IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

DESIGN THINKING BASED NON-INVASIVE MULTIPARA MONITORING SYSTEM FOR MEDICAL APPLICATIONS

Karthika A
Assistant Professor
Biomedical Engineering
SNS College of Technology
Coimbatore, India

Abhinand P S
Biomedical engineering
SNS College of technology
Coimbatore, India

Vysakh k
Biomedical engineering
SNS College of technology
Coimbatore, India

Sathyanath S H
Biomedical engineering
SNS College of technology
Coimbatore, India

Amal Chandran M
Biomedical engineering
SNS College of technology
Coimbatore, India

***Abstract* - Technology is important these days part of everyone's life. Healthcare may be similar Regulated by technology. At the hospital Patient health can be monitored through many senses a device that can connect to the Internet It helps to get regular patient information. The Internet of Things is acting as a catalyst for healthcare Plays an important role in a wide range of medical field applications.**

In this project, we created an IoT-based patient health monitoring system with ESP8266. Thing Speak is the IoT platform used in this project. Thing Speak is an open-source Internet of Items (IoT) application and API for storing and retrieving data from things via the Internet or a Local Area Network using the HTTP protocol. This IoT device may read the heart rate and assess the temperature around it. It continuously measures the pulse rate and ambient temperature and sends the data to an IoT platform

Key Words: IOT on the Platform of Things Talk, Health Monitoring System, Controller, Pulse Sensor, Temperature Sensor

I. INTRODUCTION

Healthcare technology is very popular in this pandemic situation because of coronavirus. Actually, health care technology is rapidly being revolutionized with the help of the Internet of Things (IoT). Monitoring the health status of a covid patient is a hard task because of our busy schedule and our daily work. Mostly, the elderly covid patients should be monitored periodically. So I thought to make an innovative system in this lockdown to automate the task.This device uses an ESP8266 webserver to track patient health using this monitoring system. Hence, patient health parameters such as body temperature, heart rate (BPM), blood oxygen levels (Sp02) as well as room temperature and humidity can be monitored from any device (like Smartphone, PC, Laptop, Smart TV) That support browsing capabilities.

In this project, we will learn how to build an ESP8266 based Patient Health Monitoring System. To measure Heart Rate/Pulse (BPM) and Blood Oxygen Level (SpO2), we use the MAX30100 pulse oximeter sensor. Similarly, to measure body Temperature, we use the DS18B20 temperature sensor. Meanwhile, the patient is inside the room. So we need to monitor room temperature and humidity level as well. We should keep them in a room with a certain temperature and Humidity level to not feel uncomfortable. Hence, we use the DHT22 Temperature & Humidity sensor.

II. EXISTING SYSTEM

In a hospital, either the nurse or the doctor must physically travel from one patient to the next for a health check, which may make it impossible to continuously monitor their conditions. As a result, any serious problems cannot be easily identified unless a nurse or doctor examines the person's health at the time. This could put a strain on doctors who are responsible for a large number of patients in the hospital. In addition, when a patient has a medical emergency, they are typically unconscious and unable to press an Emergency Alert Button. The IoT Based Patient Health Monitoring System utilizing ESP8266 is explained in this basic block diagram. BPM is measured by the Pulse Sensor, and environmental temperature is measured by the DS18B20 Temperature Sensor. The code is processed by the

ESP8266 and connects to WiFi and transfers data to a server for IoT devices. Thing speak is the IoT server in use here. Finally, by logging into the Thing speak channel from anywhere in the world, the data may be monitored. Sensor is capable of measuring the strain associated to the total axial forces in the range of approximately 4 times body weight with a good sensitivity and accuracy for events happening within 1s time window.

III. PROPOSED SYSTEM

Our technology continuously monitors the vital signs of the patient and detects any irregularities. Medical personal receive the monitored data. When the system detects irregularities, it sends a notification to the medical professionals. As a result, the necessity for manual monitoring by medical personnel is reduced.

