



## Hand Geometry Based Biometrics Using LabVIEW

Agam Gupta  
Thapar University  
Patiala, India

Dr. Sunil Kumar Singla  
Assistant Professor, Thapar University,  
Patiala, India

---

**Abstract:** *The ability to quickly compute hand geometry measurements from a freely posed hand offers advantages to biometric identification systems. While hand geometry systems are not new, typical measurements of lengths and widths of fingers and palms require rigid placement of the hand against pegs. Slight deviations in hand position, finger stretch or pressure can yield different measurements. Hand Geometry is a popular biometric type in verification process. Hence the proposed system is a restriction free verification system which utilizes these hand geometry features for user authentication. Geometric measurements of the human hand have been used for identity authentication in a number of commercial systems. In this paper we have developed a prototype hand geometry-based verification system and analyzed its performance. We have demonstrated the practical utility of this system by designing an application that uses hand geometry as opposed to password for restricting access to a web site. We present our preliminary verification results based on hand measurements of individuals captured over a period of time. The proposed system is reliable and user friendly as it is developed in LabVIEW. The availability of datalog files in LabVIEW makes it one of the most promising candidate for its usage as a database. The system developed in LabVIEW detects the user in almost real time with a reasonable accuracy and repeatability.*

**Keywords:** *Biometrics, Verification, Identification.*

---

### I. Introduction

Nowadays, authentication plays an important role in universal security system. In conventional knowledge based authentication systems users have to memorize passwords and in token-based systems users have to hold their ID cards. However, these conventional systems have numerous drawbacks, such as cards can be lost, stolen or easily duplicated and password also can be forgotten or stolen. On the other hand, biometric system provides a solution to these conventional problems and presents more secure and reliable authentication systems. The term "Biometrics" is being used to refer to the emerging field of technology devoted to identification and verifications of individuals using biological traits, such as retinal or iris scanning, fingerprints, face recognition, hand geometry, or finger stripes geometry. Biometric can be applied to enhance the airport security, strengthening national borders, in travel documents, visas and in preventing ID theft. Final model depends on the method used for recognition. Models for each of the users is then stored in the database. In the phase of recognition, a single picture is taken, preprocessed, and features are obtained. In the proposed system, the process of verification is used, where the input template is compared only with the model of claimed person. The feature vector is compared with features from the model previously stored in the database. The result is the person is either authorized or not authorized [1]. There are several reasons for developing hand-based authentication systems. First, hand shape can be easily captured in a relatively user friendly manner by using conventional CCD cameras. Second, this technology is more acceptable by the public in daily life mainly because it lacks a close connection to forensic applications. Finally, there has been some interest lately in fusing different biometrics to increase system performance [2,3]. The ease of use and acceptability of hand-based biometrics make hand shape a good candidate in these heterogeneous systems. Although hand-based live verification has a long history and a considerable market share [4], most studies addressing enhancements of this technology are rather recent. Increases in computing power and advances in computer vision and pattern recognition are expected to facilitate the implementation of easier to use systems with higher accuracy. Removal of pegs, to improve convenience, and use of more principled feature extraction techniques to capture the shape of the hand in more detail represent promising research directions in this area[5]. The focus of this work is on improving the efficiency, accuracy, and

robustness of hand-based verification. One can imagine utilizing various shape descriptors to provide a more powerful representation of the shape of the hand, replacing the conventional geometric features.

## II. The Design Of The System

### Hand Geometry

A biometric verification system based on hand geometry is designed. This system uses natural fusion approach as both of the biometric features originate from the same part of the body. Apart from that, unlike the other multimodal biometric system that required multiple input devices, only a single image capturing device is needed in this system. With this, the users do not need to go through the inconvenience of using several different acquiring devices for security access [6].



Figure1: Major optical components and layout of the hand imaging system

### Feature extraction and recognition

There are several choices for the selection of features in order to discriminate between hands in a biometric application. We are using hand recognition scheme that is quite different in nature. The method is based on distance measure between the contours representing the hands, and hence it is shape-based.

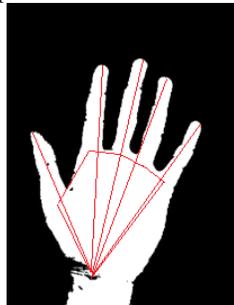


Figure2: Feature extraction of hand

The features extracted in the algorithm shown are:

- 1) Lengths joining the base of the hand and the finger tips.
- 2) Points showing the base point of each finger.
- 3) Area enclosed by the recorded points.

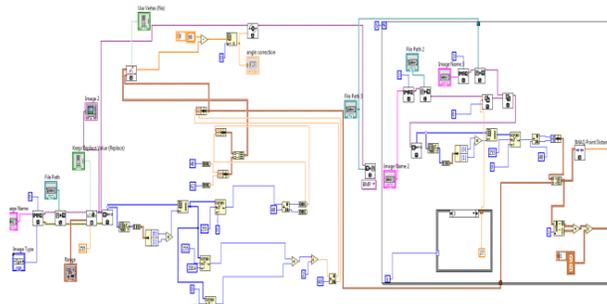


Figure3: LabVIEW representation of feature extraction of an image

### Matching and Decision

The matching stage is based on a classification algorithm that generates a distance score for each template comparison using a feature vectors' similarity measure. The score with the lowest distance value indicates the best match. Unnecessary template matching comparisons are avoided by also taking into account if the templates being compared both belong to the right or left hand, information which is obtained from the pre-processing stage.

