Cloud Based Health Monitoring System

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Abstract : Body temperature and oxygen content have an impact on human heart rate. Temperature, oxygen concentration, and heart rate are significant indicators of a healthy and prosperous human body that must be observed in order to identify any irregularities early enough for treatment. The vision is to develop a system that continuously monitors the vital functioning of human organs and reflects indicators by measuring heart rate, oxygen level, and temperature on a regular basis. Furthermore, it sends the information via Wi-Fi technology to be displayed in the computer and mobile interfaces, as well as being saved in database files and retrievable upon request. It also intends to create a common platform for the doctor and patient, allowing the doctor to view the patient's daily records. During the pandemic Covid-19, as the doctor to patient ratio according to WHO is 1:1000 in India. Due to this low doctor to patient ratio, there were less doctors to monitor huge number of patients. This can help to reduce this problem by continuous monitoring of these health parameters without physically going to hospital.

IndexTerms **- Temperature, Oxygen concentration level, Heart rate, Wi-Fi technology, Covid-19.**

I. INTRODUCTION

Telemedicine refers to the exchange of medical information from one location to another via electronic communication in order to improve the health of patients. It is cutting-edge technology. It integrates telecommunications and information technology for medical applications. It facilitates the delivery of health-care services when the distance between the doctor and the patient is more. This application will benefit rural areas. It is essential to care for patients in operating rooms, emergency rooms, and critical care units. It's also useful in respiratory therapy, recovery rooms, radiology, ambulatory, covid patient, and other sleep screening applications.

A cloud-based health monitoring system has numerous advantages. It can reduce both the risk of infection and the risk of infecting others. It also lowers the risk of other complications, making the patients more comfortable. Further to that, implementing a cloud-based patient monitoring system in hospitals may reduce costs associated with wiring installation and maintenance.

According to the World Health Organization, 17.9 million people die each year as a result of cardiovascular disease (CVD), accounting for 31 percent of all deaths worldwide. In addition, 1.33 million people died as a result of covid-19[1]. As a result, a method to prevent or assist in reducing losses is required.

The significance of vital signs stems from the fact that they can be used to determine a person's health. Any change in these symptoms indicates that the patient's medical state has deteriorated. Variations in heart rate, oxygen level, and body temperature, commonly known as vital signs, can be used to detect a variety of medical disorders. Specialized instruments for simultaneously measuring all vital signs are not portable and are hard to come by. As a result, in this project, we designed a portable heart rate, oxygen level, and body temperature monitor that can be used as a diagnostic tool on a computer or mobile device.

There are three vital signs that are standard in almost all medical settings they are as following.

- Heart rate.
- Oxygen level.
- Body Temperature.

Byeong-Gu Ahn, on the other hand, believes that many modern individuals desire to live a healthy lifestyle. Recently, there has been a lot of research and initiatives in IoT-based healthcare solutions or smart phone-based, real-time health management systems due to technology advancement. The electrocardiogram measurement is difficult when non-constrained occurs according to the change of the posture that occurs during the life.[2]

Our findings are similar to those reported by Punit Gupta. Improved health related risks and reduced healthcare costs by collecting, recording, analysing and sharing large data streams in real time is achieved efficiently by this model. The idea of this project came so to reduce the headache of patient to visit to doctor every time he needs to check his oxygen level, heart rate, temperature etc. With the help of this proposal the time of both patients and doctors are saved and doctors can also help the other emergency patient as much as possible [3].

The project's goal is to create a low-cost system that measures a person's heart rate, oxygen level, and temperature by placing sensors on the finger and then displaying the responses on a computer application interface. A microcontroller powers the compact heart rate monitor system. The advantage of this over tape-based recording systems is that the device is portable. The thesis describes how a NODEMCU can be used to analyse real-time heart rate, oxygen level, and body temperature signals. To minimise size, both the hardware and software designs are oriented towards a single-chip, microcontroller-based system NODEMCU.