Here discuss about the system architecture of our proposed system. In our proposed system we have used four sensors namely heart rate monitoring sensor (MAX30100), and body temperature sensor& Humidity Sensor (DS18B20&DSI8B20). According to power requirement of a particular sensor we have separate them .All the sensor including NodeMCU they required power supply between 1.8V to 3.5V. When the power is get ON each sensor is get initialized through NodeMCU . We have design our system in such a way that the data is get monitored in real time by using above three sensors. These monitored data is then sent to a IoT webpage .The communication between the NodeMCU and IoT web page is happen by using MQTT protocol. Then sensed data is get analyze in database and we get the desired output in the form of waveform. In database we have set the value between Normal to Critical condition. Further these data is get stored by using MySQL database for the future analysis. For the user friendly purpose we also created App by using Blynk application. So the patient can monitor or see the resulted data at home also and this Information is send to a doctors or nurses through the cloud in web application. If there is any emergency happen doctor can cooperate with patient through the Blynk app. As we know that the NodeMCU is a Wi-Fi as well as Bluetooth enabled device. So we can use our system in Indoor as well as in Outdoor applications.

IV. RELATED WORK

Modern health care system introduces new technologies like wearable devices or cloud of things. It provides flexibility in terms of recording patients monitored data and send it remotely via IOT. For this connection, there is need of secure data transmission. To transmit the data with privacy is the Moto of this paper. The proposed system introduces security of health care and cloud of things. System works in two major parts viz. storage stage and data retrieving stage. In storage stage, data is stored, updated for future use. In data retrieving stage, retrieve data from cloud. The cloud server can share with authenticated user as per request. A patient with wearable devices continually updates his record every 5 or 10 min. In emergency mode, it updates for every 1min.The wearied device will send results to phone using Bluetooth connection or NFC technology. This can able to give to cloud server using GSM and 3G.

At cloud server, each patient is defining with unique address. So, data at cloud can authenticate the right patient and provide the required request [1].Telemonitoring system via WBAN is evolving for the need for home based mobile health and personalized medicine. WBAN can able to collect the data acquired from sensor and record the output. This output results sent to controller wirelessly to health monitoring system. In this paper, Zigbee is used to in WBAN technology due to its guaranteed delay requirement for health telemonitoring system. Zigbee used in the communication [2].

Ayush Bansal, Sunil Kumar, Anurag Bajpai, Vijay N. Tiwari, Mithun Nayak, Shankar Venkatesan, Rangavittal Narayanan focuses on development of a system which is capable of detecting critical cardiac events. Using an advanced remote monitoring system to detect symptoms which lead to fatal cardiac events [3].

Hamid Al-Hamadi and Ing-Ray Chen gives trust-based health IOT protocol that considers risk classification, reliability trust, and loss of health probability as design dimensions for decision making. Comparative analysis of trust-based protocol and baseline protocols to check feasibility [4].

Muthuraman Thangaraj Pichaiah Punitha Ponmalar Subramanian Anuradha.”Digital hospital”term is introduced for hospital management. It enables automatic electronic medical records in standard. Also discusses with the implemented real-world scenario of smart autonomous hospital management with IOT [5].

V. COMPONENTS

S.N	Component Name	Description	Quantity
1	NodeMCU	ESP8266 12E Development Board	1
2	DS18B20 Sensor	DS18B20 One-Wire Waterproof Temperature Sensor	1
3	DHT22 Sensor	DHT22 Digital Humidity Temperature Sensor	1
4	Pulse Oximeter Sensor	MAX30100 I2C Pulse Oximeter Sensor	1
5	Jumper Wires	Male to Male Jumper Wires	8
6	Breadboard	Solderless Breadboard Mini	1

Table. 1: Component and specification

VI. SYSTEM AND OVERVIEW

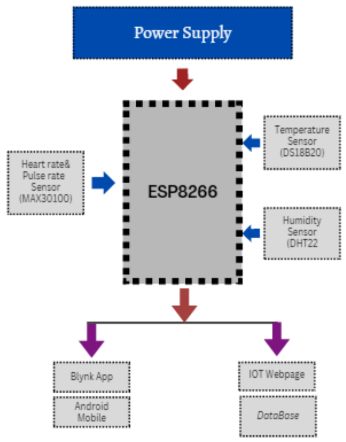

Fig. 1: Block Diagram of the System

Fig 1 shows the proposed system. The health monitoring sensors are used to collect health related data i.e. for data acquisition. Communication can be done by controller for sending data on internet wirelessly. Data processing has been done at server [6]. All data collected and aggregated at server point. To get health related information in understandable format it can be shown on web page i.e. Data management.

A. Objective

- To develop health monitoring system i.e. it Measures body temperature and heart rate.
- To design a system to store the patient data over a Period of time using cloud.
- To do analysis of collected data of sensors.

