Journal of Neonatal Surgery
ISSN(Online): 2226-0439
Vol. 14, Issue 16s (2025)
https://www.jneonatalsurg.com

OPEN ACCESS

Smart Health Monitoring System Based On Internet Of Things

Senthur N. S[*1], Vanathi A[*2], T. Livingston[3], Gavya[4], Dr. K Srinivas Rao[5]

[1]Department of Mechanical Engineering, PSN Engineering College, India.

[2]Department of Computer Science, and Engineering, Aditya University, Surampalem, India.

[3]Department of Mechanical Engineering, PSN Engineering College, Tirunelveli

[4]Department of computer science, Vellore institute of technology, Chennai, India.

Email ID: gavya.g.m@gmail.com

[5]Department of Computer Science and Engineering, MLR Institute of Technology, Hyderabad, Telangana, India

Email ID: ksreenu2k@gmail.com

***Corresponding Author:**

Email ID: senthur.ns@gmail.com,

Email ID: vanathi.andiran@adityauniversity.in

Cite this paper as: Senthur N. S, T. Livingston, Vanathi A, Gavya, Dr. K Srinivas Rao, (2025) Smart Health Monitoring System Based On Internet Of Things. *Journal of Neonatal Surgery*, 14 (16s), 96-103.

ABSTRACT

The design and construction of an Internet of Things (IoT)-based health monitoring system is presented in this study. This study looks at a comprehensive health monitoring system that is used to track a patient's several health indicators in real time. The research consists of several health monitoring sensors that helps the Doctors and Paramedical staff to monitor the patient efficiently and reduce the time of the health in charges. The Design consists of Pulse oximeter sensors, Body temperature monitoring sensor and Respiratory monitor sensor to monitor the health efficiently. The signal from the pulse oximeter sensor, Body temperature monitoring sensor and Respiratory monitor sensor are collected and the data are transferred to the mobile device via the ESP 32 WIFI module with the help of Arduino UNO. The collected data can also monitor through LCD display and the graphical representation of the reading are displayed via Thing Speak IoT software. The topic of this study is effective patient and senior citizen monitoring. This technology allows for the monitoring of the patient's temperature, blood oxygen level (SpO2), pulse rate, and breathing pattern.

This study introduces an Internet of Things-based solution that will make it easier and less expensive to use a medical gadget that would otherwise be difficult to use while at home. Every measurement used to ascertain the patient's health parameters has a 95% confidence interval with a maximum relative error of 5%. The general public's employment of these technologies as support aids in a particular circumstance may significantly affect their own life.

Keywords: *Pulse oximeter, Body temperature sensor, Respiratory module*

1. INTRODUCTION

Currently, healthcare professionals are utilizing technological resources to expand their concepts. IoT devicesare extensively employed in the healthcare sector[1]. An Internet of Things-based health monitoring system is the subject of this article. When it comes to COVID-19, high blood pressure, hypertension, and diabetes, among other conditions, there are less medical experts in rural regions than in metropolitan ones [12]. Except for government institutions, there is also a shortage of medical equipment in rural areas. Although the number of patients at these clinics is larger, they are underequipped.

Consequently, in case of emergencies, this hardware component transmits reports promptly to doctors ormedical specialists, who then act based on the information provided.

The IoT health-monitoring platform has greatly contributed to the advancement of modern medicine, as it is extensively used in the medical industry. This technology involves a patient health monitoring system that employs IoTand sensors to record the patient's temperature, heart rate, andoxygen saturation level[9].

The recorded data is displayed on an internet page. The system consists of three layers: application, logical, and physical. It is a multiparameter monitoring device capable ofsimultaneously tracking temperature, heart rate, and oxygen saturation level[10]. Heart rate is an important indicator of one's health, reflecting the heart's contractions per minute. Heart rate varies depending on activity, security risks, and emotional responses. Resting pulse refers to the heart rate when a person is at ease, which should typically range between 60 and 100 beats per minute for individuals above theage of ten. The heartbeat can change due to factors such as exercise, age, and certain medical conditions. It is crucial to monitor heartbeats in real-time, especially for patients with chronic illnesses and those affected by COVID-19. Oxygen levels in the blood are also significant, and low oxygen levelsmay indicate the need for treatment. Pulse oximetry measuresthe haemoglobin content in the blood to assess oxygen saturation levels. Normal SpO2 levels for humans are usuallyabove 95%[3].

