

# LOW POWER WEARABLE ECG AND HEALTH MONITORING SYSTEM FOR MULTIPLE-PATIENT

```
#include <Arduino.h>
```

```
#include <SoftwareSerial.h>
```

```
#include <Wire.h>
```

```
#include <LiquidCrystal_PCF8574.h>
```

```
#include <SFE_BMP180.h>
```

```
    #include <SPI.h>
```

```
#include <Adafruit_Sensor.h>
```

```
#include <Adafruit_BMP280.h>
```

```
#include <Wire.h>
```

```
#include "MAX30105.h"
```

```
#include "heartRate.h"
```

```
MAX30105 particleSensor;
```

```
const byte RATE_SIZE = 4; //Increase this for more averaging. 4 is good.
```

```
byte rates[RATE_SIZE]; //Array of heart rates
```

```
byte rateSpot = 0;
```

```
long lastBeat = 0; //Time at which the last beat occurred
```

```
float beatsPerMinute;
```

```
int beatAvg;
```

```
LiquidCrystal_PCF8574 lcd(0x27); // set the LCD address to 0x27 for a 16 chars and 2 line display
```

```
int show = -1;
```

```
int co=0;
```

```
#define BMP_SCL 13
```

```
#define BMP_SDO 12

#define BMP_SDA 8

#define BMP_CSB1 9

Adafruit_BMP280 bmp1(BMP_CSB1, BMP_SDA, BMP_SDO, BMP_SCL);

#define USE_ARDUINO_INTERRUPTS true

// Include necessary libraries

#include <PulseSensorPlayground.h>

long reading;

//int RXPin = 2;

//int TXPin = 3;

//

//SoftwareSerial sSerial(RXPin, TXPin);

const int PULSE_SENSOR_PIN = 1; // Analog PIN where the PulseSensor is connected

const int LED_PIN = 13; // On-board LED PIN

const int THRESHOLD = 550;

PulseSensorPlayground pulseSensor;

void setup() {

  Serial.begin(9600);

  Serial.println("Initializing...");


  // Initialize sensor

  if (!particleSensor.begin(Wire, I2C_SPEED_FAST)) {

    Serial.println("MAX30102 was not found. Please check wiring/power. ");

    while (1);

  }

  Serial.println("Place your index finger on the sensor with steady pressure.");

  particleSensor.setup(); //Configure sensor with default settings
```

```
particleSensor.setPulseAmplitudeRed(0x0A); //Turn Red LED to low to indicate sensor is running
```

```
particleSensor.setPulseAmplitudeGreen(0); //Turn off Green LED
```

```
if (!bmp1.begin()) {  
    // Serial.println("Sensor BMP280 device 1 was not found.");  
    //lcd.setCursor(0,1);  
    //lcd.print("not found");  
    while (1);  
}  
//Serial.println("Initialize BMP280 1 completed.");  
//lcd.setCursor(0,1);  
//lcd.print("found");  
delay(2000);  
// sSerial.begin(9600);  
    Serial.begin(9600);  
    int error;  
    Serial.begin(9600);  
    Wire.begin();  
    Wire.beginTransmission(0x27);  
    error = Wire.endTransmission();  
    lcd.begin(16, 2);  
    lcd.setBacklight(255);  
    lcd.home();  
    lcd.clear();  
    lcd.print("welcome");  
    lcd.setCursor(0, 1);  
    lcd.print("_____");
```

```
    delay(1000);

// initialize the serial communication:
Serial.begin(9600);
pinMode(10, INPUT); // Setup for leads off detection LO +
pinMode(11, INPUT); // Setup for leads off detection LO -
pulseSensor.analogInput(PULSE_SENSOR_PIN);
pulseSensor.blinkOnPulse(LED_PIN);
pulseSensor.setThreshold(THRESHOLD);
if (pulseSensor.begin())
{
    //Serial.println("PulseSensor object created successfully!");
}

}

void loop() {

// Get the current Beats Per Minute (BPM)
int currentBPM = pulseSensor.getBeatsPerMinute();

// Check if a heartbeat is detected
if (pulseSensor.sawStartOfBeat())
{
//    Serial.println("♥ A HeartBeat Happened!");
//    Serial.print("BPM: ");
//    Serial.println(currentBPM);
}
```

```
// Add a small delay to reduce CPU usage
```

```
delay(20);
```

```
if((digitalRead(10) == 1)|| (digitalRead(11) == 1)){
```

```
    Serial.println('!');
```

```
}
```

```
else{
```

```
    // send the value of analog input 0:
```

```
    Serial.println(analogRead(A0));
```

```
}
```

```
//Wait for a bit to keep serial data from saturating
```

```
delay(1);
```

```
lcd.clear();
```

```
    float pressure = bmp1.readPressure() / 100.0;
```

```
    pressure= pressure-981;
```

```
float vib= analogRead(A2);
```

```
vib = vib* (70/ 1023.0);
```

```
    delay(500);
```

```
long irValue = particleSensor.getIR();
```

```
if (checkForBeat(irValue) == true) {
```

```
    //We sensed a beat!
