

IoT based E-Health Monitoring and Room Environment Controlling System

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Abstract - The Health care monitoring systems has emerged joined of the foremost very important system and have become technology familiarized from the past decade. Health care is given the acute importance currently from most days by every country with the advent of the novel corona virus. Thus during this facet, an IOT based mostly health monitoring system is the best resolution for such a pestilence. IOT monitoring or observance of health provides a state of mobility to urge a proper diagnosis of health, albeit the doctor is at far distance. IOT is the advanced network infrastructure of property, transportation and technology. IOT based devices will implement the facilities of remote health monitoring system. So, we've got set to implement a web of things based mostly health care project which has observance moreover as monitoring system. The answer is given for measuring of body parameters like Temperature, heart rate and SPO2 rate of a patient and additionally providing a controlling system which can manage or we can say control the area surroundings parameters like Temperature, Humidity, Toxicity. In this project, we have a tendency to victimization completely different sensors and different modules for acting a unique variety of functions, and this method will generate an alert once, it needed which means at the time of any crucial conditions.

Key Words: IOT Based, Monitoring System, Controlling System, Sensors

1. INTRODUCTION

Health is usually a serious concern in each human being's growth where the humanity is advancing in terms of technology. Just like the recent corona virus attack that has ruined the economy of whole world however health care has become a major importance. In such areas wherever the epidemic is unfold, it's forever a stronger plan to monitor these patients exploitation with the help of remote health monitoring technology. Thus IOT based mostly health monitoring and controlling system is the current answer for it. Remote Patient monitoring arrangement empowers observation of patients outside of customary clinical settings (e.g. at home).

The core objective of this project is that the style and implementation of a sensible patient health monitoring and controlling system that uses sensors to trace patient health on remote location and all the examined data will be shown in a easy user interface web page so that care taker will act accordingly. The objective of developing monitoring and controlling system is to give a state of portability for any patient to diagnose patient's health even if the doctor or consultant is at far distance and also controlling the room environment where the patient is kept in absence of care taker. Every of our bodies utilizes temperature, pulse and SPO2 rate acknowledging to examine understanding well being. The sensors are coupled to a micro-controller NODEMCU ESP8266 to trace the status which is interfaced to a alphanumeric display screen. If the framework finds any drastic changes in understanding pulse rate or vital sign such as temperature or SPO2 rate in blood, the framework consequently alarms the consultant concerning the patients status over IOT and moreover indicates delicate elements of pulse and temperature of patient with the help of internet.

Another main element of the proposed system is room environment controlling system in which room environment constituents such as temperature, humidity and toxicity can be controlled according to patients health care situation. The room environment system comprises of temperature, humidity and air quality sensor which will be using for sensing the constituents of the room and if the constituents exceeds or lower then the usual limits then controlling system will gets active and and it will control all the constituents with the help of humidifier, exhaust fan, etc. connected to the system for controlling purpose.

2. OBJECTIVES

1. To make health monitoring very portable as it shows all required examined data on the go using internet, it reduces the workload of patient and can do checkup on regular basis.

2. To make patient experience better by as connected the health care system through IOT, doctor can do betterment in diagnosis accuracy as they are getting all the examined patient data at their workplace readily. It allows doctors to monitor a patient continuously and remotely.
3. It will give reduce costs for patient as they are not required to visit their consultants or doctors on regular basis.
4. For old aged people it is not possible to visit their consultant or doctor at such physical condition and most of the old aged people prefer to stay home with their dear ones rather than visiting to hospitals. Our project will help old aged group effectively.
5. This project is very useful for patient in coma and ICU patients for continuously monitoring.

