IOT BASED
HEART BEAT MONITORING SYSTEM

21CSS201T – COMPUTER ORGANIZATION ANDARCHITECTURE

Mini Project Report

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BONAFIDE

This is to certify that 21CSS201T – COMPUTER ORGANIZATION AND ARCHITECTURE, Mini Project titled“**IOT BASED HEART BEAT MONITORING SYSTEM**” is the bonafide work of **S.YAFFIN (RA2211032010053), Shivansh Shahee (RA2211032010085)** who undertook the task of completing the project within the allotted time.

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MINI PROJECT REPORT

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3.	Project Report (05)		
Total (40)			

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Chapter 1

ABSTRACT

The primary aim of this paper is to develop a hardware which displays the real time heartbeat of the patient in the smartphone. The MAX30100 Pulse Oximeter Sensor is used to detect the heartbeat and send the data to NodeMCU ESP8266 board which is connected to it. The NodeMCU also sends the data to the blynk cloud as a result it can be accessed from anywhere in the world at any time. The main intend of this project is to monitor the heartbeat of the patients remotely by the doctor. This paper explores the design and implementation of a Heartbeat Monitoring System using Internet of Things (IoT) technology. The system aims to provide real-time monitoring of an individual's heart rate, leveraging connected wearable devices equipped with sensors. Data from these devices are transmitted to a centralized IoT platform, where advanced analytics are employed to analyze and interpret the heart rate patterns. The system not only enables continuous and remote monitoring but also incorporates alert mechanisms for timely response to abnormal heart activities. The integration of IoT in healthcare holds the potential to revolutionize personalized and proactive health management, offering valuable insights for both individuals and healthcare professionals.

Chapter 2

INTRODUCTION

In medical field during emergency the top priority is to monitor the heartbeat and oxygen saturation level (SpO2) of the patient. The disease hypoxia is caused due to lowering oxygen level in the blood without causing any side effects as a result it leads to respiratory system failure or unexpected death

In hospitals a physician or a clinical staff is assigned to monitor the heartbeat of the patient by using pulse oximeter at specific time. But such a method is not suitable for monitoring the patient regularly for a long period of time. As a result, the patient may not get the proper treatment at the right time.

Thus, in order to avoid the frequent visit of the clinical staff to monitor the heartbeat or the SpO2 of the patient an IOT based heartbeat monitoring system is proposed. As a result, the patient can be monitored 24/7 by the clinal staff remotely so that the patient will get the appropriate treatment at best time.

In the present work, a blynk 2.0 cloud is used to get data from the NodeMCU ESP8266 board and display the results in the mobile application. Here the MAX30100 is an optical sensor to detect the heartbeat and it is interfaced with NodeMCU so that it can sent the detected data to it in order to display on the Blynk 2.0 application on the mobile phone.

Chapter 3

OBJECTIVE

As always, we are aware of the use of measuring heartbeats in Medical Science to diagnose various problems. Heartbeats uses to monitor the health condition of our heart. It is an ancient part of medical science to measure the current heartbeats of patients for diagnosing problems. So, in this project, we going to build an IoT based monitoring system using NodeMCU ESP8266 that will able to measure the current heartbeats and publish the data to the cloud platform BLINK 2.0. Hence the data can be accessed from anywhere around the globe (only required Internet connection). This project helps to provide high-quality support to patients & make things easier for medical staff. Normal people can also use this as a part of their life to monitor their heart health. The primary objective of this project is to develop and implement an efficient Heartbeat Monitoring System using Internet of Things (IoT) technology. This system aims to enable continuous and real-time monitoring of individuals' heart rates through wearable devices, leveraging IoT connectivity. The project seeks to design a robust and scalable architecture for data transmission, establish a centralized platform for data analytics, and integrate machine learning algorithms for the interpretation of heart rate patterns. The ultimate goal is to provide a reliable, remote monitoring solution that not only enhances individual health awareness but also facilitates timely intervention in case of abnormal heart activities, contributing to the advancement of proactive healthcare management.

