ECG based Human Authentication

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Introduction

▪The electrocardiogram (ECG) is an emerging novel biometric approach for human identification.

▪The ECG, being a record of electrical currents generated by the heart, is potentially a distinct human characteristic, since ECG waveforms and other properties of the electrocardiogram depend on the anatomic features of the human heart and body.

▪Rather than using 'knowledge-based' passwords and PINs, my research analyzes the potential of the ECG to be used for authentication and security.

▪The ECG is unique to an individual, with benefits such as resilience to replay attacks and spoofing.

ECG Basics

▪ECG is a method to measure and record different electrical potentials of the heart. The ECG may roughly be divided into the phases of depolarization and repolarization of the muscle fibers making up the heart.

▪The depolarization phases correspond to the P-wave (atrial depolarization) and QRS-wave (ventricular depolarization).

▪The repolarization phases correspond to the T-wave.(ventricular repolarization).

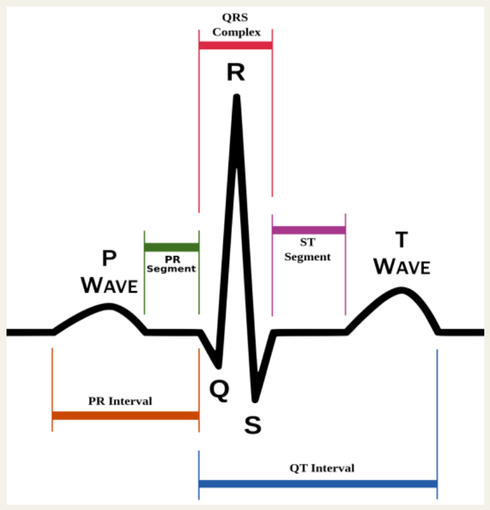
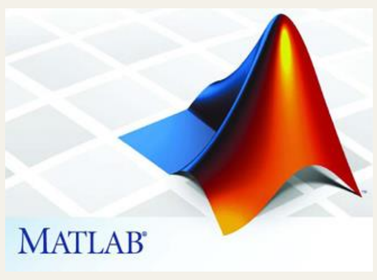
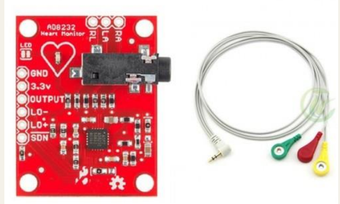


Figure 1

Technologies and Hardware





AD8232 Sensor

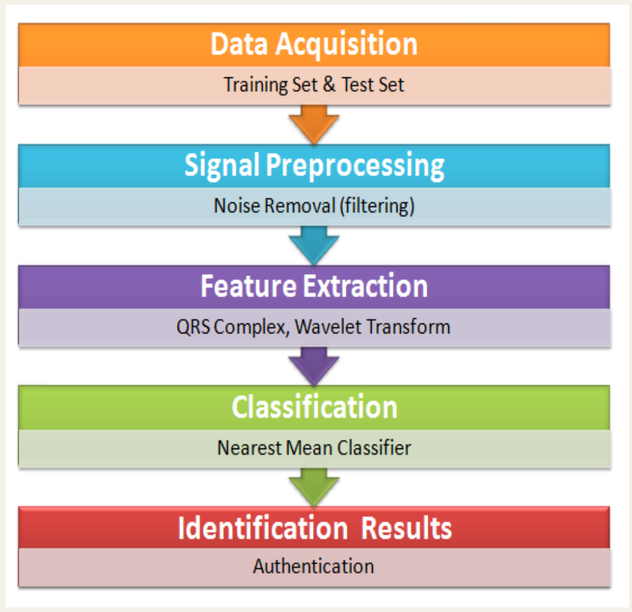
Description

▪Firstly, signals are captured using ECG sensors.

▪Preprocessing is performed which includes band-pass filters to reduce noise.