From Shubham Banka IoT in healthcare is the key player in providing better medical facilities to the patients and facilitates the doctors and hospitals as well. The proposed system here consists of various medical devices such as sensors and web based or

mobile based applications which communicate via network with the device and help to monitor and record patient's health data and medical information. The proposed outcome of the paper is to build a system to provide continuous patient's monitoring even in the remotest areas with no hospitals in their areas by connecting over the internet and grasping information through about their health status via the wearable devices provided in the kit.[4]

II. BLOCK DIAGRAM AND EXPLANATION

Fig.1 shows the block diagram of our project.

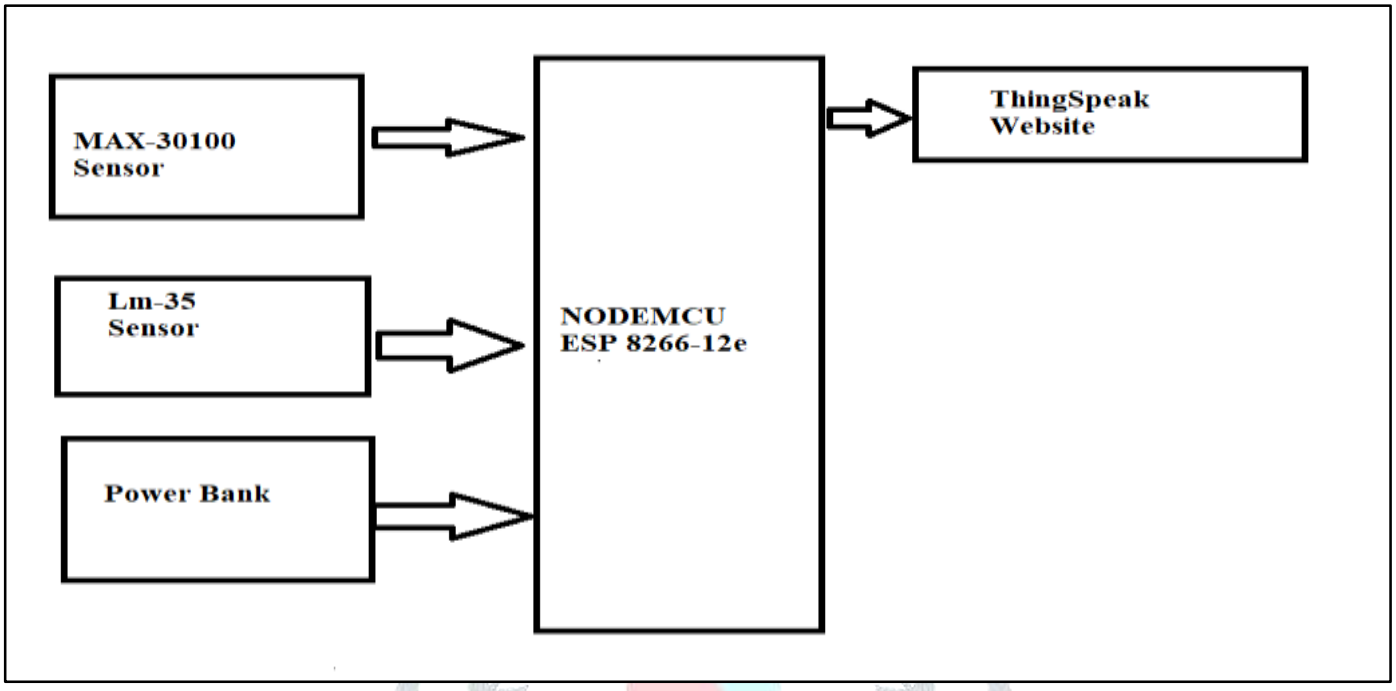

Figure 1- Block Diagram

The above figure shows the block diagram which consists of MAX30100 Sensor, LM35 Sensor and NODEMCU ESP8266-12e Wi-Fi Module. The MAX30100 Sensor is used to determine oxygen level and heart rate. The information generated from MAX30100 is provided to NODEMCU ESP8266-12e similarly the information from LM35 Sensor which is a Temperature sensor is provided to NODEMCU ESP8266-12e. NODEMCU ESP8266-12e converts the received information to readable format. Further the information is sent to ThingSpeak Website using Wi-Fi Module NODEMCU ESP8266-12e. Here the data is stored in proper format.

