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## IOT Based Patient Health Monitoring System

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### ABSTRACT

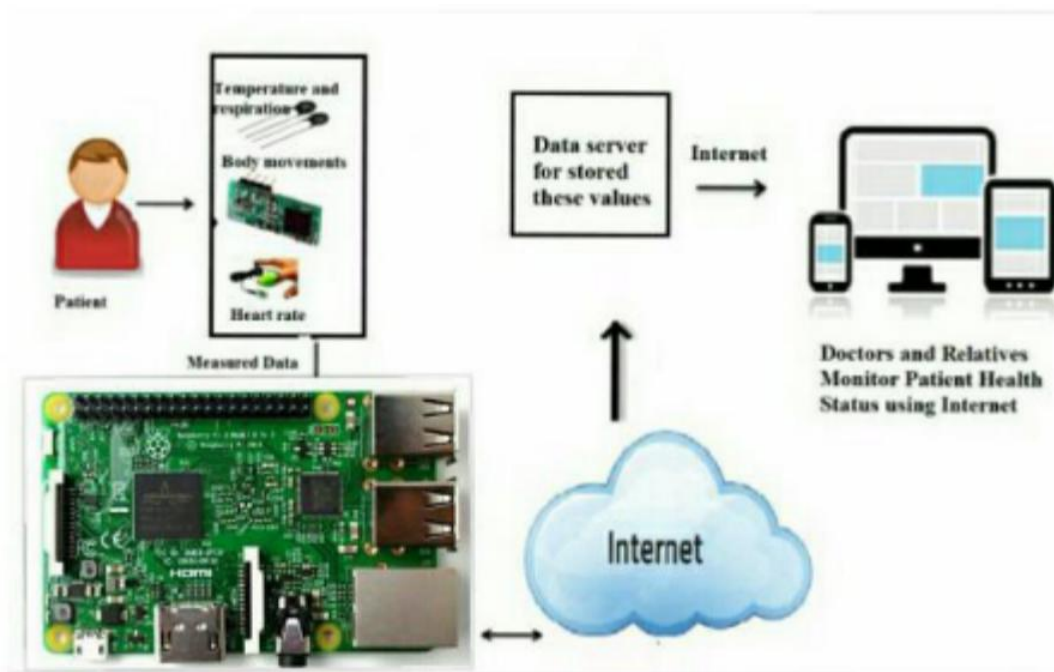
Technology plays the foremost role in healthcare not only for sensory devices but also in communication and recording. It is vital to observe varied medical parameters and post operational days. The most recent development in the healthcare communication methodology is IoT (Internet of Things). IoT is a catalyst for healthcare and plays a distinguished role in many applications. In this project, a microcontroller is used as a gateway for communication. The controller is additionally connected with a buzzer to alert the caretaker regarding variation in detector output. The sensors are connected to a microcontroller to trace the status of the patient which in turn is interfaced with the LCD display. IoT based patient health monitoring system effectively uses the internet to watch patient health status and save lives on time. For this reason fast conditional medication may be simply done by this technique. This system is easy to set up and is capable of high performance and time to time response.

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### INTRODUCTION

Revolution and rapid improvement of the internet, technology such as the Internet of Things has emerged and is snowballing. Internet of Things with cloud computing and edge computing realizes a new and more efficient way of data sharing and transmitting. The Internet of things will remodel the healthcare sector and improve the health and wellbeing of humanity. The traditional healthcare system requires patients to visit the clinic or hospital for medical checkups which is time-consuming and inefficient. The Internet of Things is capable of realizing a real-time health monitoring system that involves sensors to measure heart rate, body temperature and other body functions of patients and visualize the data in real-time. By doing so, people can have better control of their health condition. Instead of relying on infrequent visits to clinics or hospitals for various tests, people can access their health data through the internet and start to track their health conditions. The Internet of Things that realizes the connection between devices allows activities such as sending an alert email and messages during an emergency to be possible by making use of open source services such as google assistance.

