UNIMODAL AND MULTIMODEL BIOMETRIC AUTHENTICATION SYSTEMS

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Abstract: User authentication is completed through biometry that refers to the automated identification of an individual by analyzing their physiological and/or behavioural characteristics or traits. Since several of the physiological and behavioural characteristics of a personal area unit distinctive, biometry provides a a lot of reliable system of authentication instead of that of ID cards, keys, passwords, or alternative ancient systems would do. currently a days AN increasing range of states together with Asian country area unit adopting biometric systems for national security. biometry is a very important part in security connected applications such as: logical and physical access management, rhetorical investigation, IT security, identity fraud protection, and terrorist bar or detection. varied biometric identificationways area unit offered to spot a personal by measure the fingerprint, hand, face, signature, voice or a mixture of any of those traits. New biometric algorithms and technologies area unit planned, tested, reviewed, and enforced per annum. This paper is to convey a short summary of the sphere of biometry and summarize varied biometric identification techniques together with its strengths and downsides.

Keywords: *security, face, signature ,voice.*

I. INTRODUCTION

A biometric authentication system is basically a pattern recognition system which makes a personal identification by determining the authenticity of a specific physiological and/or behavioral characteristic possessed by the user. There are many physical and behavioural characteristics which include finger print, palm print, iris, retina, ear shape and typing rythm, voice respectively. Biometric authentication is preferred more than the traditional system which consists of password or carrying tokens. The person has to be present for the authentication to take place since the biometric features of individuals are not the same.

There are seven such factors to be used when selecting the suitable feature for use in biometric authentication. They includeUniversality,Uniqueness,Permanence,Measurability, Performance,Acceptabilityand`Circumvention[6].

Universality means that every person using the system should possess the feature. Uniqueness means the feature should be sufficiently different for individuals in such a way that they can be distinguished from one another. Permanence is the manner in which a feature varies over time. Measurability relates to how easily the feature is acquired or measured. The acquired data should be in a form that permits subsequent processing and extraction of the relevant feature sets. Performance is the accuracy, speed, and robustness of technology which is used. Acceptability is how well individuals in the growing population accept the technology such that they are willing to have their biometric features captured and assessed. Circumvention is the ease with which a feature might be imitated using an artifact or substitute.
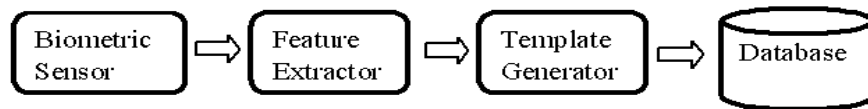
BIOMETRIC AUTHENTICATION SYSTEM*:*

Basically all the biometric authentication systems work in a similar manner. The first process is called enrollment .Information about a certain characteristic of the person is captured and is registered into a database This information is passed through an algorithm which converts it to suitable template and stores it in the database. More importantly, it is the template that is stored and maintained in the system,
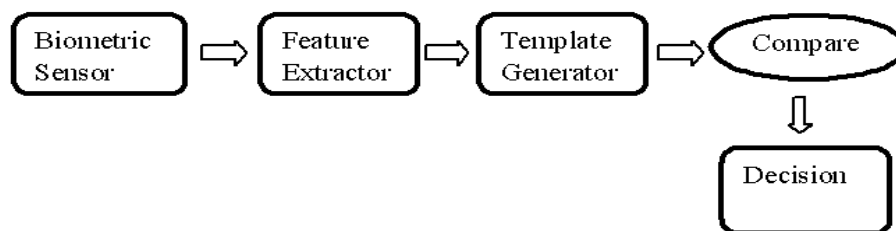
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but not the original biometric measurement as many people have the suspect. Compared with the original biometric trait, the template has a very small amount of information. When a person needs to be recognized, the system will take the appropriate measurement, translate this information into a template using the same algorithm that was used to form the original template .Then the new template is compared with the database to determine if there is a match or not. Figure 1 represents the work flow of biometric authentication technique.

III.LITERATURE SURVEY

There are a number of features that can be used for several types of biometric authentication techniques. Each technique has its own strength and weakness. Selecting the particular feature depends upon the application. No single biometric characteristic is expected to effectively meet the requirements of all the applications.

OVERVIEW OF BIOMETRICAUTHENTICATION TECHNIQUES

The techniques which are on use and under development are as follows[11].

