcd.setCursor(6, 0);
51             lcd.write(byte(1));
52             lcd.setCursor(7, 0);
53             lcd.write(byte(2));
54             lcd.setCursor(8, 0);
55             lcd.write(byte(3));
```

```
56            lcd.setCursor(9, 0);
57            lcd.write(byte(4));
58
59            lcd.setCursor(6, 1);
60            lcd.write(byte(5));
61            lcd.setCursor(7, 1);
62            lcd.write(byte(6));
63            lcd.setCursor(8, 1);
64            lcd.write(byte(7));
65            lcd.setCursor(9, 1);
66            lcd.write(byte(8));
67
68            while(analogRead(data)<100);
69
70            lcd.clear();
71          }
72        }
73
74            lcd.clear();
75            lcd.setCursor(0, 0);
76            count=count*6;
77            lcd.setCursor(2, 0);
78            lcd.write(byte(1));
79            lcd.setCursor(3, 0);
80            lcd.write(byte(2));
81            lcd.setCursor(4, 0);
82            lcd.write(byte(3));
83            lcd.setCursor(5, 0);
84            lcd.write(byte(4));
85
86            lcd.setCursor(2, 1);
87            lcd.write(byte(5));
88            lcd.setCursor(3, 1);
89            lcd.write(byte(6));
90            lcd.setCursor(4, 1);
91            lcd.write(byte(7));
92            lcd.setCursor(5, 1);
93            lcd.write(byte(8));
94            lcd.setCursor(7, 1);
95      lcd.print(count);
96      lcd.print(" BPM");
97      temp=0;
98      while(1);
99        }
```

# Applications of Heart Rate Monitor using Arduino

- A simple project involving Arduino UNO, 16×2 LCD and Heartbeat Sensor Module is designed here which can calculate the heart rate of a person.
- This project can be used as an inexpensive alternative to Smart Watches and other expensive Heart Rate Monitors.

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# Comments

**Prompt says**
NOVEMBER 4, 2017 AT 2:36 AM

hello
Is it possible to use LCD I2C?

Reply

**Prompt says**
NOVEMBER 4, 2017 AT 2:39 AM

Hello
Where is the code?

Reply

**chawki mezrag says**
NOVEMBER 5, 2017 AT 8:08 AM

can u send me the code of this project plz

Reply

**EH Staff says**
NOVEMBER 29, 2017 AT 12:15 AM

Code is uploaded.

Reply

**Nithin says**
MARCH 20, 2018 AT 9:44 PM

This code is showing error's…and
Some are red in colour which is not getting executed, kindly help me out.

Reply

**m.nagesh says**
MARCH 22, 2018 AT 4:38 AM

the display shows the high values .what is the reason for this?

Reply

**Verna Reyes says**
MAY 14, 2018 AT 8:21 PM

this codes also shows high values like 6k bpm. can you please tell us why and
what to do to change it ?

Reply

**Sng Meng Keong says**
NOVEMBER 19, 2017 AT 12:07 PM

May I know where can I buy online for Heartbeat Sensor Module with Probe (finger based)?

Reply

**Navaneetha says**
NOVEMBER 25, 2017 AT 1:22 AM

Hi,

Could you pls help me to get the video of "Heartbeat sensor using Arduino (Heart rate monitor)".
Also pls let me know the step by step process for the same.

Waiting for your response.

Reply

**EH Staff says**
NOVEMBER 29, 2017 AT 12:15 AM

We will upload it soon.

Reply

**Navaneetha says**
DECEMBER 25, 2017 AT 8:24 AM

Hi,

Could you pls let me know the advantages of this project [Heartbeat Sensor using Arduino (Heart Rate Monitor)] over the Heartbeat using Mobile Apps??

Also how can we determine the Accuracy of this project?

Reply

**Navaneetha says**
DECEMBER 10, 2017 AT 10:34 AM

Hi,

Thanks for your reply.
I have assembled components based on the mentioned circuit diagram. In addition to the mentioned circuit diagram and code, I have used 1 LED interfaced with Push button. And I have used KY-039 heartbeat sensor.
But I'm facing a problem when I press the button, It repeats the text on LCD as "Place The Finger And Press Start".
Could you pls let me know how can this issue be solved at the earliest??

Reply

**Sarah Li says**
DECEMBER 12, 2017 AT 11:18 PM

Great job! Thanks for sharing it.

I'm still waiting for you to upload the code for the robatic arm. Are you planning to share the code at any time?
Thank you,

Reply

**p.iswarya says**

DECEMBER 16, 2017 AT 1:18 AM

its very nice project

Reply

**s.divya says**
DECEMBER 16, 2017 AT 1:20 AM

its very useful.

Reply

**tim says**
DECEMBER 16, 2017 AT 4:56 PM

can you please give me directions on where to buy the components for this project and the detailed code. thanks , awaiting your reply

Reply

**Mounika.k says**
DECEMBER 17, 2017 AT 1:50 AM

Sir can u please give the step by step procedure for doing this project??
Since I have choosen this project as my bsc final year project.

Please can I get the code properly and all information about this project??

Reply

**Ravi says**

DECEMBER 18, 2017 AT 12:12 AM

Everything is in the page: circuit diagram, components, code, connection and output video.

