OXYGEN LEVEL MEASUREMENT SYSTEM

Project report submitted in fulfilment of the award of degree of

Bachelors Of Technology

In

Electronics and Communication Engineering

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CERTIFICATE

This is to certify that the work contained in the dissertation, "**Oxygen Level Measurement System** " which was submitted by the students **Sarim Khan (08610102819), Shahbaz Khan (08010102819), Akash Upadhyay (08110102819),** and **Ritik Kumar (12810102819),** satisfies a portion of the requirements for the award of the Degree of "Bachelor of Technology in Electronics and Communication Engineering" discipline to NSUT East Campus, Geeta Colony, New Delhi (Formerly known as Ambedkar Institute Of Advanced Communication Technologies and Research) affiliated by GGISPU during the academic year 2019 – 2023.

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DECLARATION

We, the seventh semester B.Tech. Electronics and Communication Engineering students at NSUT East Campus, hereby declare that we have completed and submitted the project work titled "**OXYGEN LEVEL MEASUREMENT SYSTEM"** In partial fulfilment of the course requirements for the award of a degree in Bachelor of Technology in Electronics and Communication Engineering at NSUT East Campus (Formerly known as Ambedkar Institute Of Advanced Communication Technologies and Research) in the academic year 2022–2023.

We, Sarim Khan, Shahbaz Khan , Akash Upadhyay, Ritik Kumar are responsible for the work done in this project. The reference includes the sources from where we have taken the inspiration.

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ACKNOWLEDGEMENT

It is our honour and duty to express our gratitude for the assistance and direction that many people provided in the preparation of this report. Beyond our efforts, the support and recommendations of many others play a significant role in the success of this report. Without their invaluable assistance, cooperation, and direction, it would not have been possible to prepare this report in its current form.

We owe a great deal to Dr. M. Gangadharappa, who served as our report's mentor, for his guidance, prompt advice, and suggestions in helping us complete this project successfully.

Last but not least, we would like to extend our deepest gratitude to all of our project partners who have generously supported us throughout the course of our project work and the creation of this report.

Table of Contents

Chapter 1 : Introduction

Introduction

In this project, you will learn to interface a MAX30100 Pulse Oximeter Sensor to an Arduino to measure blood oxygen and heart rate and display the results on a 16x2 LCD display. SpO2 (blood oxygen concentration) is measured in percentage, and BPM (heart rate/pulse rate) is measured in beats per minute. This device is especially useful for people who need to monitor these parameters due to medical conditions like asthma or congestive heart failure.

A pulse oximeter is a medical device that non-invasively measures the oxygen saturation of a patient's blood, as well as their heart rate. The device typically consists of a sensor that is placed on a thin part of the patient's body, such as a finger or earlobe, and a small monitor that displays the results. The sensor uses two different wavelengths of light, usually infrared and red, to determine the amount of oxygen in the blood. The device is commonly used in hospitals and critical care settings to monitor patients with respiratory or cardiac conditions, as well as in some ambulances and home settings. It is a useful tool for detecting early signs of hypoxemia, or low blood oxygen levels, which can be caused by a variety of conditions such as asthma, pneumonia, and heart failure. It is also commonly used in postoperative care to monitor the oxygenation status of patients.

Chapter 2 :

Technology Stack

Arduino

Arduino is an open-source electronics platform based on simple microcontroller boards and a development environment that makes it easy for users to write and upload code to the boards. The platform was created in 2005 by a group of students at the Interaction Design Institute Ivrea in Italy, and it has since become one of the most popular platforms for DIY electronics projects and physical computing.

The heart of an Arduino board is a microcontroller, which is a small computer on a single integrated circuit that can be programmed to perform a variety of tasks. The most commonly used microcontroller in Arduino boards is the AVR, which is produced by Atmel and has a variety of different models, each with different memory and processing capabilities. The microcontroller on an Arduino board is connected to a number of input/output (I/O) pins, which can be used to connect sensors, actuators, and other devices to the board.

The development environment for Arduino is based on the open-source programming language C++ and the Arduino Software (IDE), which is a cross-platform application that runs on Windows, Mac OS X, and Linux. It includes a code editor, a compiler, and a programmer, which together make it easy to write, upload, and debug code on the Arduino board. The software also includes a library of pre-written code, called sketches, that can be used to perform common tasks such as reading sensors and controlling actuators.

The simplicity and versatility of the Arduino platform has made it popular among hobbyists, educators, and professionals for a wide range of projects. Some examples of projects that can be built with Arduino include:

- Home automation systems that can control lights, temperature, and security
- Robotics projects such as line-following robots, robotic arms, and drones
- IoT projects that can send sensor data to the cloud for analysis
- Musical instruments and audio effects
- Wearable devices such as smartwatches and fitness trackers

The Arduino platform also has a large and active community of users and developers who share their projects, code, and tutorials online. There are also

many online resources such as tutorials, forums, and documentation that can help users to get started with Arduino and to learn more about the platform.

In summary, Arduino is a simple and versatile open-source electronics platform that makes it easy for users to create interactive projects. The platform is based on microcontroller boards, a development environment, and a community of users and developers who share their projects and knowledge. With Arduino, you can create a wide range of projects from simple to complex, from home automation to robotics, from musical instruments to IoT and more.

Types of Arduino

There are several different types of Arduino boards available, each with its own set of features and capabilities. Some of the most common types of Arduino boards include:

1. Arduino Uno: This is the most popular and widely used Arduino board. It is based on the ATmega328P microcontroller and has 14 digital I/O pins, 6 analog inputs, and a 16 MHz clock speed.
2. Arduino Mega: This board is similar to the Uno but has more I/O pins and memory. It is based on the ATmega2560 microcontroller and has 54 digital I/O pins, 16 analog inputs, and a 16 MHz clock speed.
3. Arduino Nano: This is a compact version of the Uno board and is designed for projects where space is limited. It is based on the ATmega328P microcontroller and has 22 digital I/O pins, 8 analog inputs, and a 16 MHz clock speed.
4. Arduino Pro Mini: This is a minimalistic version of the Arduino board that is intended for advanced users. It is based on the ATmega328P microcontroller and has 14 digital I/O pins, 8 analog inputs, and a 16 MHz clock speed.
5. Arduino Leonardo: This board is based on the ATmega32U4 microcontroller and has 20 digital I/O pins, 12 analog inputs, and a 16 MHz clock speed. It also has a built-in USB controller, which allows it to be used as a USB keyboard or mouse.
6. Arduino Due: This is the most powerful Arduino board, It is based on the Atmel SAM3X8E ARM Cortex-M3 microcontroller and has 54 digital I/O pins, 12 analog inputs, and a 84 MHz clock speed.
7. Arduino MKR series: it is a series of boards specially designed for IoT projects that includes WiFi, Bluetooth, LoRa, and GSM connectivity.
8. Arduino Pro series: is a series of boards that are intended for professional use, providing additional features such as increased memory and processing power, extended temperature ranges and more.

These are some of the most popular and widely used Arduino boards, but there are many other boards available as well, each with its own set of features and capabilities. The best board for a particular project will depend on the specific requirements of the project and the experience level of the user.

In this project we have used Arduino nano.

Arduino Nano

The Arduino Nano is a compact version of the Arduino Uno board that is designed for projects where space is limited. It is based on the ATmega328P microcontroller and has the following features:

