International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 07 Issue: 05 | May - 2023 Impact Factor: 8.176 ISSN: 2582-3930

Care Connect- A Next-Gen IoT Health Monitoring System

Souvik Sur[1], Syed Ifkat[2], Shaikh Musthafa,[3] Leslie Marvin[4],Dr.Panduranga Rao MV[5]

[1234]Department of Computer Science & Engineering (Internet of Things)
Jain Deemed to-be University,Bangalore-562112,India
[5] Professor,Department of Computer Science & Engineering (Internet of Things)
Jain Deemed to-be University,Bangalore-562112,India

---***---

Abstract - Doctors and nurses are obligated to regularly check on patients and maintain track of their vital health information in hospitals. It can be tough for medical professionals to continuously monitor each patient during pandemics like COVID-19 since so many individuals are admitted. The proposed approach to this issue can assist with patient monitoring and is based on IOT. The gadget can record data on Thingspeak, a cloud platform, and Blynk, a mobile app, and can monitor vital health markers including blood oxygen levels, temperature, and heart rate. The system is configured to operate automatically and can be accessed from any place with an internet connection. It continuously monitors and stores sensor data. An alert system is also implemented to inform in the event of crises.

***Key Words*:** Health, Covid-19, Monitor, ThingSpeak, Blynk

1.INTRODUCTION

The term "Internet of Things" (IoT) describes a network connection that enables items to access the Internet via communication protocols established by information sensor equipment. By exchanging information, this makes it possible to track, monitor, position, identify intelligently, and manage. It is possible to imagine our world as being composed of billions of creatures that are connected to one another over private or public Internet Protocol (IP) networks and share and transmit all kinds of information[1]. The health care system should be set up to give people the finest treatment possible whenever they need it and conveniently wherever they are.Developers of healthcare systems have recently started to adopt a new strategy that puts the patient first. The prior systemic method has two primary issues. The patient must stay within the hospital so that his health may be monitored, and first aid personnel must remain with the patient. IoT is therefore utilized to solve these two issues [2]. The Internet of Things (IoT) is a rapidly evolving technology that enables the connection of everything and anything to the internet. It aims to gather data from many sources more accurately and in less time.

2.LITERATURE SURVEY

[1]. The paper introduces a dynamic and personalized machine learning model to anticipate the spread of the COVID-19 illness. To provide customized projections depending on the pandemic's present stage, the proposed approach incorporates COVID-19 case data from several countries. To provide precise forecasts, the model takes into account a number of variables, including population density, temperature, and movement patterns.The authors constructed a mathematical model to represent the spread of COVID-19 using machine learning methods. The accuracy and dependability of the suggested model were compared to those of other models already in use, and it was discovered that it performed better overall.

[2]. The paper presents the development of a smart monitoring system to maintain water quality in fish farms. Using sensors and micro-controllers, the system tracks and logs many water quality metrics, including temperature, pH level, and dissolved oxygen. The data is then transmitted wirelessly to a central server, where it is analyzed and displayed for the fish farm owner or manager. The authors have used Arduino Uno micro-controller and sensors to measure the water quality parameters. They have also employed wireless communication modules, such as ZigBee and Wi-Fi, to transmit the data to the

server. The data is stored and processed using a database management system, and the results are displayed through a web-based interface. The system can also help to reduce the risk of disease outbreaks and improve the overall efficiency of fish farming.

[3]. The paper discusses the integration of wearable computing into the Internet of Things (IoT). The authors explore the challenges and opportunities of combining wearable devices with IoT technologies to create new applications and services for various domains, including healthcare, sports, and entertainment. They also review the current state of wearable technologies and the challenges they face in terms of power consumption, processing capabilities, and user interface design. The authors highlight the importance of developing new programming paradigms and architectures that support the development of wearable IoT applications and services. Overall, the paper provides insights into the potential of wearable computing and IoT to transform various industries and improve people's lives.

[4]. The article discusses the incorporation of big data and ambient intelligence into a wireless student health monitoring system based on the Internet of Things (IoT).The proposed system consists of various sensors that collect health data from students, which is then analyzed using big data techniques to provide insights into student health trends and behavior. The ambient intelligence feature of the system allows for personalized health recommendations and interventions based on the collected data. The authors also discuss the potential impact of the system in improving student health outcomes and reducing healthcare costs

[5]. IoT apps make it easier for individuals to live better lives by offering secure and timely remote patient monitoring, which makes them particularly useful for the provision of healthcare. Incorporating the Internet of Things, this review paper looks at the most recent advancements in healthcare monitoring systems. The paper highlights the benefits of IoT-based healthcare systems and their significance in relation to their advantages over traditional healthcare. We discuss the newest findings on IoT-based healthcare monitoring systems after doing a thorough study of the literature. Efficacy, efficiency, data protection, privacy, security, and monitoring of various systems are contrasted in the literature assessment.

