

#### • TEAM MEMBERS

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## WEEK 1

- Selection of topic for group project
- Gathering information about our project and researching about oximeter
- Presentation making

## WEEK 2

- Ordering the required components
- Study of basic code and installing all the required libraries
- Making few changes in the code
- Presentation making

## WEEK 3

- Assembly for the project
- Checking whether the code is compiling an resolving issues
- Finally running the code through arduino and the whole hardware setup
- Report making

#### WORK DISTRIBUTION

## SANJANA BATCHU

Selecting the required components for assembly

Assembly of whole project

Presentation making

## LAKSHMI PRASANNA

Involved in research work about the project about hardware assembly

Report making

presentation making

## VIVEK SANDHU

Involved in research about project

learnt about the connections required

Editing the video

## PRIYANSHU KUMAR

Done the research work about code

Learnt about libraries to be installed and resolving issues of code

Preparing the code



## WHAT IS A PULSE OXIMETER

The pulse oximeter is a small, clip-like device that attaches to a body part, like toes or an earlobe.

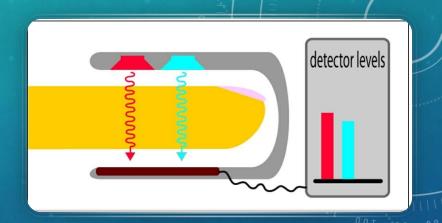
It's most commonly put on a finger, and it's often used in a critical care setting like emergency rooms or hospitals.

Some doctors, such as pulmonologists, may use it in office.

Pulse oximetry is a noninvasive and painless test that measures your oxygen saturation level, or the oxygen levels in your blood.

### **WORKING PRINCIPLE**

Oximeters work by the principles of spectrophotometry: the relative absorption of red (absorbed by deoxygenated blood) and infrared (absorbed by oxygenated blood) light of the systolic component of the absorption waveform correlates to arterial blood oxygen saturations



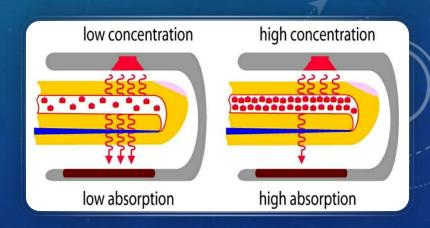
## The absorbance of light depends upon:

Concentration of light absorbing the substance

Light path length in the absorbing substance

Hbo2 and Hb absorb red and IR differently

The oximeter computer takes these factors and computes the saturation



## IMPORTANCE OF PULSE OXIMETER IN COVID PANDEMIC

In these COVID times, the necessity to check a person's oxygen saturation levels has grown quite evidently. COVID-19 effects a person's breathing capacity and hence must be monitored.

It can be used to assess the safety of patients suffering from cardiovascular or respiratory problems.

Due to lockdown, everyone resorted to online mediums be it for work-from-home or online classes. People hardly move out of their homes. Living in closed rooms increase CO2 levels in the layperson

Oximeters have been flying off the shelves for many households' first aid kits, largely because they are non-invasive, low-cost, easy to use, and effective at detecting hypoxemia (low blood oxygen levels).

## BLOOD OXYGEN LEVELS (SPO<sub>2</sub>)

**Normal:** A normal ABG oxygen level for healthy lungs falls between 80 and 100 millimeters of mercury (mm Hg). If a pulse ox measured your blood oxygen level (SpO2), a normal reading is typically between 95 and 100 percent.

**Below normal:** A below-normal blood oxygen level is called hypoxemia. Hypoxemia is often cause for concern. The lower the oxygen level, the more severe the hypoxemia. This can lead to complications in body tissue and organs.

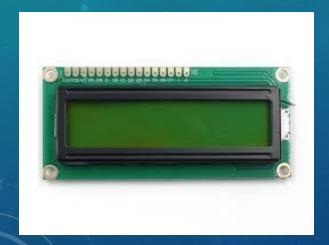
Normally, a PaO<sub>2</sub> reading below 80 mm Hg or a pulse ox (SpO2) below 95 percent is considered low. It's important to know what's normal for you, especially if you have a chronic lung condition.