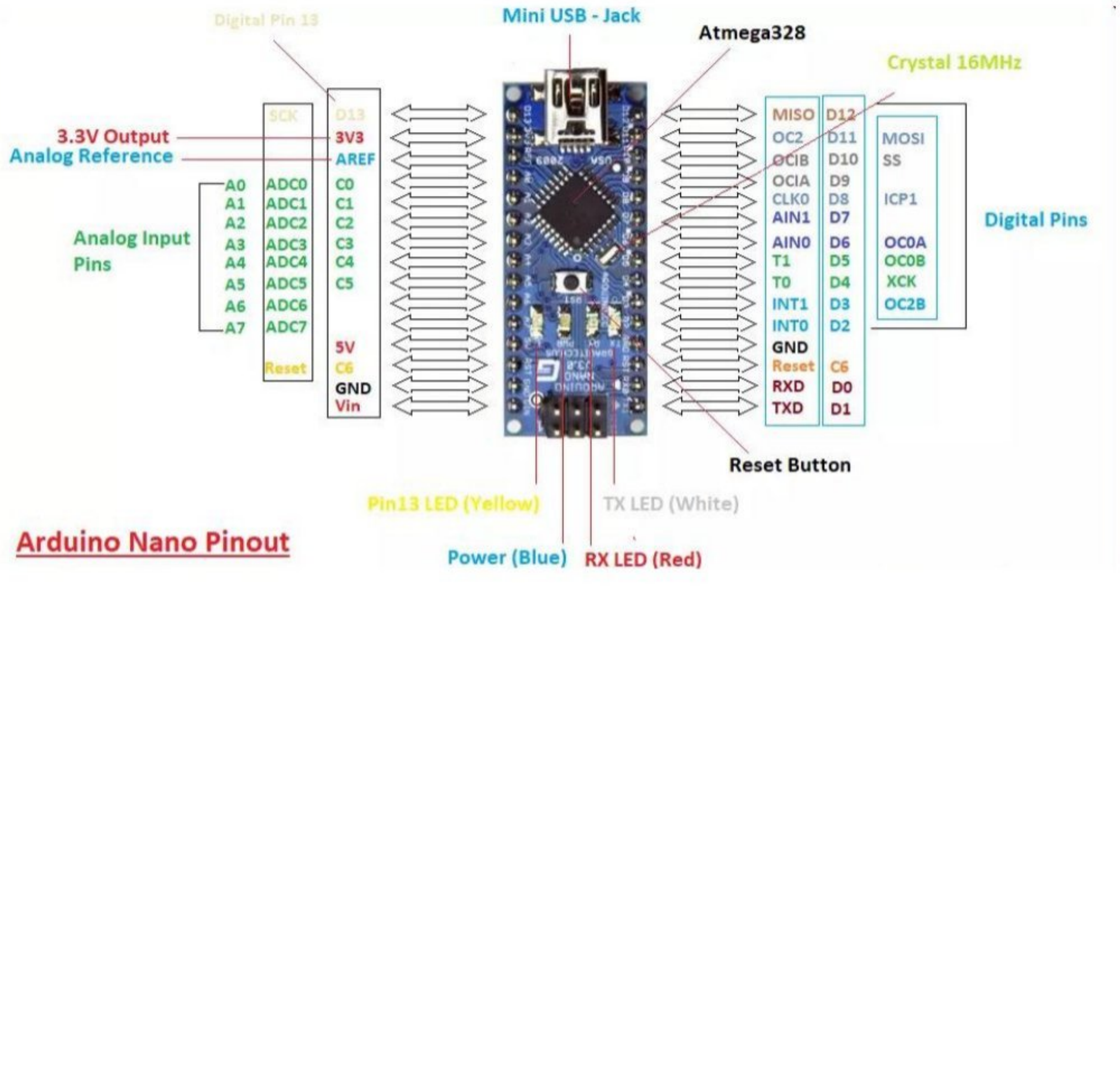
- 22 digital I/O pins: 14 of which can be used as PWM (pulse-width modulation) outputs
- 8 analog inputs
- A 16 MHz clock speed
- 32 KB of flash memory (of which 0.5 KB is used by the bootloader)
- 2 KB of SRAM
- 1 KB of EEPROM

The Nano board is powered by an external power supply, which can be connected via the Mini-B USB connector or the barrel jack. It can be powered by an external power supply or USB. The board can operate at a voltage between 7-12V and can provide up to 500mA to external devices.

One of the major advantages of the Arduino Nano is its small size, which makes it suitable for projects where space is limited. It can be easily integrated into a wide range of projects, such as robotics, wearable devices, and home automation systems. It is also a great choice for beginners who want to learn about microcontroller-based electronics and programming.

The Arduino Nano can be programmed using the Arduino Software (IDE), just like other Arduino boards. It can also be programmed using the FTDI USB-to-Serial driver, which allows you to upload your code directly from your computer to the board.

In summary, the Arduino Nano is a compact and versatile board that is suitable for a wide range of projects, particularly where space is limited. It has 22 digital I/O pins, 8 analog inputs, and a 16 MHz clock speed. It can be powered by an external power supply or USB, and can be programmed using the Arduino Software (IDE) or FTDI USB-to-Serial driver.



Arduino Nano Pinout

PCB Board

A Printed Circuit Board (PCB) is a board made of insulating material (such as fiberglass or plastic) that is used to connect electronic components together. The board is coated with a thin layer of metal (usually copper) that forms the conductive traces that connect the components.

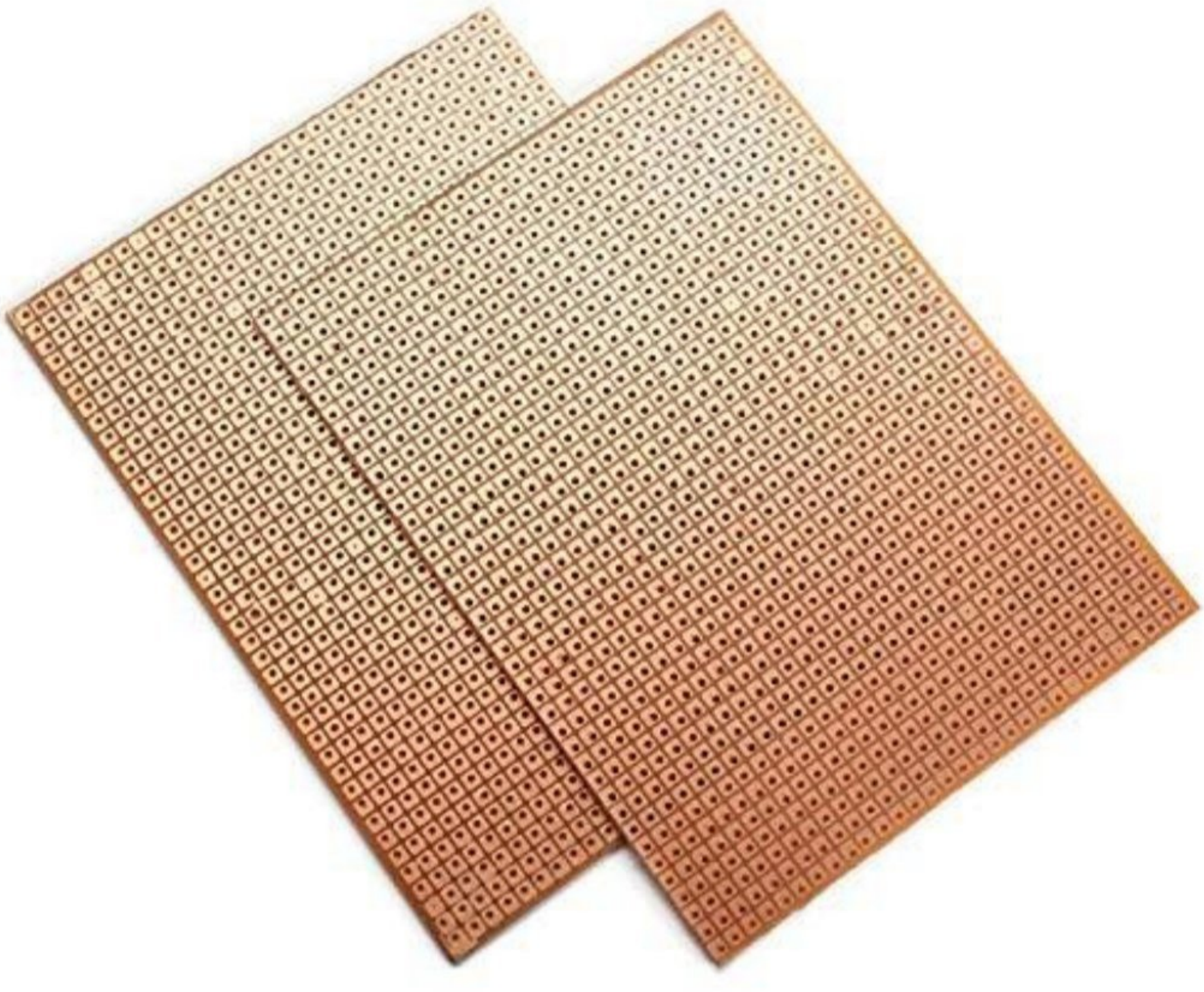
PCBs are used in a wide range of electronic devices, including computers, smartphones, televisions, and appliances. They can be found in almost any electronic device that contains a microcontroller or integrated circuit (IC).

There are two main types of PCBs: single-sided and double-sided. Single-sided PCBs have conductive traces on one side of the board, while double-sided PCBs have conductive traces on both sides. Multi-layer PCBs, which have conductive traces on multiple layers of the board, are also available.

The process of creating a PCB begins with the design of the circuit using computer-aided design (CAD) software. The design is then used to create a photomask, which is used to transfer the circuit pattern onto the board. The board is then coated with a layer of metal (usually copper), and the photomask is used to etch away the unwanted copper, leaving only the conductive traces.

The electronic components are then soldered onto the board, completing the PCB assembly process. The PCB is then tested to ensure that it is functioning correctly.

In summary, a Printed Circuit Board (PCB) is a board made of insulating material that is used to connect electronic components together. The board is coated with a thin layer of metal that forms the conductive traces that connect the components. PCBs are widely used in electronic devices, and they can be found in almost any electronic device that contains a microcontroller or integrated circuit. The process of creating a PCB involves the use of computer-aided design (CAD) software and photomask, which are used to transfer the circuit pattern onto the board, then electronic components are soldered onto the board and tested.



