

# Using Internet for Transmitting Real Time ECG

<sup>[1]</sup>Apeksha Giri, <sup>[2]</sup>Meenakshi Patil

<sup>[1][2]</sup> Savitribai Phule Pune University

<sup>[1]</sup>apeksha.giri@indiraicem.ac.in, <sup>[2]</sup> meenakshi.madgunaki@indiraicem.ac.in

**Abstract:**— As people are getting more busy day by day with increase in the heart diseases. The doctors are to be informed immediately of the necessary symptoms to react immediately and provide proper medication so the patients can work in their everyday routine.

The proposed system here provides the email with the captured ECG waveform to the doctor. The doctor is provided with the R-R interval and QRS interval so that doctor can have a sort of second opinion of about what type of heart disease is present for the patient. The given system provides programming in MATLAB and uses SMTP server to send the email to doctor.

**Index Terms:**— ECG, ECG email, Remote diagnosis.

## I. INTRODUCTION

The requirement for the doctor to monitor the patient remotely helps the patient to avoid going to the clinic or the hospital. And doctor can respond to the patients query immediately.

Here in this system the R-R interval and QRS interval is transmitted. The normal range assumed for a person for R-R interval is 0.6 to 1s and for QRS interval is 0.06-0.12s.

The doctor receives a second opinion about the possible disease from the interval values and he/she can immediately provide the medication to the patient.

## II. LITERATURE SURVEY

In [1] it is provided that the ECG can be remotely taken and the signal is processed and transferred to the server in digital format to a control room where the data can be observed for the multiple patients by the doctor continuously and if urgency is required the decision can be taken immediately and the patient will be benefited.

A system [2], in which it is divided into components which will interact with each other to particularly transmit the information to the doctor, is designed i.e. the user component and the specialist component and the data component. All the components help in deciding the ECG transmission to the concerned doctor and making the immediate arrangements for the patient.

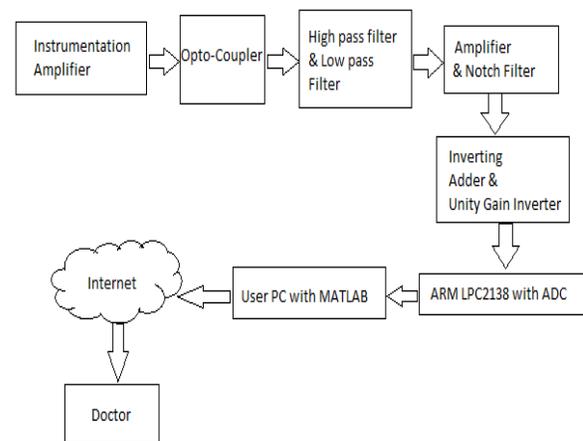
The system in [3] represents how the data for ECG is collected using Mobile Biotelemetric System (MBS) and transmitted remotely to a mobile device using a policy

engine which provide support against transient ECG conditions. The heart rate is displayed and the ECG streams can be viewed remotely.

In the system [4], the ECG is recorded and a 10 second data is obtained which is transferred on a web server where the web server will do a pre-analysis and store the ECG data according to prioritisation as to whether it is an Emergency condition or a Critical condition or normal. Then it is supplied to the remote doctor to be diagnosed further.

The system [5] represents an ECG system wherein the parameters such as heart rate, PR-interval, QT-interval, ST-interval, ST-interval, P-wave and T-wave durations are provided using LabVIEW software. These parameters are transmitted using Internet to the remote doctor where the doctor decides over the intervals provided.

## III. OVERALL STRUCTURE



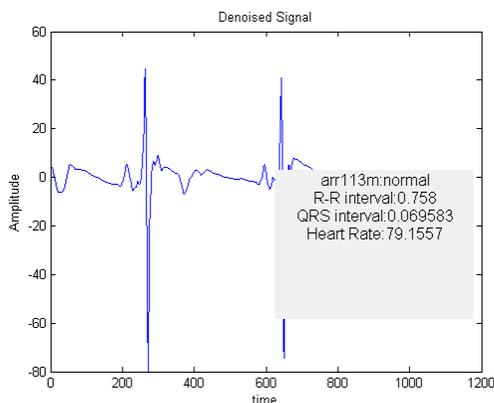
**Fig.1. System Structure**

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As shown in Fig.1 the signal from the ECG electrodes is taken and provided to the Instrumentation Amplifier. The difference signal is amplified and then given to the opto-coupler for optical isolation of the circuit from the input circuit. Then the signal is passed through the high pass filter and low pass filter to give a combined effect of band pass filter of frequency range 0-35Hz. Then the signal is amplified and passed to notch filter to remove the power line frequency component. The signal obtained at this stage is in the  $\pm 2.5V$ . The Inverting Adder converts this signal in the range -5 to 0V. Then the unity gain inverter provides the signal in the range 0-5V.

The signal is then supplied to ADC of the ARM processor LPC2138. The ARM processor converts this analog signal to the digital signal and this signal is then converted to serial data and then transmitted to the PC on the USB port. The signal is then captured in MATLAB program to provide analysis of the ECG signal to calculate the R-R interval and QRS interval. This analysed signal is transmitted over the Internet to the Doctor over the email.

#### IV. EXPERIMENTAL RESULTS

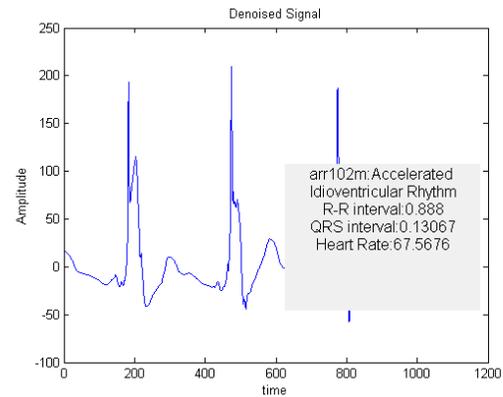


**Fig.2(a) Database file**

The name of the patient is specified along with the diseased or normal condition. The intervals are measured and transmitted in the waveform as given in Fig.2(a) & (b). Matlab is specifically used for the calculations and pan Tompkins algorithm is used along with wavelet denoising and compression function.

The results have an error of almost 5-10 samples. But the results are approximate. This will help doctor as a

second opinion for deciding upon the medication to be given to the patient.



**Fig.2(b) Database file**

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