The phrase "Internet of Things" (IoT) was coined at the beginning of the 21st century by the MIT Auto-ID Center with special mention to Kevin Ashton and David L. Brock. The concept of internet of things was put ahead in the early 21st century by the MIT Auto-ID Center with special mention to Kelvin Ashton and David L. Brock. The basic idea of the internet of things can be understood easily from two words "INTERNET" and "THINGS". Now "THING" can be anything from our daily life to an industry, organization, and Natural resources etc. So the basic approach of IOT is to collect data from the required THINGS using a network, and then use this data to give an appropriate output or action for a human or system's needs. So in simple words it's interconnection between different things to perform required action. The concept of IoT will revolutionize almost every field of work. One of the fields in which we can provide more efficient, fast, reliable service to humanity is the Medical field. Many organizations are working together to make this possible. Many names are given for healthcare with advanced technologies such as Health-IoT, IoMT, In Home Health. With the help of the IoT the healthcare system can be automated so that doctors can work more efficiently. To understand the concept of Healthcare along with IoT let us consider the figure below.



SYSTEM ARCHITECTURE

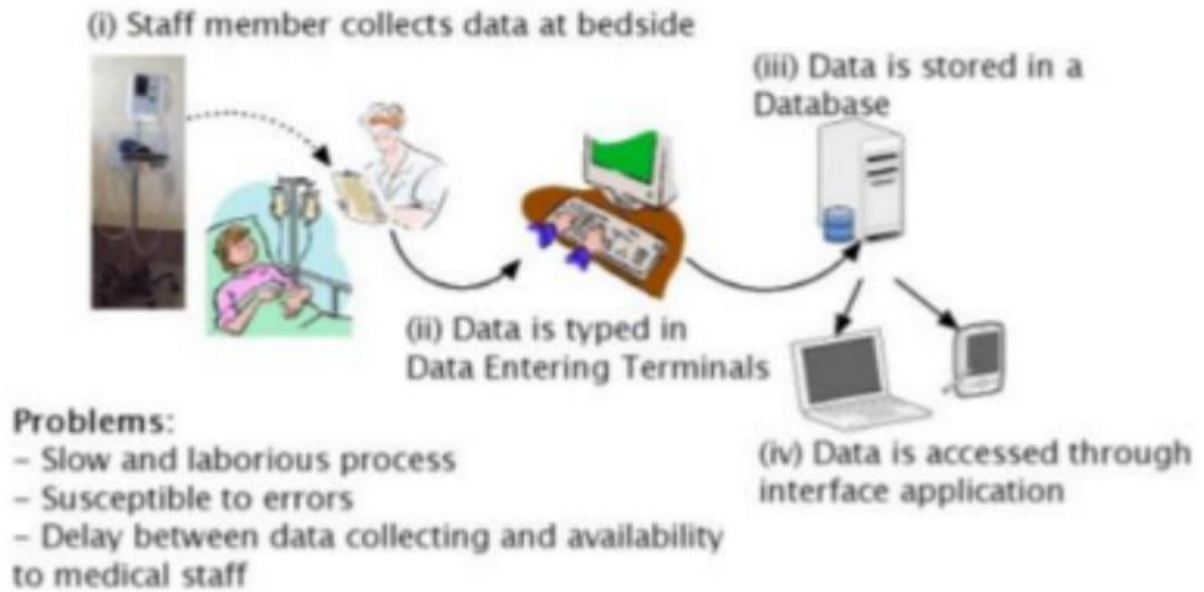
Here the different sensors such as temperature sensor, pulse sensor, oxygen sensor etc. are connected to the human body to monitor health. The data from this sensor is recorded through a local processing unit and transmitted to the healthcare server through the internet. Further this data can be used by the doctor, nurse, or some caregiver to monitor the health of the patient from anywhere as this data can be accessed through the internet from anywhere. So having a smart system, various parameters are observed that consume power, cost and increase efficiency. Medical scientists have been trying in the field of innovation and research since many decades to get better health services and happiness in human lives. Their contribution in the medical area is very important to us and cannot be neglected. Today's automotive structures have the root ideas coming from yesterday's basics. Also Early detection of chronic diseases can be easy with this technology. The body temperature, pulse rate, blood pressure and physical environment are prime parameters to diagnose the disease. This project gives temperature, pulse rate, oxygen level and physical environment with the help of air quality sensor and humidity sensor values using IoT.

