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E-Quarantine Diagnostic System

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ABSTRACT: The worldwide coronavirus pandemic has unfold to 187 countries and 15.254 million peoples worldwide. Most countries, considerably those with caseload, grapple with a deficiency of hospital beds, facilities and along good doctors, however presently we've an answer in encountering such difficulties **"*E-Quarantine Diagnostic Systems*"**. A wearable system employed in watching the COVID-19 patients throughout pre- and post-treatment. The Wearable is the combination of data which is collected from the various sensors ie, measuring the parameters of the patient. The collected information from the patients are transmitted to the hospital by means that of ***Internet server***. The information of alternative patients are gathered along within the ***Central information system*** of the hospital. the information are been endlessly monitored by the doctor and on more analysis the medications are given consequently to the patients that scale back the work force, difficulties based on transportation and availableness. And this system helps in availing hospitality services simply at home.

KEYWORDS: IOT, Patient monitoring, COVID 19, Central information system

I. INTRODUCTION

Health is usually a major concern in every growth the humankind is advancing in terms of technology. Recently, coronavirus (COVID 19) becomes an outbreak virus that patients reach quite 2.2 crore round the world. The spreading of infected people and deaths numbers are increasing daily. Most of the people square measure suffering from patients area unit attention members whether or not doctors or nurses. This paper presents the E-Quarantine system that is a planned smart Health System for looking coronavirus patients for remote quarantine. It becomes necessary to avoid wasting thousands of lives from infection or death. It is based on fused multiple data from various sensors to detect the degree of development of the disease and the seriousness of the health condition. It is based on monitoring the readings like heart pulse, respiratory rate, blood pressure, etc in realtime. The info extracted from multiple sensors area unit gathered consecutively supported by multi-variable measurements. It proposes a classification of patient's cases. It also targets observing multiple users concurrently. The projected system allows watching patients from their homes that save governmental price and time through measure the changes in patient's medical readings. It'll serve humanity at intervals the reduction of Coronavirus infection and save health care members around the world. It to boot saves hospital places for emergency cases. These systems are accustomed collect amount of your time health data and provides feedback to patients and medical specialists. Allowing every single person to seem at their health, and advising them to look out immediate treatment simply just in case of emergencies, could find yourself in saving that person's life. The utilization of those watching systems will decrease medical fees for the state within the long-standing time.

Our system is been setup of various sensors connected to the patient's body at different places which keeps monitoring the patient's health parameters later they are been gathered together using the processor called ESP32. Later the data signals are been collected and being processed later using the IOT technology the data are been transmitted to the database of the hospital.

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II. LITERATURE SURVEY

Topic	Author	Technology	Processor	Sensor
A Smart Patient Health Monitoring System Using IOT	Sentamilarsi et al	Internet of Things	Arduino	AD8232-ECG,NTC thermistor, RS232, Heart Beat sensor.
IoT Based Wearable Smart Health Monitoring System	Mehmet Taştan	Internet of Things	Arduino pro mini	PPG,APDS-9008, MCP-6001 Op-Amp, HC-06 Bluetooth Module.
LM35 Based Digital Room Temperature Meter: A Simple Demonstration	B. O. Oyebola, V. T. Odueso .	Internet of Things	Microcontroller PIC16F877A	LM35
Developing IoT Based Smart Health Monitoring Systems: A Review	Ashikur Rahaman et al	Internet of Things	Microcontroller	DS18B20 Temperature sensor, ECG sensor, pulse sensor.
Patient Health Monitoring System Using IOT Devices	Ashwini J et al	Internet of Things	Raspberry pi 2	LM 35 temperature sensor, Heart Beat, BP sensor, ECG sesor,MAX232,GSM Module
IOT Based Health Monitoring System	Prajoona Valsalan et al	Internet of Things	Microcontroller	Room temperature sensor, Humidity sensor, Pulse sensor
A Portable Node of Humidity and Temperature Sensor for Indoor Environment Monitoring	Maulana Yusuf Fathany et al	Internet of Things	Microcontroller (STM32L100)	DHT11 temperature sensor, Humidity sensor.
Wireless ECG Monitoring System: Design, Construction and Analysis	R.H.Sayyed et al	GPRS communication	LPC1768	ECG sensor
Design of a Portable Health Monitoring System Based on Node MCU	R.K.Parate, S.J.Sharma	OLED display	ESP 32 Node MCU	Pulse oximetry and Heart rate sensor (MAX30100), Temperature Sensor (DS18B20)
AD8232 based Smart Healthcare System using Internet of Things (IoT)	Ayaskanta MishraDas et al	Internet of Things	ESP8266	ECG sensor (AD8232)
IOT based Patient Health Monitoring System using Raspberry pi 3	Laxmi Bhaskar, Prof. Prabhakar Manage	Internet of Things	Raspberry pi3 Board	Heart rate sensor, Temperature sensor (DHT11), Analog to Digital converter (ADS1115)
Internet of things (IoT) based health monitoring system and challenges	M. Sathya, et al	Internet of Things	Microcontroller	ECG sensor, Temperature sensor, Respiration sensor