3.PROPOSED SYSTEM

Figure 1 shows that the input side of the model is made up of sensors that monitor various important health-related characteristics, such as temperature, pulse rate, and heart rate. The sensors involve the LM35 temperature sensor, the MAX30102 heart rate sensor, and the SPO2 sensor.

The suggested system is built by attaching every medical sensor to a micro-controller that has sufficient power. Data transfer and presentation on the visual interface start after the micro-controller is linked to the results display device.All medical data is transmitted within time through the server when the findings are shown, and it is then saved to the cloud to be shared with the specialized doctor so that they can thoroughly check the patient's condition.

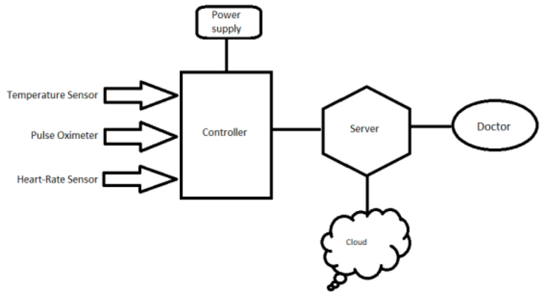


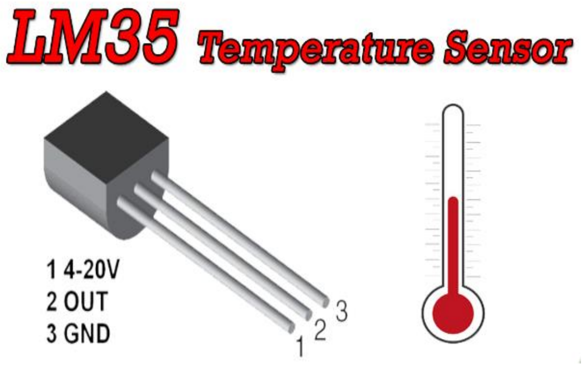
Fig -1: Block Diagram

4.MATERIALS

Hardware:

Temperature Sensor

The output voltage of the LM35 precision temperature sensor IC, which measures temperature in Celsius, is proportional to that value. It is a compact and reasonably priced sensor that is frequently employed for temperature measurement across a range of applications. Because of the LM35 sensor's linear temperature coefficient, which is 10 mV/°C. It can function in a wide temperature range of -55 to +150 degrees Celsius and requires a low voltage source of 4 to 30 volts. A common option for temperature sensing in embedded systems and IoT applications, the LM35 sensor is simple to use and only requires three pins for power, ground, and signal output.



[7] Fig -2:Temperature Sensor

Pulse Sensor:

A pulse oximeter is a non-surgical medical device used to measure a person's oxygen saturation level. It typically comprises a small clip-like device that is attached to a person's finger and detects the amount of oxygen in the blood by flashing a light through the skin and watching how the light is absorbed.

[8] Fig-3: SpO2 Sensor

Heart-Rate Sensor:

A heart-rate sensor is a gadget that continuously monitors a person's heart rate.It works by detecting the electrical impulses of the heart, which is brought on by the voluntary contractions of the cardiac muscle. The sensor generally comprises of an LED lamp that shines light into the skin and a photodetector that measures the light that is reflected back. The sensor can precisely estimate the heart rate because of how the amount of light absorbed by the blood fluctuates with the heart rate.

