A Real Time Monitoring System for Home Isolated COVID-19 Patients

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***Abstract* - During this Covid-19-time number of patients in hospital are increased. The covid-19 patients are mainly of two types one who has a serious condition and the other who has a mild covid-19 symptom. On the other way, the patients who have very serious conditions generally have all facilities, they have doctors around them and other medical staff also there to take care of the situation, but the patients who have not very serious conditions are generally isolated in their home, a problem with this home isolated patients are they do not consult with doctor day to day and what happens if patients condition become serious basically this paper is going to solve this two problem and also monitoring the patients while getting different data like a heartbeat, SpO2, body temperature, etc. along with that we used a location sharing and nearest hospitals identification. Here we design IoT, GSM/GPS-based system through which we send the patients' health data directly to the hospital and if the patients' conduction becomes serious then it sends an alert to the hospital along with the patient's location and it also sends the hospital location to the patients.**

Keywords— ESP32, IOT, GSM, COVID-19

I. INTRODUCTION

The covid-19 pandemic had hit the world very hard along with that carry the world into a severe health situation. Even the country that has a good health infrastructure has collapsed to maintain covid-19 patients in hospital [1]. They do not have a sufficient bed to admit all the patients. Similar condition. As the infection increased the doctors dived the patients into two parts first those patients who were infected strongly with covid-19 and second who have a mild infection.

Due to the shortage of beds in the hospital, patients who have a mild infection are advised to be home isolated [2]. But there are several cases happen where home insolate patients do not appoint any doctors for their regular treatment due to the high demand for doctors in the hospital. this is a serious issue where no one looking for what happens if the home isolated patient's condition becomes serious and also how he consults with their doctor day to day, even a serious condition hospital does not know the actual location of the patient and vice versa.

This additionally carries concern to the matter that there must be safe patient care as well as an observation system so as to send information to the experts as regards the organ of COVID-19 patients [3]. Accordingly, it develops into vital to make ways which take care along with that an equivalent interval give correct information about COVID-19 affected people, each alive and released in conjunction along their relations to stay record of individual health as well as an improvement by recognition of organ mistreatment medical information. However, possessing effortless accessibility to that tool convert a necessity for the patients. IOT that is Internet of Things in conjunction with information analysis will assist in fast answer retrieval, exploit vital intuition and establish a patient examination system that may facilitate each and every advisory board as well as patients. Whereas IoT will aid in the interconnecting ability to sensing element devices and simply guarded with a central system [4].The web of Things (IoT) is a system of reticulated workout models, mechanical as well as digital machines, objects, animals, or folks that square calculate given distinguishing identifiers along with that also have the ability to move knowledge in a network while not necessary person-to-person or person-to-computer communication. IoT allows care professionals to be a lot of watchful and connect with the patients proactively [5]. IoT devices labelled with sensors area units are used for the pursuit of the real-time location of medical instrumentation like wheelchairs, defibrillators, nebulizers, gas pumps, and different watching instrumentation [6-8].

Our object is to make COVID home isolated patients safe and in regular contact with a doctor through this, we save the life of the patients. IN hospital doctors generally check the COVID patient's heart rate, oxygen level, and temperature at a regular interval to identify the condition. we do the same thing while using a MAX30100 sensor which helps to calculate heart rate as well as oxygen congestion (Sp02) and

then a temperature sensor through which to measure the body temperature [9]. This peripheral is connected with the microcontroller ESP32 a 32-bit microcontroller having inbuilt WIFI and Bluetooth, along with the sensor it is again associated among the GSM and GPS device to transfer the information to patients and the Doctor from the device. This paper is basically a 2-device system where one device is placed on the patient's side and the other side is placed hospital. In second device it has a GPS connected with an ESP32 to receive the health data and the location of the patients and also share the location of the hospital with the patients. This help to provide an emergency alert into the hospital if the patient is in serious conduction and there is no need for a login base system so it reduces human error.

