Design a Prototype for Detecting Abnormalities in Heart Rhythm by Applying Technological Interventions

J. Krishna Chaithanya, A. Saiakhila, Y. Pandu Rangaiah

Abstract: This paper demonstrates the basic dialogue for heart rhythm examination of arrhythmia patients who's heart beat is conventionally irregular. In this approach, designed a device which supervises and record the heart beat by evaluating the PQRS complexes. Despite the fact as alone, there are many ECG devices which examine the heart rhythm but they are little precise because, firstly they are not taking the live data for analysis of PQRS complexes inspite many hospital clinic's are taking pre-loaded heart rhythm from few days and months and analysis is done on the data either by mathematical theorems or else by using other techniques like wavelet theorem, matlab etc. Here, focus is mainly on analysis of pqrs complexes from live data. Internet of things is been far-flung technology in extant days. So by IoT the heart rhythm and PQRS values are been displaying on web so that doctor monitor patient data up-to-date from anywhere and at any time. The device has been implemented and evaluated by using the Heart beat sensor AD8232, Raspberry Pi 3 b board, Arduino Uno, Python programming.

Keywords : Heart beat Sensor, Arduino Uno, Raspberry Pi, Heart Rhythm, Python.

I. INTRODUCTION

Recent time with the evolution of many technologies there is a need for effective heart monitoring systems because according to the reports of world health organization (WHO) CVD's are unit quantity and one reason behind the death's globally [1]. Innumerable people die per annum raised from CVDs' than from the other cause or other disease. In present day there are many hospital's ,doctors and heart monitoring devices but failing to reduce the heart strokes of a patients because the first reason is patient heart beat is not examined time to time .

Here, this paper comes up with Internet of things technology to solve this problem where doctor can monitor frequently. Secondly, many devices are just monitoring the heart rhythm they are not displaying the pqrs values. For analysis of PQRS values there are many recent solutions have come up but they store the heart rhythm from few days or months and by using this pre- defined data they do analysis by using matlab and graphic image technology [2]. But during this time arrhythmia patient may be attacked by the stroke. So, here for these issues the solution is live data should be analysed and pqrs values should be displayed on web. So that doctor can examine easily.

A. ECG Description and PQRS complexes

An electrocardiogram is a chart delineating the electrical action created by the depolarization and repolarization of atria and ventricles i.e In PQRST Complexes P is Atrial Contraction, QRS is Depolarization of Ventricles, T is Ventricular Repolarization [3]. An ECG single wave is composed of PQRS waves as shown in Figure 1. ECG signal investigation is crucial for making the information helpful in the analysis of heart condition. In this manner the improvement of productive ECG include extraction calculations is of incredible worth also, significance. The greater part of the clinically valuable data in an ECG sign is available in the interims and amplitudes characterized by its highlights. An ECG highlight extraction calculation is additionally useful in the identification of cardiovascular issues known as arrhythmias including tachycardia, bradycardia, pulse variety and so on. Beat identification is utilized to decide the pulse and recognize arrhythmias while further preparing is performed to identify unusual beats. A number of procedures have just been proposed for recognition of ECG characteristics. Many techniques where used for ECG extraction like for example DSP techniques.
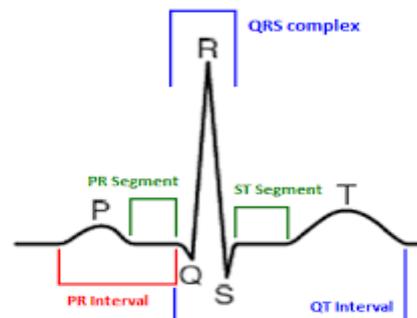

Fig 1:ECG Wavefrom

The basic motto of this paper is to monitor the arrhythmia patient continuously and display the heart beat rhythm along with P,QRS complexes and display result of his/her condition in web page. So that doctor can do analysis off his condition and monitoring patient continuously . By this way many patient live can be saved.

