

Real time IOT based detection of oxygen saturation level and bpm

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Abstract : Detection of any disease of any patient is the only main solution with the help of electronics devices patient can check our heart rate and oxygen level reading. If any problem has not human being then lifestyle has also increased. But if people have any type disease occurred in body then first doctor test and then start the treatment. If people will have any that type of electronics checking device then doctor will not be need to checking the human body problem, then doctor can directly start the treatment basis of device reading. So cardiovascular disease is very dangerous type disease for human being by this human being can be died with in second. This main problem is solved by doctor by treatment if patient reach on time. This work gives a proper system, with the help of that system patient can control our disease by himself that means there is no need of paying extra money for checking heart beat and oxygen level because all reading will have then his treatment directly started no time loss for treatment This research aim is that gives that type idea of idea for designing a device which is useful for normal human. If any device cost is very low and gives a efficient result then any person can take benefit. It design is different other type device, in which Node MCU technology and LCD display and a latest sensor max30100 is used. It will be display on LCD screen, alert by an message which will be sent through mobile phone to the doctor and oxygen level will also display on screen.

IndexTerms – Heart pulse sensor, MAX 30100, Nano board, node mcu, Blynk app

I. INTRODUCTION

Today day by day heart problem increasing, that main reason is that blood circulation is not proper. When WHO given our report in 1999 then time approximately 15 million deaths in whole world by Cardiovascular type disease. Actually cardiovascular is a heart disease. In starting the heart beat varying then human being did not know, what is the problem with his body .Any types disease when occurred with human being then proper treatment is the best solution for him but disease occurred long period time then treatment dose not safe his life. This type disease day by day increasing due to taking unwanted food, drinking impure liquids, not sleeping on time and most important thing is exercise. All people are busy with electronics devices, they have no time for morning and evening exercise .so many heart's related disease with people. So all people cannot go to hospital for checking daily, weekly and monthly our heart beat, oxygen level. This type checkup can be check by human being by self if it will have a device and with the help of that device that patient check our body reading. After checking all reading that patient can send all reading to the doctor. So if that patient has any problem then he can go to hospital in proper time and can save our life .This project is related that type of human heart problem, "**Detection of heart rate and oxygen saturation in real time**". The patient can check our heart rate and oxygen level in any place like in home, in hospital etc. Human health problem do not know any doctor because it became suddenly. Mainly this type problem occurred during travelling from one place to another place. If then time that patient will have this device then this type disease can be control on time by taking proper treatment. Now days electronics devices like mobile phone is available every person, so that person can send our daily's body reading to the doctor. We are living in electronics age so this is very easy to inform the doctor for our treatment because any treatment is success when the patient reach the hospital on proper time. So timing is the key of treatment. Present time wireless system is mostly used for transfer information with in second.

Literature review

Pelegris P¹, Banitsas K, Orbach T, Marias K. developed a technique in which heart rate monitored by mobile phone, basically they created an app and when heart rate is taken on that time it will automatically display on the mobile phone. In the mobile phone app was developed through android studio software [1].

Hui-Sup Cho and Young-Jin Park developed to find the heart rate of human with the help of UMB technology, actually to find the heart rate transferred ultrasonic wave on the wall side after collision from it strike through the human and further analysis of this signal in time domain to detect the heart rate[2].

Neramit Chirakanphaisarna heart rate measurement for subject span with in 20 to 70 years.in this heart beat is recorded in the memory card and further make a record of this heart beat reading [3].

Hamidreza Shirzadfar, Mahsa Sadat developed an optical sensor circuit inside (IR led diode) used for detection of heart rate and by using of seven segment display, showed the reading on them, afterwards heart rate value is transferred on self made mobile apps [4]

Mayank Kothari is assistant professor in NMIMPS, MPSTMEShirpur in India and he introduced in our research a microcontroller based heart beat monitoring system and in which he added a alert system .This is very useful for athletes because they need a daily checkup after that they can participate in completion. He used a software in which set a program for detection reading and also used GSM modern, GPS receiver, sensor and a microcontroller which name is PIC16F877A.[5]

Peter Leijdekkers is a faculty in Sydney university, he introduced in our research paper on cardiovascular type disease 24/7 type device which is based on personal heart beat monitoring type system in which person used a phone and information send through GSM modern and GPS system. The most thing is that in this research he used a logarithm in which stored that type of instruction when any heart beat will be disturb then red screen will be on a message will display on screen call Ambulance[6].