II. Proposed Work

Our proposed system is designed for helping the home isolated patients who are infected with COVID [10]. This system measures the symptom which occurs during COVID like heart rate, SpO2, and body temperature, and after measuring these symptoms system send its results directly to the hospital along with the location of the patients to the doctor. The system is designed in such a way that if the condition of the patients has become serious then it sends all the health data, location of the patients directly to the second device which is placed inside the hospital and also at this same time patients will also get the location of the hospital along with the nearest hospital. This is a two-device system so that there is no need for login one device is placed in the hospital that device continuously receives patient data and also alerts the patient emergency. So that hospital gets time for preparation, the login-based system has a possibility of human error what happens if the hospital has not login into the website on that case no data has been received by the hospital so we try to design a such device which has a less human interaction, less human interaction directly proportional to the less error [11].

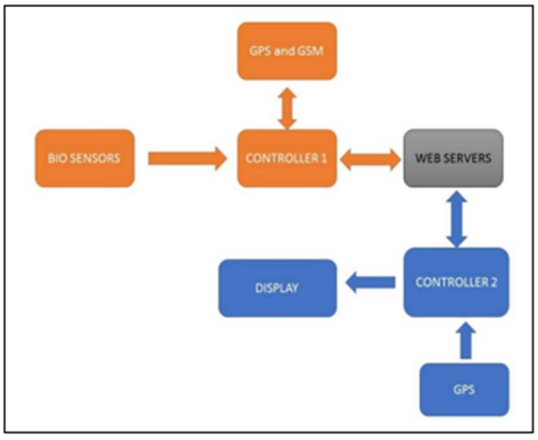

Figure 1: Architecture

Figure 1 shows the Architecture of designed system, here we use an ESP32 microcontroller to control the sensors and other peripherals in both device [12].In the primary device which places at the patient's side have biosensors to receive data from the patients like heart rate, SpO2 and body temperature .these sensors are MAX30100 and LM35 along with that primary device have a GPS and GSM .where GPS is used to track the patients' location and GSM is used to send the hospital location and the nearby hospital location link to the patients mobile.

On the other hand, in the secondary device, there is a display and GPS. Whereas GPS is used to track the hospital Location and that location is sent to the patient's device. Whereas display is used to display the patient's health data and location. In this, both the controller is communicating with each other through the web servers.

A. Circuit Diagram

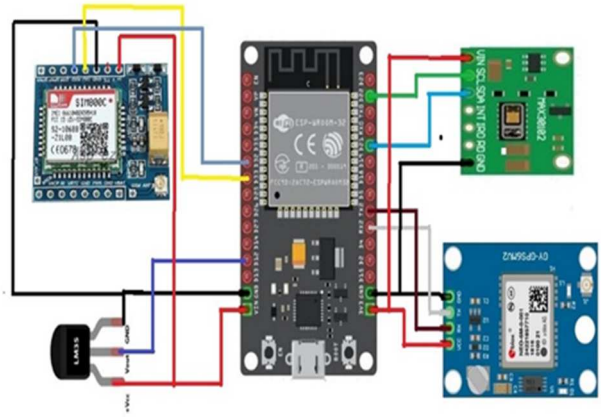

Figure 2: Controller-1 Circuit Diagram

This device is placed inside the home at the patient side, so all the necessary hardware is connected with this microcontroller. This esp32 is connected with the servers through WIFI and communicates with the second device which is placed inside the hospital. Controller1 is connected with the max30100 sensor at the pin D22 and D21 whereas D22 is an SCL pin and D21 is an SDA pin of esp32, this sensor is used to measure the patient's SpO2, and heart rate. After that temperate sensor lm35 is connected with the controller through pin number D12 and sends patients body temperature data to the controller. Here D12 also acts as ADC in esp32 along with that GPS is connected with the Tx and Rx and gsm is connected with the D33 and D32 pin of the controller [13]. Here GPS is used to detect the GPS location of the device and according to that GPS location, our device searches the nearby hospital for the patients and also sends the patients' accurate location to the second device, and GSM is used to send the health data to the patient's smartphone along with the nearby hospital search list.

