

INTERNATIONAL JOURNAL OF RESEARCH IN COMPUTER APPLICATION & MANAGEMENT

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BIOMETRICS SECURITY SYSTEM IS A TOOL FOR DAILY LIFE SECURITY

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BILASPUR

ABSTRACT

Biometric system is an important tool for security system. Biometrics is a rapidly evolving technology which is being widely used in forensics such as criminal identification and prison security and has the potential to be used in a large range of civilian application areas. Biometrics can be used to prevent unauthorized access to ATMs, cellular phones, smart cards, UID cards, desktop PCs, workstations (companies, industries, Educational institutes, shopping mall, railway stations, airports etc.) and computer networks. Biometric Recognition Systems helps to public and offer more secure and convenient process of identification compared to alternative methods of identification. The application of biometric system helps in daily life and strengthens the field of science and technology. The review article also explores applications in biometric system. Biometric security systems have been proved to be accurate and very effective in various applications.

KEYWORDS

Automated Teller Machine, BioAPI consortium, Biometric authentication systems Biometric security system, Personal Computer.

INTRODUCTION

Computer technology is more and more ubiquitous; the penetration of computer in society is a welcome step towards modernization but society needs to be better equipped to grapple the challenges associated with technology. The difficulties of staying up to date with security issues within the realm of IT education are due to the lack of current information (Ahmad et al., 2003). The recent research is focused on bringing quality security system and more reliable biometric security system.

Biometric security systems are automated methods of verifying or recognizing the identity of a living person. There are two types of biometric methods:

1. Physiological biometric methods: They are based on physiological characteristics such as fingerprints, hand geometry and retina patterns.
2. Behavioural biometric methods: They are based on some aspect of behaviour such as signature, voice, keystroke and pointing patterns.

As there is a diversity of needs in terms of the information handled, security requirements, and organizational factors, no one biometric method is likely to meet all these requirements but still helpful tool for daily life security (Deane et al., 1995).

Biometric security systems of identification are preferred over traditional methods involving passwords and PIN numbers for various reasons: the person to be identified is required to be physically present at the point-of identification; identification based on biometric techniques obviates the need to remember a password or carry a token. With the increased use of computers as vehicles of information technology, it is necessary to restrict access to sensitive/personal data. By replacing PINs, biometric techniques can potentially prevent unauthorized access to or fraudulent use of ATMs, cellular phones, smart cards, desktop PCs, workstations, and computer networks. PINs and passwords may be forgotten, and token based methods of identification like passports and driver's licenses may be forged, stolen, or lost. Thus biometric systems of identification are enjoying a renewed interest. A biometric system is essentially a pattern recognition system which makes a personal identification by determining the authenticity of a specific physiological or behavioral characteristics possessed by the user.

An important issue in designing a practical system is to determine how an individual is identified. Depending on the context, a biometric system can be either a verification (authentication) system or an identification system. The current security model for verification of identity, protection of information and authentication to access data or services is based on using a token or password, tied to and thereby representing an individual to either authenticate identity or allow access to information (Uddin et al., 2011).

ROLE OF BIOMETRICS

The physical characteristics of a person like finger prints, hand geometry, face, voice and iris are known as biometrics. Each biometric trait has its strengths and weaknesses. The suitable biometric can be selected depending upon the application in various computer based security systems. The important features of the various biometrics are discussed briefly in this section.

FINGER PRINTS

Fingerprint verification is one of the most reliable personal identification methods. Among all the biometric techniques, fingerprint-based identification is the oldest method which has been successfully used in numerous applications. Everyone is known to have unique, immutable fingerprints. A fingerprint is made of a series of ridges and furrows on the surface of the finger. The uniqueness of a fingerprint can be determined by the pattern of ridges and furrows as well as the minutiae points. Minutiae points are local ridge characteristics that occur at either a ridge bifurcation or a ridge ending. A finger print is the pattern of ridges and valley on the surface of a finger tip. The finger prints of the identical twins are different. It is affordable to scan the finger prints of a person and can be used in computer for number of applications. This method is traditional and it gives accuracy for currently available Fingerprint Recognition Systems for authentication (Jain et al., 1997). This fingerprint recognition system is becoming affordable in a large number of applications like banking, Passport, educational institution etc.