General Purpose PCB Board

MAX30100 module

The MAX30100 is a sensor module that is used to measure heart rate and blood oxygen saturation (SpO2). It is based on a photoplethysmography (PPG) sensor, which uses infrared and red LEDs to shine light through the skin and measure the changes in blood volume.

The MAX30100 module features a compact size, low power consumption, and high accuracy, making it ideal for wearable devices, health monitoring systems, and medical applications. It can be easily integrated into a wide range of projects and can communicate with a microcontroller such as Arduino using an I2C interface.

The module includes an integrated red and infrared LED, photodetector, optical components, and low-noise electronics. The LED emits light at two different wavelengths, typically red (660 nm) and infrared (940 nm), which pass through the skin and are detected by the photodetector. The changes in the intensity of the light are then processed by the module's low-noise electronics to extract the heart rate and SpO2 values.

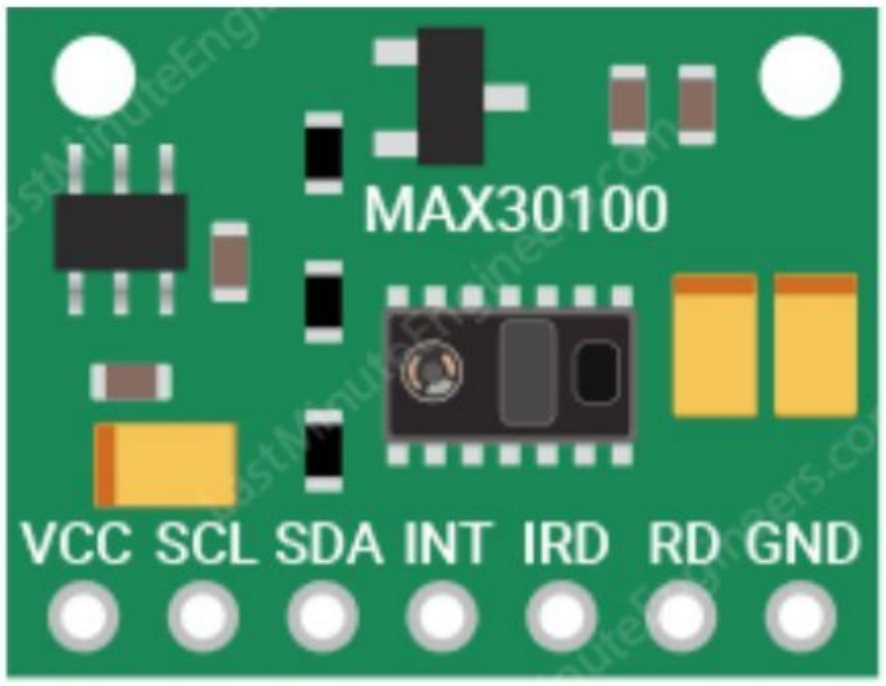
The module also features an integrated temperature sensor, which is used to compensate for temperature variations and ensure accurate measurements. The temperature sensor can also be used to monitor the temperature of the device or the environment.

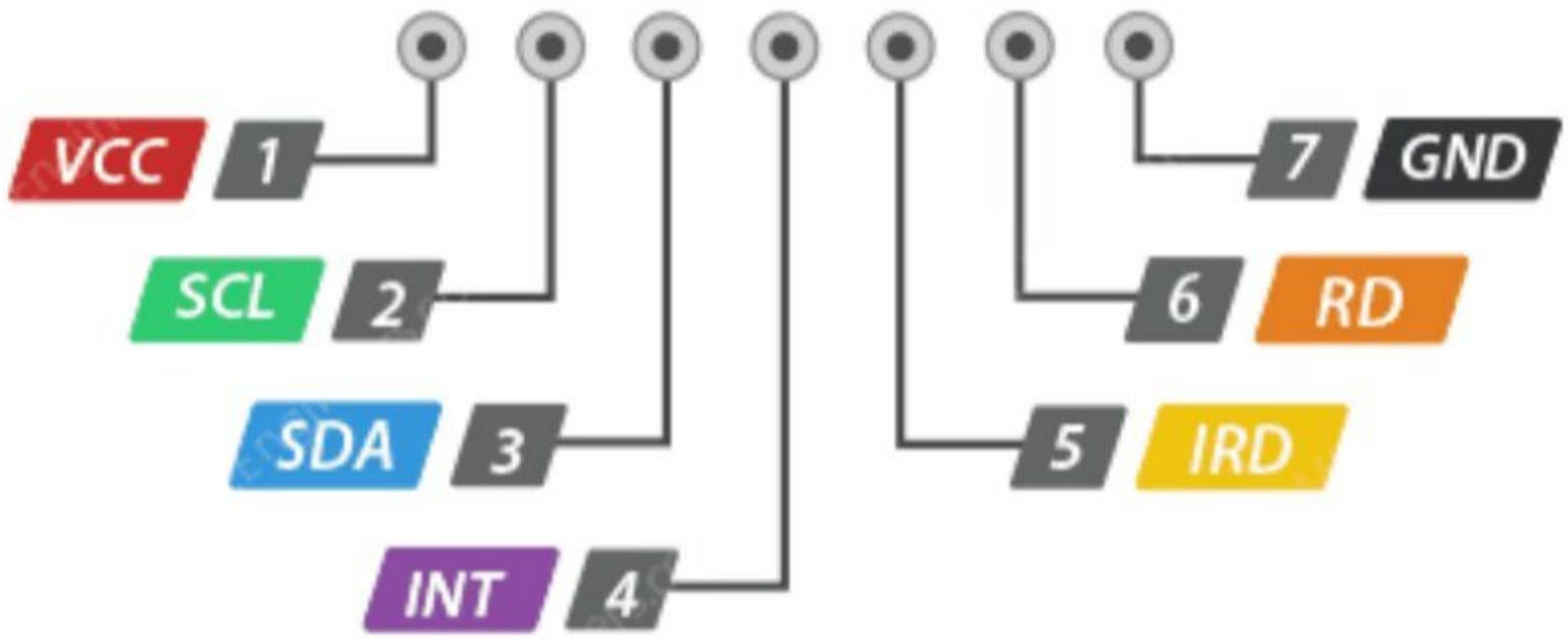
The MAX30100 module can be configured through an I2C interface and it also includes an interrupt pin that can be used to indicate when new data is available. The module can be configured to measure heart rate, SpO2, or both simultaneously.

The module also includes a number of built-in safety features, such as an LED over-current protection circuit and a photodiode over-temperature protection circuit, to ensure the safety of the user.

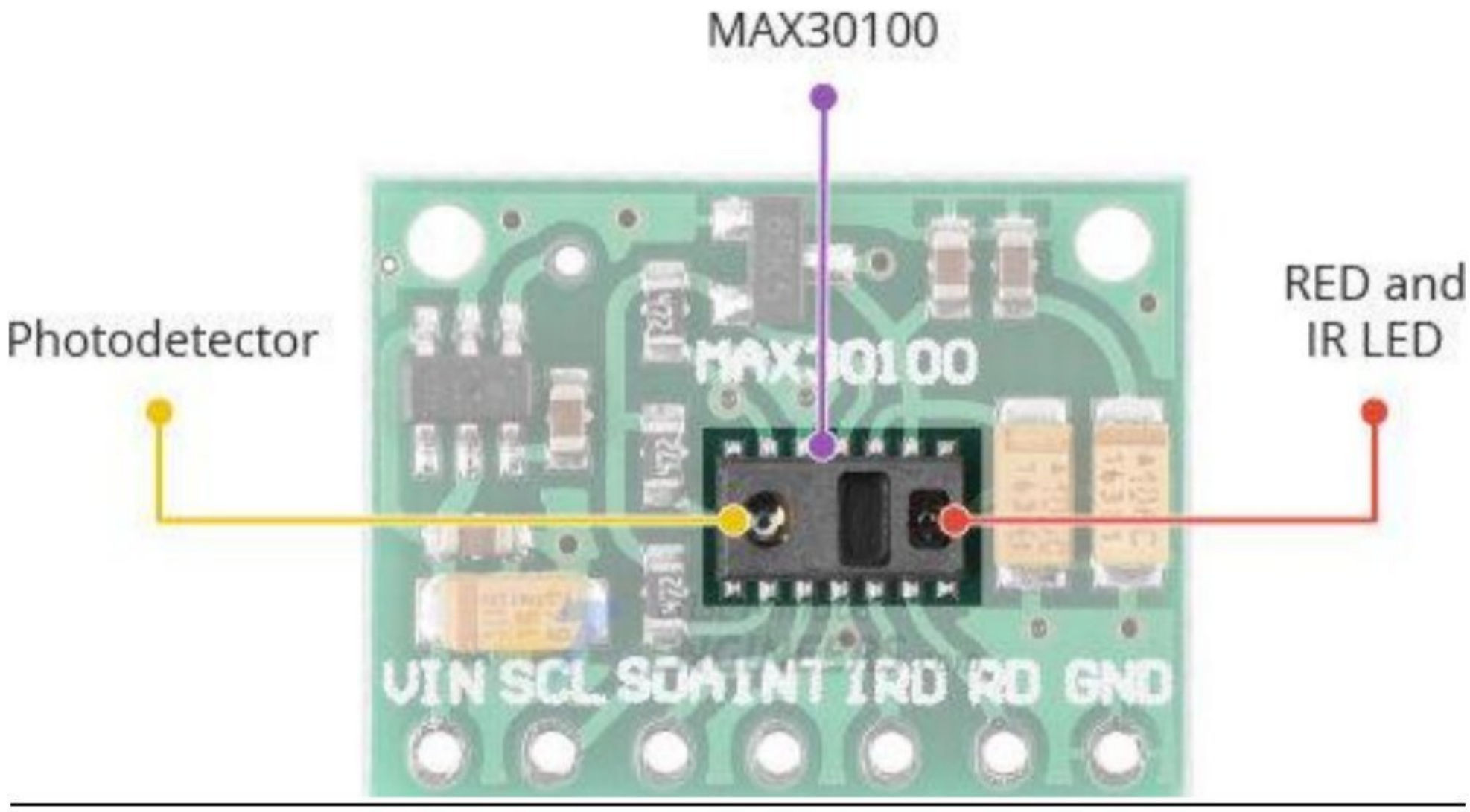
The module is available in different packages, including a surface-mount package, that makes it easy to integrate into a wide range of devices, including portable devices and wearables. The module is also compatible with a wide range of microcontrollers, such as the Arduino, which makes it easy to incorporate it into an existing project.