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Progressed IOT Based Remote Health Monitoring System	Dahlia Sam et al	Internet of Things	Arduino UNO	BP sensor, Heartbeat sensor, Temperature sensor, IR sensor, Respiration sensor
IOT Smart Health Monitoring System	Shivam Arora, Dr Amita Goel	Internet of Things	Arduino UNO	Temperature sensor,IR sensor, Respiration sensor

III. PROJECT OUTLINE

THEME OF THE PROJECT

In this situation, COVID-19 is the major disaster of all over the world. So patient quantity is to be increased day by day simultaneously doctors are insufficient. Although we are creating E-QUARANTINE DIAGNOSTIC SYSTEM to diagnosis the COVID patient's parameters like SpO2, Heart rate, temperature (both room and body) and ECG signal.

PHASE 1

The device is used for both hospitalized patients and quarantined patients. We are using some sensors for determining parameters such as AD8232 for ECG signal, DHT11 for temperature, MAX30100 for pulse oximetry and heart rate. At last, we are using ESP32 processor for interfacing. Each sensor has to be interfaced with the processor.

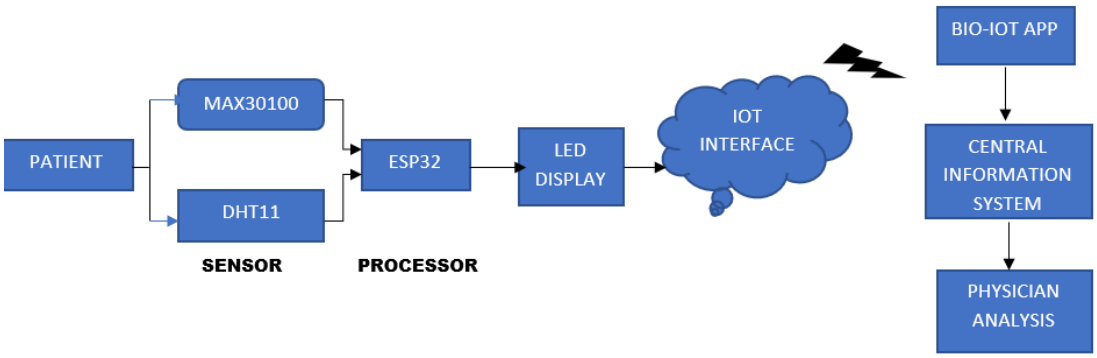
PHASE 2

Then Node MCU ESP32 with IoT web application to send the parameters of the patients. Updated database of the patient has to be visualized on the web app dashboard with the help of widgets.

SCOPE OF PROJECT

This device is for monitoring the infected person. Remote controlled technology is used for reducing infection and transportation and also reducing the equipment usage. It is majorly used for stimulates the quarantine patients in their houses to monitor patients and diagnosis the parameters and for classify the patient based on observing risk. This system is used to communicating the doctors and technicians easily.

IV. DESIGN



FLOWCHART FOR TEMPERATURE & HUMIDITY SENSOR

The above flowchart explains the data transmission from the wireless sensor to the hospital central information system through IoT. The data's are collected from the MAX30100 (heart rate and SPO2 sensor) and DHT11 (Body and Room temperature sensor) sensor. These sensor measures the patient's heart rate, SPO2, room temperature and body temperature. The collected data's are processed by the ESP32 processor. The processor comes with an inbuilt Wi-Fi and low energy Bluetooth. The resulting data's are displayed in a Light Emitting Diode. With the help of IoT interfacing the data's are transmitted to the hospital central information system. Simultaneously these data's can be viewed in a developed mobile application, this helps the healthcare professional as well as the family member to visualize the patient's condition. Thus the resulting outcome is analysed by the healthcare professional and it helps them to compare the data with the threshold value and based upon this information they can plan and provide the required treatment to the patient.