Continuous monitoring of SpO2 is necessary for individuals with chronic lung diseases or sleep apnea. Body temperature is another important parameter, particularly for individuals with illnesses like COVID-19[13]. Continuous monitoring of body temperature is essential. IoT-based healthmonitoring systems have made it convenient for users to obtain vital physiological information from home. Elderly patients, in particular, benefit from this system, as it eliminates the need for them to travel long distances to hospitals[12]. Various research studies have explored IoT-based patient monitoring systems using different sensors and microcontrollers to detect and evaluate vital signs such as body temperature, heart rate, and respiratory rate. The goal isto develop an accurate and cost-effective system that can be easily accessible to all age groups, particularly those in ruralareas with limited healthcare facilities. This system will aid inmonitoring and managing health conditions, especially duringcritical periods such as the COVID-19 pandemic.

2. METHODOLOGY

The main aim of this experiment is to build a complete health monitoring system with maximum uses. The setup consists of three health monitoring sensors namely, Pulse oximeter, Body temperature and respiratory module.

A. Components Used

TABLE I. COMPONENTS USED

S No	Components	No of ComponentsUsed
1	Pulse oximeter sensor (MAX30100)	1
2	Body temperature sensor(MLX90614)	1
3	Sound sensor (LM323)	1
4	Ardiuno Uno	1
5	ESP 32 Wroom	1
6	16x2 Liquid Crystal Display	1

The components show in Table 1 are used in Smart Healthmonitoring system.

Pulse Oximeter Sensor

Pulse oximeter sensor used to measure Heart beat rate andBlood oxygen level. MAX30100 is the sensor are used in thesmart health monitoring system.

Body Temperature Sensor

The sensor used to observe the temperature is contactlessinfra-red temperature sensor. The sensor used here is MLX90614. Body temperature sensor is used to record the temperature of the person in regular interval.

Sound Sensor

Sound sensor used to record the breath pattern of the patient. Sound sensor is placed inside the Respiratory moduleshows in figure 1. LM323 is the sensor used to record the sound pattern of the breathing.

Fig. 1. Respiratory Module used in Smart health monitoring System

Arduino Uno

Arduino Uno is the microprocessor use to process the sensor. Arduino Uno is converting the observed signals of thesensors into readings.

ESP 32 Wroom

ESP-32 Wroom MCU Module provide wirelessconnectivity between sensors and smart device.

16x2 Liquid Crystal Display

16z2 LCD is used to show the results of the data collectedfrom the sensors.

Experimental Setup

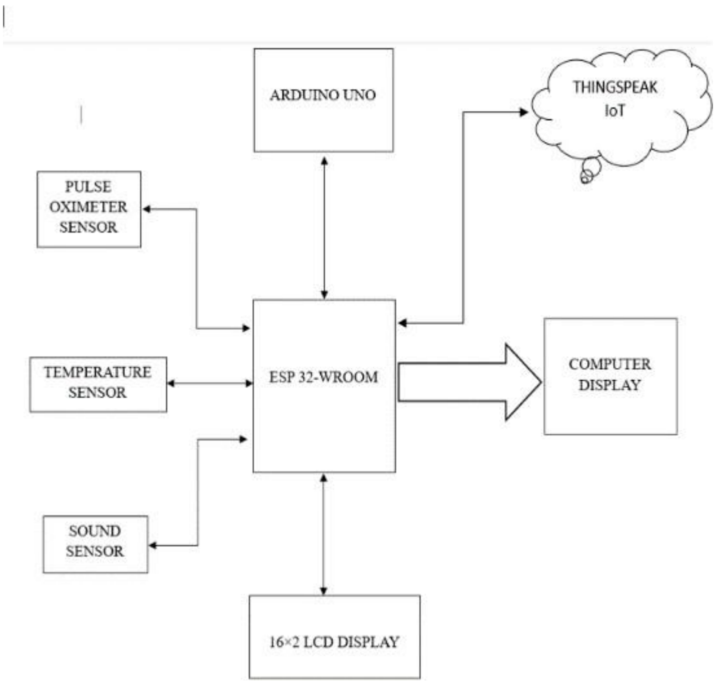


Fig. 2. Block diagram of Health Monitoring system

The above figure 2 shows the connections made in smart health monitoring system. The observed signals of the three sensors are transmitted and processed through Arduino Uno and ESP-32 Wroom and the readings shows in both LCD display and ThingSpeak IoT open software.