Chapter 4

LITERATURE SURVEY

S.no	Title of the paper	Authors	Year of Publication	Proposed work
1.	Development of IOT heartbeat and temperature monitoring system for Community health Volunteer	Saowakhon Nookhao, Vipa Thananant, Thanakorn Khunkhao	2020	Portable device and an application to measure the heartbeat and body temperature
2.	Performance assessment of MAX30100 SpO2/heartrate sensor	Kerim Bedri Saçan, Gökhan Ertaş	2017	SpO2 and heartbeat measurements were performed from the index finger, forehead and temporal bone
3.	Detecting the oxygen saturation level and heart rate using MAX30100 sensor	Muralidharan J, Sharumathi S, Sivasudhan A, Yamini K, Sathishkumar K	2023	analog-to-digital converter , Arduino Uno board , blood , digital filter , heart rate , I2C 4-pin LCD display , LED , MAX30100 pulse oximeter sensor , oxygen saturation level , photodetector , photodiode , SpO2
4.	Design and development of Pulse Oximeter using Internet of things	D Ramesh Reddy, N Saketh, D Vijay Sai	2022	effortless testing , ESP8266 Node MCU , health vitals , heart rate , MAX30100 pulse oximeter sensor , nonintrusive method , recent Covid-19 pandemic , regular updates

Chapter 5

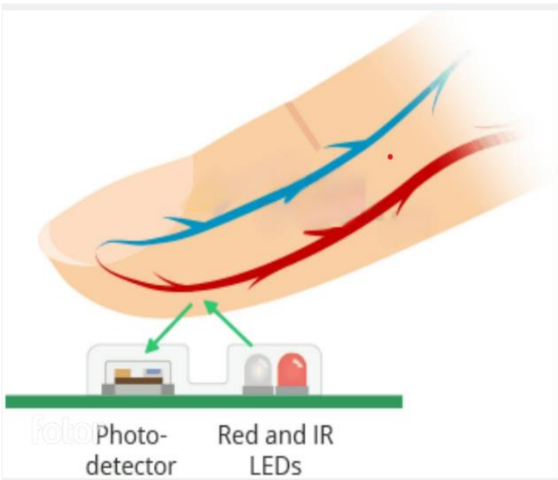
WORKING MACHANISM

MAX30100 Sensor

The MAX30100 sensor has inbuild pulse oximetry and heart rate monitor sensors in it. It consists of two LED’s, a photodetector, optimized optics, and low-noise analog signal processing in order to detect the pulse and heart-rate signals. This sensor operates on two power supplies that is 1.8V and 3.3V

Firstly the MAX30100 emits red light and Infrared radiations from the LEDs, these two lights are

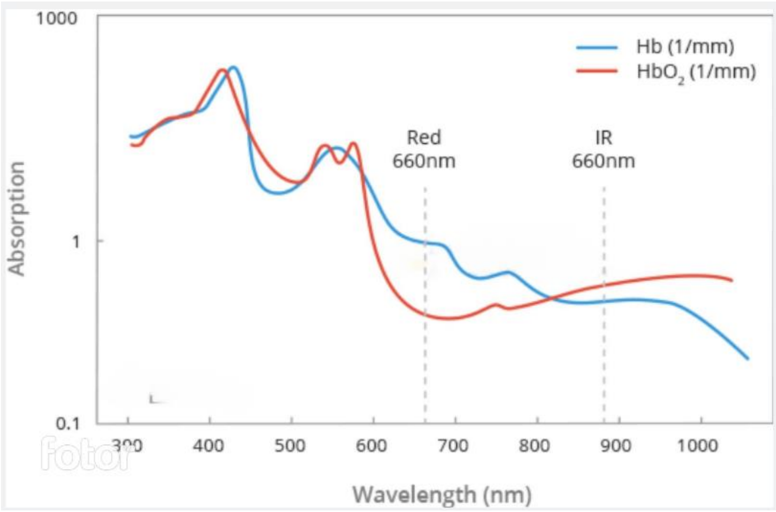
projected into the finger or earlobe or anywhere in the body where the skin isn’t thick so that these light can penetrate into the tissue. Secondly the photodetector detects the amount of reflected light. This method of measuring the pulse through light is known as Photoplethysmogram.

