

# IOT IN HEALTHCARE SECTOR-COVID-19 PATIENT MONITORING SYSTEM

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**Abstract** - Corona virus is a new virus that has not been identified in humans before which causes the corona virus disease called COVID-19. This disease was firstly discovered in China, last year in December 2019 and it spread to the world until now. The virus can easily and rapidly spread from person to person. The common symptom of COVID-19 that can be easily identified is fever or Body Temperature, blood oxygen level(Spo2) and heart rate all are playing a vital role in the covid-19 pandemic, this is the primary symptom that we have to check to identify the covid-19 virus also in day to day life this parameter determining a person's health conditions. Hence this project can help in case if the patient or person is unable to meet the doctor or requires frequent monitoring to solve all problems we are going to develop this project which can be monitor anytime and all monitor data can be stored at a cloud. Also, this project can be used at entrance of various shop, D-Marts, Clinics to monitor customers health conditions and stored their records. The result shows that the proposed system can be more efficient than the normal manually system.

**Key Words:** MAX30100 Sensor, MLX90614 Sensor, O-led, ESP8266 Wi-Fi Module, Firebase, Android Application, Web Page.

## I. INTRODUCTION:

The device pulse oximeter is a very critical part of the Hospital and Medical department as this device which plays a very important role in our life. It provides great facilities to the healthcare systems and the doctors, due to which it makes easy for the doctors and the patients to understand their health their heart rate, blood oxygen level, breathing rate to understand the problem they have. It is highly important because before when it was developed it was not easy to carry everywhere but because of the technology it can be carried everywhere. The pulse oximeter is the device which is used for measurement of oxygen saturation in our body by transmitting infrared light through a translucent area of patient. This is done non-invasively and the oxygen saturation level is compared based on the measurement. This device is responsible for saving hundreds of lives every year.

Before pulse oximeter was developed, the oxygen saturation in our body was measured by a painful arterial blood gas and it took a minimum of 20-30 min. to obtain results this delay in time is not acceptable as severe brain damage can happen within 10 min. of low oxygenation level. According to reports 1000 patients died because of undetected problems caused by low blood oxygen level and there is no estimation of patient morbidity.

The contact less body temperature is used for measuring the temperature of body and it gives the more accuracy and it is contact less without any physical touch it gives us digital output and old is using or display purpose. We are developed one kit for measure all parameters and it will be transmitted for various processing purpose using esp8266 Wi-Fi module.

## II. LITERATURE SURVEY:

According to Handbook of Biomedical Instrumentation by R.S. Khandpur [66], techniques of measuring heart rate are:

- ❖ The Average Calculation: The average calculation means the average percentage is calculated using the counting of number of pulses in given amount of time. This method is helpful as it shows the time between the beats, but it does not show or represent the true output of our heart response to the job done by it in stress and environment.
- ❖ Beat and the beat counting: This calculation is done by measuring time, which is in seconds, which is in between two consecutive pulses. Once the time is calculated the time in seconds is converted in beats/min using the formula of beats/min = (60/T).
- ❖ Now combining the beat and beat Calculation with our averaging calculation: This technique is depended on five or seven beats average. Now the advantage of using this method over the averaging method is that it is similar to the neat and beat monitoring method.
- ❖ The device which measure the heart rate, blood rate, body temperature depends on the measurement of physiological signal which is called as photoplethysmography it deals with the optical technique of measuring the changes in blood volume in the arteries.
- ❖ It acquires the PPG signal by radiating two wavelengths of light which are different through the tissue, and then it compares the light absorption characteristics of the blood under those wavelengths.
- ❖ This absorption now obeys the Beer Lambert's Law according to which the Beer Lambert's law transmittance of light through the tissue can be calculated using :  $I_{out} = I_{in} e^{-A}$
- ❖ Here the  $I_{out}$  represents the light intensity transmitted through fingertip tissue.  $I_{in}$  is the light intensity which is going into the fingertip tissue and  $A$  is the absorption factor.

