Vein Structure Authentication System

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ABSTRACT
Reliable personal recognition is an important problem in diverse businesses. Biometrics, recognition based on distinctive personal traits, has the potential to become an irreplaceable part of many identification systems. Various biometric patterns such as face, fingerprint, iris, retina, hand geometry are in use since long for personal identification, hand vein identification has emerged as a promising component of biometric study. The focus of this paper is to present a new approach for authentication of individuals using triangulation of hand vein images and simultaneous extraction of knuckle shape information. This idea of Vein Structure extraction will be based on triangulation pattern found on dorsum of hand. The biometric template after prepossessing on the captured image will be generated and will be used for authentication.

General Terms
Biometric system , hand Biometrics , Hand Vein Pattern.

Keywords
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1 INTRODUCTION
Associating an identity with an individual is called personal identification. There are two fundamentally distinct types of identification problems; the first is verification and the second is recognition, or popularly referred to as identification (Who am I?). Both problems are very challenging and have different complexities. A practical approach is to reduce the problem of verification of a person's identity is to the problem of verification of a concrete entity related to the person. These entities can be categorized into:

1.1 Something that you have in your possession
Such as an ID or member card. Or in a more general way: everybody allowed in a building has a key that identifies this group.

1.2 Something that you know
Such as a password and login for a computer. Some systems combine the first and second entities, e.g. the ATM card and PIN code combination.

1.3 Something that you are or that you do
Which is the measurement of the physical or behavioral characteristics of a person.

Hand Vein Structure in Authentication Mechanism
Our interest is to use this new biometric technique as Authentication mechanism in Information and Network based security systems that need some essential security apart from the traditional Cards and Secrete Codes. Shape of the subcutaneous vascular tree or pattern of the Individual to a reasonable accuracy for automatic personal authentication purposes.

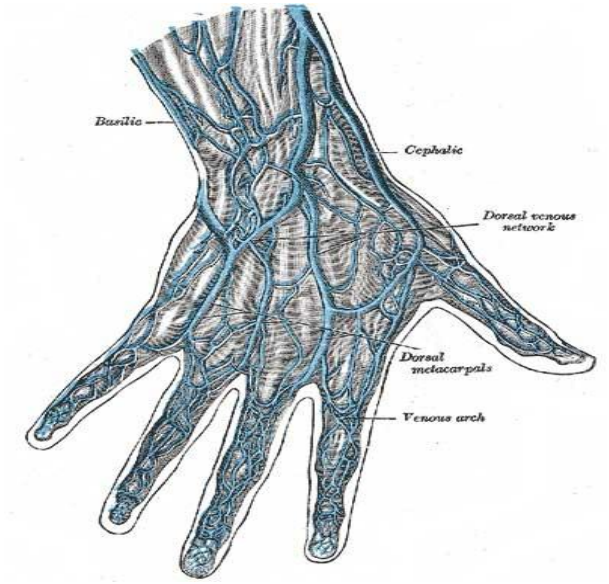

Fig1.Hand Vein Structure [1]

Fig.1.illustrates the generic vascular map found on the dorsum of the hand. There are mainly two types of hand veins found on the dorsum of the hand, namely *cephalic* and *basilic*. The *basilic* veins are the group of veins attached with surface of hand and It generally consists of upper limb of the back of hand. *Cephalic* veins are the group of veins attached with the elbow of the hand . The vascular system extends or shrinks with the respective changes in the body. The shape of hand veins changes with the change in the length of body from childhood. In general, no major growth takes place in the adult life and, hence, vein patterns are quite stable in the age group of 20–50. After that the vascular system begins to shrink with the decline in the strength of bones and muscles. These changes in vascular system make the vein pattern loose and change its size as compared to earlier. As the vascular system is a large and essential system of the body, it is largely affected due to any change in body, either by nature or by disease. Diabetes, hypertension, atherosclerosis, metabolic disorders and tumours are some diseases which affect the vascular systems and made it thick or thin.

Biometrics, which refers to automatic recognition of people based on their distinctive anatomical (e.g., face, fingerprint, iris, retina, **hand geometry** and **vein structure**) and behavioural (e.g., signature, gait) characteristics, could become an essential component of effective person identification solutions because biometric identifiers cannot be shared or misplaced, and they intrinsically represent the individual's bodily identity.

(i) Positive Identification ("Is this person truly known to the system?").

(ii) Large Scale Identification ("Is this person in the database?")

(iii) Screening ("Is this a wanted person?").

2 EXISTING SYSTEM

All The stability and uniqueness of hand vein patterns have attracted the attention of researchers for its usage in the personal identification. In last few decade lot of research work were carried out in this field to make it more accurate.

Following are list of some prior/existing research work in Hand Vein Structure in Biometric Authentication.