## OBJECTIVE

The core objective of this project is the design and implementation of a smart patient's health monitoring system. The sensors are embedded on the patient body to sense the temperature and heartbeat of the patient. Two more sensors are placed at home to sense the humidity and the temperature of the room where the patient is staying. These sensors are connected to a control unit, which calculates the values of all the sensors. These calculated values are then transmitted through an 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, heart beat, oxygen values and the room sensor values, the doctor can decide the state of the patient and appropriate measures can be taken.

## LITERATURE REVIEW

The design and development of a ZigBee based wearable physiological parameters monitoring device has been developed. The systems can be used to monitor physiological parameters, such as heart rate and temperature of a human body. The device detects if a person is medically distressed and receiver unit that is connected to a computer plot graph for monitored physiological parameters of a human body. Centralized patient monitoring systems are in huge demand as they not only reduce the labor work and cost but also the time of the clinical hospitals. Earlier wired communication was used but now Zigbee which is a wireless mesh network is preferred as it reduces the cost. Zigbee is also preferred over Bluetooth and infrared wireless communication because it is energy efficient, has low cost and long distance range (several miles).



#### CONS OF EXISTING SYSTEM

### COMPONENTS REQUIRED

#### Microcontroller

Microcontroller is the most important unit of the entire system. It is actually responsible for all the processes being preceded. It will access and control all the peripheral devices or components connected in the system.



ARDUINO UNO

#### Body Temperature Sensor

The DS18B20 is one type of temperature sensor and it supplies 9-bit to 12-bit readings of temperature. These values show the temperature of a particular device. The applications of the DS18B20 temperature sensor include industrial systems, consumer products, systems which are sensitive thermally, thermostatic controls, and thermometers.



BODY TEMPERATURE SENSOR (DS18B20)

**Pulse or Heartbeat Sensor**

Heart beat sensor is used to give digital output of pulse rate when a finger is placed on it. Here we will be making a cavity having a bright Light Emitting Diode and one LDR just opposite it. By locating the finger in between the Light Emitting Diode and LDR, the pulse of the heart is detected.



PULSE SENSOR

**Pulse Oximeter**

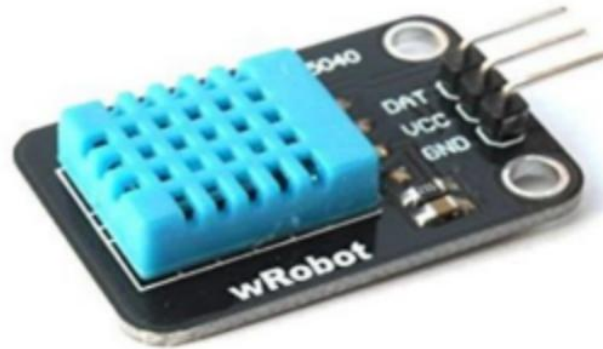
The MAX30100 Sensor is capable of measuring blood oxygen & heart rate. The blood Oxygen Concentration termed SpO<sub>2</sub> is measured in Percentage and Heart Beat/Pulse Rate is measured in BPM. The MAX30100 is a Pulse Oximetry and heart rate monitor sensor solution. It combines two LEDs, a photodetector, optimized optics, and low-noise analog signal processing to detect pulse oximetry and heart-rate signals.



PULSE OXIMETER (MAX30100)

### Humidity Sensor

A humidity sensor senses, measures and reports the relative humidity in the air as well as temperature of the surrounding environment. It therefore measures both moisture and air temperature. Relative humidity is the ratio of actual moisture in the air to the highest amount of moisture that can be held at that air temperature. The warmer the air temperature is, the more moisture it can hold. The sensor is composed of two metal plates and contains a non-conductive polymer film between them. This film collects moisture from the air, which causes the voltage between the two plates to change. These voltage changes are converted into digital readings showing the level of moisture in the air.



