Internet of Things Based Heart Beat Rate Monitoring System

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Abstract— The main objective of this paper is to develop a system which will display the real time heart rate conveniently on a smartphone device. This is achieved using the SEN 11574 pulse sensor which is an optical sensor to detect heart beats. The wireless transmission of data is achieved with the help of the NodeMCU (ESP8266) board which is interfaced with the sensor. The NodeMCU takes the data and is then sent to the blynk cloud where it can be accessed anywhere at any time. The heart rate data displayed can also be saved for further processing of the data..

Indexed Terms— Real time heart rate Monitoring, NodeMCU (ESP8266), Blynk mobile application, SEN11574 sensor.

I. INTRODUCTION

Health plays an important role in our daily routine. Real- time health monitoring for early detection of life-threatening diseases through advanced communication and detection technology often contributes to cutting-edge treatment that saves lives. Heart rate plays an important role in monitoring and evaluating health.

Function of heart is extremely important as it pumps O2 rich blood to all other vital organs. When heart fails to pump the blood properly, the results can be fatal. The overall health of the heart can be captured with accurate heart rate data. Strokes, blockages can be effectively predicted by analyzing heart rate (arrythmia).

This project aims to develop a system that conveniently displays real-time heart rate on smartphones. This is achieved by using a pulse sensor which is an optical sensor to detect heart rate. Heart rate data can be very useful whether one is designing an exercise routine, research activity or anxiety level, or just wants the shirt to blink to your heart rate. Wireless data transmission is done using a NodeMCU that is interfaced with the sensor. NodeMCU takes the data and then sends it to the blynk cloud, where it can be viewed anywhere, anytime. The displayed heart rate data can also be saved for further data processing.

II. LITERATURE SURVEY

Mr. Ved Prakash et. designed a heart rate monitoring system using pulse oximeter and fingertip sensor and 8051 microcontroller, fingertip detection system and using non- invasive PPG sensor to detect changes in heart rate. The system is not wireless and only displays data on the LCD screen. [1]

Jatin Arora et al. proposed a prototype for heart rate monitoring. The Heart Beat (HB) sensor is being developed to acclimate the input signals are taken by the LDRs (light dependent resistors) and LEDs. It detects a person's heartbeat and converts it into electrical and pulse signals. Initial signals are weak hence they are amplified with the help of an amplification circuit. The heart rate data can be extracted with the help of frequency, this is the working principle of HB sensor. User needs to place his finger on the HB sensor. [2]

Sahana S Khamitkar used Android app and Bluetooth module as well as Heart Rate (HR) module to receive heart rate signal using a noninvasive, passive technique The data collected by the HR module is sent to the Android device by a Bluetooth module. This can be used to study the person’s heart rate patterns and draw conclusions regarding his/her cardiovascular health. Bluetooth module can transmit signals to the mobile device when the device is in the vicinity (15 to 20 meters). [3]

Reshma Sai Priya Talluri et al. The heart rate sensor is used to detect the pulse. This widget will quantify the average vascular weight (MAP) in a split second and the body temperature can be viewed on an Android

device. This data is later processed to collect physiological data such as heart rate, stroke volume etc. [5]

III. BLOCK DIAGRAM

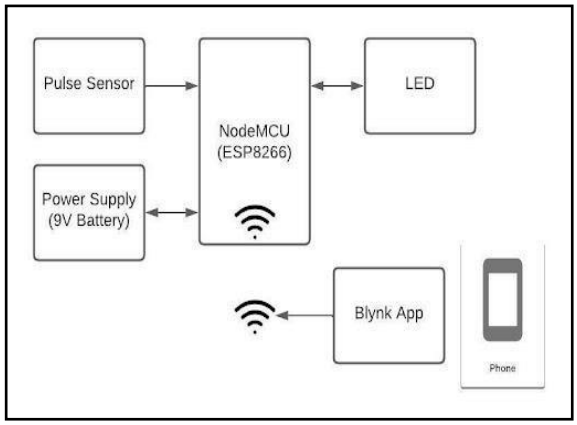

Fig 1: Block Diagram

The block diagram of the heart rate monitoring system is as shown in above diagram. The NodeMCU is the main controller and transmission component which sends data to the blynk app using WiFi. The pulse sensor is an optical sensor which measures the heart rate based on a reflection mechanism. The nodeMCU is powered using a 9V supply (a 9V battery or power adapter). The on board led shows the status of the monitoring system. The blynk.cloud web application can also be used to access the heart rate remotely.

IV. DESCRIPTION OF COMPONENTS

ESP8266 is an IoT platform which is also open source. The hardware of the module is based on ESP-12 WiFi module. ESP8266 is also known as NodeMCU which is a portmanteau of “node” and “MCU” where node refers to a data point and MCU refers to micro-controller unit. NodeMCU is the name given to the firmware used in ESP modules. Lua scripting language is used in the firmware design. The board functions as a DIP (dual in-line package). It integrates an USB controller for connecting the board to the PC and a small MCU, antenna is mounted the surface of the board. This choice facilitates easy designing of projects on a breadboard.

