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ABNORMAL HEART RATE DETECTION MONITORING SYSTEM FOR ARRHYTHMIA PATIENTS USING IoT & APPLICATION

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Abstract: This project demonstrates the basic dialogue for heart rhythm examination of arrhythmia patients.In this approach event monitors are incorporated and integrated as one device. Despite the fact as alone, these are traditional electrocardiogram recorders and are very little precise or productive in recording the information, showing the information (low determination) & discontinuous observing isn't the exact one to recognize the patient's heart rhythm.to defeat these issues both holter and event monitors are integrated each other and get exact information for time to time QRS analysis and rather than intermittent observing laid to continuous monitoring. The proposed approach is modeled by 3 leads with 1 channels to observe heart rhythm for early and severe diagnosis. In this approach holter mode used to observation of symptoms. The event recording mode can record data continuously, when symptoms are over the threshold value of heart rhythm, the device mode is automatically shifts to holter mode to record the data accurately and alters the family Doctor and care takers depend upon the condition of severity.

Index Terms **- Heartbeat sensor, Event recorder, Holter Monitor, RaspberryPi and IoT.**

I. INTRODUCTION

In many cases, Patient requires continuous monitoring and essentially needs lengthy stay in hospitals which is again becoming costly now days. Traditional monitoring system allows continuous monitoring of important parameters which require the sensors to be connected to bedside machines or PCs, and patient is really confined to bed.

However, today's busy world and increase in overtime events motivates for a monitoring system that continuously monitors remotely located patient. counting on this factor many researchers have developed patient monitoring system.ECG Holter monitoring is that the foremost generally used technique for providing ambulatory cardiac monitoring for capturing rhythm disturbances.

Event recorder records the patient's ECG values whenever these values are abnormal and saves onto SD card. Thanks to the short duration involved and therefore the unknown context within which ECG signal is captured and reliable interpretation of the recorded data is usually a challenge. Telemetry is differently of monitoring remotely located patient. However, current biomedical devices lack within the power to provide large-scale analysis, simulations and computations at the patient's location.

Wireless Sensor Network is becoming a promising technology for various applications. one among its potential deployments is within the sort of Wireless Biomedical Sensor Network (WBSN) for measuring physiological signals. Many ECG monitoring system are developed supported WSN technology.

a) Heart rhythm conditions

Atrial depolarization reflects the P motion. At the start of the P cycle, the PR period starts and ends at the start of the Q phase. It reflects the time needed to plot between the atria and hence the ventricles for electrical operation. The QRS complex expresses ventricular depolarization. It occurs on the ECG (the Q, R, and S waves) as three strongly connected waves. At the height of the S wave, the ST section begins and finishes at the start of the T wave. The ST section is an isoelectric line reflecting the time between ventricle depolarization and ventricle repolarization (i.e. ventricular contraction). Ventricular repolarization is expressed by the T wave. After the QRS complex, it seems to be like a tiny wave. The RR period starts at a wave height of 1 R and finishes at a wave height of 1 R. It describes the period between the complexes of two QRS. At the beginning of the QRS complex, the QT interval starts and ends at the top of the T wave. A threshold value is used as a standard heart rhythm when utilizing this expression from a general heartbeat wave type. If the pulse accepts it became an irregular state, the rhythm of the heart or heartbeat should be between the maximum values.

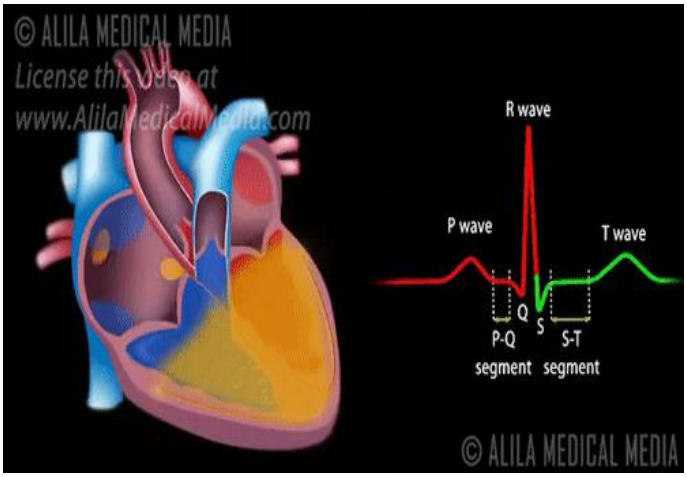

Figure 1 heart rhythm signal.