1. We analyze that the personal verification from such palm dorsal images acquired from the thermal infrared (IR) camera operating in m range. The approach is fully automated and uses the combination of multi resolution representations from the post processed thermal vein patterns. [2]

2.We analyze that approach for personal authentication using hand vein images acquired from the thermal imaging. Hausdorff distance[3] was used to generate matching scores between the extracted line patterns and illustrated promising results. The subcutaneous blood vessels absorb less radiation, in near IR (780–1100 nm) illumination, than its surrounding blood and, therefore, generates high contrast in the acquired images. Such near IR imaging of hand vein patterns have also been investigated in the literature for personal identification[4].

3. The Thermal IR Camera is elementary element or H/W of this system hence we studied of near IR imaging for the extraction of hand vein patterns. Authors have demonstrated the two-fold matching of medial axis representation, for the authentication of user[5].

4**.** We came to know that the implementation for hand vein extractor, using FPGA in and DSP processor in but with little details on the matching strategy or on the size/nature of database employed for the performance evaluation [6]

5. Another analysis shows hand vein acquisition device using near IR imaging and employed FFT based phase correlation scheme for user verification. The thermal (far IR) imaging cameras are highly sensitive to ambient conditions and very expensive. Therefore, the some existing system has focused on the solutions using near IR imaging. The imaging setup in some existing methods employed hand docking frame device (to restrict the translational and rotational changes) which are often inconvenient and not user friendly [7]

Table 1 Comparison Table of Existing Systems[8]

Reference	**Methodology**	**Imaging**	**Database**	**Performance**
T. Tanka and Kubo	FFT based phase Correlation	Near Infra Red HDF	25 User	FAR 0.73% FRR-4%
C.L. Lin and K.C.Fan	Multi-Resolution analysis and combination	Thermal Hand Vein Imaging	32 Users	FAR-1.5% FRR-3.5%
L. Wang and G.Leedhm	Line segment Hausdorff	Thermal Hand Vein Imaging	12 Users	FAR-0% FRR-0%
Y.Ding ,D. Zhuang and K. Wang	Distance between feature points	Near IR Imaging HDF	48 Users	FAR-0% FRR-0.9%
J.M. Cross and C.L. Smith	Sequential Correction in Vein maps	Near IR Imaging HDF	20 Users	FAR-0% FRR-7.9%

6. Analysis of shows, finger vein authentication, a new biometric method utilizing the vein patterns inside one's fingers for personal identification. Vein patterns are different for each finger and for each person, and as they are hidden underneath the skin's surface, forgery is extremely difficult. These unique aspects of finger vein pattern recognition set it apart from previous forms of biometrics and have led to its adoption by the many commercial applications.

7. An idea about the theoretical foundation and difficulties of hand vein recognition and the method of hand vein image feature extraction based on end points and crossing points gets cleared, and the matching method based on distances were used for the matching of vein images.

8**.** Another biometric technique using hand-dorsa, extracting vein structures is understood to us. We came to know that for conventional algorithm, it is necessary to use high-quality images, which demand high-priced collection devices. That method makes using low-cost devices possible. The results shown that they could extract the vein networks as successfully as using high-quality images in have shown a biometric authentication using contactless palm vein authentication device that uses blood vessel patterns as a personal identifying factor.

3 PROPOSED SYSTEM

This idea of Vein Structure extraction primarily based on the triangulation pattern found on dorsum of hand. A unique triangle gets formed by joint of Basilic and Cephalic vein that as whole make the very strong authentication mechanism that are unique person to person .In this system the image of hand dorsum gets captured using IR camera that reflect the vein network on dorsum , afterward the vein pattern gets extracted and quality of the image gets enhanced by using best suitable algorithm for task.

After getting the sufficient quality image the biometric template is generated and every time the new image will be matched with that template and decision is based on template matching algorithm. To improve the efficiency of this mechanism the knuckle shape and some angle formation from the tip of ring finger to middle and other finger can be used.

3.1 Knuckle Shape for Better Accuracy

Knuckle shape is the prominence of the dorsal aspect of a joint of a finger, especially of one of the joints that connect the fingers to the hand. it is a rounded protuberance formed by the bones in a joint. The image of Knuckle gets captured and its contour will be obtain .One of the key tasks after this normalization that image to make better so it can give reliable control points . From the image that can be used for alignment and extraction of region of interest (ROI). ROI is one area that will used for Vein Pattern extraction and finally for the matching of the current image and predefined template. In this approach we select knuckle tips as the control points. The knuckle tips can be easily extracted by locating the peaks in the distance from of every contour point from the middle base point , similar to the method that we analyze from [8] .

Fig.2 Drawing of the Knuckle Shape

3.2 System Block Diagram

The block diagram of Hand Vein Authentication System use palm dorsal images which gets acquire from the, near IR imaging camera.

The various blocks shown above extract and perform matching of hand vein structure using the key point triangulation. Following are the important blocks and steps from image extraction to score generation.

