INTERNET OF THINGS (IOT) BASED HEART BEAT MONITORING SYSTEM

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Abstract

The system implemented in this research is an advanced solution for monitoring the heart beat of a patient at a particular place and makes the information visible anywhere in the world. The technology behind this is Internet of Things (IoT), which is an advanced and efficient solution for connecting the things to the internet and to connect the entire world of things in a network. Here things might be whatever like electronic gadgets, sensors and automotive electronic equipment. The system deals with monitoring heart beat with sensor and send the information to the web page of" thingspeak" server and then plot the sensor data as graphical statistics. "ThingSpeak" has integrated support from the numerical computing software MATLAB from MathWorks. The data updated from the implemented system can be accessible in the internet from anywhere in the world.

Keywords: Internet of Things (IoT), ThingSpeak, Embedded Computing System, Arduino Software, ESP8266.

Introduction

Health monitoring is the major problem in today's world. Due to lack of proper health monitoring, patient suffer from serious health issues. There are lots of internet of thing (IoT) devices now days to monitor the health of patient over internet. Health experts are also taking advantage of these smart devices to keep an eye on their patients**.** IoT is rapidly revolutionizing the healthcare industry.

Materials and Methods

In this research, Pulse rate are recorded over ThingSpeak and Google sheets so that patient health can be monitored from anywhere in the world over internet. Materials used in the heart beat monitoring system composes of two sections; hardware and software. In hardware section, Arduino uno, NodeMCU and heart rate sensor are essential parts. The <ESP8266WiFi.h>,"software Serial.h" Pulse Senor Playground.h", and ThingSpeak.h" library are required for this IoT work.

Pulse Sensor SEN11574 in figure 1 is a well-designed plug-and-play heart-rate sensor for Arduino. The sensor clips onto a fingertip or earlobe and plugs right into Arduino. The front of the sensor is the side with the Heart logo. This is the side that makes contact with the skin. On the front side, there is a small round hole, which is where the LED shines through from the back, and there is also a little square just under the LED. The square is an ambient light sensor, exactly like the one used in cellphones, tablets, and laptops, to adjust the screen brightness in different light conditions. The LED shines light into the fingertip or earlobe, or other capillary tissue, and sensor reads the light that bounces back. The back of the sensor is where the rest of the parts are mounted.

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Node MCU is an open source IoT platform.[4] It includes. The firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module. The term "NodeMCU" by default refers to the firmware rather than the development kits.

ThingSpeak is an IoT platform for data collection and analytics that serves as a bridge connecting edge node devices such as temperature, humidity, pressure etc. sensors to collect data and data exploratory analysis software to analyze data. ThingSpeak serves as the data collector which collects data from edge node devices (Nodemcu/ESP8266 is this case) and also enables the data to be pulled into a software environment for historical analysis of data.

The primary element of ThingSpeak activity is the channel, which contains data fields, location fields, and a status field. After creating a ThingSpeak channel, data can be written to the channel, the data can be processed and viewed with MATLAB code, and react to the data with tweets and other alerts.

The Arduino Uno is a microcontroller board based on the ATmega328. The board carries an 8-bit microcontroller, and it comes with 14 digital input/output pins and 6 analog inputs. Six of the digital pins can be programmed to send pulse width modulation (PWM). The Uno board also comes with internal peripherals able of running the UART, SPI, and I2C communication protocols. Programs using the Arduino Uno board (Figure 2.1) can be as big as 30 Kbytes and run at 16 MHz.

