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REAL TIME SYSTEM FOR EFFICIENT PROCESSING OF CARDIAC ARRHYTHMIAS SIGNALS

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ABSTRACT

Cardiac arrhythmias is a very uncommon life threating arrhythmia which can even cause sudden death. Healthcare professionals are always looking to find out the ways in order to reduce the death rate. The new method of feature extraction and classification of arrhythmias has been developed by the authors of this paper in their previous works. In this paper, authors have proposed the methodology for the development of a real-time system for efficient processing of arrhythmic signals in order to differentiate between normal and abnormal patients. The purpose of this work is to develop a real-time system for processing the real-time signals or signals obtained from MIT-BIH arrhythmia database. For carrying out this work, we have taken the signals from MIT-BIH Supraventricular arrhythmia database and MIT-BIH Fantasia database. Authors have achieved 100% accuracy by using this method.

Keywords: MIT-BIH, Cardiac arrhythmias, real-time system.

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INTRODUCTION

Real time system is a computing system (software or sometimes hardware) associated with time limits and generates output subject to a real time constraint. These systems must ensure to produce response within specified time boundaries or often described to ascertain deadlines. For example we can say that from event to response given by system[1]. The accuracy of these systems totally depends on their sequential aspects as well as their operational aspects. Real time systems produce responses within milliseconds and may be in microseconds also. These systems does not take guarantee to generate a response within any fixed boundaries but it must ensure to give expected response which they may be given[2]. The description of real time systems as like which regulates an environment by taking data, processing them and generating the results quickly within specified time. This concept is widely used in simulation which means clock of simulation's process at real clock means without any delay the output is obtained. So, in this work we proposed such a real time system which takes input as arrhythmic signal, processes that signal and produces output within fixed boundaries in terms of normal and abnormal[3].

Related Work

Authors have studied the natural fluctuations of heart rate by using block agents and posture positions. The spectral analysis of heart rate is a powerful tool for automatic nervous system activity[4]. Hidden Markov model is used for analyzing cardiac arrhythmias by the researchers of paper[5]. In this work, they used the combination of structural and statistical knowledge of experimental signals in one single valued model. This approach can enhance the analysis of supraventricular arrhythmias with the help of exact analysis of signals and P wave information. In paper[6], authors use the holter monitors and real time system capabilities in order to provide an accurate recognition of ECG signals using smartphones. They developed two wearable smartphones for recognizing heart disorders. Authors of

paper [7], developed a highly accurate tool for clinical practices. The method they adopted is using a catheter navigating system for determining the local electrograms. Through this they recognize the cardiac chambers which will be helpful in analyzing the different patterns of arrhythmic signals.

METHODOLOGY

For analyzing any heart disorder the QRS information is very necessary step [8]. So, authors analyses the QRS portions of signals and processes in order to obtain an accurate results. The methodology we adopted for carrying out this works are as follows. Firstly we take ECG arrhythmic signals already stored in our computer system in text file or xls file. That arrhythmic signals are fed into our personal computer system with Matlab created environment. Then the data processing and feature extraction process has been carried out. For data processing and extraction of features, authors have adopted the discrete wavelet transformation method [9]. By using this method we extract the ECG signals on five levels in terms of approximation and detailed coefficients like approx. level 1 to approx. level 5 and detail level 1 to detail level 5 [10]. On the basis of that extracted coefficients from ECG signals, we have calculated the mean results of extracted features by using Matlab programming. Authors find a lot of difference in mean values of normal and abnormal signals. Our GUI has trained on recognizing these mean values. Then, GUI produces output in terms of normal and abnormal. On the second part, authors have placed the ECG electrodes on human body that directly fed ECG signals in Arduino board with ECG shield. With the help of USB port, that real time signals directly processes with the help of GUI and presents the output as shown in results section of this paper. Below displayed Fig. 1 shows architecture of proposed system.