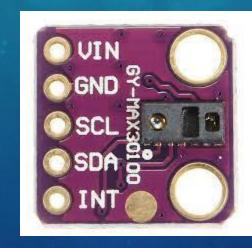
## **COMPONENTS NEEDED**



**BREAD BOARD** 



**HC-05 BLUETOOTH MODULE** 





DIGITAL (MM-) E E

SEE ARDUINO

WINDS

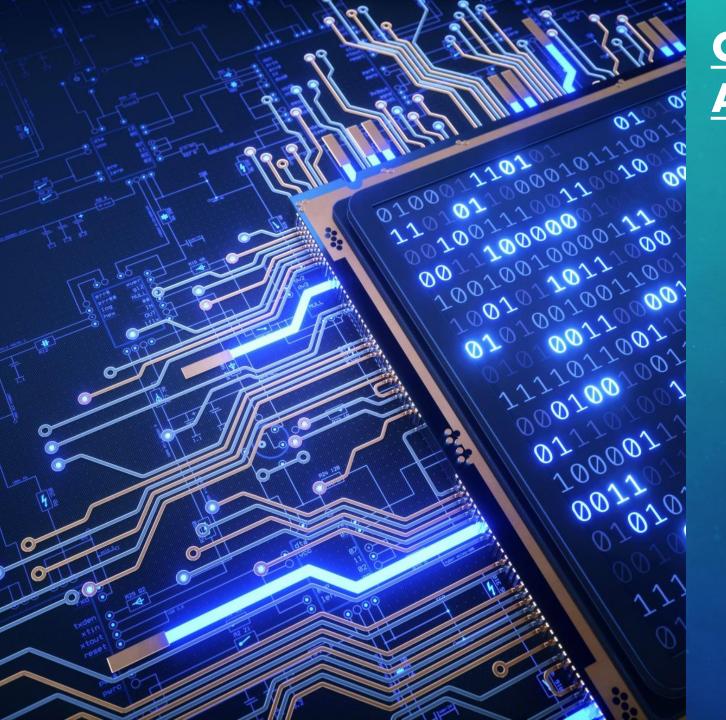
PONTE MANAGE TO SEE

PONTE MANAGE

**ARDUINO BOARD** 



JUMPER WIRES



## ORDERED COMPONENTS AND TOTAL BUDGET

ARDUINO UNO

**JUMPER WIRES** 

**BREAD BOARD** 

LCD DISPLAY

MAX30100 SENSOR

**SOLDERING IRON PEN** 

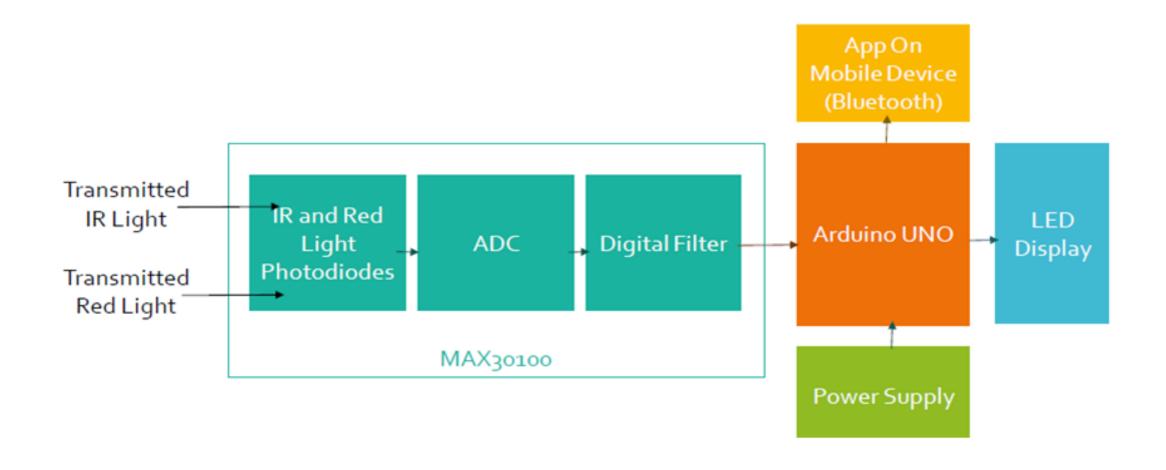