III. WORKING PRINCIPLE

In this project, we have made Cloud Based Health Monitoring System using ThingSpeak and NODEMCU ESP8266-12e. The NODEMCU ESP8266-12e is an open-source Lua-based firmware and development board designed specifically for Internet of Things (IoT) applications. The NODEMCU is operated by the ESP8266 Wi-Fi SoC firmware and hardware, which is built around the ESP-12 module. The MAX-30100 sensor is a pulse oximeter sensor which will sense pulse rate and oxygen level and will send the information to NODEMCU. Further the NODEMCU will send the collected data to ThingSpeak server via the Wi-Fi module that is ESP8266, which can help to monitor the heartbeat through the internet in any part of the world. The pulse oximeter sensor is based on the principle of photoplethysmography [5]. Photoplethysmography [Figure 2] is a method which measures the change in volume of blood through any organ of the body which causes a change in the light intensity through that organ (a vascular region). In the case of applications where the heart rate is to be monitored, the timing of the pulses is more important. The volume of a blood vessel changes in direct proportion to the heartbeat, and the volume of blood in any organ of the body changes in direct proportion to the intensity of light passing through that organ. It is also found that more the oxygenated blood, more IR light is absorbed. The basic MAX30100 sensor consists of a light-emitting diode, a detector like a light detecting resistor or a photodiode and Infra-Red light [6].