Reply

**mohd soleh says**
DECEMBER 21, 2017 AT 11:46 AM

sir how can i find the control circuit(Based on LM358)

Reply

**ashfiya says**
DECEMBER 31, 2017 AT 7:55 AM

Which software has been used for coding?

Reply

**Mounika.k says**
JANUARY 7, 2018 AT 10:24 AM

Which software we should use??please anyone give the information please…

Reply

**NineNinjas911 says**
APRIL 3, 2018 AT 3:08 AM

Arduino IDE

i know im pretty late but still...

Reply

**Mohana says**
JANUARY 8, 2018 AT 10:15 AM

Helo sir heartbeat sensor circuit diagram doesn't works
Can u please upload circuit diagram beard board connection video

Reply

**Ankit says**
MAY 8, 2018 AT 12:22 AM

Its not working the heartbeat 0 bpm always , pls give us the breadboard circuit
connection video!
Thank you !

Reply

**preetam says**
JANUARY 17, 2018 AT 2:21 AM

anybody completed this project.....???

Reply

**ashfiya says**

JANUARY 31, 2018 AT 4:07 AM

Connections are done but lcd is showing only black boxes..Can u say why so??😢😢

Reply

**Reb says**

FEBRUARY 21, 2018 AT 8:35 AM

I am also experiencing this problem

Reply

**Maaz says**

FEBRUARY 25, 2018 AT 12:46 AM

Have u solved this problem ??

Reply

**MOHSIN says**

FEBRUARY 3, 2018 AT 11:54 PM

Sir ., Can u please explain the code.

Reply

**Junaid Khan says**

MAY 15, 2018 AT 1:54 PM

Code is so simple

Reply

**Wilber Christ says**

MAY 16, 2018 AT 4:44 PM

Help me to understand

Reply

**Pat says**

FEBRUARY 11, 2018 AT 12:13 PM

Where did you get the heart rate sensor and control circuit from?

Reply

**vinitha says**

FEBRUARY 15, 2018 AT 1:52 PM

can you please explain the code….

Reply

**Daya says**

FEBRUARY 21, 2018 AT 9:03 AM

This program can use for temperature sensor??becouse use LM358

Reply

**Pooja says**
FEBRUARY 25, 2018 AT 5:42 AM

Will this code run without any errors

Reply

**Ravi says**
FEBRUARY 25, 2018 AT 11:26 PM

If you have a similar sensor and made similar connections, then yes, the code will run without errors.

Reply

**hana says**
MARCH 4, 2018 AT 10:54 AM

if( analogRead(data)<100) could you please explain this line

Reply

**Madhurjya Kashyap Bezbaruah says**
MARCH 15, 2018 AT 2:02 PM

Hey,
Can you plz give the link to find these components online.

Reply

**Ravi says**
MARCH 19, 2018 AT 12:23 AM

We bought most of the components from a local electronics store. Sorry, couldn't help you.

Reply

### Waiam says
MARCH 29, 2018 AT 3:59 AM

can you please describe what this part mean in the code ?
byte customChar1[8] =
{0b00000,0b00000,0b00011,0b00111,0b01111,0b01111,0b01111,0b01111};
byte customChar2[8] = {0b00000,0b11000,0b11100,0b11110,0b11111,0b11111,0b11111,0b11111};
byte customChar3[8] = {0b00000,0b00011,0b00111,0b01111,0b11111,0b11111,0b11111,0b11111};
byte customChar4[8] =
{0b00000,0b10000,0b11000,0b11100,0b11110,0b11110,0b11110,0b11110};
byte customChar5[8] =
{0b00111,0b00011,0b00001,0b00000,0b00000,0b00000,0b00000,0b00000};
byte customChar6[8] = {0b11111,0b11111,0b11111,0b11111,0b01111,0b00111,0b00011,0b00001};
byte customChar7[8] = {0b11111,0b11111,0b11111,0b11111,0b11110,0b11100,0b11000,0b10000};
byte customChar8[8] =
{0b11100,0b11000,0b10000,0b00000,0b00000,0b00000,0b00000,0b00000};

Reply

### Ravi says
MARCH 31, 2018 AT 12:11 AM

This part of the code is responsible for the "Heart" symbol that you see on the LCD.

Reply

### Ankit says

MAY 8, 2018 AT 12:24 AM

Pls give us Breadboard connection video
Thank you!

Reply

**HAMDI says**
MARCH 31, 2018 AT 2:27 PM

I want to add an enzyme device in the case of heart rate less than 67 and alarm in the case of heartbeat higher than 80 possible limit modify the code

Reply

**Pon Sabareeswaran says**
APRIL 1, 2018 AT 11:23 PM

could you pls explain me the loop of this code

Reply

**Divya says**
APRIL 6, 2018 AT 4:07 AM

I had to build the control circuit due to non availability. . But now the output heart beat is coming in the range of 2000 and above.. what could be the reason

Reply

**sarah says**

APRIL 15, 2018 AT 12:30 PM

I have the same problem, did u detect the problem ??