Saurabh Sagar research is based on heart problem in which he used a IoT and raspberry pi technique which is very useful for cardiovascular disease. In this research he used a IoT device which works on GSM technology if any problem in health then it will be inform to the particular person by

GSM module or through internet because in this time internet is available everywhere in all over India. This is that type system it divided into two parts one is hardware and other is software [7].

II. METHODOLOGY

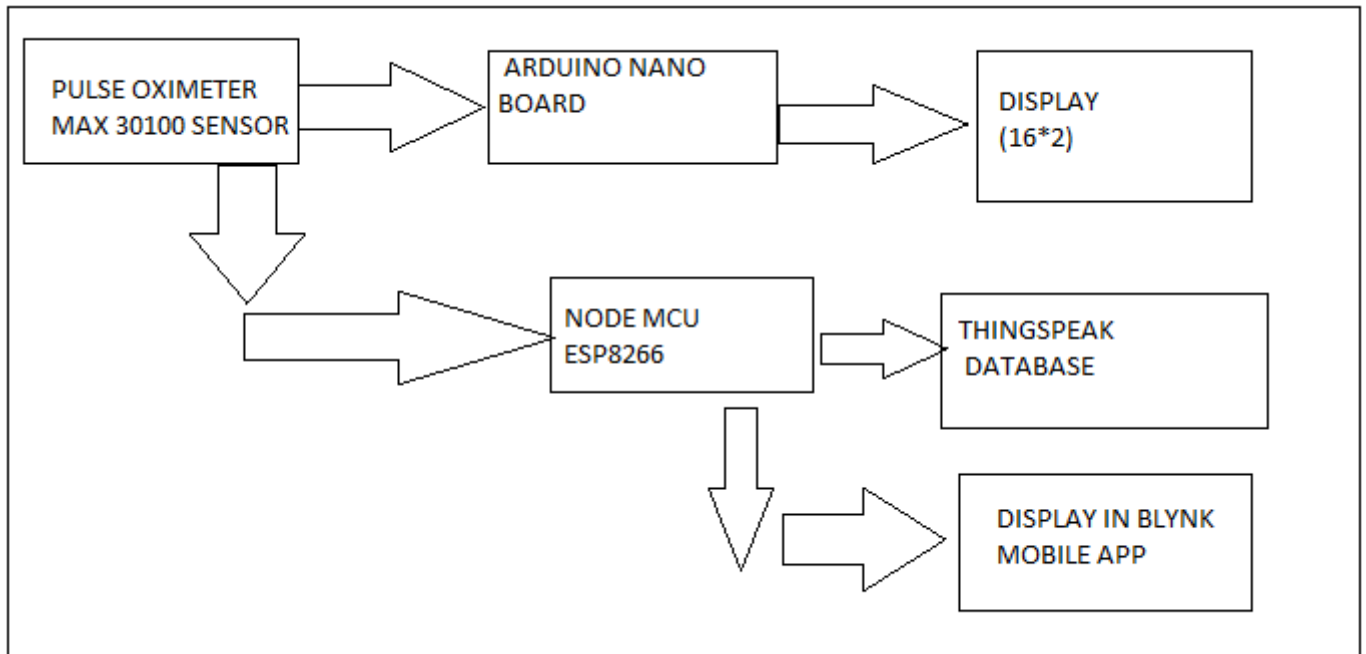


fig.1. block diagram of system design prototype

With fig 1 is showing the basic flowchart of

1- MAX 30100 Pulse oximeter With NANO board

MAX30100 is an dual circuitary. It is also called pulse oximeter. By this sensor heart rate, heart beat and blood saturation level can be detected. It is an integrated circuit in which Photo detector transducers attached on the opposite side of led. Two types of led is also present First one is red led and second one is IR led. The frequency range of red led is the 650 nm and infrared led range is 850 nm. The main function of the red led is to detect the oxygen saturation level, when the red light is passing through the skin on that time[8], inside figure 3 types of skin layer is present(endoderm , mesoderm and ectoderm layer is present. When red light is passed on the outer layer of skin, during that time heart supply blood through the artery and blood supply rate is around 1 sec duration. Blood hemoglobin color is red and red light is absorb in the blood cell so on the receptor side photo register will not detect any type of light. So some readings will be generated and that reading will be range of 0 to 1024 mv range and further it will compared to reference value and generate a proper value.

For the heart rate measurement IR sensor measure the duration of blood pumping supply from the artery. Heart beat 72 per minute for a normal person and bpm is calculated by total peaks generated per 60 sec. In the pulse oximeter total 5 pins is there they are such as (SCL, SDA, INT, Vcc, GND). the connection with nano board is like this SCL- A4, SDA- A5, INT- D2, Vcc- 5V

2- Nano Board

This board is quite similar to arduino uno board, but difference is only size in nano and uno board. uno board processing speed is high compare than nano board.