3. LITERATURE REVIEW

| Title of Paper | Details of Publication with Date and Year | Literature Identified for Project |
|--|--|---|
| <p>A SMART PATIENT HEALTH MONITORING SYSTEM USING IOT</p> | <p>International Journal Of Pure and Applied Mathematics.</p> <p>Year of publication : 2018</p> <p>Authors : C.Senthamilarasi, J.Jansi Rani, B.Vidhya, H.Aritha.</p> | <p>The health care monitoring systems has emerged as one of the most vital system and became technology oriented from the past decade. Humans are facing a problem of unexpected death due to various illness which is because of lack of medical care to the patients at right time. The primary goal was to develop a reliable patient monitoring system using IOT so that the health care professionals can monitor their patients, who are either hospitalized or at home using an IOT based integrated health care system with the view of ensuring patients are cared for better. A mobile device based wireless health care monitoring system was developed which can provide real time online information about physiological conditions of a patient mainly consists of sensors, the data acquisition unit, micro-controller (i.e., Arduino), and programmed with a software (i.e., JAVA). The patient’s temperature, heart beat rate, EEG data are monitored, displayed and stored by the system and sent to the doctor’s mobile containing the application. Thus, IOT based patient monitoring system effectively monitor patient’s health status and save life on time.</p> |
| <p>A SECURE IOT BASED HEALTHCARE SYSTEM WITH BODY SENSOR NETWORKS</p> | <p>IEEE ACCESS</p> <p>Year of publication : December, 2016</p> <p>Authors : KUO-HEI YEH (Senior Member, IEEE)</p> | <p>The ever-increasing advancement in communication technologies of modern smart objects brings with it a new era of application development for Internet of Things (IoT)-based networks. In particular, owing to the contact less nature and efficiency of the data retrieval of mobile smart objects, such as wearable equipment or tailored bio-sensors, several innovative types of health care systems with body sensor networks (BSN) have been proposed. In this paper, we introduce a secure IOT based health care system, which operates through the BSN architecture. To simultaneously achieve system efficiency and robustness of transmission within public IOT based communication networks, we utilize robust crypto primitives to construct two communication mechanisms for ensuring transmission confidentiality and providing entity authentication among smart objects, the local processing unit and the back end BSN server. Moreover, we realize the implementation of the proposed health care system</p> |

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| | | with the Raspberry PI platform to demonstrate the practicability and feasibility of the presented mechanisms. |
| IMPLEMENTATION OF CLOUD-ASSISTED SECURE DATA TRANSMISSION IN WBAN FOR HEALTH-CARE MONITORING | <p>Springer Link Conference paper</p> <p>Year of publication : April 2018</p> <p>Authors : Sohail Saif, Rajni Gupta, Suparna Biswas</p> | <p>This work presents the cloud-assisted secure WBAN for health care application. There are various security issues associated with WBAN, which need to be solved to provide a secure real-time health monitoring system. Through this implementation, the patient's vital signals can be accessed in a secure manner in real time remotely by sensors and networks without visiting doctor's clinic or hospital. Here, we provide the cost-effective solution for the transmission of the patient's health data to doctor with proper confidentiality, authenticity, freshness, and security using cloud computing. In this work, the bio signals of patients and doctors are used to provide authenticity and vital signals are encrypted by using Advanced Encryption Standard (AES) for the secure m-health application. We have experimentally analyzed the average end-to-end delay for secure health care application is 14.59 and 19.31 ms in off-peak hours and peak hours respectively.</p> |
| A FRAMEWORK FOR MONITORING OF DEPRESSION PATIENT USING WBAN | <p>Research Gate Conference paper</p> <p>Year of publication : March 2016</p> <p>Authors : Suparna Biswas, Jatia Saha, Chandreyee Chowdhury</p> | <p>Wireless Body Area Networks consist of low power lightweight wearable and/or implantable sensor nodes that are often placed remotely for applications like ubiquitous health care, military, sports, entertainment and many other areas. Depression is becoming a common problem in human beings. In this paper the proposed work presents a framework to monitor the depression patient with the help of their daily physical activities, posture movement, location detection, behavioral changes, and significant biomedical parameter changes using WBAN sensors. It monitors the patient, generates alarm and notifies the caregiver if any abnormal situation occurs.</p> |

Table -1: Literature Review

4. RESEARCH GAP IDENTIFIED FROM LITERATURE REVIEW

- (1) In previous IOT based e-health care management system the system was always limited to examination of two to three important vital parameters.
- (2) Along with this parameters such as toxicity of room, air quality of room, etc is also measured which is not important to measure as it is already required to maintain the room well cleaned and sanitized where the patient is admitted.
- (3) So the justification for measuring such parameters like toxicity of room, air quality of room, etc is not valid.
- (4) GPS is also included in healthcare management systems for finding the patients location whereas there is no need for GPS system as patient will always stay at one place prior to his health concern suggested by consultant.
- (5) By adding much features such as SMS alert, email alerts, etc. complexity of system will increase and it will lead to either system failure or hardware failure.

