IJIREEICE
ISSN (Online) 2321 – 2004
ISSN (Print) 2321 – 5526
INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH IN ELECTRICAL, ELECTRONICS, INSTRUMENTATION AND CONTROL ENGINEERING
Vol. 4, Issue 6, June 2016

Web Based Real Time ECG

Apeksha Giri[1], Baliram Gayal[2]

M.E. Student, E&TC Department, Indira College of Engineering and Management, Parandwadi,. Pune India[1]

Asst. Professor, E&TC Department, Indira College of Engineering and Management, Parandwadi, Pune, India[2]

Abstract: Thinking about present ECG scenario it is expected that the ECG data should be available on the mobile phones and internet and even in absence of doctor at the hospital the required treatment should be started immediately. The doctor in his absence at the hospital should be able to check the ECG and allow for fast ECG check and take corrective action immediately. Considering this factor the proposed system allows the ECG trace should be captured by the PC to which it is connected and allow for capturing ECG image and send it in real time to remote location where the doctor can check the ECG and take immediate action if necessary. Heart rate would be a feature indicated and whether it comes under the group of tachycardia or bradycardia is also indicated.

Keywords: ECG, remote monitoring, real time diagnosis

I. INTRODUCTION

The real time ECG capture has become a necessity in the recent lifestyle where everybody is busy in their routines. Following everyday routine we tend to forget about our health and thus sudden emergencies requiring medical attention may be just thus ignored and it may result disturbing our life completely.

Thus in this busy lifestyle it is necessary that we take care of our health. In such a case it may be beneficial if we are able to take ECG recording at home or office, and transfer it over the Internet and allow doctor to take the immediate decisions if any cardiac emergency occurs.

This allows for remote monitoring of the ECG even in the hospitals and in the absence of doctors in the hospital the patients can still be diagnosed by the hospital personnel. The hospital personnel thus can send the ECG in real time and allow doctor to remotely diagnose the disease and indicate the medication as soon as possible.

II. LITERATURE SURVEY

In [1] we come across the ECG interpretation done in a systematic manner as sequence of questions that when answered helps to diagnose the cardiac disease faster and more accurate. This system is developed using HTML5 based web technology. A 12-lead ECG system is diagnosed and thus proper recognition of disease is facilitated using this questions series.

The system in [2] is classified as consisting of user component, specialist component and a data component. The user component can use any device, such as PC, laptops, or mobile devices with Android and can send recorded ECG signal and data specific to the patient to the data component.The specialist component is the doctor side application requiring a web browser that can help access the data provided from the user component. Thedata component stores the data related to all the user components. Another system [3] used HTML5 and Java Script and thus developed an ECG viewer which was platform independent and can be viewed using any web browser. This application is intended to be used in HIS.

Bingchuan Yuan and John Herbert [4] developed a system in which various sensors such as ECG, blood pressure, and blood oxygenation sensors could be remotely monitored. They developed a system in which the Body area network provided the data wirelessly to an intermediate gateway; can be a PC that in turn sent the data to the remote clinician to view it online using flash application in a web browser and the clinician can provide analysis report to be sent for the same.

The system in [5] represents a database and visualization monitor system. The data is collected from the sensors sensing ECG, blood pressure, temperature etc. The data gathered is made available remotely using a web browser to visualize the data. The challenges they faced were the storing the continuous data that is provided by the sensors, communication between Applet and Web server, making the visualization as per the clinician requirements.

The system specified by [6] stores the data obtained from the ECG sensor on a web server developed by the authors. Then the data is made available remotely using Internet and web browser and Java application stored on the web server. The information for the six leads is generated using 2-lead system. The calculations for the other four leads is also specified.
The system developed in the [7] is a measurement system for various sources such as ECG, SpO2, Blood pressure, glucose and body temperature. This data is then transmitted to the healthcare gateway which relays this information through the Internet. The system is based on Open Services Gateway Initiative platform (OSGi).