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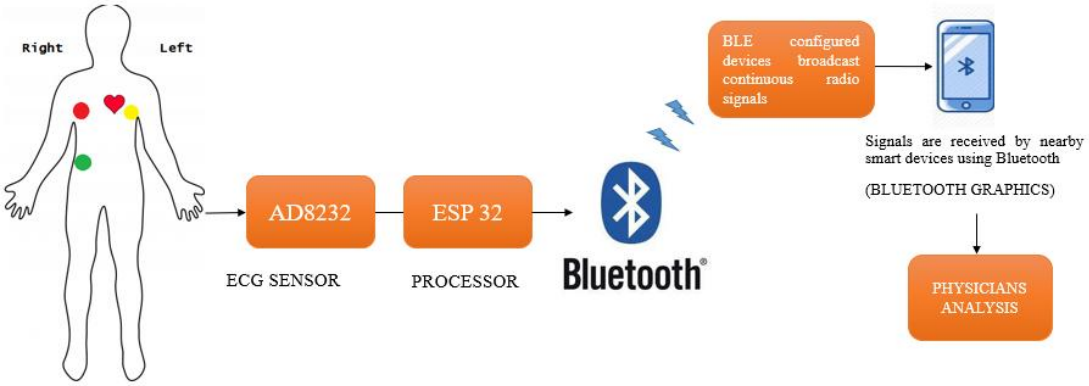


FLOWCHART FOR ECG SENSOR

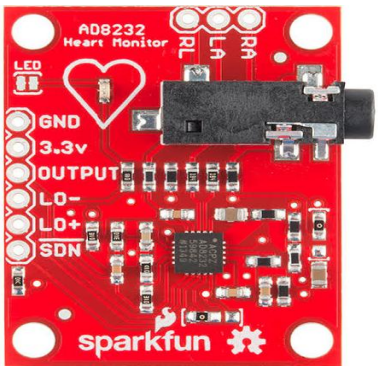
The above flowchart explains the data transmission from the wireless sensor to the smartphone via Bluetooth. The data's are collected from the ECG sensor pad connected with the AD8232 (ECG sensor) sensor. These collected data's are processed by the processor ESP32. The ESP32 comes with an inbuilt Wi-Fi, low energy Bluetooth and Bluetooth classic. The ESP32 and the smart phone are paired via low energy Bluetooth. The Bluetooth configured processor broadcast continuous radio signals. These signals are received by nearby smart devices using Bluetooth low energy. The signal provides ID number to the smart phone. Thus the ECG waveform is being observed through a mobile application. The resulting outcome is analysed by the physician and the concern treatment is provided to the patient.

V. METHODOLOGY

HARDWARE COMPONENTS USED

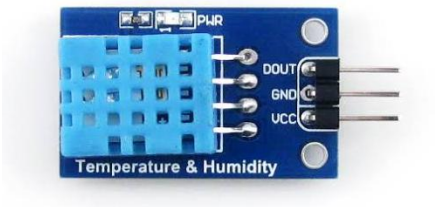
ECG SENSOR

The device is AN integrated signal acquisition block for ECG and different bio potential measuring applications. It's designed to extract, amplify, and filter very little bio potential signals within the presence of clamant conditions, like those created by motion or remote electrode placement. This model allows for an ultralow power analog to digital converter (ADC) or an embedded microcontroller to amass the output signal simply.



ROOM TEMPERATURE SENSOR

This is a basic, low worth digital temperature and humidity device. it's one wire digital humidness and temperature detector, that provides humidness and temperature values serially with one-wire protocol. The sensing element provides relative humidity value in percentage (20 to 90% RH) and temperature values in degree (0 to °C). DHT11 component uses resistive wetness measure element, and NTC50 temperature measure part.



PULSE AND HEART RATE

It is a pulse oximetry and heart rate monitoring sensor. It combines a combination of LEDs, a photodetector, optimized optics, and low-noise analog signal method to observe pulse oximetry and heart-rate signals. The device operates from 1.8V and 3.3V power provides and it may also be power driven down with facilitate of software system with negligible standby current, allowing the power to be connected in the least times.