Advantages: Very high accuracy, most economical biometric PC user authentication technique, most developed biometrics, easy to use, small storage space required for the biometric template, reducing the size of the database memory required and standardized.

Disadvantages: For some people it is very intrusive, because it is still related to criminal identification. It can make mistakes with the dryness or dirtiness of the finger's skin, as well as with the age (children, because the size of their fingerprint changes quickly). Image captured at 500 dots per inch (dpi). Resolution: 8 bits per pixel. A 500 dpi fingerprint image at 8 bits per pixel demands a large memory space, 240 Kbytes approximately → Compression required (a factor of 10 approximately).

HAND GEOMETRY

The hand geometry recognition system depends on a number of measurements taken from the human hand, including its shape, size of palm, length and width of the fingers. This method is very simple and easy to use. As there is no effect of environment factors such as dry weather or dry skin, this does not appear to have dry negative effects on the authentication accuracy. Also hand geometry information may not be invariant during the growth period of the children (Ong et al., 2003).

Advantages: Though it requires special hardware to use, it can be easily integrated into other devices or systems. It has no public attitude problems as it is associated most commonly with authorized access. The amount of data required to uniquely identify a user in a system is the smallest by far, allowing it to be used with Smart Cards easily.

Disadvantages: Very expensive. Considerable size. It is not valid for arthritic person, since they cannot put the hand on the scanner properly.

SIGNATURE

Signature verification is the process used to recognize an individual's hand-written signature. Dynamic signature verification uses behavioural biometrics of a hand written signature to confirm the identity of a person. This can be achieved by analyzing the shape, speed, stroke, pen pressure and timing information during the act of signing. On the other hand there is the simple signature comparison which only takes into account what the signature looks like. So with dynamic signature verification, it is not the shape or look of the signature that is meaningful, it is the changes in speed, pressure and timing that occur during the

act of signing, thus making it virtually impossible to duplicate those features. Devices which enable dynamic signature verification store the behavioural factors and the captured signature image itself for future comparison in their database. These devices account changes in one's signature over time by recording the time and the dynamic features each time a person uses the system.

Advantages: Non intrusive, Little time of verification (about five seconds), Cheap technology.

Disadvantages: Signature verification is designed to verify subjects based on the traits of their unique signature. As a result, individuals who do not sign their names in a consistent manner may have difficulty enrolling and verifying in signature verification. Error rate: 1 in 50.

FACE

The human face plays an important role in our social interaction, conveying people's identity. Using human face as a key to security, the biometrics face recognition technology has received significant attention in the past several years due to its potential for a wide variety of applications in both law enforcement and non-law enforcement. As compared with other biometrics systems using fingerprint/palmprint and iris, face recognition has distinct advantages because of its non-contact process. Face images can be captured from a distance without touching the person being identified, and the identification does not require interacting with the person. In addition, face recognition serves the crime deterrent purpose because face images that have been recorded and archived can later help identify a person. The face is the commonly used biometric characteristics for person recognition. The most popular approaches to face recognition are based on shape of facial attributes, such as eyes, eyebrows, nose, lips, chin and the relationships of these attributes. As this technique involves many facial elements; these systems have difficulty in matching face images. The face recognition systems which are used currently impose a number of restrictions on how facial images are obtained. This face recognition system automatically detects the correct face image and is able to recognize the person (Uddin et al., 2011).

Advantages: Non intrusive. Cheap technology.

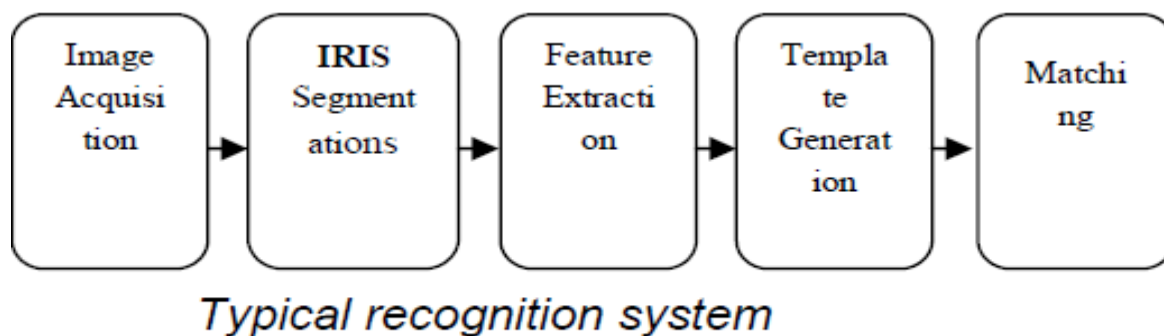
Disadvantages: 2D recognition is affected by changes in lighting, the person's hair, the age, and if the person wear glasses. Requires camera equipment for user identification; thus, it is not likely to become popular until most PCs include cameras as standard equipment.