The implementation of [8] includes operating system, web server and application. The browser is provided with the IP address of the tele-monitoring system. The web server initially sends the static page and runs a CGI program which in turn processes the ECG signal and after diagnosing the ECG for the cardiac rate and diseases displays final result.

LabVIEW was used as a graphical user interface in [9] and with its web publishing tool it could be accessed from any remote location using Internet. Thus the patient side LabVIEW served to be the server and the other locations as clients. Thus the analysis of various signals such as ECG, SaO2 and temperature was carried out in [9]. The results were R-R interval for ECG, SaO2 percentages, ºF and ºC display for temperature.

In [10] also the captured ECG data and heart rate is transferred to the server computer which in turn makes the data available remotely to be viewed by the doctors. In [11] also the recorded ECG from Holter ECG monitor was displayed in the web browser using ECG viewer applets.

[12] and [13] are the books referred for ECG.

III.HARDWARE AND OVERALL IMPLEMENTATION

The ECG hardware is as follows:

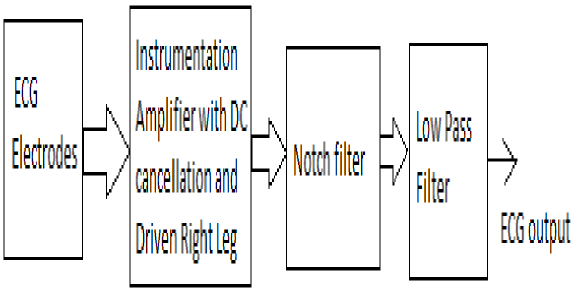

Fig. 1. The Hardware Overview

Figure 1 shows hardware overview. The ECG electrodes capture the surface potentials of the patient which corresponds to cardiac activity. The signals are preferably taken from the right and left arm. The signal is passed to Instrumentation amplifier.

The instrumentation amplifier calculates the difference signal from right and left arm. It amplifies this difference signal and then the signal is passed to DC cancellation circuit.

The DC cancellation circuit cancels the DC component if any present in the signal. This is because the signal should not get chopped or clipped and pure signal is made available to the Notch filter. An integrator is used as the DC cancellation circuit. The instrumentation amplifier with integrator serves the job of high pass filter thus the lower frequency components are removed from the signal.The Notch filter removes the 50 Hz noise and thus filters with unity gain. A Fliege filter is implemented as a Notch filter as the mismatch in the component values doesn’t change the notch depth.
The low pass filter is implemented to remove higher frequency distortion introduced in the ECG signal. It is a first order low pass filter.

The overall system is designed as follows:

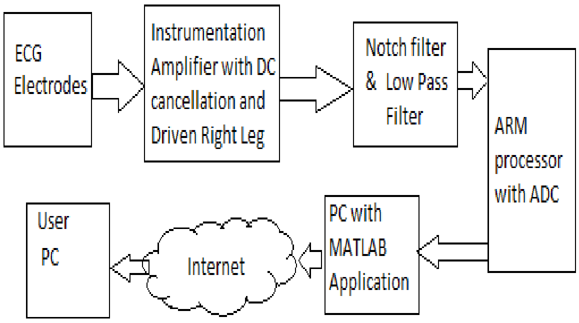

Fig. 2. Overall System

Figure 2 shows how the signal after the Low pass filter is processed. It is passed to ADC and then to the ARM processor. The analog to digital conversion followed by ARM processor acquire the signal digitizing the signal to a serial signal and then the signal is passed to the PC where the MATLAB application further makes the signal available to SMTP server and which again in turn just provides the available signal remotely on mail and the ECG can be viewed remotely.

In MATLAB the calculation regarding heart rate is done, and analysis regarding tachycardia and bradycardia is done.
Figure 3 shows the flow of signal in software part.

