Review Article

TONGUE PRINTS AS A BIOMETRIC AUTHENTICATION TOOL

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ABSTRACT

Identity fraud is a serious threat to society. Efficient identification systems are at urgent need to society. Among various personal identification biometric methods tongue print is a new biometric authentication tool that is unique and cannot be easily forged because no two tongue prints are similar. The tongue is a unique organ as it can be displayed for inspection and palpation, in this act offering a proof of life, and yet it is otherwise well protected in the mouth and is difficult to forge. By means of its shape and texture, its aspects and colour analysed in a particular moment, this organ is helpful to identify from one individual to another. The tongue also presents both geometric shape information and physiological texture information which are potentially useful in identity verification applications. The present paper provides literature review for tongue marks in personal identification.

Key Words: biometrics, personal identification and tongue prints

INTRODUCTION:

Biometric authentication is an important process for the identification and verification of individuals for security purposes. There are many biometric systems that are currently in use and also being researched. Tongue print is a new biometric authentication tool that is unique and cannot be easily forged because no two tongue prints are similar.[1]

Tongue is a vital internal organ well encased within the oral cavity and protected from the environment. It has unique features which differ from individual to individual and

even between identical twins. The tongue also presents both geometric shape information and physiological texture information which are potentially useful in identity verification applications. The color, shape, and surface features are characteristic of every individual, and this serves as a tool for identification. [2]

Many modes of biometric systems have come into existence such as fingerprint, iris scan, skin color, signature verification, voice recognition, and face recognition. The search for a new personal identification method secure has led to the use of the lingual impression or the tongue print as a method of biometric authentication. [3]Tongue prints provides both static and dynamic features for authentication.[4]

Tongue prints as other Biometric system

Biometrics refers to a real-time identification system that is used in the identification of a person using a specific physical or behavioral characteristic which is compared with a library of characteristics of many other people.[1] The ideal biometric characteristics have following qualities:

1. Robust: Unchanging on an individual over time. ñRobustnessò is measured by the probability that a submitted sample will not match the enrollment image.
2. Distinctive: Showing great variation over the population. ñDistinctivenessò is measured by the probability that a submitted sample will match the enrollment image of another user.
3. Available: The entire population should ideally have this measure in multiples. ñAvailabilityò is measured by the probability that a user will not be able to supply a readable measure to the system upon enrollment.
4. Accessible: Easy to image using electronic sensors. ñAccessibilityò can be quantiýed by the number of individuals that can be processed in a unit time, such as a minute or an hour.
5. Acceptable: People do not object to having this measurement taken on them. ñAcceptabilityò is measured by polling the device users[5]

The different biometric systems that are employed for security purposes are fingerprint, retinal scan, skin color, voice check, palm print, face scan, signature check, etc. Each of these systems has their own advantages and disadvantages. Tongue recognition is attracting a great deal of attention because of its usefulness in many applications.[6]

Numerous advantages exist in using tongue print over other biometric systems such as fingerprint, voice check, and retinal scan. The tongue is unique to every person with respect to its shape and surface textures. Since it is an internal organ, it can

be easily exposed for inspection and the exposed surface carries the required information. The physiological texture and shape remain constant. It is well protected from the external environment, and so it is not affected by external factors. It is also a reliable proof of life. In recent years, tongue print is gaining momentum as an important tool in biometric authentication.[2]

Tongue print collection

Tongue prints can be obtained in different ways. A simple visual inspection of the tongue reveals many features such as the color of the tongue, mobility, surface textural variations, and any other special characteristics if present.

The analysis of the lingual morphological aspects preserved using the alginate moulding technique, is the most reliable technique for recording tongue prints.[7]

A recent study has validated the use of tongue prints in forensic identification. The study also proposed the use of alginate impression in obtaining lingual impression as an efficient technique.[8] According to this technique an Alginate impression of the dorsal surface of the tongue was made [fig1] and a positive replica was prepared using Type II dental stone [Fig 2 & 3]. The photographs and the cast were analyzed and compared for morphological features such as shape and characteristics of fissures.

Fig 1: Alginate impression of the dorsal surface of the tongue

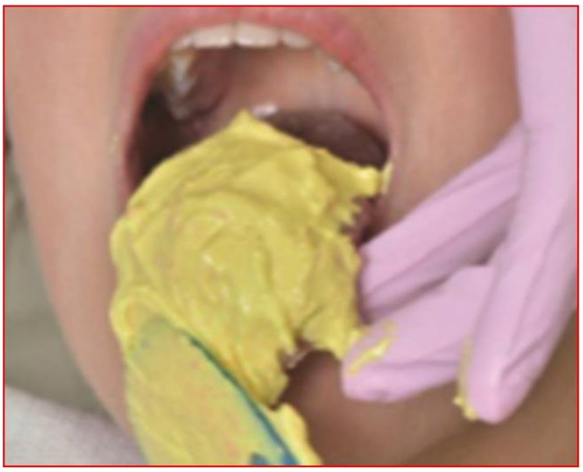

Fig 2 & 3: Positive replica was prepared using Type II dental stone

Three reference points were considered to determine the shape of the tongue. The reference points included the region of the tongue in contact with the commissure of the lips (when protruded outside the mouth) and the tip of the tongue. The results obtained in shape of tongue are U or V shaped or any other if any. The fissures in tongue are interpreted as shallow, deep or absent & tongue texture can be physiological, scrotal and geographic.[9]

A study carried out in Hong Kong Polytechnic University in 2007, was designed to develop tongue image database, which included both tongue geometric shape and surface textures of individuals, and this database was assumed to be a valuable resource for assessment, comparison, and evaluation.[1]

Other methods tried are capturing the video of a tongue and extracting images from the same as the tongue is a non rigid organ. Alternate method includes sublingual vein analysis, which is one of the common methods employed in tongue diagnosis.[10] Three-dimensional analysis of the tongue is a viable option for assessment. An ultrasound technique has been employed using an ultrasound transducer placed in the sublingual area to analyze the tongue function. Histological examination of the tongue can also be undertaken.[11]

Sexual dimorphism in tongue prints: When considering sexual dimorphism, it has been observed that scrotal tongue and geographic tongue were characteristic of female patients. Patients with sharp tip at the lingual apex were females and males had septate tips according to a study. The length and width of the tongue differed between males and females, with males having an increased length and width compared to females. In histological examination, it has been observed that there is a significant difference in the orientation of the muscle fibers of the tongue among men and women.[8]

Indian Perspectives

In India, this system of identification is still at grassroot level and needs more quantum of research and planning to implement the same. Creation of a database is pivotal for identification, but there is no national database available currently in India. Furthermore, there is no scanning device yet been created for capturing the tongue prints. In India, database creation is mandatory to explore the use of tongue prints in forensics.[12] Dentist can play an important role by collecting images of tongue routinely for all patients for data base creation.[7]

CONCLUSION

Tongue print being a unique record and one that cannot be forged is a better

biometric authentication tool than others, and since it is personalized and constant, it can be used for forensic identification purposes too. However future research is required to implement tongue prints in biometric authentication.

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