International Journal of Ethics in Engineering & Management Education
Website: www.ijeee.in (ISSN: 2348-4748, Volume 1, Issue 12, December 2014)

Hand Vein Structure Authentication Based System

Pavitra R
Digital Communication and networking
Pacific Institute of Technology
Udaipur, India

Deepti Natawat
HOD, Asst. Prof. CSE Dept.
Pacific Institute of Technology
Udaipur, India

***Abstract*— A biometric feature provides a high security access system. Traditional method uses PIN number, password, key, and etc to identify a person is unreliable and provide a low level security. It provides more reliable feature than the password based authentication system as biometric characteristic cannot be lost or forgotten, biometric feature are difficult to replicate, and require the person to be present for the authentication process. Many biometric such as face , finger print, iris and voice have been developed. But here verification using vein pattern is less developed. Biometric authentication is perform in insecure because of information leakage issue, so overcome this the implementation of biometric hand vein authentication Hand vein patterns are the vast network of blood vessels underneath a person's skin.**

***Index Terms*— Biometric, Hand vein structure, Authentication**

I. INTRODUCTION

A biometric is a physiological or behavioral characteristic of a human being that can distinguish one person from another and that theoretically can be used for identification or verification of identity. For a biometric to be practically useful, ideally it should be unique, universal, permanent, recordable, and acceptable—more on these properties of practical biometrics later.

Biometrics involves using the different parts of the body, such as the fingerprint or the eye, as a password or form of identification. Currently, Federal Bureau of Investigation use the fingerprints from a crime scene to find a criminal. However, biometrics is becoming more public. Iris scans are used in United Kingdom at ATM's instead of the normal codes.

In our Project we are presenting authentication based on hand vein recognition .The vein patterns are unique individual and are stable over a long period of time It is invisible to human eye that way its avoid the external distortion and it is not easy to replicate the vein patterns as compared to other biometric traits.

Due to the uniqueness, stability, and high resistance to criminal tampering, vein pattern offers a more secure and reliable traits for biometric authentication system. This paper investigates a method of personal authentication.

The recognition system of back hand vein is composed of four stages:

1. Obtaining the image of back of hand vein
2. Extracting the vein pattern from the vein images of back of hand
3. Getting the features from the vein pattern
4. The matching schemes

Some of the advantages that vein pattern recognition provides are:

1) The vein patterns are unique to each individual. Apart from size, the pattern does not change over time. This feature makes it suitable for one-to-many matching, for which hand geometry and face recognition may not be suitable. Vein recognition technology has a False Rejection Rate (FRR) of 0.01% and a False Acceptance Rate (FAR) of 0.0001%, hence making it suitable for high-security applications.

2) Veins are located underneath the skin surface and are not prone to external distortion the way fingerprints are. This reduces the high failure to enroll (FTE) rate caused by bad samples. Vein patterns are difficult to replicate because they lie under the skin surface. Fingerprints can be duplicated using gummy fingers. Additionally, some vein recognition models come with 'liveness' detection that senses flow of blood in veins.

3) User friendliness: This technology overcomes aversion to fingerprinting and related privacy concerns since its traditional association to criminal activity is non-existent. In countries such as Japan, where there is strong opposition to fingerprinting, vein recognition has become the biometric technology of choice. It is relatively quick as it takes less than 2 seconds to authenticate. Some noncontact models are more hygienic than fingerprint readers.

4) Potential fusion with other biometric technologies: With the popularity of multimodal biometrics, vein recognition technology could be used in conjunction with hand or fingerprint biometrics. Vein recognition can provide one-to-many matching, and hand geometry can be used for one-to-one matching, thereby enhancing security

5) The vein image acquisition is non-contact and the problem public hygiene is alleviated.

6) No obstructions are involved and thus the quality of vein patterns is acceptable to be further processed.

7) Vein recognition belongs to the kind of live body identification, while fingerprint or hand shape recognition may be not .

8) Vein pattern is an internal feature and difficult to forge.