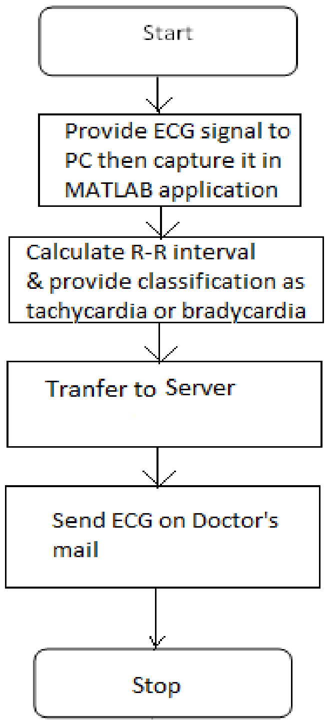

Fig. 3. Flowchart

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH IN ELECTRICAL, ELECTRONICS, INSTRUMENTATION AND CONTROL ENGINEERING
Vol. 4, Issue 6, June 2016

The hardware is as shown below in figure 4.

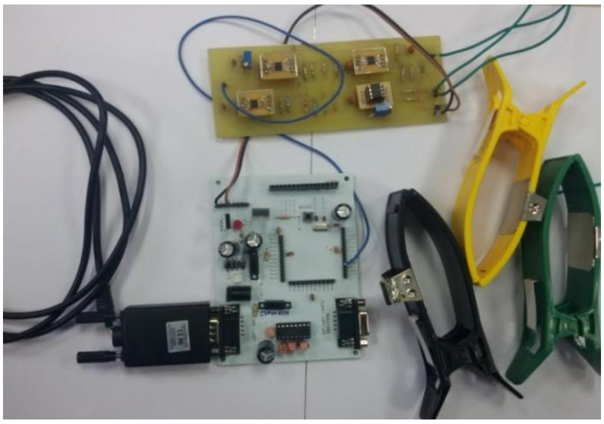

Fig. 4. Hardware

IV. RESULTS

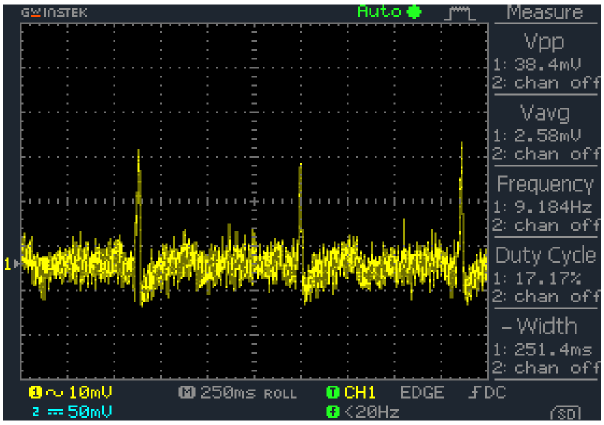

Fig. 5. Noisy ECG

The noisy ECG is as shown in above figure 5.

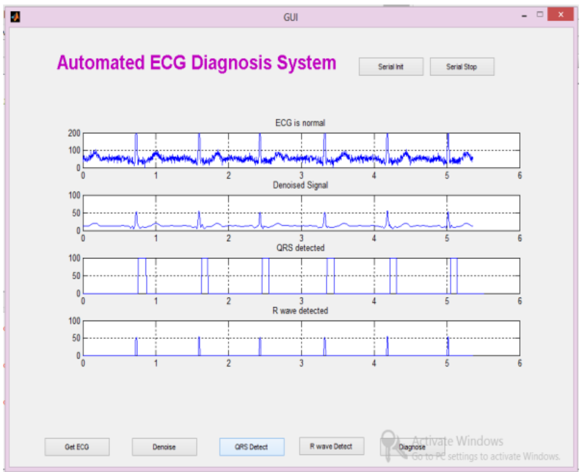

Fig. 6. ECG result sent to the doctor

Figure 6 shows the ECG result that is sent to the doctor on his email. Thus Doctor checks this ECG and comes to know whether a normal or abnormal ECG is present. The system is able to classify tachycardia and bradycardia and also ventricular tachycardia and superventricular tachycardia.

