# E-QUARANTINE DIAGNOSTIC SYSTEM

**[1]Hashmitha.S, [2]Karkuzhali.J, [3]Keerthana.M, [4]UmaBarathi. R, [5]Dr.Devarajan. V**

[1,2,3,4]UG Students, [5]Associate Professor
Department of Biomedical Engineering,
Rajiv Gandhi College of Engineering and Technology, Puducherry.

***Abstract:*** The global coronavirus pandemic has spread to 187 countries and 15.254 million peoples worldwide. Most countries, significantly those with caseload, grapple with a scarceness of hospital beds, facilities and together decent doctors, but presently we've a solution in encountering such difficulties **"E-Quarantine Diagnostic Systems"**. A Wearable system used in monitoring the COVID-19 patients during pre- and post-treatment. The Band is the combination of data which is collected from the various sensors ie, measuring the parameters of the patient. The collected data from the patients are transmitted to the hospital by means of ***Internet server***. The data of other patients are gathered together in the ***Central Information System*** of the hospital. The data are been continuously monitored by the physician and on further analysis the medications are given accordingly to the patients which reduce the manpower, difficulties based on transportation and availability. And this system helps in reaching hospitality services easily at homes.

## I. INTRODUCTION

Health is often a significant concern in each growth the mankind is advancing in terms of technology. Recently, coronavirus (COVID 19) becomes a pandemic virus that patients reach more than 2.2 crore around the world. The spreading of infected people and deaths numbers are increasing daily. Most people are affected by patients are healthcare members whether doctors or nurses. This paper presents the EQuarantine system that's a planned sensible Health System for watching 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 data extracted from multiple sensors are 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 will serve humanity within the reduction of Coronavirus infection and save health care members round the world. It additionally saves hospital places for emergency cases. These systems will be accustomed collect period of time health info and provides feedback to patients and medical specialists. Permitting each single person to look at their health, and advising them to search out immediate treatment just in case of emergencies, may end up in saving that person's life. The utilization of those watching systems will decrease medical fees for the state within the long-standing time.

Heart rate and temperature are a number of the foremost necessary traits of the body that are major contributors to deciding a patient's health condition. The number of heart beats per minute is denoted as pulse rate of the patient. It's additionally mentioned as pulse rate of the body. The normal heart rate of a healthy adult is sixty to one hundred beats per minute. The typical human heart rate is seventy beats per minute for males and seventy-five beats per minute square measure for females. Males aged twelve and older have quicker heart rates than males. The rate changes with malady, because of injury to body, heart, and exercise.

Hence heart rate is crucial in decisive one's health condition. Diabetes could be a common disease everywhere the planet. According to the World Health Organization (WHO), there are about 422 million people in the world suffering from diabetes and the amount is increasing day by day.

The E-Quarantine system is mainly used in monitoring the Covid-19 patients during their quarantine period ie, while pre- or post-treatment. The readings are been continuously monitored by the physicians and any slight changes in the observed reading the doctors alert the patient and make them to the hospital or changes in medications are given accordingly. Our system plays a vital role in protecting the frontier warriors from getting affected from the virus. Using the E-Quarantine system it reduces the manpower and also saving warrior's lives

Our system is been setup of various sensors connected to the patient's body at different places which keeps monitoring the patients 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. And later those reports are been verified continuously during their entire quarantine period and change in their parameters, alert signals are sent to their hospital and its fine they continue with their medication

## II. LITERATURE SURVEY

| TOPIC | AUTHOR | TECHNOLOGY | PROCESSOR | SENSOR |
|---|---|---|---|---|
| A Smart Patient Health Monitoring System Using IOT | C.Senthamilarasi, J.Jansi Rani, B.Vidhya, H.Aritha | 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, Md.Milon Islam, Md.Rashedul Islam, Muhammad Sheikh Sadi, Sheikh Nooruddin. | Internet of Things | Microcontroller | DS18B20 Temperature sensor, ECG sensor, pulse sensor. |
| Patient Health Monitoring System Using IOT Devices | Ashwini J, Akshay, Annapurna, Nagesh. | 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, Tariq Ahmed Barham Baomar, Ali Hussain Omar Baabood. | 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, Syifaul Fuada, Irfan Gani Purwanda, Sinantya Feranti Anindya. | Internet of Things | Microcontroller (STM32L100) | DHT11 temperature sensor, Humidity sensor. |
| Wireless ECG Monitoring System: Design, Construction and Analysis | R.H.Sayyed, Nazneen Akhtar, A. R. Khan, Gulam Rabbani | 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 Mishra, Biswarup Chakraborty, Debajyoti Das,Priyankar Bose, | 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) |
| IOT Based Health Monitoring System Using Blynk App | R.Priyanka, M.Reji | Internet of Things | ESP32 | Temperature Sensor (DS18B20), Blood Pressure Sensor |
| Internet of things (IoT) based health monitoring system and challenges | M. Sathya, S. Madhan, K. Jayanthi | Internet of Things | Microcontroller | ECG sensor, Temperature sensor, Respiration sensor |
| Progressed IOT Based Remote Health Monitoring System | Dahlia Sam, S.Srinidhi, V. R. Niveditha, S.Amudha, D. Usha | 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 (LM35), Pulse sensor (IR sensor), Respiration sensor |

