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IoT Based Health Monitoring System

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***Abstract*—**The corona pandemic has brought a huge rise in the popularity of health monitoring systems. Health has become one of the most focused issues in present times. In order to prevent any serious health related issues, a timely and convenient diagnoses is available through IoT based health monitoring systems. In this system, a patient's certain health related parameters will be measured and his or her condition will be predicted accordingly which will help prevent a lot of future complications.

Keywords—Internet of Things, Health, Sensors

I. Introduction:

The Internet of Things (IoT) can be described as a network of things that are attached with sensors, software and other technologies for the purpose of data collection and transmission over the internet. Physical items can communicate and collect data with minimal human intervention thanks to low-cost computers, the cloud, big data, analytics, and mobile technologies. This saves money and improves accuracy. A lot of parameters can be measured using an IoT based health monitoring system. Some of them are mentioned below:

A temperature sensor is used to calculate body temperature. The normal body temperature is considered to be around 37 degree Celsius. Fever is a higher than normal body temperature and can therefore be measured using a temperature sensor. Any fluctuation in the body temperature can be sensed and reported using a temperature sensor.

The count of constrictions of the heart per minute is used to determine the speed of the heartbeat It can vary depending on the physical needs of the body, such as the need to take in oxygen and excrete carbon dioxide. It is usually equal to the pulse at any given time. Change might occur as a result of physical activities, sleep, worry, stress, disease, or the use of medicines.

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Electrocardiography (ECG or EKG) is a process that uses electrodes attached to the skin to record the electrical movement of the heart over time. The ECG is used to assess the rate and movement of heartbeats, the relative size and placement of heart chambers, the presence of any damage to the heart's muscle cells or conduction system, the influence of cardiac medicines, and the function of pacemakers that have been placed.

A pulse oximeter has gained a lot of attention during the pandemic. The oxygen saturation levels in the blood are measured by it. Minor changes can be detected using this device. It was the most widely used health monitoring system in the last two years. The pandemic garnered a lot of attention for health monitoring systems and IoT based health monitoring systems helps us to get alerts and proper diagnoses.

In this paper, the section II is a generalized block diagram of an IoT based health monitoring system, the section III is a literature survey conducted by our team and the section IV and V include the future scope and conclusion drawn from the research.

II. Block Diagram:

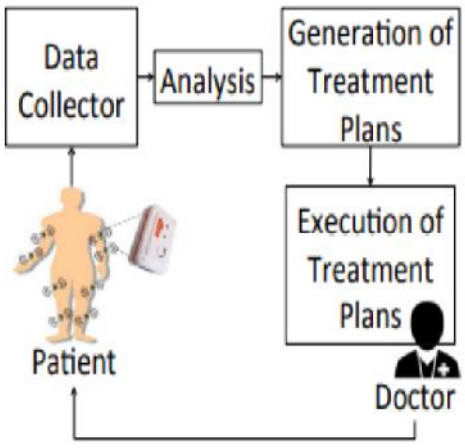

Fig. 1 (BLOCK DIAGRAM)

Generalized block diagram of an IoT-based health monitoring system

III. Literature Survey:

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Himadri Nath Shah et al. have made a health monitoring system that leverages a three tier architect featuring :-

(i) Wireless Body Server Network (WBSN)

(ii) Graphical User Interface

(iii) Base Station

The Wireless Body Server Network consists mainly of sensors. The Base Station stores the data as files for future use and the GUI sends a message to the doctor or the patient's family. The author and his team used a GSM modem for data communication,and the ATmega 328p microcontroller in ArduinoUno Board with a LCD and a Wi-Fi module. The sensors used by the author are:

1. Temperature Sensor(LM35)

2. ECG sensor

3. Heart Beat Sensor

The team also used the ESP8266 Wi-Fi Module along with a 16*2 LCD and a Piezo Electric Buzzer [1].

