Online Synthetic ECG Sharing System

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Abstract: Telemonitoring is a medical practice that involves remotely monitoring patients. Many times, in the hospitals patient may have an emergency, and their doctor requires proper guidance from expert doctors and there may no possibility of available expert doctors each time. In such cases, especially in rural area local doctor suggests patients to move in urban area for advance treatment. But many times patients cannot afford these travelling and hospital expenses and in emergency cases patients may not have time to travel or they are not in situation to move in another place for treatment. Here using dynamic model based on three couple ordinary differential equation is introduced which is capable of generating realistic ECG signal. The operator can specify the mean and standard deviation of the heart rate, the morphology of the heart rate cycle and the power spectrum of RR tachogram (distance between two consecutive ventricular depolarisation(R) waves). Using these attributes we will generate synthetic ECG. This model may be employed to assess biomedical signal processing techniques which are used to compute clinical statistics from the ECG.

Keywords: Dynamic Model, RR Tachogram, Synthetic ECG, Heart Rate Variability (HRV).

1. Introduction

Online synthetic ECG Sharing system is one kind of Business application. This system presents a model for generating a synthetic ECG signal with realistic PQRST morphology and prescribed heart rate dynamics\cite{1}. The aim of this model is to provide a standard realistic ECG signal with known characteristics, which will be generated with specific statistics such as the mean and standard deviation of the heart rate and frequency-domain characteristics of heart rate variability (HRV), for instance, low-frequency/highfrequency (LF/HF) ratio, defined as the ratio of power between 0.015–0.15 Hz and 0.15–0.4 Hz in the RR tachogram. By generating a signal which represents a typical human ECG, this facilitates a comparison of different signal processing techniques. A synthetic ECG will be generated with different sampling frequencies and different noise levels in order to establish the performance of a given technique. The performance assessment would be used as a “standard” and would enable clinicians to ascertain which biomedical signal processing techniques were best for a given system.

This system is useful in the Hospitals, Medical cares. When in the hospitals there may patient get an emergency, then Client doctor want to communicate with Expert doctor for the treatment advices. Each time there may be less possibility of availability of Expert doctor for such kind of situations online synthetic ECG sharing system will be helpful. Using this system expert doctor will be able to treat patient and give suggestions.

2. Methodology

Project is mainly divided into four modules:
1. Patient module
2. Client Doctor module
3. Server module
4. Expert Doctor module

1. Patient module

Patient can see the previous medical report as per its need using username and password.
Patient can Manage his profile.
3. Client Doctor Module

The client doctor uses this module to access service from the remote server doctor. Following are the features that would be included in this module:

- Client doctor can manage his own list by using this module.
- Client can send Live ECG to the expert doctor.

4. Server Module

This is the module via which the user would be able to update in server side database. The user may post his blog, take the blog offline, edit an already posted blog or moderate the comments for his blog post. Below are the things he can possible do via this module:

- Add a new Doctor to the system.
- Add moderators for his blog post.
- Categorize the Doctors according to category.
- Provide searching features for the reader to search the post of their interest.

5. Expert Doctor Module:

The doctor in this module is expert for providing services. The server doctor module can be handled by the expert doctor. In case he chooses to expert login then the following would be done:

- Expert doctor can manage his own list by using this module.
- Expert doctor is able to add and remove his own client doctors list.
- Expert doctor can sent report back to the client doctor in order to provide the treatment to remote patient.

3. Heart Rate Variability

Analysis of variations in the instantaneous heart rate time series using the beat-to-beat RR-intervals (the RR tachogram) is known as HRV analysis[1]. HRV analysis has been shown to provide an assessment of cardiovascular disease. The heart rate is given by the reciprocal of the RR-interval in units of beats per minute. Spectral analysis of the RR tachogram is typically used to estimate the effect of the sympathetic and parasympathetic modulation of the RR-intervals. The two main frequency bands of interest are referred to as the LF band (0.04–0.15 Hz) and the HF band (0.15–0.4 Hz).

4. Algorithm

Step 1: Input an ECG’s file.
Step 2: Calculate length of input ECG File and make a nodes list.
Step 3: Extract time, voltage and peak value from ECG file for every node.
Step 4: Perform step 5 for every node (containing time, voltage, peak)
Step 5: Calculate X-co-ordinate and Y-co-ordinate for current ECG node using following formula

- ECG animation first point $X_0=0$
- ECG animation next point $Y_0=0$
- ECG animation next point $X_{ECG \text{ animation} \times 1}$
- ECG animation next point $Y=(\text{voltage value} \times \text{frame amplitude})/\text{parameter amplitude}$

Draw line between last point and current point
Step 6: Calculate P-Wave, PQ interval, QRS complex, QT interval, ST interval, T-Wave[1].

5. Results

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7. References