B. Detailed Description of Component

6.1 NodeMCU (ESP8266)

NodeMCU is an open source LUA based firmware developed for ESP8266 wi-fi chip. By exploring functionality with ESP8266 chip, NodeMCU firmware comes with ESP8266 Development board/kit i.e. NodeMCU Development board [7].

The NodeMCU is a micro controller with integrated Wi-Fi, which means that there is no need for an additional Wi-Fi chip set. The design of the SoC allows communication through the GPIOs by connecting to the Internet and transmitting data over the Internet. This is a perfect connection for the Internet of Things (IoT). It has a price of about Rs. 699 and it is depending upon retailer, with a physical size of 49 × 24.5 × 13 mm and consumes 0.00026–0.56 W of power [8].This is the best hardware around in terms of cost and this chip is the future of the IoT. Today, many retailers offer ESP8266 Breakout boards to facilitate our work. The NodeMCU is an easily usable board and it has a variety of pins. It has a USB connection port to connect to the computer.

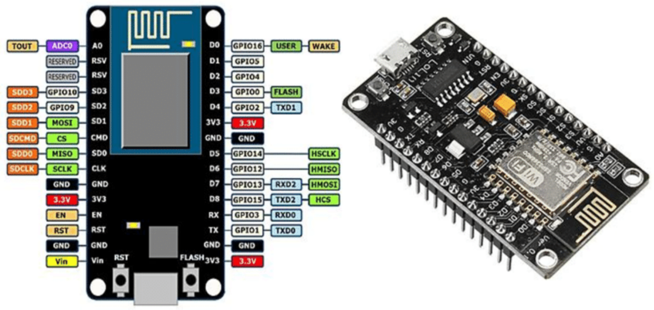

Fig. 2: NodeMCU ESP8266

6.2 MAX30100 Pulse Oximeter Sensor

MAX30100 is an integrated Pulse Oximetry and Heart Rate monitor sensor solution. It requires a 1.8V to 3.3V power supply to operate. Also, we can power it down through program code by decreasing its standby current and providing a power supply all the time. This oximeter sensor has two LEDs, photodetector optimized optics, and low-noise-analog signal processing to detect heart-rate signals [9].

The MAX30100 Pulse Oximeter has two built-in LEDs, in which one emits red light and the other emits infrared light. To measure pulse rate, only infrared light is required. But, both red light and infrared light are used to measure oxygen saturation (Sp02) levels in the blood. When the heart pumps the blood, there is more oxygenated blood and when the heart rests, the amount of oxygenated blood also gets decreased [10]. Hence, by knowing the time between the rise and fall of oxygenated blood, we determine the pulse rate.

Its major function is to read the absorption levels for both red light and infrared light sources and stored them in a buffer. Which can be read through I2C communication. Oxygenated blood absorbs more infrared light. So, it passes more red light. But, deoxygenated blood absorbs red light and passes more infrared light.

Fig. 3: MAX30100 Pulse Oximeter Sensor

6.3 DS18B20 One-Wire Waterproof Temperature Sensor

This is a pre-wired and waterproof version of the DS18B20 sensor. This sensor is useful for measuring temperature from -55°C to 125°C (-67°F to +257°F) even in wet conditions. It has a long wire, so it's useful when a patient is a little far. Actually, the cable of this sensor is jacketed in PVC.

DS18B20 is a digital sensor, so there is no signal degradation in long distances. It is fairly precise, i.e. ±0.5°C over much of the range. This sensor works great with any microcontroller using a single digital pin. The downside is it uses the Dallas 1-Wire protocol, which is complex and requires a bunch of code to communicate [11].

Fig. 3: DS18B20 One-Wire Waterproof Temperature Sensor

6.4 DHT22 Digital Humidity Temperature Sensor

The DHT22 is a simple, ultra-low-cost digital temperature & humidity sensor. DHT22 uses a capacitive humidity sensor and a thermistor to measure the surrounding temperature and humidity. It sends data in digital signal form so no analogue input pin is required.

Fig. 4: DHT22 Digital Humidity Temperature Sensor

VII. APPLICATIONS

The Internet of things based health monitoring system has following applications.

- It can be used by doctors to monitor the temperature of the patient by reducing the chances of diseases transfer with help clinical thermometer.
- It can be used to monitor the temperature of patient with more accuracy.
- It can be used by patient to monitor the pluses of heart beats.
- It can also be used by head of the ward of hospital to transfer information of patient to the concern doctor via SMS or through internet.
- It can be also used by ambulance automobiles to transfer information of patient on the way to the emergency ward of concern hospital.
- It can also be used by laboratory technician to monitor and diagnose the tests of concern disease [12].