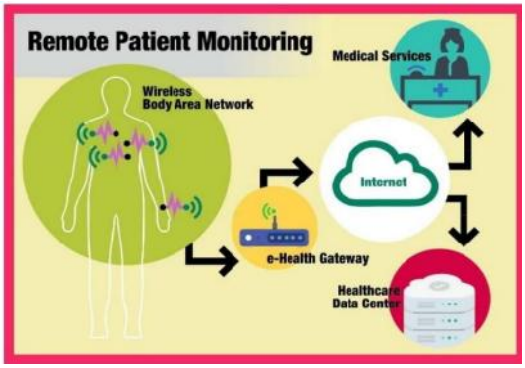

Fig. 2 Hardware used in [1]

Tamilselvi V. et al. used Arduino UNO as the microcontroller, to connect all of their sensors. The components used are:-

1) Maxim MAX30205 Integrated Body Temperature Sensor

2) Heart Rate Sensor

3) Eye Blink Sensor

4) Body Movement Sensor

5) SP02 Sensor

6) ARDUINO IDE

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The team also used a GSM Device and ESP-8266 wifi module [2].

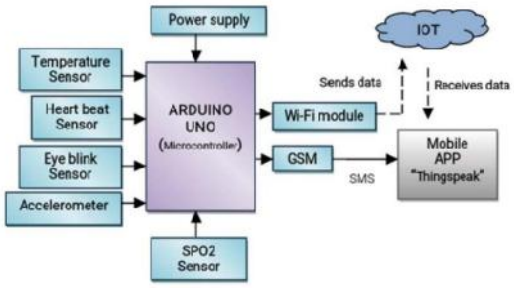

Fig. 3 Proposed System in [2]

Mittal RovinaMartis et al. proposed a system with Arduino Uno as the microcontroller,sensors like LM-35 and a BP/pulse test kit. A WiFi Module(ESP 8266-01) for transmitting the monitored data, a 16X2 LCD, and a regulated power supply. They also proposed using a GUI that displays the monitored data in a graphical form [3].

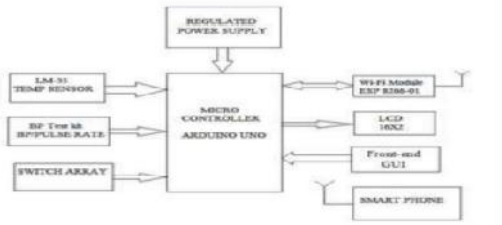

Fig 4

Block Diagram of IoT based heath monitoring system [3]

Sangeethalakshmi K. et al. proposed a system using Li-fi technology in which they would use light waves to find the glucose in the system. The proposed system uses the following sensors:

1) Temperature Sensor(LM35)

2) Blood Pressure Sensor

3) Electrocardiogram Sensor(AD8232)

4) Pulse-Oximeter Sensor(MAX30100)

ESP32 was used by the team to connect all the devices together. They also used GSM to notify the patient whenever any of the health metrics reached or exceeded thresholds.
ThingSpeak, a cloud-based IoT analytics programme that allows you to compile, visualise, and analyse live data streams, was used by the team [4].

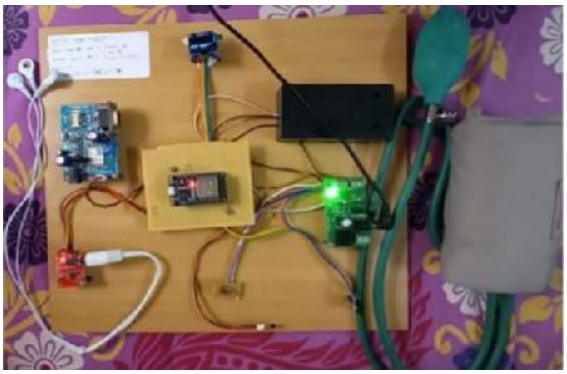

Fig. 5 Overview of the Kit in [4]

K. Narendra Swaroop et al. have made the health monitoring system in which the primary hardware blocks work using RPi3 Model B. Health monitoring sensors and wireless communication (BLE, Wi-Fi and GSM) are integrated to overcome the challenges [5].

Pawan Singh et al. have made the health monitoring system they have proposed that due to high speed internet access and advanced sensor technology it is possible to track human and other objects [6].

RishabBoussada et al. suggested an identity-based cryptography-based e-health monitoring system. They've also developed KEIBE, an efficient identity cryptography technique. By permitting the KGC to only generate a partial private key for a specific entity, this KE-IBE technique solves the key escrow problem. To safeguard session keys between communicating entities, the KE-IBE scheme is utilised [7].