HUMIDITY SENSOR (DHT-11)

### Air Quality Sensor

This sensor is designed for comprehensive monitoring over indoor air conditioning. It's responsive to a wide scope of harmful gasses, such as carbon monoxide, alcohol, acetone, thinner, formaldehyde and so on. Due to the measuring mechanism, this sensor can't output specific data to describe target gasses concentrations quantitatively. But it's still competent enough to be used in applications that require only qualitative results, like auto refresher sprayers and auto air cycling systems.



AIR QUALITY SENSOR (MQ-6)

### Wi-Fi Module ESP8266

This is a self-contained System-On-Chip (SOC) with integrated TCP/IP protocol stack so that any microcontroller may gain access to any predefined Wi-Fi network. This system can host an application or offload all Wi-Fi networking functionality from another application processor. This Wi-Fi module is utilized in our proposed model to store collected data of patients within the dedicated offload all ThingSpeak channel using the Wi-Fi system.



WIFI MODULE ESP8266 (N0DE MCU)

### Arduino LCD Screen

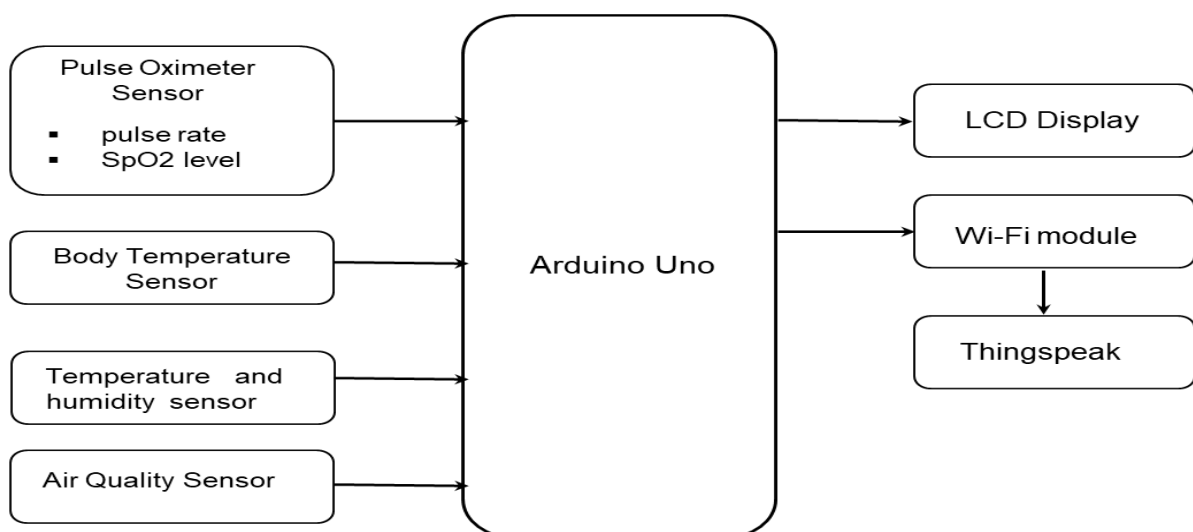
The Liquid crystal display is a type of display that uses the liquid for its operation. It accepts the serial input from sensors & uploads the sketch to the arduino. The library that allows us to control the LCD display is called Liquid crystal library.

### Buzzer

The buzzer or beeper is a gadget that creates sound. It can be mechanical, electromechanical or piezoelectric. Buzzer is used in our proposed system for emergency alerts in critical conditions of patients.