In summary, the MAX30100 is a sensor module that can be used to measure heart rate and blood oxygen saturation (SpO2) using a technique called photoplethysmography. It is a compact, low-power, high-accuracy sensor that can be easily integrated into a wide range of projects and it can communicate with a microcontroller such as Arduino using an I2C interface. The module includes an integrated red and infrared LED, photodetector, optical components, and low-noise electronics, as well as a temperature sensor. It also includes a number of built-in safety features to ensure the safety of the user and it is available in different packages that make it easy to integrate into a wide range of devices.





MAX30100 pinout



16x2 LCD

A 16x2 LCD (liquid crystal display) is a type of display that uses liquid crystals to display text and/or graphics. The name "16x2" refers to the fact that the display has 16 columns and 2 rows of dots or pixels. These types of displays are commonly found in electronic devices such as computers, televisions, and mobile phones. They are known for their low power consumption and high visibility in various lighting conditions.

LCDs work by manipulating the alignment of liquid crystals in response to an electric current. The crystals are sandwiched between two layers of glass, with polarizing filters on each side. When no current is applied, the crystals are in a random alignment, which causes light to scatter and the display appears dark. When a current is applied, the crystals align in a specific way, which allows light to pass through and the display appears bright. By controlling the alignment of the crystals, the display can be used to display text and/or graphics.

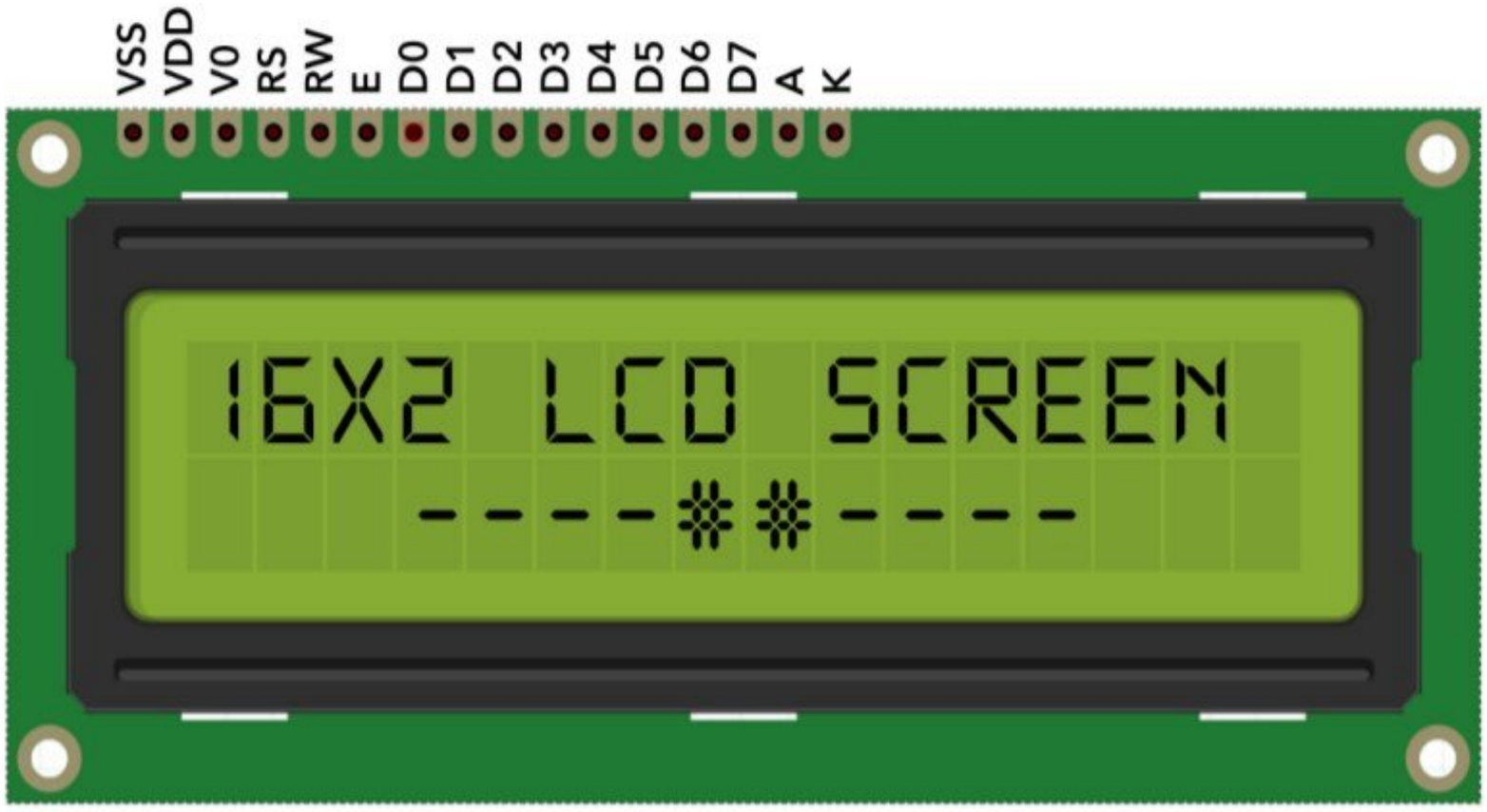
One of the main advantages of LCDs is their low power consumption. They use significantly less power than other types of displays, such as CRT (cathode ray tube) displays. This makes them ideal for portable electronic devices, where battery life is a major concern. They are also more durable and have a longer lifespan than CRT displays.

Another advantage of LCDs is their high visibility in various lighting conditions. They can be easily read in bright sunlight or dimly lit rooms. This makes them suitable for use in outdoor applications, such as digital signage, as well as indoor applications, such as computer monitors and television screens.

16x2 LCDs are widely used in various electronic projects, particularly in embedded systems and microcontroller-based projects. They are simple to interface with microcontrollers, and various libraries and tutorials are available for easy implementation. They are also widely used in home appliances, automotive, and industrial controls, as they are low cost and easy to read.

In summary, a 16x2 LCD is a type of display that uses liquid crystals to display text and/or graphics. It has 16 columns and 2 rows of dots or pixels, and is commonly found in electronic devices such as computers, televisions, and mobile phones. They are known for their low power consumption and high visibility in

various lighting conditions, making them a popular choice for a wide range of applications.