V. CONCLUSION

The ECG signal thus obtained from the electrodes is processed to obtain digital signal and then that signal is further processed in MATLAB to obtain the R-R interval and the classification as a tachycardia or bradycardia signal and thus heart rate is calculated. Then this signal is provided to SMTP server. Then at a remote location the doctor can view the ECG signal on his desktop using Internet. Further development possible in this, is inclusion of further processing to detect other diseases as well and also integrating it with BP or EEG measurements.

REFERENCES

[1] Andrew W Cairns; Raymond R Bond; Dewar D Finlay; Cathal J Breen; Daniel Guldenring; Robert Gaffney; Pat Henn; Aaron J Peace, “Interactive Progressive-based Approach to Aid the Human Interpretation of the 12-lead Electrocardiogram”, 2015 Computing in Cardiology Conference (CinC), IEEE, September 2015, 197-200.

[2] Robson Pequeno de Sousa; KátiaElizabeteGaldino; Misael Elias de Morais; Carlos Wilson D. de Almeida; Adson D. D. da Silva; Valderi M. da Silva; Luiz A. C. Filho; Saulo S. de Toledo, “A Computer Aided Diagnosis of ECG”, 2014 IEEE 27th International Symposium on Computer-Based Medical Systems, May 2014, pp. 511-512.

[3] Jesus D Trigo, Miguel Martinez-Espronceda, AitorEguzkiza, Luis Serrano, “An HTML5-based ECG Viewer”, Computing in Cardiology 2013, IEEE, September 2013, pp. 979-982.

[4] Bingchuan Yuan, John Herbert, “Web-based Real-time Remote Monitoring for Pervasive Healthcare”, Pervasive Computing and Communications Workshops (PERCOM Workshops), 2011 IEEE International Conference on, March 2011, pp. 625 – 629.

[5] Duarte Pereira; Adriano Moreira; Ricardo Simões, “Challenges on real-time monitoring of patients through the Internet”, 5th Iberian Conference on Information Systems and Technologies, IEEE, June 2010, pp. 1-5.

[6] IstvanBosznai, Ferenc Ender, and HunorSantha, “Web Server Based Remote Health Monitoring System”, 2009 32nd International Spring Seminar on Electronics Technology, IEEE, 2009, pp. 1-6.

[7] Hsu Chih-Jen, “Telemedicine Information Monitoring System”, 10th International Conference on e-health Networking, Applications and Services, HealthCom 2008, IEEE, July 2008, pp. 48-50.

[8] Yanzheng LI, Shuicai WU, Jia LI, Yanping BAI, “The ECG Tele-monitor Based on Embedded Web Server”, 1st International Conference on Bioinformatics and Biomedical Engineering, 2007, pp. 752-755.

[9] Patricia Mendoza, Perla Gonzalez, Brenda Villanueva, Emily Haltiwanger, Homer Nazeran, “A Web-based Vital Sign Telemonitor and Recorder for Telemedicine Applications”, Proceedings of the 26th Annual International Conference of the IEEE EMBS San Francisco, CA, USA,Vol. 3, September 2004, pp. 2196-2199.

[10] M. Nambu, K.Nakajima, T. Tamura, “WWW Based ECG Transfer for Home Care using JAVA Script”, Proceedings of the Second Joint EMBS/BMES Conference, Houston, TX, USA, October 2002, Vol. 3, pp. 1891-1892.

[11] K Y Kong, CY Ng, K Ong, “Web-Based Monitoring of Real-Time ECG Data”, Computers in Cardiology, IEEE Conference, pp. 189-192, 2000.

[12] ECG Interpretation Made Incredibly Easy, 5thEd., 2011, Lippincott Williams & Wilkins.

[13] John R. Hampton, ECG Made Easy, 6thEd., 2003, Churchill Livingstone.