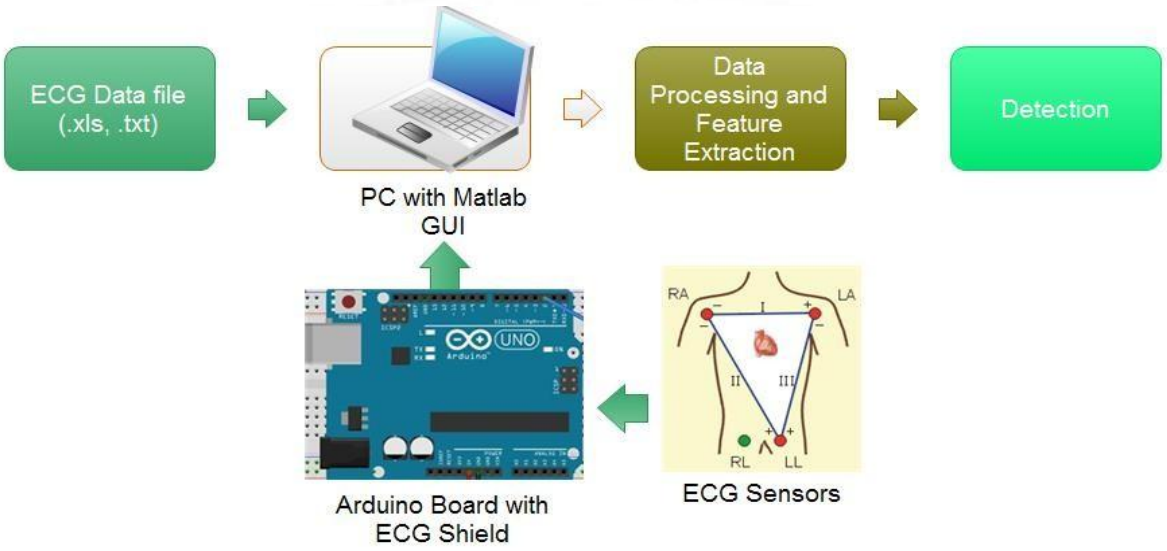

Figure 1: Architecture of proposed system

RESULTS AND DISCUSSION

The results of this work are generated by using Matlab programming by implementing the above explained methodology. Below Fig. 2 and Fig. 3 illustrates the experimental ECG signals (abnormal and normal) respectively have been chosen for realizing the efficiency of this proposed method.

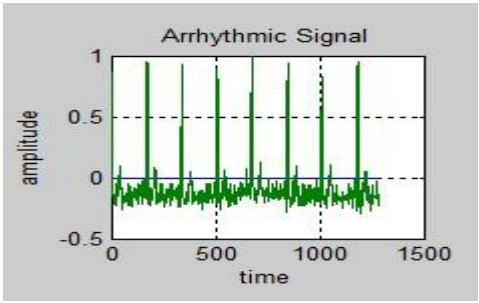

Figure 2: Experimental arrhythmic signal

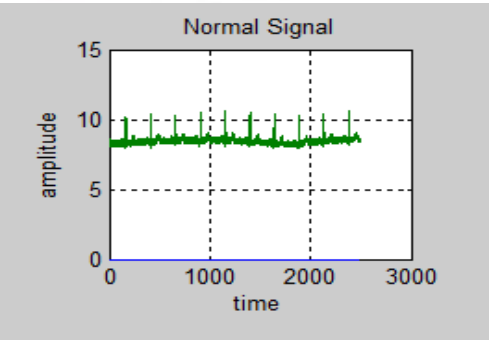

Figure 3: Experimental normal ECG signal

These experimental signals when fed into the computer system for processing and feature extraction; produce output shown in Fig. 4 and Fig. 5. The GUI has been developed by the authors of this paper by using the concept of Matlab programming.