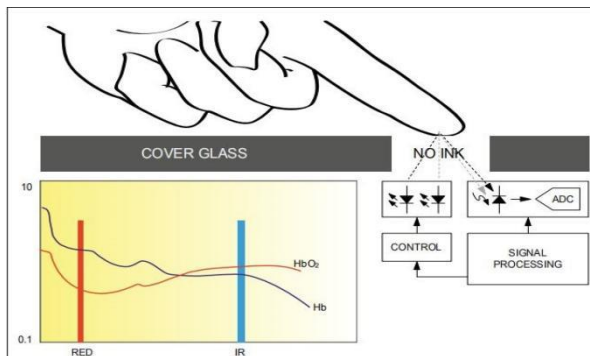


Fig -1: - Transmission and Reflection Method

❖ Reflective type blood oxygen saturation detection system based on MAX30100 Jixi Wan<sup>1</sup>, Yehuda Zou<sup>2</sup> School of Electronic Engineering and Automation, Guilin University of Electronic Technology Guilin, China Email: wjx\_funny24@163.com Ye Li\*, Jun Wang<sup>2</sup> Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences Shenzhen, China Email: \*ye.li@siat.ac.cn.

❖ Oxygen is the key material of human's life, and oxygen saturation is one of the important indexes reflecting organic oxygen delivery status. Determining oxygen saturation in human blood by transmittance oximetry is well developed as a monitoring technique, which is applied widely in clinical diagnosis or house health care.

❖ However, reflectance detecting is necessary in many circumstances, such as cerebral oxygen saturation, muscle oxygen saturation, or fetal oxygen saturation monitoring. So, the reflective type oxygen saturation detection system gradually has become main flow of development

❖ depend on the principle of oxygen saturation measurement, this paper introduces a blood oxygen saturation detection system design scheme based on the integrated chip MAX30100, which can simplify the circuit design and reduce system footprint, designing time and system power consumption.

❖ Through introduces the system hardware and software structure, signal processing methods and other aspects of the study to realize the fingertip pulse signal acquisition and noise reduction processing. After the practical test, the system prototype machine realizes the function of pulse oxygen saturation detection.

### III. TECHNICAL BACKGROUND :

❖ The corona virus which identified within the year 2019 (COVID-2019), it had been first appeared in Wuhan city within the China in December 2019, it spread quickly or we will say rapidly person to person round the world then brought the pandemic.

❖ It has caused a devastating effect on daily lives, public health, and the global economy. It is necessity of the current situation to detect the growing positive cases as quickly as possible so as to avoid the quickly spreading of the pandemic and treat the patients as early as possible. The need for additional diagnostic tools has increased as there are no accurate automated tool-kits available.

❖ The health issues have been of a greater problem over the years especially this day where the pulse and the heart rate of humans produce various ways to enter disease in our body. Now the Heart-related diseases are the leading cause of mortality around the world. There is a high need for continuous monitoring of cardiac data from our body as they are a very significant and important index of one's health. Traditional methods of measuring heart rate, spo<sub>2</sub>, and body temperature values are slow and require time, and usually requires the presence of a physician.

❖ This makes nocturnal monitoring impossible. So, for adults and other critical patients it is necessary to maintain the pulse rate in the range of 60bpm-100bpm but if the pulse rate goes below 60bpm then there are chances of Heart attack, high level of potassium in blood. Also, in the last 8 month the COVID-19 is a disease caused by the SARS-CoV-2 virus that primarily attacks a person's respiratory system. Some milder symptoms can include fever, aches, but it can also lead to more serious conditions such as pneumonia. A person who has pneumonia or even slight shortness of breath does not know when to go to a hospital, especially as they start to get even more overwhelmed.

❖ So, we try to solve this issue by using a system consisting of embedded system which has hardware and software and IOT based solution for monitoring measuring of pulse rate, heart rate, body temperature.

❖ This device will continuously monitor the level of blood oxygen in the customer or peoples and allowing rapid intervention if blood oxygen level goes down below the safe value which will be shown on the analytical platform for easy assessment of the health conditions and monitoring .

❖ Especially in this condition where the test kits are going out of stock and ventilators shortage is present and if the patient or person is unable to meet the doctor or requires frequent monitoring.

❖ The earlier technique used to store the data of the customers entering the shops is done by us manually. So, a solution this problem is development of the QR code scanner which detects the QR code and then the data can be stored online without the human intervention.

### IV. TECHNICAL SPECIFICATION:

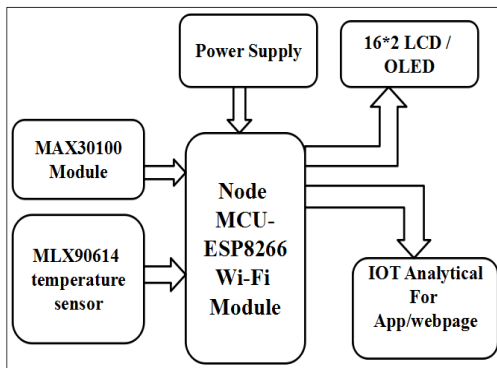
In this project we will do the process of the detection of the symptoms of Covid-19 with the help of the controller, and various sensors which deals with the heart rate monitoring, blood oxygen level monitoring, temperature monitoring. The NodeMCU requires the operating voltage of about 3.3V-5v. It has SRAM of 64kb. Along with the other sensors. The data will be displayed on the O-led who will provide the reading. The data will be also displayed on the internet-based cloud platform which will show the output in stats so the doctors or government worker can easily monitor.

