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An IoT-Cloud Based ECG Telemonitoring System for Smart Healthcare

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Abstract – **Internet of Things (IoT) promises to revolutionize the health-care sector through remote, continuous, and non-invasive monitoring of patients. An IoT platform for prediction of Cardiovascular Diseases using a Signal Quality Aware-IoT-enabled ECG telemetry system, intervals detection application has been presented that contains a Processing signal and alert physician for emergency through Android application. It is helpful for the physician to analysis the heart disease as easy and accurate. We are developing a continuous ECG monitoring system by which people can check their ECG signal even at their home, identify any problem in heart or identify cardiovascular diseases and alert the physician for emergency. The size of system is small and it requires less maintenance and operational cost.**

Keywords: IOT, ECG signal, Android, cardiovascular diseases.

1. INTRODUCTION

Electrocardiography (ECG) is the interpretation of the electrical activity of one's heart over a period of time. Recently, there has been increased interest and demand in ECG measurement devices called Electrocardiograms (ECG) for use in the medical and research fields. This application will attempt to give the reader a background on ECG signals as well the methods and design techniques that go into designing an ECG demonstration board. It will focus on amplifiers for the small ECG signals as well as some of the various Ways of reducing various noises in the system; this includes explaining the Right Leg Drive circuit. Essentially, the action potentials from different nodes in the heart are what make up electrocardiograph (ECG) signals. ECG signals are comprised of the superposition of the different action potentials from the heart beating as ECG machines use electrodes to convert the ionic signals from the body into electrical signals to be displayed and used for data analysis. However, due to the size of the signals and outside noise, ECG requires amplification and filtering to produce high quality signals.

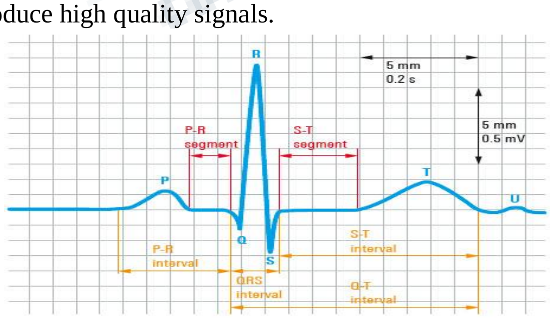

Figure 1: Superposition of all the action potentials produces the ECG signal.

II. ECG SEGMENTS

PR Segment:
The PR segment begins at the endpoint of the P wave and ends at the onset of the QRS complex. It represents the duration of the conduction from the a trio ventricular node, down the bundle of His and through the bundle branches to the muscle.

ST Segment:
The ST segment begins at the endpoint of the S wave and ends at the onset of the T wave. During the ST segment, the atrial cells are relaxed and the ventricles are contracted so electrical activity is not visible. The ST segment is normally isoelectric.

III. ECG INTERVALS

QT Interval:
The QT interval represents the duration from the depolarization to the repolarization of the ventricles. It begins at the onset of the QRS complex and ends at the endpoint of the T wave.

PR Interval:
The PR interval begins at the onset of the P wave and ends at the onset of the QRS complex. This interval represents the time the impulse takes to reach the ventricles from the sinus node. It is termed the PR interval because the wave is frequently absent. Normal values lie between 0.12 and 0.20 seconds.

QRS Interval:
The QRS complex begins at the onset of the Q wave and ends at the endpoint of the S wave. It represents the

duration of ventricular depolarization. Normally all QRS complexes look alike. They are still termed QRS complexes even if all three waves are not visible. Bizarre morphology and duration prolongation may be symptomatic of aberrant conduction, ventricular ectopic or ventricular escape beats, ventricular hypertrophy, or molecular problems, such as electrolyte imbalance or drug toxicity.

IV. OBJECTIVE

An ultra-low power, secure, fully integrated IoT platform for prediction of Cardiovascular Diseases using a Signal Quality Aware-IoT-enabled ECG telemetry system. intervals detection application has been presented that contains a level-crossing ADC and alert physician for emergency through SMS. It is helpful for the physician to analysis the heart disease as easy and accurate.

V. TECHNOLOGY

IoT devices can be used to enable remote health monitoring and emergency notification systems.

VI. LITERATURE SURVEY

[1] GyanapravaMishra, KumarBiswal. The Authors proposed a novel wavelet-based denoising method using coefficient thres holding technique.

[2] Yao Zou, Jun Han, SizhongXuan. The Authors proposed to design an energy-efficient ASIC system for both ECG recording and R-peak detection.

[3] NassimRavanshad, HamidrezaRezaee. Developing level-crossing-based QRS detector for cardiac monitoring devices.

[4] Yan Fang, Chao Li, Lijun Sun. The Authors are proposed the framework for early warning of Cardiovascular diseases (CVDs) under mobile environment, which is a real-time and personalized problem involving various complex knowledge.