II. LITERATURE REVIEW

Onder Yakut et al enact the ECG monitoring system using e-health sensor platform and raspberry pi as the development board. Moreover, a connection board developed by cooking hacks was used as an interface between e-health sensors shied and raspberry pi as the sensor was designed originally for interfacing with Arduino. The statistics obtained by electrodes was sent to the data base by using the software written C++ language.

Jan aid Mohammed et a1 enact the android –based health monitoring system using IOT platform. This paper presents the information about required infrastructure viz. IOIO 1microcontroller, communication protocols, data base management system and large file compression system.

STEFANO Di pascoli et a1 developed low-power ECG monitoring system with a wearable facility. The focus of this development was to design a system with attributes viz. low cost,

Wear ability and low energy per bit. In this proposed system the ZigBee protocol was used for data transmission from sensor. This system used low power ADC developed by Texas instrument (ADS1246).

III. PROPOSED BLOCK DIAGRAM

This chapter briefly explains about the proposed block diagram of the project. It discusses the design and working of the design. This design differentiated into software and hardware which helps to detect the abnormality of the patient. Which alerts the other people (registered mobile users) through buzzer in real-time, remote area through SMS and web application. In ICU conditions a MEMS sensor used to sense the position of the patient.

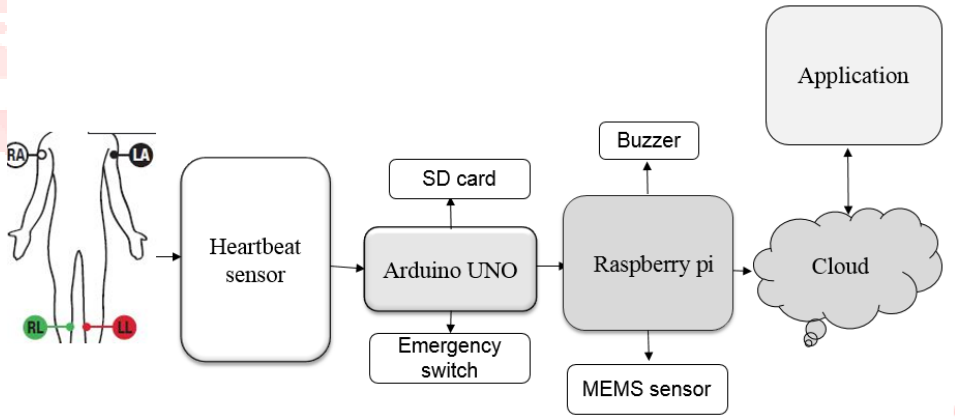

Figure 2 proposed heartrate detection system.

i. HEARTBEAT SENSOR

The below figure 3 is AD8232 Heartbeat Sensor. An uncommitted operational amplifier enables the AD8232 to make a three-pole low-pass filter to get rid of additional noise. To improve common-mode rejection of the road frequencies within the system and other undesired interferences, the AD8232 includes an amplifier for driven lead applications, like right leg drive (RLD). The AD8232 includes a quick restore function that reduces the duration of otherwise long settling tails of the high-pass filters. After an abrupt signal change that rails the amplifier (such as a leads off condition), the AD8232 automatically adjusts to a better filter cutoff. This feature allows the AD8232 to recover quickly, and thus, to require valid measurements soon after connecting the electrodes to the topic. The AD8232 is out there during a 4 mm × 4 mm, 20-lead LFCSP package. Performance is specified from 0°C to 70°C and is operational from −40°C to +85°C.

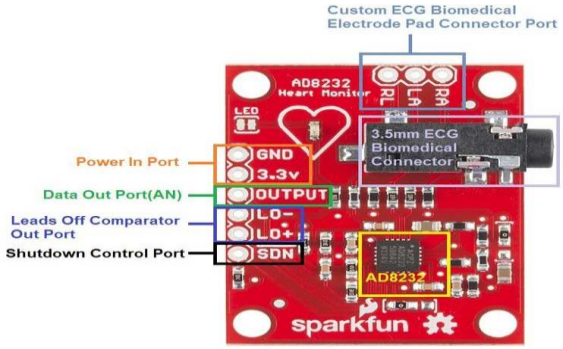

Figure 3 AD8232 heartbeat sensor.

ii. ARDIUNO MODULE

The below figure 4 is Arduino UNO module. Arduino is employed for building differing types of electronic circuits easily using of both a physical programmable circuit card usually microcontroller and piece of code running on computer with USB connection between the computer and Arduino. Programming language utilized in Arduino is simply a simplified version of C++ which will easily replace thousands of wires with words.

