

# IOT based Heartbeat and Oxygen level Monitoring System

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## ABSTRACT

A pulse oximeter is used to measure the oxygen level of a person, which shows how much proportion of the oxygen carrying molecules in the blood are actually carrying oxygen. The saturation point oxygen level is very important to monitor while a patient is at risk for the further process of medication, as a result of the worldwide transmission of severe COVID-19 has evolved into an unprecedented pandemic. Currently with unavailability of pharmaceutical treatments and low vaccination rates, this novel coronavirus results in a great impact on public health, society and global economy which are likely to last for many years. Internet of things platform is preferred to be utilized to achieve this goal due to its ubiquitous sensing ability and seamless connectivity. IOT technology is changing our lives through smart healthcare or smart city or smart home which aims to build a more convenient and intelligent community. In our system, we are going to measure the saturation point oxygen level as well as pulse rate would be stored in system and it will be available to user side. To monitor person oxygen and heart rate using pulse oximeter. The pulse oximeter is designed using infrared and visible light detection from light that passes through person finger from an emitter. The absorption will tell when blood is moving through the finger and show the results of oxygen and pulse rate. The output of this analog circuit will be connecting to nodeMCU which compute the heart rate and oxygen level from these rates. The values will upload and display on application as well as on LCD.

**Keyword :** - LCD, NodeMCU, Oximeter, MAX30100, ESP32.

## 1. INTRODUCTION

Wireless tracking of human body parameters has attracted significant interest in recent years due to its wide ranging applications such as rehabilitation, virtual reality, sports science, medical science, surveillance, in recent times, wireless sensors and sensor networks have become a great interest to research, scientific and technological community. So, in this project, we build a pulse oximeter using MAX30100 Pulse oximeter and ESP32 that will track the Blood Oxygen level and send the data via internet by connecting to a Wi-Fi network. This way, we can monitor multiple patients remotely by maintaining social distance with the patients. The obtained data will be shown as a graph which makes it easier for tracking and analyzing the patient's condition. Previously, we have also built other heart rate monitors using pulse sensors. And if you are interested in other Covid-19 related projects, you can check out the Human body thermometer, Smart IR Thermometer for fever monitoring, and Wall-Mount Temperature scanner that we build earlier.

Other than the Covid-19 application, this project can also be widely used in chronic obstructive pulmonary disease (COPD), asthma, pneumonia, lung cancer, anemia, heart attack or heart failure, or in congenital heart defects.

Do note that, the sensor used in this project is not medically rated, and the project is not tested for fail-proof applications. Always use a medically rated pulse oximeter to determine the pulse and oxygen level of the patient and discuss it with a medical practitioner. The project discussed here is only for educational purposes.

