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A Novel Authentication System Based on Hidden Biometric Trait

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Abstract

This paper proposes a novel authentication system using hidden biometric trait called finger vein (FV). Proposed finger vein acquisition device captures the superficial vein pattern present under the skin of finger. The vein pattern of all fingers of human being is not same. Each finger of same person has different vein pattern. It is the hidden part which is not seen by normal eye sight hence less possible to forge. The paper highlight the primary set up of NIR based finger vein acquisition device to capture the superficial vein pattern that shows the unique features require for recognition. This Paper explores the bilateral and contrast limited histogram equalization technique to enhance finger vein raw samples captured by proposed finger vein acquisition. The performance is verified using Local Binary Pattern (LBP) algorithm. The recognition accuracy is represented by graph between True Acceptance Rate (TAR) vs. True Rejection Rate (TRR). It is observed that TAR Vs TRR for standard data base is 94. 5% and for own data base is 94.34%. It shows that FV has potential for personal identification.

Keywords: *Finger vein, Acquisition device, superficial, modality, vein pattern, LBP, TAR, TRR.*

1. Introduction

Traditional authentication systems are based on the password, access card, lock and key etc. The identity of the user using traditional trends have a lot of issues of stolen the card, misuse of card, forgotten the password and different password attacks. Today's wireless word the transaction through internet is demanding from the users hence needs to develop the authentication system that gives more security of individual identity. Modern authentication system based on human physiological and behavioral detail that gives the security to personal information and not easy to forge is known as biometric recognition system. This paper explores the new hidden biometrics trait named finger vein (FV) for authentication.

Vein detection is tedious process because it is hidden and not seen by normal human sight. It is based on the IR light in which IR light passing through finger is absorbed by hemoglobin of blood and shows dark black lines known as vein [1]. The unique characteristics of finger vein are it is internal part hence impossible to forge, unique, reliable, secure and difficult to trace by eye. It has small size of template as compared to hand vein, less failure to enroll rate (FET), no issues of wet, dry, dirt like finger print [3]. During vein acquisition, exposed time of IR light is very less so that it is safe for human body. The X-ray and vein pattern detection are based on the IR light but the vein is just the pattern present beneath the finger skin known as superficial pattern. Penetration level and exposed time of IR light is different from X-ray [2]. The vein pattern of weak person whose hemoglobin level is not up to the mark is unable to capture. Author in [4, 5] used Infrared light to capture an image of a finger and developed a method to extract the centerline of vein without changing the width and illumination. Vein pattern with finger contour is extracted for recognition in [6]. Unimodal biometric based on hand vein using multi feature based recognition system is reported in [7]. Authors proved that recognition accuracy is more than multimodal biometric recognition system. NIR based finger vein acquisition device of 890 nm has implemented and pre processing techniques like vein normalization, orientation, and Gabor filter shows the improvement in raw vein samples. Minutia feature point is extracted for personal recognition in [8]. Considering the thickness and orientation of finger, author proposes three NIR light-emitting diodes of 760 nm, and a CCD sensor of preset window (W200×80) spread and shows that circular Gabor filter enhanced vein

Ridges Yu Lu used contrast-limited adaptive histogram equalization (CLAHE) method to improve contrast of cropped vein images and Gabor features are extracted for recognition [10]. To improve the contrast, the captured hand vein is enhanced by different histogram equalization methods such as histogram equalization, adaptive histogram equalization; contrast limited adaptive histogram in [11]. Author [12] proposed the skin surface information for registration by calculating the rotation and translation of finger.

2. Finger Vein Based Recognition System

Biometric recognition system consists of finger vein acquisition from proposed acquisition device, feature extraction, template formation, and matching and decision unit. By matching the template between the enrolled and claim identity, decision is declared that claim identity is genuine or imposter.

2.1. Finger Vein Acquisition Device

Data acquisition is the crucial task which indicates the identity of individual. It is important to capture the actual finger vein samples which should not get manipulated or changed. Finger vein acquisition device is based on NIR optical source and simple IR camera that captured the vein pattern. NIR imaging is safer because it penetrate the only the superficial area of the finger. When light is radiated in the finger, temperature of the skin increases, but it is controlled by adjusting operational parameter of LED that make LED within safe temperature range [13]. In this finger is in non-contact with NIR LEDs and acquisition of vein is in milliseconds hence safer.

The proposed device is consisting of power supply, optical source and IR camera. The finger vein capturing device is based on NIR LEDs and IR sensitive camera. The capturing device consists of power supply unit, LEDs assembly, capturing unit, and display. Finger is placed on NIR assembly. When power is ON, light radiated from the NIR LEDs that passes through the finger and is absorbed by haemoglobin of blood and shows blood vessel pattern captured by IR camera. IR camera is installed on laptop. Driver of laptop are changed because webcam is inbuilt in laptop which senses the visible light while IR camera senses the IR light. If the display screen is desktop, then driver are not changed. The detail design of each block of proposed capturing device is as shown in figure 1[18].

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