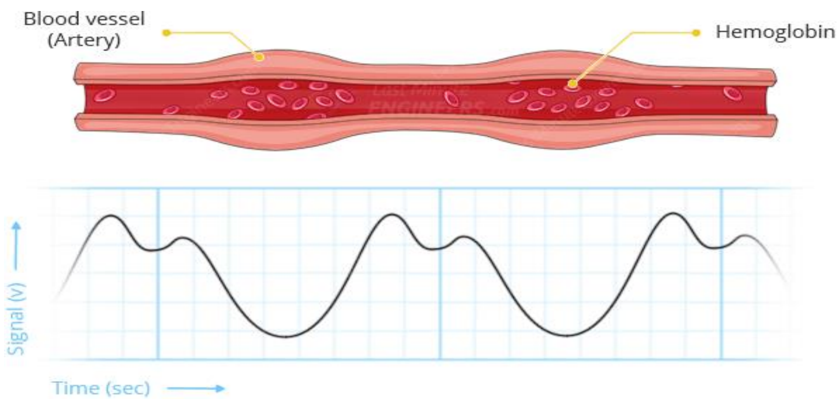


Heart Rate Measurement Pulse Oximetry

Pulse oximetry is based on the principle that the amount of RED and IR light absorbed varies depending on the amount of oxygen in your blood. The following graph is the absorption-spectrum of oxygenated hemoglobin (HbO2) and deoxygenated hemoglobin (Hb).

As you can see from the graph, deoxygenated blood absorbs more RED light (660nm), while oxygenated blood absorbs more IR light (880nm). By measuring the ratio of IR and RED light received by the photodetector, the oxygen level (SpO2) in the blood is calculated.

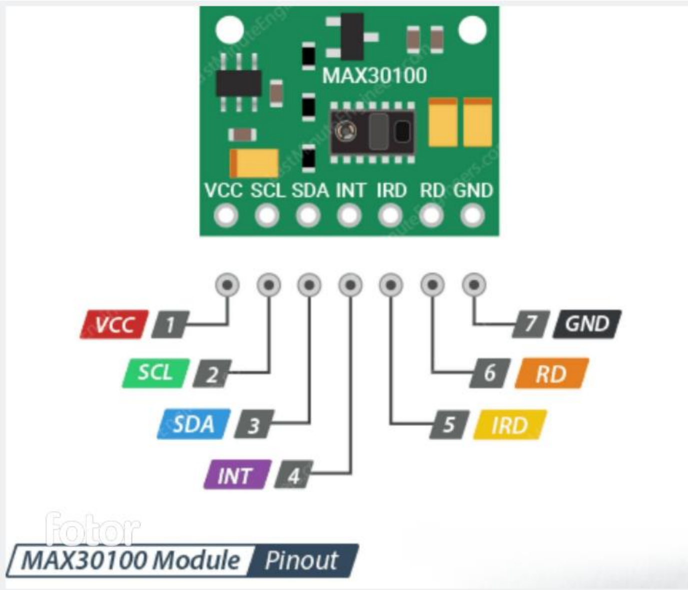




Chapter 6

MAX30100 MODULE PINOUT

The MAX30100 module brings out the following connections.



VIN is the power pin. You can connect it to 3.3V or 5V output from your Arduino.

SCL is the I2C clock pin, connect to your Arduino’s I2C clock line.

SDA is the I2C data pin, connect to your Arduino’s I2C data line.

INT The MAX30100 can be programmed to generate an interrupt for each pulse. This line is open-drain, so it is pulled HIGH by the onboard resistor. When an interrupt occurs the INT pin goes LOW and stays LOW until the interrupt is cleared.

IRD The MAX30100 integrates an LED driver to drive LED pulses for SpO2 and HR measurements. Use this if you want to drive the IR LED yourself, otherwise leave it unconnected.

RD pin is similar to the IRD pin, but is used to drive the Red LED. If you don’t want to drive the red LED yourself, leave it unconnected.

GND is the ground.

