Portable Heart Diseases Detector

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Abstract : **The word 'Health' has paved its way into the minds of the masses. Issues related to health are increasing at an alarming rate. Cardiovascular diseases, once considered to be a malady for the middle aged, are now prevalent among young adults. It is said that heart diseases kills 1 person every 33 seconds in India. The proposed model aims at detecting the occurrence of heart diseases by diagnosing the ECG signal. The chances of death due to heart diseases can be greatly reduced by enabling access to immediate medical attention. This paper mainly emphasizes on collection and inspection of ECG signal for determination of a heart diseases condition. Here, the survey on various behaviors' and conditions observed in the ECG during heart diseases would be discussed which is further processed and accordingly notified to the concerned individuals. The device aims to reduce the response time in case of occurrence of a heart disease which is crucial to prevent major damage to the distressed muscles in the heart.**

IndexTerms - Cardiovascular diseases, Raspberry Pi, ECG circuitry, heart diseases.

I. INTRODUCTION

The heart is a central organ in terms of functioning of the human body. The Myocardium performs the pumping actions in heart which is also referred to as the wall of the heart. In (Fig.1) heart attack, this muscle tissue is denied oxygen-carrying blood due to a blocked artery Myocardial infarction, occurs when many cells die due to a shortage of Oxygen.
The (Fig.2) functioning of a heart can be graphically represented as a cardiogram, commonly known as EKG or ECG waveform. It represents the activity of heart in terms of a series of electrical pulses which consists of 5 major data points- P, Q, R, S, T. Each of these denotes a peak in the ECG waveform. Analyzing these points can give an indication of any abnormalities that occur in the PQRST waveform.

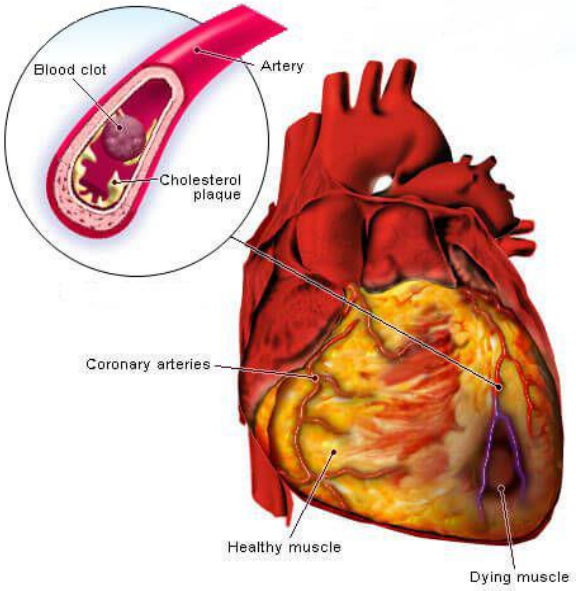

Fig.1Affected Heart

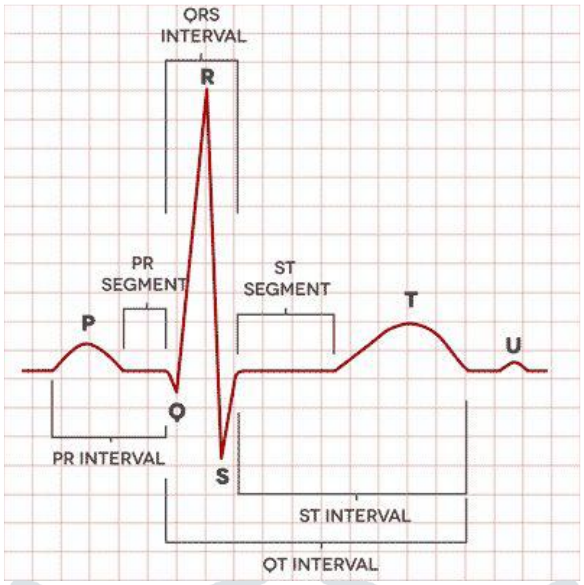

Fig.2Normal ECG Signal

The proposed subject aims at using a real time ECG signal obtained from an ECG circuitry with the help of reusable electrodes attached to the patient's pulse points (three fingers).

