National Aeronautics and Space Administration

Sensors

Method and Device for Biometric Verification and Identification

Biometric Subject Verification and Identification Based Upon Electrocardiographic Signals

NASA has developed a method for verifying the identity of a person based on his or her heartbeat electrocardiogram signal. The technique uses an algorithm that has been shown to be more reliable than other current procedures, such as fingerprint verification, retina verification, or detecting biometric identifiers from heart signals. It eliminates artifacts and abnormal beats, thereby reducing overall error. The process automatically extracts from one or more electrocardiographic leads (channels) a set of biometric features which are characteristic to an individual and can be employed to verify the identity of one individual or to identify an individual from a group. The electrocardiographic signal is recorded in each lead from a pair of electrodes placed on the skin of the individuals arms or legs. Each electrocardiographic lead characterizes the hearts electrical vector as projected on a separate dimension. This allows a multidimensional characterization of the hearts electrical activity, which can result in improved subject verification performance.

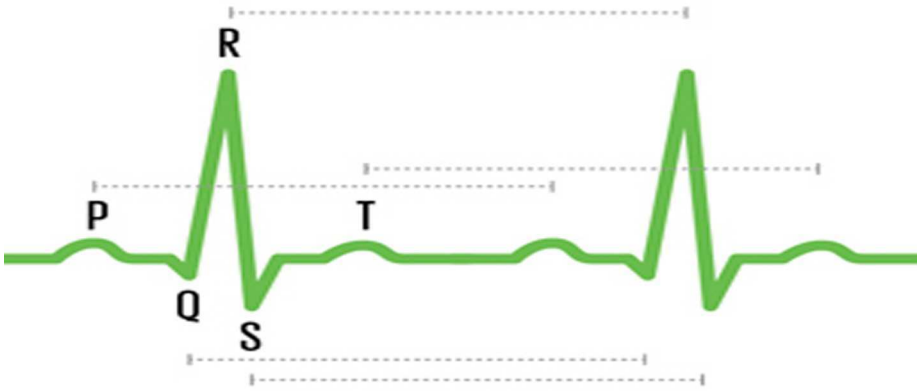
BENEFITS

- Better performance by employing multiple electrocardiographic leads
- Uses both physiological and anatomical characterization of the heart
- Eliminates artifacts and abnormal beats that overall errors are reduced

technology solution

THE TECHNOLOGY

The advantage of using cardiac biometrics over existing methods is that heart signatures are more difficult to forge compared to other biometric devices. Iris scanners can be fooled by contact lenses and sunglasses, and a segment of the population does not have readable fingerprints due to age or working conditions. Previous electrocardiographic signals employed a single template and compared that template with new test templates by means of cross-correlation or linear-discriminant analysis.The benefit of this technology over competing cardiac biometric methods is that it is more reliable with a significant reduction in error rates. The benefit of this technology is that it creates a probabilistic model of the electrocardiographic features of a person instead of a single signal template of the average heartbeat. The probabilistic model described as Gaussian mixture model allows various modes of the feature distribution, in contrast to a template model that only characterizes a mean waveform. Another advantage is that the model uses both physiological and anatomical characterization of the heart, unlike other methods that mainly use only physiological characterization of the heart. By combining features from different leads, the heart of the person is better characterized in terms of anatomical orientation because each lead represents a different projection of the electrical vector of the heart. Thus, employing multiple electrocardiographic leads provides a better performance in subject verification or identification.



One of the applications of the technology is in the field of mobile biometric subject verification

APPLICATIONS

The technology has several potential applications:

- Personnel identity verification
- Mobile biometrics
- Justice/Law enforcement
- Homeland Security/Airports/ National ID documents
- Military Organizations

PUBLICATIONS

Patent No: 8,924,736

More Information

National Aeronautics and Space Administration

Agency Licensing Concierge

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