VIII. CIRCUIT DIAGRAM AND CONNECTIONS

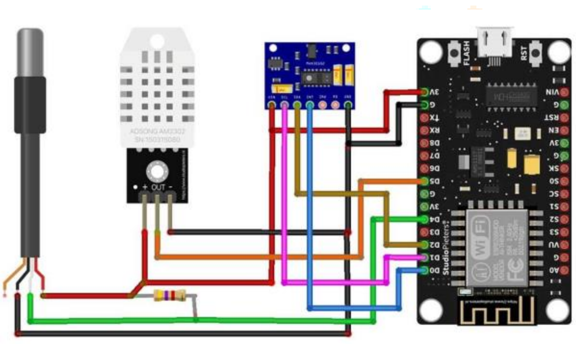

Fig. 5: Circuit Diagram

MAX30100 Pins	NodeMCU ESP8266 Pins
SDA	D2
SCL	D1
INT	D0
VCC	3.3V
GND	GND

Table. 2: Interfacing of MAX30100 with NodeMCU

DS18B20 Pins	NodeMCU ESP8266 Pins
VCC	3.3V
GND	GND
Signal	D4

Table. 3: Interfacing of DS18B20 with NodeMCU

DHT22 Pins	NodeMCU ESP8266 Pins
VCC	3.3V
GND	GND
Signal	D5

Table. 4: Interfacing of DHT22 with NodeMCU

IX. RESULTS

9.1 Hardware setup

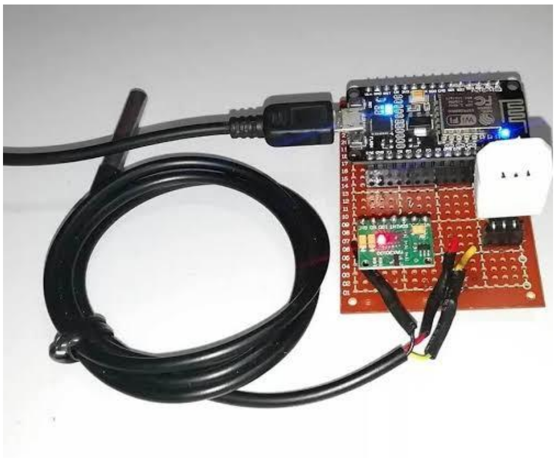

Fig. 6: Hardware Setup

9.2 Arduino ide

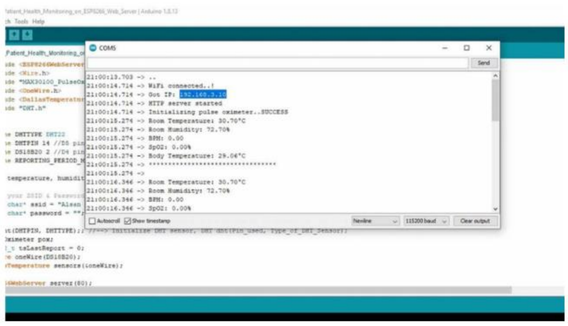

Fig. 7: Arduino ide with COMS port Enabled

Once the code is uploaded to your NodeMCU ESP8266 board, you can open the serial monitor to see the program into action. The NodeMCU ESP8266 will connect to your Wi-Fi Network. Once connected, it will display the ESP8266 IP Address.

Now, copy the ESP8266 IP Address and paste it on your Web Browser. It will display the room temperature, room humidity, Heart Rate, Blood Oxygen Level, and body temperature

9.3 Output

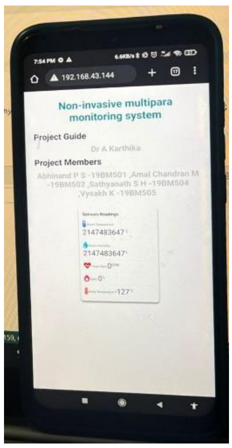

Fig. 8: Sensor Output in Smartphone

X. CONCLUSION

Internet of the things has great importance, not only to monitor the health related problems but also transfer information of the patient to doctors. Internet of the things reduce the burden of doctor as well as the burden family member for the routine checkup of a patient. More importantly, it can reduce the chances of other fetal diseases spread from person to person in ward such as HBs [13]. It can also reduce the time wasting of the patient and doctor for routine checkup.