International Journal of Ethics in Engineering & Management Education
Website: www.ijeee.in (ISSN: 2348-4748, Volume 1, Issue 12, December 2014)

Because of this and the live body identification, high security of vein recognition is preserved.

Fingerprint Recognition

Introduction Fingerprint identification is one of the most well-known and publicized biometrics. Because of their uniqueness and consistency over time, fingerprints have been used for identification for over a century, more recently becoming automated (i.e. a biometric) due to advancements in computing capabilities. Fingerprint identification is popular because of the inherent ease in acquisition, the numerous sources (ten fingers) available for collection, and their established use and collections by law enforcement and immigration.

A fingerprint usually appears as a series of dark lines that represent the high, peaking portion of the friction ridge skin, while the valleys between these ridges appears as white space and are the low, shallow portion of the friction ridge skin. Fingerprint identification is base d primarily on the minutiae, or the location and direction of the ridge endings and bifurcations (splits) along a ridge path.

A fingerprint recognition [1] system based on Minutiae based matching quite frequently used in various fingerprint algorithms and techniques. The approach mainly involves extraction of minutiae points from the sample fingerprint images and then performing fingerprint matching based on the number of minutiae pairings among two fingerprints in question.

But it has relatively low percentage of verification rate as compared to other forms of biometrics. Also a major challenge in Fingerprint recognition lies in the pre processing of the bad quality of fingerprint images which also add to the low verification rate[1].

Password Based Authentication

The use of passwords [2] is a major point of vulnerability in computer security, as passwords are often easy to guess by automated programs running dictionary attacks. Passwords remain the most widely used authentication method despite their well-known security weaknesses. User authentication is clearly a practical problem. From the perspective of a service provider this problem needs to be solved within real-world constraints such as the available hardware and software infrastructures. From a user's perspective user-friendliness is a key requirement.

A novel authentication scheme that preserves the advantages of conventional password authentication, while simultaneously raising the costs of online dictionary attacks by orders of magnitude was proposed[2] which was easy to implement and overcomes some of the difficulties of previous methods of improving the security of user authentication schemes[2].

However passwords are difficult to remember and can lead to information leakage.

Automatic Speech Recognition

Automatic speech recognition [3] is being used in a variety of assistive contexts, including home computer systems, mobile telephones, and various public and private telephony services.

Despite their growing presence, commercial speech recognition technologies are still not easily employed by individuals who have speech or communication disorders. While speech disorders in older adults are common, there has been relatively little research on automatic speech recognition performance with older adults. However, research findings suggest that the speech characteristics of the older adult may, in some ways, be similar to dysarthric speech. Dysarthria, A common neuro-motor speech disorder, is particularly useful for exploring automatic speech recognition performance limitations because of its wide range of speech expression

IRIS Recognition

The randomness of iris pattern makes it one of the most reliable biometric traits[4]. On the other hand, the complex iris image structure and the various sources of intra-class variations result in the difficulty of iris representation. A novel efficient multiscale approach for human iris recognition was introduced[4] based on combined feature extraction methods by considering both the textural and topological features of an iris image which is invariant to translation, scale and rotation.

The disadvantages of iris recognition is that a person who has a color blindness or who are blind cannot pass through this iris recognition test.

The drawbacks of iris scanning include greater initial cost and the fact that it's still a relatively untried technology (some trials, for example, have found a much greater rate of false matches than originally claimed). Civil liberties campaigners have also voiced privacy concerns—that future iris-scanning technology could be developed that will allow people to be tracked covertly (at a distance of some meters) without either their knowledge or cooperation.

Face Recognition

Two types of face recognition tasks were proposed: one from still images and the other from video [5].The still image problem has several inherent advantages and disadvantages. For applications such as drivers' licenses, due to the controlled nature of the image acquisition process, the segmentation problem is rather easy. However, if only a static picture of an airport scene is available, automatic location and segmentation of a face could pose serious challenges to any segmentation algorithm. On the other hand, if a video sequence is available, segmentation of a moving person can be more easily accomplished using motion as a cue. But the small size and low image quality of faces captured from video can significantly increase the difficulty in recognition.