**POTENTIOMETER** 

**RESISTANCES** 

**BLUETOOTH MODULE** 

ALL WERE ORDERED IN AMAZON THE TOTAL COST OF MAKING IS 2500 INR

#### **WORKING OF PULSE OXIMETER**



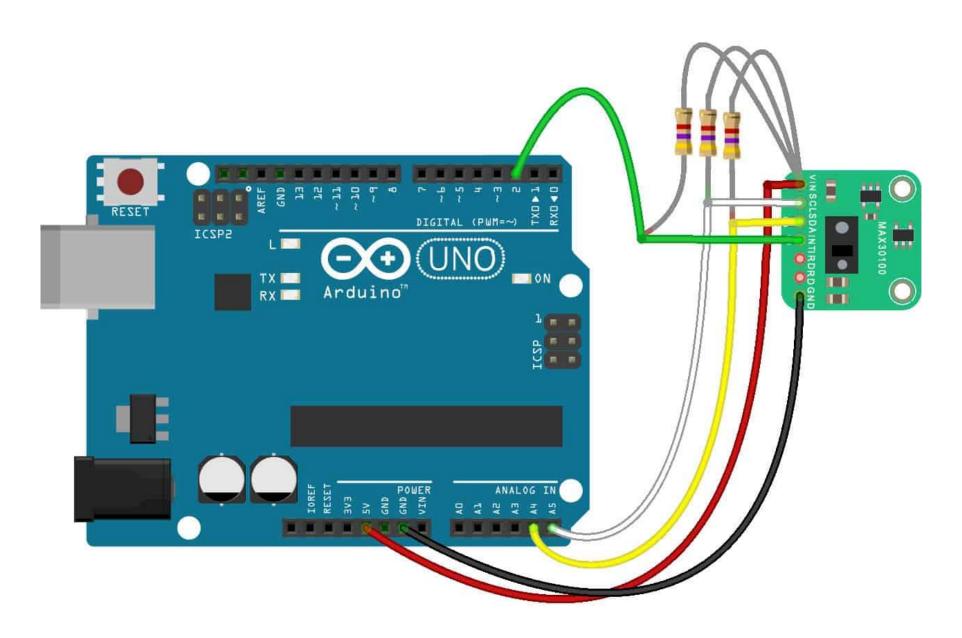
## UNDERSTANDING THE SENSOR

#### **Definition of Pins**



Number	Pins	Definition of Pins	
1	VIN	Power Input 1.8V - 5.5V	
2	SCL	IIC-SCL	
3	SDA	IIC-SDA	
4	INT	MAX30100 INT	
5	IRD	MAX30100 IR_DRV	
6	RD	MAX30100 R_DRV	
7	GND	Ground	

