ISSN: 2278 - 1323
International Journal of Advanced Research in Computer Engineering and Technology (IJARCET)
Volume 2, Issue 6, June 2013

Hand Geometry Recognition System Using Feature Extraction

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Abstract- **Biometrics traits such as fingerprints, hand geometry, face and voice verification provide a reliable alternative for identity verification and are gaining commercial and high user acceptability rate. Hand geometry based biometric system has proven to be the most suitable and acceptable biometric trait for medium and low security application. Geometric measurements of the human hand have been used for identity authentication in a number of commercial systems.**

This paper proposes a technique for hand biometric feature extraction using hand contour matching. Hand shape feature is obtained by using Euclidian distance from starting reference point and then calculate the tip and valley point of finger. Then apply some mathematical calculation for calculate the hand geometry features like finger length, width and perimeter.

Index Terms: **hand geometry, feature extraction, mathematical calculation.**

1. INTRODUCTION:

Personal identification using biometric methods is gaining attention in today's automated world. Biometric recognition can be done using physiological or behavioral characteristics of the individual. The physiological characteristics signifies using human body parts for authentication like fingerprint, iris, ear, palm print, face etc. The behavioral characteristics include action done using body parts like voice, signature and gait etc. for authentication.

The existing biometric verification systems employ various biometric traits such as fingerprint, face, iris, retina, voice, signature, palm print etc. Hand geometry - based recognition is considered both user friendly as well as fairly accurate biometric system.

Biometric system has four characterstics:

- universality, which means the characteristic should be present in all individuals;
- uniqueness, as the characteristic has to be unique to each individual;
- Permanence: its resistance to aging;
- Measurability: how easy is to acquire image or signal from the individual;
- Performance: how good it is at recognizing and identifying individuals;
- Acceptability: the population must be willing to provide the characteristic

Biometric systems can be used for identification and recognition purposes. In all cases there should be a database where biometric features from a set of individuals are stored. The role of the system is to compare an input with all the entries in the database and verify if there is a match, thus confirming the identity of the individual. To compare any kind of biometric characteristics it is necessary to represent them in a stable fashion.

That is divided into two tasks:

1. Represent a biometric characteristic in reproducible and stable features that resist input variability.
2. Compare such features so users can accurately be identified.

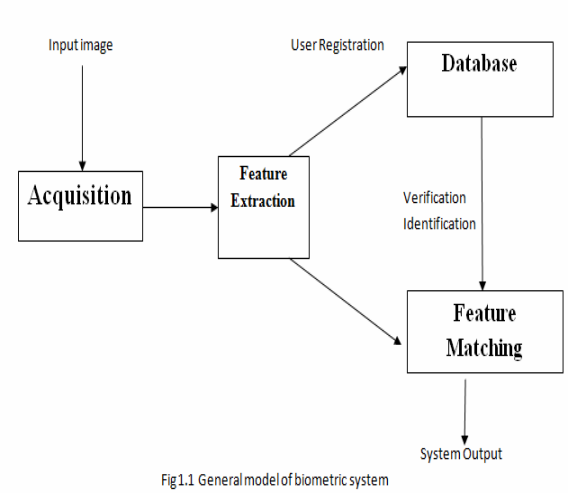

Fig 1.1 General model of biometric system

2. LITRECTURE REVIEW

Hand geometry refers to the geometric structure of hand, which includes lengths of fingers, widths at various points on the finger, diameter of the palm, thickness of the palm, etc. These features are not as discriminating as other biometric characteristics (such as fingerprints), they can easily be used for verification purpose.

Hand biometric systems have evolved from early approaches which considered flat-surface and pegs to guide the placement of the user's hand to completely platform-free, non-contact techniques were user collaboration is almost not required . This development can be classified into three categories according to the image acquisition criteria:

- Constrained and contact based. Systems requiring a flat platform and pegs or pins to restrict hand degree of freedom.
- Unconstrained and contact based. Peg-free scenarios, although still requiring a platform to place the hand, like a scanner.
- Unconstrained and contact-free. Platform-free and contact-less scenarios where neither pegs nor platform are required for hand image acquisition.