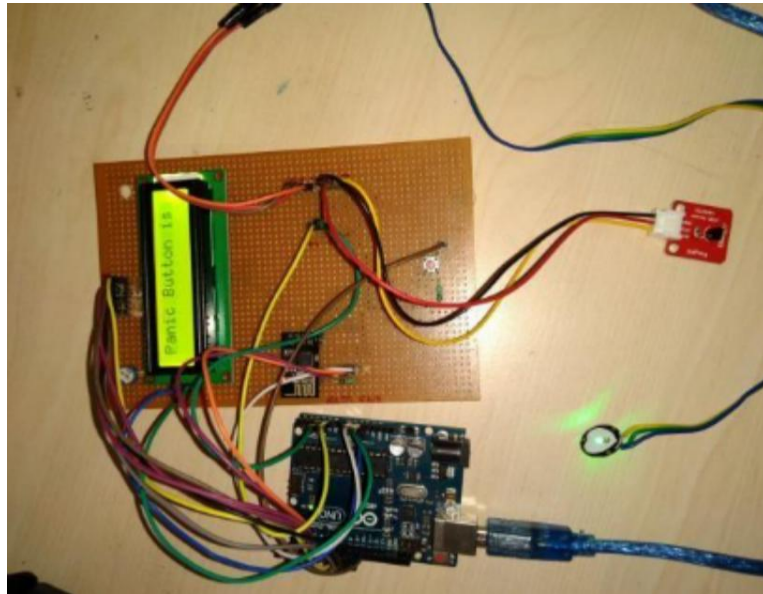
## WORKING

In this project, detecting the various parameters of the patient using the Internet of Things is done. In health monitoring systems based on IoT projects, the real time factors of the patient are sent to the cloud by using internet connection. These data can be sent to anywhere in the world, so that the user will view the details anytime. In IoT based patient health monitoring systems, data of the patient's health are often seen by doctors or their loved ones. The reason behind this is that the data has to be accessed by visiting an internet site or computer address, whereas in the Global System for Mobile communication based patient monitoring system. IoT based health monitoring systems have various senses. Initially we sense the temperature level, pulse rate and oxygen level of the patient and then humidity and air quality of the room in which the patient presents, with the help of temperature sensor, heartbeat sensor, blood pressure sensor, humidity sensor and air quality sensor. A buzzer has been used in this system so that whenever any particular health parameter goes beyond the ideal limit or any abnormal situation arises, a buzzer as alarming system are used in this proposed system. Buzzer or beeper creates sound during critical conditions ,by which a nurse or caretaker will take proper action instantly. The corresponding doctor or nurse would be notified instantly allowing them to provide the proper treatment in time. This is extremely useful since the doctor will detect the patient's health parameters simply by visiting an internet website or IP address. And today several IoT apps are also being developed. So the doctor and relatives will monitor or track the patient's health through Android apps.



BLOCK DIAGRAM OF PROPOSED SYSTEM

The above block diagram reflects that data collected through sensors are processed through the Arduino Uno and are stored in the ThingSpeak cloud through the internet. To measure the body temperature of the patient, a temperature sensor (DS18B20) is connected.



PHYSICAL CONNECTIONS OF DIFFERENT SENSORS

A pulse sensor is connected, which measures heart pulses, and helps to determine the heartbeat of the patient. Similarly, a pulse oximeter, all sensors are connected with Arduino. To add a bridge between the patient and doctor, a ThingSpeak server and a web portal are introduced. The Wi-Fi module (ESP8266) is linked with the Arduino causing patient's data to be stored via the IoT interface through the local internet. LCD display is used to show real time values to patients and it's caretakers. A buzzer starts beeping during abnormal conditions and simultaneously a SMS dropped to a predefined mobile number. The sensors are interfaced by coding the microcontroller which is Arduino Uno. Power is supplied via adapter or battery. A charge controller has been connected for minimizing excess voltage to control the power supply. The Arduino connection pin of 5 volts, analog input 0 and ground are connected to the power supply and synchronous with the system.