(6) There are no such designs which will operate combinations of important vital parameters such as oximetry rate, heart rate, body temperature, etc. and also no easy platforms for viewing the results. There are also no such designs with controlling the room environment alongside with monitoring of patient.

5. COMPONENTS LIST

5.1 Health Monitoring System

(1) Arduino UNO : The Arduino UNO is an open-source microcontroller board based on the Microchip ATmega328P micro controller and developed by Arduino.cc. Every IOT project has it's own brain and we are using Arduino as a brain for our project. The main feature Arduino is that it provides both digital(14 pins) as well as analog(6 pins) input/output pins providing interfacing with various expansion boards and other circuit. It has a n inbuilt clock speed of 16MHz. It can be programmed as per need and has a flash memory of 32KB.



Figure -1: Arduino UNO

(2) NODEMCU ESP8266 (Micro controller) : We have used NOCEMCU ESP8266 as a main functioning micro controller. NODEMCU is an open-source LUA based firmware and development board specially targeted for IOT based Applications. It works on ESP8266 Wi-Fi SOC based on ESP-12 module.

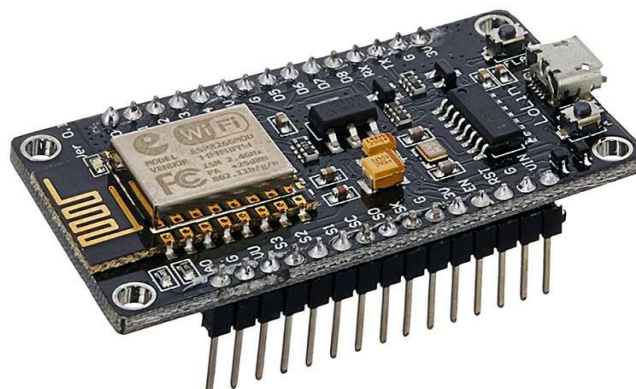


Figure -2: NODEMCU ESP8266

(3) Temperature Sensor (LM35) : We have used LM35 as a temperature sensor for our project. It works on variation of output voltage, based on the temperature around it. It is used to measure the temperature from ranging -55°C to 150°C. It can be easily interface with any micro controller that has ADC function or any development platform like Arduino.



Figure -3: Temperature sensor

(4) Heartbeat Sensor :- Heart beat detector is meant to grant digital output of warmth beat once a finger is placed thereon. Once the heart detector is functioning, the beat LED flashes in unison with every heart beat. This digital output will be connected to small controller on to live the Beats Per Minute (BPM) rate. It works on the principle of illumination modulation by blood flow through finger at every pulse.

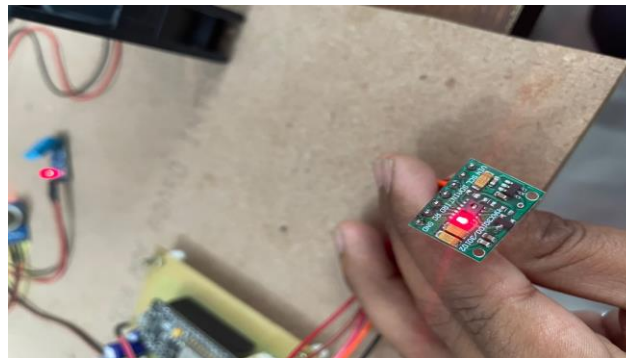


Figure -4: Heartbeat sensor

(5) Oximeter sensor (MAX30100) : We have used MAX30100 as our SPO2 sensor for monitoring oxygen level in human blood. It is associated in integrated pulse measuring instrument and heart-rate monitor sensor solution. It is an optical sensor that derives its readings from emitting two wavelengths of light from two LED—a red and an infrared one—then measuring the absorbance of pulsing blood through a photo detector. It consists of I2C digital interface to communicate with host micro controller. It operates at supply in the range of 1.8V to 3.3V.



Figure -5: Oximeter sensor

5.2 Room Environment Controlling System

(1) Humidity Sensor (DHT11) : We have used DHT11 in our room environment controlling system as a temperature and humidity measurement device. It is a cheap and readily available in market digital sensor for sensing temperature and humidity. It can be easily interfaced with any available micro controller such as Arduino, etc. It uses thermistor and capacitive humidity sensor.