Figure 4 Arduino UNO.

iii. RASPBERRY PI MODULE

The below figure 5 is Raspberry Pi Model B+ is a updated revision of the Model B. It increases the number of USB ports. In addition, it has improved power circuitry which allows higher powered USB devices to be attached and now hot plugged. The full size composite video connector has been removed and the functionality moved to the 3.5mm audio/video jack.

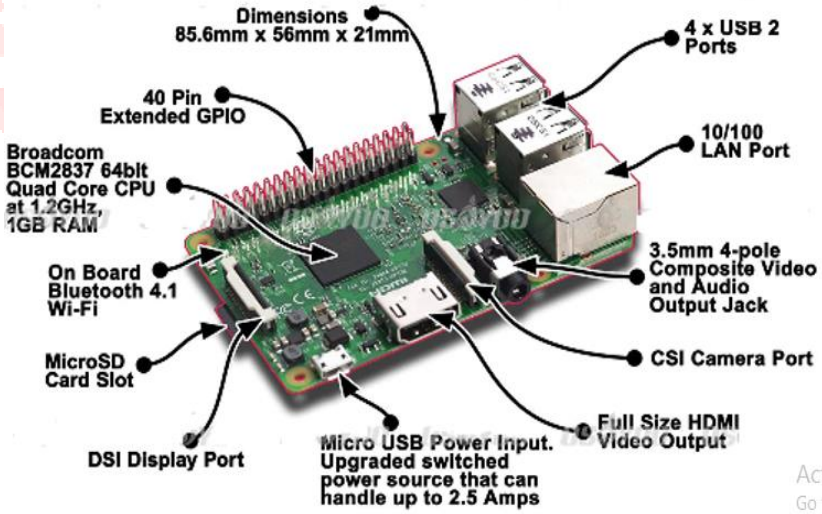

Figure 5 Detailed Raspberry Pi.

iv. WORKING FLOW

The below flowchart figure 6 is about proposed heartrate detection system. This flow is from Holter monitor which monitors the values of heart rhythm until emergency switched or abnormal heart rhythm detected. After getting detection transmits the information to registered users.

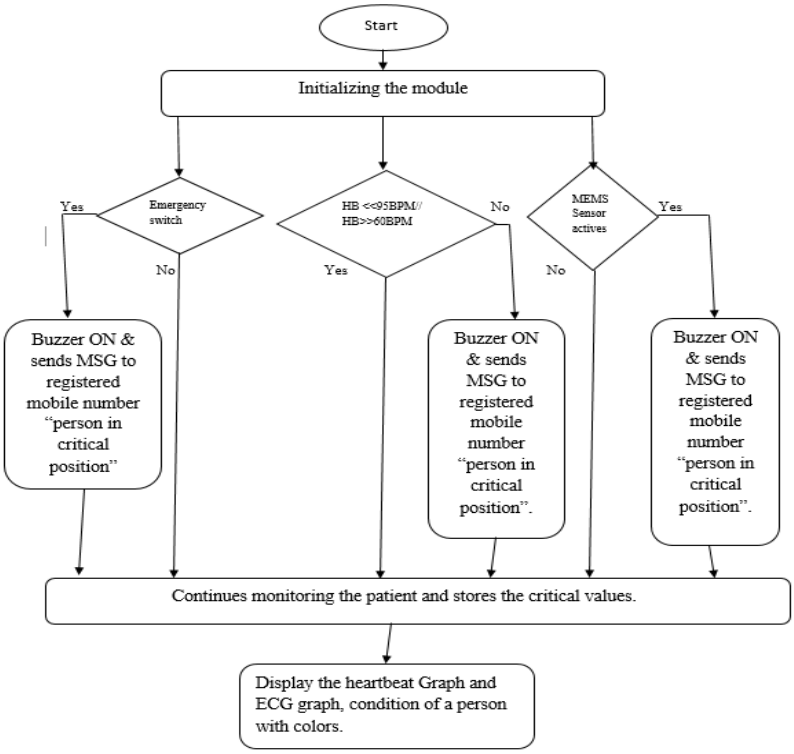

Figure 6 working flow system of heartrate detection.

IV. IMPLIMENATION AND RESULTS

To check the proposed system result. System has to be established with hardware. After that a software has to be procced through the system in a systematic way. This system can classified into two ways i.e.., real time and remote.

