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RESEARCH ARTICLE

THE EAR AS A BIOMETRIC

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Abstract— *Biometrics is the science of identifying or verifying the identity of a person based on physiological or behavioral characteristics. Biometric identification methods have proved to be very efficient, more natural and easy for users than traditional methods of human identification. Biometric authentication systems are essentially pattern recognition systems, the physiological characteristics being fingerprint, face, and hand geometry, DNA and iris recognition. The main aim of the project is to develop a biometric authentication system using the ear. The process will involve several steps from acquisition of the image to the point where a positive identification can be made using the system. The image will be acquired using a digital camera. The photo is then processed, stored and used for the identification process. After the raw data is obtained, the Region of Interest (ROI) which is the area containing the ear image is chosen. Feature extraction filters the uniqueness data out of the raw data and combines them into the biometric feature. The method applied for this is Edge detection Iris recognition is considered as one of the most reliable biometric authentication technique. An iris recognition system captures human eye image using a near infrared iris sensor which passes through three steps to be transformed into an iris template. These three steps are iris segmentation, iris normalization and iris feature encoding Recognition involves either verification or identification. Verification is one to one comparison where claim of an identity is verified, e.g., an employee of an office. On the contrary, identification is one to many comparison where an identity is watched against an entire database.*

I. INTRODUTION

Identification is the basis of every access control system. Basically there are three different methods for verifying identity:

1. Possessions, like cards, badges, keys
2. Knowledge, like user id, password, Personal Identification Number (PIN)
3. Biometrics like fingerprint, face, ear.

Unfortunately, the first two carry within them an unavoidable weakness: they are only slightly linked to their owners. In contrast to this, biometric identification methods directly check the identifiable person.

Biometrics is the science of identifying or verifying the identity of a person based on physiological or behavioral characteristics. Physiological biometrics use algorithms and other methods to define identity in terms of data gathered from direct measurement of the human body. Finger print and finger scan, hand geometry, palm prints, Iris and retina scanning and facial geometry are all examples of physiological biometrics. Behavioral biometrics is however defined by analyzing a specific action of a person. Examples of these include voice identification, signature dynamics, keystroke dynamics and motion recognition

Generally, biometric identification techniques can be divided in two broad categories. These are:

1.Active biometrics: They are inherently invasive. They require the subject to participate actively in both enrolling into the system and during subsequent identification. The willing participation of the subject in the controlled environment of these systems is intrinsic to the success of the identification. Examples include all Fingerprint technologies, Hand geometry technologies, Retina scanning technologies and Signature recognition technologies.

2.Passive biometrics: do not require a user's active participation and can be successful without a person even knowing that they have been analyzed. Examples include Voice recognition technologies (limited), Iris recognition technologies (limited) and Facial recognition (truly passive).

