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Research Article

IoT based Covid Patient health monitor during self quarantine

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Abstract

Since the advent of the novel coronavirus (COVID-19) illness pandemic in 2019, social separation and quarantining have become normal procedures around the world. Frequent hospital appointments are minimized due to full adoption of the above control procedures. However, some people's physiological vital needs still necessitate routine monitoring in order to live a healthier lifestyle. Interaction based hospital visits were already considered non-obligatory, thanks to recent technological breakthroughs in the areas of Internet of Things (IoT) technology, smart home automation, and healthcare services. To that purpose, a virtual smart home healthcare care plan is proposed for monitoring patients' condition and obtaining prescriptions from doctors while at residence. Aside from that, doctors can diagnose illnesses using data collected virtually from the patient. For effective patient's doctor's dual real time communication, an Android-based mobile application that connects with an internet application is built. Sensors are built into the system to capture physiological health parameters of patients automatically. Increased body temperature, an irregular heart rate, and a coughing are the most prevalent Covid19 symptoms. This proposed project will detect these indications and ensure that an individual's basic health is monitored. Heart rate and body temperature monitoring are usually highly significant because anomalies in either can suggest other underlying conditions such as fat, high blood pressure, low blood pressure, flu, and so on. In times of pandemic, the need of a health-monitoring system has become even higher than previously. Finally this work planned to use sensors, communication modules with internet- mobile application pair to monitor the COVID patient from their home itself. In this paper it was discussed and proposed very clearly.

Keywords: *Arduino Uno Controller (ATMEGA328P), Heartbeat sensor, Digital humidity, Temperature sensor, GSM module, WI-FI module, Internet of Things with mobile app.*

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I. Introduction

In the current circumstances, the spread of the COVID-19 pandemic has had a significant influence on the world. To lessen its impact, the only possible solution is to slow the disease's spread and contain it. The easiest strategy to limit and control the sickness is to keep an eye on the Potentially Infected Person in quarantine and enforce the predetermined location even during quarantine time. It is only possible with the support of Internet of Things (IoT) technology such as remote collection, monitoring, management, and analysis of disease symptoms. Because vaccinations are slow to get to market, an IoT based platform can be used to monitor and anticipate the occurrence of COVID-19 by employing sensing devices like heart rate, temperature, oxygen levels, and other respiratory systems. In this paper Arduino based tool can be used for programming and good hardware interfacing to obtain the health details of the COVID 19 patients during their quarantine from their home. It's a fantastic open access microcontroller system for electronics hobbyists to develop projects quickly, conveniently, and inexpensively with minimal use and monitoring. The use of IoT and Arduino together is a novel technique to bring the Internet of Things into health care. Keep an eye on the patient's system. The Arduino Uno Board takes data from sensors and sends it to an IoT website via wireless transmission. Transmission of medical data, as well as correct decision-making based on the information gathered and the understanding of the patient, could be a challenging task in the Internet of Things. The Patient Health Monitoring System, which is mostly based on the Internet of Things, is being used for this proposed task. The Arduino is expected to collect the given parameters and analyse the data collected from different sensors. PHMS with Arduino also sends out notifications to patients about precautionary actions. This programme provides the patient with medical assistance as well as the following steps to take in the event of a clinical emergency. The use of IoT in conjunction with Arduino could be a novel way to incorporate the Internet of Things to the Patient Medical System. Arduino Board receives data from sensors and sends it wirelessly to the Internet of Things website. The proposed Patient health Monitoring system is undoubtedly being put to the test in terms of pulse rate, vital signs, and blood pressure levels, among other things. In chapter 2 the proposed system working methodology will be discussed, in chapter 3 the hardware description of the proposed work will be discussed and in chapter 4 the implementation of this work will be discussed clearly, in chapter 5 the experimental arrangements and its results were discussed. At last the conclusion was discussed in chapter 6.

II. Proposed work of IoT based Covid patient health monitoring system

We have specific COVID 19 Quarantine centres built up to handle COVID patients during outbreaks. Because Covid is an extremely infectious disease, it is critical to isolate Covid patients, but doctors must also check their health [29]. It's becoming more difficult to maintain track of the health problems of so many isolated patients as the number of instances grows.

The problems here are:

- Doctors must keep track of their patients' health on a frequent basis.
- The number of patients for doctors to monitor is growing.
- The doctors are putting themselves at risk of infection only to keep an eye on things.