In this paper, the author and the team have used the concept of health indexes, Arduino, respective biosensors and ThingSpeak Server and Application Website. Also the Space is maximised in his health monitoring system for critical cases [8].

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The author and the team used microcontroller (arduino uno) and they are connecting sensors which are Pulse Sensor (MAX30100), DS18B20 Sensor, with arduino uno. As it's arduino uno it doesn't have inbuilt wifiptbluetooth support so Bluetooth module (HC05)have been used .The author has also used node MCU ESP8266 and buck converter for this system. An app was made by author which can be used by normal user and doctor. [9].

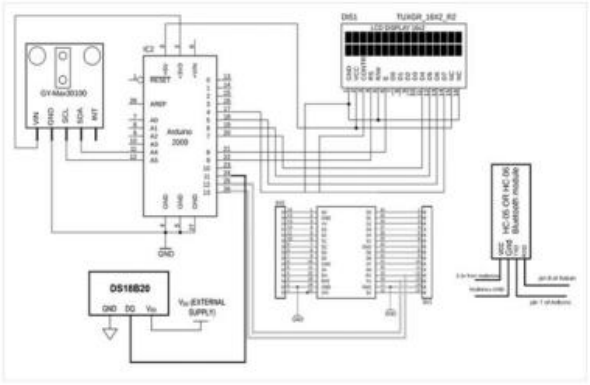

Fig. 6 Block diagram of the system in [9]

Md. Milon Islam et al. used esp32 for connecting all the sensors. The following components are used by the authors:-

1. Microcontroller(esp32)
2. Heart beat sensor
3. Curie Temperature Sensor (LM35)
4. Court Temperature Sensor (DHT11)
5. Carbon monoxide Sensor (MQ-9)
6. Carbon dioxide Sensor (MQ-135)

As it is ESP32, so no wifi module or Bluetooth was required [10].

Fig. 7

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The overall system architecture of the healthcare monitoring system [10]

D. S. R. Krishnan and team used microcontroller arduino uno and the author is connecting sensors which are temp sensor(LM-35) , ecg sensor(LM-358), with arduino uno. As it's an arduino uno it doesn't have inbuilt wifiptbluetooth support so wifi module (esp8267)have been used so that it can send the data to the website [11].

Vani yeri et al. designed a circuit using Arduino Uno as a microcontroller . The data taken from the sensors are sent to arduino. And the data acquired by arduino is now compared with the threshold set value of each sensor. If the value is above or equal to threshold then an alert message is passed to the doctor with the help of a wifi module with all details (data) of all sensors. So , for comparison or changes of data . Data was sent to the cloud for saving data.

Sensors/ hardware :-

1. Pulse sensor
2. Temperature sensor
3. Spo2
4. Wifi- module(for sending data to the cloud)
5. GSM module

And after measuring we can see the reading on the LCD screen. If the doctor wants to see the progress or the data of the patient then on the mobile app doctors need to write the hospital name and patient name to see the data of that patient [12].

In this proposed system, various sensors have been used. The sensors used are as follows:

1. Temperature Sensor (LM35)
2. Heartbeat Sensor
3. Vibration Sensor
4. Blood Pressure Sensor

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Their respective results are sent to the database via Raspberry Pi and can be monitored from anywhere worldwide through the internet facilitated via GSM module. ADC(MCP3008) is used to convert the analog signals received from the sensors to digital signals and the database used is MySQL [13].

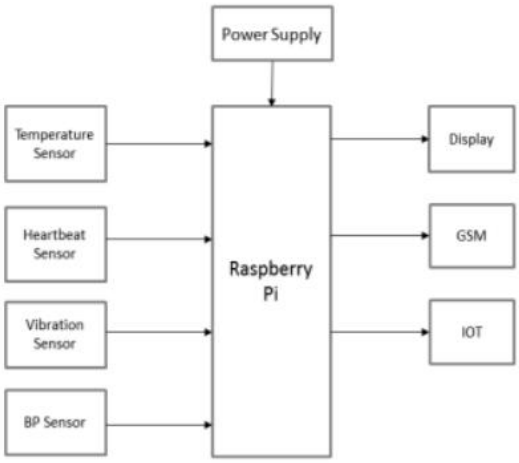

Fig. 8 Block Diagram of the system in [13]

The author used a hardware comprised of the following:

1. ARM development board
2. Electrochemical cell (Electrode)
3. Electrocardiogram
4. Wifi pt
5. Human Fat Analysis circuit
6. LCD screen.