3.2.1 After capturing the image the first step is to determine the ROI(Region Of Interest)

That contains the parameter (feature to be extract) require to make the biometric template.

3.2.2 From the RIO the map of vein founded on palm Dorsal get extracted and image contour are also calculated to determine the knuckle tip that is main initial parameter of this authentication system. The image contours extracted from the acquired images are used for the image normalization and segmentation of region of interest (ROI) that will leads to accuracy of system by image enhancement.

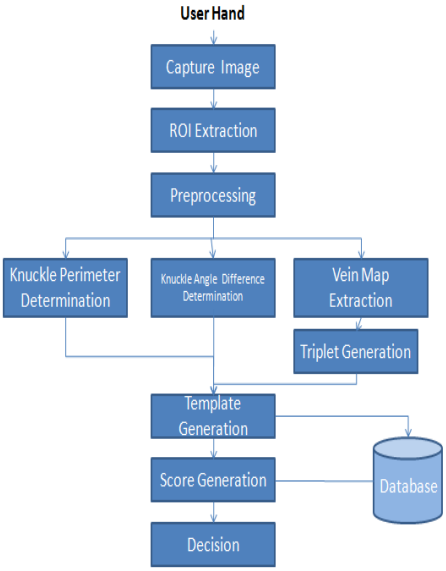

Fig.3 Block Diagram of system

3.2.3 From the vein map the vein bifurcation and endings points are selected as key points to extract local vein properties, A vein bifurcation is defined as vein point where vein forks or diverges into branch veins, and the vein ending is the point at which vein ends or disappears abruptly. This disappearance could be due to the abrupt ending of blood vessels or their poor visibility as shown in the diagram.

3.2.4 In this approach we also implement the utility of knuckle shape features since these features can be simultaneously extracted from the acquired images. The matching scores will be computed from these knuckle shape features are used for further improve the performance of the hand vein authentication.

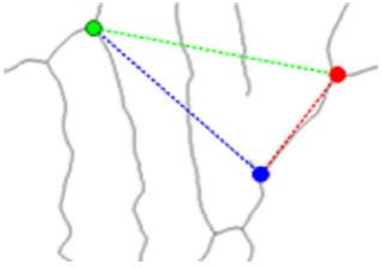

Fig. 4 Vein Bifurcation

3.2.5 After extracting the all parameter next step is the score generation which is as follows ,

The feature extraction approach is to use unique topological structure from the hand vein minutiae that will use Delaunay

triangulation . A minutiae can be represented by its position and type, i.e., where denotes the position and denotes the type of minutiae (vein bifurcation or endings). The idea is to extract meaningful minutiae groups, i.e., triplets or triangles, from the hand vein map to achieve rotation and translation invariant representation of local information. From a minutiae triangle we separately compute three lengths , Then all the sides of triangle are sorted to avoid considering all possible orders of same lengths, we considered four types of triplets, i.e., depending on the combinations of three types of minutiae. The number of minutiae points that can be extracted from the ROI images is limited.

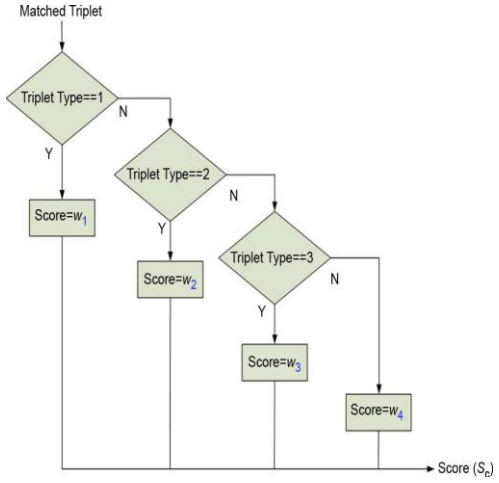

Fig.5 Score Generation from Triplets

Once the extracted triplets are matched, using the criteria, the matching scores are assigned. The score assignment scheme is hierarchical and assigns higher scores to more likely true matches. If two triplets having three bifurcation points, i.e., type 1, are matched then there is higher probability that they corresponds to the same user vein map. Therefore, such matches are assigned higher score.

3.3 Applications

This hand vein based biometric system has the ability to become;

[1] Biometric system for user authentication and authorizing.

[2] This system can also used in multimodal biometric system.

[3] In pattern matching to find and match the pattern of vein of hand dorsum.

[4] Conclusion

[5] As fraud in our society grows, as the pressure to deliver inexpensive authentication services mounts, the problem of reliable personal identification become mandatory hence we come up with this new idea of biometric authentication that can be used at many places from commercially to governmental environment.

[6] Hope that this new physical biometric feature will be able make its place among other available biometric technologies and can be used alone or as a multi-biometric system with any other well known biometric feature.

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