## II. LITERATURE SURVEY

1. In the paper titled “Design of a Portable Health Monitoring System Based on Node MCU”, authors R.K.Parate, S.J.Sharma have designed a health monitoring system based on Node MCU to monitor temperature, heart rate and oxygen saturation level (SpO<sub>2</sub>) signals, sensed by respective sensors. The necessary signal conditioning circuits have been designed in our laboratory using off-the shelf electronic components. A Data acquisition system has been designed using ESP 32 Node MCU. The designed system is a low-cost alternative to the commercially available USB controller based health monitoring systems. Firmware has been developed and deployed into the Node MCU using arduino IDE. The acquired data has been displayed on OLED display. The result shows maximum errors in the measured parameters within 2%. The designed system helps to achieve portability, high functionality and low cost which makes it an easy accessible tool for public, hospital, sports healthcare and other medical purposes.
2. Harshal S Yeotkar, Dr. V.T. Gaikwad in the paper “IOT BASED HUMAN BODY PARAMETERS MONITORING BY USING WEARABLE WIRELESS SENSOR NETWORK” deals with remote monitoring technique that could precisely monitor human body parameters is useful in applications such as medical science, sports science, rehabilitation, virtual reality and surveillance. Most of the existing systems used for monitoring human body parameter require wiring that restrains the natural movement. To overcome this limitation, a wearable wireless sensor network using Accelerometer, Pulse Oximeter and Heart-Rate Sensor, Temperature sensor and Galvanic Skin Response sensor have been developed for monitoring physiological human body parameters. The person is wirelessly monitored with his own location. This system can be easily adapted to monitor athletes and infants. The wireless feature enables the unrestrained motion of the human body as opposed to a wired monitoring device and makes the system truly portable, fast and reliable. The lightweight and compact size of the developed sensor node makes it easy attachment to the body.
3. In the paper titled “DESIGN AND DEVELOPMENT OF IOT BASED PULSE OXIMETER”, authors have proposed to develop a pulse oximeter to measure the saturation point oxygen level and the same would be stored in the cloud and also it is available live to the client’s hand held device (mobile phone).In this paper, we seek to monitor a patient’s heart rate and blood-oxygen level using a pulse oximeter. The pulse oximeter is designed using infrared and visible (red) light detection from light that passes through a patient’s finger from an emitter. The absorption will tell when blood is moving through the finger and how much of this is oxygen-rich. The output of this analog circuit will be fed into an Node microcontroller, which computes the pulse and oxygen level from these numbers. The values are uploaded to a cloud computing web host called Thingspeak from where it can be viewed.
4. In the paper titled “Development of Smart Healthcare Monitoring System in IoT Environment”, authors Md. Milon Islam ,Ashikur Rahaman, Md. Rashedul Islam, , The system introduced smart healthcare to monitor the basic important signs of patients like heart rate, body temperature, and some measures of hospital room’s condition such as room humidity, the level of CO and CO<sub>2</sub> gases. The rate of success between the observed data and actual data is approximately greater than 95% for all cases of the developed healthcare system. Authentic medical staff can view and track the data in real-time even though the patients perform the tests outside of the hospital. The system can also benefit nurses and doctors in situations of epidemics or crises as raw medical data can be analyzed in a short time. The developed prototype is very simple to design and use. The system is very useful in the case of infectious disease like a novel coronavirus (COVID-19) treatment.
5. IoT based System for Heart Rate Monitoring: This paper proposes a heart rate monitoring detection system using IoT. Nowadays treatment of most of the heart-related diseases requires continuous as well as long term monitoring. IoT is very useful in this aspect as it replaces the conventional monitoring systems with a more efficient scheme, by providing critical information regarding the condition of the patient accessible by the doctor. In addition, the nurses or the duty doctor available at the hospital can monitor the heart rate of the patient in the serial monitor through the real-time monitoring system.
6. Internet of things (IoT) based health monitoring system and challenges: In this paper, we found the importance and fruitful benefits of implementation of IoT in remote health monitoring systems. The

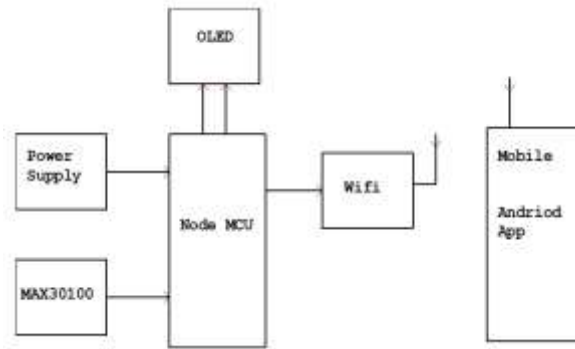
compact sensors with IoT will make a huge impact on every patient's life, that even though they are away from home and physician, this helps them to reduce the fear of danger. The sensory data can be acquired in home or work environments. Also, the challenges in sensing, analytics and prediction of the disease are also highlighted and those can be addressed to provide a seamless integration into the medical field. Patients will be given with the necessary wearable sensors capable of measuring Electrocardiography (ECG), Temperature, Electromyography (EMG) muscle activity, respiratory rate, and sweating and blood glucose level. Using these devices, diseases such as arrhythmia, fever, neuromuscular abnormality, blood pressure, obesity and diabetes. The sensors used nowadays can be easily placed in contact with the skin in multiples body parts are highly preferable so that to obtain accurate measures.