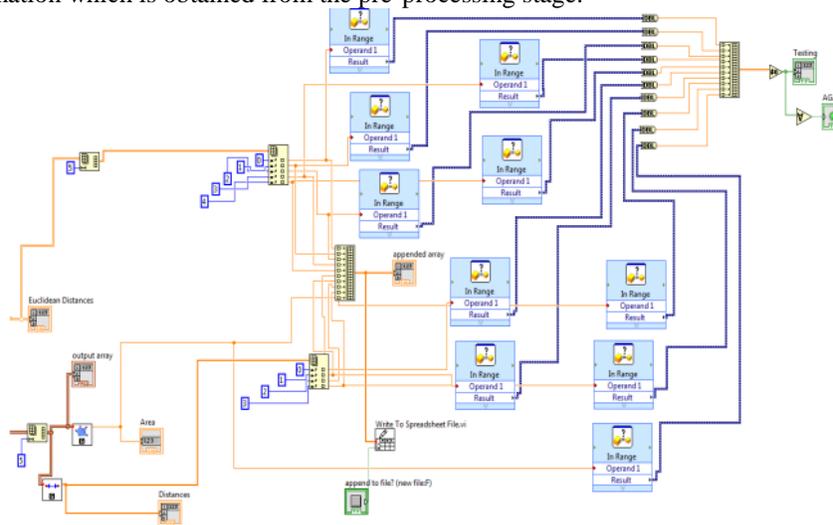


Figure4: LabVIEW representation of matching an image

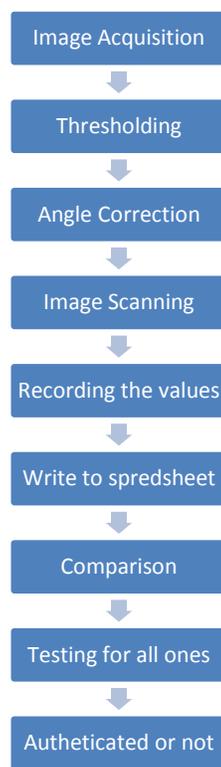


Figure5: Block diagram representation of the algorithm

### III. Results

The hand-shape image's database used in experiment was collected by a camera, which consisted of five person's images and ten images per person. There are different changes in hand placement, angle, light and so on in collection process. During the process of registration, it needed to deal with the hand image firstly, extract contour curve of five fingers. We could obtained the centroid sequence of finger by doing same processing to the input image in the process of authentication, and then took the sequence into template of declaring identity to calculate the average distance with 10 templates respectively. Comparing

the distance with predetermined threshold value of the user, if the value was less than the threshold value, the finger was of the declared user's. Otherwise it was not. Finally, according to the result of five fingers, decision can be made. Averaging the correct rate of each user, we could get the correct recognition rate by 99.8% of our hand shape recognition system. So we could see that our system has high accuracy. However, as the hand feature is not unique, the error rate is still high, which is the common problem in current hand recognition.

#### **IV. Conclusion and future scope**

In this paper, new hand geometry based biometric technique for verification using LabVIEW has been proposed. It has been demonstrated that this biometric type uses simple technique and works quite well for human verification. Unlike other biometric approaches the proposed one does not use complicated methods, techniques or procedure to attain high accuracy. Rather it uses fewer features than others and users can place their hands freely without needing pegs to fix the placement of their hand. Thus it would be convenient for practical implementation. In future, an attempt will be made to develop more efficient feature extraction algorithms and an automated feature extraction device to attain higher accuracy. Thus following points are inferred during the process:

1. Ideal for Medium and Low Security based Biometrics.
2. Can be used together with other Biometrics Palm Prints.
3. Non Geometrical hand features such as color can be used.

#### **References**

- [1] R. Sanchez-Reillo, C. Sanchez-Avila, and A. Gonzalez-Marcos. Biometric identification through hand geometry measurements. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, Vol. 22, No. 10:1168–1171, October 2000.
- [2] A. Ross and A. Jain. Information fusion in biometrics. *Pattern Recognition Letters*, 24(13):2115–2125, 2003.
- [3] A. Kumar, D. C. M. Wong, H. C. Shen, and A. K. Jain. Personal verification using palmprint and hand geometry biometric. *Time-Varying Image Processing and Moving Object Recognition*, Guildford, UK, pages 668–678, June 2003.
- [4] Biometrics market and industry report 2004-2008.[http://www.biometricgroup.com/reports/public/market\\_report.html](http://www.biometricgroup.com/reports/public/market_report.html).
- [5] A. Jain, A. Ross, and S. Pankanti. A prototype hand geometry-based verification system. *Proc. 2nd Int. Conf. on Audio- and video-based personal authentication (AVBPA)*, Washington, USA, pages 166–171, March 1999.
- [6] S. Selvarajan, V.Palanisamy, B.Mathivanan, "Human Identification and Recognition System using More Significant Hand Attributes", *Proceedings of the International Conference on Computer and Communication Engineering* 2008.