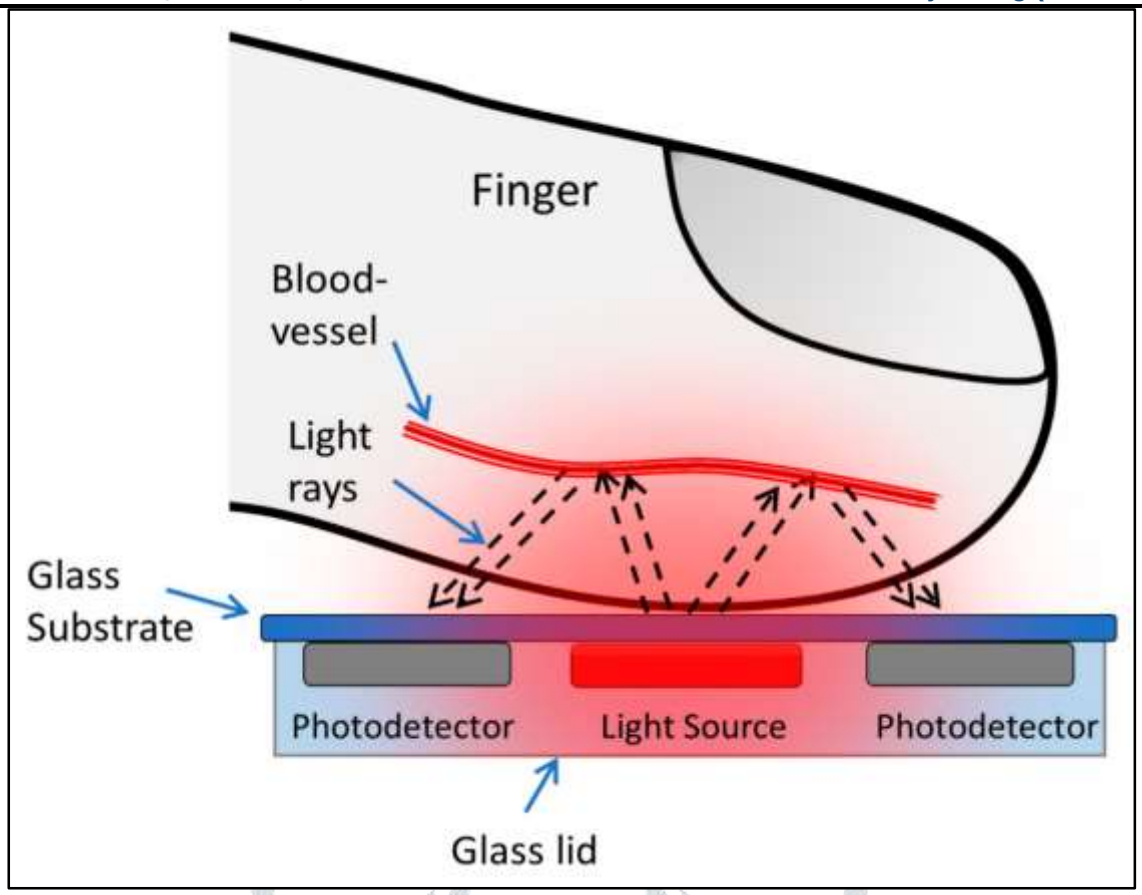

Figure 2-Photoplethysnography

LM35 is a temperature sensor which works in range of -55ºC to 150ºC. The temperature of the body is then sent to Thingspeak website through NODEMCU. Thingspeak is an open source IOT platform where we can save the data and retrieve whenever required from anywhere.

IV. RESULTS AND DISCUSSION

The figures below show graphical representation of patient's three vital signs.

