HEART BEAT DETECTION AND MONITORING SYSTEM

A PROJECT REPORT

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Abstract

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. When the heart beats, the volume of blood cells under the sensor increases and this reflects more IR waves to sensor and when there is no beat the intensity of the reflected beam decreases. The pulsating reflection is converted to a suitable current or voltage pulse by the sensor. The sensor output is processed by suitable electronic circuits to obtain a visible indication (digital display).

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CHAPTER – 1

INTRODUCTION

Introduction

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 easier 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 Phones, chest straps, etc.

Pulse oximetry depends on the optical characteristics of hemoglobin, the blood protein that carries oxygen. When hemoglobin is more highly oxygenated, it becomes more transmissive to red light and more absorptive to infrared light. When hemoglobin contains little oxygen, it becomes relatively more transmissive to infrared, and more absorptive to red light. This property means that by measuring the ratio of red light to infrared light passing through the patient’s finger, the probe can produce a signal proportional to the amount of oxygen in the blood. In addition, the surge of blood on each heartbeat generates a signal representative of the patient’s pulse rate.

CHAPTER - 2

LITERATURE SURVEY

2.1 EXISTING PRODUCTS

Stethoscope

The stethoscope is a medical device for auscultation, or listening to internal sounds of an animal or human body. It typically has a small disc-shaped resonator that is placed against the skin, with either one or two tubes connected to two earpieces. A stethoscope can be used to listen to the sounds made by the heart, lungs or intestines, as well as blood flow in arteries and veins. In combination with a manual sphygmomanometer, it is commonly used when measuring blood pressure.

2.2 PROBLEM STATEMENT

The problem is to develop a system for accurate and reliable detection and tracking of heart beats. The system should be able to detect abnormal heart rhythms or arrhythmias, which can be life-threatening if not treated promptly. Additionally, the system should be non-invasive, user-friendly, and cost-effective. It should also be designed to work in various conditions such as during physical activity, sleep, and other daily routines. Solving this problem would provide an important tool for diagnosis and treatment of heart conditions, and make heart beat monitoring more accessible to people from all walks of life.

CHAPTER -3

PROPOSED SOLUTION

3.1 OVERVIEW

The development of accurate and reliable heartbeat detection systems has been made possible with advances in technology, including machine learning algorithms and wearable devices. These systems can monitor heart rate and rhythm continuously, providing real-time information about any abnormal activity that may require medical attention. Detection of heartbeat systems is also being developed for use in telemedicine, allowing healthcare professionals to remotely monitor patients with heart conditions. These systems can also help individuals monitor their own heart health, promoting early detection and prevention of heart disease. Overall, the detection of heartbeat is a critical aspect of modern medicine, and ongoing research and development in this field hold great promise for improving the detection and treatment of heart conditions.