IRIS

The iris is biological feature of a human. It is a unique structure of human which remains stable over a person lifetime. The iris is the annular region of the eye. The left and right irises of an individual can be treated as separate unique identifier. The iris information can be collected by iris image. The accuracy of iris based recognition system is promising. Each iris is believed to be distinctive and even the irises of identical twins are also different. The iris recognition system has become more users friendly and cost effective. The iris have a very low false accept rate as compared to other biometrics like finger print, face, hand geometry and voice. Iris recognition is treated as the most reliable biometrics and has been widely applied in public and personal security areas. However it is recommended that the users have to cooperate with the iris cameras to make their iris images well captured. The restricting factors of iris image acquisition are analyzed and the optical formulas are derived. The properties of the Iris that enhance its suitability for use in automatic identification include:

- Protected from the external environment
- Impossibility of surgically modifying without the risk of vision
- Physiological response to light.
- Ease of registering its image at some distance (Sharma and Kumar, 2011)

FIGURE 1: IRIS RECOGNITION SYSTEM



Advantages: Very high accuracy. Verification time is generally less than 5 seconds. The eye from a dead person would deteriorate too fast to be useful, so no extra precautions have to be taken with retinal scans to be sure that user is a living human being.

Disadvantages: Intrusive. A lot of memory for the data to be stored. Very expensive.

RETINA

Along with iris recognition technology, retina scan is perhaps the most accurate and reliable biometric technology. It is most difficult to use and requires well-trained, and is perceived as being moderately to highly intrusive. The users have to be cooperative and patient to achieve a proper performance. Basically the retina, a thin nerve on the back of the eye, is the part of the eye which senses light and transmits impulse through the optic nerve to the brain. Blood vessels used for biometric identification are located along the neural retina which is the outermost of the retina's four cell layers. Research has proven that the patterns of blood vessels on the back of the human eye were unique from person to person. It has been proved that these patterns, even between identical twins, were indeed unique. This pattern also doesn't change over the course of a lifetime. Retinal scanners require the user to place their eye into some sort of device and then ask the user to look at a particular spot so that the retina can be clearly imaged. This technology involves using a low-intensity infrared light source through an optical coupler to scan the unique patterns of the retina. The reaction of the vascular information is being recorded. Retina scanning works well in modes, identification and verification.

Advantages: Very high accuracy. There is no known way to replicate a retina. The eye from a dead person would deteriorate too fast to be useful, so no extra precautions have to be taken with retinal scans to be sure the user is a living human being.

Disadvantages: Very intrusive. It has the stigma of consumer's thinking it is potentially harmful to the eye. Comparisons of template records can take upwards of 10 seconds, depending on the size of the database. Very expensive.

VOICE

The voice recognition systems have been currently used in various applications. Voice is a combination of physical and behavioural biometrics. The features of person voice are based on the vocal tracts, mouth, nasal activities and lips movement that are used synthesis of sound. These physical characteristics of human speech are invariant for individuals. The behavioural part of the speech of person changes over time due to age, medical conditions, and emotional state. The speaker dependent voice recognition systems are text dependent; and the speaker independent systems are what he or she speaks (Swartz and Magotra, 1997). The speaker dependent voice recognition system is more difficult to design but provides more protection.

Advantages: Non intrusive. High social acceptability. Verification time is about five seconds. Cheap technology.

Disadvantages: A person's voice can be easily recorded and used for unauthorized PC or network. Low accuracy. An illness such as a cold can change a person's voice, making absolute identification difficult or impossible.