International Journal of Ethics in Engineering & Management Education
Website: www.ijeee.in (ISSN: 2348-4748, Volume 1, Issue 12, December 2014)

II. System Requirement Specification

The first step in developing anything is to state the requirements. This applies just as much to leading edge research as to simple programs and to personal programs, as well as to large team efforts. Being vague about your objective only postpones decisions to a later stage where changes are much more costly.

The problem statement should state what is to be done and not how it is to be done. It should be a statement of needs, not a proposal for a solution. A user manual for the desired system is a good problem statement. The requestor should indicate which features are mandatory and which are optional, to avoid overly constraining design decisions. The requestor should avoid describing system internals, as this restricts implementation flexibility. Performance specifications and protocols for interaction with external systems are legitimate requirements. Software engineering standards, such as modular construction, design for testability, and provision for future extensions, are also proper.

The analyst must separate the true requirements from design and implementation decisions disguised as requirements. The analyst should challenge such pseudo requirements, as they restrict flexibility. There may be politics or organizational reasons for the pseudo requirements, but at least the analyst should recognize that these externally imposed design decisions are not essential features of the problem domain.

Functional requirement specification:

Functional requirements precisely states the functions of the system what it should do and what it should not do. Functions are provided to the users in a GUI. All the functionalities are provided in the main interface.

Non-functional requirement specification:

The non-functional requirements arise through user needs, because of budget constraints, because of organizational politics, with other software or hardware systems. The non-functional requirements may come from required characteristics of the software (product requirements),theorganization developing the software(organizational requirements) or from external sources. The following are the types of functional requirements.

- Product requirements:
- Usability requirements:

The usability requirements are which the application interfaces are designed to interact with the system and external devices.

- Efficiency requirements:

The efficiency requirements include the processing time, responsive time and memory utilization. The memory utilization is more because of the more images to store for further processing's.

- Reliability requirements:
  - Hardware reliability
  - Software reliability
  - Operator reliability
- Portability requirements:

since we have developed through the java swings which is light weight component to support for the portability.

- Organizational requirements:
- Delivery requirements:

this can be done through the appropriate planning and the man power .

- Implementation requirements:
- we are using the iterative process model through this we feel more flexible because of if any changes needed can be done easily .
- External requirements:
- Legislative requirements:
- Safety requirements:

This will not give any damage to society by using of this software because it is not a critical system.

Domain Requirements:

A domain requirement basically means the workspace or the range or the environment in which the product will work properly. Basically the domain requirement includes both the things i.e. functional and the non-functional requirement So, for the proper working of the project it is required that the product should meet the functional and the non-functional requirements. It includes the things like the full modules and there working and the technology used .The product should be fully functional without any kind of errors and without any kind of difficulties .This may also cover the hardware requirements as the product will also needs the good and efficient hardware for the working of the software product.

If the product doesn't work properly then it means that it the analyst has not gathered the proper information i.e for the proper working of the product. So tit is really a big and difficult task for the system analyst to find the full domain requirement so that the software product will be fully functional and should work in most efficient manner so that it should produce good results with less time consumption. The analyst should also see at the security, robustness and the efficiency. All type of testing should be done so that when the product is live it should not produce any kind of error or problem, as it will produce a bad impression on the image of the company.

Customer Requirement Specification:

The customer requirement specifications are the needs of the client for a particular project. The customer has different thoughts regarding of the project, before he is going to give the software requirements he has to think about the following constraints. The following constraints are the questions as soon as he thinks to develop a project.

- The client as soon as think about the project he has to think first whether the application software is really necessary to our environment.
- The next is the duration of the project i.e. how long it takes, to came to existence in our environment.