3.2 BLOCK DIAGRAM

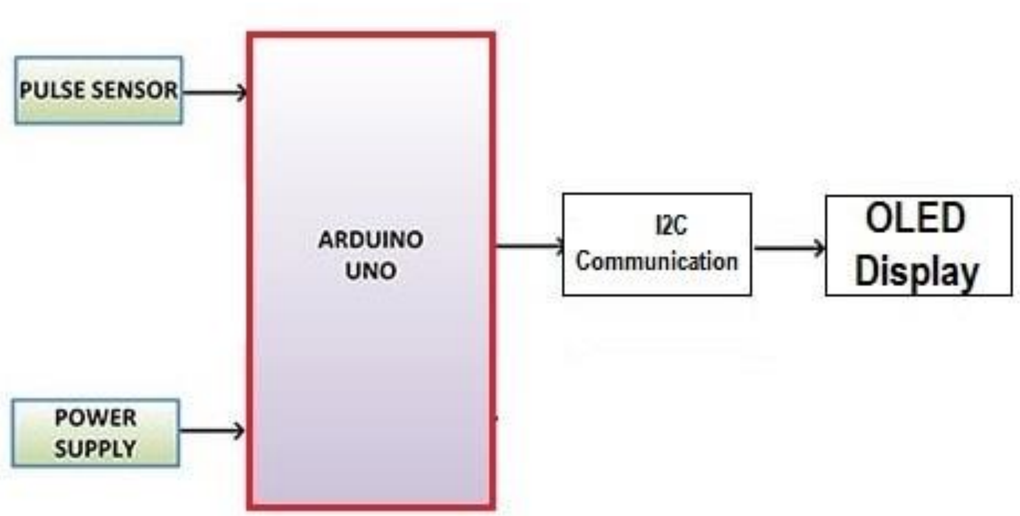

Fig 3.1 Block Diagram

3.3 CIRCUIT DIAGRAM

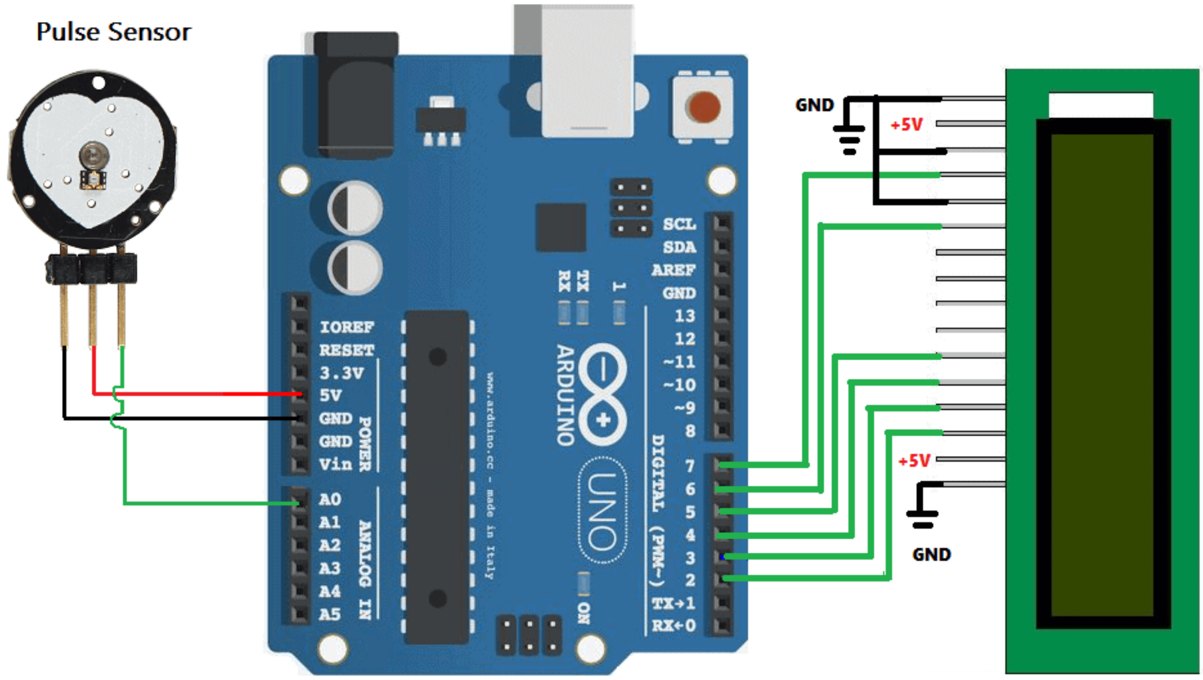

Fig 3.2 Circuit Diagram

CHAPTER - 4

HARDWARE DESCRIPION

4.1 COMPONENTS

4.1.1 ARDUINO UNO

Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins, 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started. You can tinker with your UNO without worrying too much about doing something wrong, worst-case scenario you can replace the chip for a few dollars and start over again. "Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, past or outdated boards see the Arduino index of boards.

Fig 4.1 Arduino UNO

4.1.2 PULSE SENSOR

A pulse sensor is a device that is used to detect and measure the heart rate or pulse of an individual. It works by detecting the changes in blood volume that occur with each heartbeat. Pulse sensors are typically worn on the finger, wrist, or earlobe, and they use light-emitting diodes (LEDs) and photodiodes to detect the pulse. The LED shines light onto the skin, and the photodiode detects the amount of light that is reflected back. When the heart beats, the amount of blood in the blood vessels changes, causing a variation in the amount of light that is reflected back to the photodiode. This variation in light is used to determine the heart rate. Pulse sensors are commonly used in fitness tracking devices, such as smartwatches and activity trackers, to monitor the heart rate during exercise and other physical activities. They can also be used in medical settings to monitor the heart rate of patients, such as during surgery or in intensive care units. The use of pulse sensors has become increasingly popular in recent years, as they provide a convenient and non-invasive way to monitor heart rate. With ongoing advancements in sensor technology, pulse sensors continue to improve in accuracy and reliability, making them an important tool for monitoring heart health.