CHARACTERISTICS OF SUCCESSFUL BIOMETRIC IDENTIFICATION METHODS

The following factors are needed to have a successful biometric identification method:

- The physical characteristic should not change over the course of the person's lifetime.
- The physical characteristic must identify the individual person uniquely.
- The physical characteristic needs to be easily scanned or read in the field, preferably with inexpensive equipment, with an immediate result.
- The data must be easily checked against the actual person in a simple, automated way.

Other characteristics that may be helpful in creating a successful biometric identification scheme are:

- Ease of use by individuals and system operators.
- The willing (or knowing) participation of the subject is not required.
- Uses legacy data (such as face recognition or voice analysis).

Advantages to Biometric identification technology

- Biometric identification can provide extremely accurate, secured access to information; fingerprints, retinal and iris scans produce absolutely unique data sets when done properly.
- Current methods like password verification have many problems (people write them down, they forget them, they make up easy-to-hack passwords).
- Automated biometric identification can be done very rapidly and uniformly, with a minimum of training.
- Your identity can be verified without resort to documents that may be stolen, lost or altered.

BIOMETRIC AUTHENTICATION SYSTEMS

In general biometric authentication systems work in two modes:

1. **Enrolment mode:** In this mode biometric user data is acquired. This is mostly done with some type of biometric reader. Afterwards the gathered information is stored in a database where it is labelled with an user identity such as name, identification number to facilitate authentication (Jain and Ross, 2004).
2. **Authentication mode:** Again biometric user data is acquired RST and used by the system to either verify the users claimed identity or to identify who the user is. While identification involves the process of comparing the users biometric data against all users in the database, the process of verification compares the biometric data against only those entries in the database which are corresponding to the users claimed identity. In general one can consider the verification of the identity of a person as a two-class problem: either the person is who he/she claims to be (client) or the person fails to be the one he/she claims to be (impostor).

So we are basically dealing with a binary-decision scheme where we either accept or reject a person. Simple biometric systems usually consist of the following four components:

Sensor modules: This module acquires biometric user data. Examples of sensor modules would be retina-scanner or a fingerprint sensor.

Feature extraction modules: This module is responsible for extracting feature values of a biometric trait. If hand geometry would be used as a biometric trait then feature values would include width of fingers at various locations, width of the palm, thickness of the palm, length of fingers etc.

Matching modules: The matching modules compare the acquired biometric features against those stored in a database.

Decision-making modules: The user's identity is either established or a claimed identity is accepted or rejected.

This is based on the results of the matching modules. Since we are dealing with a binary decision scheme it is obvious that the decision-making module can make two kinds of errors. The errors, which can be made in the process of verification, are called: False Rejection (FR): when an actual client gets identified as an impostor.

False Acceptance (FA): when an actual impostor gets identified as a client.

PROBLEMS WITH BIOMETRICS

In theory collecting and verifying biometric data is no problem but in today's demanding real-world applications there are lot of problems with biometric systems. One of those problems is that biometric traits extracted from persons tend to vary with time for one and the same person and to make it even worse, this variation is itself very variable from one person to another. Most of the other problems are caused by extreme or constantly changing surroundings and the nature of certain biometric measures.

Noise: Noisy biometric data like a person having a cold (voice recognition), a simple cut on ones finger(fingerprint scan) or different lighting conditions(face detection) are some examples of noisy inputs. Other examples are misconfigured or improperly maintained sensors or inconvenient ambient conditions like dirt on a sensor for fingerprints or voice recognition with loud background noise. The problem with noisy biometric data is that authorised personnel may get incorrectly rejected (FR), if the noisy data affects the extracted features so much, that no match can be found in the biometric database. The other extreme situation would occur if noise would change the extracted features in such a way, that the result feature set would match to another person (FA).

Distinctiveness: While a biometric trait is expected to vary significantly across individuals, there may be large similarities in the feature sets used to represent these traits. Thus, every biometric trait has a theoretical upper bound in terms of discrimination capability (Jain and Ross, 2004; Jain and Ross, 2003).

Non-universality: The problem of non-universality arises when it is not possible to acquire certain biometric traits from all users. That means that even though a person has a fingerprint, it still may be impossible to acquire that trait because of the poor quality of the ridges which make up the fingerprint.