A. FINAL PROJECT PROTO TYPE SETUP

Once complete internal connection setup is done. From heart sensor to the pi and connected to a person. Power supply is established to the system. Checking various probabilities of outcomes of the prototype. The outputs can monitored in Arduino IDE, putty software, thingspeak and web application.

Figure 7 proposed Heartrate Detection project setup.

B. ECG RESULTS ON ARDUINO IDE SOFTWARE

After a project setup is successfully done then Arduino IDE software is used to plot the ECG value with respect to speed of 9600buadrate.the figure 8 represents the wave model of ECG signal.

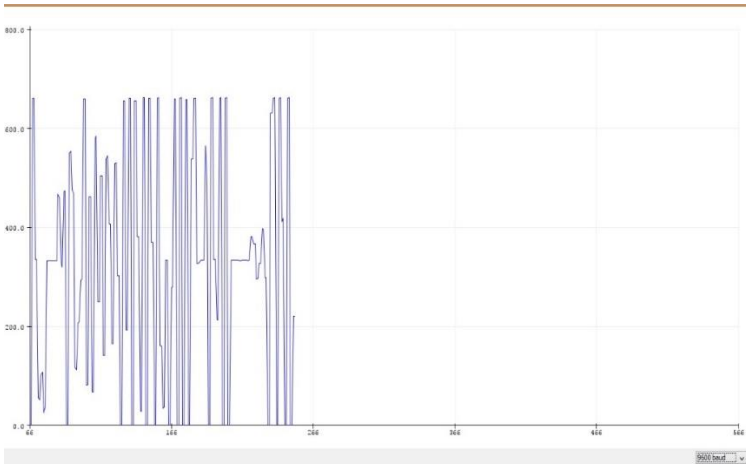

Figure 8 proposed system Arduino IDE plotter.

C. RESULTS ON ARDUINO IDE WITH ECG DATA AND HEARTRATE:

In Arduino IDE software after advanced code developed to then ECG values and heart beat values are plotted in different colors. From below figure 9 proposed system plotting with ECG and heart rhythm values. Given that 'RED' indicates ECG value and yellow indicates Heart Beat in which BPM (Beats per Minute) with speed of 9600baudrate.

Figure 9 proposed system plotting with ECG value and heart rhythm values.

D. MONITORING RESULTS

After login to the Raspberry Pi. Data initialization with respect to Raspberry Pi. That performs GSM checking. After GSM successfully connected. Monitors the ECG three electrode value such as(x, y, z) referred as (positive, negative, common). It is connected to GSM, the continues monitoring of a patient heart rhythm and storing the data. When electrodes detect a critical heart rhythm. Also sending a message to a registered mobile user "Patient is in critical position" with time and date, so it can alert the patient relatives or doctors.

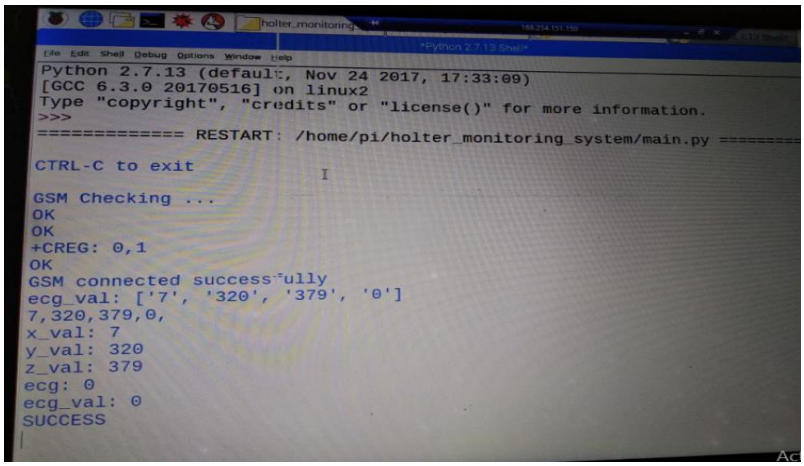

Figure 10 proposed system monitoring in pi.

E. ThinkSpeak (IoT)

Thingspeak is an open source platform from google (https//www.thingspeak.com) which can be able to watch the real-time data and it is easy to create and develop a cloud account.it can store the values of heartbeat which is in thingspeak (cloud) Graph with time and date from below figure 11.the title is given as holter monitoring system with y-axis as ECG Graph and x-axis as Date. This cloud stores the data for limited time (depends the version bought from thingspeak website).

