IoT Based Covid Patient Health Monitoring System

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ABSTRACT
The COVID-19 pandemic situation has made timely Health monitoring a major concern for saving a life. The busy routine life is a major challenge for doctors to regularly monitor the Health of a COVID Patient. To overcome this problem faced by the family members and doctors in this pandemic situation, we have designed a smart Health monitoring system using IoT (Internet of Things). This system immediately checks and alerts about the critical situations faced by the COVID Patients. This system uses NODEMCU ESP8266 controller, for continuous tracking of the Patient's Blood Oxygen saturation (SpO_2) level. Additionally, Patient Health parameters such as Body Temperature, Heart rate (BPM), as well as Room Temperature and Humidity can also be measured. The Patient Health data are collected and stored in an IoT platform (BLYNK). These Patient Health parameters can be monitored from anywhere by any devices such as Smartphones, Laptop, PC, Smart TV's etc… that supports browsing capabilities. If the levels of Blood Oxygen Saturation (SpO_2) gets lower, it sends a warning immediately to the family members, doctors and to the nearest hospital through mail, phone call and SMS (Short Message Service). By Checking the data obtained from the system, necessary actions could be taken before the problem becomes severe. Thus, the Patient's life can be saved in time by using this proposed system.
Keywords—NODEMCU ESP8266, SpO_2, BPM, BLYNK, GPS.

1. Introduction
During COVID-19 pandemic situation, many people weren't able to do regular check-ups and nowadays, many people suffer from Heart problems as well as respiratory problems and this problem ultimately leads to death of the COVID Patient. The busy routine life is a major challenging one for the doctors to monitor the Health of a single COVID Patient. To overcome this problem faced by the family members as well as doctors in this pandemic situation, we have designed a "Iot Based Covid Patient Health Monitoring System". This system can able to measure blood Oxygen saturation level (SpO_2) and Heart rate which is measured in BPM (Beats per Minute). When Patient's SpO_2 level becomes low, our proposed system can handle the critical situations faced by the COVID Patients immediately. We are able to check Heart rate as well as SpO_2 level in home itself without any pain. Let's see our setup and working of our proposed system in detail.

2. Related works
In the past days, people went to hospitals to check their Oxygen saturation level (SpO_2) as well as Heartbeat rate (which is measured in BPM) by using a regular pulse oximeter. But in this pulse oximeter, we are able to measure the values but we cannot store the values that were measured earlier. Here generally, Internet of Things (IoT) is used to store the data (i.e., values) that are measured in the pulse oximeter and the readings can be continuously collected, monitored and stored in the IoT platform and these readings can be viewed in any electronic devices such as mobile phones, laptop, smart TV's etc… that supports browsing capabilities. The existing system is in clip-like structure to measure the Health parameters. This dissertation describes a system that can help COVID Patient to

measure SpO 2 level as well as Heartbeat which is measured in BPM (Beats Per Minute) and alert the Patient's family members when the Patient's SpO 2 level becomes low. This study begins by using the NodeMCU ESP8266 controller, for continuous tracking of the Patient's Blood Oxygen Saturation (SpO 2) level and Heart rate (BPM). Our proposed system is in wristband like structure and we can able to take our proposed system to anywhere to measure the Health parameters. The Patient's Health data are collected and stored in an IoT platform (BLYNK). These Patient's Health parameters can be monitored from anywhere by any devices such as Smartphones, Laptop, PC, Smart TVs, etc... that supports browsing capabilities. In this proposed system, we have indicated three colours for the range indication of Health parameters. They are red, yellow and green. Green colour indicates that the Patient is in good Health, yellow colour indicates that the Patient's Health condition is in little risk stage and red colour indicates that the Patient's Health condition is in risk. If the levels of Blood Oxygen Saturation (SpO 2) of COVID Patient get lower, this system sends a warning immediately to the Family members as well as Doctors through Mail and Mobile alerting system with Pop-up notification. By checking the data obtained from the system, necessary actions could be taken before the problem becomes severe. Thus, the Patient's life can be saved in time by using this proposed system.

3. Block diagram of proposed system

The system mainly consists of five major units. The two units are,

- Supply Unit
- Sensing Unit
- Controlling Unit
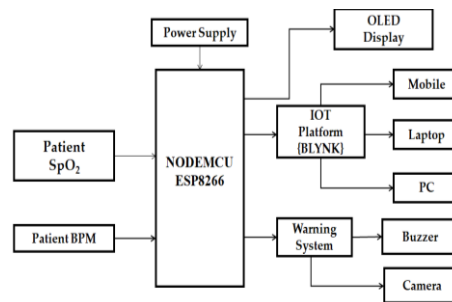- Displaying Unit and
- Alerting Unit

Fig. 1. Block Diagram

3.1 SUPPLY UNIT:
- Here, we used power supply named Li-Po battery which is rechargeable and this battery is added with booster module (3V-5V) which is used to give power to our proposed system.