International Journal of Ethics in Engineering & Management Education
Website: www.ijeee.in (ISSN: 2348-4748, Volume 1, Issue 12, December 2014)

- Another one is regarding of the cost, it meets with our budget proposed for that project.
- The client thinks about that we require any training for their existing staff to use that particular project.
- The client has gone through with the above constraints well and he thinks that he had meet all the constraints, he will going to think about the requirements that are needed for his application software. The software requirements of the clients are in the fairly abstract.
- The client requires that they were already using any other technology, so he needs to develop another biometric technology to do his work in more secure way.
- The client needs that he requires the more user friendly system and also it should not be more complex to use.

The remaining requirements will decide when the client and the software engineering people meet together for compromising the needs that are required by the client as well as it can be possible to do by developers.

Hardware Requirement:

Processor	-	Dual Core
RAM	-	1GB RAM
Hard disk	-	80 GB
CD drive	-	40 x Samsung
Monitor	-	15' Samtron color
Keyboard	-	108 mercury keyboard
Mouse	-	Logitech mouse
External Hardware	-	IR-Webcam

Software Requirement:

- Operating System - Win XP/SP2
- Technology - JAVA
- Development IDE - Eclipse 3.x
- Database - Mysql

III. IMPLEMENTATION

Image processing

The image is converted from jpeg to BMP. Then its contrast is enhanced using Histogram Equalization technique

Algorithm for Histogram equalization

Step 1: Start
Step 2: Input Image
Step 3: Create a histogram of the image for each pixel
Step 4: Calculate the scale factor for each pixel with the histogram of the image
Step 5: The value of scale factor are inserted into a histogram look up table
Step 6: using the value of scale factor modify the histogram of the image
Step 7: Output the modified image
Step 8: stops

The image is then converted into grey scale from using grey scale technique

Algorithm for Grey scale:

Step 1: Start
Step 2: Input image
Step 3: Get the R, G, B values of a pixel
Step 4: Compute the value 0.299*R + 0.587*G + 0.114*B
Step 5: After computing the weighted average, create a new pixel with this average as its component value.
Step 6: Repeat the procedure from 3 to 5 for all the pixels in the image.
Step 7: Output the converted grayscale image.
Step 9: Stop
The edges of hand veins are detected using Canny Edge detection algorithm

Algorithm for Canny Edge detection:

Step1: start
Step 2: Input image
Upper threshold =7.5
Lower threshold =2.5
Step 3: Noise of the image is filtered using Gaussian filter
Step 4: Apply sobelmass Sx and Sy to the 3*3 pixel neighborhood of current pixel in both X and Y directions
Step 5: The sum of each masks value times the corresponding pixel is computed as Gx and Gy.
Step 6: The square of Gx^2 plus Gy^2 is computed which gives the edge strength
Step 7: Compute the inverse langent of Gx/Gy which gives the direction
Step 8: Trace along the pixels
Step 9: If current pixel has a gradient strength greater than the defined lower threshold the edge direction of the current pixel is determined
Step 10: The row and the column of the next possible pixel in the direction is determined.
Step 11: Its edge direction and gradient strength are determined by repeating the steps from 4 to 7
Step 12: Compare the gradient strength .if it is greater than the lower threshold the pixel is set to white
Step 13: The next pixels along that edge is tested by repeating the steps from 3 to 11
Step 14: Output the image with edges
Step 15: Stop
The features of the image are detected using Hough Line Transform algorithm.

Algorithm For Hough line Transform:

Step 1: Start
Step 2: Input grey scale edge detected image.
An accumulator array initialized to zero.
Step 3: Identify an image points which is in the image.
Step 4: Draw all possible lines passing through each of these points.
Step 5: For each line passing through a point, the corresponding cells are incremented by one.

International Journal of Ethics in Engineering & Management Education
Website: www.ijeee.in (ISSN: 2348-4748, Volume 1, Issue 12, December 2014)

Step 5: For each of these lines determine r and theta by drawing perpendicular lines from those lines to the origin.
Step 6: These are repeated for each the points.

Step 7: A graph, known as a Hough space graph, is then created for each of r and theta.

Step 8: The point where the curves intersect gives a distance and angle. This distance and angle indicate the line which intersects the points being tested

Step 9: Cells are incremented in the accumulator array when the line pass through multiple points

Step 10: The cell that has the highest value represents the line that passes through the most number of points in the source image array.