No	Symbol	Function
1	VSS	Ground
2	VDD	5V +
3	V0	Contrast
4	RS	Register
5	RW	Read/Write
6	E	Enable
7	D0	Data bus
8	D1	Data bus
9	D2	Data bus
10	D3	Data bus
11	D4	Data bus
12	D5	Data bus
13	D6	Data bus
14	D7	Data bus
15	A	Anode (5V+)
16	K	Cathode (GND)

Regulator

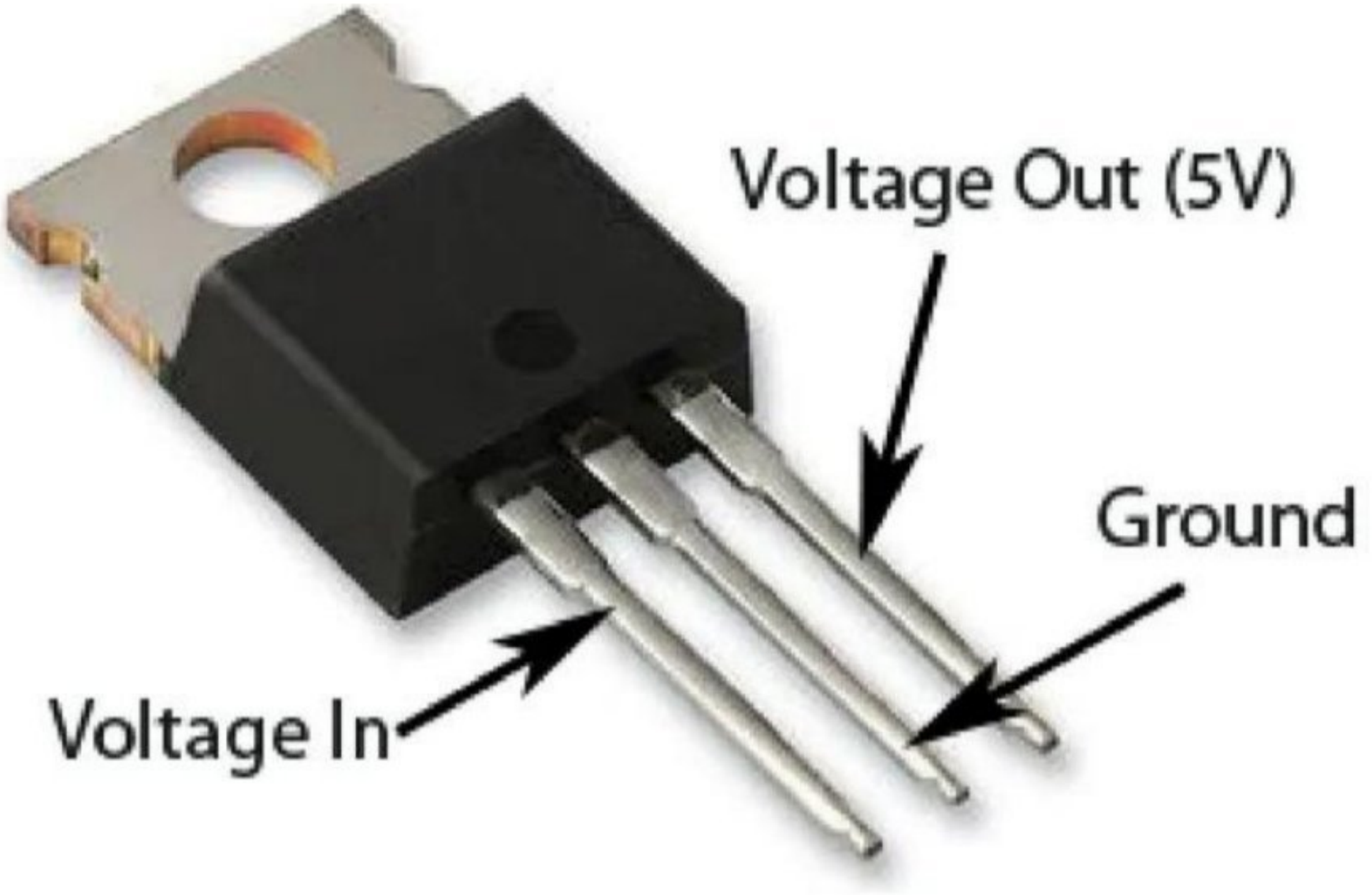
A 5V regulator is an electronic device that is used to convert a higher voltage input, such as 12V or 24V, into a stable 5V output. The device is typically used to provide a stable power supply for electronic devices that require a specific voltage, such as microcontrollers, sensors, and other low-power devices.

There are different types of voltage regulators, including linear regulators and switching regulators. Linear regulators work by using a voltage drop across a pass transistor to reduce the input voltage to the desired output voltage. They are simple and inexpensive, but they are less efficient than switching regulators and can be less reliable.

Switching regulators, on the other hand, use a switching element, such as a transistor, to rapidly switch the input voltage on and off, which allows the regulator to convert the voltage efficiently. They are typically more efficient and reliable than linear regulators.

5V voltage regulators are widely used in electronic projects, particularly in embedded systems and microcontroller-based projects, as they provide a stable power supply for the microcontroller and other electronic components. They are also used in home appliances, automotive and industrial controls, as they are low cost and easy to use.

In summary, a 5V regulator is an electronic device that is used to convert a higher voltage input into a stable 5V output. It is typically used to provide a stable power supply for electronic devices that require a specific voltage. There are different types of voltage regulators available, including linear regulators and switching regulators, with the latter being more efficient and reliable.



5V Regulator

Jumper Wire

Jumper wires, also known as jumper cables or simply jumpers, are short electrical wires with connectors on each end that are used to connect components on a breadboard or circuit board. They are typically made of stranded or solid-core copper wire and are insulated with plastic or rubber.

Jumper wires come in various lengths and colors, and are used to connect different parts of a circuit together. For example, they can be used to connect a microcontroller to a sensor, or to connect a power supply to a circuit board. They can also be used to make temporary connections while testing a circuit, or to change the connections of a circuit without having to solder or unsolder components.

Jumper wires are commonly used in electronic projects, particularly in prototyping and development. They make it easy to quickly and easily connect and disconnect different parts of a circuit, allowing for flexibility and experimentation. They are also widely used in educational settings, such as in schools and maker spaces, as they are easy to use and understand.

In summary, jumper wires, also known as jumper cables or jumpers, are short electrical wires with connectors on each end that are used to connect components on a breadboard or circuit board. They are typically made of stranded or solid-core copper wire and are insulated with plastic or rubber. Jumper wires come in various lengths and colors and are widely used in electronic projects, particularly in prototyping and development. They make it easy to quickly and easily connect and disconnect different parts of a circuit, allowing for flexibility and experimentation.

Resistor

A resistor is an electronic component that resists the flow of electrical current. It is used to limit the current in a circuit, provide bias to a semiconductor device, or to adjust the voltage levels in a circuit.

Resistors are typically made of carbon, metal alloy, or metal film and are identified by their resistance value, measured in ohms (Ω). They also have a tolerance, which is the allowable variation of the resistance value. The resistance value can be represented by color codes, alphanumeric codes or by the resistance value itself.

Resistors come in various shapes, sizes and power ratings. They can be fixed or variable. Fixed resistors have a fixed resistance value and are used to provide a known amount of resistance in a circuit. Variable resistors, also known as potentiometers, have adjustable resistance and are used to adjust the resistance in a circuit, such as volume control in a radio.

Resistors are widely used in electronic circuits, in combination with other components such as capacitors and inductors, to create different types of filters that can be used to shape the frequency response of a circuit. They are also used to divide voltage, to bias transistors, and to limit current in a circuit.

In summary, a resistor is an electronic component that resists the flow of electrical current. It is used to limit the current in a circuit, provide bias to a semiconductor device, or to adjust the voltage levels in a circuit. Resistor are typically made of carbon, metal alloy, or metal film and are identified by their resistance value, measured in ohms (Ω). They come in various shapes, sizes and power ratings, and can be fixed or variable. They are widely used in electronic circuits, in combination with other components to create different types of filters and for other applications.

Battery

A 9V 6F22M battery is a type of 9-volt battery that is commonly used in portable electronic devices such as smoke detectors, remote controls, and small electronic toys. The "6F22" part of the name refers to the physical size of the battery, which is similar to that of an AA battery, but slightly shorter. The "M" at the end of the name is the indication of the chemical system used in the battery, which is typically a zinc-carbon system.

9V batteries like the 6F22M are known for their high energy density and portability, making them ideal for use in portable electronic devices. They are also widely available and relatively inexpensive, making them a popular choice for low-cost electronic projects.

One of the main drawbacks of 9V batteries like the 6F22M is their relatively short life compared to other types of batteries, such as AA or AAA batteries. They also have a relatively low capacity, which means that they need to be replaced or recharged more frequently.

In summary, a 9V 6F22M battery is a type of 9-volt battery that is commonly used in portable electronic devices such as smoke detectors, remote controls, and small electronic toys. The "6F22" part of the name refers to the physical size of the battery and "M" at the end of the name is the indication of the chemical system used in the battery. These batteries are known for their high energy density and portability, but have a relatively short life and low capacity compared to other types of batteries.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GENERAL PURPOSE

Chapter 3 :
Implementation

Interfacing MAX30100 Pulse Oximeter Sensor with Arduino

The MAX30100 pulse oximeter sensor is a simple-to-use sensor that can be interfaced with the Arduino Nano to measure heart rate and blood oxygen saturation levels. Here are the steps you can follow to interface the MAX30100 sensor with the Arduino Nano:

1. Connect the MAX30100 sensor to the Arduino Nano using the I2C pins. Specifically, connect the SDA pin on the sensor to the A4 pin on the Nano and the SCL pin on the sensor to the A5 pin on the Nano.
2. Install the MAX30100 library for Arduino by downloading it from the internet or from the Arduino library manager.
3. In the Arduino sketch, include the library at the top of the code using the line "#include <MAX30100.h>".
4. Initialize the sensor by creating an instance of the MAX30100 class and setting the required settings like sample rate, LED current, and pulse width.
5. In the loop() function, read the sensor data using the appropriate functions provided by the library, like readHeartRate() and readSpO2().
6. Use the data read from the sensor to perform calculations or display the results on an LCD or serial monitor.
7. Upload the sketch to the Arduino Nano and test the circuit by measuring the heart rate and blood oxygen saturation level using the sensor.