## III. PROPOSED SYSTEM

This system is constructed on internet of Things (IOT) – primarily based technology to cut back the exposure of doctors or frontline attention employees to Covid patients. It may be simply put in in hospital premises or quarantine centres. Our paper proposes a customised health care system that monitors the heart beat rate, body temperature, ECG, heart rate of patients also as room humidness via sensors and transmits the information through Wi-Fi that allows the medical staffs to urge data from the server. It is suggested that a healthcare should provide good room conditions to facilitate the patient. So, room temperature is measured here. The major hardware components used here are MAX30100 sensor for both heart rate and pulse rate measurement, AD8232 sensor for ECG measurement, LM35 for measuring body temperature and DHT11 for measuring room temperature. These sensors are connected to a processing unit called ESP32. ESP32 is the heart of the system. ESP32 collects sensing element information so wirelessly transfers them to IoT websites. The board uses its Wi-Fi and its own process unit, that is Xtensa dual-core 32-bit LX6 chip. And later the data are transferred using the IOT technology to the hospital's database.

## IV. HARDWARE COMPONENTS

### 1) ECG SENSOR

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

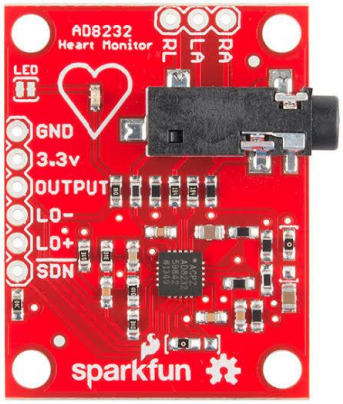



Fig no 1. AD8232 Sensor

**2) ROOM TEMPERATURE SENSOR:**

This is a basic, low value digital temperature and humidness sensing element. It is a single wire digital humidity and temperature sensor, which provides humidity 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 sensing element uses resistive humidness measuring element, and NTC50 temperature measuring element.


Fig no 2. DHT11 Sensor

**3) BODY TEMPERATURE SENSOR:**

This is a temperature measuring device having an analog output voltage proportional to the temperature. It provides output voltage in Centigrade (Celsius). It doesn't need any external calibration circuitry. The sensitivity of the sensor is 10 mV/degree Celsius. As temperature increases, output voltage also increases. It's is a 3-terminal device used to measure live temperature starting from -55 °C to 150 °C. The sensor gives temperature output which is more precise than thermistor output.


Fig no 3. MAX30205 Sensor

**4) PULSE AND HEART RATE**

It is a pulse oximetry and heart rate monitor sensor solution. It combines a pair of LEDs, a photodetector, optimized optics, and low-noise analog signal process to watch pulse oximetry and heart-rate signals.The device operates from 1.8V and 3.3V power supplies and can be powered down through software system with negligible standby current, allowing the power to stay connected in the least times.


Fig no 4. MAX30100 Sensor

**5) RESPIRATORY RATE**

The sensor is latex-free, magnet-free, and Velcro free, and can be worn over clothing. Since the respiration detector is employed with any rate, it's connected to any input of any encoder (with the exception of channel A of the ProComp2). Generally, however, it is connected to an input with a lower sampling rate.

**6) PROCESSOR**

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

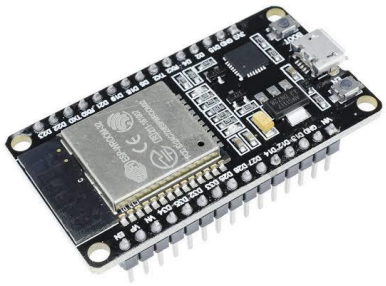
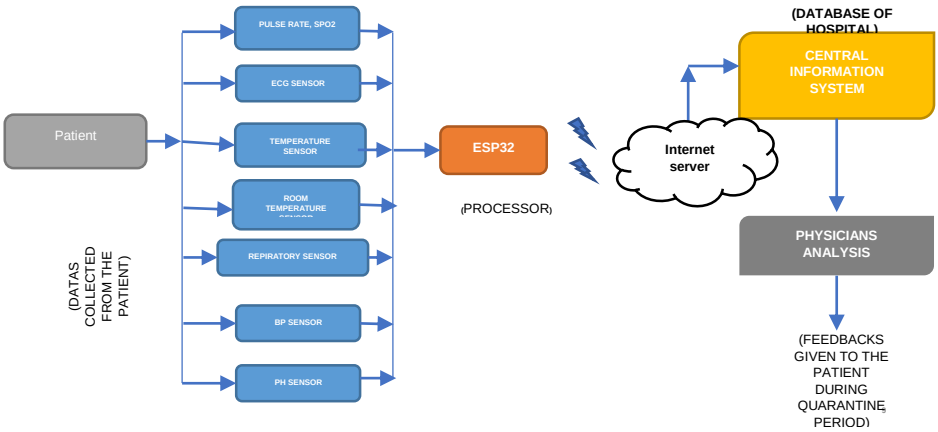