To address this problem, we created a remote IoT-based health monitoring system that allows many Covid patients to be monitored virtually over the web. The system uses a heartbeat sensor, a temperature sensor, and a blood pressure sensor to monitor the patient's pulse, temperatures, and blood pressure [30]. The suggested IoT-based Covid patient health monitoring system was created with the Micro controller, which serves as the project's brain. A pulse sensor that records heart rate in minutes is used by Arduino to collect real time health data [31]. The person's body temperature is measured using an Arduino digital thermometer. Single temperature controller is attached to Arduino to monitor temperature range so that we can modify according to our fitness and mental temperature, and a humidity sensor is used to detect the humidity in the region so that it would not affect health. Whenever the patient's heartbeat is recognized, the buzzer emits audible sounds. This gives health-care workers a quick overview of how a patient's heart performs in a specific health state. Only hearing to the sounds can notice an irregular heartbeat. The typical ESP8266 IoT component is responsible for integrating the machine to the web and providing health information to the IoT (Thingspeak) servers for storing and monitoring. It interfaces to Arduino via UART. Can indeed this region convey patient health information to the computer, but it can also show real-time data on a 16* 2 LCD screen. This is useful for health care providers who are on-site and actively monitoring the patient. The figure 1 shows the proposed work block diagram.

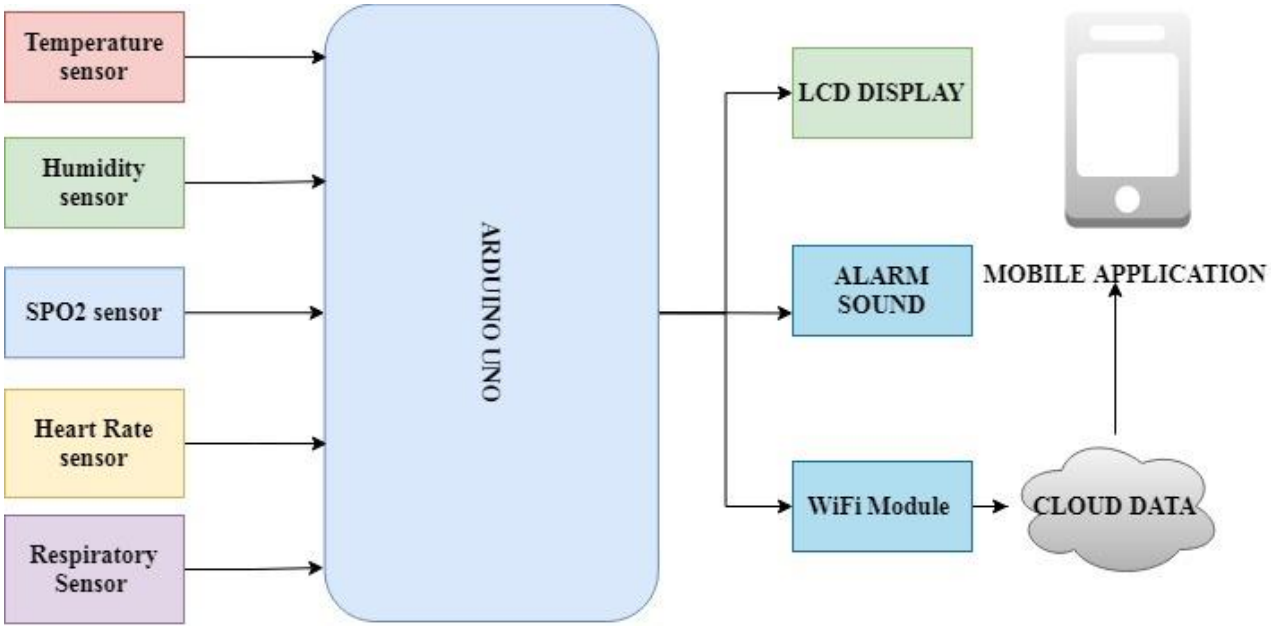

Figure 1: Block diagram of the proposed system

III. Hardware description of the proposed work

The following hardware equipments are essential for this proposed work

- Arduino UNO
- Heartbeat sensor
- Temperature sensor
- ESP8266 (Wifi Module)
- LCD display
- SPO2 Sensor
- Humidity sensor