Note that this is a general outline, and more detailed instructions and specific code will be required to successfully interface the sensor with the Arduino Nano.

Connecting Arduino nano with 16x2 LCD

To connect an Arduino Nano to a 16x2 LCD, you will need to use the PCB board to connect the LCD's pins to the Arduino's pins. The 16x2 LCD has 16 pins, but only 6 of them are used to connect to the Arduino.

1. Connect the LCD's VSS pin to the Arduino's GND pin.
2. Connect the LCD's VDD pin to the Arduino's 5V pin.
3. Connect the LCD's RS pin to the Arduino's digital pin 12.
4. Connect the LCD's RW pin to the Arduino's GND pin.
5. Connect the LCD's E pin to the Arduino's digital pin 11.
6. Connect the LCD's D4-D7 pins to the Arduino's digital pins 5-2 respectively.

Once you have connected all the pins, you can upload a sample sketch to the Arduino that will display some text on the LCD. You can use the LiquidCrystal library that comes with the Arduino IDE to control the LCD.

Working of MAX30100 Pulse Oximeter and Heart-Rate Sensor

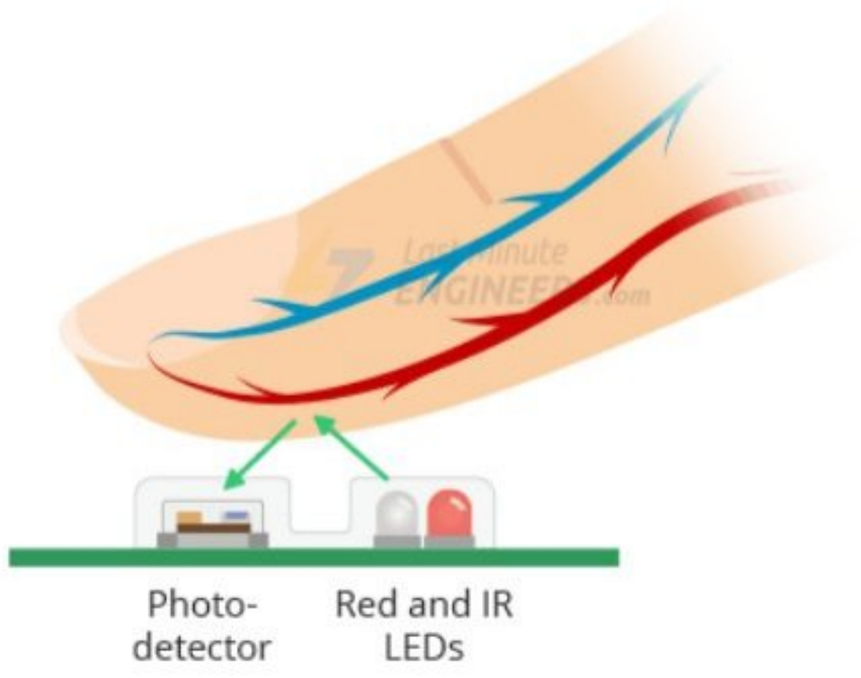
The MAX30100 is a pulse oximeter and heart-rate sensor that uses photoplethysmography (PPG) to measure the amount of blood flow in the finger, and then uses that information to calculate the heart rate and oxygen saturation (SpO2) of the person wearing it.

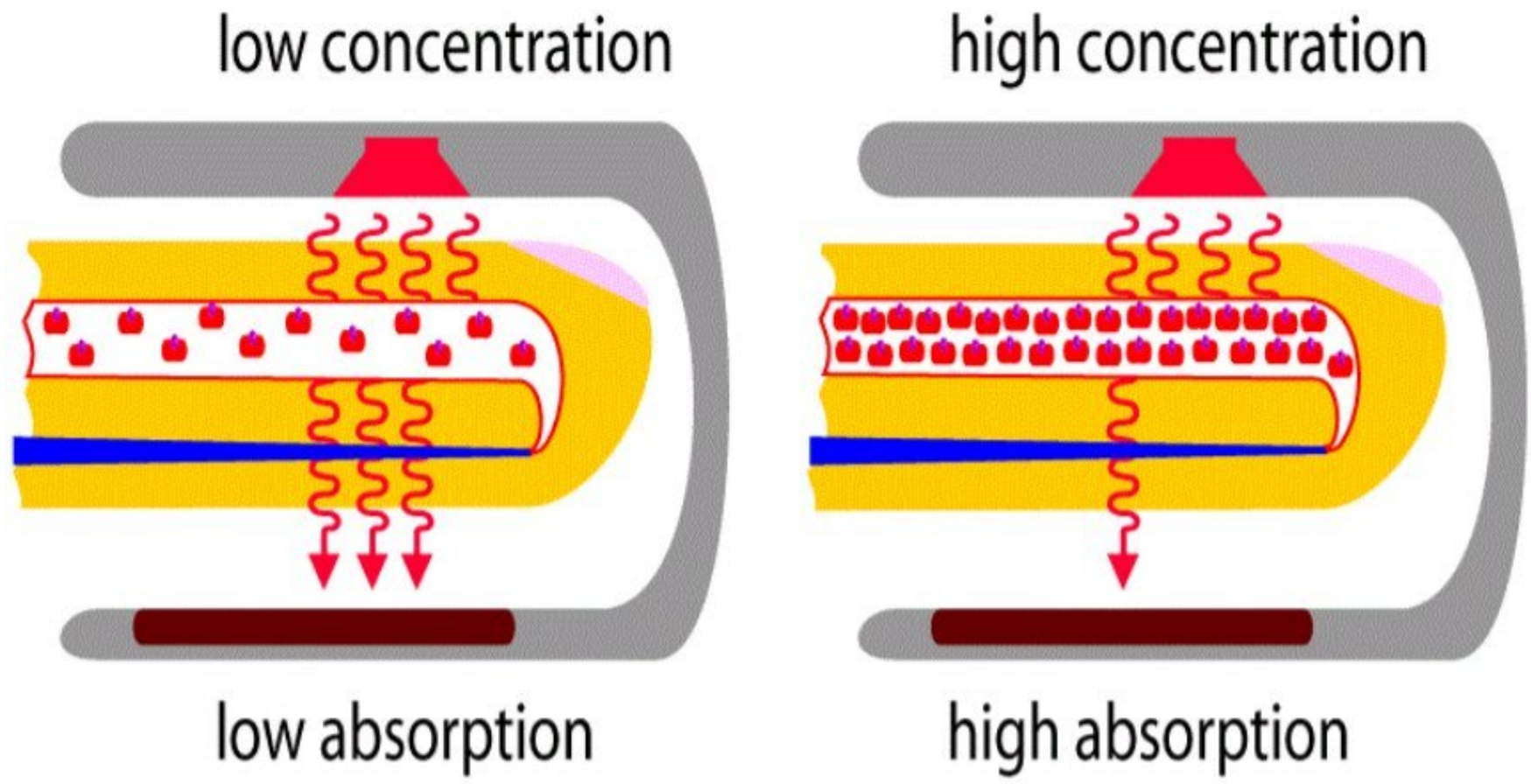
The sensor works by emitting two different wavelengths of light (red and infrared) into the finger and then measuring the amount of light that is absorbed. The red light is absorbed more by the blood, while the infrared light is absorbed more by the tissue. By measuring the amount of light absorbed at each wavelength, the sensor can calculate the amount of oxygenated and deoxygenated hemoglobin in the blood, which is used to calculate the SpO2.

The sensor also detects the changes in the volume of blood in the finger, caused by the blood flow, which is used to calculate the heart rate. The MAX30100 sensor uses a LED and a photodiode to detect the changes in the volume of blood in the finger.

The sensor communicates with the microcontroller using I2C communication protocol, which allows for easy integration with a wide range of microcontroller platforms, including Arduino, Raspberry Pi, and others.

The sensor is commonly used in various applications such as fitness trackers, portable medical devices, and other wearable devices.





