International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 08 Issue: 09 | Sep 2021 www.irjet.net p-ISSN: 2395-0072

Real Time Blood Oxygen Saturation Analytics for Pandemic

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Abstract - *The impact of the COVID-19 pandemic is drastically changing the lives of people, including the lives of young people. Schools and universities have closed, exams and events postponed, the usual health information services are limited, socializing with friends and wider family is highly discouraged and, in some places, even punishable. This paper presents an implementation of wearable, portable, low power consumption, real-time remote bio-signals monitoring system for covid patients based on the internet of thing technology. Based on that, this paper utilizes a mobile application and web dashboard as Internet of Things platforms to monitor remotely the live electrocardiogram signal, heart rate, SPO2 and the body temperature of patients. The signals are measured and processed by using a high-speed microcontroller. The main contribution of this paper is transfer of an electrocardiogram signal to a smart mobile phone to be watched by a doctor. This assists in heart diseases diagnosing before the worst case can happen. Finally, the obtained results of this project are illustrated on both smart phone and web dashboard as well. A buzzer is also included in this work to indicate the minimum and maximum saturation level of patient information.*

***Key* Words:** COVID-19, Electrocardiogram, Health Information Services, Internet of Things, Pandemic, Patient Information

1.INTRODUCTION

Health is always a major concern in every growth human is advancing in terms of technology. Like the recent corona virus attack that has ruined the economy of China to an extent is an example how health care has become of major importance. In such areas where the epidemic is spread, it is always a better idea to monitor these patients using remote health monitoring technology. So, Internet of Things (IoT) based health monitoring system is the current solution for it [1]. Remote Patient Monitoring arrangement empowers observation of patients outside of customary clinical settings (e.g., at home), which expands access to human services offices at bring down expenses [2]. The core objective of this project is the design and implementation of a smart patient health tracking system that uses Sensors to track patient health and uses internet to inform their loved ones in case of any issues. The objective of developing monitoring systems is to reduce health care costs by reducing SMS based patient flourishing viewing and IOT based patient checking framework. In IOT based framework, subtle parts of the patient flourishing can be seen by different clients [4]. The explanation behind this is the information should be checked by passing by a site or URL. While, in GSM based patient viewing, the flourishing parameters are sent utilizing GSM by strategies for SMS. In most of the rural areas, the medical facility would not be in a hand reach distance for the natives [5]. So normally the people physician office visits, hospitalizations, and diagnostic testing procedure [3]. Each of our bodies utilizes temperature and pulse acknowledging perusing understanding wellbeing.

In rural hospitals, the facilities for health caring are limited. The poor quality of health management enables issues in health care system Everyone should get the knowledge of own health as easy and early as possible. Also, it should be worth for each. Latest report of The India Spend analysis of data says that the 500,000 doctor's shortage in India. WHO defines the doctor patient ratio will be 1:1000 which has been failed in India [6-8]. In developing countries there is lack of resources and management to reach out the problems of individuals. In this COVID-19 pandemic daily routine check-up of the patient in hospitals who is not affected by the corona may be expose to virus and affects his health. For this purpose, various systems which give easy and assured caring unit has been developed. This system reduces time with safely handled equipment [9-11]

The main aim of the proposed system is to provide efficient, Low cost and accurate remote human body monitoring using IoT [12]. we have focused on the data readability of the sensors where anybody can easily identify the status of the health without any prior technical knowledge. Giving care and health assistance to the bedridden patients at critical stages with advanced medical facilities have become one of the major problems in the modern hectic world. Proper implementation of such systems can provide timely warnings to the medical staffs and doctors and their service can be activated in case of medical emergencies [13-15].

2. METHODOLOGY

The core objective of this project is the design and implementation of a smart patient health tracking system. Fig.1 shows the overview of the proposed system. The sensors are embedded on the patient body to sense the

Oxygen saturation level, temperature, and heartbeat of the patient. These sensors are connected to a control unit, which calculates the values of all the sensors. These calculated values are then transmitted through a IoT cloud to the base station. From the base station the values are then accessed by the doctor at any other location. Thus, based on the temperature and heartbeat values and the room sensor values, the doctor can decide the state of the patient and appropriate measures can be taken.