3. WORKING

A. Circuit Interface

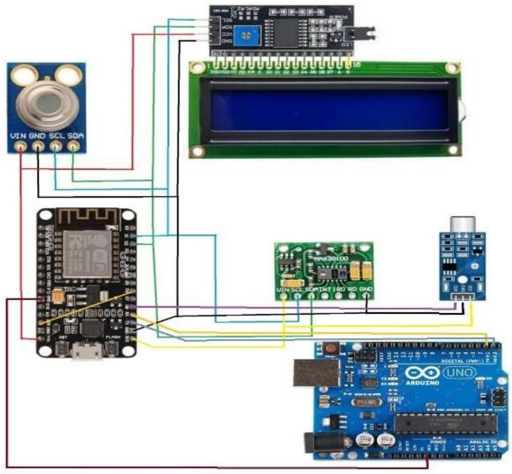


Fig. 3. Interfacing of Smart Health Monitoring System

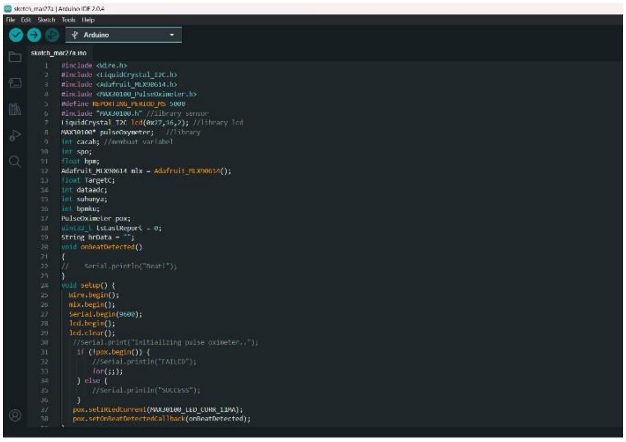


Fig. 4. Arduino Serial Monitoring

4. RESULTS AND DISCUSSION

A. Data Visualization in 16x2 Liquid Crystal Display

The data are explained from top left corner to bottom right corner. **T** represents the temperature; **S** represent Sound signal observed from the respiratory module. 1 means yes and 0 means no, **P** represents pulse level and **O2** represents the Blood oxygen level. The LCD shows in figure 5. .LCD is used for quick analysis of the patient health level.

Fig. 5. LCD Data Visualization

B. ThinkSpeak IoT Visualization

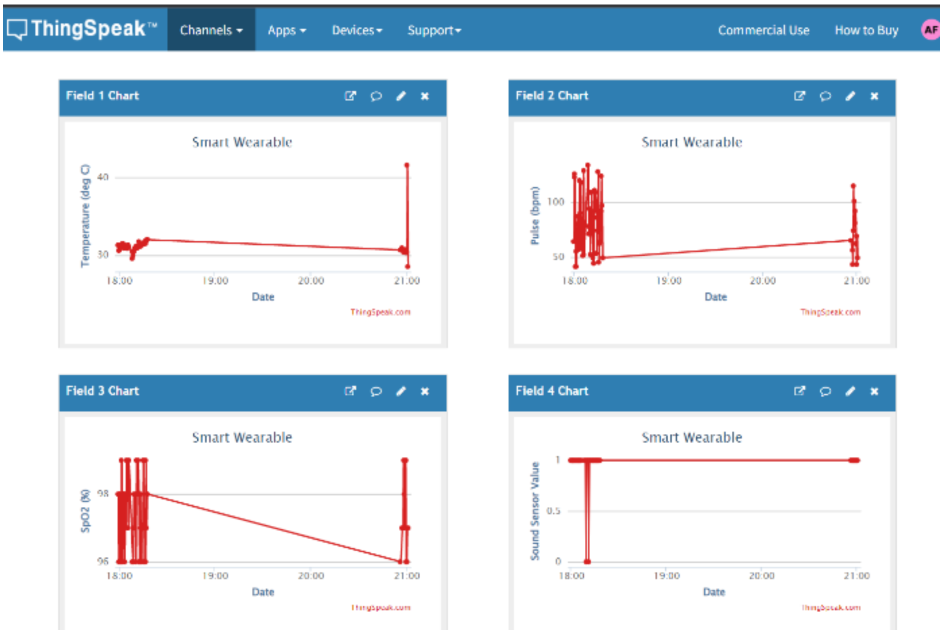


Fig. 6. ThinkSpeak IoT Data Visualization

The above figure 6, represents 4 different data and the data are represented in time intervals with graphical representation. The top left represents Temperature, Top right represents the pulse, bottom left represents the Spo2 level and the Bottom right represent respiratory readings.