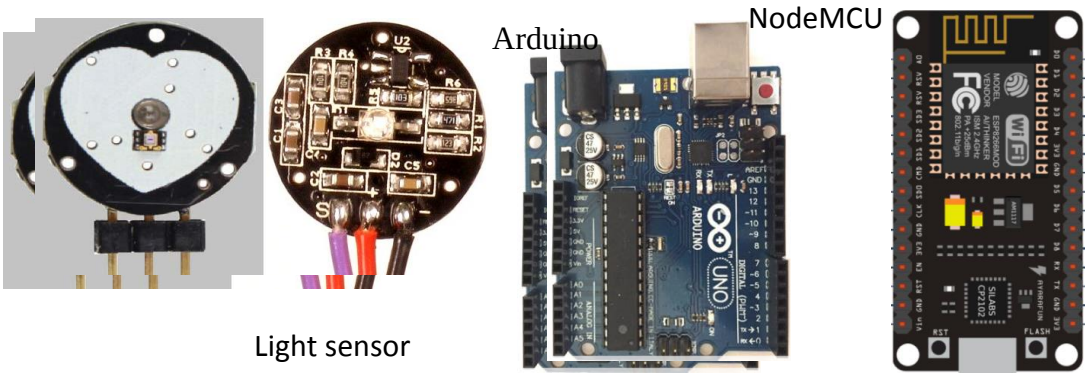

Figure 1 Components used in IoT heart rate monitoring sytem

The sensor data are received by Arduino uno. And then, Arduino sends these data to Node MCU ESP826612E which sends data to thingspeak cloud. The analog output of light sensor is connected to analog pin A0 of Arduino. Digital pin D2 and D3 are defined as the receive and transmit pin of Arduino. The transmit pin D3 of Arduino is connected to the receive pin of Node MCU as shown in figure 2.

Three programs are used in IOT based heart beat monitoring system. One is sketch for Arduino sending the data to Node MCU. Second is to upload the data to the thingspeak server via Node MCU. The data are down loaded to PC or smart phone The block diagram of communication to and from thingspeak is illustrate in figure 3. Third program is to visualize the heart beat using processing software.