Chapter 7

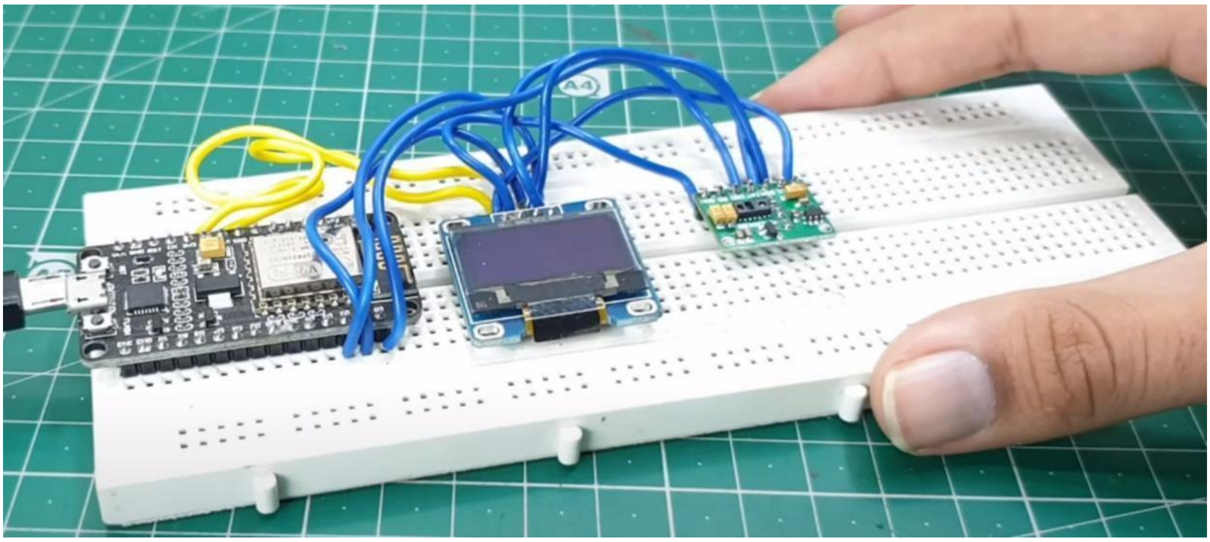
IMPLEMENTATION

Working of MAX30100 Pulse Oximeter and Heart-Rate Sensor

The device has two LEDs, one emitting red light, another emitting infrared light. For pulse rate, only the infrared light is needed. Both the red light and infrared light is used to measure oxygen levels in the blood.

When the heart pumps blood, there is an increase in oxygenated blood as a result of having more blood. As the heart relaxes, the volume of oxygenated blood also decreases. By knowing the time between the increase and decrease of oxygenated blood, the pulse rate is determined.

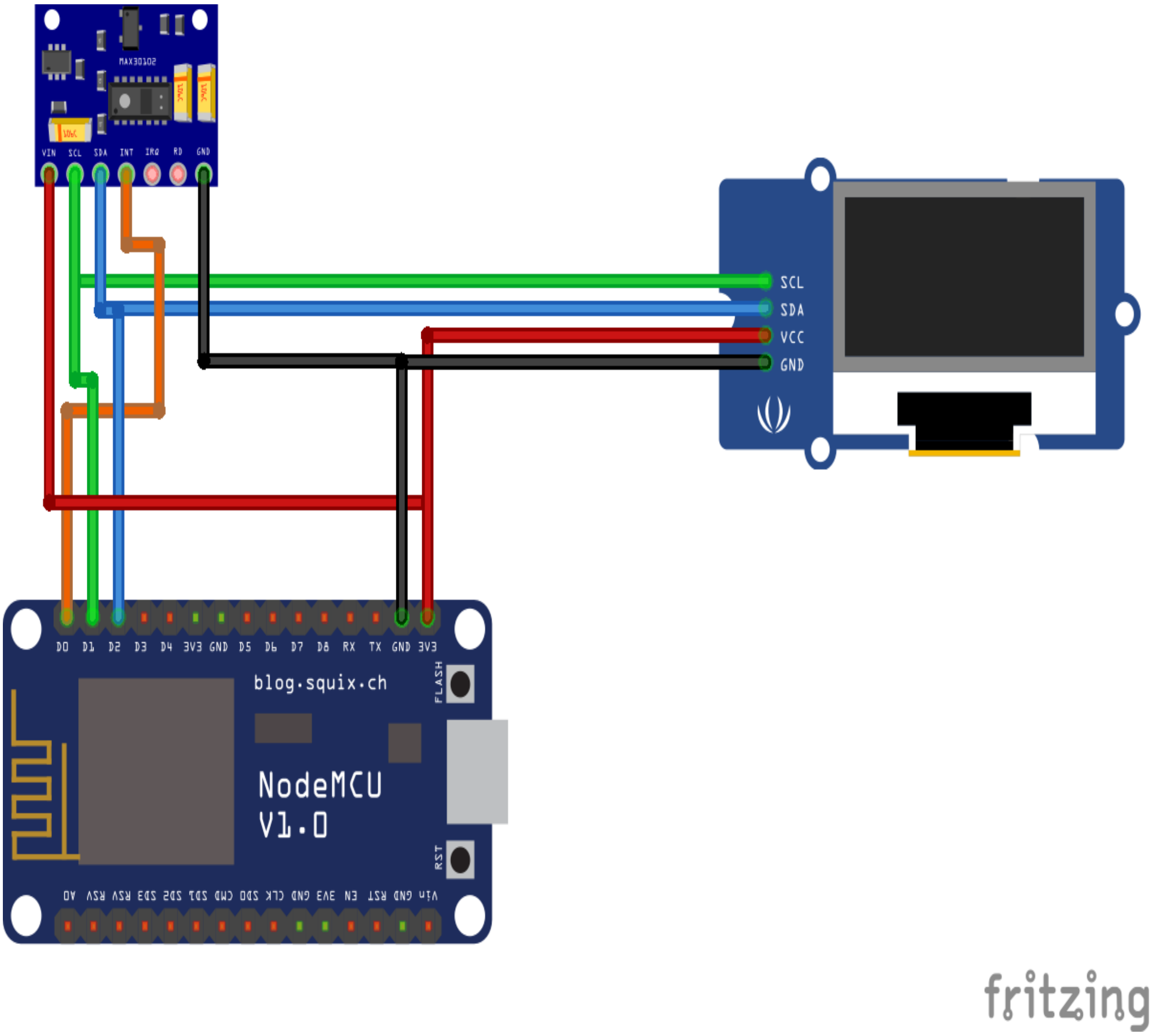
It turns out, oxygenated blood absorbs more infrared light and passes more red light while deoxygenated blood absorbs red light and passes more infrared light. This is the main function of the MAX30100: it reads the absorption levels for both light sources and stored them in a buffer that can be read via I2C.