3.2 SENSING UNIT:
- This unit senses and processes the obtained values from MAX30100 Sensor.
- MAX30100 Sensor is used to detect Oxygen level and also Heartbeat

3.3 CONTROLLING UNIT:
- NODEMCU ESP8266 is used to collect the data as measured in MAX30100 sensor (pulse oximeter).
- NODEMCU ESP8266 sends data to the IOT platform software named BLYNK for real-time readings that are saved in this software.

3.4 DISPLAYING UNIT:
- It consists of two parts – IOT software and OLED Display.
- An IOT software named BLYNK, collects the data from NODEMCU ESP8266.
- We can be able to view these readings in electronic devices such as smart phones, laptops, PC's etc…,

● OLED display displays the value by getting information from NODEMCU ESP8266 and it displays the value. For Heartbeat, it displays the value and it displays the waveform in P, Q, R, S, T

3.5 ALERTING UNIT:

● It has two parts – Buzzer and Camera
● Buzzer alerts when the Patient's Health parameters decrease below the threshold value and the camera turns ON automatically.
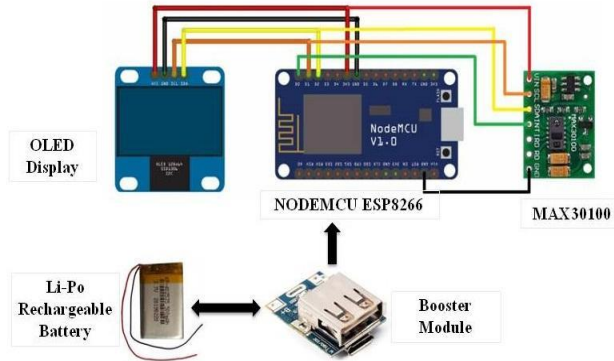● Camera helps to monitor the condition of the Patient in their living room.
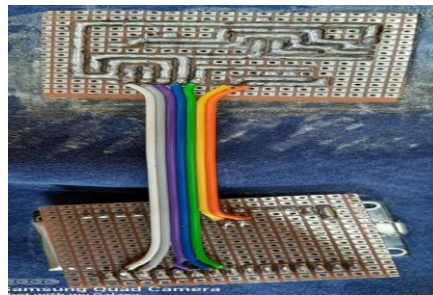

Fig. 2. Circuit diagram

Fig. 3. OLED display and NODEMCU ESP8266 are soldered and interconnected

Fig. 4. Prototype
4. Results and discussions

Fig. 5. Working of proposed system

This diagram shows that the system is working with the help of power supply. We can't able to measure Temperature of human due to without placement of finger on the sensor which is in the green one coloured component called MAX30100 (i.e, Pulse Oximeter) and here the PUSH Button is used to refresh the values (i.e, We can able to check Heartbeat, Temperature multiple times) by pressing the button.

After keeping a finger on the MAX30100 Sensor, the sensor sends infrared rays on the blood to detect Heartbeat easily. This Process is explained in the figure as given below
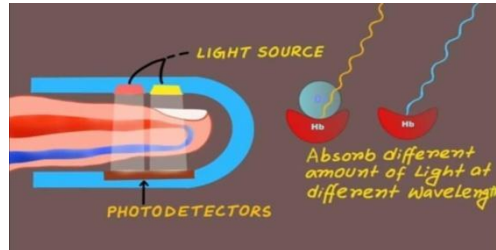

Fig. 6. Heartbeat detection using infrared rays

After this process is done, the sensor collects information and sends it to NODEMCU ESP8266 and this further sends information to the OLED display and thus, the output needed for us is displayed on the screen.
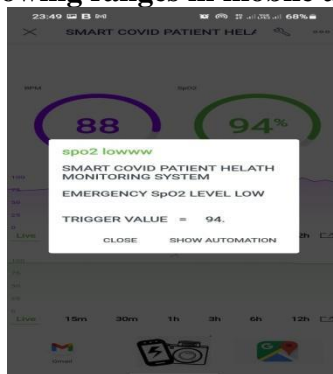

Fig. 7. Showing ranges in mobile application
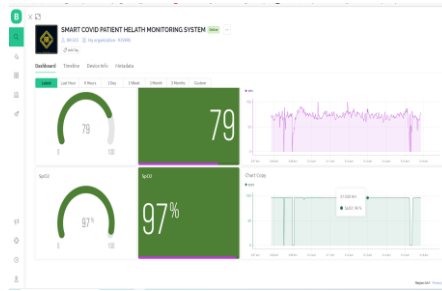

Fig. 8. Mobile popup alert for low range

Fig. 9. Obtaining and storing the data from the proposed system using BLYNK IoT platform
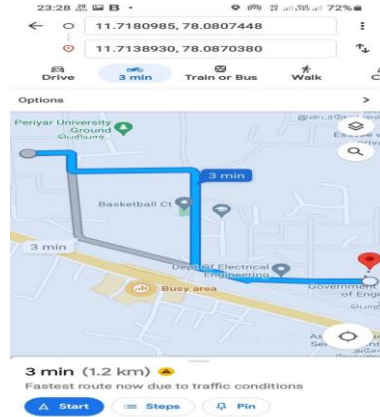