II. LITERATURE SURVEY

Hussain[2015] has proposed a technique to extract PQRST values by using simple mathematical algorithm and designed a GUI [Graphical User Interface] by using matlab to display the ECG [4].

Muhammad[2014] in his paper he has clearly explained by using novel windowing algorithim approch how an these PQRS wave are selected. Even this paper deals with ECG timing intervals and the equation are given to caluculated interval rate [5].

Mehak [2017] has incorporated in his paper that how to use Internet of Things technology with respect to health monitoring system. Here the patient health conditions and patient health parameters like heart rate,tempearture are send to cloud using this technology by which doctor can examine the condition of patient before he comes to the hosptial [6].

Jasti Sowmya Sree[2019] in this journal it has been explained that the predefined values are taken and stored in the cloud .If the patient heart rate or temperature doesnot matches with the predefined values in the cloud then it automatcally sends alert to patient family or relatives via sms [7].

.Deepshikha Goyal[2012] this paper deals with how patient can be monitored from remote places with low cost health monitoring system here patient helath parameters like pluse rate, tempearture and blood pressure.The data of these parameters are displayed on the LCD .Tablet PC is used to store the parameters by using bluetooth.If incase internet is not available then they are stored on local database when network is available it automatically send data to the cloud [8].

III. ARCHITECTURE AND DESIGN OF A SYSTEM

This suggested system is an amalgam of numerous modules specifically, Heart beat sensor module, primary module and Arduino uno module. The below Fig.1, Fig.2 constitutes of the flow of the device working and block diagram. The Heart beat sensor module is responsible for extracting the heart rhythm from human heart through the electrodes which are attached to the patient body. Arduino uno in this system mainly acts as ADC .This module accepts the heart rhythm from the heart beat sensor and direct to the primary module for further analysis of the heart rhythm and extracts PQRS complexes.

Primary module is the centre of this system is the Raspberry Pi 3 b, its function include, obtaining the heart beat processing and analysis the heat rhythm and displaying both rhythm and PQRS complexes. Storing them in database and displaying in web. The primary module likewise acts as embedded web server and is accountable for displaying the rhythm. Database is used to store the patients data.

Another crucial role of the primary module is the way to go about as an installed web server, the essential obligations of this server incorporate, transmitting the heart beat and pqrs complexes. Python code is utilized to program certain parts of this framework for analysis of heart rhythm to extract pqrs complexes values. Standard Python libraries relating to the web.The framework is additionally arranged utilizing Apache to go about as a server, which is valuable to remotely screen the conditions. The proprietor can sign in to the server utilizing a devoted static IP doled out to the Raspberry Pi another significant activity of this server is to provide a alert in colour as well as gives beep sound in case of a heart rate exceed the limit .
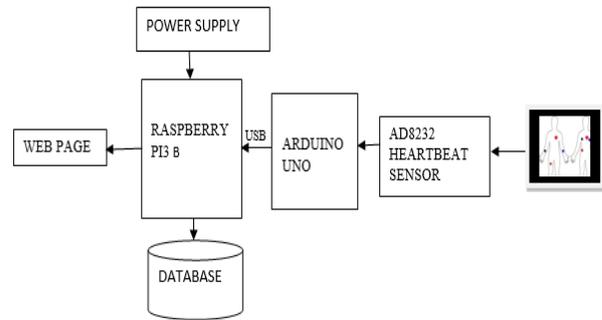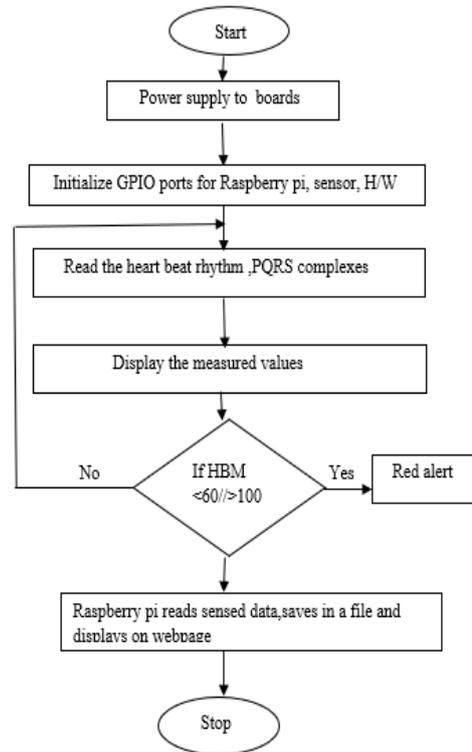

