

# ECG BASED HEART DISEASE DIGNOSIS USING MACHINE LEARNING

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**Abstract:** ECG play an important role to diagnose heart diseases. Monitoring patient with arrhythmia, predicts health condition of patient at very early stage. In this paper a low cost real time ECG acquisition done using three electrode ECG sensor. ECG sensor placed on body surface to detect QRS peak and output of ECG sensor is connected to AD8232 ECG module. Output of ECG module connected to ADC microcontroller IC. Further it is connected to raspberry pi for displaying peak output and detecting normal and arrhythmia ECG. Machine learning Libraries are used for detecting arrhythmic heart disease.

**Index Terms - ECG; Python Language; Diagnosis; Heart Rate.**

## I. INTRODUCTION

According to the Centers for Disease Control (CDC), Heart disease is major health concern. Heart disease is the leading cause of death, it is major cause of abnormal deaths. ECG detect heart activity without any penetration or damage to the body. ECG data obtain from sensors contain lot of noise and having very low frequency. So we need to amplify and filter that signal to obtain relevant data. Heart Diseases are of different types which occur in different ways and affect the different parts of body. Heart Beats detect the heart condition of normal and abnormal person. If Electric pulses in heart that leads to heart beat do not work properly leads to Arrhythmias. These make the heart beat in a way it should not, whether that be too fast, too slowly, or too erratically. Heart beat rate varies with age. Normal heart rate of person is in between range of 60 to 100 BPM. Congenital heart defects related to person who born with abnormal heart Athletes have different criteria of heart rate that is in between 40 to 100 BPM, as they go through intense physical activity. On world Heart day of 2015. It is estimated that cardiovascular diseases, are the world's number one killers, claiming 17.5 million lives a year globally. Unhealthy lifestyle is major cause of heart diseases. So there is need of hour to create heart-healthy environment and heart-healthy choices to all individuals.

## II. LITERATURE SURVEY

For instance Kusum Tara, Ajay Krishno Sarkar Dept. of Electrical and Electronic Engineering Rajshahi University of Engineering & Technology Rajshahi-6204, Bangladesh analyzed Real-time Monitoring of Heart Conditions via Electrocardiogram Processing at Different Lifestyle Situations. They designed the monitoring system that can produce and process the ECG signals within MATLAB tool. They detected QRS peak as QRS peak will be different at different lifestyle situation [1].

Another Researcher Yedhukrishna P and Ajai V Babu of Rajagiri School of Engineering and Technology Dept. Electronics and Communication Cochin, Kerala, India done portable ECG analysis. Heart being important function unit of body ECG monitoring algorithm was develop to nullify the error to detect R peak for arrhythmia analysis [2]. Hamza Djelouat, Hamza Baali, Abbes Amira, Faycal Bensaali College of Engineering Qatar University. The paper investigate the incorporation of SC (Compressive sensing) in IOT based ECG monitoring system. They detected abnormality of heart beat using different pattern recognition algorithms [3]. K Raj Mohan, Ilango Paramasivam, Subhashini Sathya Narayan. School of Information Technology & Engineering, VIT University, Vellore. Provided a critical survey on Prediction and Diagnosis of Cardio Vascular Disease. According to them 60% of world population is victim of heart diseases. The health care industry collects huge amount of data every day. But this data is not mined. Data mined techniques are used to get appropriate result. Main aim of this study is to detect causes of cardiovascular diseases and machine learning techniques are used for medical diagnosis [4].

Swathi. O. N, Ganesan. M, Lavanya. R, Department of Electronics and Communication Engineering, Amrita School of Engineering, Coimbatore, used R peak for detection and feature extraction for the Diagnosis of heart diseases. They detected the R peaks from denoised ECG signal with an accuracy of 97.56%. Signals are classified into normal and abnormal signals with 80% accuracy using support vector algorithm [5].