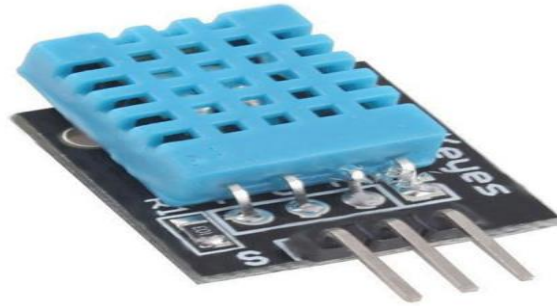


Figure -6: Temperature and Humidity sensor

(2) Air Quality Sensor (MQ135) : We have used MQ135 in our room environment controlling system as our gas detector sensor. It has both digital as well as analog output. Sensitive material of respective sensor is SnO₂, which has lower conductivity in clean air. It is cheap and readily available in market for various suitable operations.



Figure -7: Air quality sensor

(3) Voltage Regulator (LM7805) : We have used the LM7805 series of three terminal positive regulators as voltage regulator. Every sort type employs internal current limiting, thermal close up and safe operating space protection, creating it primarily indestructible. Although designed primarily as fixed voltage regulators, these devices are often used with external parts to get adjustable voltages and currents.

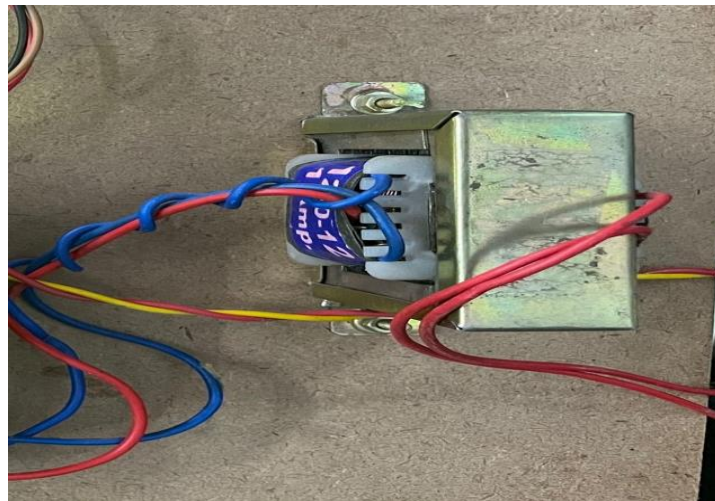


Figure -8: Voltage regulator

6. METHODOLOGY AND SYSTEM DESIGN

6.1 Health Monitoring System

6.1.1 Problem Identification

The medical world these days faces two basic issues once it involves patient observance. Firstly, the wants of health care’s provider’s presence close to the side of the patient and secondly, the patient is restricted to bed and wired to giant machines.