Fig. 1.Block diagram

Fig. 2.Flow Chart

IV. DESCRIPTION OF THE SYSTEM

A. Heart Rhythm Extracting sensor

Here in Fig.3 shows the Heart Rhythm extracting sensor is AD8233 .This is utilized to check the electrical movements of the heart. The electrical advancement are outlined out as an Electro-cardiogram. Electro-cardiograph is utilized to help separate different heart conditions.

The AD8232 from Ana-log Devices is a devoted single lead heartbeat screen front end encouraged circuit.

The AD8232 is a fused sign embellishment obstruct for ECG and other bio potential estimation applications. It is expected to separate, upgrade, and channel little bio potential banner inside seeing disorderly conditions, for instance, those made by development or remote terminal position. This Heart beat sensor is interfaced with Arduino uno because Arduino has ADC inbuilt.[3]
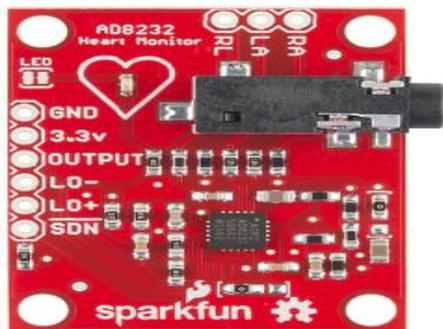

Fig. 3. Heart beat Sensor

B. Primary Module

The primary module of the system is a Raspberry Pi 3 b board in Fig. 4. Which is developed by the Raspberry Foudation. Here Raspberry pi 2 is repalced with Raspberry pi 3 b beacuse pi 3 has on board WI-FI module and speed is increased compared to pi 2. Raspberry pi 3 b is encorporated with BCM43438 wireless Lan and bluetooth connectivity on single board. It consists of 4 USB in 2 port, 40 GPIO pins which are extendable, memory as RAM which is 1GB,To store the data and to load the OS it has micro SD card port, Quad Core 1.2GHz Broadcom BCM2837 64bit CPU, 100 base Ethernet, it has full size of HDMI, For connecting the camera it has CSI camera port, for touch screen display it is having DSI display port, 2.5A switched USB power sup-ply which is upgraded. The raspberry pi3 is a quad-center processor with 64bit solidi-fies the arm cortex-a53 It is having official operating system has Raspbian and it is having official programing language has python. The Raspberry pi is designed in such a manner that the operating system like Linux can be run even it is having Raspbian has its official language. Here primary module plays an key crucial role. In this system WI-FI in Raspberry pi 3 b is used to display the heart rhythm and PQRS complexes in web page which is created.

Fig. 4.Raspberry Pi 3 b Module

V. HEART BEAT RATE DETECTION, PQRS DETECTION AND ANALYSIS

Different kinds of methods where used for detection of Heart rate and PQRS complexes like detection based on the GUI (Graphical User Interface) with Matlab,based on DSP,Wavelet transfrom ,mathematical morphologies so on.[2], [4], [7]. In these method the data of electrical activities of heart is taken from past few days,weeks,months and analysis is done on it. Where data is not live ,during this span of analysis the arrthymia patient who heart is irregular all the time will face a server problem and there are huge changes for loosing his life even .So, here the live data is taken from patient through the electrodes attached to patient body and heart beat sensor senses the heart rhythm from thses electrodes and sends to primary module via Arduino where the analysis is done based on the alogirthm used in this system and code runs in the primary module.