Fig 2: NodeMcu (ESP8266)

The SEN-11574 pulse sensor is used for sensing heartbeat rate. The ambient light sensor along with a green LED is mounted on the surface of the sensor. Similarly, the circuit responsible for further processing of the weak signal such as noise cancellation and amplification are mounted on the other side of the sensor.

The LED is placed above a vein of the human body, such as the ear lobe or the tip of the finger, however it should be placed immediately on the top of a vein. When the LED is positioned over the vein, it begins to emit light. When the heart begins to beat, blood begins to flow via the veins. We can check the heart rates once we check the blood flow.

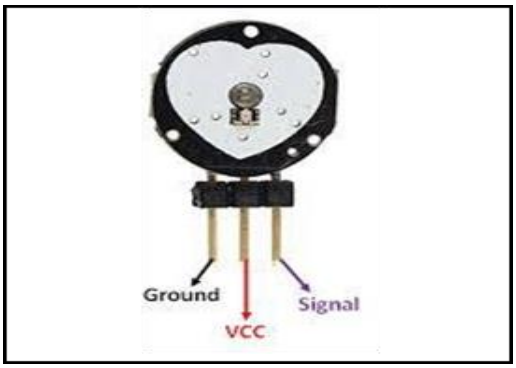

Fig 3: Pulse Sensor (SEN11574)

Blynk is an IoT platform that is supported by iOS, Android and Web applications to control various IoT boards with the help of internet. The IoT boards that are supported include: Arduino, Raspberry Pi and NodeMCU. The interface helps in the controlling of hardware from anywhere. It can also display and store

the data for further processing. The processed data can be visualized with the help of various widgets. The data can also be further processed remotely.

The three major components of the Blynk Platform are Blynk App or Blynk Web app which is with its clean GUI it helps us to create software interfaces for the IoT hardware using widgets. Blynk Server is responsible for all the communication from and to hardware. It can handle millions of devices seamlessly allowing multiple connections for different users. Blynk libraries is available for all hardware platforms and has files to process the incoming and outgoing commands.

The Arduino IDE is a multi-platform, open-source software used to develop sketches for various IoT boards. The IDE supports C and C++ programming languages and the IDE itself is written in Java, C and C++. Arduino IDE works across many operating systems such as Windows, macOS, Linux. The version used in this work is 1.8.16. Sketches written in Arduino is saved with a .ino extension the code can then be uploaded to the board that's connected via an USB cable. The process of developing the sketch is called sketching. The code editor itself is feature rich and has auto format function to make the codes easy to read. Along with a great code editor it also provides debug support, console support, serial monitoring and serial plotting functions. Arduino IDE is an excellent software for anyone who wants to develop IoT and Wireless Network systems. The circuit model for the system is shown below.