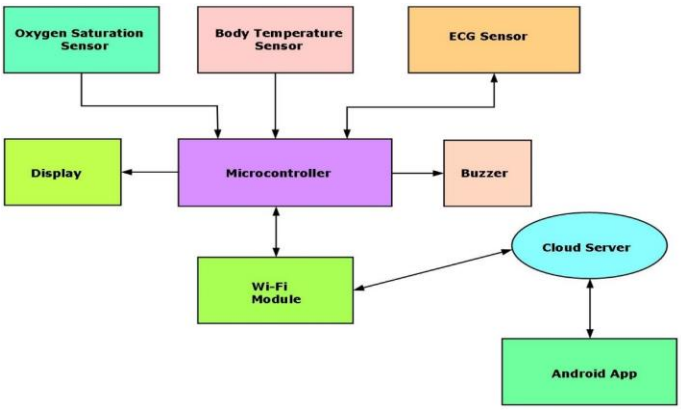

Fig. 1: Block Diagram OF Real Time blood patient analytics system for Pandemic diseases

The main objective of this system is to record the various sensor information and display it to the users in a simple user-friendly manner. The recorded information which can be accessed through the app and web dashboard will indicate whether the reading is within the normal limits. It will also notify the user and the contacts regarding the medication requirements such as dosage, intake time etc. The proposed system comprises of sensors that monitor different health parameters, namely pulse rate, electrocardiogram (ECG), body temperature and oxygen saturation (SPO2). The components used are described as below.

2.1 Microcontroller:

To begin, we're going to connect the Wi-Fi module to the Arduino controller. The ESP8266X is a 3V Arduino board; if you supply 5V to the Arduino, connect the VCC as CH-PD (pin) to the 3V stick of the controller.

2.2Pulse oximetry Sensor and body Temperature sensor

MAX30102 Pulse Oximeter is used in the proposed design to measure the temperature and oxygen saturation. Pulse oximeter is a non-invasive test which employs a probe that can be secured to a finger or earlobe. It measures the oxygen saturation level in blood. Normal oxygen saturation levels are between 95 and 100 percent. Low oxygen saturation levels below 90 percent can cause cells to be strained and damaged. Pulse oximeter is used to monitor the health conditions of a patient with problems that affect blood oxygen levels such as anemia, heart attack, heart failure etc.

2.3 ECG Sensor:

AD8232 ECG is adopted to measure the heart's electrical activity at rest. ECG (Electrocardiogram) provides information such as the heart rate and rhythm. It can also provide information regarding the enlargement of the heart due to high blood pressure (hypertension), signs of decreased oxygen delivery to the heart, increased thickness of heart muscle and also reveal indications of a previous heart attack.

2.4 WIFI Module

Wi-Fi Module is an economical Wi-Fi microchip. Its integration with TCP/IP protocol stack allows microcontroller to access Wi-Fi. This is integrated onto the microcontroller board.

3. WORKING OF THE SYSTEM

Microcontroller relates to the components of the sensing unit, WIFI Module, and is powered by an external battery. The sensors are attached onto the patient's body. The system proposed will work as a real-time monitoring system. According to the adjustments such as time interval between each reading made in the application, the readings of the sensors are recorded by the application and displayed on the display. The processed data are sent to the web dashboard and android, iOS application using cloud computing where each data is stored and can be monitor. A simple prototype model of our proposed is as shown in fig. 2