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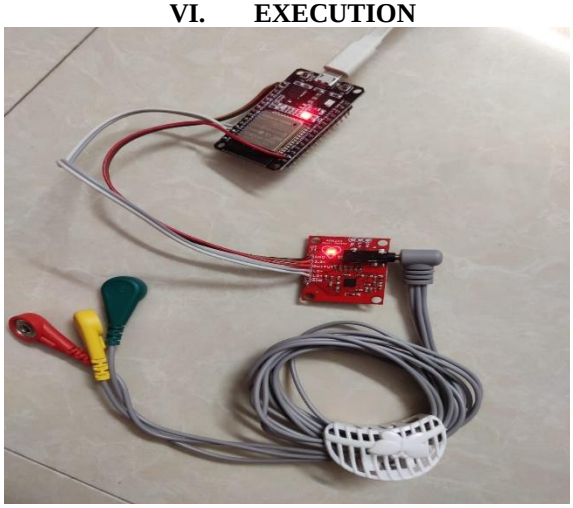
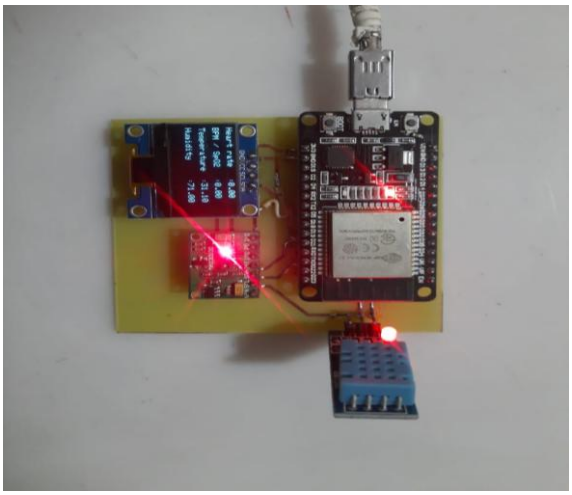
PROCESSOR

This is a style for low power IOT applications in mind. It has high method power with in-built Wi-Fi / Bluetooth and Deep Sleep operational capabilities makes it ideal for many IOT devices. Also, since Arduino IDE has formally discharged board managers for ESP32 it's become very easy to program these devices.

VI. EXECUTION

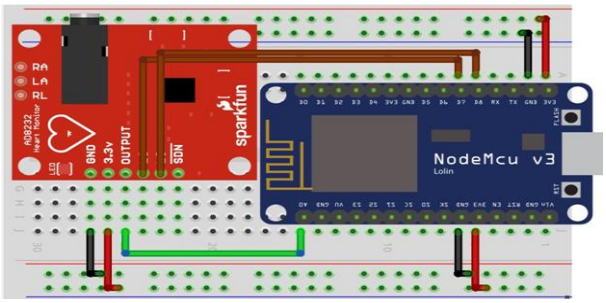




CONNECTION

ECG SENSOR

It is the sensor which is used to measure the ECG signal of the patient. This sensor is connected to the ESP32. AD8232 has GND, 3.3V, LO-, LO+ pins. These pins are connected to the respective pins of processor. Initially, ground (GND) pin of AD8232 is connected to the ground pin of ESP32. The OUTPUT pin of AD8232 is connected to the VP pin of ESP32. Then LO+ pin of sensor is connected to the D2 pin of ESP32 and LO- pin of AD8232 is connected to D3 pin of ESP32. At last, 3.3V pin of AD8232 is connected to the power supply pin of processor. For single supply operation, it gives 2.0V to 3.5V.



LINE DIAGRAM OF AD8232

DHT11 SENSOR

This sensor is used for measuring both body and room temperature of the patient. It has three pins such as VCC, DATA, and GND. It is connected to the ESP32. VCC pin of sensor is connected to the power supply pin of processor. GND pin of DHT11 is connected to the ground pin of processor. At last, DATA pin of sensor is connected to the D8 pin of processor.

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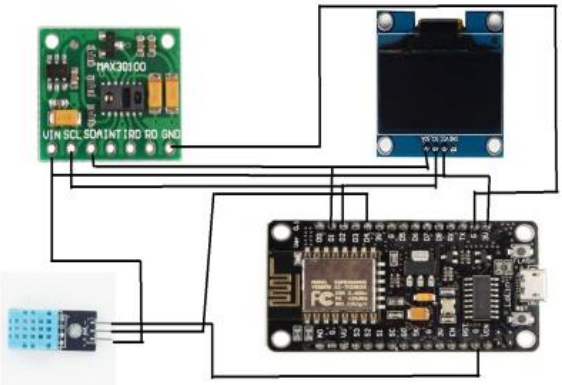
MAX30100 SENSOR

It is the sensor which is used to measuring the pulse oximetry and heart rate of the patient. It has 14 pins. SDA pin of sensor is connected to the D2 pin of processor. SCL pin of MAX30100 is connected to the D1 pin of processor. Then VCC pin of sensor is connected to the 3.3v pin of processor. At last, GND pin of sensor is connected to the ground pin of processor. Other pins are NC.