Akanksha Agrawal and Dhanashri H.Gawali NBN Sinhgad School of Engineering, Savitribai Phule Pune University, Pune India done Comparative Study of ECG Feature Extraction Methods. ECG detects electrical activity of heart by placing many electrodes on body. Hence obtaining appropriate method to extract features of ECG. The provided different methods for this purpose and done comparative study based on sensitivity, predictively and accuracy. Different methods are Adaptive threshold, Auto-regression (AR), Histogram approach, Wavelet transform, Independent Component Analysis (ICA) etc. The frequency of the ECG signal lies in the range of 0.05 to 100 Hz. and it has a dynamic range is of 1-10mV [6]. Lida Zhang, Zachary King,

Begum Egilmez, Jonathan Reeder, Roozbeh Ghaffari, John Rogers, Kristen Rosen<sup>2</sup>, Michael Bass, Judith Moskowitz, Darius Tandon, Lauren Wakschlag, and Nabil Alshurafa Measured Fine-grained Heart-Rate using a Flexible Wearable Sensor in the Presence of Noise. Embedded electrodes and sensors continuously measure electrical activity of heart. Due to various activity in daily living skin deformation happens and we get noisy ECG data. The recent advance science activity in wearing comfort generated comfortable and flexible sensor which helps to detect QRS complex peak. The paper capture the noisy ECG signal with the help of four lead ECG sensor and with the help of machine learning framework classifier like SVM(support vector machine) and neural network minimized the noise without disturbing the nearest R peak[7].

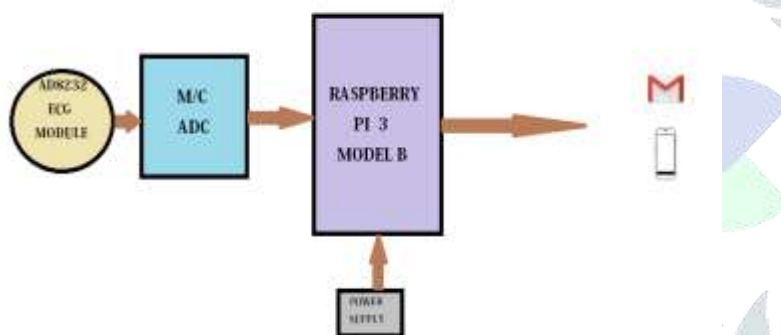
Oleh Viunyskyi and Vyacheslav Shulgin Dept. of Transmitters, Receivers and Signal Processing National Aerospace University Kharkiv, Ukraine In the paper Fetal ECG and Heart Rhythm Analyzing Using Baby Card they obtain information of fetus using abdominal fetal electrocardiogram monitoring. Fetal heart rate and the shape of the PQRST complex, which are indicators of the degree of fetal distress. Aim of this project is to study fetus heart activity [8].

Shouhai Xue<sup>1</sup>, Xinxiang Chen<sup>1</sup>, Zhen Fang, and Shan hong Xia, the paper on An ECG Arrhythmia Classification and Heart Rate Variability Analysis System based on Android Platform for arrhythmia classification and heart rate variability (HRV) analysis. Medical technologies constant renewal medical facilities Android platform is adopted to develop an ECG signal processing application for real-time arrhythmia classification and HRV analysis [9]

Megha Koshti<sup>1</sup>, Prof. Dr. Sanjay Ganorkar M. E Student, Department of ENTC (VLSI & EMB), Genba Sopanrao Moze College of Engineering, Balewadi, Pune, Savitribai Phule Pune University Pune India. The paper on IoT Based Health Monitoring System by Using Raspberry Pi and ECG Signal. As World Wide Web is continuously going to evolve. So the system that uses embedded devices and web technology A novel heart rate detection algorithm based on the continuous wavelet transform has been implemented, which is specially designed to be robust against the most common sources of noise and interference present when acquiring the ECG in the hands.[10].

### III. SYSTEM IMPLEMENTATION

#### 3.1 Block diagram:



#### 3.2 ECG module:

ECG module sensor is used to measure electrical activity of heart. It is based on AD8232 Analog device IC. Output obtain from ECG module is analog reading. As ECG obtain from human body is very noisy. ECG module firstly filter out the noise from ECG which is obtain from human body and amplify that signal. Module break out nine connection from IC, this connection can be connected to arduino or raspberry PI.

#### 3.3 Arduino

It is microcontroller board. Microcontroller was developed with the purpose to make the task easy. It is widely used in embedded system, it is open source platform. It is program using C language. Output obtain from ECG module is analog. In this project Arduino microcontroller is used to convert analog signal into digital signal which is further connected to Raspberry-PI.