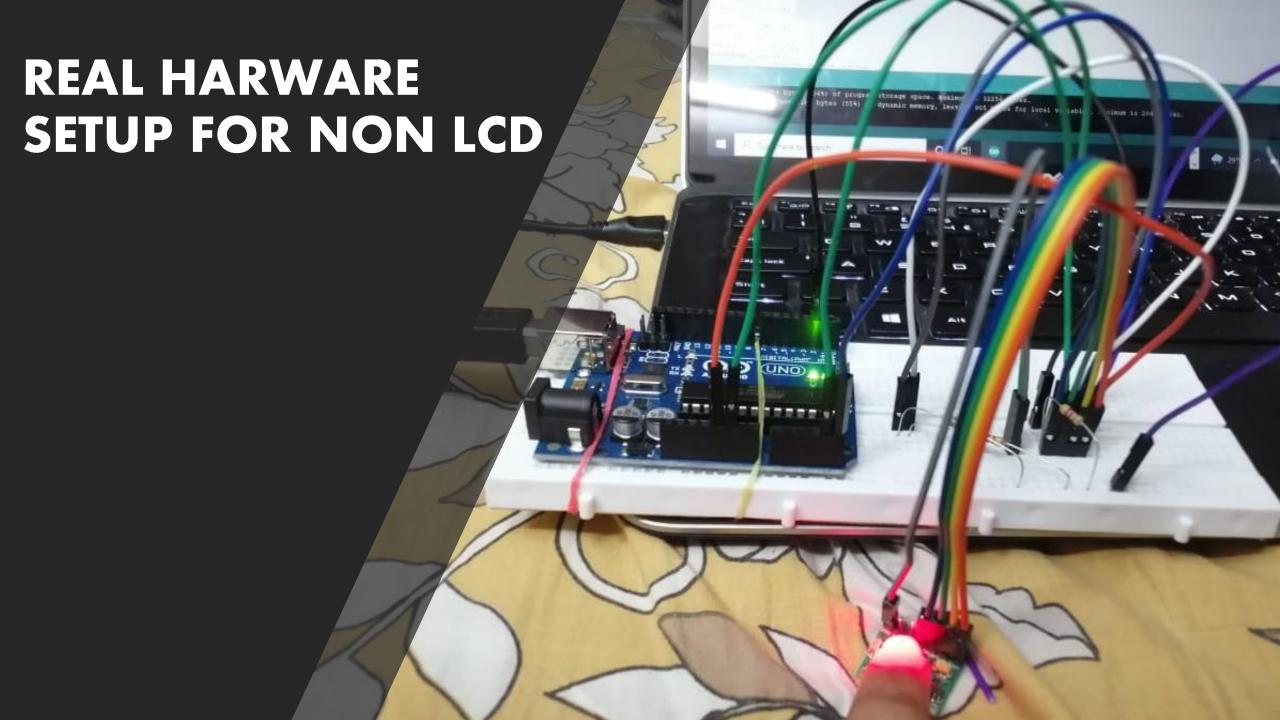
#### WIRING FOR THE SERIAL MONITOR TEST



#### Wiring for our serial monitor test (no LCD test)

#### **PINS Connections**

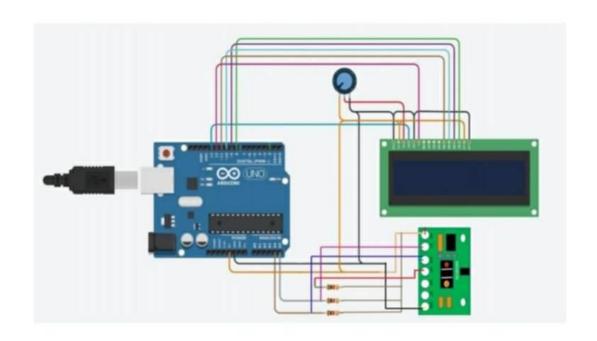
From	Pins	connected to
Arduino	A4	SDA of sensor
Arduino	A5	SCL of sensor
4.7k resistor	VIN of sensor	SCL of sensor
4.7k resistor	VIN of sensor	SDA of sensor
4.7k resistor	VIN of sensor	INT of Sensor
Arduino	2	INT of Sensor
Arduino	GND	GND of sensor
Arduino	5V	VIN of Sensor

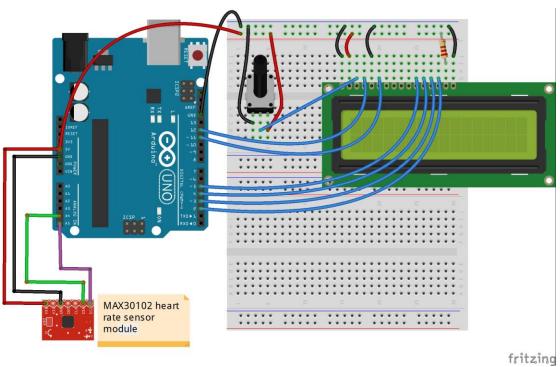


# CODE

```
#include < Wire.h >
 #include "MAX30100_PulseOximeter.h"
 #define REPORTING_PERIOD_MS 1000
PulseOximeter pox;
uint32_t tsLastReport = 0;
void onBeatDetected()
Serial.println("beat!");
void setup() {
Serial.begin(115200);
Serial.println("Initializing pulse oximeter...");
if(!pox.begin()){
 Serial.println("FAILED");
 for(;;);
else
Serial.println("success");
pox.setIRLedCurrent(MAX30100_LED_CURR_7_6MA);
pox.setOnBeatDetectedCallback(onBeatDeatected);
void loop()
pox.update();
if(millis() - tsLastReport > REPORTING_PERIOD_MS) {
 Serial.print("Heart Rate: ");
 Serial.print(pox.getHeartRate());
 Serial.print("bpm / SpO2:");
 Serial.print(pox.getSpO2());
 Serial.println("%");
 tsLastReport = millis();
```