LINE DIAGRAM OF MAX30100 & DHT11

VII. SOFTWARE USED

IOT TECHNOLOGY

Before web of Things, patients' interactions with doctors were restricted to visits, tele and text communications. There was no method doctors or hospitals may monitor patients' health endlessly and create recommendations consequently. This patient monitoring has been made possible through Internet of Things (IOT).

Internet of Things (IoT)-enabled devices have created remote observation within the health care sector attainable, unleashing the potential more patients safe and healthy, and empowering physicians to deliver superlative care. It's conjointly raised patient engagement and satisfaction as interactions with doctors became easier and additional economical. Moreover, remote observation of patient's health helps in reducing the length of hospital keep and prevents re-admissions. IoT conjointly encompasses a major impact on reducing health care prices considerably and rising treatment outcomes. IoT is without doubt reworking the health care business by redefining the area of devices and other people interaction in delivering health care solutions. IoT has applications in health care that profit patients, families, physicians, hospitals and insurance corporations

IOT FOR PATIENTS

Devices transformed into wearable in the form of bands are worn by the patient and that device helps to monitor room temperature, body temperature, heart rate, blood pressure etc. These devices are also tuned to alert calorie count, abnormal conditions, blood pressure variations and much more. This has made a revolution in people's lives, mainly for elderly people by tracking the health condition constantly. This technology is mainly appreciated by people living and their families. Any abnormal condition or variations will be indicated both to the family members and the health providers.

IOT FOR PHYSICIANS

With the help of monitoring equipment and wearable embedded with IoT, physicians can track patient's health more efficiently. They can also monitor patients adherence to treatment procedure and can also provide immediate medical attention if needed. IoT enables healthcare professional to be more cautious and can connect with patients proactively. Data collected helps physicians to provide the best treatment for patients and reach the required results.

FIREBASE

Firebase a mobile application development platform from Google with powerful options for developing, handling, and enhancing applications.

Firebase is essentially a group of tools developers will consider, making applications and increasing them supported demand.

Firebase aims to resolve 3 main issues for developers:

- Build an app, fast
- Release and monitor an app with confidence
- Engage users

Firebase consists of package development kits (SDKs), which permit mobile and net developers to access cloud practicality merely, securely, and dependably. They automatically compensate for poor network connectivity. There's a firebase net console for sanctionative, administering, and securing parts. There are instruction tools and REST APIs for additional in-depth usage.

Some Firebase components are better known than others. There are few dependencies between parts that permits for progressive adoption of practicality. Firebase authentication and analytics are the foremost wide used.

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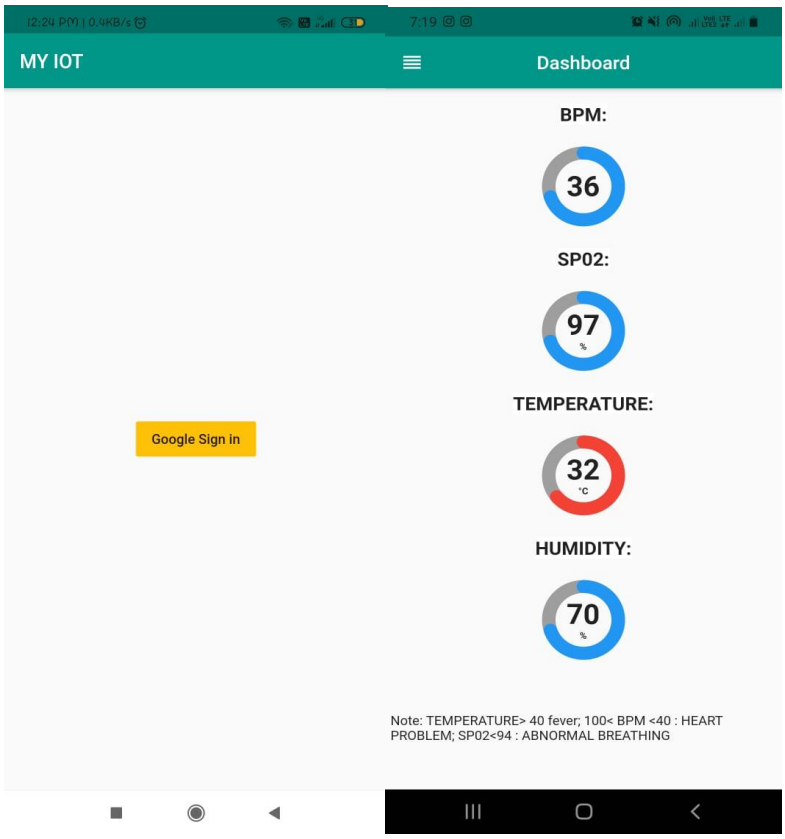
Firebase has evolved to become a platform that enables mobile and net front-end developers to develop complete applications while not the requirement for back-end servers. Recent enhancements have greatly expedited server less solutions which offer a viable, scalable, cost-efficient different to Cloud Virtual Machine server solutions.