[9] Fig-4: Cardiac Monitor

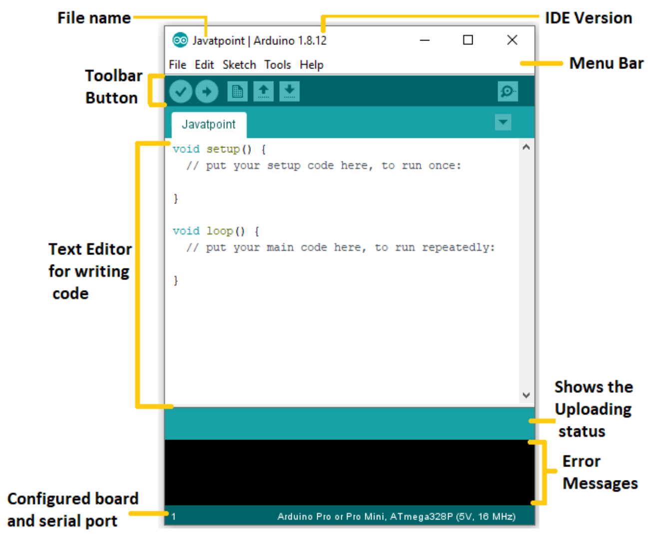
Arduino UNO

The Arduino UNO board is built on an ATmega328P CPU. It is one of the most well-liked Arduino boards and was developed for newcomers and hobbyists who want to plunge into the world of electronics and programming. A 16 MHz quartz crystal, 6 analogue inputs, 14 digital input/output pins, a power jack, a USB connection for programming, and a USB connector for power are all included. It may be powered by an external power source or a USB connection. The Arduino UNO board is easy to use, comes with a fundamental programming language, and has a sizable user population of individuals who contribute code, tutorials, and projects. This board is adaptable and fairly priced, and it may be used for many different things.

[10] Fig - 5: Arduino UNO

ARDUINO IDE SOFTWARE

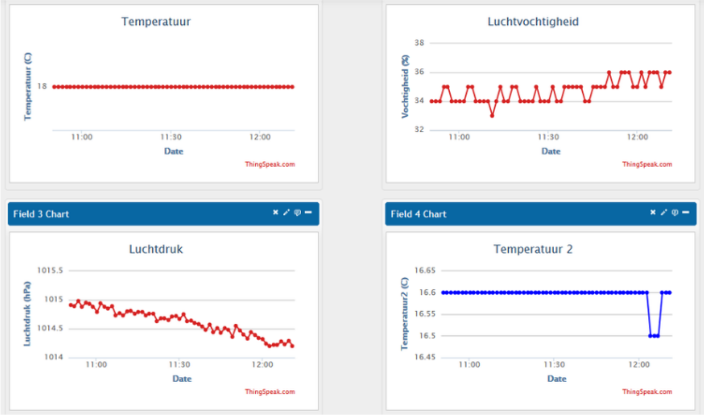
Arduino boards are programmed and programmes are made for them using an open-source programme called the Arduino IDE (Integrated Development Environment). It may be used with a variety of operating systems, including Windows, macOS, and Linux, as it is cross-platform. The Arduino IDE's straightforward user interface and C/C++-based programming language are designed to make it simple to use. A text editor for writing and editing code, a serial monitor for communicating with the Arduino board, and a compiler for translating code into a language the board can understand are all included. The Arduino IDE also includes a huge library of pre-written code and project examples that may be used to kickstart new projects.



[11] Fig - 6: Arduino IDE

Thingspeak:

Thingspeak is an IoT analytics platform that enables the collection, visualization, and cloud-based analysis of real-time data streams.



[12] Fig - 7: ThingSpeak

Blynk:

An IoT-based application called Blynk is in charge of facilitating communication between hardware and software.

Both of the aforementioned systems are beneficial since they offer safe, simple-to-use services for presenting patient sensor output data from anywhere with internet connection.

[13] Fig - 8: Blynk

5.METHODOLOGY

Step 1: Sensor setup

Connect the temperature, pulse sensor, and SpO2 sensors to the Arduino/NodeMCu board.

Program the board to read the sensor data.

Step 2: Blynk app setup

Create a Blynk account and create a new project.

Add the necessary widgets (e.g., gauge, value display) to display the health parameters.

Generate an authentication token to connect the Blynk app to the Arduino/NodeMCu board.

Step 3: Arduino/NodeMCu programming

Use the Arduino IDE or NodeMCU Lua language to program the board.

Read the sensor data and send it to the Blynk app using the Blynk API.

Set up alerts for abnormal readings.

Step 4: ThingSpeak setup

Create a ThingSpeak account and create a new channel to receive the sensor data.

Generate a write API key to allow the Arduino/NodeMCu board to send data to the channel.

Step 5: Arduino/NodeMCu programming for ThingSpeak

Modify the Arduino/NodeMCu code to include the ThingSpeak library and send the sensor data to the ThingSpeak channel using the write API key.

Step 6: Testing and deployment

Test the system to ensure that it is functioning properly.

Deploy the system to COVID-19 patients in quarantine.