### V. RESOURCE REQUIRED:

The project is embedded system where it consists of the hardware and the software. The hardware consists of the main head which is NodeMCU it will control all the sensor data and send it to the cloud-based server which will share the data. The other sensors.

MAX30100 and the MLX90614 sensor which we use for various body disease detection. The software part requires the Arduino IDE which will be used to program the NodeMCU, the other software which we require for development of applications/webpage required android studio and programming language java, DSA, HTML, CSS, PHP JS etc. and QR code scanner.

**VI. BLOCK DIAGRAM:**



**i. Power Supply:**

A power supply is an electronic component that provides electric power to an electrical load. The first function of a power supply is to convert electric current from a source to the correct current, voltage, and frequency to power the load. As a result, due to which, power supplies are sometimes referred to as electric power converters. Some power supplies are separate standalone pieces of kit, while others are built into the load appliances that they power. There are different voltage ranges from that we are using 5v/9v dc power adapter or battery.

**ii. O-LED:**

The o-led here is used to display the output which is a very creative way to display the output and shows the health data. The o-led makes it more useful as it shows the image of heart and lines so the user can easily understand it what the data is present in our body.

An organic-light-emitting diode known as OLED also called as organic electroluminescent is a light emitting diode LED in which the emissive electroluminescent layer is a film of organic compound that emits light depend on an electric current. And we choose this because of it compatible to display images character symbols etc.

**iii. MAX30100 Module:**

MAX30100 is a pulse oximetry which is integrated and heart-rate monitor sensor. It combines two LEDs which are IR and Red light, low-noise analog signal processing, optimized optics, a photo detector, in a detect pulse oximetry and heart-rate signals. It's fully configurable through software registers and hence the output data is stored digitally during in a 16-deep FIFO within the device. It has an I2C digital interface to communicate with a host controller.

The pulse-oximetry MAX30100 has subsystem consists of ambient light cancellation ALC which has proprietary discrete time filter and 16-bit sigma delta ADC. It also has an capability of ultra-low-power operation which makes it ideal for battery operated systems. MAX30100 sensor operates on a supply voltage within the range of 1.8 to 3.3V. It can be used in medical monitoring devices, fitness assistant devices, wearable

devices, etc. The MAX30100 operates on the power supply in the range of 1.8V and 3.3V and may be powered down through software, permitting the facility supply to stay connected always. With negligible standby current.

**iv. MLX 90614:**

The MLX90614 is a non-contact infrared temperature measurement device using infrared lights. The IR sensitive thermopile detector chip and therefore the signal conditioning ASIC are combined within the same TO-39 can. Integrated into the MLX90614 are a coffee noise amplifier, 17-bit ADC and powerful DSP unit thus achieving high accuracy and determination of the thermometer.

The thermometer comes factory built with a digital SMBus output giving full access to the measured temperature within the complete temperature range with a resolution of 0.02°C. The user can design to get the digital output to be pulse width modulation PWM. Also it has capability to the 10-bit PWM is continuously transmit the measured data in range of -20 to 120°C, with an output resolution of 0.14°C.5).

**v. NodeMCU:**

Node MCU is an IOT-Platform which is low cost highly used device. it had been first included firmware which runs on the ESP8266 Wi-Fi SoC from the corporate of Espressif Systems, and hardware which was supported the ESP-12 module. Later, support for the ESP32 32-bit MCU was given by Espressif System.

**❖ Specifications:**

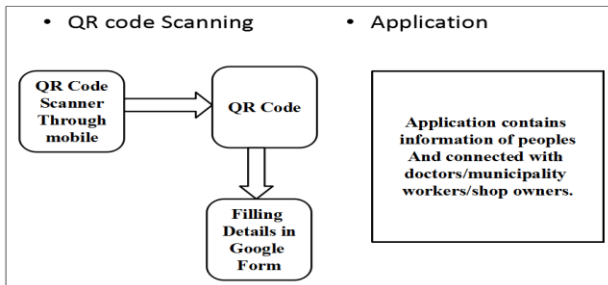
- Microcontroller: Tensilica 32-bit RISC CPU Xtensa LX106.
- Operating Voltage: 3.3V.
- Input Voltage: 7-12V.
- Digital I/O Pins (DIO): 16.
- Analog Input Pins (ADC): 1.
- UARTs: 1.
- SPIs: 1.
- I2Cs: 1.
- Flash Memory: 4 MB.
- SRAM: 64 KB.
- Clock Speed: 80 MHz.
- USB-TTL based on CP2102 is included onboard, Enabling Plug n Play.
- PCB Antenna.
- Small Sized module to fit smartly inside your IoT projects.

