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Access Control using Contactless Biometric Hand Geometry Recognition

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ABSTRACT

In this project, we are developing authentication system for user based on palm dorsal vein patterns. Image processing algorithms are used for minutiae feature points extraction and Delaunay Triangulation is used for feature matching. The knuckle points are used for identifying the Region of Interest (ROI) in the given Infrared Image of Palm dorsal. After getting the ROI, the image is further processed to detect bifurcation points of the veins. These points are called Minutiae points. These points are matched using Delaunay Triangulation and score for the database images is calculated. Based on maximum matching score the authentication of the user is done.

Keywords: bifurcation; biometric; knuckle point; minutiae; Palm dorsal; scoring; triangulation.

1. INTRODUCTION

The current major scenario in Information Technology world is authentication because of increase in crime rate. Authentication is essential in almost every application to provide the services to the appropriate user. Authentication using smart card with (PINS), combination of numbers, magnetic swipe cards are traditionally used techniques. Unique username and passwords is commonly used and mostly preferred user authentication technique. But major drawback of these techniques is they are vulnerable and can be tampered easily. They can be hacked and misused very easily. So, authentication using biometrics was introduced to remove these constraints. Every human has unique features that can be used as authentication. Unlike most other types of recognition, biometric techniques are securely tied to our physical bodies.

This technique of biometrics used for verifying a person's identity from either physical characteristics like finger print, face, hand print, thermal image, scent or iris pattern or physical traits like voice pattern, hand writing or acoustic signature. Convenience, improved security and fraud reduction are some of the benefits often acquired with the use of biometrics.

Biometrics can be implemented using contact-based and contactless feature acquisition methods. Procurement of features using contact-based method was inconvenient because in a scenario of fingerprint or palm-print recognition system, some people may not choose to place their fingers on a fingerprint scanner for the fear of contracting a disease and fingerprints cannot be taken correctly if they are moist or oily. So, we propose a system for authentication by contactless biometric hand geometry using 3D camera. 3D camera is best for accuracy which will help in taking accurate hand geometry.

2D and 3D hand geometry features were used in earlier implemented systems. This method has disadvantages in the scenarios like if the fingers got cut then it will be difficult to retrieve the features

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accurately and it will not be beneficial if the security is breached by using dead person's hand features. To remove this drawback and ensure the aliveness of the access requesting person, palm vein recognition technology was introduced. This technique ensures the aliveness of the person so that strong security constraints can be applied. This paper proposes a system with dorsal palm vein authentication for access control.

Hand vein pattern recognition system provides more advantages than any other biometric authentication system. Some of them are as follows:

1. Aliveness: Hand vein pattern can only be extracted if the person is alive; otherwise vein patterns cannot be traced. Hence forgery of the hand vein pattern cannot be made.
2. Contactless: This authentication system is hygienic as it accepts the hand vein image without making the hand contact with the device. It is convenient for the users who do not want to place their hand on the device in fear of infection.
3. Internal Features: The features used for the recognition system are internal body features which enhances the rate of accuracy. Hence they cannot be forged.
4. Secured: As this system is contactless, uses aliveness and internal features, it is hard for intruders to tamper the system.

2. LITERATURE SURVEY

Earlier researches in hand vein biometric authentication system include palmer part, dorsal part and finger vein. Malki et al. [1] has made use of palmer region vein pattern using cellular neural network for feature extraction and used direct image comparison and resulted 99.5%. But, false detection error rates were not projected. L. Wang et al. has used thermal vein patterns in dorsal hand vein and their results show the vein images are affected by various factors such as temperature, nearness of vein to the skin which reduces the efficacy of hand vein pattern biometrics [2]. A. K. Jain et al. also has used the thermal hand vein patterns in dorsal hand veins and used hierarchical orientation field estimation algorithm resulted in smoother orientation and improved performance but, generated errors while matching features from incorrect minutiae extraction and inaccurate alignment. Poor image quality had adverse effect on the accuracy [3]. Lin and Fan had investigated the personal verification by acquiring images of palm vein from the thermal infrared (IR) camera. This is a fully automated approach and uses the multi resolution combination representations from the thermal vein patterns that is being post. They proposed an approach for personal identification using thermal images of palm-dorsal vein patterns captured by IR camera and defined ROI extracting finger points of the vein pattern (FPVP) in each ROI and multiple features area extracted from each FPVP, but the accuracy is affected by the ambient temperature and the thickness of the overlapping skin, condition of the vein walls, the degree of the venous encouragements, etc. [4]. Wang Lingyu et al. investigated far infrared thermography and near infrared imaging techniques and experimented on population of 150 participants but it is sensitive to surrounding conditions and human body conditions and does not provide a stable image quality and faces problems occurred by hairs and line patterns on skin [5]. Hausdorff distance matching technique is used for matching two line segments and measure the similarity of two points, but this paper uses only lines of face for verification which is not convincing for verification and authentication [6]. In this paper Naoto Miura et al. had proposed a method that extracts the finger vein pattern from unclear images of fingers by making use of line tracking which starts from various positions achieving robust pattern extraction and reporting 0.145% EER in personal identification, but in cold weather the veins of fingers become unclear that increases the mismatch ratio and 3D rotation of finger reduces the identification accuracy [7]. G Sathish et al. had proposed a technique of highly robust dual watermarking using hand vein for securing digital images and had used WASET database and used hausdorff distance for matching the palm vein images [8]. G. Sathish et al. worked on a procedure for hand vein feature extraction based on