3- Node MCU

It is a wifi module. The main function of this module is to transfer the data and signal from the sender to database or app.

It is a microcontroller programmer kit in which Arduino programme can be burn, and there is nothing extra required component for burning the programme, all of programme can be burn inside this[9].

For using node mcu, inside Arduino software , attach esp8266 library json file, and when the json file inserted in this than during selection of board manager

4- Pulse sensor

The Pulse Sensor is a fitting and-play beat sensor for Arduino. It will in general be used by understudies, pros, contenders, makers, and game and flexible fashioners who need to successfully join live heartbeat data into their projects.Essence it is a consolidated optical escalating circuit and disturbance clearing out circuit sensor. Catch the Pulse Sensor to your ear ligament or fingertip and fitting it into your Arduino ,you can arranged to examine beat. Moreover it have an Arduino demo code that make it easy to use[10].

5- Sending the sensor at the blynk app

after capturing the heart rate signal from the pulse sensor, by putting the blynk app authentication code on the Arduino software and burn blynk programme on Arduino board[11].

6- Thingspeak database

This database provides to store all the content data and signal as a queue format in thingspeak database. it is a free of cost and for using there is no extra cost required in this. The main advantage of the thingsapeak database, it helps the automatically plot the graph without any extra coding[12].

Software portion

1- Arduino programming with MAX30100

In this portion inside Arduino software, insert the MAX30100 pulse oximeter library file, insert the lcd display library and burn the programme into board, here basic portion of coding mention is here

```

// Register a callback for the beat detection
pox.setOnBeatDetectedCallback(onBeatDetected);
}

void loop()
{
// Make sure to call update as fast as possible
pox.update();

// Asynchronously dump heart rate and oxidation levels to the serial
// For both, a value of 0 means "invalid"
if (millis() - tsLastReport > REPORTING_PERIOD_MS) {
Serial.print("Heart rate:");
Serial.print(pox.getHeartRate());
Serial.print("bpm / SpO2:");
Serial.print(pox.getSpO2());
Serial.println("%");

tsLastReport = millis();
}
}

```

Fig.2 arduino programming for pulse oximeter MAX30100

2- Heart rate plot form on the Thingspeak database

for the plotting of graph in the thingspeak database, first the procedure is to create an account on the website <http://thingspeak.io> after successful creation of the account, select the required field, for example our requirement is plot a

```

#define pulsePin A0
#include <ESP8266WiFi.h>

const char* ssid = "ardram";
const char* password = "ardrock1";

WiFiClient client;

const int channelID = 804784;
String writeAPIKey = "FQFO4NLSUONK7EEL";
const char* server = "api.thingspeak.com";
const int postingInterval = 10 * 1000;

int rate[10];
unsigned long sampleCounter = 0;
unsigned long lastBeatTime = 0;
unsigned long lastTime = 0, N;
int BPM = 0;
int IBI = 0;
int P = 512;
int T = 512;
int thresh = 512;
int amp = 100;
int Signal;
boolean Pulse = false;
boolean firstBeat = true;
boolean secondBeat = true;
boolean QS = false;

void setup() {
Serial.begin(9600);
WiFi.begin(ssid, password);
while (WiFi.status() != WL_CONNECTED) {
delay(500);
}
}

```

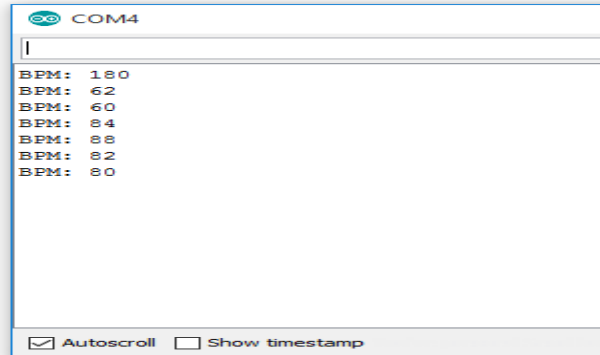


Fig .3 arduino programming for thingspeak database

single graph so select only field 1. And when it saved, on the time it shows an channel id and public api key, and in the Arduino programming inserted that channel id and public api key. Two api key is generated first one is public and second is private. Public api key is selected only on that time when graph shared to everyone , and for personal use select the private api key. It is clear with fig.3

```

/* Comment this out to disable prints and save space
#define BLYNK_PRINT Serial

#include <ESP8266WiFi.h>
#include <BlynkSimpleEsp8266.h>

// You should get Auth Token in the Blynk App
// Go to the Project Settings (nut icon).
char auth[] = "fd10e2c35f5e4b57b368e768ef993e";

// Your WiFi credentials.
// Set password to "" for open networks.
char ssid[] = "ardram";
char pass[] = "ardrock1";

void setup()
{
  // Debug console
  Serial.begin(9600);

  Blynk.begin(auth, ssid, pass);
}

void loop()
{
  int heartrate=analogRead(A0);
  Blynk.run();
  Blynk.virtualWrite(V0, heartrate);
}
    
```