The ECG signals obtained from the above are checked for predefined conditions to detect the heart diseases. In the proposed model, for testing purpose, abnormal waveforms are synthesized using MATLAB software. These waveforms are then fed to the Raspberry Pi for simulation through the program code to check for any abnormalities.

II. RELATED WORKS

Previously there have been a few technologies which were used passively to monitor the heart condition for diagnosing heart attack. These include ZENICORECG, OMRON HCG-801 where readings were user initiated and the data was sent to a database which was then analyzed by the doctor to detect the presence of any discrepancies. This restricted its usage for patients having risk of heart diseases and is under observation. Also, due to the absence of wireless capabilities, remote monitoring was difficult. None of these allow the user to do a self-test with noninvasive sensors, or without the assistance of a health professional. Existing technologies.

Include heart attack detection system using android and a self-test to detect a heart attack using phone and sensors. They mainly focus on personal ECG monitoring. These systems notify the doctor with ECG report and user's present location. These, being very similar to the proposed device, lack the automatic detection and risk level indication of heart attack.

Thus, the user remains uninformed about his heart condition. The proposed device aims at automatic detection of heart diseases by constantly analyzing the continuous ECG signal obtained from the body of the user. This ECG signal runs through an algorithm that indicates the level of risk of heart attack to the user- a feature absent in past and existing technologies. The algorithm analyzes the discrepancies occurring in each wave pulse and the recursion of these discrepancies in consecutive pulses. When the heart diseases are identified using cloud analysis, the doctor can retrieve medical report from the cloud.

III.SYSTEM ARCHITECTURE

The architecture of this system consists of multiple individual parts namely ECG circuitry, analog to digital converter (ADC), Raspberry Pi 3 model b, cloud part.

The ECG circuitry (Fig.4) consists of a single OP AMP IC 741, 3 electrodes and resistors. Power supply applied to the mentioned circuit should be of 9V. The circuit mainly comprises of a voltage divider made by using resistors R4 and R5. R3 is used to bring the input body voltage which is usually in the form of mV (mile volts) to a potential comparable to the supply for amplification. The output signal needs to be in a specified range. Resistors R1 and R2 are used in the design to set this range by splitting the supply. This complete ECG circuitry can be replaced by any ECG waveform generating device available in the market