#### 3.4 Raspberry-PI

It is single board computer made by Raspberry-PI foundation. It is very chip computer that runs on Linux. It provide set of GPIO pin that allow you to explore Internet of things (IOT). In this project Raspberry-Pi is used to find out Heart Disease using python language and with the help of machine learning approach. It uses non-supervised machine learning algorithm. With importing machine learning libraries.

### 3.5 Machine learning:

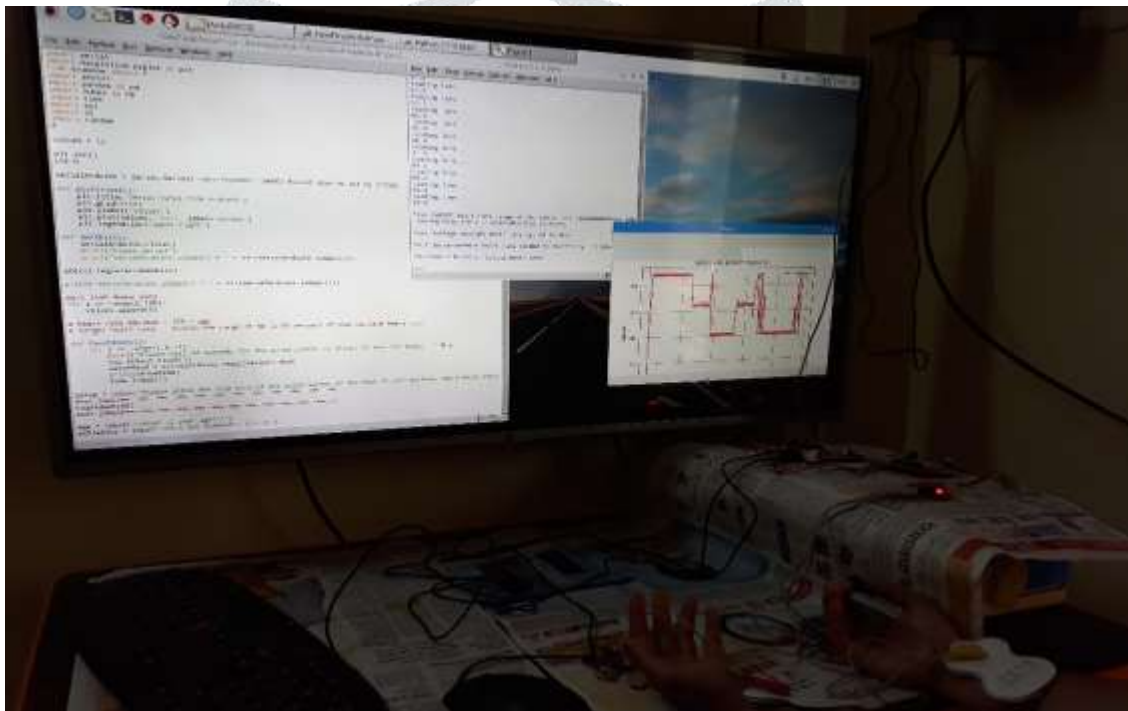
Machine learning is algorithm that allow software application to predict output without being explicitly programmed. Machine algorithm generally categorized as supervised and unsupervised machine learning algorithm. The process involve in machine learning is similar to that of data mining.

Supervised machine learning require data analyst to take inputs and provide desired output with desired machine learning skills. In supervised machine learning, in training state it learn the input pattern and output associate with that pattern. In training state it applies the result and give specific output related to given input based on what he learn in its training state.