## RESULTS



LCD SCREEN SHOWING HEART RATE OF BODY BY PULSE SENSOR



LCD SCREEN SHOWING TEMPERATURE OF BODY BY LM-35



INTERFACING WITH MOBILE AS WELL AS LAPTOP



OUTPUT OF SENSORS UPLOADED ON THINGSPEAK SERVER

## APPLICATION

IoT healthcare is the most emerging field in the medical area. This project is mainly for elderly people who are alone at home. It is also helpful for senior citizens living alone or with 1 or 2 members. This is really helpful when relatives or members of the family have to go out for some unavoidable reasons. Multi challenged people can use this project. Disabled patients who find difficulty to go to doctors on a regular basis or for patients who need continuous monitoring from the doctor. IoT tracking proves really useful when we need to record, monitor and keep track of changes in the health parameters of the patient. In the Internet of Things based patient monitoring system, we can have a database of the health parameters. This helps the doctor to easily find the changes in the health parameters or history of the patient while suggesting the treatment or medicine for the patient. Hospital stays are reduced due to remote patient monitoring. Hospital visits for regular check-ups are also minimized.

## FUTURE SCOPE

The future work of the project is very essential in order to make the design system more advanced. In the designed system the enhancement would be connecting more sensors which measures various health parameters. We can also add a GPS module in an IoT based health monitoring system using Arduino and Wi-Fi modules. The GPS module will find out the location or position of the patient using longitude or latitude received. Then it will send the location to the cloud using Internet Of Things and then doctors can find out the position of the patient in case they have to take some preventive



action or the nearest hospital will be informed automatically using GPS and an ambulance will be sent to the patient. And establishing a Wi-Fi-mesh network will also increase the communication range. The future developed systems can overcome the coverage area range limitations. Smart hybrid cloud and artificial intelligence can be introduced to monitor multiple patients' condition by boosting up server capacity at a time. Substantial efforts have been made in IOT-driven healthcare services and applications. Various research activities concerning how the IOT can address pediatric and elderly care, chronic disease supervision, private health, and fitness management for deeper insights into industry trends and enabling technologies.

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## CONCLUSION

With the wide use of the internet, this work is concentrated on executing the internet technology to establish a system which would communicate through the internet for better health. The Internet of Things rules the whole world in various fields, mainly in the health care sector. Hence the present work is done to design an Internet of Things based smart patient health tracking system using an Arduino microcontroller. In this pulse rate sensor is used to detect the heartbeat and temperature sensor to read the temperature and sends the data to the cloud using the internet. This information is also sent to the LCD display, so patients can easily know their health status. During critical situations to alert the doctor, the warning message is sent to the doctor's phone and at the same time buzzer turns to alert the caretaker. The doctor can view the sent data by logging the specific website or IP address. Hence a continuous patient monitoring system is designed.