Fig .4 arduino programming for blynk app

III. RESULT

BPM: 180
 BPM: 62
 BPM: 60
 BPM: 84
 BPM: 88
 BPM: 82
 BPM: 80
 BPM: 80

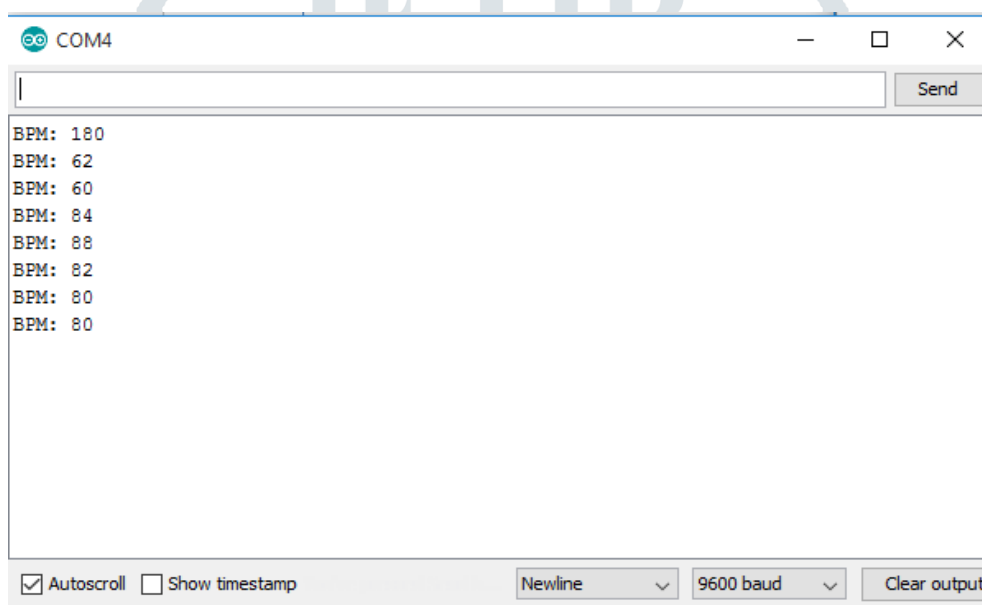


Fig. 5 bpm rate is showing in the Arduino serial monitor

Table.1 Heart rate and Oxygen level testing on different patient

Name	Heart Rate	Oxygen level %
Patient 1	62	70%
Patient 2	60	70%
Patient 3	84	90%
Patient 4	82	89%
Patient 5	80	85%
Patient 6	80	85%