A wireless health monitoring system has been presented in this work. By referring the system, the healthcare professionals can monitor, diagnose, and guide their patients all the time. The physiological data are stored and published online. Hence, the healthcare professional can monitor their patients from a foreign location at any time. Our system is simple [14]. This system is just few wires connected to a small kit with a smartphone. The system is very power efficient. It is reliable to use, fast, accurate, and high efficiency. Finally, the reliability and validity of our system are ensured via field tests. During field test it show that our system can produce medical data that readings are same as values produced by the existing medical equipment.

XI. REFERENCES

[1] Shivleela Patil, Dr. Sanjay Pardeshi "Health Monitoring system using IoT"IRJET-V514375, Sangli,India on 2018.

[2] Ebrahim Al Alkeem1, Dina Shehada1, Chan Yeob Yeun1,M. Jamal Zemerly ,Jiankun Hu "New secure healthcare system using cloud of things", Springer Science+Business Media New York 2017Yeun1,M. Jamal Zemerly ,Jiankun Hu "New secure".

[3] Afef Mdhaffar, Tarak Chaari , Kaouthar Larbi, Mohamed Jmaiel and Bernd Freisleben "IoT-based Health Monitoring via LoRaWAN", IEEE EUROCON 2017.

[4] S. M. Riazul islam, Daehan kwak, MD. Humaun kabir, Mahmud hossain, and Kyung-sup kwak,"The Internet of Things for Health Care:A Comprehensive Survey" , DOI 10.1109/TDSC.2015.2406699, IEEE Transactions Andrzejowski, P.; Giannoudis, P.V. The 'diamond concept' for long bone non-union management. J. Orthop. Traumatol. 2019.

[5] Muthuraman Thangaraj Pichaiah Punitha Ponmalar Subramanian Anuradha, "Internet Of Things (IOT) Enabled Smart Autonomous Hospital Management System – A Real World Health Care Use Case with the Technology Drivers", 2015 IEEE International Conference on Computational Intelligence and Computing Research. A.Jeethendria1, S.Senthilmuguran, Monitoring Human Joint Movement Using Wearable Computing, vol 3, April 2014.

[6] S. J. Jung and W. Y. Chung, "Flexible and scalablen patient's health monitoring system in 6LoWPAN," Sensor Lett., vol. 9, no. 2, pp. 778–785, Apr. 2011.

[7] Z. Wan, Y. Song, and Z. Cao, "Environment Dynamic Monitoring and Remote Control of Greenhouse with ESP8266.

[8] M. Medina-De-La-Cruz and A. Mujaico-Mariano, "Implementation of a System for the Evaluation of Environmental Factors that Use the Internet of Things," in 2018 IEEE Sciences and Humanities International Research Conference (SHIRCON), Lima, 2018, pp. 1–4. (ITNEC), Chengdu, China, 2019, pp. 377–382.

[9] I. Chiuchisan, I. Chiuchisan, M. Dimian, and U. Street, "Internet of Things for E-Health: An Approach to Medical Applications," in Computational

[10] Anbumani.S1, Kavin.R2, Saranya.A3, Dineshkumar.T4, Premkumar.R5, "An Intelligent Patient Tele-Monitoring System Using Android Technology",International Journal of Research in Engineering and Technology, Vol.4, Issue 02, pp.477-482, 02 Feb-2015

[11] Vishesh Pamadi and Bradford G. Nickerson, "Getting Started With 1-Wire Bus Devices", TR15-235, University of New Brunswick Fredericton, N.B. E3B 5A3 Canada August 25, 2015.

[12] S. H. Almotiri, M. A. Khan, and M. A. Alghamdi, "Mobile health (m-health) system in the context of IoT," in Proc. IEEE Int. Conf. Future Internet Things Cloud Workshops, Vienna, Austria, 2016, pp. 39–42.

[13] W. A. Jabbar et al., "Design and Fabrication of Smart Home With Internet of Things Enabled Automation System," IEEE Access, vol. 7, pp. 144059–144074, 2019.

[14] L. C. S. Paavan, T. G. Sai, and M. K. Naga, "An IoT based Smart Garbage Alert System," in 2019 3rd International Conference on Trends in Electronics and Informatics (ICOEI), Tirunelveli, India, 2019, pp. 425–430.Informatics (ICACCI), Udupi, 2017, pp. 431–436.