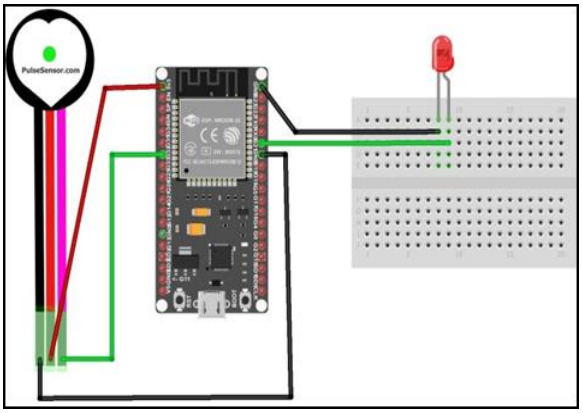

Fig 4: Circuit Model

V. RESULT

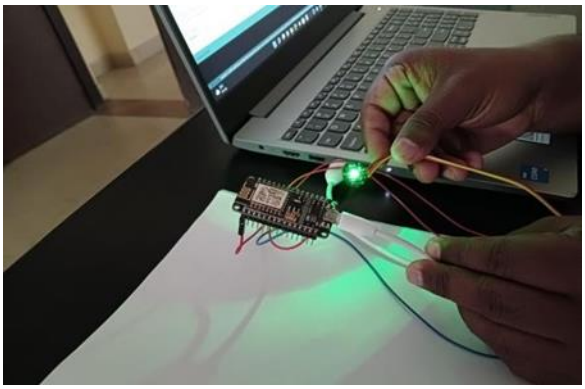

Fig 5.1: Working of Heart Rate Monitoring system usingPulse Sensor

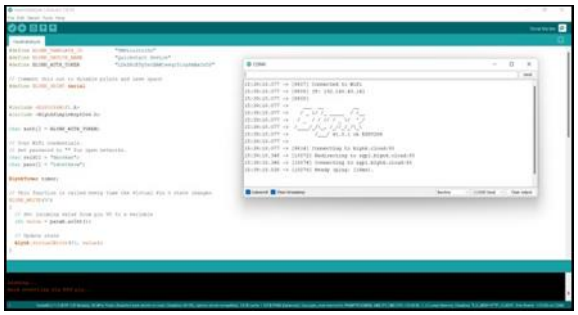

Fig 5.2: Heart Rate Output Using Arduino Ide

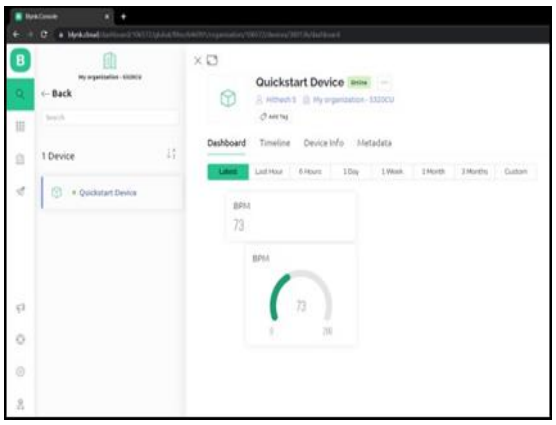

Fig 5.3: Heart Rate Output Using Blynk App

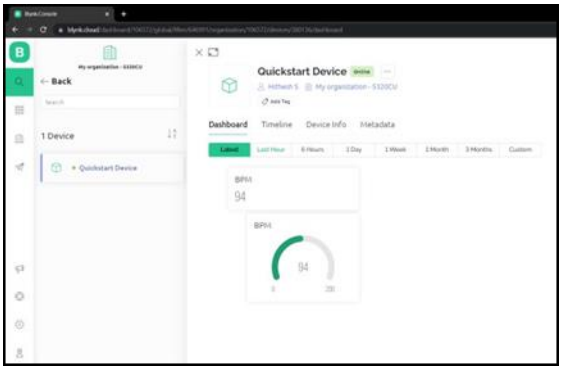

Fig 5.4: Heart Rate Output Using Blynk App

Heart rate is directly associated with intensity of exercise. Overtraining and arrhythmia can be detected by gathering heart rate data. Helps detect changes in heart rate associated with other health ailments. Remotely monitoring data saves precious time needed for diagnosis. Energy expenditure can also be estimated if VO2max is known. Variation of heart rate is also associated with stress which can be monitored and controlled.

When you use a heart rate monitor for any activity, it is clear about how much effort is required to complete a particular task and what the situation is (eg, medication, caffeine, sea level, time of day, etc.). You will get the data. What do we have to do with your body and show yourself to achieve the selected physical performance of the day. Heart rate monitors are a great tool for clearly viewing and assessing the state of the cardiovascular system during physical activity. Again, consciousness is power! This is great information to share with your doctor and can provide you with great insights into your health. Heart rate is an indication of the ability of the heart to recover from an exercise/training. The faster the heart recovers the better the heart's health is. A slow recovery often isn't a serious problem but can be due to an underlying, undiagnosed ailment in which case proper medical attention is paramount. The pulse sensor used in the project is fairly accurate (85% accuracy) and the method is non-invasive and simple. Optical heart rate sensors are also cheap and reliable in most everyday cases such as exercise monitoring and strength training.

With NodeMCU, the data can be recorded directly and it can be shared over WiFi to any mobile device that is set up with proper credentials.With NodeMCU, you can record data directly and share it over WiFi on your mobile device. [4]

The disadvantages are the optical heart rate sensor used in the project is cheap and fairly accurate (85%). However, medical heart rate monitors require 90% accuracy to make an accurate diagnosis. Heart rate cannot simply predict overall cardiovascular health and is often misleading as these symptoms require EKG for proper diagnosis in people with arrhythmias. Using a development board like NodeMCU makes the system bulky and more difficult to transfer. Therefore, a dedicated PCB is recommended and costs many times higher. To get accurate readings, one needs to hold the optical heart rate sensor against fingertips or earlobe. In some cases, it may not work effectively. For example, when measuring the heart rate of a person with dark skin, the sensor is not accurate (because light cannot effectively reflect back). [4]

VI. CONCLUSION

In this paper an IoT based heart rate monitoring system is proposed and developed using NodeMCU, a pulse sensor and Blynk Web application. The heart rate data collected can be processed and sent to the Blynk platform directly for further processing and remote diagnosis. The heart rate is read as an analog signal and then is printed as a digital discrete value. The system was able to capture and read the heart rate and send the data over to the Blynk Web application using WiFi, so the experimental results obtained were fairly accurate and can serve as a data set for rempte diagnosis and other health studies and assessments. Heart rate of 40 or less is categorised as low, 40-100 as moderate and >100 as high depending on the patients age. Project approaches the problem of heart rate monitoring using sensor network and wireless technology.

This version of the project only reads and saves the data to display. There are huge chances for improvement here. The data can be time stamped for more detailed processing of the heart rate. A buzzer can be interfaced to sound a beep when irregular heart rate is detected by the system. The whole setup can be integrated with other medical measurement system to provide a full scale health monitor. Individual

components used in the project can be integrated and packaged as a single printed circuit board making it easy to handle and carry around. All the data from different people can be processed with an AI program to get better insights of the overall health pattern and heart function. A display can also be added to the system which can display real time heart rate and provide GUI for the users

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