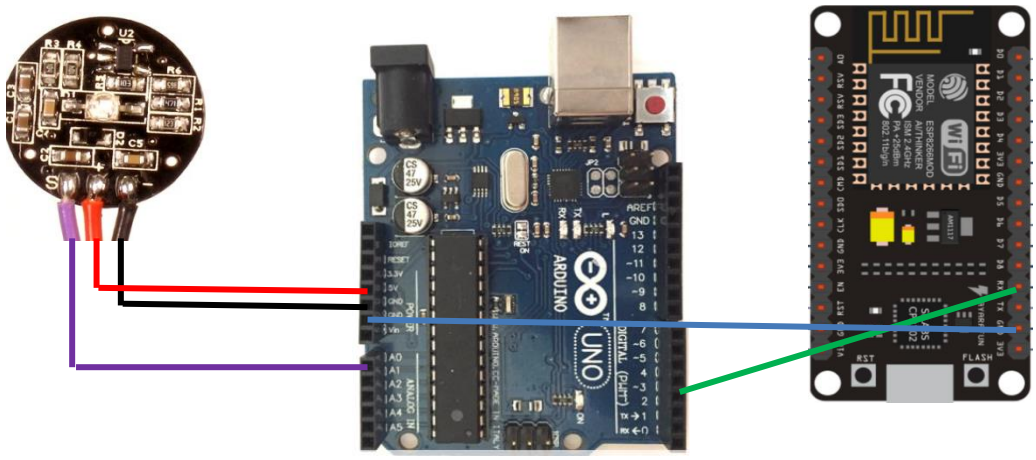

Figure 2 Cicuit connection of monitoring system of IoT

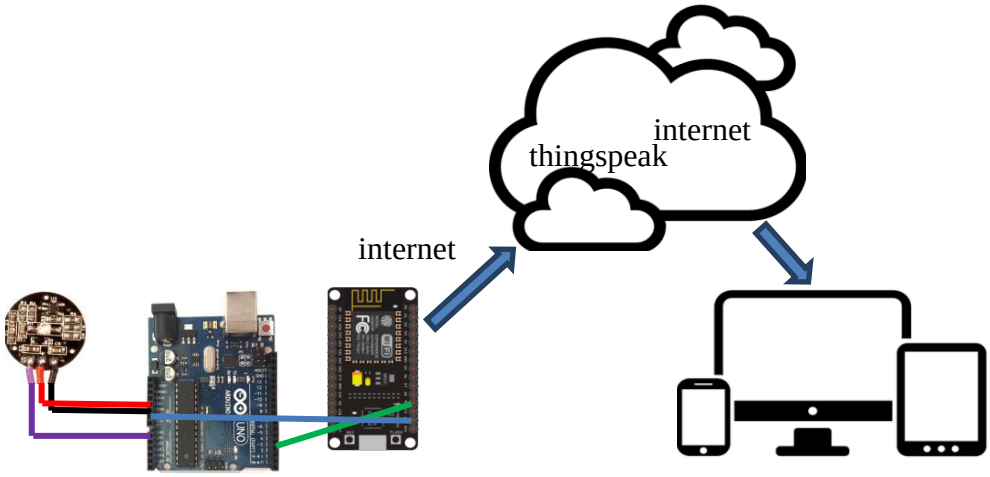

Figure 3 Block diagram of IoT communication

The following part of program is data sending from Arduino to NodeMCU.

```
serial Output() ;
  if (QS == true){
       digital Write(blinkPin,HIGH);
       fadeRate = 255
       serialOutputWhenBeatHappens();
       QS = false;
       ESPSerial.write(BPM);
      }
     else {
     digitalWrite(blinkPin,LOW);
     }
       ledFadeToBeat();
 delay(20);
```

The following is sending data from Node MCU to thingspeak;

```
while(!Serial.available()){}
    int BPM = Serial.read();
    sendDataThingSpeak(BPM);
    Serial.print("BPM is ");
    Serial.println(BPM);
```

And then, select the channel in thingSpeak window.

```
int x = ThingSpeak.writeField(my Channel Number, 1, number, my WriteAPIKey);
```

Results

Firstly, the output data from the sensor is examined by Arduino. The graph shown in figure 4 is drawn with data received by Arduino and it is displayed by serial plotter which is built-in Arduino IDE.

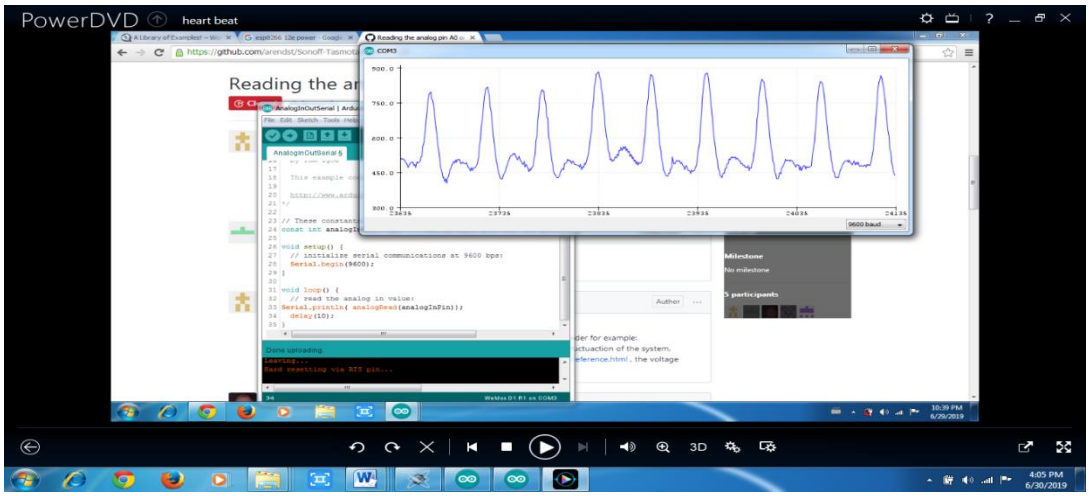

Figure 4 Heart rate by Arduino IDE

According to the waveform, the sensor has Good sensitivity. After testing sensor, it is connected to NodeMCU through Arduino. The heart beat wave form can be visualized by using the processing software. The heart rate – time graph, the sending heart rate data on serial monitor and pulse rate wave form are illustrated together in the figure 5.