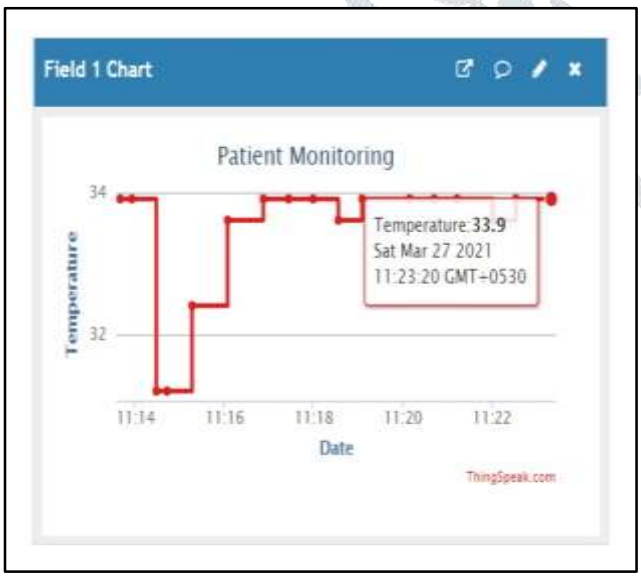

Chart 1-Temperature Monitoring

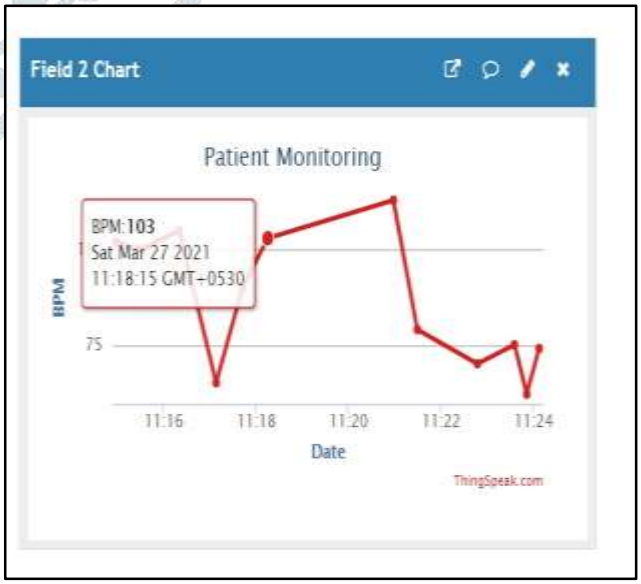

Chart 2-Heart Rate Monitoring

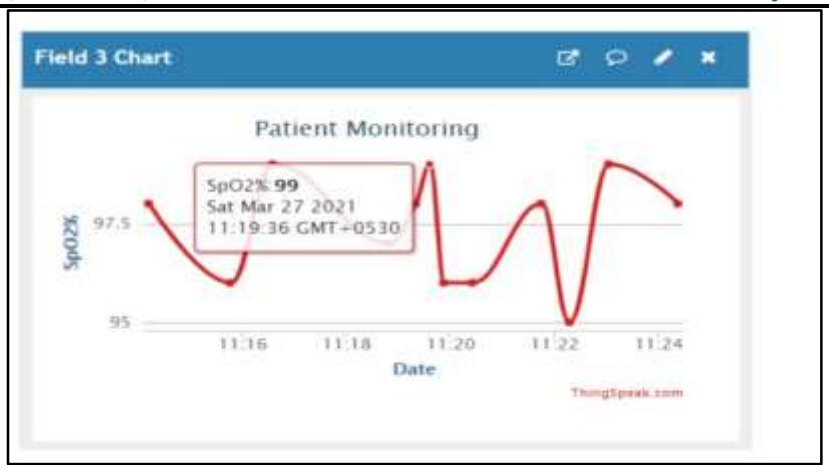

Chart 3- Oxygen Level Monitoring

The chart 1 shows the graphical representation of patient's temperature monitoring. From the chart we can also determine the date and time.

The chart 2 shows the graphical representation of patient's heart rate measured in BPM. From the chart we can also determine the date and time.

The chart 3 shows the graphical representation of patient's oxygen level. From the chart we can also determine the date and time. Also, the data is updated every minute.

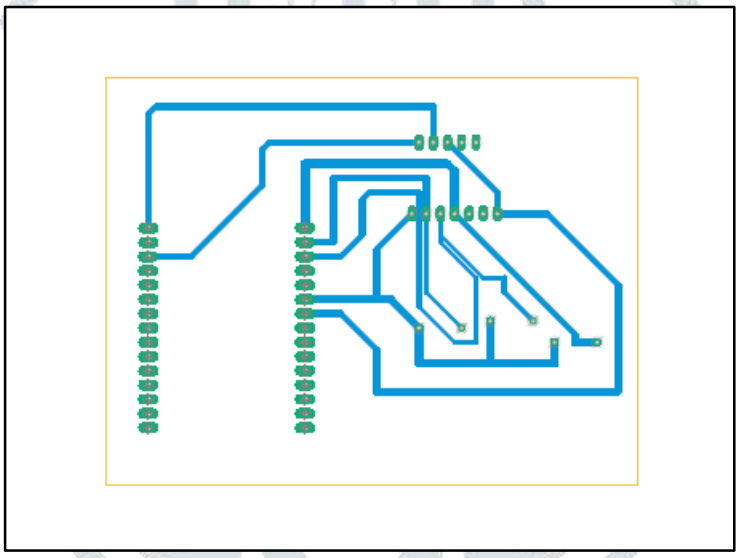

Figure 3-PCB Design

The figure 3 shows the PCB layout which was designed using Eagle software.

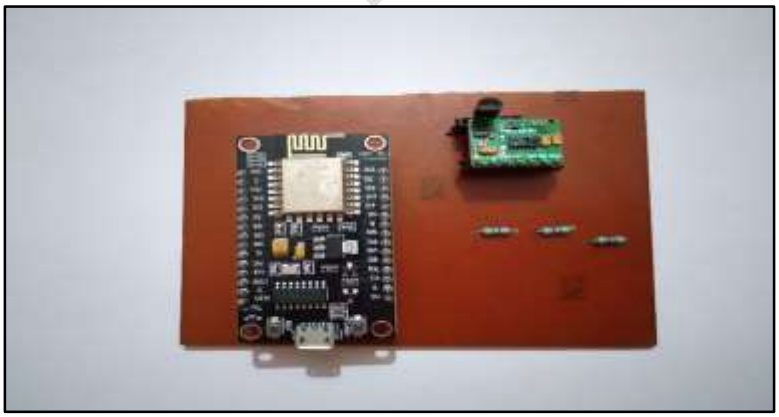

Figure 4- Circuit

The figure 4 shows the picture of circuit which was designed by PCB Etching method using ferric chloride solution.