Fig no 5. ESP32 Processor

**V. DESIGN:**

It may consist of sensors like ECG sensor, temperature sensor, room temperature sensor, respiratory sensor, BP sensor and PH sensor. These all sensors are connected to the patient and monitored continuously. The ESP32 processor is been used in processing the data and further transferred using IOT technology by setting up an internet server. The data of patients are gathered together in the central information system of the hospital. The data are been continuously monitored by the physicians and further medications are given according to the patients.




## VI. Implementation of IOT Technology

This IoT based health monitoring devices monitors the patient 24/7 [22] By using wearables and other home monitoring equipment embedded with IoT, physicians can keep track of patients' health more effectively [14].IoT based devices can thus provide both detection and emergency response services [15]. The main advantages of IOT in healthcare system is reduced Errors, decreased cost, better patient experience, improved disease management and homecare.

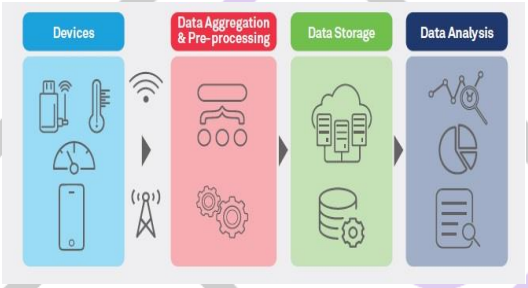



Fig no 6. IOT Implementation

## VII. INTERFACING:

The system is implemented using all the hardware components. ESP32 is being used as a processor. ESP32 has been used as a processing device since it can communicate with other Wi-Fi and Bluetooth devices and it has an inbuilt Wi-Fi module. The parameters measured are heart rate, SPO2, ECG, Body temperature and Room Humidity. These parameters are measured using its respective sensors. All these sensors are connected with ESP32 through its physical pins. The VCC and GND of all the sensors are connected to the VCC and GND of ESP32 processor. From these sensors embedded within the patient's body, physiological data is collected. Then a small hardware capable of pre-processing the acquired data and a communication software to transmit that data. The batteries are expected to be working continuously without charging and replacement. The acquired data can be relayed to health centre through Internet for storage.

### INTERFACING OF ECG SENSOR

The AD8232 ECG sensor is interfaced with the ESP32 processor. There are 6 pins in AD8232 Breakout Board. SDN is not connected. The OUTPUT pin of the sensor is connected to analog A0 of Processor. The LO+ & LO- is connected to the D5 & D6 of the Processor. The AD8232's 3.3V pin is connected to the VCC of the Processor. And the GND of AD8232 is given to the GND of Processor.

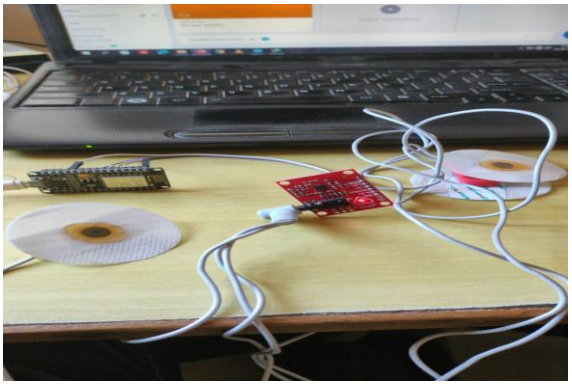


Fig no 7. ECG Implementation

The electrodes are placed according and are identified using the cable color

- **RA:** Red electrode placed under right clavicle near right shoulder within the rib cage frame.
- **LA:** Yellow electrode placed under left clavicle near left shoulder within the rib cage frame.
- **LL:** Green electrode placed on the left side below pectoral muscles lower edge of left rib cage.

The sensors have to be snapped to the sensor pad before application to the body. The closer to the heart the pads are, the better for the measurement.