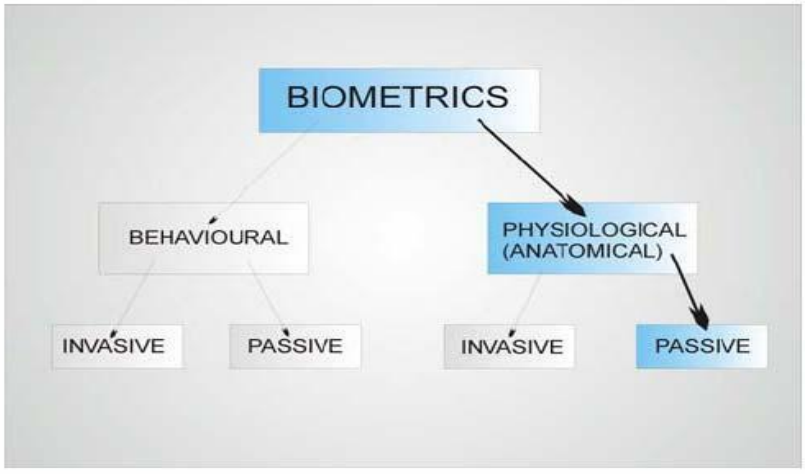

Fig.1 Biometrics method

II. THE EAR AS A BIOMETRIC

In proposing the ear as the basis for a new class of biometrics, there is the need to show that it is viable (i.e., Universal, unique, Permanent, Collectable). In the same way that no one can prove that fingerprints are unique, there is no absolute way to show that each human has a unique pair of ears. Instead, an assertion that this is probable can be made based on supporting evidence from two experiments conducted by Alfred Iannarelli (Appendix 2). It is obvious that the structure of the ear does not change radically over time. Medical literature reports that ear growth after the first four months of birth is proportional. It turns out that even though ear growth is proportional, gravity can cause the ear to undergo stretching in the vertical direction. The effect of this stretching is most pronounced in the lobe of the ear, and measurements show that the change is non-linear. The rate of stretching is approximately five times greater than normal during the period from four months to the age of eight, after which it is constant until around 70 when it again increases.

Since every individual has ears, it is rational to conclude that the ear is universal. The ear is also collectable using various means.

The human ear has three main sections, which consist of the outer ear, the middle ear, and the inner ear. The outer ear is used in this experiment. A diagram of the outer is shown below.

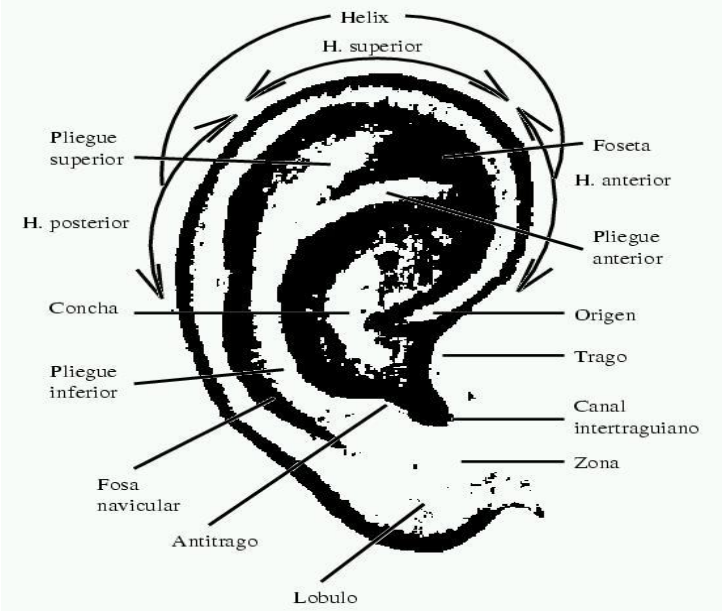

Fig 2. Anatomy of the outer Ear

III. ADVANTAGES OF USING THE EAR

The use of the ear has certain advantages. These include:

- It is passive. Unlike the fingerprint and iris, it can be easily captured from a distance without a fully cooperative subject.
- Unlike the face, the ear is a relatively stable structure that does not change much with the age and facial expressions. The shape does not change due to emotion as the face does, and the ear is relatively constant over most of a person's life.
- The ear's smaller size and more uniform color are desirable traits for pattern recognition. The uniform distribution of color means that almost all information is conserved when converting the original image into gray scales.

IV. CONCLUSION

This project was aimed at developing a biometric authentication system based on human ear images. An invariant geometrical method was used in order to extract features needed for classification. After the feature extraction, authentication is performed based on simple comparison between a new input image and an already existing one.

The human ear is a perfect source of data for passive person authentication in many applications. In a growing need for security in various public places, ear biometrics seem to be a good solution, since ears are visible and its images can be easily taken, even without the knowledge of the examined person. Then the robust feature extraction method can be used to determine personality of some individuals, for instance terrorists at the airports and stations. Access control to various buildings and crowd surveillance are among other possible applications. Ear biometrics can be also used to enhance effectiveness of other well-known biometrics, by its implementation in multimodal systems. Since most of the methods have some drawbacks, recently, the idea of building multimodal (hybrid) biometrics systems is gaining lot of attention.

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