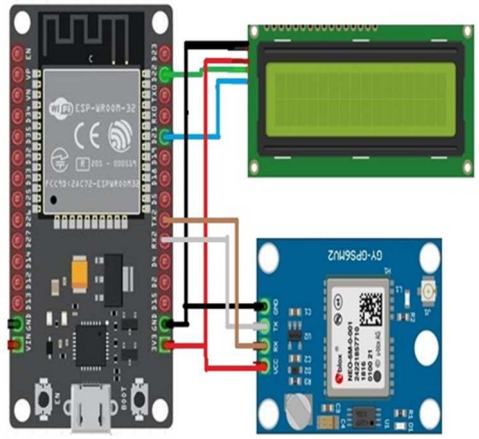

Figure 3:Controller-2 Circuit Diagram

This device is tThe second device is placed inside the hospital to receive the patient's data and location from the primary device. this esp32 is connected with a GPS module and LCD. GPS is connected with the Tx and Rx pin of the esp32 and LCD is connected with the pin numbers D22 and D21. This esp32 is also connected with the web servers which help him to communicate with the primary device and receive the patients' health data directly to the device without any login and password method or any mobile application and display on the LCD [13]. Here hospital will also get an emergency alert when the patient's health becomes serious along with his current location and at that interval patients also get the hospital location.

III. Implementation And Results

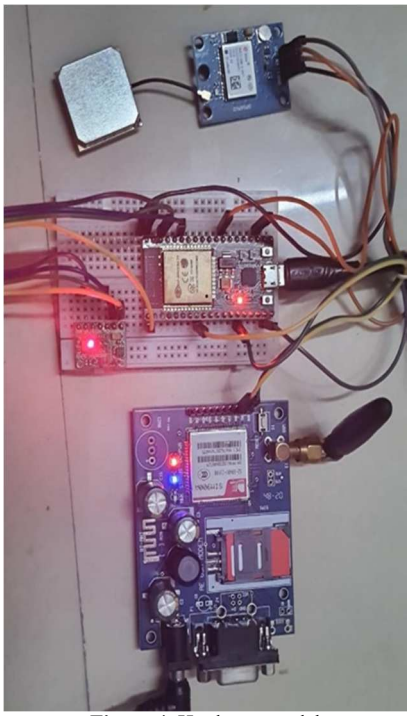

Figure 4: Hardware model

The hardware model is shown above in which the equipment is assembled properly to get the result exactly what we want. The device which is placed at the patient's end and the other device which is placed inside the hospital is run properly [14]. In this, a threshold value is set in which the patient's conditions cross the threshold value then the device placed in the hospital gets a message from the device which is in place on the patient's side.

The given figure 5 shows the sensor reading when human health is normal. This sensor measures mainly three parameters of any human body and those are body temperature, heartbeat rate and the third one is oxygen level. In previous work, only two parameters of the human body are to be considered that is heart rate and oxygen level. [14]

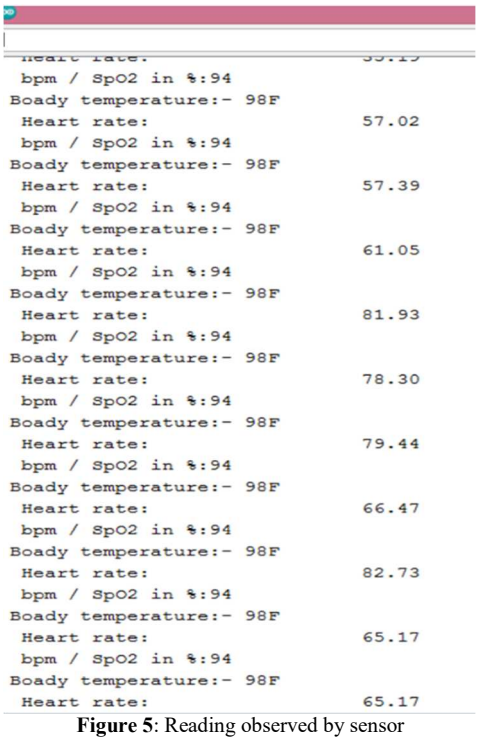

Figure 5: Reading observed by sensor

TABLE I. Reading Obtained By Max30100 Sensor When Patients Condition Is Normal

S. No.	SENSORS READING		
	Body Temperature	Heart Rate	SpO2(%)
1	98F	57.02	94
2	98F	57.39	94
3	98F	61.05	94
4	98F	81.93	94
5	98F	78.30	94
6	98F	79.44	94
7	98F	66.47	94
8	98F	82.73	94
9	98F	65.17	94

In the above table, it is mentioned that it is the MAX30100 sensor reading. In which various readings are mentioned. In previous work, the MAXA30100 sensor reads only two parameters of the healthy human body but now in my research, this sensor reads three parameters of any person that is given below. [15]. The normal body temperature of a human is 98 F and the oxygen level is 94 percent and the heart rate are varying that is ups and downs which would be considered normal.