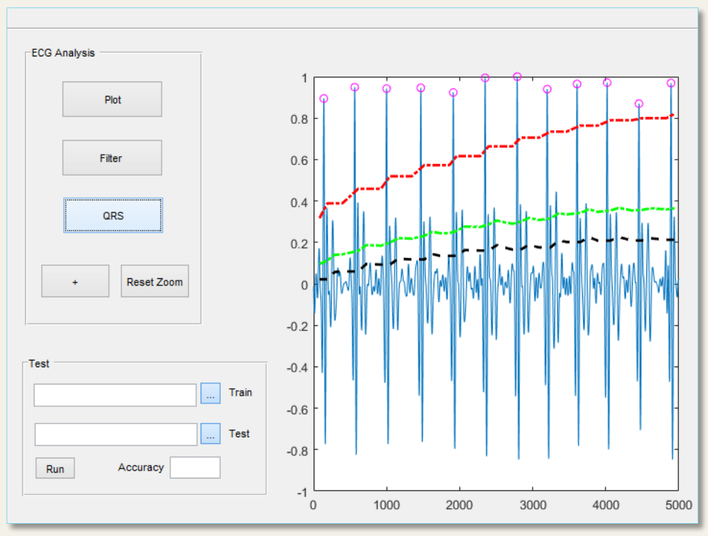
▪Feature Vector is formed for further classification, by extracting QRS Complex.

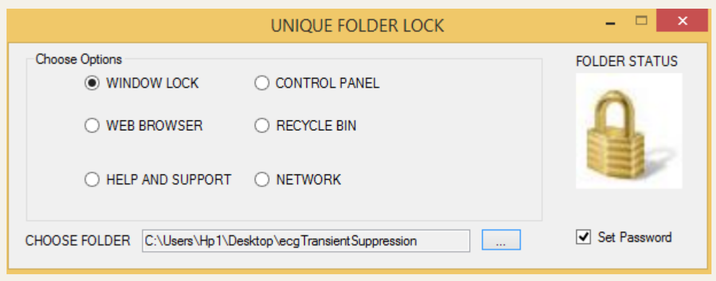
▪Classification methods are used for pattern recognition. (Nearest Mean Classifier and Euclidean Distance).



State of the art

Currently, We have developed a folder Locker which acquires real time ECG Signals to unlock any folder.

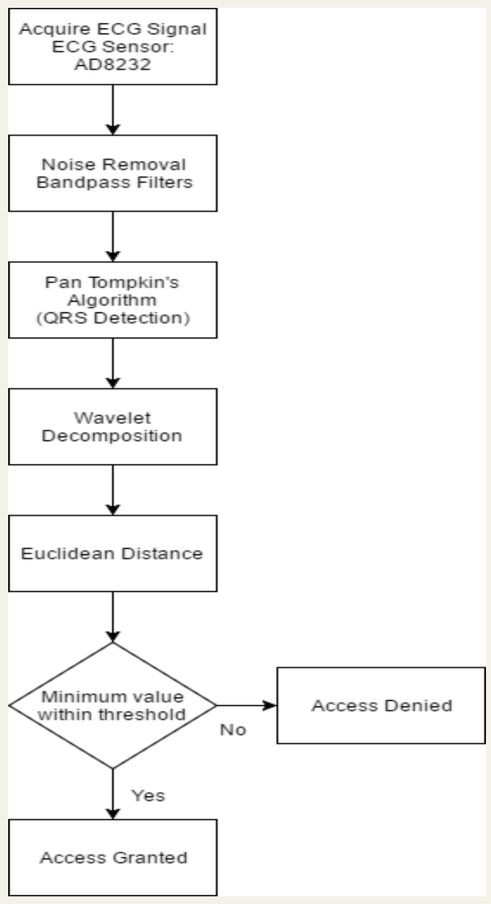




Literature Review

Belgacem et al. [21]	Amplitude and normalized time distances between successive fiducial points.	Discrete Wavelet Transform & Random Forest Algorithm-Authentication	20	100%
Singh et al. [22]	Fiducial points P-QRS-T Complexes	Template Matching	50	98%
Fred et al. [23]	Partial Fiducial Approach(Use of R wave to perform segmentation)	Template Matching & SVM	64	EER- 9.1%
Shen [13]	Fiducial	Template Matching + DBNN	20	100%
Israel [11]	Fiducial	LDA	29	98%
Chiu[12]	Non Fiducial	Waverlet Distance+LDA	35	100%
Janani, David[9]	Both	KNN + Bayesim	17	88%

Flow Chart



Future Work

We intend to develop a wearable device to perform real time ECG based authentication.

Application

▪Immediate applications of our technology include scenarios of low security and low user throughput, such as recognition in mobile phones, laptop computers, cable TV interfaces, and user-tuned in-game experience.

▪ If combined with other modalities, there are several use cases where the ECG stands as an important add-on.

Guided By

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