

Contactless Biometric Security System using Finger Knuckle Patterns

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Abstract - Biometric identification systems are well popular in the current world and have higher acceptance than any another security systems that are currently available. Finger knuckle based identification techniques is also one among them. Finger knuckle patterns have higher accuracy and precision as that of fingerprint patterns and can be used in many places. Here we discuss the usage finger knuckle patterns for a security system in which the authentication procedure is done through matching the finger knuckle patterns. This paper also highlights a new methodology for feature extraction and preprocessing of the image which are different from conventional methods

Key Words: Authentication, Biometric, Feature extraction, Finger knuckle Identification, Security.

1. INTRODUCTION

In this advancing era, there are multiple types of security mechanisms and each and every individual is trying to secure their authentication and identity from thefts. Now almost all the sectors uses some kind of security for their users like pins, passwords, unique patterns and even biometric systems, of these biometric systems have gained a wide user acceptance due to its higher level of security and ease of access. While considering the biometric systems there are mainly two kinds of conventional biometrics. The biometric systems that are based on behavioural patterns and that are based on physiological patterns. The biometric systems that are based on behavioural patterns include handwriting and keystroke dynamics. And the physiological biometric identification systems include face and fingerprint. Somehow these biometric systems are suffering from attacks as the external body features can be copied by several techniques. In this situation there arises a new technique which used the iris patterns but this was not widely accepted because of the least user acceptance. The brightness of light which are emitted by the device during the image capturing process tends to create discomfort for the eyes. And also slight variance in illumination caused large impact on the image captured which compromised the method's accuracy. So contact based techniques were found more vulnerable to spoofing and many other type of attacks and the emergence of contactless biometric systems provided a solution to this to a certain extend.

Even though many contactless biometric security systems were built most of them used fingerprint patterns for their means of identification. Finger knuckle patterns also provided same level of security with greater precision as that of fingerprint patterns but were never used widely. But

taking the case of security of a particular system finger knuckle patterns can be effectively used as an identification method.

Contactless biometric systems using finger knuckle pattern provide many features such as:

- Finger knuckle patterns do not change with time. They are permanent patterns.
- Finger knuckle pattern acquisition is very user friendly.
- Finger knuckle patterns provide greater dissimilarity between each individual.
- Each individual have normally ten fingers on their hand, so ten different patterns is available for each.
- Finger knuckle patterns can be captured only from a living body.
- Finger knuckle patterns are easier to be detected than fingerprint patterns as its patterns are more visible.
- Since the patterns are more visible the identification and authentication will be much faster than the conventional methods.

Here trying to create a contactless biometric security system using the finger knuckle patterns. The main aim of this security system is to provide fast and accurate security mechanism for securing the data.

1.1 The working of the project

This project is compatible with every working systems as it is just a security mechanism. It act as a gateway for the user to the system. When the user needs to access a particular service in the system, a new window will be opened which will be the asking the user to login using the registered knuckle print. And the user need to show his knuckle patterns towards the webcam or the camera device associated with the system. As soon as the system recognized the user is a valid one it will automatically redirect the user towards the particular service he was about to access.

2. LITERATURE SURVEY

2.1 Existing System

Existing contactless biometric system using finger knuckle patterns either uses 2D or 3D images as their input. In this field the most efficient method was as described in [3] and their method is very simple. And in their work they uses a combination of 3D and 2D feature extraction for more

accuracy and an illumination controller to vary the lighting in different conditions. But this process is very costly and is slow because 3D image reconstruction and feature extraction processes are done here and are reconstructed from the acquired 2D images and these processes will take too much time and is not suitable for a live security system.

