**Source Code/Program**

The **Program/Source Code** for **IoT Based Patient Health Monitoring on ESP32 Web Server** is given below. You need to install a few libraries for source code compilation. The library link is given below as well. Download all the libraries and add to the Arduino IDE.

1. [Arduino MAX30100 Library](https://drive.google.com/open?id=15w7Hp_Lg7FVVQoou1A56JgNDZADBuN15" \t "_blank)  
2. [OneWire Library](https://github.com/PaulStoffregen/OneWire" \t "_blank)  
3. [Dallas Temperature Library](https://github.com/milesburton/Arduino-Temperature-Control-Library)  
4. [DHT11 Library](https://www.circuitbasics.com/wp-content/uploads/2015/10/DHTLib.zip)

#include <WiFi.h>

#include <WebServer.h>

#include <Wire.h>

#include "MAX30100\_PulseOximeter.h"

#include <OneWire.h>

#include <DallasTemperature.h>

#include <dht.h>

#define DHT11\_PIN 18

#define DS18B20 5

#define REPORTING\_PERIOD\_MS     1000

float temperature, humidity, BPM, SpO2, bodytemperature;

/\*Put your SSID & Password\*/

const char\* ssid = "Alexahome";  // Enter SSID here

const char\* password = "12345678";  //Enter Password here

dht DHT;

PulseOximeter pox;

uint32\_t tsLastReport = 0;

OneWire oneWire(DS18B20);

DallasTemperature sensors(&oneWire);

WebServer server(80);

void onBeatDetected()

{

  Serial.println("Beat!");

}

void setup() {

  Serial.begin(115200);

  pinMode(19, OUTPUT);

  delay(100);

  Serial.println("Connecting to ");

  Serial.println(ssid);

  //connect to your local wi-fi network

  WiFi.begin(ssid, password);

  //check wi-fi is connected to wi-fi network

  while (WiFi.status() != WL\_CONNECTED) {

  delay(1000);

  Serial.print(".");

  }

  Serial.println("");

  Serial.println("WiFi connected..!");

  Serial.print("Got IP: ");  Serial.println(WiFi.localIP());

  server.on("/", handle\_OnConnect);

  server.onNotFound(handle\_NotFound);

  server.begin();

  Serial.println("HTTP server started");

  Serial.print("Initializing pulse oximeter..");

  if (!pox.begin()) {

    Serial.println("FAILED");

    for (;;);

  } else {

    Serial.println("SUCCESS");

    pox.setOnBeatDetectedCallback(onBeatDetected);

  }

   pox.setIRLedCurrent(MAX30100\_LED\_CURR\_7\_6MA);

  // Register a callback for the beat detection

}

void loop() {

  server.handleClient();

  pox.update();

  sensors.requestTemperatures();

  int chk = DHT.read11(DHT11\_PIN);

  temperature = DHT.temperature;

  humidity = DHT.humidity;

  BPM = pox.getHeartRate();

  SpO2 = pox.getSpO2();

  bodytemperature = sensors.getTempCByIndex(0);

  if (millis() - tsLastReport > REPORTING\_PERIOD\_MS)

  {

    Serial.print("Room Temperature: ");

    Serial.print(DHT.temperature);

    Serial.println("°C");

    Serial.print("Room Humidity: ");

    Serial.print(DHT.humidity);

    Serial.println("%");

    Serial.print("BPM: ");

    Serial.println(BPM);

    Serial.print("SpO2: ");

    Serial.print(SpO2);

    Serial.println("%");

    Serial.print("Body Temperature: ");

    Serial.print(bodytemperature);

    Serial.println("°C");

    Serial.println("\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*");

    Serial.println();

    tsLastReport = millis();

  }

}

void handle\_OnConnect() {

  server.send(200, "text/html", SendHTML(temperature, humidity, BPM, SpO2, bodytemperature));

}

void handle\_NotFound(){

  server.send(404, "text/plain", "Not found");

}

  String SendHTML(float temperature,float humidity,float BPM,float SpO2, float bodytemperature){

  String ptr = "<!DOCTYPE html>";

  ptr +="<html>";

  ptr +="<head>";

  ptr +="<title>ESP32 Patient Health Monitoring</title>";

  ptr +="<meta name='viewport' content='width=device-width, initial-scale=1.0'>";

  ptr +="<link href='https://fonts.googleapis.com/css?family=Open+Sans:300,400,600' rel='stylesheet'>";

  ptr +="<style>";

  ptr +="html { font-family: 'Open Sans', sans-serif; display: block; margin: 0px auto; text-align: center;color: #444444;}";

  ptr +="body{margin: 0px;} ";

  ptr +="h1 {margin: 50px auto 30px;} ";

  ptr +=".side-by-side{display: table-cell;vertical-align: middle;position: relative;}";

  ptr +=".text{font-weight: 600;font-size: 19px;width: 200px;}";

  ptr +=".reading{font-weight: 300;font-size: 50px;padding-right: 25px;}";

  ptr +=".temperature .reading{color: #F29C1F;}";