- Respiratory sensor
- Buzzer
- Mobile

3.1 Arduino UNO

Based on the ATmega 328p microcontroller, the Arduino board is an open source microcontroller. It's one of the most widely used development boards for testing and serving as an Internet of Things (IoT) connection. Other components on the board include a serial connection, a crystal oscillator, and a voltage regulator, among others. It has 2 kilobytes of RAM, 1 kilobyte of ROM, and 32 kilobytes of flash memory, and this can be readily configured using the open software Arduino Software. In Arduino, there seem to be a lot of GND pins, and you can get any of them to grind the circuit. 5V (4) & 3.3V (5): The 5V pin gives 5 volts of power to the Arduino UNO, while the 3.3V pin delivers a 3.3 volts impact. The parts used in the Arduino, for most part, range from five to 3.3 volts. ANALOG(6): Analog In pins create a subtitle space beneath the 'Analog In' label (A0 to A5 in UNO). DIGITAL (7): the analogue pins are replaced by digital pins on the far side (0 to 13 in UNO). Those pins are used for every digital input (such as indicating when a button is pressed) and digital output (such as indicating when a button is pressed) (such as semiconductor diode power supply). PWM (8): Those pins function as regular digital pins, but they can also be also used Pulse Width Breadth Variation. The figure 2 shows the Arduino UNO controller.

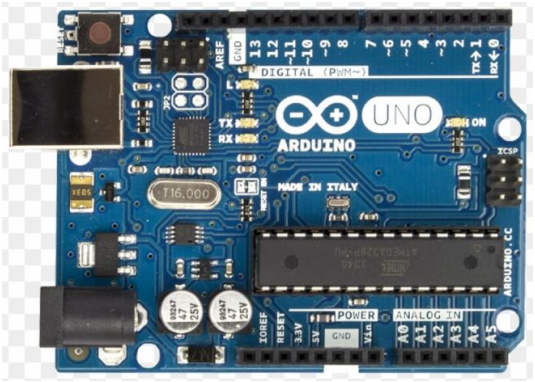

Figure 2: Arduino UNO controller

3.2 Heartbeat sensor

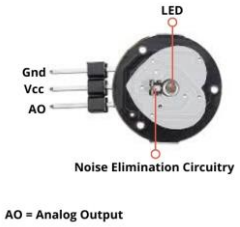

Figure 3: Heart beat sensor

A heartbeat sensor is a device that measures the heart rate, or the pace at which the heart beats. To monitor the Arterial Pressure or Blood Pressure, we utilise thermometers and a

sphygmomanometer to determine the body temperature. The heart beat sensor is depicted in Figure 3.

3.3 Temperature sensor

The LM35 series is a heat resistant heat exchanger with a Centigrade temperature that is so well. The Lm35 series are precision integrated over Kelvin's restricted direct temperature sensors in that it does not require the user to create massive, uninterruptible power outages in order to take accurate Centigrade measurements. The LM35 gadget provides usual details of 1/4° C at ambient temperature and 3/4° C in addition to the complete range of temperatures of 55°C to 150°C without the need for external measurement. The temperature sensor is depicted in Figure 4.

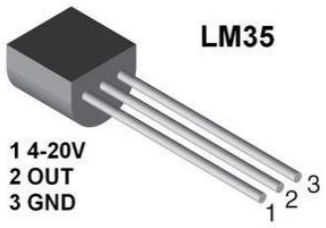

Figure 4: Temperature sensor

3.4 ESP8266 (Wifi Module)

For net production, the ESP8266 might be a very easy and inexpensive instrument. The module will function as an Associated Objective access point (which can display a hotspot) and as a channel (which can connect to Wi-Fi), downloading data and transferring it to the web, resulting in a Web of Things that is as simple as accessible. It can also get data through the web exploitation API, which allows any project to access any online-based data, allowing it to create smarter. Another unique characteristic of this module is that it is frequently configured to take use of the Arduino IDE, making it very straightforward to use. The ESP8266 module only operates at 3.3V; 3.7V can cause the module to die when it alerts you and your circuits. The Wifi module is depicted in Figure 5.

Figure 5: WiFi Module

3.5 LCD display

Figure 6: LCD Display

LCD is a flattened optical display system that combines the light-modulating properties of liquid crystals with polarizers. To produce colour or monochrome images, liquid crystals employ a backlight or reflector rather than emitting light directly. The LCD display is depicted in Figure 6.