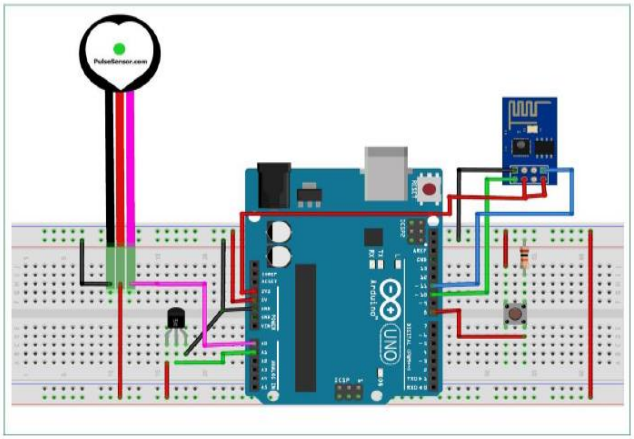

Fig. 2: Prototype model of the system for Pandemic diseases

In case an emergency event is triggered, the application will send a notification and alarm of the situation. The mobile application will also provide an interface which notifies the user and the contacts of the medication that needs to be taken, according to the time specified. The application records these details and sends it to the web dashboard and to the applications accordingly.

4. RESULTS AND DISCUSSIONS

In this chapter we discuss about the complete results of our project and its advantage, disadvantages. Here, ESP8266X Arduino board has been used towards the development of a health monitoring system. Finally, health related information like body temperature, Heart rate and Oxygen saturation levels are sent and updated over the cloud using Blynk application. A typical patient health information as observed in the hardware module and in the cloud are as discussed below.

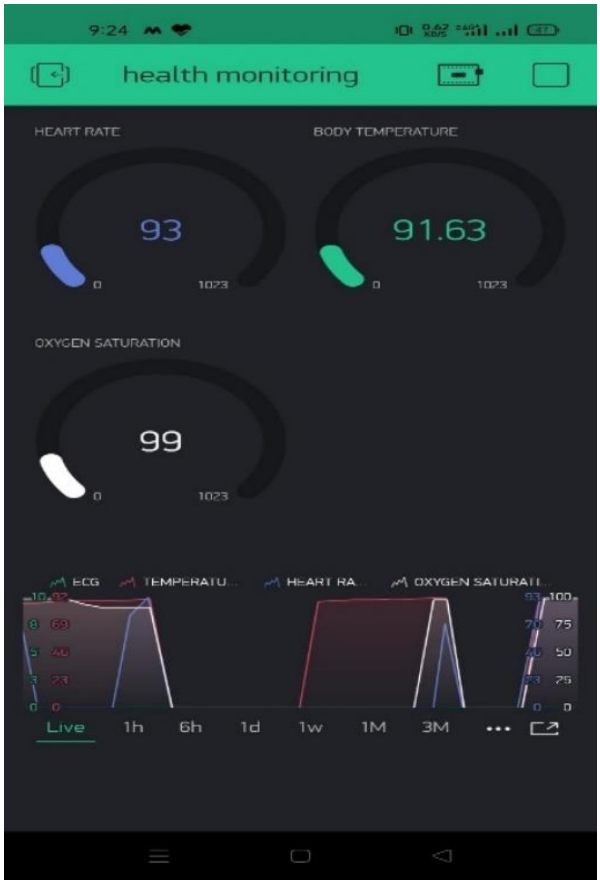

Fig. 3. Health Parameters in Blynk application

Fig. 3 shows the health parameters which can be visualized and monitored using the developed application in an unconnected state. The Heart rate, Body temperature and Oxygen saturation are the critical parameters for a patient being monitored. In the display, Heart rate, Body temperature and Oxygen saturation are indicated using Blue, Green and White colors respectively.

Fig. 3 shows the graph plotted between the values of health parameters and the time. The variation of these values can be monitored in live or over the hour, day, week and even month. The circuit which is used to develop the application is shown in Fig. 4. The LCD display has been used to display health parameters such as Heart rate, Body temperature and Oxygen saturation.