  ptr +=".humidity .reading{color: #3B97D3;}";

  ptr +=".BPM .reading{color: #FF0000;}";

  ptr +=".SpO2 .reading{color: #955BA5;}";

  ptr +=".bodytemperature .reading{color: #F29C1F;}";

  ptr +=".superscript{font-size: 17px;font-weight: 600;position: absolute;top: 10px;}";

  ptr +=".data{padding: 10px;}";

  ptr +=".container{display: table;margin: 0 auto;}";

  ptr +=".icon{width:65px}";

  ptr +="</style>";

  ptr +="</head>";

  ptr +="<body>";

  ptr +="<h1>ESP32 Patient Health Monitoring</h1>";

  ptr +="<h3>www.how2electronics.com</h3>";

  ptr +="<div class='container'>";

  ptr +="<div class='data temperature'>";

  ptr +="<div class='side-by-side icon'>";

  ptr +="<svg enable-background='new 0 0 19.438 54.003'height=54.003px id=Layer\_1 version=1.1 viewBox='0 0 19.438 54.003'width=19.438px x=0px xml:space=preserve xmlns=http://www.w3.org/2000/svg xmlns:xlink=http://www.w3.org/1999/xlink y=0px><g><path d='M11.976,8.82v-2h4.084V6.063C16.06,2.715,13.345,0,9.996,0H9.313C5.965,0,3.252,2.715,3.252,6.063v30.982";

  ptr +="C1.261,38.825,0,41.403,0,44.286c0,5.367,4.351,9.718,9.719,9.718c5.368,0,9.719-4.351,9.719-9.718";

  ptr +="c0-2.943-1.312-5.574-3.378-7.355V18.436h-3.914v-2h3.914v-2.808h-4.084v-2h4.084V8.82H11.976z M15.302,44.833";

  ptr +="c0,3.083-2.5,5.583-5.583,5.583s-5.583-2.5-5.583-5.583c0-2.279,1.368-4.236,3.326-5.104V24.257C7.462,23.01,8.472,22,9.719,22";

  ptr +="s2.257,1.01,2.257,2.257V39.73C13.934,40.597,15.302,42.554,15.302,44.833z'fill=#F29C21 /></g></svg>";

  ptr +="</div>";

  ptr +="<div class='side-by-side text'>Room Temperature</div>";

  ptr +="<div class='side-by-side reading'>";

  ptr +=(int)temperature;

  ptr +="<span class='superscript'>&deg;C</span></div>";

  ptr +="</div>";

  ptr +="<div class='data humidity'>";

  ptr +="<div class='side-by-side icon'>";

  ptr +="<svg enable-background='new 0 0 29.235 40.64'height=40.64px id=Layer\_1 version=1.1 viewBox='0 0 29.235 40.64'width=29.235px x=0px xml:space=preserve xmlns=http://www.w3.org/2000/svg xmlns:xlink=http://www.w3.org/1999/xlink y=0px><path d='M14.618,0C14.618,0,0,17.95,0,26.022C0,34.096,6.544,40.64,14.618,40.64s14.617-6.544,14.617-14.617";

  ptr +="C29.235,17.95,14.618,0,14.618,0z M13.667,37.135c-5.604,0-10.162-4.56-10.162-10.162c0-0.787,0.638-1.426,1.426-1.426";

  ptr +="c0.787,0,1.425,0.639,1.425,1.426c0,4.031,3.28,7.312,7.311,7.312c0.787,0,1.425,0.638,1.425,1.425";

  ptr +="C15.093,36.497,14.455,37.135,13.667,37.135z'fill=#3C97D3 /></svg>";

  ptr +="</div>";

  ptr +="<div class='side-by-side text'>Room Humidity</div>";

  ptr +="<div class='side-by-side reading'>";

  ptr +=(int)humidity;

  ptr +="<span class='superscript'>%</span></div>";

  ptr +="</div>";

  ptr +="<div class='data Heart Rate'>";

  ptr +="<div class='side-by-side icon'>";

  ptr +="<svg enable-background='new 0 0 40.542 40.541'height=40.541px id=Layer\_1 version=1.1 viewBox='0 0 40.542 40.541'width=40.542px x=0px xml:space=preserve xmlns=http://www.w3.org/2000/svg xmlns:xlink=http://www.w3.org/1999/xlink y=0px><g><path d='M34.313,20.271c0-0.552,0.447-1,1-1h5.178c-0.236-4.841-2.163-9.228-5.214-12.593l-3.425,3.424";

  ptr +="c-0.195,0.195-0.451,0.293-0.707,0.293s-0.512-0.098-0.707-0.293c-0.391-0.391-0.391-1.023,0-1.414l3.425-3.424";

  ptr +="c-3.375-3.059-7.776-4.987-12.634-5.215c0.015,0.067,0.041,0.13,0.041,0.202v4.687c0,0.552-0.447,1-1,1s-1-0.448-1-1V0.25";

  ptr +="c0-0.071,0.026-0.134,0.041-0.202C14.39,0.279,9.936,2.256,6.544,5.385l3.576,3.577c0.391,0.391,0.391,1.024,0,1.414";