#### Wiring for LCD based pulse oximeter

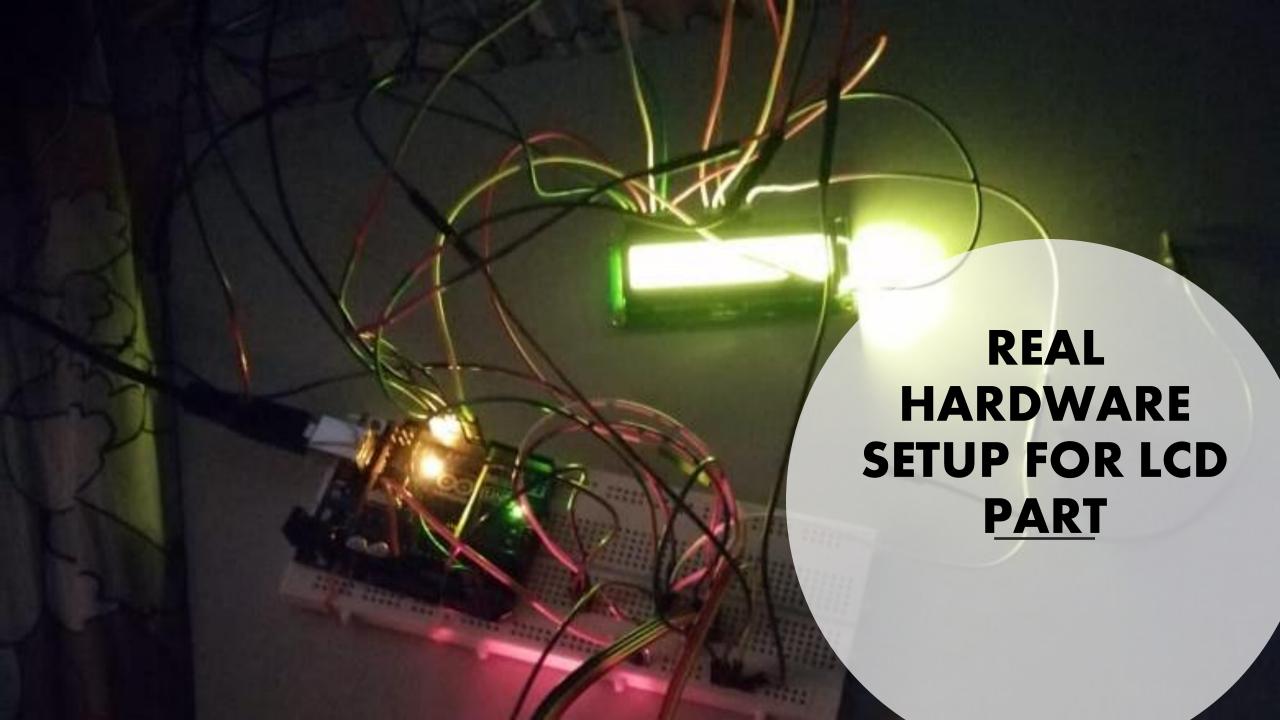


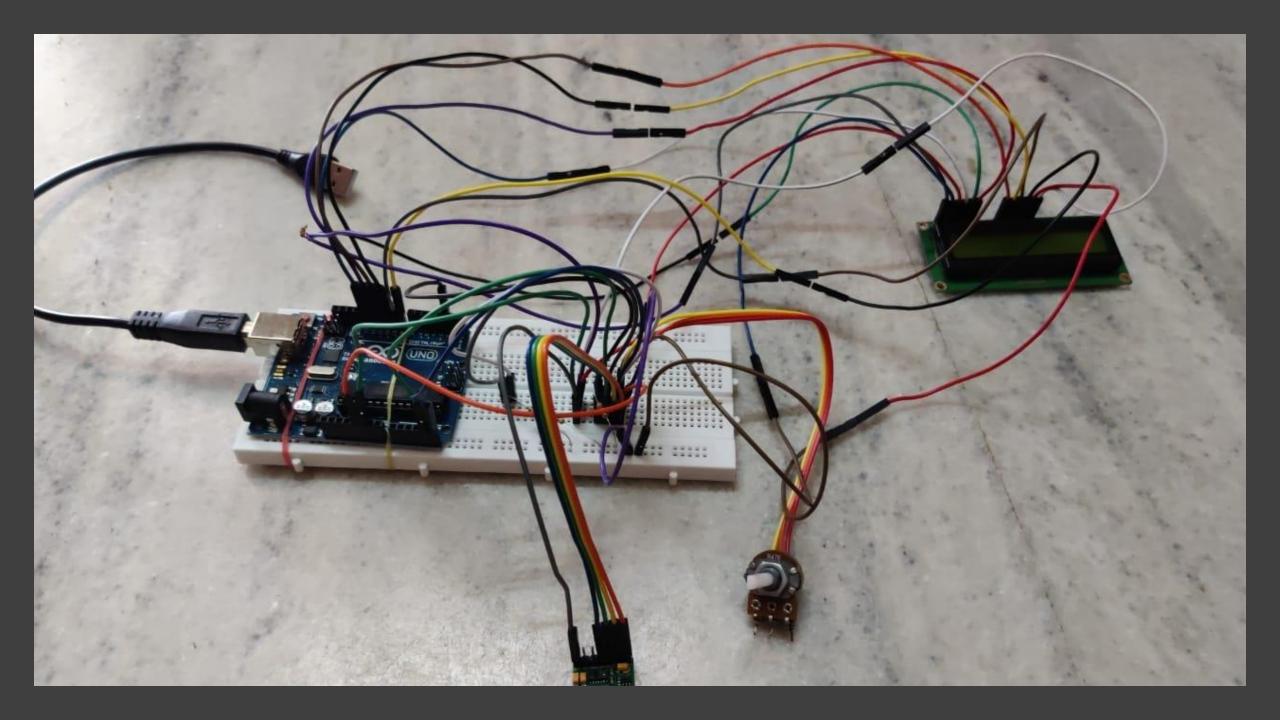


#### Wiring for LCD test

#### **PINS Connections**

From	Pins	connected to
Arduino	13	LCD pin 4
Arduino	12	LCD pin 6
Arduino	-11	LCD pin 11
Arduino	-10	LCD pin 12
Arduino	-9	LCD pin 13
Arduino	8	LCD pin 14
Arduino	5V	VIN of sensor+One End of potentiometer+Pin 2 of LCD +Pin 15 of LCD
Arduino	GND	GND of Sensor +other end of potentiometer + Pin 1 of LCD +Pin 5 of LCD + Pin 16 of LCD
Arduino	A4	SDA of sensor
Arduino	A5	SCL of sensor
LCD	3	Middle end of Potentiometer
4.7k resistor	VIN of sensor	SCL of sensor
4.7k resistor	VIN of sensor	SDA of sensor
4.7k resistor	VIN of sensor	INT of Sensor





### **CODE USED**

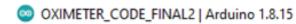
OXIMETER\_CODE\_FINAL2 | Arduino 1.8.15

File Edit Sketch Tools Help



OXIMETER\_CODE\_FINAL2

```
#include <LiquidCrystal.h>
#include <Wire.h>
#include "MAX30100_PulseOximeter.h"