3.6 SPO2 Sensor

Pulse oximetry is a test that measures the amount of oxygen in the blood. It's a simple, painless way to see how well oxygen gets to the portions of your body farthest from your heart, including your arms and legs. The SpO2 sensor is depicted in Figure 7.

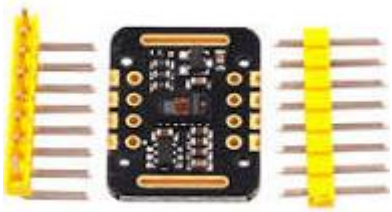

Figure 7: SPO2 Sensor

3.7 Humidity sensor

A humidity sensor is a device that detects humidity in its surroundings and turns the data into an electrical output. The total level of humidity for air at the same temperature is compared to the live humidity data at the very same temperature to determine humidity level. The humidity sensor is depicted in Figure 8.

Figure 8: Humidity Sensor

3.8 Respiratory sensor

Figure 9: Respiratory Sensor

With the help of an Arduino based system, the respiratory tracking system can assess a patient's breathing rate. The patient's breaths through a mask with a thermistor and the equipment then monitor the patient's respiratory rate. The respiratory sensor is depicted in Figure 9.

IV. Design and working Methodology of the proposed work

The patient's body observation system, such as pulse rate and body temperature, is used by an IoT based Covid patient health observation system. The patient's fingers are connected to a heartbeat sensor, and the temperature sensor element is also connected to the body of the patient. Temperature sensing device might be a sensing element accompanied by resistance, and pulse rate sensing element, vibration sensing element, it's sent through a variety of associate signalling. One temperature sensor and another heart rate sensor are employed in this system. We have used BLYNK Android app to select the information using sketches, and data was transferred to the IoT cloud via Smartphone and IoT technology. A Wi-Fi network is established to utilise this programme. Wi-Fi module connects Arduino Uno board to Wi-Fi network capability. From two senses, the Arduino board learnt sin. After that, via the Wifi module, this information is transferred to the IoT cloud. On the LCD panel, rated inputs are presented. This information will be sent to the IoT cloud at the very same time, and the collected data is presented on the monitor when the app is accessed. Some of the advantages of the proposed system are listed below

- Doctors can monitor patients remotely without risk of infection
- A single doctor can care for up to 500 patients at a time using this system.
- In the event of a health emergency, the doctor receives an immediate alarm.

V. Experimental arrangements of the proposed work and its results

Sensors with peripherals such as Biosensor pads and sensors cables, alarm, Arduino UNO, Wi-Fi adapter, and LCD screen are part of the entrepreneurial setup for this system, as shown in Fig.10. We utilised 3 senses in our approach. To begin, we were using an LM35D temperature sensor to take the patient's temperature. The temperature sensor should be put on the armpits or tongue for the optimum accuracy. The heartbeat sensor was yet another sensor included in this work; it monitors the heart rate by detecting the backlight LED striking the light sensor on front side. When the device is activated on the fingernail and ear, it provides better precision. The Arduino board's analogue pins were used to link all of the sensors. The result of the LM35 sensor were translated to a temperature in degrees Celsius, and the output of the DIY pulse sensor was translated to a heart rate in beats per minute on the Arduino system, but these power factors were transformed to output. The picture was extracted from the Arduino IDE software's serial architecture. As a consequence, the heartbeat was characterised by spikes. Because the Atmega328 tiny controller on board includes a 10 bit built-in ADC, Arduino allows digital output between 0 to 1023 levels for analogue input. To calculate the amount of pulses, set a limit of 520. As a result, the higher-than-limit output rate was used to compute and quantify the heart rate in Beats per Minute. On the LCD panel, these data are summarized.