**VII. SOFTWARE REQUIREMENT:**

Android studio for App development and supported language java kotlin etc., Arduino IDE for programming purpose of hardware that is in c

language, for web page development we required web designing language's HTML, CSS, JS/PHP etc.

**VIII. SOFTWARE PART:**

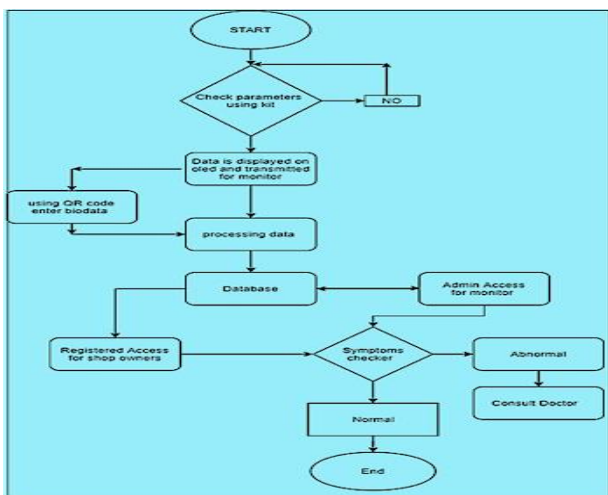


**IX. FLOW CHART /ALGORITHM:**

❖ **Algorithm:**

- Stand against the entrance of the shop.
- Then check the parameters for the detection of the symptoms.
- The parameters check will be heart rate, body temperature, blood oxygen level.
- If the body temperature, blood oxygen level, heart rate is high than the required value then the customers will be asked to consult the doctors and entry is denied
- The data is stored via. internet on cloud application..
- If the body temperature, heart rate, blood oxygen level is normal then the entry will be granted..
- The last stage will be of entering the people's information using QR scanner and google digitally instead of entering the data by humans.

❖ **Flow chart:**



**X. QR CODE SCANNER:**

A QR code is called as quick response it uses four standardized encoding modes that are numeric, byte/binary, alphanumeric, and to store data efficiently extensions may also be used. A QR code whose full form is Quick Response code is a type of matrix barcode or we can say two-dimensional barcode which was designed in 1994 for the automotive industry in Japan. the QR codes contain the data for a tracker that points to a website or application, locator, identifier, and barcode is a machine-readable optical label that contains information about the item to which it is attached.

A QR code consists of black squares arranged during a square grid on a white background, which may be read by an imaging device like a camera and processed using Reed-Solomon error correction until the image are often appropriately interpreted. the specified data is then extracted from patterns that are present in both horizontal and vertical components of the image.

**XI. METHODOLOGY:**

❖ **Data Collection:**

- Real time data is collected using developed kit.
- Data contains two mainly part.
  - Parameters (Body temperature, heart rate, blood oxygen level).
  - Person information (Name, Mobile no, Address, Age, Gender, Aadhar No).

❖ **Data Preparation and Arrangement:**

- All the data is combined and stored on cloud and accessed through android based application.
- Filtering and arrange data in required manner (remove duplicates, correct errors, null values etc.)
- Sorting data in ascending order to easy analysis.

❖ **Monitoring and Evasion:**

- Check Available data if find data having symptom then inform that person for evasion purpose.

**XII. CONCLUSION:**

The project produces the readings of the heart, pulse rate and the body temperature which gives the idea of health issues to the patient and it can be checked anywhere in any condition. Since it is IOT based the patient can get easy access to the readings and easy interpretation of data. Hence, we can used it by multiple one the application is it is used in the entrance of the shop to monitor the customers health data the data is stored digitally using QR code scanner. If the person is symptomatic then still is not allowed to enter shop. And the data of the person is stored at shop owner.

**XIII. FUTURE SCOPE:**

In future consideration, some other parameters could be added such as blood pressure, glucose level detector. The data of every user who

checked it could be store in a database to instantly access it when and required. Also using web cam, the mask detections is possible for highly security aspect, the continues monitoring system can be added for mask detection if the person has wore the mask even in the society's as well.

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