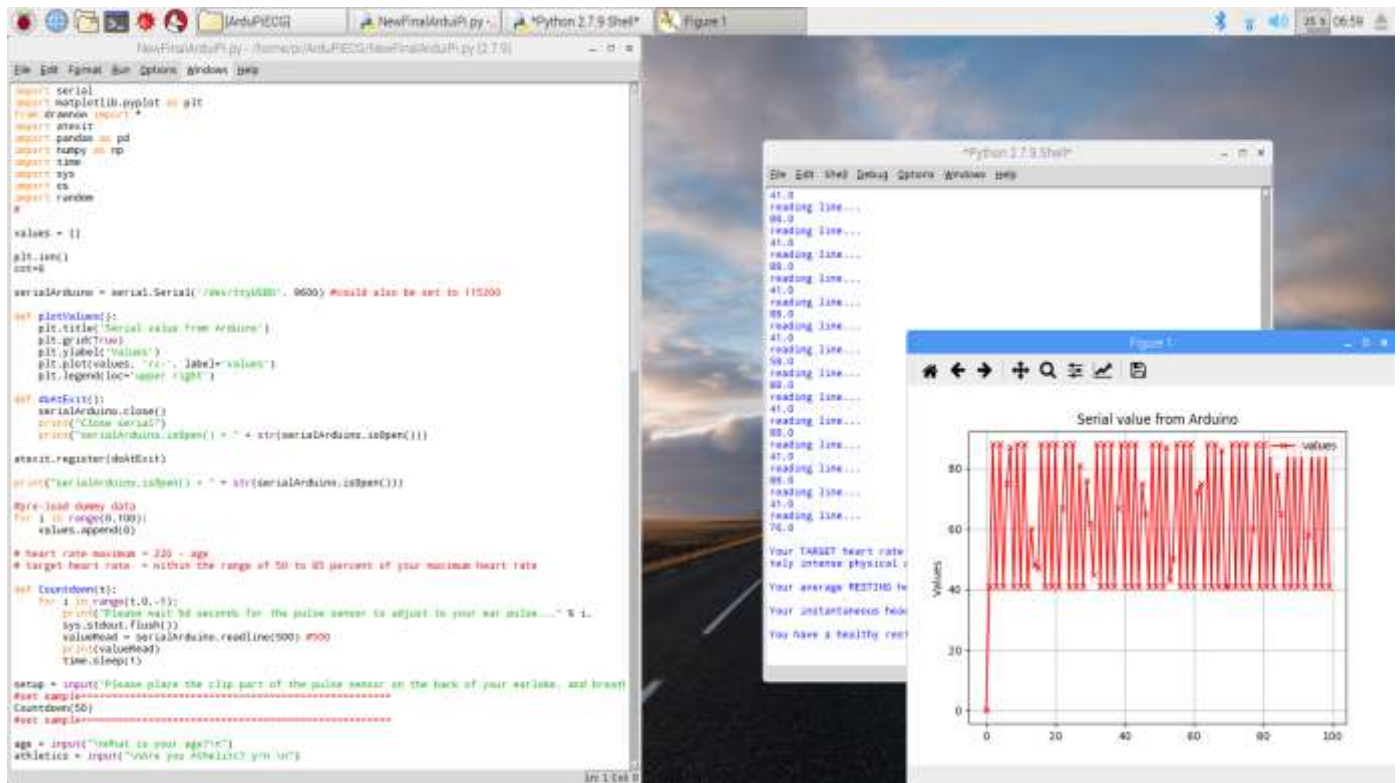
In unsupervised learning algorithm it does not need to train desired output data.it uses deep learning approach to review data and obtain desire output

## IV. RESULTS

### 4.1 Project photo:



4.3 Output screen:



4.3 Output Datasheet

Sr. No	Age	Athlete	Heart Rate	Actual Reading from Doctor	Disease
1	26	No	77.07	75	Normal
2	25	No	64.17	72	Normal
3	46	No	88.64	76	Normal
4	15	No	76	72	Normal
5	22	Yes	60.33	55	Normal
6	10	No	121	125	Tachycardia
7	14	No	120	115	Tachycardia
8	8	No	111.04	105	Tachycardia
9	68	No	58	53	Bradycardia
10	70	No	55	52	Bradycardia

## V. CONCLUSION

As a conclusion to develop a circuitry with less complexity and able to move. Using raspberry pi and python results are presented. Python language is easy to understand and decreases the length of code. It shows that real time data collection is not possible in matlab which can be done using this system. Internet technology helps to send the obtain result of arrhythmia through mail to the particular person. It determine heart rate and abnormalities related to heart rate like tachycardia, bradycardia. The system gives result .with 90% accuracy.

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## BIOGRAPHY



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