Identification System using Finger Knuckle Features

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Abstract—
In this paper, efforts are focused to develop a compact system that consists of a finger knuckle print sensor (Sony Digital Camera) which acts as a biometric sensor unit with a direct interface to an external PC for storing finger knuckle print. Added to the finger knuckle print sensor discuss the techniques for finger knuckle recognition. Finger knuckle print sensor consists of a set of digital camera that captures the raw image of finger knuckle print. A camera (Sony DSC-W380) is fitted in the small, rectangular notch of acrylic bracket.

The image of the finger knuckle print is captured through reflected light by digital camera. The Image is processed through an algorithm to extract the features set and form the finger knuckle print template for biometric authentication. Different algorithms for finger knuckle print recognition are pointed out and future researches about fusion level with correlated modality (Finger Vein) are suggested.

Keywords—sensor, finger knuckle print, algorithm, *template* finger vein,

I. Introduction

The importance of biometrics is emergent in the criminology and access control system for identification and verification respectively. Fingerprint technology is one of the most popular forms of biometric technology. Practically no particular modality is best each have its merits and demerits. After a long time research in the area of biometrics it is studied that a lot of scope of research in the interesting correlated modality with fingerprint is finger knuckle print and finger vein

Finger-knuckle-print is one of the emerging biometric traits. Woodard and Flynn [4-5] are the first who develop the use of finger knuckle print in biometric systems. They set up a 3-D finger back surface database with the Minolta 900/910 sensor. They used the curvature based shape index for feature extraction. Later, Kumar and Ravikanth [6-7] proposed 2-D finger-back surface imaging. They developed a system to capture hand-back images and then extracted the finger knuckle areas. They used the methods such as PCA, LDA and ICA for feature extraction and matching. Finger knuckle area only occupies a small portion of the acquired image but Kumar's design, the acquisition device is quite have a large size to captured hand-back images [8-9] Lin Zhang, Lei Zhang, and David Zhang developed a specific data acquisition device is to capture the FKP images. They used the Band-Limited Phase-Only Correlation (BLPOC) based method to register the images and further to evaluate their similarity. [Lin Zhang, Lei Zhang, and David Zhang]

II. Proposed System

A. *Motivation*

Fingers print is the most acceptable modality for authentication but fingers are easily injured from everyday activities. Understanding the basic structure of the hand [1-2] and fingers Geometry [3] the idea come in mind that the correlated modality can use for authentication i.e the back surface of finger (finger Knuckle). It is also known as dorsum of the hand [7] has not still fascinated the interest of newcomer. The back surface image pattern of finger is unique and such images can be obtaining online, offline for authentication.

B. *FKP Sensor*

The proposed FKP recognition system is composed of an FKP sensor and a data processing unit. The FKP sensor (Fig. 1-a) is composed of a finger bracket with white background, digital camera and computer system that store a number of samples form a database. The finger bracket size is (LxBxH) (14cm x13cm x12cm). The distance between the digital camera (resolution is 14 mega pixel) lens and finger supporter is 10cm. Rectangular block are used to fix the position of the whole finger. If the distance is less than 10 cm it is difficult to capture the full finger and if distance is more it affect on the quality of image. The size of the finger supporter is (LxW) (10cmx2cm) so that whole finger of any size can capture. The size of finger is changes according to gender and age.

The captured FKP image is raw samples process by preprocessing module consist of resize, cropping and removal of noise. The cropped image is process through the different algorithm to extract the features for matching.

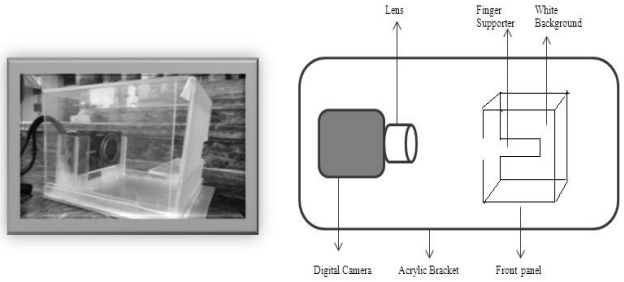

Fig.1 Finger Knuckle Capture Device

II. Preprocessing

The Finger Knuckle samples are collected from my college the samples of right hand index and right hand middle finger knuckles are acquired by the sensors. The five samples of each unit of each person. Total 500 finger knuckle samples are collected under the resolution of (). Transfer raw samples to computer system. The raw image is of (4300x3200) in size so resize the raw image by size of(648x486). After resizing extracts the ROI by selecting the X (Bottom) axis and Y axis (center of phalangeal) [10-11].Then crop the interested area i.e. all features are centered as shown in Fig 2.

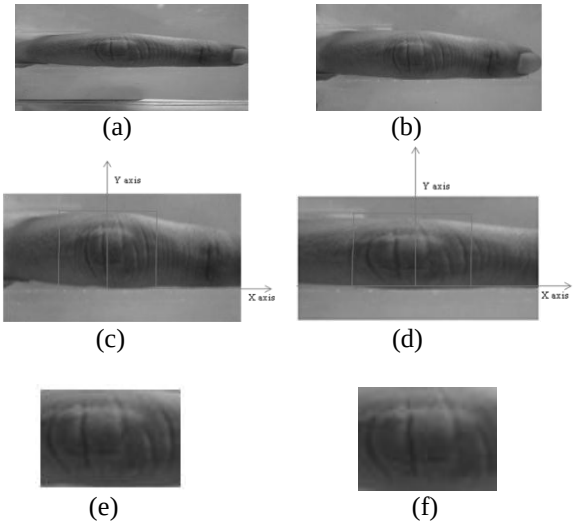

Fig. 2 (a) and (b) Original image of finger knuckle; (c)and (d)ROI extraction of (a)and (b); (e)and (f) cropped image of (c) and (d)respectively.

