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| **Programs\_for\_microcontroller**//program 1 //Example 5 of the SparkFun library to measure the heart rate/\* Optical Heart Rate Detection (PBA Algorithm) using the MAX30105 Breakout <https://github.com/sparkfun/MAX30105_Breakout>This is a demo to show the reading of heart rate or beats per minute (BPM) using a Peripheral Beat Amplitude (PBA) algorithm.It is best to attach the sensor to your finger using a rubber band or other tightening device. Humans are generally bad at applying constant pressure to a thing. When you press your finger against the sensor it varies enough to cause the blood in your finger to flow differently, which causes the sensor readings to go wonky. Hardware Connections (Breadboard to Arduino): -5V = 5V (3.3V is allowed) -GND = GND -SDA = A4 (or SDA) -SCL = A5 (or SCL) -INT = Not connected The MAX30105 Breakout can handle 5V or 3.3V I2C logic. We recommend powering the board with 5V but it will also run at 3.3V.\*/#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 ratesbyte rateSpot = 0;long lastBeat = 0; //Time at which the last beat occurredfloat beatsPerMinute;int beatAvg;void setup(){ Serial.begin(115200); Serial.println("Initializing..."); // Initialize sensor if (!particleSensor.begin(Wire, I2C\_SPEED\_FAST)) //Use default I2C port, 400kHz speed { Serial.println("MAX30105 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}void loop(){ 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; } } Serial.print("IR="); Serial.print(irValue); Serial.print(", BPM="); Serial.print(beatsPerMinute); Serial.print(", Avg BPM="); Serial.print(beatAvg); if (irValue < 50000) Serial.print(" No finger?"); Serial.println();}// program 2//measure oxygen level and heart rate /\*This demo shows heart rate and SPO2 levels. It is best to attach the sensor to your finger using a rubber band or other tightening device. Humans are generally bad at applying constant pressure to a thing. When you press your finger against the sensor it varies enough to cause the blood in your finger to flow differently, which causes the sensor readings to go wonky. Hardware Connections ( to Arduino): -5V = 5V (3.3V is allowed) -GND = GND -SDA = A4 (or SDA) -SCL = A5 (or SCL) -INT = Not connectedThe MAX30105 Breakout can handle 5V or 3.3V I2C logic. We recommend powering the board with 5V, but it will also run at 3.3V.\*/#include <Wire.h>#include "MAX30105.h"#include "spo2\_algorithm.h"MAX30105 particleSensor;#if defined(\_\_AVR\_ATmega328P\_\_) || defined(\_\_AVR\_ATmega168\_\_)uint16\_t irBuffer[100];uint16\_t redBuffer[100];#elseuint32\_t irBuffer[100];uint32\_t redBuffer[100];#endifint32\_t bufferLength;int32\_t spo2;int8\_t validSPO2;int32\_t heartRate;int8\_t validHeartRate;void setup() { Serial.begin(115200); // Initialize sensor if (!particleSensor.begin(Wire, I2C\_SPEED\_FAST)) { Serial.println(F("MAX30105 was not found. Please check wiring/power.")); while (1); } byte ledBrightness = 60;  byte sampleAverage = 4;  byte ledMode = 2;  byte sampleRate = 100; // Options: 50, 100, 200, 400, 800, 1000, 1600, 3200 int pulseWidth = 411; // Options: 69, 118, 215, 411 int adcRange = 4096; // Options: 2048, 4096, 8192, 16384 particleSensor.setup(ledBrightness, sampleAverage, ledMode, sampleRate, pulseWidth, adcRange);}void loop() { bufferLength = 100;   for (byte i = 0; i < bufferLength; i++) { while (particleSensor.available() == false)  particleSensor.check();  redBuffer[i] = particleSensor.getRed(); irBuffer[i] = particleSensor.getIR(); particleSensor.nextSample();  } // Calculate heart rate and SpO2 after first 100 samples (first 4 seconds of samples) maxim\_heart\_rate\_and\_oxygen\_saturation(irBuffer, bufferLength, redBuffer, &spo2, &validSPO2, &heartRate, &validHeartRate); int lastHeartRate = 0; int lastSpO2 = 0; while (1) { // Dump the first 25 sets of samples in the memory and shift the last 75 sets of samples to the top for (byte i = 25; i < 100; i++) { redBuffer[i - 25] = redBuffer[i]; irBuffer[i - 25] = irBuffer[i]; } // Take 25 sets of samples before calculating the heart rate for (byte i = 75; i < 100; i++) { while (particleSensor.available() == false)  particleSensor.check();  redBuffer[i] = particleSensor.getRed(); irBuffer[i] = particleSensor.getIR(); particleSensor.nextSample();  } // After gathering 25 new samples recalculate HR and SpO2 maxim\_heart\_rate\_and\_oxygen\_saturation(irBuffer, bufferLength, redBuffer, &spo2, &validSPO2, &heartRate, &validHeartRate); // Check if the values are valid if (validHeartRate && heartRate >= 60 && heartRate <= 120) { lastHeartRate = heartRate; } if (validSPO2 && spo2 >= 89 && spo2 <= 100) { lastSpO2 = spo2; } // Print the last valid values Serial.print("HR="); Serial.print(lastHeartRate); Serial.print(", SPO2="); Serial.println(lastSpO2); }}// program3: //Capture and plot Electrocardiogram Signal void setup() {Serial.begin(9600); pinMode(10,INPUT); pinMode(11,INPUT);}void loop() {if((digitalRead(10)==1)||(digitalRead(11)==1)){ Serial.println(“:D"); } else{ Serial.println(analogRead(A0)); } delay(10);} |