LiquidCrystal 1cd(13,12,11,10,9,8);
#define REPORTING_PERIOD_MS 1000
PulseOximeter pox;
uint32_t tsLastReport = 0;
void onBeatDetected()
 Serial.println("Beat!");
void setup()
   Serial.begin(115200);
   Serial.print("Initializing pulse oximeter..");
   lcd.begin(16,2);
   lcd.setCursor(0,0);
```



File Edit Sketch Tools Help



#### OXIMETER\_CODE\_FINAL2

```
lcd.setCursor(0,1);
lcd.print("DIY PROJECT");
delay(2000);
lcd.clear();
lcd.setCursor(0,0);
lcd.print("BY GROUP 20");
delay(2000);
lcd.clear();
lcd.setCursor(0,0);
lcd.print("TEAM MEMBERS");
lcd.setCursor(0,0);
delay(2000);
lcd.clear();
lcd.println("K.L.PRASANNA");
lcd.setCursor(0,1);
lcd.print("20CH10032");
delay(3000);
lcd.clear();
lcd.setCursor(0,0);
lcd.println("SANJANA BATCHU");
lcd.setCursor(0,1);
lcd.print("20MA20015");
delay(3000);
lcd.clear();
lcd.setCursor(0,0);
lcd.println("PRIYANSHU KUMAR");
lcd.setCursor(0,1);
lcd.print("20PH20030");
delav(3000):
```