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## REFERENCES

- (i) R. Alekya, Neelima Devi Boddeti, K. Salomi Monica, Dr.R. Prabha, Dr.V. Venkatesh, "IoT based Smart Healthcare Monitoring Systems: A Literature Review", *European Journal of Molecular & Clinical Medicine* ISSN 2515-8260 Volume 7, Issue 11, 2020.
- (ii) M. Sathya, S. Madhan, K. Jayanthi, "Internet of things (IoT) based health monitoring system and challenges", *International Journal of Engineering & Technology*, 7 (1.7) (2018) 175-178.
- (iii) ShivleelaPatil, Dr. Sanjay Pardeshi, "Health Monitoring system using IoT", *International Research Journal of Engineering and Technology (IRJET)* e-ISSN: 2395-0056 Volume: 05 Issue: 04 | Apr-2018 p-ISSN: 2395-0072.
- (iv) PramaDebnath, Apple Mahmud, AhsanulKabir Hossain, S M Imrat Rahman, "Design And Application Of Iot Based Real-Time Patient Telemonitoring System Using Biomedical Sensor Network". Research Article.
- (v) PrajoonaValsalan, Tariq Ahmed BarhamBaomar, Ali Hussain Omar Baabood, "IOT BASED HEALTH MONITORING SYSTEM", *Journal of Critical Reviews* ISSN- 2394-5125 Vol 7, Issue 4, 2020.
- (vi) *International Journal of Engineering Research & Technology (IJERT)* ISSN: 2278-0181 | Special issue- 2019. Published by RTICCT - 2019 Conference Proceedings.
- (vii) C.Senthamilarasu, J.Jansi Rani, B.Vidhya, H.Aritha, Volume 119 No. 16 2018, 59-70 ISSN: 1314-3395 (on-line version) Special Issue.
- (viii) YedukondaluUdara, SrinivasaraoUdara, Harish H M, Hadimani H C, "Health monitoring system", *International Journal of Engineering and Manufacturing Science*. ISSN 2249-3115 Volume 8, Number 1 (2018) pp. 177-182.
- (ix) Gulraiz J. Joyia, Rao M. Liaqat, Aftab Farooq, and SaadRehman, "Internet of Medical Things (IOMT): Applications, Benefits and Future Challenges in Healthcare Domain", *Journal of Communications* Vol. 12, No. 4, April 2017.
- (x) Real time internet application with distributed flow environment for medical. <https://csdl.computer.org/csdl/proceedings/icgciot/2015/7910/00/07380578-abs.html> [Sept 11, 2021].
- (xi) Muhammad Sajjad, Shahryar Shafique Qureshi, Muhammad Afnan, "IOT BASED HEALTH MONITORING SYSTEM USING ARDUINO UNO, GSM SIM900D MODULE AND WIFI MODULE ESP8266". *International Journal of Scientific & Engineering Research* Volume 9, Issue 12, December-2018 16, ISSN 2229-5518.
- (xii) Abdulaziz A. Albeshir, "IoT in Health-care: Recent Advances in the Development of Smart Cyber-Physical Ubiquitous Environments". *IJCSNS International Journal of Computer Science and Network Security*, VOL.19 No.2, February 2019.
- (xiii) KahkashanTabassum, "IoT in Health-care: Recent Advances in the Development of Smart Cyber-Physical Ubiquitous Environments" ISSN: 2641-6336 DOI: 10.33552/ABBA.2018.01.000505, *Annals of Biostatistics & Biometric Applications*
- (xiv) BennetPraba, AnujKakar, Anushri Sharma, 239 Systematic Review Pharmacy Vol 12, Issue 5, Mar Apr, 2021, "IoT Based Handheld Smart Health

Monitoring System for COVID-19” ,Sys Rev Pharm 2021; 12(5): 239-242 E-ISSN 0976-2779 P-ISSN 0975-8453, Research Article.

(xv) K.Santhiya, B.Kamalakannan, S.Muthugowtham, A.Pandian, R.Rampradeep, ”Human Body Sensor Health Monitoring System in the Fusion of Iot and Cloud Computing” , ISSN 2394-2320 International Journal of Engineering Research in Computer Science and Engineering (IJERCSE) Vol 5, Issue 3, March 2018.

(xvi) Pavithra B, Sangeetha, “An IoT Based Automatic Patient Health Monitoring System” International Journal of Engineering Research and Applications, ISSN: 2248-9622, Vol. 10, Issue 8, (Series-V) August 2020, pp. 25-32, DOI: 10.9790/9622-1008052532 25.

(xvii)Prof. Virendrakumar A. Dhotre, Samadhan B. Kadam, Yogiraj L. Mane, Yogesh H. Mane and Satish S. Kore, IoT based Health Monitoring System, ”International Journal of Trend in Research and Development”, Volume 6(2), ISSN: 2394-9333 IJTRD | Mar – Apr 2019.

(xviii)SakilAhammed, Nazmul Hassan, Sheik HasibCheragee, Abu Zafor, Md. Touhidul Islam, “An IoT-based Real-Time Remote Health Monitoring System”, SSRG International Journal of Recent Engineering Science Volume 8 Issue 3, 23-29, May-June, 2021, ISSN: 2349 – 7157 /doi:10.14445/23497157/IJRES-V8I3P104 © 2021.

(xix) Md. Milon Islam, AshikurRahaman, Md. Rashedul Islam, “Development of Smart Healthcare Monitoring System in IoT Environment”, SN Computer Science, 13 May 2020,

(xx) Prema T. Akkasaligar, SoumyaPotnis, ShambhaviTolnur, ”Review of IOT Based Health Monitoring System”, International Journal of Research in Advent Technology (IJRAT) Special Issue E-ISSN: 2321-9637, 27th February 2019.