1. FINGERPRINT BASED AUTHENTICATION:

Fingerprint-based authentication has been the foremost eminent and common technique for person identification and verification. The finger prints of identical twins area unit totally different {completely different} and additionally it varies otherwise from different fingers of identical hand. A fingerprint consistsof pattern of ridges and valleys that is gift on the surface of the tip. The formation of such patterns is set throughout the primary seven months of craniatedevelopment. Fingerprints seem as a series of dark lines and white areas once captured employing a detector device. There area unit 2 most distinguished native ridge characteristics. they're ridge ending and ridge bifurcation. A ridge ending is outlined because the purpose wherever a ridge ends dead. A ridge bifurcation is that the purposewherever a ridge diverges into several branch ridges. place along t, these options area unit referred to as trivia. Most fingerprint matching systems area unit supported the subsequent four varieties of fingerprint illustrationschemes: grayscale image, part image, skeleton image and trivia. attributable to the distinctiveness, compactness, and compatibility of the options utilized by human fingerprint specialists, minutiae-based system is employed a lot ofcompared to alternative techniques [1].

Fig.2 Finger print

A.K Jain in the leasty respect} have developed an improved minutiae-extraction rule that's quicker and a lot ofcorrect than their earlier rule (1995). Associate in Nursing alignment-based minutiae-matching rule has been projected. This rule is capable of finding the correspondences

between input trivia and therefore the keep model while not resorting to thorough search and has the power to compensate adaptively for the

nonlinear deformations Associate in Nursingd inexact transformations between an input and a template[7]. the disadvantage or weakness of this method is that finger print patterns aren't recognized absolutely once the fingers area unit wet or fingers that has wrinkles. a lot of over the trivia may be simply disturbed with injury or wound on the finger and therefore the quality of the fingerprint get pale for cultivators and labourers.

2. PALMPRINT AUTHENTICATION:

Similar to the fingerprints, palms of the human hands contain unique pattern of ridges and valleys. The area of the palm is much larger than the area of a finger and, as a result of which, palm prints are expected to be more distinctive than the fingerprints. In addition to the features of the finger print ,human palms also contain additional distinctive features such as principal lines and wrinkles that can be captured even with a lower resolution scanner[]. When using a high Resolution palm print scanner, all the features of the palm such as geometry features (which include width, length and area of a palm), ridge and valley features (minutiae and singular points such as deltas), principal lines, and wrinkles may be combined to build a highly accurate biometric authentication system [11] . Neha Mittal at all acquired the palm print image using an acquisition system developed at IIT Delhi. The Region of interest (ROI) is extracted from the palm print image by finding a tangent of curves between fingers. The perpendicular

bisector of this tangent divides the rectangular area enclosing the palm print into two equal parts.

Fig.3 Palm Print

The features extracted from the ROIs are used for matching. Two approaches are suggested for the feature extraction. In the first approach the ROI is divided into a suitable number of non-overlapping windows from which fuzzy features are extracted [9]. The drawback is that palm print scanners need to capture a large area, that they are bulkier and more expensive than the fingerprint sensors and like fingerprint wet palms and wrinkled palms have their own limitations. [4] discussed about Intelligent Sensor Network for Vehicle Maintenance System. Modern automobiles are no longer mere mechanical devices; they are pervasively monitored through various sensor networks & using integrated circuits and microprocessor based design and control techniques while this transformation has driven major advancements in efficiency and safety. In the existing system the stress was given on the safety of the vehicle, modification in the physical structure of the vehicle but the proposed system introduces essential concept in the field of automobile industry. It is an interfacing of the advanced technologies like Embedded Systems and the Automobile world. This "Intelligent Sensor Network for Vehicle Maintenance System" is best suitable for vehicle security as well as for vehicle's maintenance. Further it also supports advanced feature of GSM module interfacing. Through this concept in case of any emergency or accident the system will automatically sense and records the different parameters like LPG gas level, Engine Temperature, present speed and etc. so that at the time of investigation this parameters may play important role to find out the possible reasons of the accident. Further, in case of accident & in case of stealing of vehicle GSM module will send SMS to the Police, insurance company as well as to the family members.