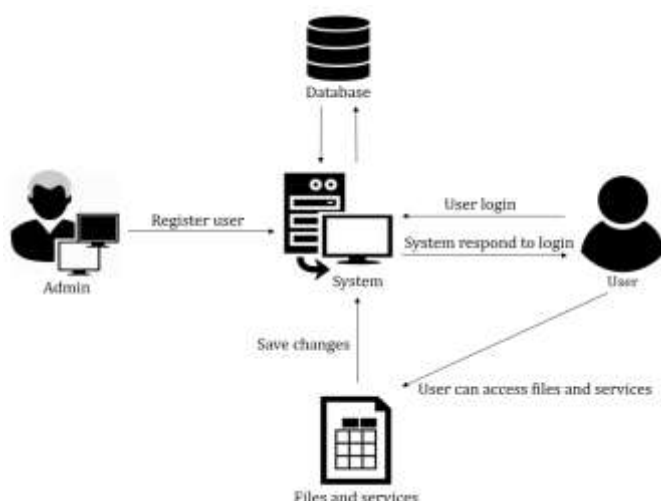
2.2 Proposed System

The proposed system is a contactless biometric security system using the finger knuckle patterns and the system can be used as a gateway for any of the applications that are existing or that are upcoming. The image acquisition is made through the computer system's webcam and the illumination variance problem is solved by placing an illumination controller itself and the lighting is provided with necessary number of LEDs that are connected to the illumination controller.

The project is a live system so that the results are expected to be very fast and accurate for that we use a method by the combination of the Convolutional Neural Network (CNN) and the Speedup Robust Feature (SURF) algorithm. This combination can provide necessary fast results as expected and the results will be very accurate. The SURF algorithm is used for more accuracy and speedup the process of pattern detection. As this speedup happens the overall speed of the system will be increased and thereby the system will be more acceptable for the users.

The dataset is created at first by registering the knuckle images of all the users of the system and train those in the neural network and when the user try to login using his/her knuckle print the system will automatically detect the person within the least possible time. Since we are using a contactless method there is no chance for conventional types of spoofing attacks or attacks by copying the patterns of a registered user

3. SYSTEM ARCHITECTURE



4. OVERVIEW OF METHODS AND ALGORITHMS

The contactless biometric security system using the finger knuckle patterns is not a new approach many works and studies have been conducted on this field and day by day it becomes an advancing technology and the major advancements are happening in the methods that are used for capturing the images and preprocessing, feature extraction and matching.

The method that is used here is a conventional neural network based technique and we uses the SURF algorithm. Conventional neural networks are really complex feed forward networks. The CNN method is used for the image classification and recognition due to its higher accuracy. And can be used to work well in the behind scenes of image classification.

The speedup robust feature (SURF) algorithm is used as feature detector and identifier. It can be used for the applications such as object recognition, image registration or 3D reconstruction. The SURF algorithm can perform much faster than any other algorithms for the same purpose. SURF can be used for the object recognition and region of interest and if this used with our convolutional neural network it would be a great achievement because both the advantages of the CNN and the processing speed of the SURF can result in a method which is very effective in detecting and matching finger knuckle patterns in a live situation.

5. ADVANTAGES & DISADVANTAGES

5.1 Advantages

- The usage of CNN with the SURF make the recognition process much faster.
- Lower recognition time makes the system more acceptable among the users.
- The architecture is so simple that the system is flexible to further changes.
- The presence of illumination controller results in images of higher quality. And it also helps in avoiding noises due to dark environment and thereby avoid false detection of patterns.
- Only the registered users can access the data, thus providing confidentiality and integrity to the data.
- Knuckle patterns are of higher dissimilarity for each individual so that it is also a unique identification mark, so the usage of them in a security system increases the protection.

5.2 Disadvantages

- Separate hardware need to be built for the illumination controller.
- The resolution of webcams of every computers might not feasible for the necessary quality of the input

images, so those systems will have to add extra camera which will provide necessary image quality.

6. CONCLUSION

The contactless biometric identification system using finger knuckle patterns which uses the CNN and SURF are likely to produce more result than any other systems using the conventional image processing algorithms. This is very easy to implement and have very simple architecture. The users will be very convenient with this new approach as the detection rate is very high and in least possible time.



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BIOGRAPHIES



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