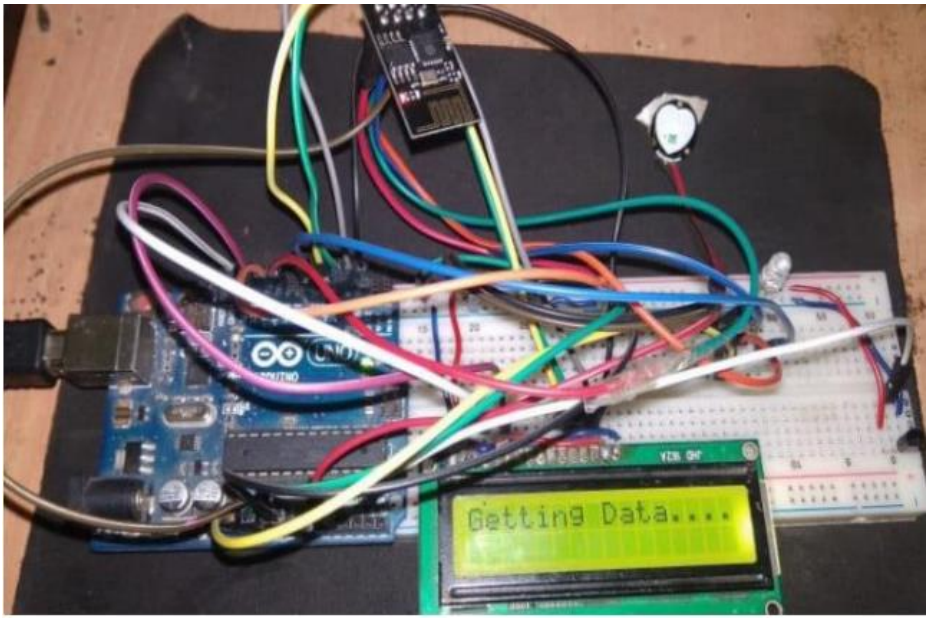

Figure 10: Experimental arrangements of the proposed work

After the connection made as per the above discussion the below output results were taken. From the figure 11 the output results of COVID patients can be found lively and from figure 12 the COVID patient's status were found through the IoT. That's through the mobile application. From the mobile application the COVID patient's activities can be easily found. Figure 13 shows the expected outlook of the proposed work. Table 1 shows the realization of the work in real time scenario with patient information.