APP DEVELOPMENT

BIO_IOT

It is an app developed to view the data which is been collected from the hardware and transmitted by means of IoT technology. This app can be used remotely to view the patient's data very easily using your mobile. This reduces time and energy spent towards monitoring the condition of the patient.



DEVELOPED APP OUTPUT

BLUETOOTH GRAPHICS

The app

VIII. RESULT AND DISCUSSION

ECG SENSOR OUTPUT

The AD8232 ECG module integrated with the AD8232 IC which is used for monitoring the ECG signal. This sensor is interfaced with the processor ESP32. There are three colour modules in the sensor. The modules are placed like Einthoven triangle in the patient body. This device broadcast continuous radio signals. Then the signals are received by nearby smart phones using Bluetooth graphics. Then it is shared to the respective doctors and technicians. It gives clear signal from PR and QT intervals of the patient.

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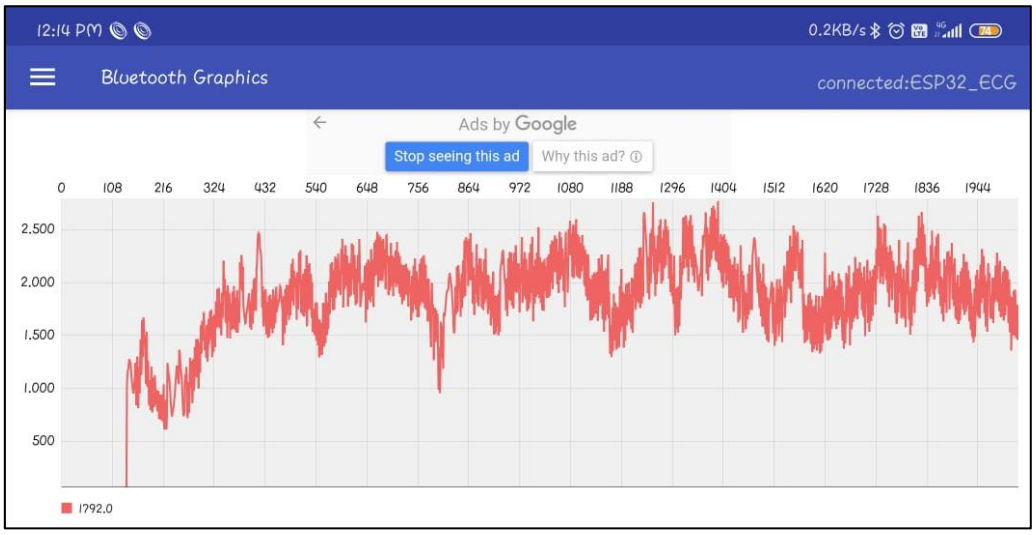