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3. IRIS RECOGNITION:

The iris could be a skinny, circular structure within the eye, that is liable for dominant the diameter and size of the pupil and conjointly controls the number of sunshine reaching the tissue layer. The iris is that the ring-shapedregion of the attention that is finite by the pupil and also the sclerotic coat (white of the eye) on either aspect. The visual texture of the iris is made throughout craniate development and it stabilizes throughout the primary 2 years of life [18]. every iris is distinctive and, like fingerprints, even the irises of identical twins square measure completely different. it's very tough to surgically amendment the feel of the iris. And also, it's relatively simple to notice artificial irises. Associate in Nursing iris recognition algorithmic rule initial should localize the inner and outer boundaries of the iris that square measure the pupil and structure severally in a picture of an eye fixed. additional process is finished to exclude eyelids, eyelashes, and reflective reflections that usually obturate elements of the iris. The set of pixelscontaining solely the iris is then analyzed. in step with the authors S. Mohammadi and A. Kaldi the models relating to the technologyacceptance squaremeasure as follows: Theory of Reasoned Action (TRA), Technology Acceptance Model (TAM), psychological feature Model (MM), Theory of Planned Behavior (TPB), Combined tam-o'-shanter and TPB (C-TAM-TPB), Model of laptop Utilization (MPCU), Innovation Diffusion Theory (IDT), and Social psychological feature Theory (SCT).Among them , Technology Acceptance Model (TAM), one among the foremostwide applied models relating to technology acceptance to extract to a small degree pattern coding the data that is required to match 2 iris images[12].

Fig 4 Iris

The disadvantage is, A careful balance of sunshine, focus, resolution and distinction is important to extract the feature vector from localized image. the first iris-based recognition systems needed respectable user participation and were overpriced, And conjointly the iris recognition became tough for the cases of lense and watery eyes[1].

4. RETINA BASED AUTHENTICATION:

The human tissue layer may be a skinny tissue composed of neural cells that's set at the posterior portion of the attention. every person's tissue layer is exclusive attributable to the advanced structure of the capillaries that offerthe tissue layer with blood. The network of blood vessels within the tissue layer is therefore advanced that even identical twins don't share an analogous tissue layer pattern[19]. The image acquisition of the tissue layer needdssomeone to peep into AN eye-piece and specialize in a particular spot within the field of vision in order that a planned a part of the retinal vasculature can be imaged. The planned formula by Joddat fathima the least bit consists of 3 stages; i.e. preprocessing, feature extraction and eventually the matching method. In preprocessing, it extracts the tube-shaped structure pattern from input retinal image victimisation wavelets and multilayered thresholding technique. Second stage extracts all attainable feature purposes and represents every feature point with a feature vector. The planned system matches the guide feature vectors and input image feature vector victimisation Mahalanobis distance[2].
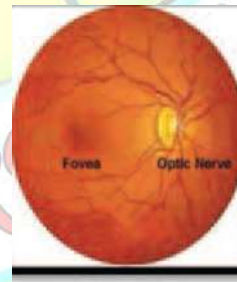

Fig. 5 Retina

The disadvantages embrace, the image acquisition wants cooperation of the topic, e contact with the lense, and needs a aware effort on the a part of the user. of these factors affected the general public acceptableness of retinal biometric. Retinal vasculature will reveal some medical conditions, e.g., high blood pressure, that is another issuedeterring the general public acceptance of retinal scan-based biometric system. tissue layer patterns is also altered in cases of polygenic disease, eye disease or retinal chronic disorders[11]

5.FACE RECOGNITION:

Humans usually use faces to acknowledge people. Face Recognition algorithms is divided into 2 main approaches. one in every of them is geometric, that focuses at characteristic options like the placement and form of facial attributes as well

as the eyes, eyebrows, nose, lips and chin, and their spatial relationships. the opposite kind is photometrical, that could be aapplied math approach that distills a picture into values and compares the values with templates to eliminate variances. a number of the favored face recognition algorithms embrace Principal element Analysis , Elastic Bunch Graph Matching Hidden Andrei Markov model, Linear Discriminate Analysis and Multi linear mathematical space Learning[1]. A new rising trend, claimed to attain improved accuracies, is three-dimensional face recognition. during this technique 3D sensors ar accustomed capture data concerning the form of the face. This data is then accustomed determinedistinctive options on the surface of a face, like the contour of the attention sockets, nose, and chin. Another risingtrend known as skin texture analysis uses the visual details of the skin, as captured in normal digital or scanned pictures and turns thedistinctive lines, patterns, and spots apparent in an exceedingly person's skin into a mathematical space[1].
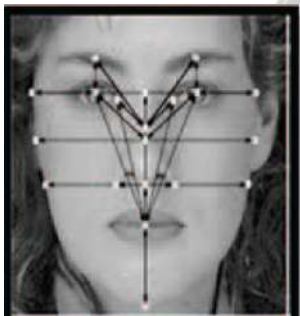

Fig. 6 Face

The limitations within the strategies for face detection and recognition systems is that they'll be full of, countenance, presence or absence of structural elements occlusion, pose, image orientation and imaging conditions.[1].