Monitor the health parameters and alert healthcare professionals in case of abnormal readings.

Step 7: Data analysis

Use the ThingSpeak platform to analyze the data and generate reports on the health parameters of the patients.

Share the reports with healthcare professionals to aid in the diagnosis and treatment of COVID-19 patients.

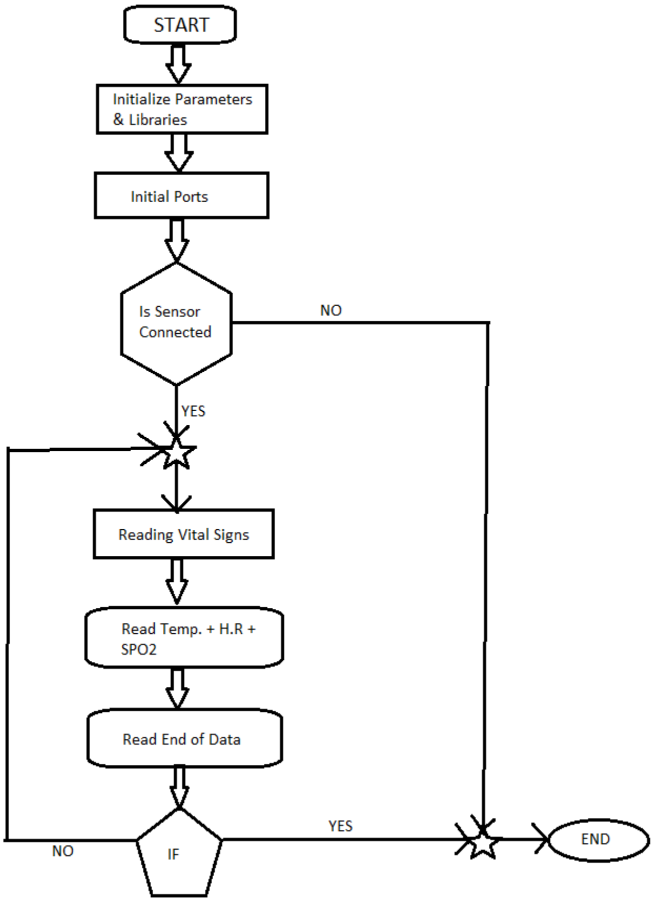


Fig - 9: Flow chart

Sending Alert to mobile in case of emergency:

The process of sending emergency alerts from a patient's IoT-based smart health monitoring system to a doctor via Blynk and ThingSpeak may involve the following steps:

Patient's IoT device: The patient's IoT device continuously monitors their vital signs such as heart rate, blood pressure, oxygen level, and temperature.

IoT device to Blynk: The device is connected to the Blynk app on the patient's smartphone via Wi-Fi or cellular network. The Blynk app displays the real-time data from the device on the patient's smartphone.

Blynk to ThingSpeak: The data from the Blynk app is sent to the ThingSpeak cloud platform for storage and further processing.

Alert threshold: The doctor sets an alert threshold for each vital sign that if exceeded, will trigger an emergency alert.

Alert notification: When the vital sign readings of the patient cross the alert threshold, ThingSpeak sends an emergency alert notification to the doctor via email, SMS, or push notification.

Doctor's response: Upon receiving the alert notification, the doctor can review the patient's data and take immediate action, such as contacting the patient or sending an ambulance.

[23]Figure 10: Mobile Alert

Working Procedure:

The project's primary elements are displayed, including the sensors (heart-rate, temperature, and pulse-oximeter sensors), the Arduino uno micro-controller that reads and analyses the data, and the preview unit that shows all the findings. It is used to connect a micro-controller to the test unit. Following complete circuit connection, the micro-controller gathers and analyses all signals before sending them via serial to the monitoring device (laptop) where they can be viewed in the main user interface. After that, the sensors are attached to the body so that data analysis may begin. It works as follows:

Hardware setup: The system consists of a NodeMCu/Arduino board, temperature sensor, pulse rate sensor, Wi-Fi module, and power supply.

Sensor data acquisition: The temperature and pulse rate of the patient are monitored using the temperature and pulse rate sensors connected to the NodeMCu/Arduino board.

Data processing: After the NodeMCu/Arduino board processes the data it sends it to the Wi-Fi module after processing.

Data transmission: The data is transmitted over Wi-Fi to the ThingSpeak cloud platform.