For more detail observation data, we can observe results separately. Figure 7,8,9 & 10 represents the separate data of data from ThinkSpeak IoT.

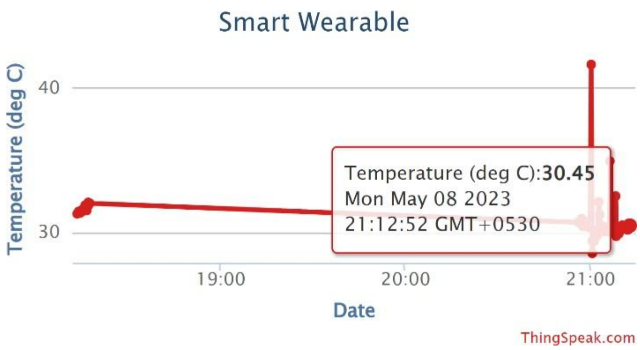


Fig. 7. Temperature Observed in 9.12 PM

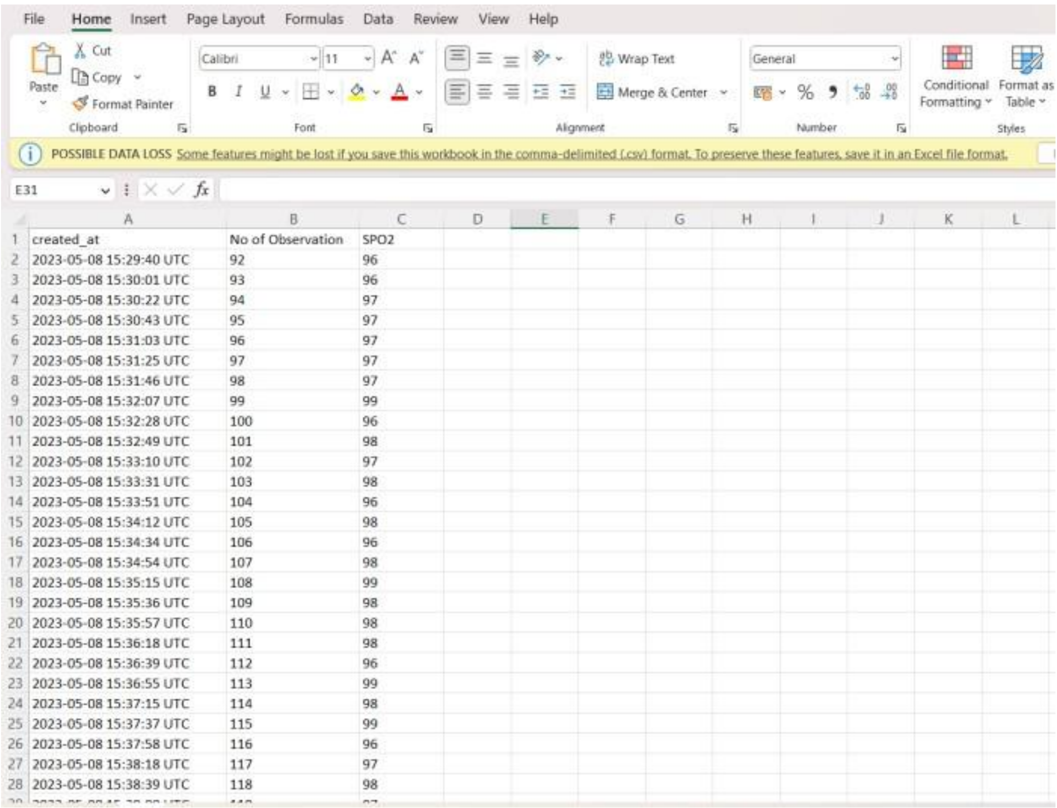
Fig. 8. Breath Observed in 9.13 PM

Fig. 9. Pulse Observed in 9.00 PM

Fig. 10. SPO2 Observed in 9.02 PM

Excel Sheet Data Visualization

The observed data from the sensor are shown in Excel format in ThingSpeak IoT.