6.EAR SHAPE RECOGNITION:

The shape and appearance of the human ear is unique to each individual and only a little change occurs during the lifetime of an adult The ear growth between four months to eight years old would be linear, and after that it is constant until around 70 and it increases again [1]. Ear recognition is being investigated as potential biometric, due to its stability and predictable changes. Basically ear images can be acquired in a manner similar to face images, and they can be used in the same scenarios. The ear recognition approaches are based on matching the distance of salient points on the pinna from a landmark location on the ear. In this paper, we have proposed a new approach for an automated system for human ear identification. Our proposed method consists of three stages. In the first stage, preprocessing of ear image is done for its contrast enhancement and size normalization. In the second stage, features are extracted through Haar wavelets followed by ear identification using fast normalized cross correlation in the third stage. The proposed method is applied on USTB ear image database and IIT Delhi ear image database [3]. The disadvantage is that the features of an ear are not expected to be very distinctive in establishing the identity of an individual and if the ear is covered with hair recognition is difficult[1].

Fig 7 Ear shape

7. VOICE RECOGNITION:

Voice recognition is outlined to be the identification of the one that is speaking by characteristics of their voices, that is thought as voice life science. Voice recognition has been used for the past four decades and it uses the acoustic optionsof speech that are found to completely different between individuals[1]. These acoustic patterns mirror each anatomy that embody size and form of the throat and mouth and learned behavioural patterns like voice pitch, speaking vogue. during this work, login authentication happens in 3 stages: Text primarily based secret verification, speech verification, speaker verification. The speech verification additionally encounters the record and replay downside, within which the users' voice is recorded and replayed at the time of login. this can be overcome by generating the random pass-phrase whenever the user logs in. This ensures the physical presence of the user whereas work in [16]. Physiological characteristics of human speech ar similar for a personal, however the behavioural a part of the speech of someonechanges over time because of age, medical conditions, and spirit ,etc.

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Fig. 8 Voice recognition

The limitation is that Voice isn't terribly distinctive and should not be acceptable for large-scale identification.
The speech of a person changes over time due to age, medical conditions, and emotional state. In voice-based recognition speech features are sensitive to a number of factors such as background noise[1].

8. BODY ODOR BASED AUTHENTICATION:

Each object has its own odor and it is spread which lies on the characteristic of its chemical composition and this could be used for distinguishing various objects. Odor recognition is a contactless physical biometric that attempts to confirm a person's identity by analyzing the olfactory properties of the human body odor. To improve performance of Identification authentication, the authors Hua Fang at all presents a novel authentication scheme, which collects human body odor using gas sensor arrays. It detects and analyzes human body odor by Gas Chromatography & Mass Spectrometry, Principle Component Analysis, Neural Network and other pattern identification technologies to confirm the identity of the individual. Theoretical analysis indicates that the technique satisfies security, feasibility and effectiveness.[10]

9. DNA BASED AUTHENTICATION:

Deoxyribonucleic acid (DNA) may be a molecule that encodes the genetic directions employed in the event and functioning of all renowned living organisms and plenty of viruses [20]. polymer testing may be a technique that has terribly high degree of accuracy. The applied math sampling shows that 1-in-6 billon probability of 2 individuals having identical pattern. it's the foremost distinct biometric symbol accessible for mortals apart from that of monozygotic twins [20]. polymer doesn'tmodification for someone throughout his lifetime; so its duration level is incontestable. this processes

for gettingpolymer samples ar quite intrusive, that need some sort of tissue, blood or different body sample. rhetorical scientists use polymer in blood, semen, skin, spittle or hair found at against the law scene to spot an identical polymer of a private. This method is formally termed polymer identification, however it should even be known as as "genetic fingerprinting". In polymer identification, the lengths of variable sections of repetitive polymer, like short bike repeats and minisatellites, ar compared between individuals. The 3 problems that limit the utility of this bioscience for different applications: 1) polymer matching isn't exhausted time period, 2)a physical sample is needed, whereasdifferent biometric systems solely use a picture or a recording, 3) privacy problems sincepolymer sample taken from a private shows the susceptibleness of someone to some diseases.