DWT, Adaptive Thresholding and Filtering techniques. But this technique was tested only for WASET database images [9].

3. PROPOSED SYSTEM

In this application, we develop a new approach of hand vein extraction and verification using minutiae matching algorithm .Firstly the image processing algorithms are used for minutiae feature points extraction and Delaunay Triangulation is used for feature matching. The knuckle points are used for identifying the Region of Interest (ROI) in the given Infrared Image of Palm dorsal. After getting the ROI, the image is further processed to detect bifurcation points of the veins. These points are called Minutiae points. These points are matched using Delaunay Triangulation and score for the database images is calculated. The scores are generated by subtracting the count of bifurcation triplets of the input image from the count of bifurcation triplets of the database image, provided a condition for checking whether the count of minutiae triangles for database image is bigger. Based on maximum matching score the authentication of the user is done. Working of our system:

- While log-in user will be authenticated based on registered palm dorsal image.
- If palm dorsal vein pattern images matches then user will declared as authorize user.

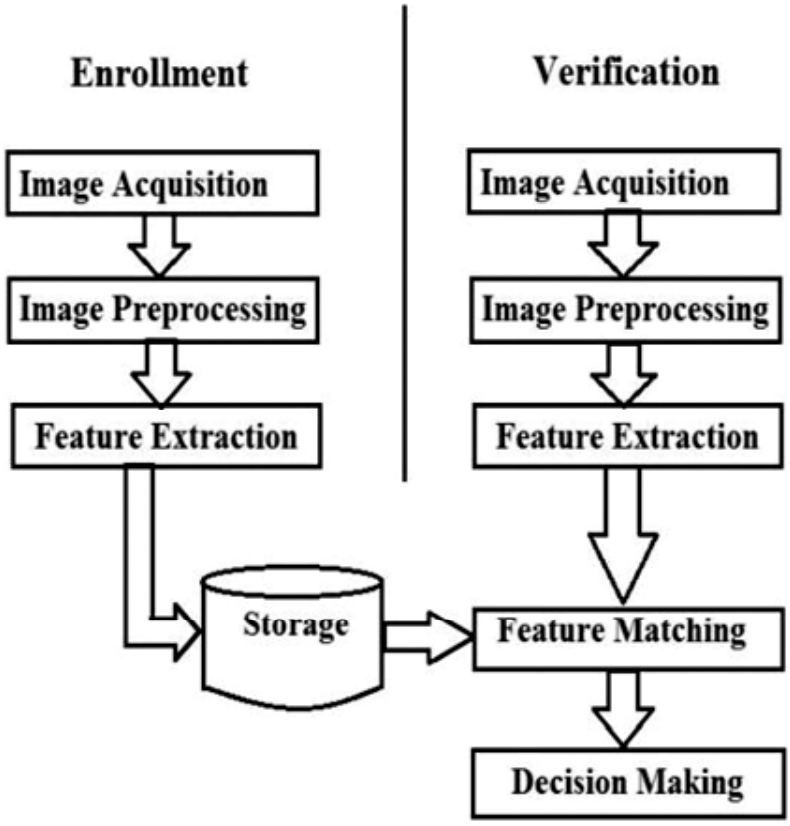

Figure 1: Flowchart of Proposed System

4. CONCLUSION AND FUTURE SCOPE

In the past years, vein recognition has attracted more and more In the past years, vein recognition has attracted more and more research interest, as the second-generation biometric identification technology. Palm vein patterns are invisible and impossible to forge virtually, increasing the system's security. The system is also much more accessible for people with some physical disabilities. The digitally encrypted palm vein patterns cannot be read by any other system. As we are designing the system which is contactless,

the test taker need not touch the palm vein sensor, removing the possibility of smudging. Earlier experiments were carried out on very small database creating doubts on the validity for larger databases. In this paper we are trying to remove this constraint by experimenting on larger databases. We are planning to do verification and matching based on low quality image dataset without affecting the efficiency of our system.

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