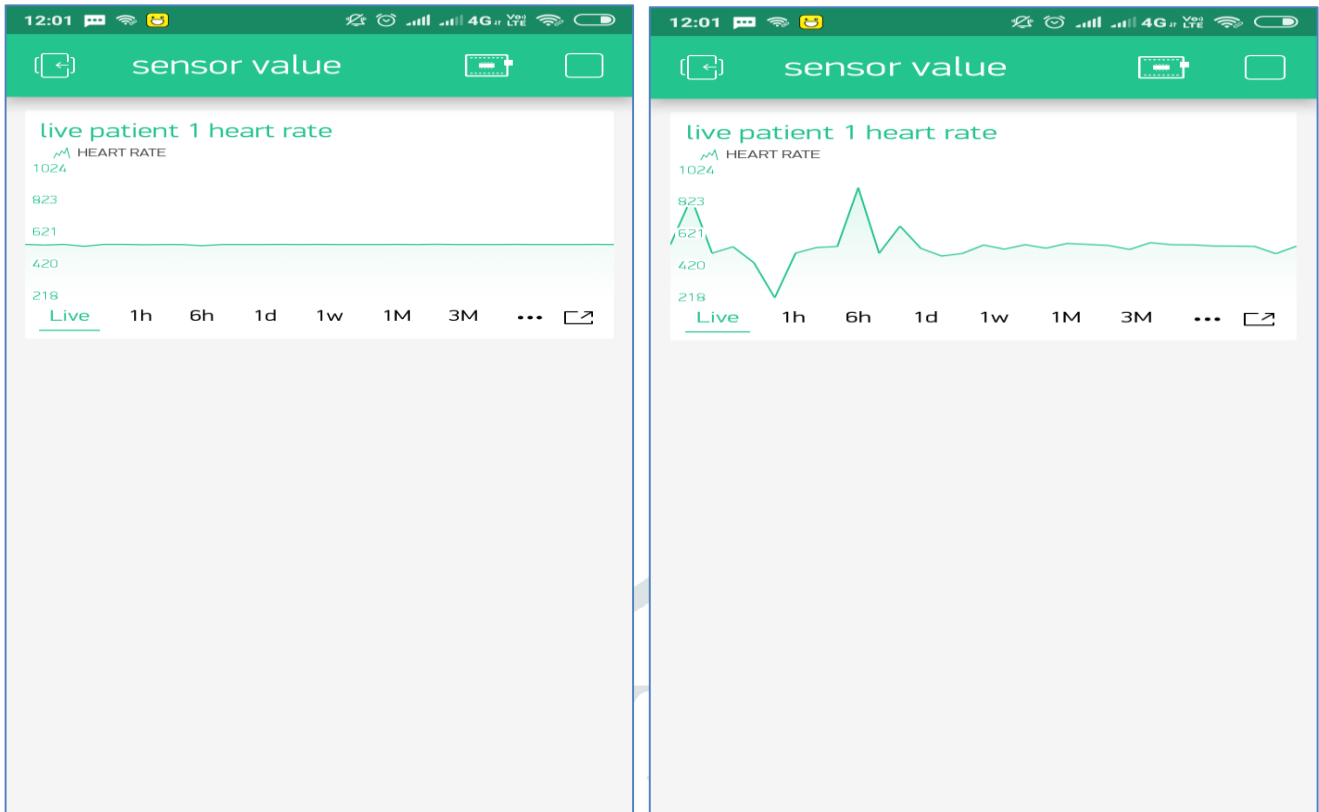


Fig .6 Mobile Blynk app is showing the status of heart rate of patient 1 Case.i. without figure Case ii. With figure



Fig .7 Thingspeak IOT platform shows the pulse rate for patient 1

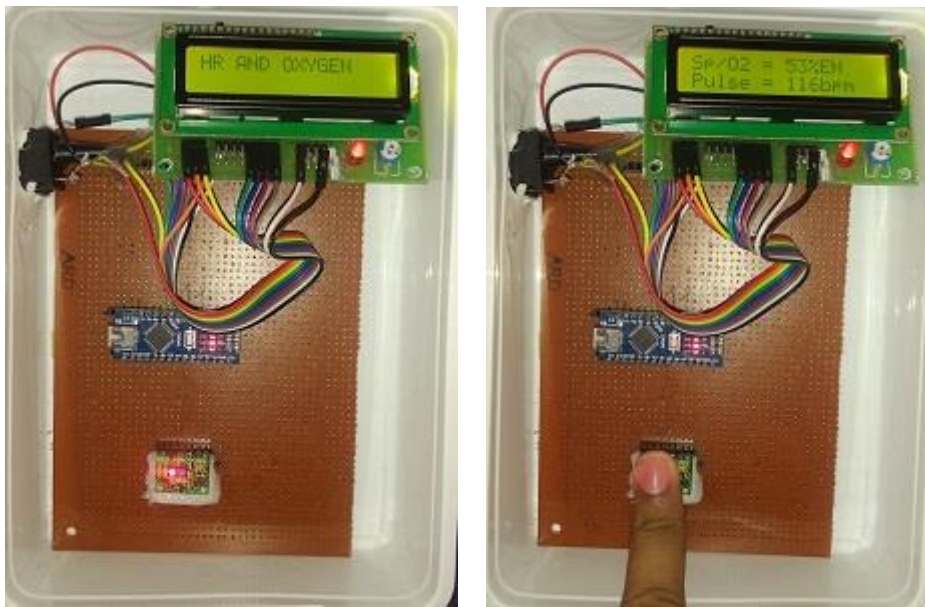


FIG.8 DEVICE PROTOTYPE SHOWS THE OXYGEN AND HEART RATE LEVEL

IV. ADVANTAGE

- Its size is less and portable and easily can be use
- Maintaince is very simple
- Online prescription will be given by seeing the heart rate.
- Operating supply voltage is very less

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