**Abstract**

* **Project Idea**

Recent advances in the computing, signal processing, and medical fields has allowed biometric systems to uniquely identify and authenticate humans in a computationally feasible manner. Biometric systems can rely on a number of features including fingerprints, voice, face, hand geometry and iris. However, both face and fingerprint can be compromised using counterfeit credentials. Researchers have begun investigating the use of the heart electrocardiogram (ECG) signal as a biometric trait to identify individuals.

The purpose of this research project is to develop a real time system for biometric authentication with the electrocardiogram (ECG) signal. The ECG, being a record of electrical currents generated by the beating heart, is potentially a distinctive human characteristic, since ECG waveforms depend on the anatomic features of the human heart and body. Like a fingerprint, the ECG is unique to an individual, with additional benefits such as resilience to replay attacks and spoofing. By examining the feature vectors obtained by processing ECG signals, and extracting unique features using discrete wavelet transform, our research investigates the possibility of biometric human identification based on the ECG.

1. **Preprocessing :**

|  |
| --- |
| *S* (*n*), *n* =1,2,3...*N* |

To eliminate noises, the signals are processed with a filter. The filter is a combination high-pass filter and low- pass filter. A high-pass filter with a cutoff frequency of 0.5Hz is used to eliminate the baseline drift. A low-pass filter with a cutoff frequency of 45Hz is used to eliminate high frequency noise such as power line interference.

1. **QRS Detection :**

The QRS Complex of ECG Signal is the most distinctive among all the features of ECG. Implementing Pan- Tompkin's Algorithm, allows efficient detection of QRS Complex, and thereby simplifying the task of feature extraction.

*R*(*nk* ), *k* =1,2,3..., *M* Where *nk* is the location of *R* point.

Since the positions of *R* peaks *R*(*nk* ) are determined, a 128-point signal segment *SSk* can be obtained by taking data points from the backward 43rd point to the forward 84th point.

|  |
| --- |
| *SSk* =[*S*(*nk* −43): *S*(*nk* +84)] |

Four such signal segments form a 512-points synthesis signal *F* that is denoted as

*F* = [*SS*1 *SS*2 *SS*3 *SS* 4].

1. **Obtaining Wavelet Coefficients by Discrete Wavelet Transform :**

One synthetic signal extracted from original ECG signal with 512- points data length. With 'Haar' wavelet, the 512-points wavelet coefficients decomposed from the signal were used as the biometric “identity card” of the subject. We decompose the signal with level-9 decomposition. Wavelet coefficients decomposed from 512-points synthetic signal is shown in Fig(4).

1. **Identification :**

When the ECG of an unknown individual is acquired, Euclidean distance measure is applied to calculate the difference in the 512-point wavelet coefficient feature set between the unknown subject and all enrolled subjects. The subject with minimum computed distance, is the final identification result.