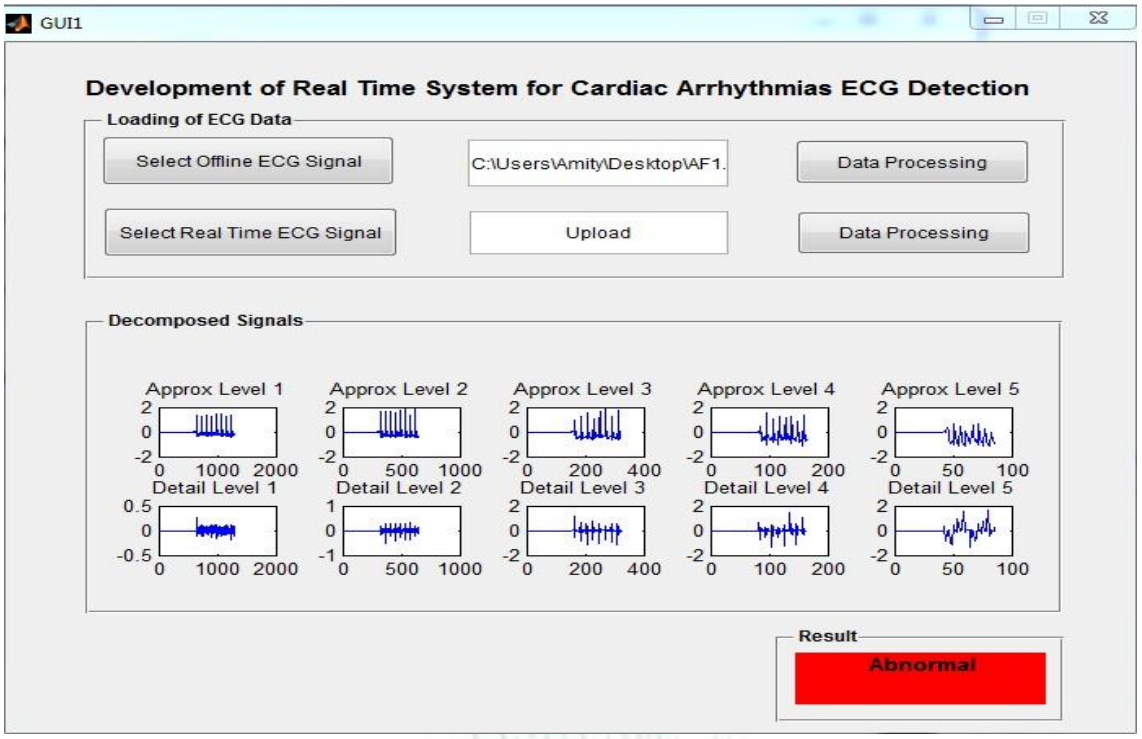

Figure 4: Data processing of arrhythmic signal on proposed system

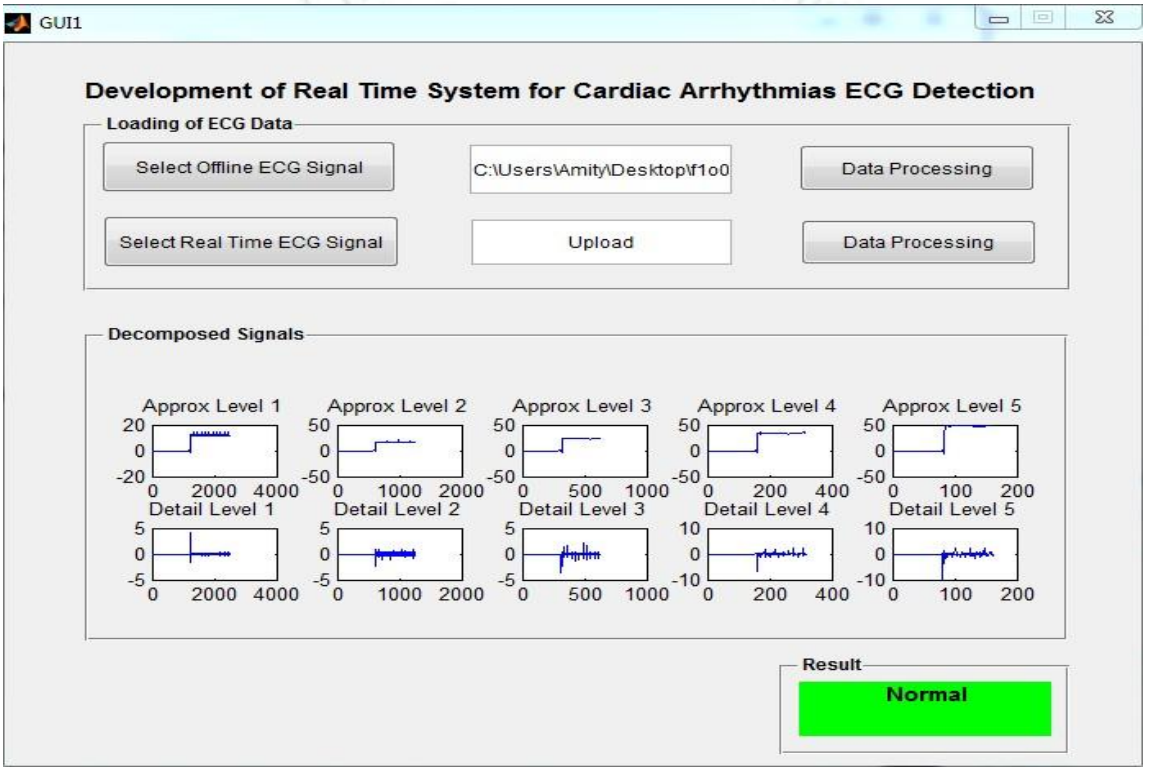

Figure 5: Data processing of normal signal on proposed system

CONCLUSION

This paper develops a real time system for efficient processing of arrhythmic signals for separating between normal and abnormal signals. Authors firstly decompose the experimental signals and obtained approximate and detailed coefficients as approx. level 1 to approx. level 5 and detailed coefficients from detail level 1 to detail level 5. After processing of this data our system produces output in terms of normal and abnormal. The achieved accuracy of this proposed system is found to be 100%. This proposed developed system is found to be very beneficial for health care professionals in identifying and treating arrhythmic patients.

Conflicts of Interest: All authors declare that they have no conflicts of interest.

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