Interfacing MAX30100 Pulse Oximeter with NodeMCU ESP8266

We will now interface MAX30100 Pulse Oximeter with NodeMCU ESP8266 and I2C 0.96″ OLED Display. The circuit diagram & connection is given below. we can assemble the device exactly as shown in the figure below.

Both the MAX30100 & OLED Display has common I2C Pins. So connect their SDA pins to D2 & SCL



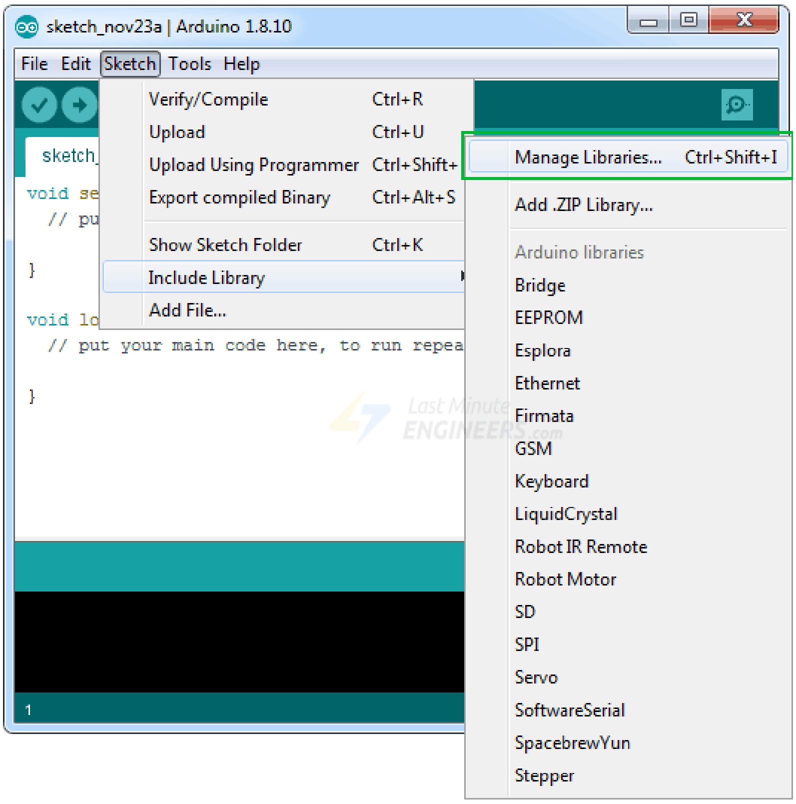
pins to D1 of NodeMCU ESP8266 Board. The power supply required by OLED Display & NodeMCU is 3.3V. So connect their VCC terminal to 3.3V of NodeMCU.