```

```
    long delta = millis() - lastBeat;
```

```
    lastBeat = millis();
```

```
    beatsPerMinute = 60 / (delta / 1000.0);
```

```

if (beatsPerMinute < 255 && beatsPerMinute > 20) {
    rates[rateSpot++] = (byte)beatsPerMinute; //Store this reading in the array
    rateSpot %= RATE_SIZE; //Wrap variable

    //Take average of readings
    beatAvg = 0;
    for (byte x = 0 ; x < RATE_SIZE ; x++)
        beatAvg += rates[x];
    beatAvg /= RATE_SIZE;
}
}

int k=irValue/1000;

// Serial.print("IR=");
// Serial.print(k);
// Serial.print(", BPM=");
// Serial.print(beatsPerMinute);
// Serial.print(", Avg BPM=");
// Serial.print(beatAvg);

if (irValue < 50000)
//   Serial.print(" No finger?");
//
// Serial.println();

lcd.clear();
lcd.print("ECG: ");
lcd.print(analogRead(A0));
lcd.setCursor(0, 1);

```

```
lcd.print("SpO2: ");
```

```
lcd.print(k);
```

```
delay(1000);
```

```
lcd.clear();
```

```
lcd.print("T: ");
```

```
lcd.print(vib);
```

```
lcd.setCursor(0, 1);
```

```
lcd.print("BP: ");
```

```
lcd.print(pressure);
```

```
delay(1000);
```

```
Serial.print(analogRead(A0));
```

```
Serial.print(",");
```

```
Serial.print(k);
```

```
Serial.print(",");
```

```
Serial.print(vib);
```

```
Serial.print(",");
```

```
Serial.print(pressure);
```

```
Serial.print(",");//
```

```
Serial.print("0");
```

```
Serial.println(",");
```

```
Serial.print("\n");
```

```
delay(1000);
```

```
if((analogRead(A0)>100)&&(analogRead(A0)<400))
```

```
{
```

```
lcd.clear();
```

```
lcd.print("abnormal egc");
```

```
//digitalWrite(9, HIGH);
```

```
delay(500);
```

```
}  
else  
{  
  
    //digitalWrite(9, LOW);  
}  
if((vib>50))  
{  
    lcd.clear();  
    lcd.print("abnormal temp");  
    //digitalWrite(9, HIGH);  
    delay(500);  
}  
else  
{  
  
    //digitalWrite(9, LOW);  
}  
// if(currentBPM>130)  
// {  
//     lcd.clear();  
//     lcd.print("abnormal bmp");  
//     //digitalWrite(9, HIGH);  
//     delay(100);  
// }  
// else  
// {  
//  
//     //digitalWrite(9, LOW);
```



```
// }  
if(((analogRead(A0)>100)&&(analogRead(A0)<400))||(vib>50))  
{  
  
    digitalWrite(9, HIGH);  
    delay(100);  
}  
else  
{  
  
    digitalWrite(9, LOW);  
}  
  
}
```