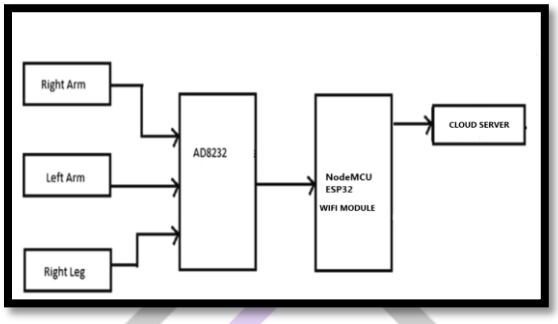



Fig no 8. Block Diagram of AD8232 with ESP32

We can visualize the ECG waveform remotely from any part of the world and we can visualize the ECG waveform on Serial Plotter Screen. We have used an IOT Platform named as "Ubidots" in which we send data to the cloud from any Internet-enabled device.

Using the WIFI connectivity option in the processor we can connect the Processor and the IOT platform. Where the processed data are transferred to the Platform and it can be viewed from anywhere from the world without any disruption. By logging on to the account of the Ubidots you will be able to view the patient's condition.

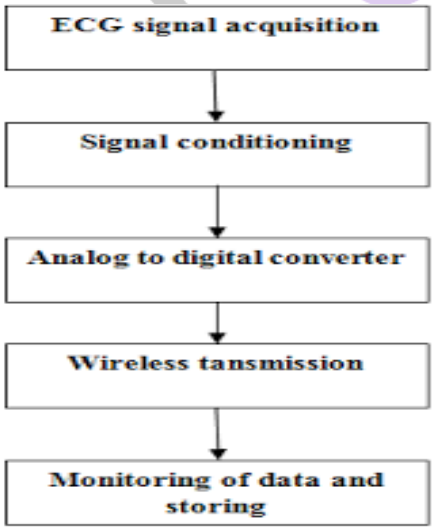



Fig no 9. ECG Block Diagram

So Ubidots is one such platform.


Fig no 10. Output

## VIII. PERFORMANCE MONITORING

It is a set of processes and tools to be able to determine how well fast applications are running. The word of technology is constantly evolving and software applications are more complex, dynamic and widely distributed than ever before. Basic application architecture has also changed formats over tie, from stand alone to client-server, then to mobile devices and cloud services. It involves the measurement of performance over time against indicators of performance. It helps in monitoring and managing the performance of the sensors. It may involve the performance of the ESP32 processor. By, using the internet of things, all corresponding data can be monitored. It is a smart healthcare to monitor the basic important signs of patients like heart rate, body temperature, PH level, blood pressure and respiratory rate. The patient can be monitored continuously by using patient monitoring system using IOT technology.

Fig no 11. Performance Monitoring

## INTERACTION OF MEDICATION

The interaction between doctor and patient is a central part of health care and the practice of medicine. The medical officers explain about the patient's condition. The doctor is providing medical advice to the patient These interactions are providing psychological support to the patient.

## INTERNET SERVER SETUP

The Internet of medical things is an ecosystem of smart devices that can communicate with each other in a real-time environment and formulate results. This reduces human errors to a vast degree and eliminates a lot of decision-making delays. The captured information is transferred through Wi-Fi or Bluetooth. The detectors store the information on a centralized cloud/server to be later analysed for better healthcare service.

Fig no 12. Internet Server Setup

## PHYSICIAN ANALYSIS

The collected medical reports from the patients are been gathered together and it is been presented to the physician. The physician analyses the report and monitors the patient's condition during the quarantine period. Any mild or heavy changes observed from the patient they will be immediately contacted by the hospital and may be taken to the hospital directly and further medications are given accordingly.

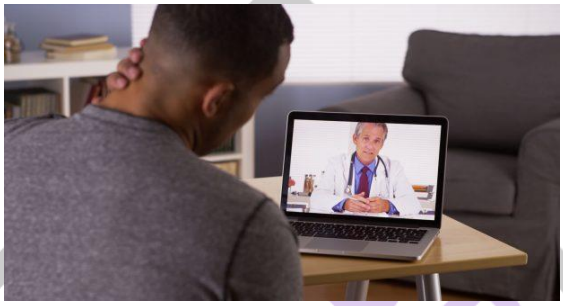


Fig no 13. Physician Analysis

| RESPIRATORY RATE | BLOOD PH LEVEL | HEART RATE | BLOOD PRESURE | BODY TEMPERATURE | RISK LEVEL |
|---|---|---|---|---|---|
| Low | Normal | Normal | Normal | Normal | High |
| Low | Medium | Normal | Medium | High | High |
| Low | Normal | Low | Normal | High | Very High |
| Normal | Normal | Medium | High | High | High |
| High | High | Normal | High | Normal | High |
| High | Normal | Normal | High | High | Mild High |
| Normal | Normal | Normal | High | Medium | Medium |
| Normal | Normal | Medium | Lowest | Normal | Medium |
| High | Normal | Medium | Medium | Normal | Medium |

## 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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