10. MULTIMODEL BIOMETRICS:

Due to the external manufacturing limitations of sensors and inherent limitations of the technique in biometrics, no single biometric technique can give high 100% accurate results. This situation can be changed by using combination of biometric features and algorithms. This technique of using multiple biometric features is said to be multimodal biometric fusion or simply multibiometric system. These systems are expected to be more reliable due to the usage of multiple, independent pieces of evidence.
One type of such fusion is done by combining finger print and iris of the individual. The author R.Parkavi at all says that the main aim of their paper is to provide multilevel authentication in biometric systems. In this paper, they are using fingerprint and iris of a person for the automatic identification of an individual by combining finger print and iris of a person at the matching-score level. The techniques called Minutiae matching and Edge detection is used for this purpose. The performance of the proposed technique has been evaluated and accuracy has been increased by minimizing the FAR (False Acceptance Rate) and FRR (False Rejection Rate)[8]
The author gives a multimodal biometrics system that combines features of fingerprint and palm print to overcome several limitations of unimodal biometrics. Preprocessing is a heart of image processing. Feature enhancement is the prior step. In this system feature enhancement of input image which are the images of fingerprint and palm print are performed by applying a series of preprocessing techniques. Modified Gabor filter is used to independently extract a fingerprint and palm print feature which provides more accuracy as compared to traditional Gabor filter .In addition to this Short Time Fourier transformation is applied for better quality of resultant images. In the later step the resultant images are combined in feature

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level fusion method and finally using Euclidean distance method the features are classified to match the resultant image with database template[13].

Another system for multimodal biometric recognition which is based on finger knuckle and finger vein which uses feature-level fusion and k-support vector machine classifier[7].

All the techniques used in biometrics are compared using the following metrics:
Universality, Uniqueness, Permanence, Measurability, Performance, Acceptability, Circumvention.

Table 1 represents the comparison of various techniques based on the seven factors.

Techniques	Universlity	Uniqueness	Permanence	Measurability	Performance	, Acceptability	Circumvention
Fingerprint	M	H	H	M	H	M	M
Palmprint	M	H	H	M	H	M	M
Iris	H	H	H	M	H	L	L
Retina	H	H	M	L	H	L	L
Face	H	L	M	H	L	H	H
Ear	M	M	H	M	M	H	M
Infrared Thermogram	H	H	L	H	M	H	L
Voice	M	L	L	M	L	H	H
Body odor	H	H	H	L	L	M	L
DNA	H	H	H	L	H	L	L

ANALYSIS:

The first biometric feature used was the fingerprint. Finger print was widely accepted by the users , highly unique different even for identical twins and was easy to implement. But the finger print has chances of fading. The next was the palm print which is likely similar to fingerprint , different for identical twins. Palm print is a large area which needs a large sensor and watery palms will be difficult to detect. Next is the iris which is even accurate. Unlike finger print or the palm print iris recogntion was not widely accepted since users felt

that it would affect the eyes. Next was the retina which had its advantages and disadvantages. The advantage is that they are accurate and unique for identical twins.The disadvantage is that the retina pattern will change due to chronic disorders. The next is face recognition .they are done using the placement and form of facial attributes as well as the eyes, eyebrows, nose, lips and chin, and their spatial relationships. The disadvantage is that they differ due to the variations in the position of the face and the image positions. There are many other biometric authentication features which have their own disadvantages. To overcome the disadvantages of unimodel biometrics multimodel biometrics was introduced in which more than one biometric feature is combined to get more optimal result.

IV CONCLUSION:

In this age of digital impersonation, biometric techniques are being used increasingly as a tool to identity theft. The argument is that a measurable physiological or behavioral characteristic of an individual is a more reliable indicator of that individual than legacy systems such as passwords and PINs. The principal objective of this paper is to give an overview of the fast developing and exciting area of automated biometric techniques. Various biometric authentication techniques are presented that are currently in use across a range of environments or still in limited use or is under development or still in the research realm. The use of multimodal biometric techniques will be more efficient for the identification, verification and authentication of the individual.

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