There has been several hand geometry verification systems published in literature. Jain et al. [2] developed a pegged hand geometry verification system for web security. Later Jain and Duta [3] developed another pegged system which aligns the two images and define a metric,
Mean Alignment Error as the average distance between corresponding points measured between the images to be verified. Wong and Shi [4] developed system which uses a hierarchical recognition process, with gaussian mixture model used for the one set of features and a distance metric classification for a different set of features. Geometrical features have received notorious attention and research efforts, in comparison to other hand parameters. Methods based on this strategy (like widths, angles and lengths) reduce the information given in a hand sample to a N-dimensional vector, proposing any metric distance for computing the similarity between two samples.
In this paper we purpose to extract features like length, width, centroid , min axis length, max axis length by using some mathematical function.

3. PERPOSED SYSTEM

In our research, we do not fix the hand's position in the image acquisition process. We take image from scanner. Proposed method which consists of hand geometry and their feature and we extract features by using image processing techniques and mathematical calculation.

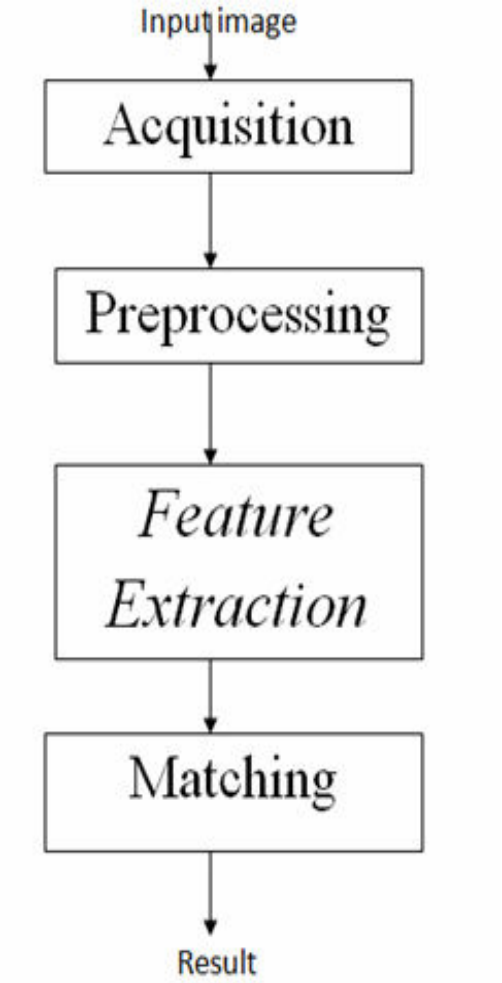

Fig 3.1 System Architecture

The steps in the palm print biometric system are:

A. Acquisition: The images are captured using a scanner. The input image is a color image of both left and right palm without any deformity. This provides a simple, low-cost, non contact, comfortable and user-friendly acquisition mechanism. We do not fix the hand's position in the image acquisition process. We take image from scanner in three different angles (90,180, -180 angle).The input image is stored in jpeg format. In cases of standard

deformity such as a missing finger the system expresses its inability to process the image.

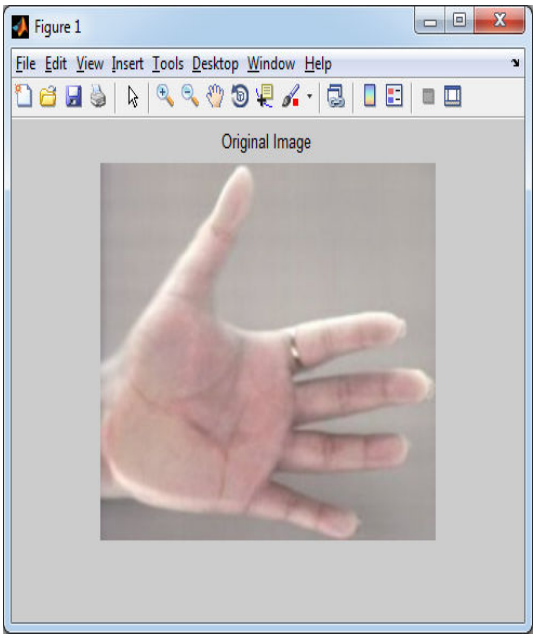

Fig 3.2 Acquisition of palm print

B. Preprocessing: The next stage is Palm Print preprocessing module. In this module we prepare the image for feature extraction. In this stage color image transform into gray level image then we reduce the noise pixels from the gray image.