Data storage and visualization: The ThingSpeak platform stores the received data and provides real-time visualization of the temperature and pulse rate of the patient on a graphical interface.

Mobile app integration: The Blynk app is integrated with the ThingSpeak platform to provide real-time alerts to the caregiver or physician in case of any abnormality in the patient's temperature or pulse rate.

Alert generation: Whenever the temperature or pulse rate of the patient crosses a threshold value, the Blynk app sends an alert to the caregiver or physician, who can then take appropriate actions.

Overall, this system provides an efficient and easy-to-use platform for monitoring COVID-19 patients in quarantine, which can help in the timely identification and management of any health issues, thereby improving the overall outcome of the disease

6.RESULT AND DISCUSSION

The effectiveness of the instruments employed in the creation of the suggested system that has been put into practise as well as the veracity of the scientific findings are taken into consideration. All of the patient's vital signs—including temperature, rate of cardiac, and the amount of oxygen saturation—were successfully measured. Real-time signals were used for each one of them. Health care personnel are alerted to the need to respond quickly and administer medical procedures in the case of emergency. Doctors may access all of these findings via the cloud platform and the ThingSpeak server, and it will notify them by SMS in case of an emergency.

Another outcome of this article is the achievement of a cheap cost, as the price of project necessaries like sensors and micro-controllers is not expensive. The database has been correctly saved in the cloud-platform, making it possible to easily access it when needed. As a consequence, people only need to visit the hospital in an emergency.

7.FUTURE SCOPE

Here are some potential future scopes for the project:

1.Integration of more sensors: The current project uses sensors to monitor vital health parameters such as heartbeat, temperature, and blood oxygen levels. In the future, additional sensors can be added to monitor other parameters such as blood pressure, respiratory rate, and glucose levels.

2.Predictive analytics: The system can be enhanced to use machine learning algorithms and predictive analytics to forecast the likelihood of certain health conditions based on sensor data.

3.Remote monitoring: The system can be expanded to allow healthcare professionals to monitor patients remotely. This would enable doctors to track the health of patients who are not in the hospital, which could be particularly useful for patients in rural or remote areas.

4.Patient engagement: The system can be designed to encourage patient engagement and involvement in their own healthcare. For example, patients can be given access to their health data and encouraged to set goals and track their progress.

5.Integration with Electronic Health Records (EHRs): The system can be give a patient a more complete picture of their medical history, coupled with EHRs. Doctors may be able to make better choices regarding patient treatment as a result.

8.CONCLUSIONS

From the above, it can be inferred that In order to provide a persistent monitoring system to locate patients, an improved approach has been developed to monitor the patient's health utilising the Internet of Things. To offer patients with ongoing, affordable healthcare, this sector is also attracting a lot of attention. An increased number of biosensors can be used to further the existing work. A more thorough monitoring system will be created by using these sensors, which will track a variety of physiological indicators.

9.REFERENCES

[1] Muhammad Zia Ur Rahman, Ali Hassan Raza, Abeer Abdulaziz AlSanad, Muhammad Azeem Akbar, Rabia Liaquat, Muhammad Tanveer Riaz, Lulwah AlSuwaidan, Halah Abdulaziz Al-Alshaikh, Hatoon S Alsagri. Real-time artificial intelligence based health monitoring, diagnosing and environmental control system for COVID-19 patients[J]. Mathematical Biosciences and Engineering, 2022, 19(8): 7586-7605. doi: 10.3934/mbe.2022357

[2] N. A. J. Salih, I. J. Hasan, and N. I. Abdulkhaleq, 2019 Design and implementation of a smart monitoring system for water quality of fish farms, Indonesian Journal of Electrical Engineering and Computer Science, 14 (1), pp. 44-50.

[3] Cirani S, Picone M. Wearable computing for the internet of things. IT Prof. 2015;17(5):35–41.

[4] Hong-tan L, et al. Big data and ambient intelligence in IoT-based wireless student health monitoring system. Aggress Violent Behav. 2021. https://doi.org/10.1016/j.avb.2021.101601.