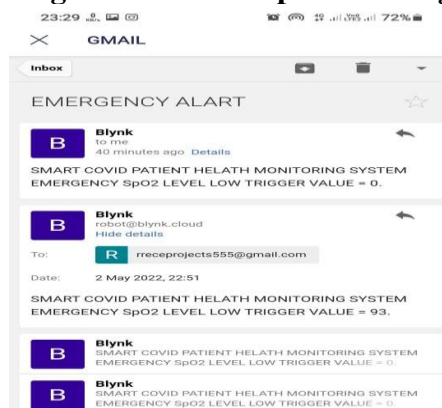**Fig. 10. Tracking the location of patient using google maps**

Fig. 11. Receiving mail from BLYNK denoting SpO2 level of the patient

CONCLUSION
In this project, we have learned how to make an easy and wearable COVID Patient Health Monitoring System with the help of sensors and ARDUINO IDE software. By using this system, we can able to test Heartbeat Oxygen Saturation level of patients in home itself under any circumstances. Colour Indication of measured Patient's Health parameters helps people to know about the condition easily. When Patient SpO2 level becomes low, monitoring can be done effectively by sending messages/mail to the Doctors and Family members.
Additionally, we can also be able to track the location of the Patient for medical treatments in time. In future days, we assure that this system can play an important role in the medical field.

References
1. Khan, M. M., Mehnaz, S., Shaha, A., Nayem, M., & Bourouis, S. (2021). IoT-Based Smart Health Monitoring System for COVID-19 Patients. Computational and Mathematical Methods in Medicine, 2021.

2. Taiwo, O., & Ezugwu, A. E. (2020). Smart Healthcare support for remote Patient monitoring during covid-19 quarantine. Informatics in medicine unlocked, 20, 100428."

3. Jaafari, S., Alhasani, A., & Almutairi, S. M. (2020, September). Certain Investigations on IoT system for COVID-19. In 2020 International Conference on Computing and Information Technology (ICCIT-1441) (pp. 1-4). IEEE.

4. Mukati, N., Namdev, N., Dilip, R., Hemalatha, N., Dhiman, V., & Sahu, B. (2021). Healthcare assistance to COVID-19 Patient using internet of things (IoT) enabled technologies. Materials Today: Proceedings.

5. Mohammed, M. N., Syamsudin, H., Al-Zubaidi, S., AKS, R. R., & Yusuf, E. (2020). Novel COVID-19 detection and diagnosis system using IOT based smart helmet. International Journal of Psychosocial Rehabilitation, 24(7), 2296-2303.

6. Praba, B., Kakar, A., & Sharma, A. (2021). IoT based handheld smart Health monitoring system for COVID-19. Systematic Reviews in Pharmacy, 239-242.

7. Ganji, K., & Parimi, S. (2021). ANN model for users' perception on IOT based smart Healthcare monitoring devices and its impact with the effect of COVID 19. Journal of Science and Technology Policy Management.

8. Choyon, M. M. S., Rahman, M., Kabir, M. M., & Mridha, M. F. (2020, December). IoT based Health Monitoring & Automated Predictive System to Confront COVID-19. In 2020 IEEE 17th International Conference on Smart Communities: Improving Quality of Life Using ICT, IoT and AI (HONET) (pp. 189-193). IEEE.

9. Bhardwaj, V., Joshi, R., & Gaur, A. M. (2022). IoT-Based Smart Health Monitoring System for COVID-19. SN Computer Science, 3(2), 1-11.

10. Naik, B. N., Gupta, R., Singh, A., Soni, S. L., & Puri, G. D. (2020). Real-time smart Patient monitoring and assessment amid COVID-19 pandemic–an alternative approach to remote monitoring. Journal of Medical Systems, 44(7), 1-2.

11. Neha G. Relan and Prof. Dharmaraj R. Patil. "Implementation of Network Intrusion Detection System using Variant of Decision Tree Algorithm." In International Conference on Nascent Technologies in the Engineering Field (ICNTE), pp. 4799-7263. IEEE, 2015.

12. Hafsiya, T. H., & Rose, B. (2021, March). An IoT-Cloud Based Health Monitoring Wearable Device for COVID Patients. In 2021 7th International Conference on Advanced Computing and Communication Systems (ICACCS) (Vol. 1, pp. 266-269). IEEE.

13. Nandy, S., & Adhikari, M. (2021). Intelligent Health Monitoring System for Detection of Symptomatic/Asymptomatic COVID-19 Patient. IEEE Sensors Journal, 21(18), 20504-20511.

14. Kumar, K., Kumar, N., & Shah, R. (2020). Role of IoT to avoid spreading of COVID-19. International Journal of Intelligent Networks, 1, 32-35.

15. Anjali, K., Anand, R., Prabhu, S. D., & Geethu, R. S. (2021, July). IoT based Smart Healthcare System to Detect and Alert Covid Symptom. In 2021 6th International Conference on Communication and Electronics Systems (ICCES) (pp. 685-692). IEEE.