Sensors used:

ECG Sensor module AD8232 was used for heart rate measurement.

In order to operate wifi pt, the ESP 8266 is used and the database used is MySQL [14].

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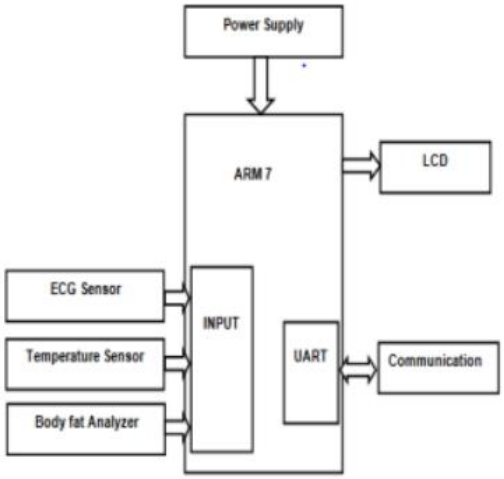

Fig. 9 **Block Diagram of the system in [14]**

The author and team have proposed a system with low cost and low power consumption using the LoRaWAN module. The approach mentioned in this paper is based on collection of data via medical sensors. The data is transmitted using LoRaWAN[15].

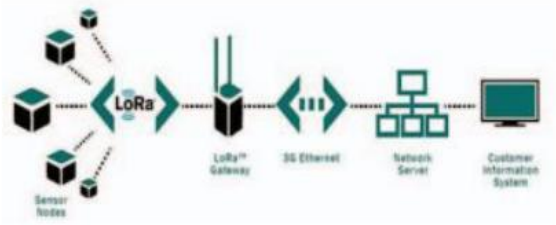

Fig. 10 **LoRaWAN: General Architecture [15]**

KhinThet Wai et al. have proposed a system with the following sensors:

1. Temperature sensor(DS18B20)
2. Blood pressure sensor
3. Heartbeat sensor(AD8232)

The microcontrollers used are NodeMCU and Arduino UNO. Ubidots has been used to store the data which is routed from the microcontroller [16].

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IV. Future Scope:

Many more parameters can be added for monitoring in the future. As for decreasing the cost and making it more affordable we can use esp32 as microcontroller because it is cheaper then arduino and it has inbuilt wifi-module. For decreasing the power consumption of our device we can use zigbee because it uses less power as compared to others.

During situations, that need instant medical attention we can add first aid measures to ease down the situation.

V. Conclusion:

Before IoT, patient to doctor interactions were very limited. IoT enabled devices have made things a lot easier as they allow us to communicate with the doctor from the comfort of our homes. On the other hand doctors can also keep an eye on their patients while staying in hospitals.

To decrease medical mistakes, IoT devices track the delivery of medications and the reaction to therapy. Because IoT devices can gather and analyse large amounts of data, they offer a lot of promise for medical research. In the event of a medical emergency, real-time remote monitoring via IoT devices and smart notifications may detect illnesses, cure diseases, and save lives.

VI. References:

[1] Saha, H. N., Paul, D., Chaudhury, S., Haldar, S., & Mukherjee, R. (2017), “Internet of Thing based healthcare monitoring system”, 2017 8th IEEE Annual Information Technology, Electronics and Mobile Communication Conference (IEMCON), doi:10.1109/iemcon.2017.811724.

[2] Tamilselvi, V., Sribalaji, S., Vigneshwaran, P., Vinu, P., &GeethaRamani, J. (2020), “IoT Based Health Monitoring System”, 2020 6th International Conference on Advanced Computing and Communication Systems (ICACCS), doi: 10.1109/icaccs48705.2020.9074192 .

[3] Mittal RovinaMartis, Mohammed Zakir, “IoT Based E-Health Monitoring System Using Arduino UNO”, ISSN:2349-5162, Vol.5, Issue 5, pp.1471-1476, May-2018, https://www.jetir.org/papers/JETIR1805421.pdf.