	created_at	No of Observation	SPO2
2	2023-05-08 15:29:40 UTC	92	96
3	2023-05-08 15:30:01 UTC	93	96
4	2023-05-08 15:30:22 UTC	94	97
5	2023-05-08 15:30:43 UTC	95	97
6	2023-05-08 15:31:03 UTC	96	97
7	2023-05-08 15:31:25 UTC	97	97
8	2023-05-08 15:31:46 UTC	98	97
9	2023-05-08 15:32:07 UTC	99	99
10	2023-05-08 15:32:28 UTC	100	96
11	2023-05-08 15:32:49 UTC	101	98
12	2023-05-08 15:33:10 UTC	102	97
13	2023-05-08 15:33:31 UTC	103	98
14	2023-05-08 15:33:51 UTC	104	96
15	2023-05-08 15:34:12 UTC	105	98
16	2023-05-08 15:34:34 UTC	106	96
17	2023-05-08 15:34:54 UTC	107	98
18	2023-05-08 15:35:15 UTC	108	99
19	2023-05-08 15:35:36 UTC	109	98
20	2023-05-08 15:35:57 UTC	110	98
21	2023-05-08 15:36:18 UTC	111	98
22	2023-05-08 15:36:39 UTC	112	96
23	2023-05-08 15:36:55 UTC	113	99
24	2023-05-08 15:37:15 UTC	114	98
25	2023-05-08 15:37:37 UTC	115	99
26	2023-05-08 15:37:58 UTC	116	96
27	2023-05-08 15:38:18 UTC	117	97
28	2023-05-08 15:38:39 UTC	118	98

Fig. 11. Excel Sheet Data Visualization

Figure 11 shows the excel sheet data of SPO2 levels. Thedata are given with the time interval and date where the dataare collected.

Fabricated Product

Figure 12 shows, the smart health monitoring system based on Internet of Things (IoT) technology has been thoroughly tested for accuracy and data transfer. It utilizes Wi- Fi connectivity to seamlessly transmit data from themonitoring module to the cloud. The system focuses on the development of the module, which serve as the final productfor health monitoring. These modules are designed to be monitor health at any time, ensuring accurate readings and enabling data monitoring and transfer without requiring highly technical personnel, as often seen in hospitals.

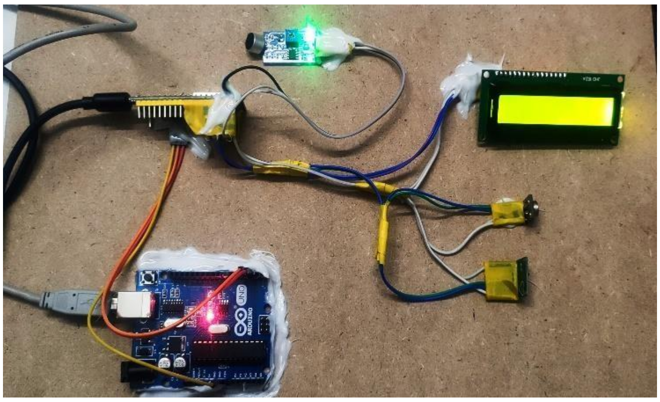


Fig. 12. Top View of Smart Health Monitoring System

The system incorporates a separate lithium-ion battery that powers the entire setup. This power source enables the sensorsto capture readings at regular intervals and transfer them to thesoftware responsible for updating and managing the data. By utilizing Wi-Fi, the system ensures secure and efficient data transmission to the cloud, where it can be stored, accessed, and analyzed.

E. Arduino Serial Monitoring

The uploaded coding successfully to both Arduino UNO and ESP 32-WROOM. Figure 4 represents the Serial monitor;we will see our both Arduino UNO and ESP 32-WROOM connected to the programmed WIFI and allocated with an IPaddress. Then initiated MQTT reference to ThingSpeak IoT cloud and 22 connected thereto. Then it started publishing Heartrate, percentage of oxygen saturation SPo2 data, Temperature of the body and detect the breathing pattern of the person to the ThingSpeak IoT platform.

Now the reading can be seen both in LCD and a graphicalrepresentation of the data of patient health and other data areshown via Thing Speak IoT

5. CONCLUSION

Healthcare monitoring devices are currently available in the market at exorbitant prices. However, this research offersa solution that eliminates the need for frequent manual healthmonitoring. The research employs various sensors to collect crucial health data from patients. A pulse oximeter sensor measures the pulse level and oxygen level in the blood, whilea temperature sensor gathers patient data at regular intervals.Additionally, a respiratory module observes the breathing pattern of the patient. As a result, this research provides an elegant and efficient method for monitoring the health of patients.