6.1.2 Block Diagram

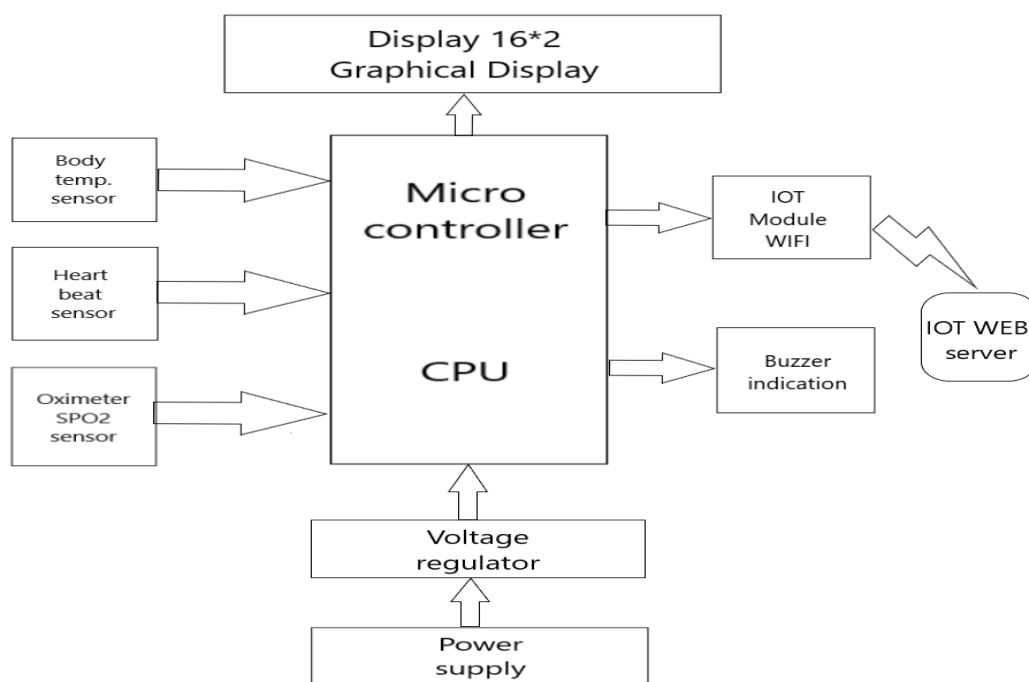


Fig -9: Health Monitoring System

6.1.3 System Design

The health monitoring system consists of many health monitoring sensors. They are temperature sensor, heart beat sensor, SPO2 sensor. Sensors are used for determining the well being of health care. To run the system initially we need to connect Arduino with power supply as it is the main unit. In input side we have connected temperature sensor, heartbeat sensor and SPO2 sensor and on the another side i.e. output side we have connected a LCD display to show the output. As we have also designed a IOT web page to view the results remotely, one can view his/her examined results by going to the respective web page.

First of all, a finger is placed in the heart beat sensor so the system can read the data and simultaneously the result is also shown on the LCD display. Same results are also uploaded in the designed IOT web page for remote viewing. Similar process is done with heartbeat sensor and SPO2 sensor by placing a finger in respective sensors.

6.2 Room Environment Controlling System

6.2.1 Problem Identification

According to literature review there was no such systems designed or in existence which will simultaneously monitor healthcare as well as control the room environment where the patient is hospitalized. So we are proposing a system which will perform both the task simultaneously for betterment in health care.