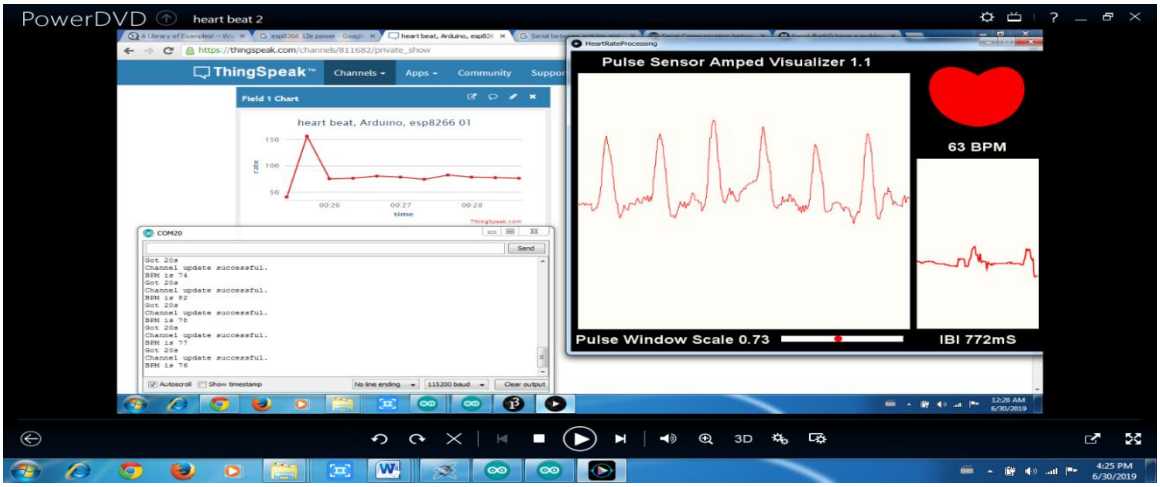

Figure 5 Heart rate monitoring on PC.

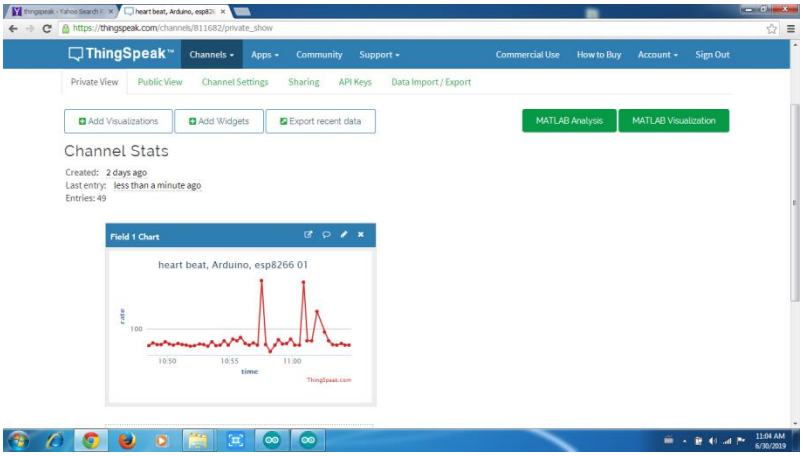

Figure 6 Heart rate displayed on thingSpeak

Figure 7 Heart beat display on phone

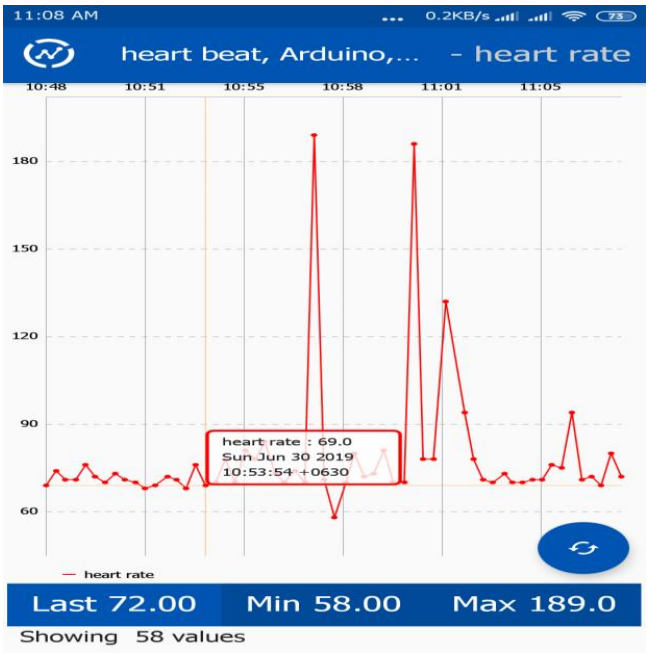

Figure 8 Analysis of heart rate

The heart rate can be received by smart phone, tablet which has internet accessibility as well as PC. Figure 7 and figure 8shows the heart rate and Matlab analysis on phone respectively.

Conclusion

This is an important sensor based system which has the latest technology implemented in it. And it has many applications & advantages. IoT Healthcare is the most demanding field in the medical area. Patient health parameter data is stored over the cloud. So it is more beneficial than maintaining the records on printed papers kept in the files. Or even the digital records which are kept in a particular computer or laptop or memory device like pen-drive.

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