[5] Samir V.Zanjala, Girish. R. Talmale. The Authors proposed the elderly people and the people victims of chronicle diseases who need to take the medicines timely without missing are suffering from dementia, which is forgetting things in their daily routine.

[6] Aboobacker sidheeque, Arith Kumar. The Authors proposed System is to send an alert to the controller which then transmits this over the internet and alerts the doctors as well as concerned users.

[7] Udit Satija, Barathram Ram Kumar, & all. The Authors proposed the design and development of a light-weight ECG SQA method for automatically classifying the acquired ECG signal into acceptable or unacceptable class and real-time implementation.

[8] Bhoomika.K ,Dr. K N Muralidhara. Proposed system is to continuous monitoring of the patients over internet.

[9] Fizar Ahmed. The architecture for heart rate and other data monitoring technique. kNN classification algorithm to predict the heart attack by using the collected heart rate data and other health related perimeter.

[10] B.S.Raghavendra, Deep, Bera, Ajit Bopardikar & all. In this paper, dynamic time wrapping (DTW) distance based approach for classification of arrhythmic ECG beats.

VII. PROBLEM STATEMENT

In recent days taking an ECG is a hard task, patients has to search for hospitals which is equipped with the ECG monitoring system. Patients cannot afford the cost of taking ECG due to high cost. Size of the present ECG monitoring system is large; it requires a lot of maintenance and operational cost.In our project, we are developing a continuous ECG monitoring system by which people can check their ECG signal even at their home, identify any problem in heart or identify cardiovascular diseases and alert the physician for emergency. The size of system is small and it requires less maintenance and operational cost.

VIII. PROPOSED SYSTEM

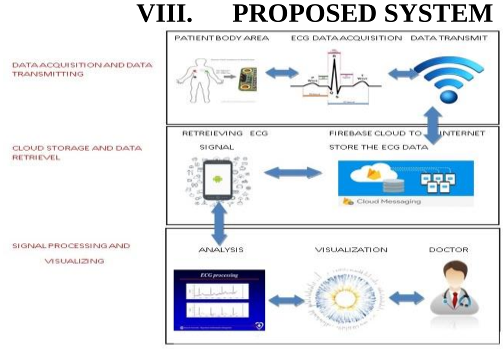

Figure -7 proposed system Architecture

VIII.A. DATA ACQUISITION AND DATA TRANSMITTING

The human ECG signal is taken using Ardino and AD8232. AD8232 is a ECG sensor which senses electrical activity of human heart.Arduino is a controller which gets data from AD8232.The transmitting of signal to the cloud using ESP8266 WIFI module.

VIII.B. CLOUD STORAGE AND DATA RETRIEVAL

Using Esp8266 Wifi module, we are uploading the ECG signal to cloud.

CloudUsed-Firebase.

VIII.C. METHODOLOGY USED IN SIGNAL PROCESSING

QRS Detection Algorithm:

Step 1: Differentiate

The signal is differentiated to provide the QRS complex slope information. We use a five-point derivative with the transfer function.

The difference equation is,

y(nT)=(1/8T)[-x(nT-2T)-2x(nT-T)+2x(nT+T)+ x(nT-2T)].

Step 2: Squaring Function

After differentiation, the signal is squared point by point. The equation of this operation is,

y(nT)=[x(nT)]2.

Step 3: Moving Window Integration

To obtain waveform feature information in addition to the slope of the R wave. It is calculated from,

y(nT)=(1/N)[x(nT-(N-1)T)+x(nT-N-2)T+…+x(nT)]

Step 4: Fiducial Mark

It can be determined from this rising edge according to the desired waveform feature to be marked such as the maximal slope or the peak of the R wave.

Step 5: Adjusting the Thresholds

The thresholds are automatically adjusted to float over the noise. Low thresholds are possible because of the improvement of the signal-to- noise Ratio by the band pass filter. The higher of the two thresholds in each of the two set is used for the first analysis of the signal.

Step 6: The original ECG signal delayed by the total processing time.

Step 7: The output pulse marking the location of QRS complex.

IX. CONCLUSION

In this paper, we present a IoT-enabled ECG telemetry system for cardiac health monitoring applications. This paper proposes a light-weight ECG method for automatically assessing the quality of acquired ECG signals under resting, ambulatory, and physical activity environments. Experimental results demonstrate that the proposed ECG outperforms other existing methods based on the morphological and RR interval features and machine learning approaches. The experimental study further demonstrates that the ECG signals are severely distorted under more intensive physical activities. Real-time evaluation results further show that the proposed ECG telemetry system significantly reduces Size of ECG system. From this paper, we believe that the proposed IoT-enabled cardiac health monitoring framework has significant potential in improving the resource utilization efficiency of IoT-enabled devices and the reliability of unsupervised ECG signal analysis and diagnosis system by reducing the false alarm rates under severe noisy ECG recordings.

X. REFERENCES

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