Step 11: Stop
Then the authentication is done using Hamming distance algorithm and image matching algorithm

Algorithm for Hamming Distance:

Step 1: Start
Step 2: Input two sets of numbers
Counter = 0
Min Distance = Integer.Max – Value
Step 3: Compare two numbers .if they are not equal increment counter else counter equal to 0
Step 4: If counter equal to zero return counter
Step 5: else if Counter is not equal to zero compare it with min Distance .whichever is smaller is returned
Step 6: Stop

Algorithm for image matching

Step1: Start
Step 2: Take the image features that are created during login
Step 3: Check if the corresponding user-id exits in the database and get the image features of the corresponding image
Step 4: Both the image features are subtracted and the corresponding value is divided is divided by the feature values in the database
Step 5: If the resulting value is less than 0.08 then the person is allowed to log in else not
Step 6: Stop

IV. PERFORMANCE EVOLUTION

In our project, we have reduced cost of system considerably to make device “cheap”. So, we have used webcam for this purpose by making the webcam sensitive to IR region and then is used to obtain vein images.

V. CONCLUSION

The Hand vein structure authentication is a biometric system that recognizes the shapes of the vein pattern in the back of the human hands captured using a infrared camera, performs image processing, extracts some features and compares these features with already present image’s features in order to authenticate a person. As the usage of biometric technologies expands, the need for different modalities for different applications becomes imperative. Vein recognition has great potential as a convenient, easy-to-use biometric technology with high security and accuracy levels. The technology is gaining momentum, but whether it can displace fingerprint biometrics and become successful with high-profile government deployment remains to be seen.

It should be developed further completely with automation feature rather than manual process involvement. The time taken for processing the image could be reduced.

REFERENCES

[1] Sangram Bana1 and Dr. Davinder Kaur2,Fingerprint Recognition using Image Segmentation in (Ijaest) in International Journal Of Advanced Engineering Sciences And Technologies,2011

[2] Benny Pinkasy Tomas Sanderz,Securing Passwords Against Dictionary Attacks

[3] Victoria Young,MHSc, and Alex Mihailidis, Difficulties In Automatic Speech Recognition

[4] MakramNabti, LahouariGhouti and Ahmed Bouridane,An effective and fast iris recognition system based on a combined multiscale feature extraction technique,2007

[5] W. Zhao,R. Chellappa,P. J. Phillips and ,A. Rosenfeld,Facerecognition:An emerging biometric,2003

[6] Xi Li, XiangbinLiu ,Zhicheng Liu “A Dorsal Hand Vein Patter Recognition Algorithm”2010 3rd International Congress on Image and Signal Processing (C,ISP2010).

[7] Wang Lingyu and Graham Leedham,“Near- and far- infrared imaging for vein pattern biometrics,” Proc. of the IEEE International Conference on Video and Signal Based Surveillance (AVSS 06), IEEE Press, Nov 2006.

[8] M Heenaye-Mamode Khan, R.K.Subramanian, and N. A. MamodeKhan,“Low dimensional representation of dorsal hand vein features using principle component analysis (pca),” World Academyof Science, Engineeringand Technology, vol. 49, pp. 1001–1007,2009.

[9] M. Badawi, “Hand vein biometric verification prototype: A testing performance and

[10] Patterns similarity,” in IPCV, 2006, pp. 3–9.N. A. Mamode Khan and MaleikaHeenaye-Mamode Khan, “An efficient dimension

[11] Reduction algorithm to extract dorsal hand vein pattern on generalized method of moments and moore-penrose generalized inverse procedure,” IJCSNS International Journal of Compute.

About the Authors

Pavitra R, Completed Masters in Computer Science and engineering at Pacific Institute Of Technology Udaipur, India. Completed bachelor of engineering in Information Science and engineering at CMRIT, Bangalore, India.
Her area of interest is Computer Science and digital Image Processing related to medical electronics.