[5] Abdulmalek, S.; Nasir, A.;Jabbar, W.A.; Almuhaya, M.A.M.;Bairagi, A.K.; Khan, M.A.-M.; Kee,S.-H. IoT-Based HealthcareMonitoring System towards Improving Quality of Life: A Review.Healthcare 2022, 10, 1993. https://doi.org/10.3390/healthcare10101993

[6] K. K. Patel, S. M. Patel, and P. G. Scholar, 2016 Internet of Things-IOT: Definition, Characteristics, Architecture, Enabling Technologies, Application & Future Challenges, *Int. J. Eng. Sci. Comput.*, vol. 6, no. 5, pp. 1–10

[7] S. D. M. Sneha N. Malokar 1 2017 , An IOT Based Health Care Monitoring System A Review, *Int. J. Innov. Res. Comput. Commun. Eng.*, vol. 5, no. 4, pp. 8198–8205

[8] A. Kakkar, 2019 An IoT Equipped Hospital Model: A New Approach for E governance Healthcare Framework, *Int. J. Med. Res. Heal. Sci.*, vol. 8, no. 3,pp. 36– 42

[9] K. Haripriya, C. M. Aravind, V. Karthigayen, and P. Ganesh, 2016 Patient Health Monitoring System Using IoT and Cloud Based Processing, *Indian J. Sci. Technol.*, vol. 9, no. S1, pp. 1–7

[10] J. J. Rani, 2018 A SMART PATIENT HEALTH MONITORING SYSTEM, vol. 119, no. 16, pp. 59–70

[11] I. M. and S. S. S. Shubham Banka1, 2020 Smart healthcare monitoring system using iot, *Int. J. Adv. Sci. Technol.*, vol. 29, no. 6, pp. 2788–2796

[12] Ejaz, A. (2022, March 21). LM35 temperature sensor - working. Circuits DIY. Retrieved April 18, 2023, from https://www.circuits-diy.com/lm35-temperature-sensor-working/

[13] S. M. W. (2022, January 12). Medical Technology News, research and analysis. The Conversation. Retrieved April 18, 2023, from

https://theconversation.com/us/topics/medical-technology-7396
[14] Engineers, L. M. (2022, May 15). Interfacing MAX30100 pulse oximeter and heart rate sensor with Arduino. Last Minute Engineers. Retrieved April 18, 2023, from https://lastminuteengineers.com/max30100-pulse-oximeter-heart-rate-sensor-arduino-tutorial/
[15] Sur, S. (2022). Daqport Arduino sketch. Daqarta. Retrieved April 18, 2023, from https://www.daqarta.com/dw_rraa.htm
[16] Arduino IDE, J.T. (2022) Arduino IDE - JavaTpoint, www.javatpoint.com. Available at: https://www.javatpoint.com/arduino-ide (Accessed: April 19, 2023).
[17] diy_bloke, I. (2017) Send sensor data (dht11 & BMP180) to ThingSpeak with an Arduino, using cable or WIFI (ESP8266) or use ESP8266 alone (updated August 2016), Instructables. Instructables. Available at: https://www.instructables.com/Send-sensor-data-DHT11-BMP180-to-ThingSpeak-with-a/ (Accessed: April 19, 2023).
[18] Ifkat, S.M.W. (2020) Nodemcu ESP8266 BLYNK SSL application for linux server load averages, Go to Forum Page. Available at: https://www.unix.com/programming/283678-nodemcu-esp8266-blynk-ssl-application-linux-server-load-averages.html (Accessed: April 19, 2023).
[19] Mohammad Monirujjaman Khan, Safia Mehnaz, Antu Shaha, Mohammed Nayem, Sami Bourouis, "IoT-Based Smart Health Monitoring System for COVID-19 Patients", Computational and Mathematical Methods in Medicine, vol. 2021, Article ID 8591036, 11 pages, 2021. https://doi.org/10.1155/2021/8591036
[20] K. Dinesh et al. International Journal of Institutional & Industrial Research ISSN: 2456-1274, Vol. 3, Issue 1, JanApril 2018, pp.22-24
[21] Rahman, M. Z. U., Raza, A. H., AlSanad, A. A., Akbar, M. A., Liaquat, R., Riaz, M. T., ... & Alsagri, H. S. (2022). Real-time artificial intelligence based health monitoring, diagnosing and environmental control system for COVID-19 patients. Mathematical Biosciences and Engineering, 19(8), 7586-7605.
[22] N. J. Abed and Ehab Abdulrazzaq Hussein 2021 J. Phys.: Conf. Ser. 1818 012044 . DOI 10.1088/1742-6596/1818/1/012044
[23] Emergency Mobile Alert. (n.d.). Emergency Mobile Alert &Raquo; National Emergency Management Agency. https://www.civildefence.govt.nz/get-ready/civil-defence-emergency-management-alerts-and-warnings/emergency-mobile-alert/