[4] Sangeethalakshmi K., Preethi Angel S., Preethi U., Pavithra S., Shanmuga Priya V., Patient health monitoring system using IoT, Materials Today: Proceedings, 2021, ISSN 2214- 7853, https://doi.org/10.1016/j.matpr.2021.06.188.

[5] K. Narendra Swaroop, Kavitha Chandu, Ramesh Gorrepotu, Subimal Deb, "A health monitoring system for vital signs using IoT" Internet of Things, Volume 5, 2019, pp. 116-129, https://doi.org/10.1016/j.iot.2019.01.004.

[6] Singh, Pawan (2018), " INTERNET OF THINGS BASED HEALTH MONITORING SYSTEM : OPPORTUNITIES AND CHALLENGES" International Journal of Advanced Computer Research, Volume 9, Jan- Feb 2018, doi: 10.26483/ijarcs.v9i1.5308.

[7] RihabBoussada, Mohamed ElhoucineElhdhili, Leila AzouzSaidane "Toward Privacy Preserving in IoT E-health Systems: A Key Escrow Identity-based Encryption Scheme" 15th IEEE Annual Consumer Communications & Networking Conference (CCNC), 2018, doi: 10.1109/CCNC.2018.8319218.

[8] Anirvin Sharma, Tanupriya Choudhury, Praveen Kumar "Health Monitoring & Management using IoT devices in a Cloud Based Framework" 2018 International Conference on Advances in Computing and Communication Engineering (ICACCE), Paris, France, DOI:10.1109/ICACCE.2018.8441752.

[9] Mohammad Monirujjaman Khan, SafiaMehnaz, AntuShaha, Mohammed Nayem, and Sami Bourouis, "IoT-Based Smart Health Monitoring System for COVID-19 Patients",vol.2021 , 16nov2021,11 pages , 2021, https://doi.org/10.1155/2021/8591036.

[10] Md. Milon Islam, AshikurRahaman, Md. RashedulIslam,"Development of Smart Healthcare Monitoring System in IoT Environment",SN Computer Science, Article number: 185 (2020) ,26may 2020 ,11 pages , 2020 ,https://doi.org/10.1007/s42979-020- 00195-y.

[11] D. S. R. Krishnan, S. C. Gupta and T. Choudhury, "An IoT based Patient Health Monitoring System", 2018 International Conference on Advances in Computing and Communication Engineering (ICACCE), 22-23 June 2018, 7 pages, 2018, https://doi.org/10.1109/ICACCE.2018.8441708.

[12] V. Yeri , D. C. Shubhangi , "IoT based Real Time Health Monitoring", 2020 Second International Conference on Inventive Research in Computing Applications (ICIRCA), 15-17 July 2020 , 5 pages ,2020, 10.1109/ICIRCA48905.2020.9183194.

[13] Shubham Banka, Isha Madan, S.S. Saranya, "Smart Healthcare Monitoring using IoT", International Journal of Applied Engineering Research ISSN 0973-4562, Volume 13, pp. 11984- 11989, 2018, https://www.ripublication.com/ijaer18/ijaerv13n15_40.pdf.

[14] 2. Melisa Pereira, Kamath K. Nagapriya, "A Novel IoT Based Health Monitoring System Using LPC2129", 2nd IEEE International Conference On Recent Trends in Electronics Information & Communication Technology (RTEICT), pp. 564-568, 2017, DOI: 10.1109/RTEICT.2017.8256660.

[15] 3. AfefMdhaffar, TarakChaari, Kaouthar Larbi, Mohamed Jmaiel, Bernd Freisleben, “IoTbased Health Monitoring via LoRaWAN”, IEEE EUROCON 2017 -17th International Conference on Smart Technologies, pp. 519-524, 2017, DOI: 10.1109/EUROCON.2017.8011165.

[16] KhinThet Wai, Nyan Phyo Aung, Lwin LwinHtay, “Internet of Things IoT Based Healthcare Monitoring System using NodeMCU and Arduino UNO”, International Journal of Trend in Scientific Research and Development–IJTSRD, ISSN: 2456-6470, Volume-3, Issue-5, pp.755-759, August 2019,https://doi.org/10.31142/ijtsrd26482.