Table-1: Heart rate and PQRS complexes of different patients

Patients	P	Q	R	S	Heart beat rate	Status of patient heart beat
Patient 1	0.019	0.007	0.63	0.02	67	Normal
Patient 2	0.02	0.009	0.6	0.05	70	Normal
Patient 3	0.14	0.12	0.65	0.06	71	Normal
Patient 4	0.3	0.2	0.75	0.06	75	Normal
Patient 5	0.002	0.001	0.83	0.123	110	Abnormal
Patient 6	0.3	0.21	0.92	0.287	81	Normal
Patient 7	0.22	0.192	0.77	0.171	87	Normal
Patient 8	0.4	0.091	0.88	0.282	88	Normal
Patient 9	0.3	0.02	1.0	0.189	90	Normal
Patient 10	0.001	0.00	0.6	0.2	55	Abnormal

VI. EXPERIMENTAL RESULTS

The segment spotlight on the results of final suggested device, this device has been designed to identify patients heart rhythm and analysis it ,based on the code written in raspberry pi and identifies PQRS complexes.The heart rhythm and PQRS complexes are displayed in the web page and stores them in the database. Once the electrodes are attached to the patient body and device is ON then automatically the code runs and starts displaying and storing the data which doctor can view from anywhere at any time because of IoT technology used in it.If any abnormalities in heart rhythm is found then it displays alert symbol in a red colour , gives sound.
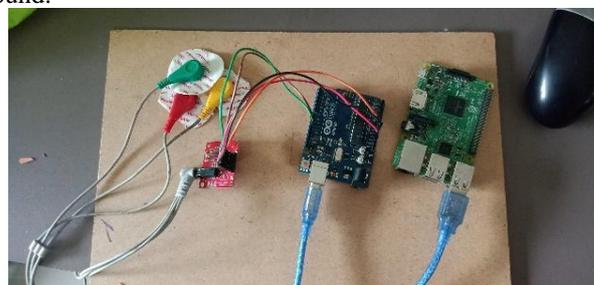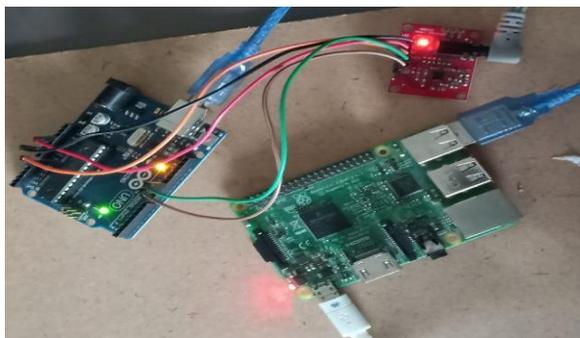

Fig. 5.İntial setup
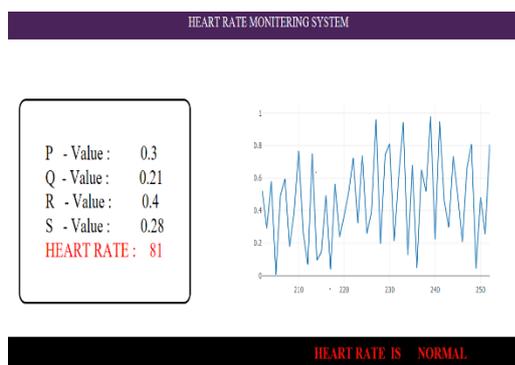
Fig. 6.Final Setup

Fig. 7. Output

VII. CONCLUSION

This paper demonstrates an algorithmic approach for detecting abnormalities in heart rhythm by using technological intervention , lowing the cost, cut back of power because of single chip utilization and the Internet as its chief support. This paper deals with the Health monitoring system which is used for analysis of heart beat rhythm, extraction and detection of PQRS complexes are shown in this paper. By this approach the delay for analysis is reduced and this approach is patient and doctor friendly . Future technologies would be concentrating more on live data recognizing and focuses on T wave as well.

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