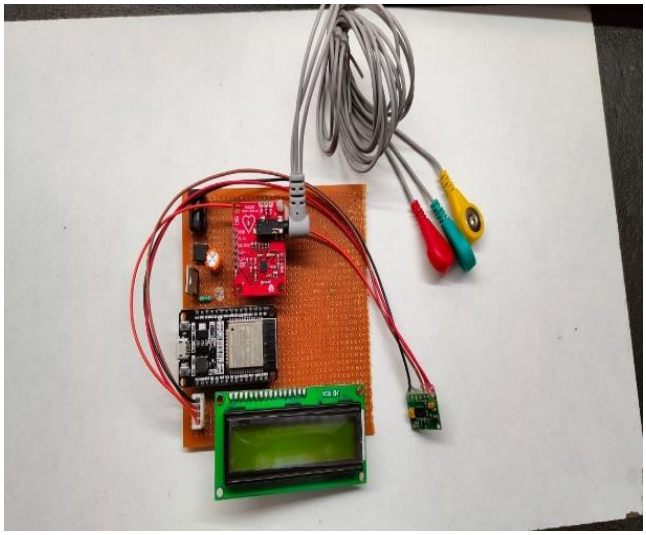

Fig. 4. Implemented Circuit of the proposed system

When finger is placed on the sensor the circuit starts to generate values for the specified health parameters as shown in Fig. 5. Buzzer makes sound in the following conditions:

- If the Heart rate goes below 48 and above 102
- If the Oxygen saturation comes below 95
- If the temperature goes above 97F

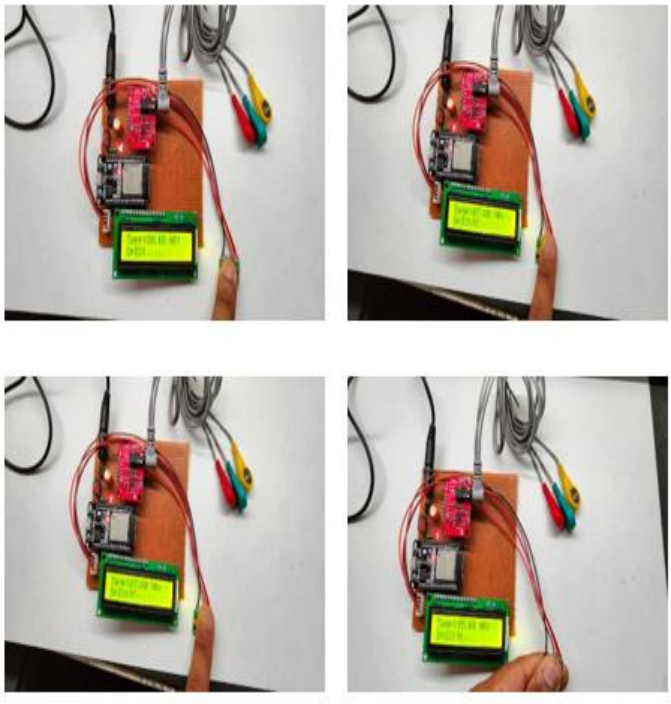

Fig. 5. Test Condition from patient being monitored at different instances

5. CONCLUSIONS

We employed the cloud computing technology to store data, which can be safely saved throughout time and accessed at

any point in time. Cloud processing is also useful for keeping track of patient information. In the event of an emergency, specialists and doctors can quickly review patient reports and take immediate action. As a result, providing appropriate guidance at the appropriate moment will help to avoid a crisis. The concerned person can interact with the patient without having to be physically present. The system automatically develops a diagram of body changes and sends it to the doctor. Because the body temperature parameter is so important, a doctor may readily forecast the condition a patient is having and save time. The idea is especially beneficial to people who live in rural areas and do not have access to all medical services. This might be thought of as a mini home clinic where you can simply sit and have a routine checkup. In future the complete system can be made wireless in such a way that both acquisition of data from the sensors as well as monitoring system via wireless mode. Such a package would contain the circuiting for inputs from ECG sensors, EEG sensors, pressure measurement and pulse rate transducers. This wearable module can transmit the data continuously over a fiber optic link or through an internet digital radio. The received data can be stored in separate memory and be processed by a microcontroller. This enhancement will enable monitoring of patients to be more flexible and strain-free.

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