Figure 6: Reading observed by sensor

This figure shows the MAX30100 display in which the patient's condition parameter is displayed on the screen which is placed in the hospital [16]. In which the patient's condition crosses the threshold value which is not a desirable situation. So, if the condition of patients is serious their body temperature increases, their oxygen level is high, and their heart rate of patients in also increased. Then the device which is placed on the patient's side sent the data of the patient to the particular hospital. Then the module connected to the hospital gets the message from the patients.

TABLE II. READING OBTAINED BY MAX03100 SENSOR WHEN PATIENTS CONDITION IS SERIOUS

S. No.	SENSORS READING		
	Body Temperature	Heart Rate	SpO2(%)
1	99F	230.82	95
2	99F	230.82	95
3	99F	230.82	95
4	99F	230.82	95
5	99F	230.82	95
6	99F	230.82	95

The given table represents the serious condition of patients. The normal body temperature of human body is 98F but now it is increased i.e., 99F [17]. The heart rate also increases which is 230.82. And the third parameter which is measured by the MAX30100 sensor is oxygen level that is increased up to 95%.

In the previous work the device only measures two parameters that is oxygen level and heart rate but in our work the device measure three parameters along with that it also provides the location of patients and hospitals to each other. In the previous work, the location feature was not there. But our device also shares the location of patients to the hospital when the condition was serious, and the hospital sends the location of the hospital to the patient's device [15]. The device which is placed on the patients' side has GSM in it. The main work of GSM is that it sends the location of hospital to the patient's mobile phone which was send by the hospital. So, in this way patients get an easy way to find the location of hospital without much delay.

When the patient's condition is serious that is the parameter measured by the sensor that crosses the threshold value. Then our device is searching the nearby hospital because in our device the GSM is installed which is send to the patient's mobile phone. Then serious patients can easily get to the hospital around him.

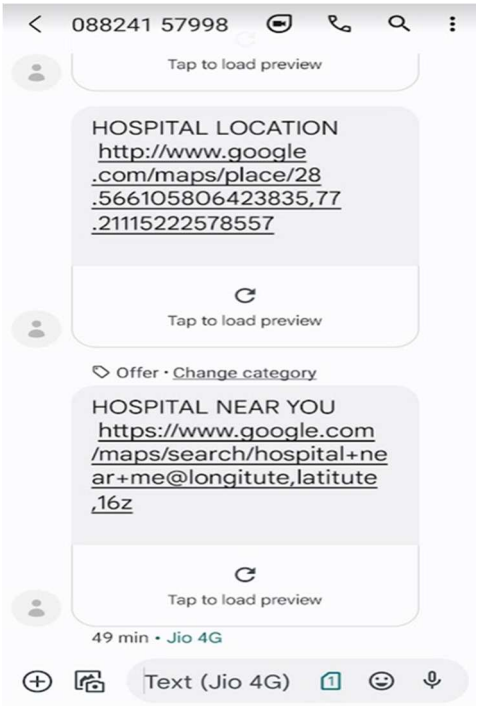

Figure 7: Location send by hospital in your phone

The above picture shows the screen of the mobile phone of patients in which the location is sent by hospital through GSM installed in the device which is placed on the patients' side.

IV. CONCLUSION

In this proposed system we design an advance medical system in which patients who have a COVID-19 system can easily communicate with doctors while isolated at home. this system helps doctors and patients both too easy communication, tracking patient's health through continuous data reading, and also it helps to track the patients to hospital and hospital for pre-preparation while patients visit the hospital in serious condition. While adding the nearby hospitals link feature this system helps patients to reach the nearest hospital if the communicating hospital is far from the patients' location to save patients' life.

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