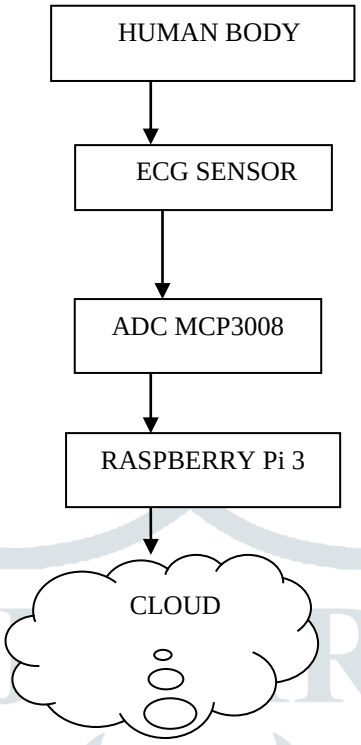

Fig.3 System Architecture

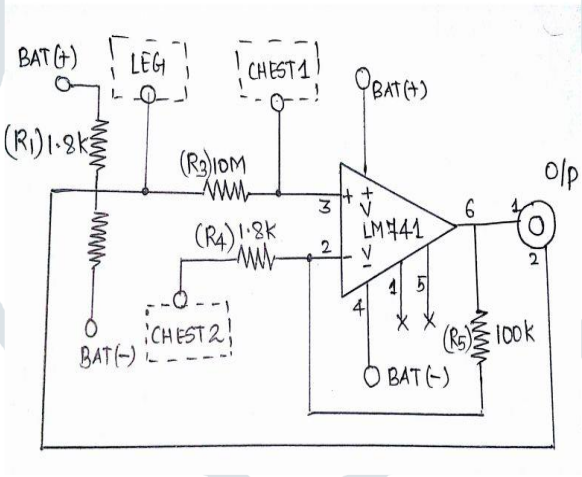

Fig.4ECG circuitry

The obtained output from the ECG circuitry is the passed through a differential amplifier circuit so as to scale the voltage from mill volts to the range of 0V - 5V for input to MCP3008 which is used as an ADC. This is necessary to get identifiable values for same magnitude positive and negative values of ECG wave. The array of digitized sampled points so obtained is sent serially to Raspberry Pi which is stored and analyzed by the software program stored onto it.

Apart from the physical hardware, a major part of the working comprises of running the algorithm in as few lines of code as possible to fulfill the memory and time constraints. Efficiency in execution of the algorithm is largely responsible in reducing the delay between the occurrence and detection of abnormalities. Raspberry Pi has an array of in-built programming languages amongst which our model uses Python. The reason being that this language allows the concept to be expressed in fewer lines of code when compared to other available languages. Python Also provides added ease in debugging errors due to the syntax it follows.

IV. FUNCTIONING OF SYSTEM

The whole model is divided into 3 parts:

Part 1: consists of ECG circuitry from which the analog ECG signal is obtained. This ECG signal is converted to digital sampled data points. These data points are serially given to Raspberry Pi. The ECG signals obtained will be

Of a normal healthy human being.

Part 2: consists of an algorithm run by the Raspberry Pi.
It is mainly run by using individual data points. It evaluates for the several generalized conditions:
1) Heart rate should be in the range 60-120 BPM
2) QRS width should not be greater than 120 MS.
3) The height of QRS should be greater than twice the average of all the points.

Part 3: consists of interfacing the Raspberry Pi with the ECG sensor and MCP3008.

V.PIN CONFIGURATION FOR INTERFACING

RPI (GPIO PIN number)	MCP 3008	ECG sensor
1		VCC
6		GND
9	GND	
17	VCC	
19	MOSI	
21	MISO	
23	SCLK	
24	CE	
	AD0	OUT

VI.RESULTS

Its displays real time ECG signal of a normal person. When all conditions are within limits and there is no risk detected. The output seen through cloud and Raspberry pi3 when abnormalities are detected. It can be seen how the device detects the risk level and can be retrieved by the doctor at distant area.

VII. CONCLUSION

The proposed idea is implementable over a device for the several basic heart diseases conditions. The commercial Implementation is realistic with minimal changes in design and size of the model. It can not only aid the patient to keep track of his activities but also draw the attention of people in medical assistance as soon as risk level crosses the threshold.

However, unavailability of networks leads to failure in alerting ambulance and doctor. The heart diseases detection through ECG waveform is the screening test which further needs to be accompanied with factors like careful diagnoses of the ECG waveform to avoid misconception of heart diseases which are rare to occur, symptoms of heart attack, etc. and minute factors like age and gender of the person, high blood pressure, high blood cholesterol, overweight and obesity. The device in all acts as a powerful assistive diagnosis tool. In this paper, the conditions for analysis of heart diseases by analyzing the pulse waveform and the algorithm used to do the same were discussed in detail and the results obtained have been displayed accordingly.

VIII. FUTURESCOPE

1. The proposed model can be made portable as it can be attached to accessories like wallets or mobile phone cases that are commonly used in daily lives.
2. The size of the device can be scaled down using VLSI to customize the components specifically for the intended purpose only thereby making it lighter and more comfortable to be used as a portable device.
3. The device can be extended to make a heart monitoring system.

IX. REFRENCES

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