In summary, the IoT-based health monitoring systemdescribed above offers a convenient and accurate solution formonitoring health. The module, with their ability to provide continuous and reliable readings, along with the dedicated lithium-ion battery and Wi-Fi connectivity, eliminate the needfor manual intervention and enable seamless data transfer forefficient monitoring and analysis.

6. ACKNOWLEDGMENT

The authors sincerely thank our PSN Engineering college For facilitating the laboratory and equipment to carry out the experimental research.

REFERENCES

[1] K. Revathi, T. Tamilselvi, G. Gomathi, and R. Divya, "IoT Based Pulse Oximeter for Remote Health Assessment: Design, Challenges and Futuristic Scope", FP-IJEER, Vol 10, Issue 3, pp 557-56.

[2] U. Ganesan, N.E.E.Paul,G.H. Krishnan, S.Aarthi, I.K.Swamy, "Detecting Diabetes Mellitus from Tongue Image Hybrid Features and Neural Network Classifier", Proceedings of 4th International Conference on Cybernetics, Cognition and Machine Learning Applications, ICCCMLA2022, 2022, pp.425-427.

[3] Kakumanu Vamsi Sree Sai Ganesh, S.P. Shibu Jeyanth and A. Ruhan Bevi," IOT based portable heart rate and SpO2 pulse oximeter", hardware, Vol 11, April 2022.

[4] Safayat Reza Anan, Md. Azizul Hossain, Md. Zubayer Milky, Mohammad Monirujjaman Khan,Mehedi Masudand Sultan Aljahdali, "Research and Development of an IoT-Based Remote Asthma Patient Monitoring System", J. Healthc. Eng., Vol 2021, Nov. 2021.

[5] Muhibul Haque Bhuyan and Mashuk Sheikh, "Designing, Implementing, and Testing of a Microcontroller and IoT-based Pulse Oximeter Device", IOSR-JEEE, Vol 16, Issue 5, pp 38-48, October 2021.

[6] Jian Qiao, Zhendong Zhang and Enqing Chen,"Optimization of IoT- Based Motion Intelligence Monitoring System", Complexity, Vol 2021, April 2021.

[7] Bikash Pradhan, Saugat Bhattacharyya and Kunal Pal,"IoT-Based Applications in Healthcare Devices", J. Healthc. Eng., Vol 2021, March2021.

[8] Ika Noer Syamsiana and Nur Anis Agustina, "Designing IoT-Based Independent Pulse Oximetry Kit as an Early Detection Tool for Covid-19 Symptoms", 3rd IC2IE, pp 443-448.

[9] T.Mohanraj, B.Arun kumar, S.Shahu lHammed, R.Santhosh, "A Review on Internet of Things (IoT) Based Pulse Rate, Blood Pressure, Body Temperature Monitoring System, I-SMAC, pp 78- 79, November 2020.

[10] Mian Mujtaba Ali, Shyqyri Haxha, Munna M. Alam, Chike Nwibor and Mohamed Sakel, "Design of Internet of Things (IoT) and Android Based LowCost Health Monitoring Embedded System Wearable Sensor for Measuring SpO2, Heart Rate and Body Temperature Simultaneously", Wirel. Pers. Commun., Vol 111, Issue 4, pp 2449– 2463, December 2019.

[11] A.Von Chong, M.Terosiet, A.Histace and O.Romain," Towards a novel single-LED pulse oximeter based on a multispectral sensor for IoT applications", Microelectronics J., Vol 88, pp. 128- 136, 2019.

[12] Mohd. Hamim, Sumit Paul, Syed Iqramul Hoque, Md. Nafiur Rahman and Ifat-Al-Baqee, "IoT Based Remote Health Monitoring System for Patients and Elderly People", ICREST, pp 533-538, February 2019.

[13] Kovuru Chandu Chowdary, K.Lokesh Krishna, K.Lalu Prasad and K.Thejesh, "An Efficient Wireless Health Monitoring System", I- SMAC 2018, pp 373-377, Feburary 2019.

[14] Uyang Xie, Yongjie Gao, Yuchun Li, Yu Lu and Weixi Li,"Development of Wearable Pulse Oximeter Based on Internet of Things and Signal Processing Techniques", EMS 2017, pp 249-254, May 2018.

[15] R.R. Adiputra, S. Hadiyoso and Y. Sun Hariyani, "Internet of Things: Low Cost and Wearable SpO2 Device for Health Monitoring", Int. J. Electr. Comput. Eng. Syst., Vol 8, No 2, pp 939-945, Aprill 2018