Reply

**sajid says**

APRIL 7, 2018 AT 12:57 PM

nothing is showing on LCD after putting program

Reply

**Ravi says**

APRIL 9, 2018 AT 12:23 AM

Make sure that all the connections are correct. Check if the LCD is working with Arduino or not (like displaying "Hello World"). Try to change the Pins of Arduino (which are connected to the LCD). I assure you that the code is tested and works well.

Reply

**Edson says**

APRIL 9, 2018 AT 5:38 PM

Hello can you tell me where can buy the clip to insert finger and control circuit or heartbeat sensor? Can you email me the link please? Thank you..

Reply

**Ravi says**

APRIL 10, 2018 AT 4:05 AM

Sorry. We bought the sensor (and the clip) from a local electronics store. Not sure about its online availability.

Reply

**Edson says**
APRIL 14, 2018 AT 1:07 AM

What is the store name?

Reply

**Ravi says**
APRIL 14, 2018 AT 6:40 AM

Modern Electronics

Reply

**A says**
APRIL 12, 2018 AT 9:04 PM

why are you using count = count * 6?

Reply

**Ravi says**
APRIL 12, 2018 AT 11:41 PM

We are taking the count for a period of 10 seconds. This result is being multiplied by 6 to get the beats per minute value.

Reply

**Tranducanh says**
APRIL 14, 2018 AT 6:39 AM

ravi can you show me how to make finger clips and control circuitry? thank you

Reply

**robert says**
APRIL 15, 2018 AT 10:56 AM

how to upload this code in ardino and what is the process.

Reply

**Ravi says**
APRIL 15, 2018 AT 11:43 PM

Connect your Arduino to the computer and open Arduino IDE. Select the correct Arduino board and PORT. Type in your code and click on upload.

Reply

**sarah says**
APRIL 15, 2018 AT 11:41 AM

Hello! can anybody help me please ! I realised this project and I'm facing a problem. I used a KY 039 detector wish is made with a phototransistor and photodiode. When I place my finger in it the lcd screen shows an anormal response like 6024 BPM . I don't know what the problem is. Give me some heeeelp pleaaaaase . Thank youuuuu

Reply

**ANKUGAH DENNIS says**
APRIL 19, 2018 AT 6:04 PM

please how can i get the CIRCUIT diagram for the control circuit based on the LM358 and its components involved

Reply

**Ravi says**
APRIL 20, 2018 AT 1:13 AM

I have already given the circuit diagram of the control circuit using LM358.

Reply

**Ankugah Dennis says**
APRIL 23, 2018 AT 11:12 AM

Please what are the limitations of the project

Reply

**Emon says**
APRIL 25, 2018 AT 10:54 AM

What to do if i wants to calculate data continuously without pressing the button(but measure for 10 sec when it gets a pulse) and wants to show the bpm in Android bluetooth terminal?

Reply

**Prathyusha says**
APRIL 27, 2018 AT 1:52 AM

Where is the logic explained

Reply

**Rashi says**
APRIL 27, 2018 AT 1:58 AM

Please explain the code

Reply

**Wilber Christ says**
MAY 16, 2018 AT 4:39 PM

Sorry i need the numbers which introduce that heartbeart sensor with probe…and also the number of that controler circuit with LM358….because i want to buy them online.

What if i use KY039,do i need to change the code or to change the gain???

Is it possible to connect (join) this circuit with the temperature sensor in order to display the BPM and the value of temperature of surrounding at the same time with the same LCD????

Please i need your response…help!!!!!!!

Reply

**John Lloyd Gonzales says**
MAY 29, 2018 AT 8:35 AM

Sir may i ask the features of this system about 4 feature please thanks it would be a huge help

Reply

**Ankugah Dennis says**
JUNE 1, 2018 AT 4:58 AM

Please whenever I measure the heartbeat it's in Thousands
instead of Tens

Reply

**Satvik says**
JUNE 8, 2018 AT 10:20 AM

Where can we find the heart rate sensor?

Reply

**Madhav Manohar says**
JUNE 12, 2018 AT 8:08 PM

Can this work without the LM358? I connected the data pin of the sensor into A0, ground to ground and power to 5v.

Reply

**Ankugah Dennis says**
JUNE 14, 2018 AT 4:03 AM

Sir please can you help me out
Whenever I measure the heartbeat it's result is always given in 6054 please kindly help me
sort this very problem

Reply

**CJ says**
JULY 9, 2018 AT 11:44 PM

WHY DID U CHOOSE FIRST OP AMP`S AMPLIFCATION FACTOR IS 1001?
IS THERE ANY SPECIFIC REASON?

Reply

**Ajay Sharma says**
JULY 19, 2018 AT 12:51 PM

How can I get this computer for making heart beat sensor.

Reply

**Meg says**
JULY 26, 2018 AT 3:32 PM

Can not see the code
pls post

Reply

**Ravi says**

JULY 30, 2018 AT 2:03 AM

Code is already uploaded in the page. Please check it once again.

Reply

# Leave a Reply

Your email address will not be published. Required fields are marked *

Comment

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