6.2.2 Block Diagram

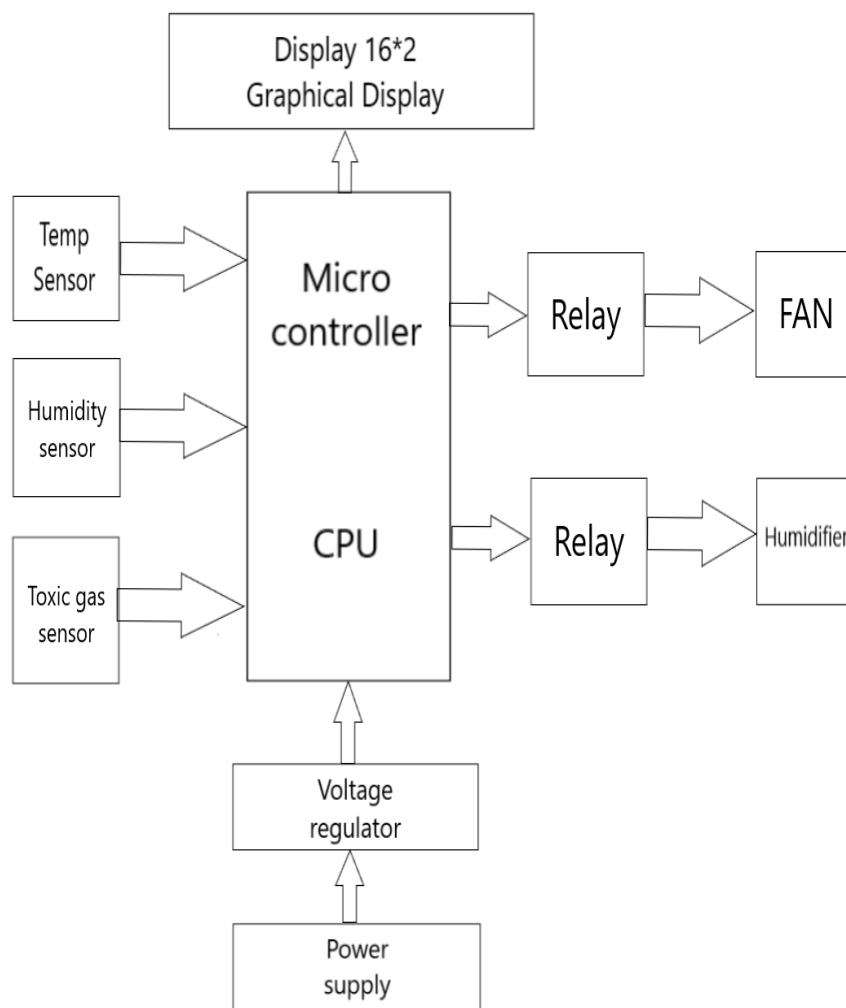


Fig -10: Room Environment Controlling System

6.2.3 System Design

The room environment controlling system consists of many sensors. They are temperature sensor, humidity sensor and air quality sensor. These sensors are used for determining the suitability of the room environment for the patient. If room environment is not suitable for the patient then the system will control it.

First of all, the sensors detects and reads the room environment like temperature sensor reads the room temperature, humidity sensor reads the room humidity and air quality reads the presence of toxic gases in the room. If any of the element reach its peak level then the room environment controlling system gets active.

Heater/Humidifier is connected to temperature sensor for controlling the room temperature whenever it exceeds or lower withing its acceptable limits. Exhaust fan is attached to air quality sensor, whenever it detects any presence of toxic gases in room it will turn ON the exhaust fan to throw out those harmful gases.

7. RESULT

7.1 Health Monitoring System

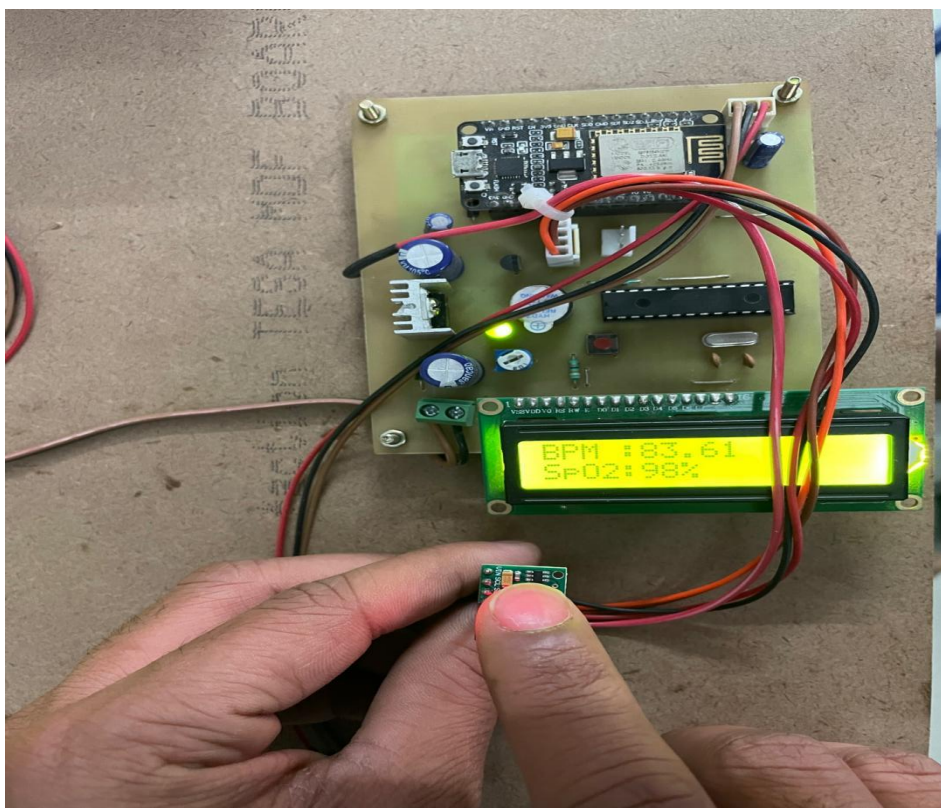


Fig -11: Result of Health Monitoring System

In above image Health monitoring system is shown displayed with resulting examined heart rate and blood oxygen level (SPO2) in a human being.

| Testing | Normal Value | Observed Value | Error Rate |
|---------------------------|--------------|----------------|------------|
| Temperature | 35°C - 38°C | 38°C | ± 2°C |
| Heart Rate | 60 - 100 | 83.61 | ± 5 BPM |
| Blood oxygen level (SPO2) | 95% - 100% | 98% | ± 2% |