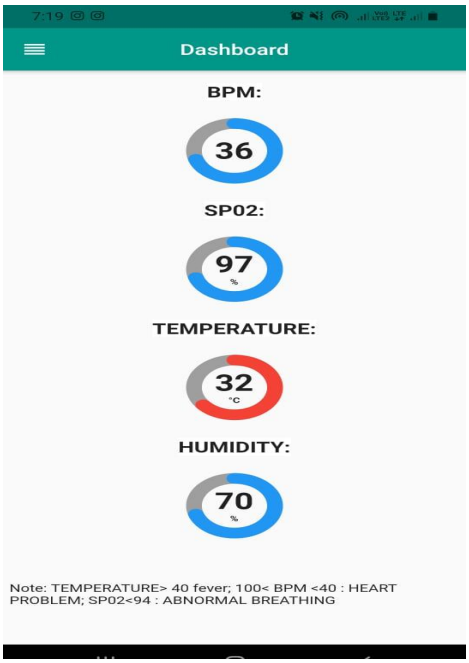
BLUETOOTH OUTPUT

DHT11 SENSOR OUTPUT

The DHT11 sensor is used for determining the both room and body temperature of the patient. The sensor is interfaced with the processor ESP32. This sensor gives the output value both LCD display and the bio-IoT application which is created for this device separately by us. It gives normal room and body temperature.

MAX30100 SENSOR OUTPUT

It is used to determine the SpO2 and the heart rate of the patient. This sensor is also interfaced with the process sor ESP32. Literally, the process of this sensor is similar to the DHT11 sensor. Both sensors give the output at the same time and the same way of the displaying process.



DEVELOPED APP OUTPUT

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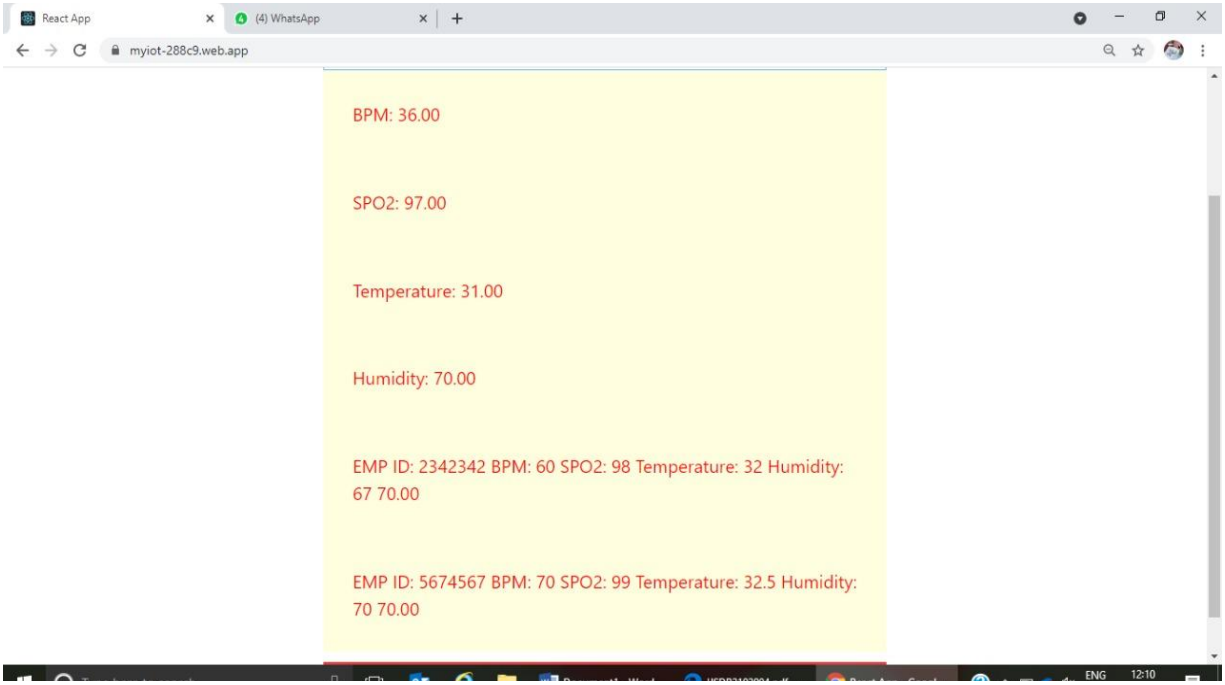

WEBSITE OUTPUT

IX. CONCLUSION

This paper presents the E-Quarantine system for monitoring infected patients with coronavirus remotely that uses for reducing infection and save hospital's places and equipment for high-risk patients only. The essential objectives of the EQuarantine system that simulates the Quarantine for patients in their houses to monitor patients and classify the patients based on observing disease risks. The proposed system E-Quarantine monitors the patient's case flow and predicts the emergency cases around 24 hours based on the supervised previous data. This system will play a major role in communicating the doctors and the physicians, helping in better communication.

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