  ptr +="c-0.195,0.195-0.451,0.293-0.707,0.293s-0.512-0.098-0.707-0.293L5.142,6.812c-2.98,3.348-4.858,7.682-5.092,12.459h4.804";

  ptr +="c0.552,0,1,0.448,1,1s-0.448,1-1,1H0.05c0.525,10.728,9.362,19.271,20.22,19.271c10.857,0,19.696-8.543,20.22-19.271h-5.178";

  ptr +="C34.76,21.271,34.313,20.823,34.313,20.271z M23.084,22.037c-0.559,1.561-2.274,2.372-3.833,1.814";

  ptr +="c-1.561-0.557-2.373-2.272-1.815-3.833c0.372-1.041,1.263-1.737,2.277-1.928L25.2,7.202L22.497,19.05";

  ptr +="C23.196,19.843,23.464,20.973,23.084,22.037z'fill=#26B999 /></g></svg>";

  ptr +="</div>";

  ptr +="<div class='side-by-side text'>Heart Rate</div>";

  ptr +="<div class='side-by-side reading'>";

  ptr +=(int)BPM;

  ptr +="<span class='superscript'>BPM</span></div>";

  ptr +="</div>";

  ptr +="<div class='data Blood Oxygen'>";

  ptr +="<div class='side-by-side icon'>";

  ptr +="<svg enable-background='new 0 0 58.422 40.639'height=40.639px id=Layer\_1 version=1.1 viewBox='0 0 58.422 40.639'width=58.422px x=0px xml:space=preserve xmlns=http://www.w3.org/2000/svg xmlns:xlink=http://www.w3.org/1999/xlink y=0px><g><path d='M58.203,37.754l0.007-0.004L42.09,9.935l-0.001,0.001c-0.356-0.543-0.969-0.902-1.667-0.902";

  ptr +="c-0.655,0-1.231,0.32-1.595,0.808l-0.011-0.007l-0.039,0.067c-0.021,0.03-0.035,0.063-0.054,0.094L22.78,37.692l0.008,0.004";

  ptr +="c-0.149,0.28-0.242,0.594-0.242,0.934c0,1.102,0.894,1.995,1.994,1.995v0.015h31.888c1.101,0,1.994-0.893,1.994-1.994";

  ptr +="C58.422,38.323,58.339,38.024,58.203,37.754z'fill=#955BA5 /><path d='M19.704,38.674l-0.013-0.004l13.544-23.522L25.13,1.156l-0.002,0.001C24.671,0.459,23.885,0,22.985,0";

  ptr +="c-0.84,0-1.582,0.41-2.051,1.038l-0.016-0.01L20.87,1.114c-0.025,0.039-0.046,0.082-0.068,0.124L0.299,36.851l0.013,0.004";

  ptr +="C0.117,37.215,0,37.62,0,38.059c0,1.412,1.147,2.565,2.565,2.565v0.015h16.989c-0.091-0.256-0.149-0.526-0.149-0.813";

  ptr +="C19.405,39.407,19.518,39.019,19.704,38.674z'fill=#955BA5 /></g></svg>";

  ptr +="</div>";

  ptr +="<div class='side-by-side text'>Blood Oxygen</div>";

  ptr +="<div class='side-by-side reading'>";

  ptr +=(int)SpO2;

  ptr +="<span class='superscript'>%</span></div>";

  ptr +="</div>";

  ptr +="<div class='data Body Temperature'>";

  ptr +="<div class='side-by-side icon'>";

  ptr +="<svg enable-background='new 0 0 19.438 54.003'height=54.003px id=Layer\_1 version=1.1 viewBox='0 0 19.438 54.003'width=19.438px x=0px xml:space=preserve xmlns=http://www.w3.org/2000/svg xmlns:xlink=http://www.w3.org/1999/xlink y=0px><g><path d='M11.976,8.82v-2h4.084V6.063C16.06,2.715,13.345,0,9.996,0H9.313C5.965,0,3.252,2.715,3.252,6.063v30.982";

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  ptr +="c0-2.943-1.312-5.574-3.378-7.355V18.436h-3.914v-2h3.914v-2.808h-4.084v-2h4.084V8.82H11.976z M15.302,44.833";

  ptr +="c0,3.083-2.5,5.583-5.583,5.583s-5.583-2.5-5.583-5.583c0-2.279,1.368-4.236,3.326-5.104V24.257C7.462,23.01,8.472,22,9.719,22";

  ptr +="s2.257,1.01,2.257,2.257V39.73C13.934,40.597,15.302,42.554,15.302,44.833z'fill=#F29C21 /></g></svg>";

  ptr +="</div>";

  ptr +="<div class='side-by-side text'>Body Temperature</div>";

  ptr +="<div class='side-by-side reading'>";

  ptr +=(int)bodytemperature;

  ptr +="<span class='superscript'>&deg;C</span></div>";

  ptr +="</div>";

  ptr +="</div>";

  ptr +="</body>";

  ptr +="</html>";

  return ptr;

}