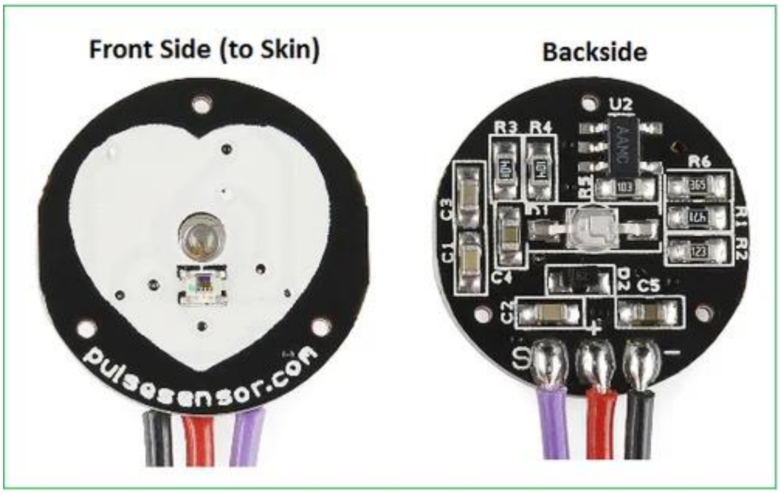

Fig 4.2 Pulse Sensor

4.1.3 LCD DISPLAY

LCD stands for "Liquid Crystal Display". It is a type of flat panel display commonly used in electronic devices such as televisions, computer monitors, smartphones, and digital watches. LCD screens work by manipulating the properties of liquid crystals, which are molecules that can change the way they reflect light when an electric current is applied. The liquid crystals are sandwiched between two sheets of polarizing material, and an array of transistors controls the amount of electric current that flows through each pixel, causing the crystals to either block or allow light to pass through. LCD displays are known for their slim profile, low power consumption, and high resolution. They are widely used in consumer electronics due to their affordability and versatility. However, they can suffer from limited viewing angles and colour accuracy compared to other display technologies such as OLED.

Fig 4.3 LCD Display

CHAPTER -5

SOFTWARE DESCRIPTION

5.1 ARDUINO IDE V-1.8.57

The Arduino IDE is an open-source software used to program Arduino boards. Version 1.8.57, released on May 26, 2020, is an older version of the IDE. It includes features such as compatibility with a wide range of microcontrollers, a simple and user-friendly interface for writing, compiling, and uploading code, built-in code examples and libraries, support for programming languages such as C++, C, and Assembly, and tools for serial communication and debugging. However, since version 1.8.57, newer versions of the IDE have been released with improvements and bug fixes. It is generally recommended to use the latest version available to ensure optimal performance and stability. Upgrading to the latest version can provide access to additional features and fixes for any issues present in previous versions. In summary, while version 1.8.57 is a capable IDE, it is advisable to upgrade to the latest version to take advantage of the latest improvements and features.