The Fig.3 shows two samples of each unit captured by the developed sensor. Images from the each finger are taken at time interval and day interval.

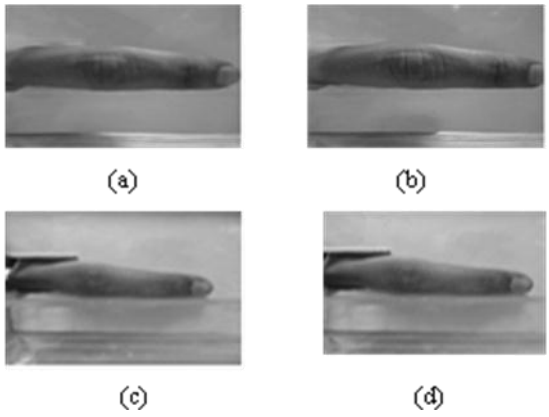

Fig. 3(a) and (b) are right index FKP (c) and (d) right middle FKP

A. *Finger Knuckle Feature*

Finger is always put in bending position on the finger supporter when the FKP image is captured, the bottom boundary of the finger which is on the supporter is stable every time and can be taken as the *X*-axis of the region of interest now allocate the *Y*-axis in the center of the phalangeal joint because most of important features are centered in that area .The line features on the two sides of the phalangeal joint turned (u shaped) in different direction. [10]. The other features like number of line on both sides of the phalangeal joint, Spacing between lines and length of lines.

B *Proposed Framework*

- Samples are collected by developed sensor. Apply the preprocessing process on sample for conversion of raw images to fine image .
- After preprocessing image is process by the algorithm for feature extractions that form the template of enrolled finger knuckle. The Feature set is forwarded to matching unit to generate the matching score and match between the claims and enroll identity. Then according to threshold, binary (Yes/No) decision will be declared as shown in Fig.3.

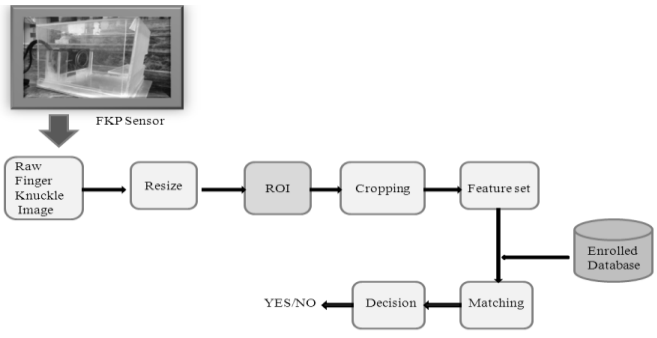

Fig.3Proposed framework of finger knuckle recognition

A. *Algorithm*

Ajay Kumar, Senior Member, IEEE, and Ch. Ravikanth has used the PCA, Linear Discriminant Analysis, Independent Component Analysis, (for finger knuckle feature extraction and get EER 3.97%, 5.81%, 4.94%. The system is rigorously experimented on a database from 105 users and achieved promising results. [7] Lin Zhang, Lei Zhang, and David Zhang developed a specific data acquisition device to capture the FKP images. To match two FKPs, they used Band-Limited Phase-Only Correlation (BLPOC) based method to register the images and further to evaluate their similarity. Extensive experiments demonstrated the efficiency and effectiveness of the proposed technique. The proposed FKP authentication has merits of high accuracy, high speed, small size and cost-effective. [12].A novel local-global feature fusion (LGFF) based FKP recognition method was proposed by Lin Zhanga, Lei Zhanga, David Zhanga and Hailong Zhubhave. Specifically, the EER of LGFF is 0.402% and it can operate at a low FRR of 1.5236% with a low FAR of 0.0515% on their FKP database. A feature extraction scheme which combines orientation and magnitude information.[13] Lin Zhanga, Lei Zhanga, David Zhanga and Hailong Zhub extracted feature using Gabor filter. Extensive experiments were conducted and promising results demonstrate the efficiency and effectiveness of the proposed technique. [11]

B. *Proposed Algorithm*

As per survey of finger knuckle recognition it is concluded that the above algorithms are successful to decline the error equal rate. The proposed system is in process to implement concept of fusion techniques at different level to achieve promising result. The system is called as mono modality with multiple approaches .In future the proposed FKP can integrate with another correlated modality of finger vein that can boost the conventional parameter along with the security of person authentication which is very chief requirement for authentication. [14]

III. Conclusion

This paper presents the development of new finger knuckle acquisition device which is compact and simple in design. The paper discusses the conventional FKP capture devices and recognition algorithm. The main focus of the proposed system will to improve the previous result and security parameter using the fusion method.

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