File Edit Sketch Tools Help



#### OXIMETER\_CODE\_FINAL2

```
pox.setIRLedCurrent(MAX30100_LED_CURR_7_6MA);
    pox.setOnBeatDetectedCallback(onBeatDetected);
void loop()
    pox.update();
    if (millis() - tsLastReport > REPORTING_PERIOD_MS)
       Serial.print("Heart rate:");
       Serial.print(pox.getHeartRate());
       Serial.print("bpm / Sp02:");
       Serial.print(pox.getSp02());
       Serial.println("%");
       lcd.clear();
       lcd.setCursor(0,0);
       lcd.print("BPM : ");
       lcd.print(pox.getHeartRate());
       lcd.setCursor(0,1);
       lcd.print("Sp02: ");
       lcd.print(pox.getSp02());
       lcd.print("%");
       tsLastReport = millis();
```

#### **Activate Windows** Go to Settings to activate Windows.

60























```
Initializing pulse oximeter.. Initializing pulse oximeter.. SUCCESS
Heart rate:57bpm / Spo2:99%
Heart rate:73bpm / Spo2:98%
Heart rate: 800pm / Sp02:97%
Boat t
Seat!
Beart rate:945pm / Sp02:98%
Heart rate:73tpm / Sp02:99%
los_setCursor(0,0);
of this complete page contains the commands related to user interface
les.printin("WELCOME USER");
 W- 89 8105092
 Led. sercursor 10, 11;
 ACE . FELDE I TERM TO DIV PROJECT !!
 - 189 (2000) 2
 Lot clear();
 Lod Ber Charge (D. D):
 LOS DELETA PERSON INCOME.
 Statch uses 12182 Sytem (37%) of program
 olohal variables use $47 bytes [469] of dynamic memory.
            Type here to search
```

## READINGS OF SERIAL MONITOR

### PROBLEMS WE FACED WHILE COMPILING THE CODE

```
pox.update:
unit32 tsLastReport = 0;
void onBeat()
  serial.printIn("BeatDetected");
void setup()
    Serial.begin(115200);
    Serial.print("Initializing pulse oximeter..");
    lcd.begin(16,2);
    lcd.setcursor(0,0);
                                                                                                                                                                                                      Copy error messages
'pox' does not name a type; did you mean 'pow'?
  IMETER_CODE_Finall:84:20: error: 'tsLastReport' was not declared in this scope
if (millis() - tsLastReport > REPORTING_PERIOD_MS)
  IMETER CODE Finall:84:35: error: 'REPORTING PERIOD MS' was not declared in this scope
    if (millis() - tsLastReport > REPORTING PERIOD MS)
                                                                                                                                                                           Activate Windows
                                                                                                                                                                           Go to Settings to activate Windows.
```



CHALLENGES WE FACED
 WHILE COMPLETING THE PROJECT

Due to lockdown we received a few components late

We have faced many errors during compiling our code but worked collectively to know what are the extra libraries needed to install for working our code

All the assembly was done right but there was some problem with the lcd screen

So we couldn't show the readings on LCD screen but the readings were properly shown on the serial monitor

Due to time constraints and lack of further components for assembly app development was put to halt



• VIDEO DEMONSTRATION OF OUR ENTIRE PROJECT :

https://youtube/kAblgwoKZCM

#### **REFERENCES:**

- https://datasheets.maximintegrated.com/en/ds/MAX30100.pdf
- https://www.electroniclinic.com/max30100-pulse-oximeterarduino-code-circuit-and-programming/
- https://how2electronics.com/interfacing-max30100-pulseoximeter-sensor-arduino/
- https://store.arduino.cc/digital/create
- https://how2electronics.com/interfacing-max30100-pulseoximeter-sensor-arduino/



### **ACKNOWLEDGEMENTS**

• WE THANK ALL THE PROFESSORS AND TA'S FOR COOPERATING WITH US FOR OUR PROJECT COMPLETION AND SUBMISSION

WE SINCERELY THANK **PROFESSOR JAYAN**(JAYANARAYAN) FOR HELPING US COMPLETING
AND SUGGESTING US BETTER WAYS TO
COMPLETE OUR PROJECT

AND THANKS FOR THE DIY LAB TO LET US DO OUR PROJECT AND GET HANDS ON EXPERIENCE ABOUT REAL PROJECTS OUT THERE AND UNDERSTANDING THE TECHNOLOGY IN A BETTER



## • THANK YOU