Fig 5.1 Arduino IDE V 1.8.57

5.2 CODE STRUCTURE

```
#include <LiquidCrystal.h>

LiquidCrystal lcd (6, 5, 3, 2, 1, 0);

int data=A0;

int start=7;

int count=0;

unsigned long temp=0;

byte customChar1[8] =
{0b00000,0b00000,0b00011,0b00111,0b01111,0b01111,0b01111,0b01
111};

byte customChar2[8] =
{0b00000,0b11000,0b11100,0b11110,0b11111,0b11111,0b11111,0b11
111};

byte customChar3[8] =
{0b00000,0b00011,0b00111,0b01111,0b11111,0b11111,0b11111,0b11
111};

byte customChar4[8] =
{0b00000,0b10000,0b11000,0b11100,0b11110,0b11110,0b11110,0b11
110};

byte customChar5[8] =
{0b00111,0b00011,0b00001,0b00000,0b00000,0b00000,0b00000,0b00
000};
```

```
byte customChar6[8] =
{0b11111,0b11111,0b11111,0b11111,0b01111,0b00111,0b00011,0b00
001};

byte customChar7[8] =
{0b11111,0b11111,0b11111,0b11111,0b11110,0b11100,0b11000,0b10
000};

byte customChar8[8] =
{0b11100,0b11000,0b10000,0b00000,0b00000,0b00000,0b00000,0b00
000};

void setup ()

{

lcd.begin(16, 2);

lcd.createChar(1, customChar1);

lcd.createChar(2, customChar2);

lcd.createChar(3, customChar3);

lcd.createChar(4, customChar4);

lcd.createChar(5, customChar5);

lcd.createChar(6, customChar6);

lcd.createChar(7, customChar7);

lcd.createChar(8, customChar8);
```

```
pinMode(data,INPUT);

pinMode(start,INPUT_PULLUP);

}

void loop ()

{

 lcd.setCursor(0, 0);

 lcd.print("Place The Finger");

 lcd.setCursor(0, 1);

 lcd.print("And Press Start");

  while(digitalRead(start)>0);

   lcd.clear();

   temp=millis();

   while(millis()<(temp+10000))

   {

      if(analogRead(data)<100)

        {

         count=count+1;

         lcd.setCursor(6, 0);

         lcd.write(byte(1));
```

```
    lcd.setCursor(7, 0);
    lcd.write(byte(2));
    lcd.setCursor(8, 0);
    lcd.write(byte(3));
    lcd.setCursor(9, 0);
    lcd.write(byte(4));
    lcd.setCursor(6, 1);
    lcd.write(byte(5));
    lcd.setCursor(7, 1);
    lcd.write(byte(6));
    lcd.setCursor(8, 1);
    lcd.write(byte(7));
    lcd.setCursor(9, 1);
    lcd.write(byte(8));
    while(analogRead(data)<100);
    lcd.clear();
   }
}
    lcd.clear();
```

```
lcd.setCursor(0, 0);

count=count*6;

lcd.setCursor(2, 0);

lcd.write(byte(1));

lcd.setCursor(3, 0);

lcd.write(byte(2));

lcd.setCursor(4, 0);

lcd.write(byte(3));

lcd.setCursor(5, 0);

lcd.write(byte(4));

lcd.setCursor(2, 1);

lcd.write(byte(5));

lcd.setCursor(3, 1);

lcd.write(byte(6));

lcd.setCursor(4, 1);

lcd.write(byte(7));

lcd.setCursor(5, 1);

lcd.write(byte(8));

lcd.setCursor(7, 1);
```

```
 lcd.print(count);

 lcd.print(" BPM");

 temp=0;

 while (1);

}
```

CHAPTER - 6

RESULT

RESULT

Heartbeat detection and monitoring can be achieved through two methods: electrocardiography (ECG) and photoplethysmography (PPG). ECG detects the electrical activity of the heart by placing electrodes on the skin, providing a detailed and accurate view of the heart's electrical activity, making it ideal for diagnosing arrhythmias. However, it requires specialized equipment and trained personnel, limiting its use in remote or home settings. PPG, on the other hand, is a simpler and more portable method that detects heartbeats using a light source and a sensor to measure blood volume changes. PPG is lightweight, easy to use, and suitable for home or outpatient settings. However, it may not be as accurate as ECG in detecting some heart conditions, and it can be affected by external factors like light and movement. In conclusion, ECG and PPG are both effective methods for detecting and monitoring heartbeats, with the choice of method depending on the patient's needs and the monitoring setting. ECG is more suited to diagnosing specific heart conditions, while PPG is ideal for monitoring heart function in a wider range of settings.

Fig 6.1 Detection of Heartbeat

CHAPTER - 7

CONCLUSION & FUTURE SCOPE

Conclusion

Overall, the project demonstrated the effectiveness of non-invasive methods for detecting and monitoring heartbeats. By using ECG and PPG, doctors and nurses can quickly identify any irregularities in a patient's heart function and take appropriate action to diagnose and treat any underlying conditions. With further advances in technology, these methods are likely to become even more accurate and reliable, making them an essential tool in modern healthcare.

Future Scope

Smart Rings: These are devices you wear on one of your fingers like a piece of jewellery. They also use optical detection to track your heart rate and other vital signs. These devices are still very new, and there’s limited data on their accuracy.

Smartphones: Various smartphone apps across the different platforms offer the ability to measure your pulse rate. Some of these uses optical detection to find your pulse rate by holding your finger to the camera lens, with the camera’s flash used to illuminate the blood vessels under your skin. Others use the camera itself, pointed at your face, to detect your pulse rate based on visible — but undetectable with your eyes — changes in your skin

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