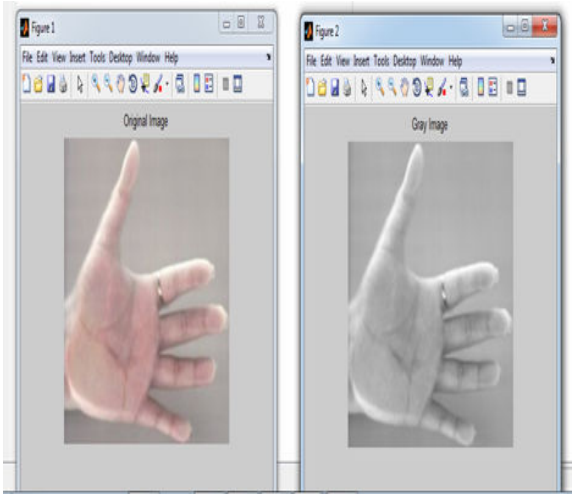

Fig 3.3 RGB Color to Gray color

Furthermore the gray level image is binarized.

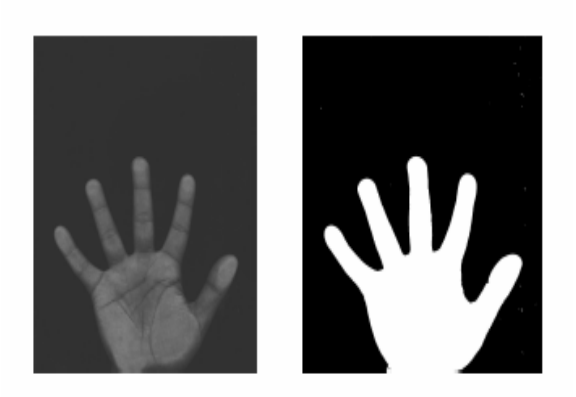

Fig 3.4 gray image and binarized image

C. Feature Extraction: The feature extraction module is the most important module in a biometric system. The feature extraction module extracts the features of hand geometry.

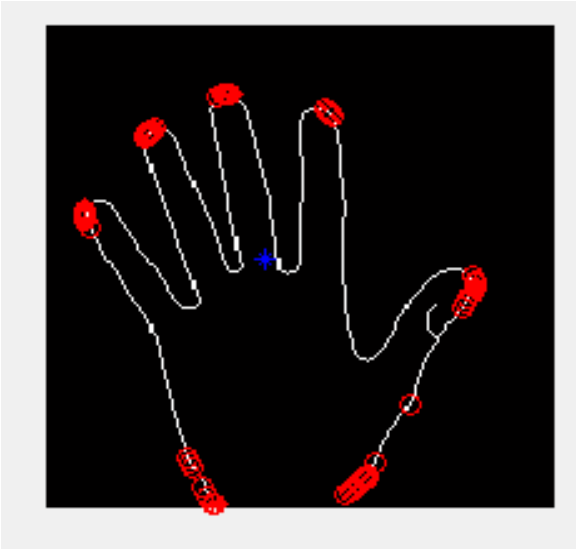

Fig 3.5 Feature Extraction

We calculate features of hand print by using reference point:

a) Tip point of all fingers including thumb.
b) Starting reference point and ending reference point
c) Centriod of the hand
d) Major axis length
e) Minor axis length
f) Perimeter

***D.* Matching:**

The last module of the biometric system is matching. Here the features extracted in the previous section are matched up with the features of that individual previously stored in the database. The proposed system produces a match score based on a

comparison scheme. The match score represents the closeness of the current image to the one present in the database. A higher score represents a higher closeness of the images. Based on experimentations a threshold is decided. The threshold is a value which lies in the range of match score. For any image if the match score is less than the threshold the image is rejected as a match to the database image specified. However if the match score of an image is higher than the threshold it is said to match the image in the database.

4. EXPERIMENTS AND RESULTS

There are 50 test users in our experiments. Six image of the hand is acquired from each user, three from left hand and three from right hand. It is used for the enrolment process to define the users' templates, or feature vectors. The features are extracted and match with database.

5. CONCLUSION

The Hand geometry has proved to be a reliable biometric. The proposed work shows how to utilize the contour of the hand to extract features using very simple mathematical formulas. We are attempting to improve the performance of hand geometry based verification system by reducing the amount of features and integrating new features. Further we can make a multi model biometric system for improve the efficiency of the system.

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