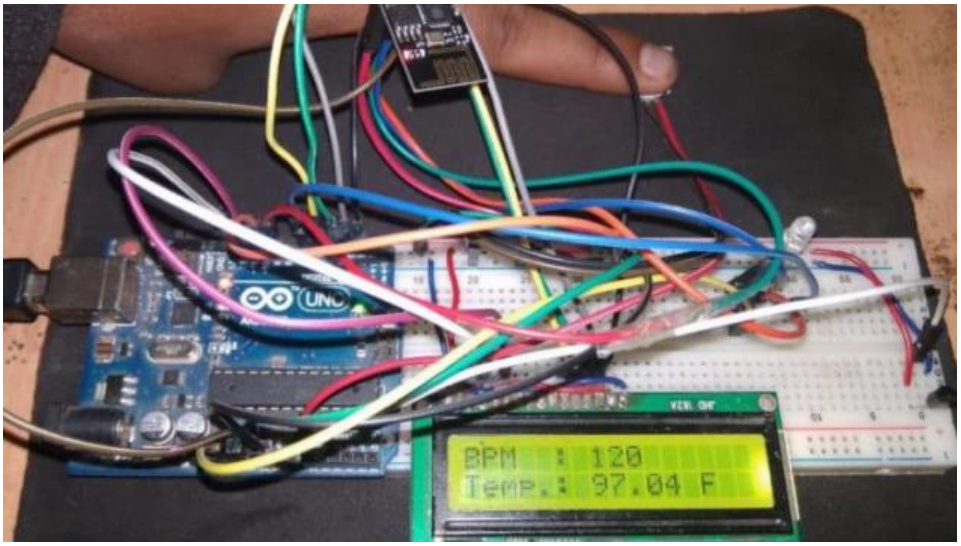

Figure 11: COVID patients Status obtained lively

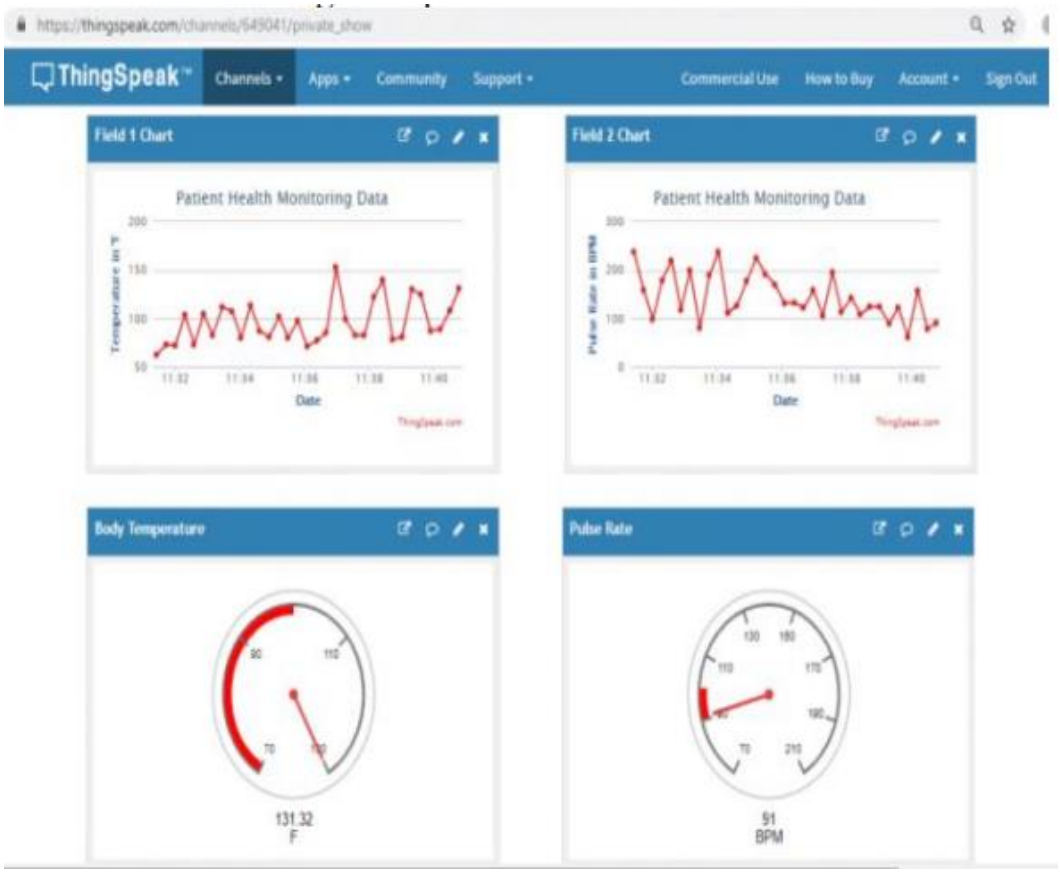

Figure 12: COVID patients Status through IoT

Figure 12: Expected sensors and hardware arrangements in real time

Table 1: Real time data realization with Patient

COVID PATIENTS HEALTH CARE MONITORING SYSTEM					
S.NO	**Temperature**	**Pulse rate**	**Heart rate**	**Patient information**	**Date and Time**
1	98.3	NORMAL	121	Antony	6.7.2021 & 6.31 AM
2	99.9	NORMAL	125	Antony	6.7.2021 & 5.15 PM
3	102.3	CRITICAL	172	Antony	7.7.2021 & 5.15 AM
4	100.4	NORMAL	123	Antony	7.7.2021 & 8.15 PM

VI. Conclusion

By lowering the rate of infectious disease transmission, the proposed strategy will have a significant influence on people's quality of life. Patients who have been diagnosed with COVID-19 and are undergoing treatment will not have any need to travel about often, resulting in improved quality of life and a lower transmission rate. Actual deployment with IoT devices, evaluation of the mobile app using only a real world scenario, and recording of feedback for improvements are all ongoing phases of the existing system. It is suggested that the proposed system be implemented in hospitals for use in different agencies following rigorous testing and evaluation. Once fully completed, the proposed web & mobile application could be integrated into current hospital internet sites as a gateway or released as a new application for clinics without existing domains. New additions, such as a physiological data gathering device, should also be added into the existing system. We plan to develop our app beyond the Android platform to certain other IOS devices in the future for greater versatility. Because the proposed COVID patient health monitoring system may be tracked daily, documented, and maintained as a database, it could be used widely in emergency situations. IoT devices may be combined with computer computers in the future, allowing databases to be shared between intensive care and treatment centres. Also, in this pandemic, health monitoring is quite useful; we may avoid going to the hospital on a frequent basis and instead check ourselves at home.

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