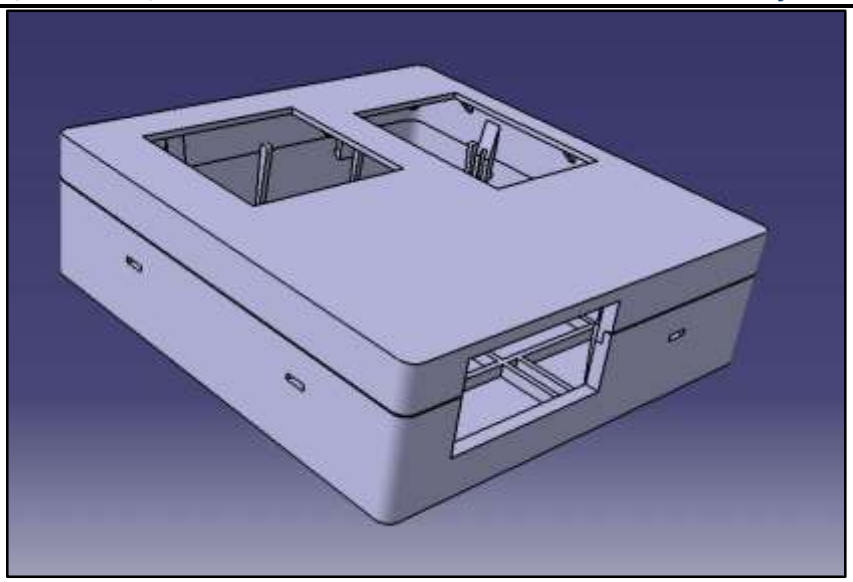

Figure 5-Box Design

The figure 5 shows the design of box designed using Catia software. Box is designed to protect circuit from physical damage.

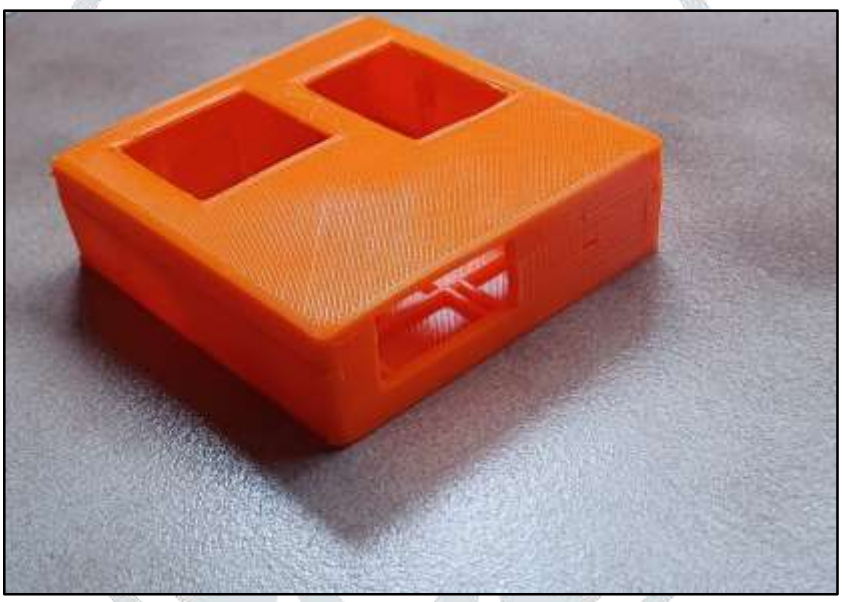

Figure 6-3D printed box

The figure 6 shows the 3D Printed Box using WOL3D ENDER.

V. CONCLUSION

The Cloud Based Health Monitoring System is designed to ensure that the time required for monitoring a patient is reduced. The doctor can observe patient's vital signs from anywhere in the world as it is necessity in today's situation of covid-19. As we know medical professionals are also at high risk while physically monitoring infected/covid positive patient so this device also ensures safety of medical personnel as they can monitor patient from wherever they are. In future we can also add blood pressure monitoring system.

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