7. Design of Mobile Healthcare Monitoring System Using IoT Technology and Cloud Computing: This project presents an implementation of wearable, portable, low power consumption, real-time remote bio-signals monitoring system based on the internet of thing technology. This implementation provides an improved step-in remote health monitoring field. Numbers of people, who require health care increase year by year and the conventional bio-signals monitoring systems require patients' attendance in person inside hospitals. This might cause an inefficient situation to take care of the patients, especially those who have critical and unstable health conditions. Therefore, internet technology along with modern electronic devices could offer promising solutions in this field. Based on that, this project utilizes a mobile application as an IoT platform to monitor remotely the live ECG signal, heart rate, SPO2, and the body temperature of patients. The signals are measured and processed by using a microcontroller-based device (Arduino). The main contribution of this paper is sending an electrocardiogram (ECG signal) to a specific smart mobile phone to be watched by a doctor. This assists in heart diseases diagnosing before the worst case can happen. Finally, the obtained results of this project are illustrated on both smartphone and personal computer (PC) as well.
8. Intelligent Healthcare Monitoring in IoT: The proposed health monitoring system monitors and tracks the patients' health conditions like body temperature and heartbeat periodically. The buzzer in the system alerts the nearby person and the message is send to the consultant doctor's mobile phone in case of any emergency. The data are stored in the cloud "ThingSpeak". Hence, the health tracking professionals can monitor the patients from anywhere at any time. Thus our intelligent health monitoring system is able to transmit the sensed data to the doctor's PC or mobile Phone. This project would help in reducing the random risks of tracing a patient medical highly.
9. IoT Platform for COVID-19 Prevention and Control: A Survey: This paper proposes a fog-cloud combined IoT platform for COVID-19 prevention and control b implementing five NPIs, including COVID-19 Symptom Diagnosis, Quarantine Monitoring, Contact Tracing & Social Distancing, COVID- 19 Outbreak Forecasting, and SARS-CoV-2 Mutation Tracking. Table I summarizes various studies considering different layers of the proposed IoT platform. We review the recent IoT-based studies which can be applied for implementing the five NPIs. We discuss how the recent technological advancements such as fog computing, clouding computing, artificial intelligence, and big data analysis, can be utilized for IoT and COVID-19.

### III. PROPOSED METHODOLOGY

#### 3.1. Methodology

In this project, we are going to use latest microcontroller Node MCU which has in-built Wi-Fi technology. It operates on 5 V DC supply. To monitor heartbeats and oxygen level in human body, MAX30100 Pulse oximeter sensor is used. This sensor will sense the oxygen level and heartbeats and gives output to Node MCU. OLED is connected further for displaying heartbeat per minutes BPM and % oxygen level. We can check the status of the same on Android App also. We will be developing an Android App with Blynk.



**Fig -1 Block Diagram**

The block diagram of the system shows in figure.1. It contains different blocks. The node MCU will control all process. We can code and connect circuitry to node MCU. The Pulse Oximeter and Heart rate Sensor module based upon Maxim's MAX30100 integrated IC which is a compact low cost integrated solution for measuring Heart Rate as well as Pulse oximeter .The output of node MCU will displayed on mobile app via WIFI.

### 3.2 Hardware Requirement

- Node MCU
- MAX 30100 Pulse Oximeter
- LCD Display
- Battery

### 3.3 Software Requirement

- Arduino IDE
- OrCAD
- Altium

## IV. RESULTS AND DISCUSSIONS

### 4.1 Software side

Our system results display on blynk application. It will show person oxygen level as well as their pulse rate or heartbeat.



**Fig -2 Results on Blynk application**

### 4.2 Hardware Side

(a) Electronic Circuit: In figure 3 shows, all hardware components integrated.



**Fig -3 Electronic Circuit**

(b) Initial LCD Display :



**Fig -4 Initial LCD Display**

(c) Heartbeat and Oxymeter Sensor:



**Fig -5 Heartbeat and Oxymeter Sensor**

(d) Result of LCD Display after insertion fingertip on sensor



**Fig -6 Results on LCD Display**

### 4.3 Advantages

1. Fully automatic system.
2. Use of latest IOT technology.
3. Display of heartbeat rate and oxygen level in percentage of both LCD and android application.

### 4.4 Applications

Wireless tracking of human body parameters has attracted significant interest in recent years due to its wide ranging applications such as rehabilitation, virtual reality, sports science, medical science, surveillance, in recent times, wireless sensors and sensor networks have become a great interest to research, scientific and technological community. So, in this project, we build a pulse oximeter using MAX30100 Pulse oximeter and ESP32 that will track the Blood Oxygen level and send the data via internet by connecting to a Wi-Fi network. This way, we can monitor multiple patients remotely by maintaining social distance with the patients.

## V. CONCLUSION

Thus, we have successfully studied various sensors interfacing with Node-MCU microcontroller. We also studied and worked for the hardware (PCB making, power supply design, drilling, soldering, and wiring) of the project. We studied that, using IoT technology, user can itself monitor and control the devices in the Medical field as per our application.

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