Chapter 8

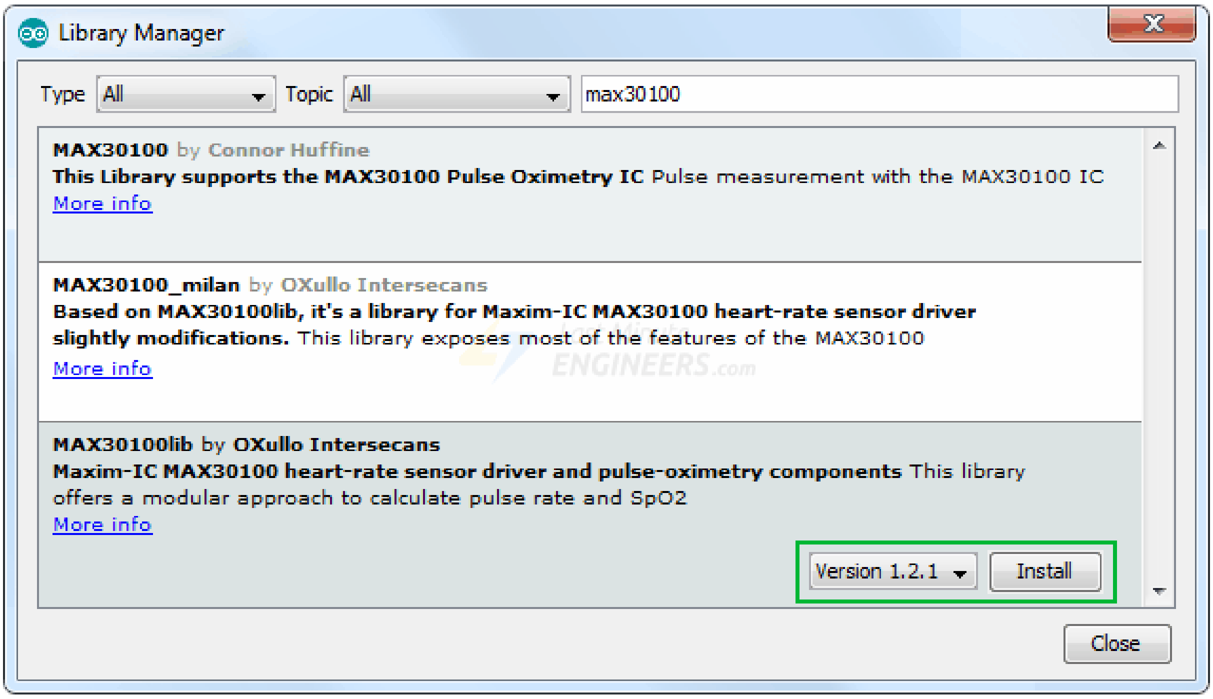
LIBRARY INSTALLATION

There are several libraries available for the MAX30100 sensor. However in our example, we are using the one by OXullo Intersecans. This library exposes most of the features of the MAX30100 and offers simple and easy to use functions to calculate pulse rate and SpO2. You can download this library from within the Arduino IDE Library Manager.

To install the library navigate to the Sketch > Include Library > Manage Libraries… Wait for Library Manager to download libraries index and update list of installed libraries.



Filter your search by typing max30100. There should be a couple entries. Look for MAX30100lib Library by OXullo Intersecans. Click on the entry, and then select Install.



Now the required library are successfully installed in the

Chapter 5

Appendix – I (BLYNK SETUP)

Step 1:

click on the new project give your project a name. I am giving the “**IoT pulse oximeter**” select the **NodeMCU** board and then set the connection type as **WiFi**. Finally, click on **create** button.

Step 2:

The Blynk Authentication token will be sent to your **email** address. We will need it later on **programming**. Tap on the **plus (+)** icon on your main screen and add two **gauges** then we will add two **value display** widgets.

Step 3:

One will show you the **BPM** values and others will show you the oxygen level (Sp02). For BPM We'll select the virtual pin **V1** and we'll set the value from **0 to 130** you can also set the colors for this gauge. Now we'll set the Value Display. we'll add the same values in the value display also because they both will act the same.

Step 4:

Now we'll do for the oxygen level. we'll select the virtual **V2** pin and we'll select the values from **0 to 100** give it some color I'm giving blue and we'll set the one-second refresh rate. we will do the same for value display settings with the same pin that is **V2** same values **0 to 100** & one-second refresh rate and color.

Step 5:

Final Blynk Result is shown below