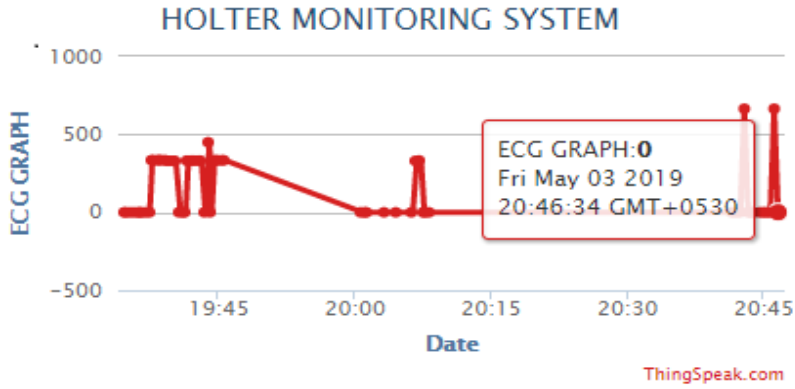

Figure 11 Thingspeak storage Graph with Date and Time.

F. RESULTS ON MOBILE APPLICATION

An android application is developed which shows the heartbeat graph and status with time and date. Whenever a heat beat value is in the range of threshold it shows a green color. If the heartbeat value is out of range then it shows the red color. A special button is created to check the stored abnormal data in the form of 'view critical values'.

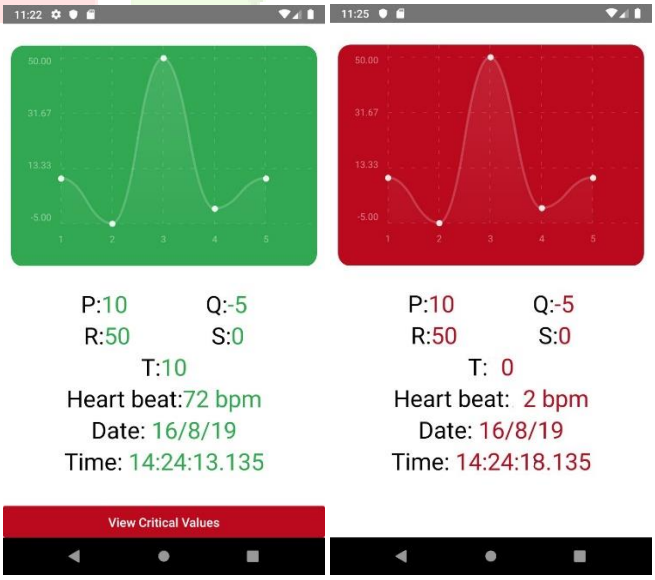

Figure 12 Mobile Application (app) monitoring with condition, date and Time.

G. STORED CRITICAL VALUES

On process of heartbeat monitoring in the application. Some critical values are flows out of the real-time monitoring such values are stored. That can be viewed with time and date.

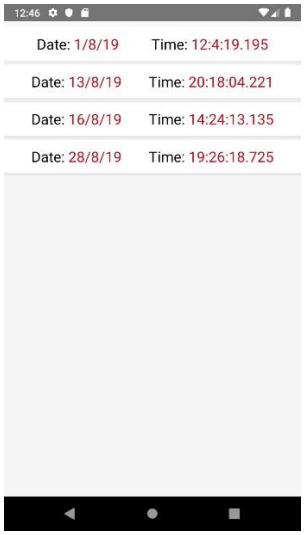

Figure 13 Mobile Application (app) storing the critical values with Date and Time.

By going on trails with different people with different age groups and gender from below table1. Based on testing results, the device performance is very well it is giving 65-90BPM (Beats per Minutes) range output.

Test results of different age groups

Gender	Age	BPM (beats per minute)	Status
male	45	75	normal
male	19	80	normal
female	36	82	normal
female	55	68	normal
male	66	59	critical

TABLE 1

V. CONCLUSION AND FUTURE WORK:

This prototype is designed to monitor the people's health condition and record continuously. The ECG levels are taken from the person and monitored continuously. This values are stored in the SD card and things speak cloud continuously. If a patient is connected with this system. Whenever he feels any discomfort then Emergency switch is pressed to alert. Or another method is monitor continually, if any change in heartrate it alerts. Such like Buzzer will be activated and GSM sends the message to respective mobile number. By using a cloud 'url' .the ECG graph is plotted according to time and date. If person is not in position to press then he may tilt in any direction, movement sensed by (micro-electromechanical system) MEMS sensor, it trigger Arduino will receive signal and buzzer, data transmitted to event recorder will be activated. Entire proposed system can be modified. By using advanced technology, it can more optimizable with power and size.

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