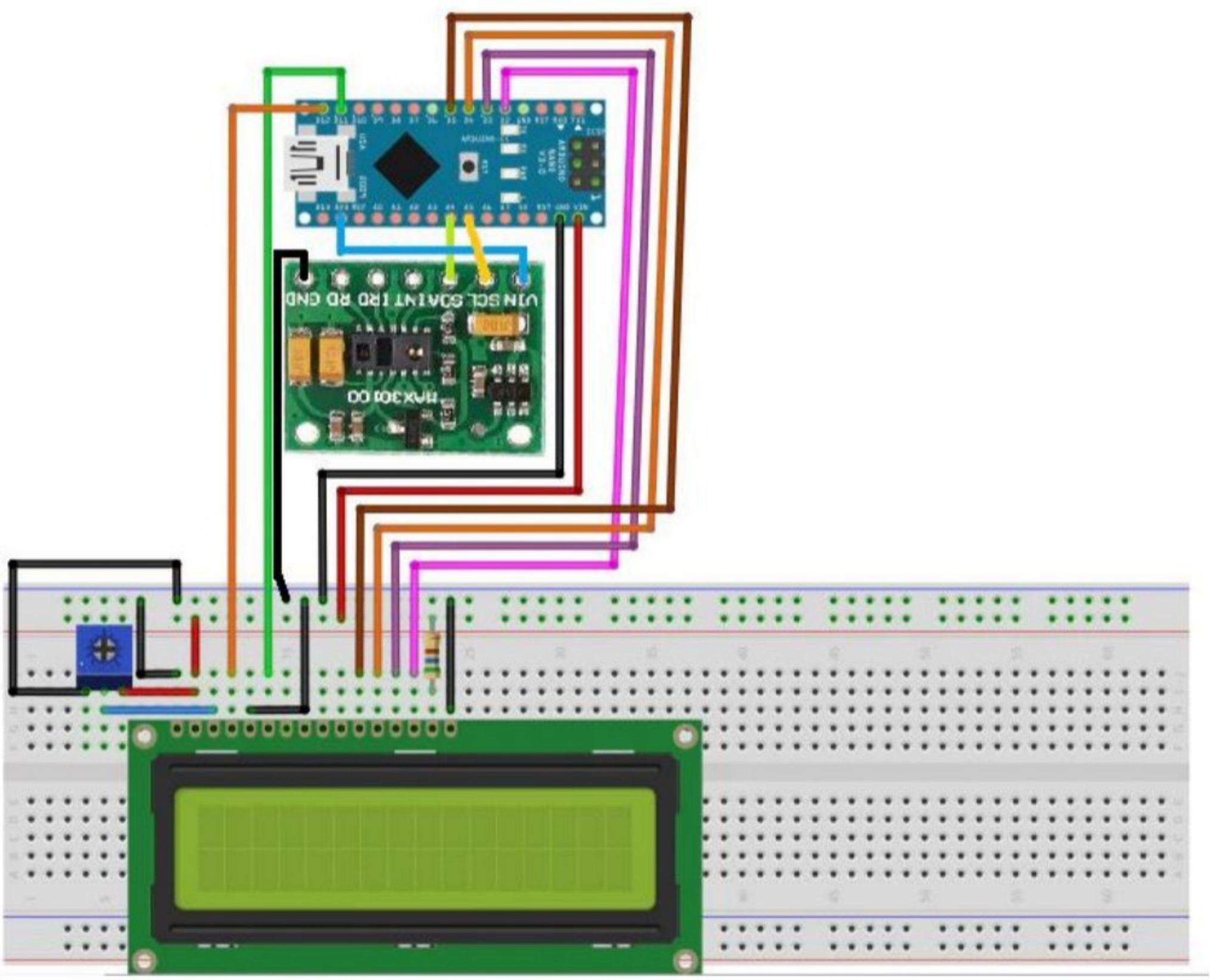
A pulse oximeter works by shining two different wavelengths of light (usually red and infrared) through a finger or earlobe, and then measuring the amount of light that is absorbed. The red light is absorbed more by the oxygenated hemoglobin in the blood, while the infrared light is absorbed more by the deoxygenated hemoglobin. By measuring the amount of light absorbed at each wavelength, the pulse oximeter can calculate the ratio of oxygenated to deoxygenated hemoglobin in the blood, which is used to calculate the oxygen saturation (SpO2) of the person wearing the device.

The pulse oximeter also detects the changes in the volume of blood in the finger or earlobe, caused by the pulse, which is used to calculate the heart rate. This is done by using a photodetector, which detects the changes in the light intensity caused by the blood flow.

The device typically has a small LED light source and a photodetector on one end, which is placed against the skin. The device then uses the ratio of light absorbed by the blood to calculate the oxygen saturation and heart rate.

The device can be used in a variety of settings including hospitals, clinics, and even at home to monitor the oxygen saturation of patients with conditions such as COPD, asthma, or other lung diseases. In addition, pulse oximeters are also commonly used in the aviation industry and in high altitude sports to ensure that pilots and climbers are getting enough oxygen.