Table -2: Readings of Health monitoring system

7.2 Room Environment Controlling System

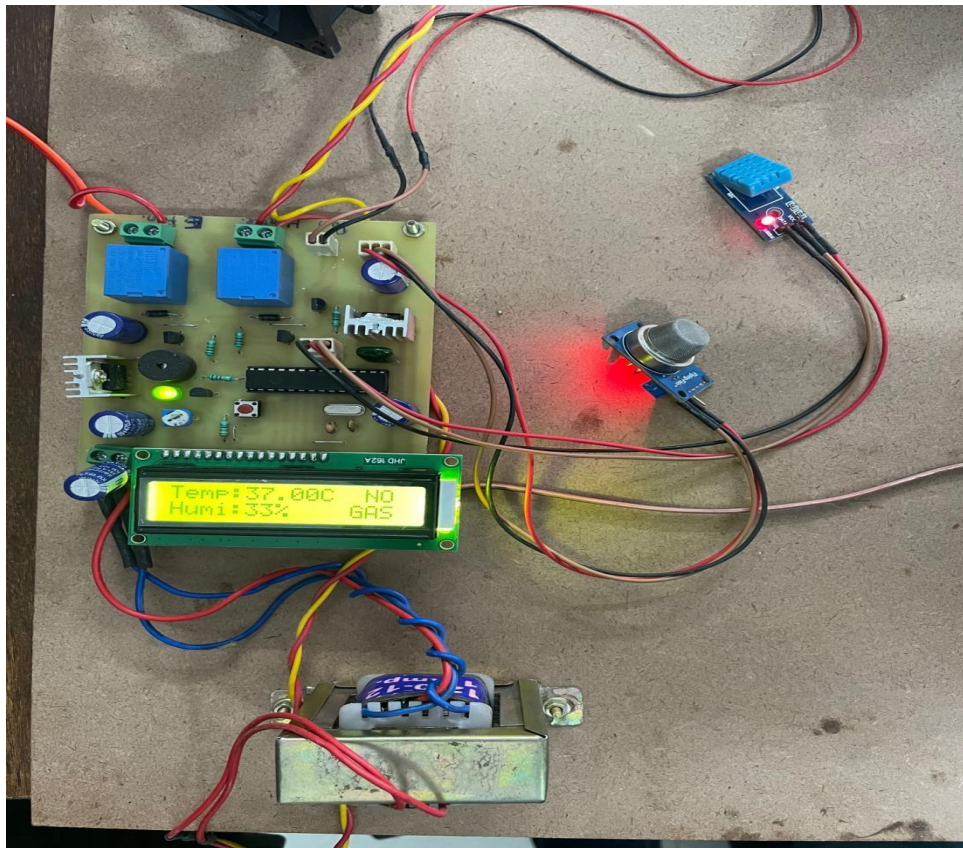


Fig -12: Result of Room Environment Controlling System

In above image Room environment controlling system is shown displayed with detected room temperature, room humidity and harmful gases in surroundings (room environment).

| Testing | Normal Value | Observed Value | Error Rate |
|---|--------------|----------------|------------|
| Temperature (varies according to weather condition) | 25°C - 30°C | 37°C | ± 2°C |
| Humidity | 30% - 50% | 33% | ± 2% |

Table -3: Readings of Room environment controlling system

8. CONCLUSION

IOT based health monitoring system is current trend with the development in IOT in the field of health care management system. In general IOT based health care monitoring is a platform which connects smart sensors attached to human body for check up on regular basis. This system offers the doctors to take advantage of the large quantity of attention, knowledge and provide right intervention to the proper patient at the proper time. Therefore personalized care could be given to the patient. Our developed system is giving the opportunity to monitor patient continuously by using the IOT web page service along with the live monitoring.

IOT based room environment controlling system developed is a new concept in IOT based applications. Aside from monitoring of human being it is required to keep the room suitable for the patient where it is hospitalized and it is the main motive behind the development of room environment controlling system. This system will help patient in absence of care taker to automatically manage the room temperature, humidity and presence of toxic gases.

With improvement made in this project, this system can give a tough competition with respect to price and performance to the products existing in the market.

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10. REFERENCES

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