Circuit Diagram

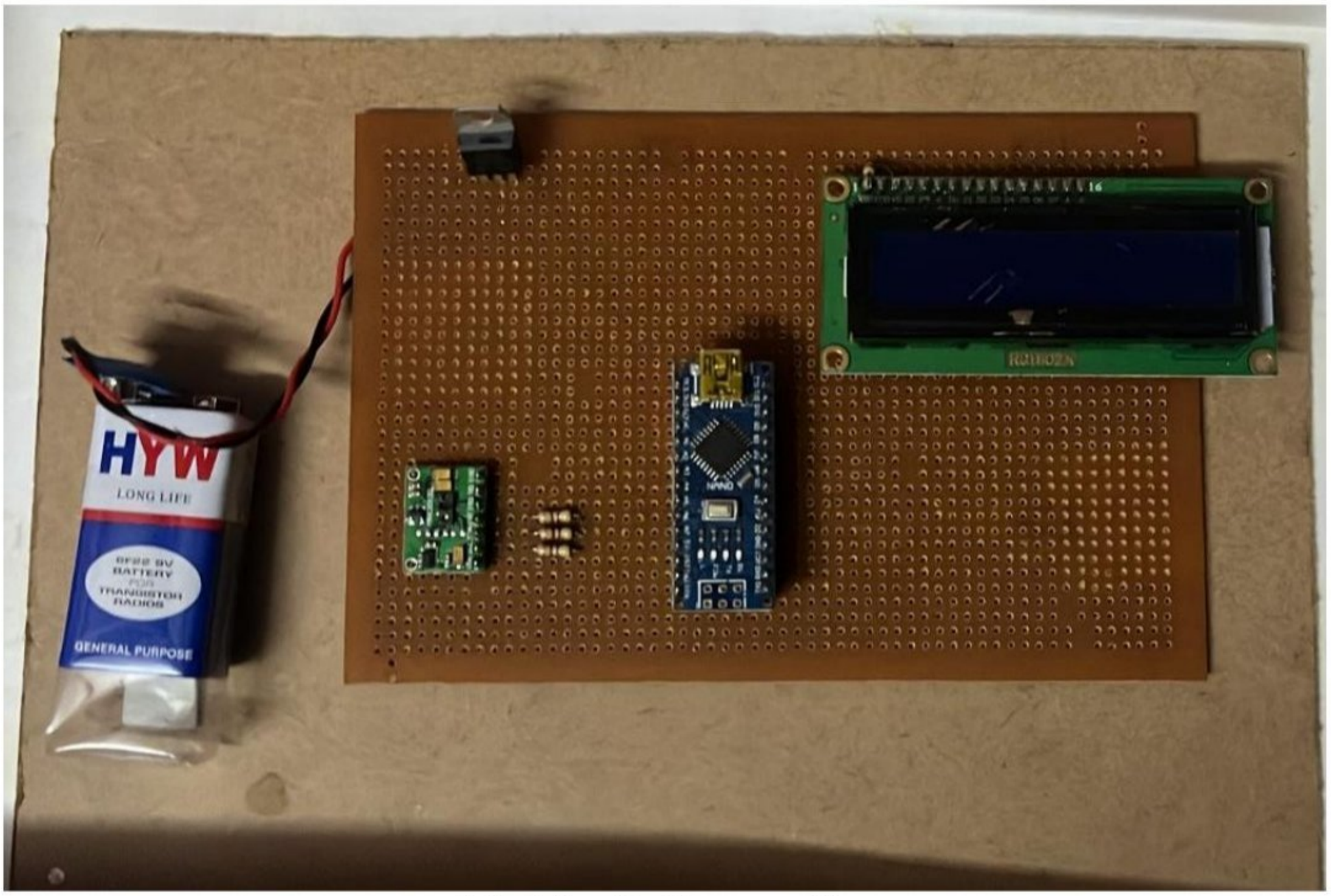


Arduino Program

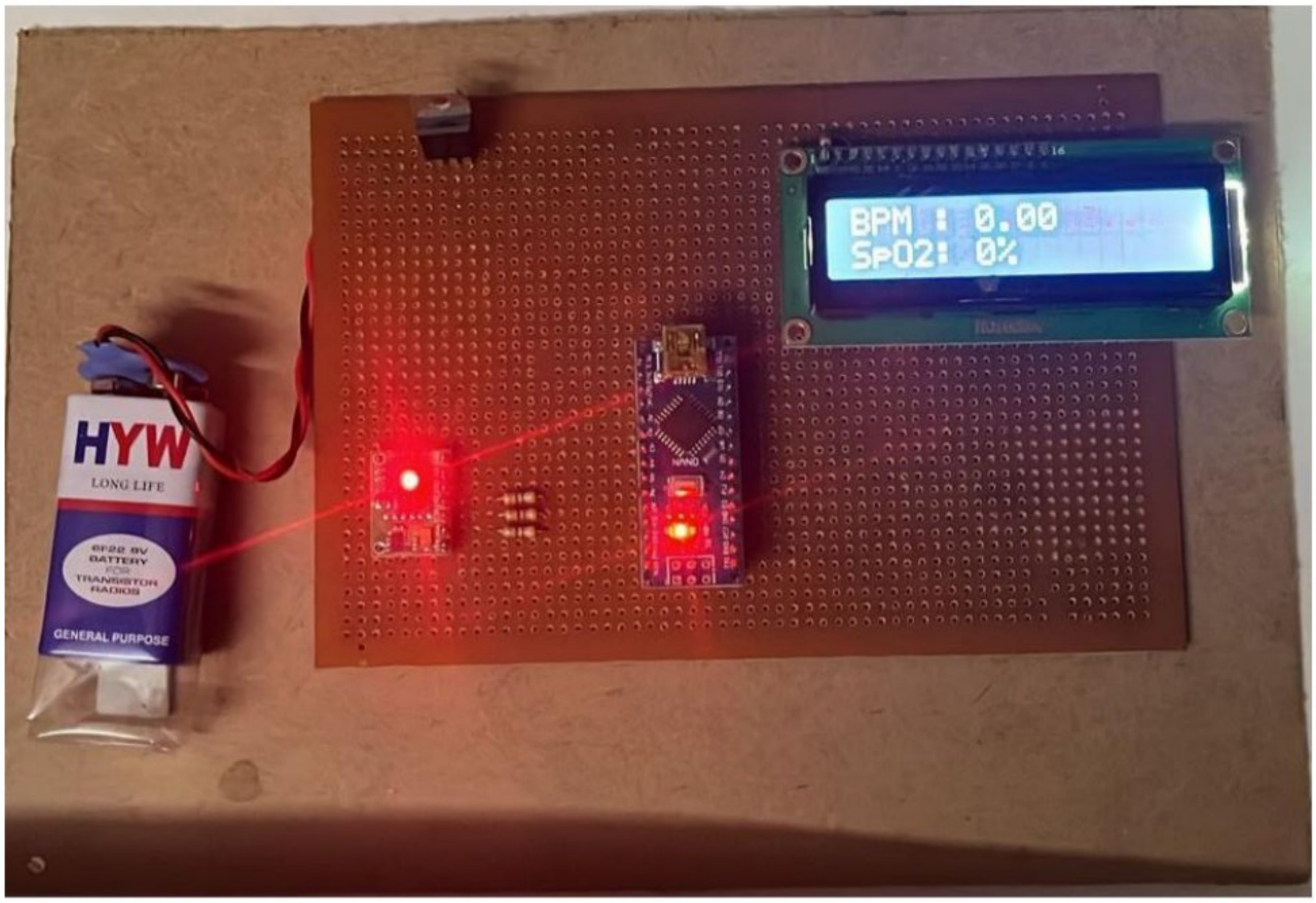
```
#include <LiquidCrystal.h>
#include <Wire.h>
#include "MAX30100_PulseOximeter.h"

LiquidCrystal lcd(12, 11, 5, 4, 3, 2);
#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.print("Initializing...");
    delay(3000);
    lcd.clear();
    // Initialize the PulseOximeter instance
    // Failures are generally due to an improper I2C wiring, missing power supply
    // or wrong target chip
    if (!pox.begin()) {
        Serial.println("FAILED");
        for(;;);
    } else {
        Serial.println("SUCCESS");
    }
   pox.setIRLedCurrent(MAX30100_LED_CURR_7_6MA);
     // Register a callback for the beat detection
     pox.setOnBeatDetectedCallback(onBeatDetected);
}
void loop()
{
    // Make sure to call update as fast as possible
    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("%");

    lcd.clear();
    lcd.setCursor(0,0);
    lcd.print("BPM : ");
    lcd.print(pox.getHeartRate());

    lcd.setCursor(0,1);
    lcd.print("SpO2: ");
    lcd.print(pox.getSpO2());
    lcd.print("%");
    tsLastReport = millis();
  }
}
```

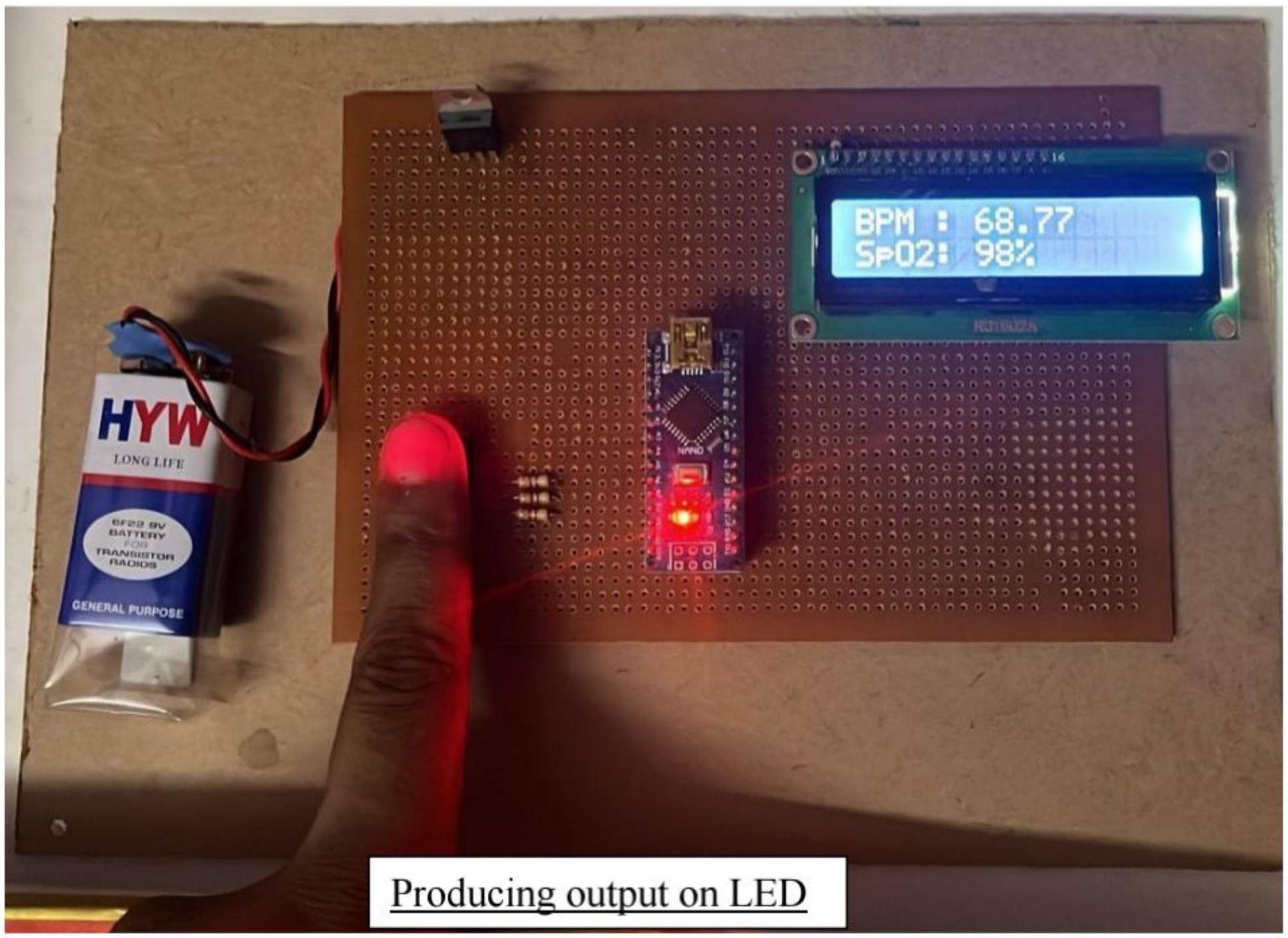
Working Model



Model with Power off



Model with battery connected



Producing output on LED

Chapter 4 : Conclusion

Conclusion

In this project, we created an Oxygen level Measurement System using Arduino nano and max10300 sensor that monitors Sp02 in percentage and heart rate in BPM(beats per minute) and displays the readings on a 16x2 LCD display.

In conclusion, using an Arduino Nano and MAX30100 to build a pulse oximeter is a cost-effective and flexible solution that can provide accurate and reliable measurements of oxygen saturation and heart rate. The compact size and low power consumption of the Arduino Nano and MAX30100 make it easy to build a portable device that can be used in a variety of settings, including hospitals, clinics, and at home. The Arduino platform is open-source and can be easily customized to suit the user's needs. It can be used in multiple applications and is a great solution for a wide range of patients and settings. Overall, using an Arduino Nano and MAX30100 to build a pulse oximeter is a reliable and practical solution for monitoring oxygen saturation and heart rate.

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