MULTI BIOMETRIC SYSTEMS

Most of the problems and limitations of biometrics are imposed by unimodal biometric systems. Unimodal biometric systems rely on the evidence of only a single biometric trait. Some of these problems may be overcome by multi biometric systems and an efficient fusion scheme to combine the information presented in multiple biometric traits. It is evident that problems like non-universal traits, distinctiveness and security problems are easier and better to deal with if more biometric traits are present. So if a person fingerprint can not be acquired by a sensor, other biometric methods like voice recognition and retina scans are taken into account and the resulting data is validated against the biometric database.

STANDARDS

The biometrics industry includes more than 150 separate hardware and software vendors, each with their own proprietary interfaces, algorithms, and data structures. Standards are emerging to provide a common software interface, to allow sharing of biometric templates, and to permit effective comparison and evaluation of different biometric technologies.

The BioAPI consortium has released an open system standard called the BioAPI. Today the BioAPI has been accepted as an ANSI standard - ANSI/INCITS 358-2002. The BioAPI is implemented in the C programming language and it is intended to provide a high-level generic biometric authentication model suited for any form of biometric technology. The BioAPI also provides primitives that allow the application to manage the capture of samples on a client, and the enrolment, verification and identification on a server (The BioAPI Consortium, 2001).

BIOMETRICS OF THE FUTURE

Many of the technologies discussed thus far are paving the way of the future. However, newer technologies (gait recognition, lip print identification, body odour) are gaining more and more acceptance.

1. In the medical field

Gait recognition, which measures body gestures and movements, is being used by physical therapists to help detect and remedy human movement patterns. This behavioural biometric technique recognizes the uniqueness in the ways people walk by scanning human movement, then digitalizing (via binary transfer) the data, and storing the data for a match. It can detect, classify, and identify humans from distances up to 500 feet away and under all weather conditions in both day and evening. Its accuracy remains a current drawback.

2. In the forensic science community

Lip Print identification: The use of Lip Print identification is gaining more acceptances. Similar in the logic of fingerprinting, lip prints provide an alternative form of identification. The hassle of reading ones lips and piercing issues prove to be challenges. The main drawback is the user effort required for authentication.

Body odour recognition: Body odour recognition (chemical odour analysis) is seen as another biometric. Yet still unproven, we know that certain breeds of dogs excel at using their sense of smell to track humans. At least one company is working on a device to identify people based on body odours. The scientific basis of the work is that the chemical composition of odours can be identified using special sensors. The Researchers and scientists has pioneered similar research that has application to drug and bomb detection technologies. The drawbacks of this technology include inconsistencies in chemical composition resulting from hormonal or emotional changes (Network Security Technologies, 2003).

Biometrics applies in network security: The biggest problem for network security is the authentication system. For most systems, they mainly use and rely on passwords which is a combination of letters, characters and/or numbers. However, passwords need to be renewed within a certain period of time to maintain a high level of security. Moreover, it might be copied and used by unauthorized users. To fix that problem, biometrics security system can be applied. The most use of biometrics security system in network is the logical access control method. It will verify person's identification for secure workstation logon or network logon to get access control to the system (Reid, 2004).

The main obstacles of biometrics will continue to involve complexity and privacy issues surrounding information abuse. Many of the biometric techniques are easy to fool such as the case of a fingerprint saved on a piece of candy; and systematic bypass of determined and creative hackers. In other words, today's hacker is becoming smarter than ever (Chaim, 2003). Physiological biometric technology and finger scan technology (36%) will continue to dominate the biometric market. However, other technologies such as hand 27%, signature 5%, iris 16%, voice 6%, and facial 11% recognition are all gaining popularity. And handwriting technology is becoming popular with banks and credit cards authorization.

Biometrics usage will continue to work in conjunction with security software (firewalls, antivirus, encryption) and security hardware (token and smart cards, and firewall/VPN devices); in security sensitive environments such as airports and casinos; with law enforcement; prisons, jails, amusement and theme parks, corporate time systems, in assisting the disabled and mentally challenged; with new technologies for laptops not communicating with a corporate network; on desktops communicating with a corporate network; and more vendor product and service line expansion. The popularity of e-business will continue to be the driving force behind advanced security needs.

When choosing a biometric system, the following items should be considered when deciding. Characteristics such as speed, accuracy, user-friendliness, low-cost, public acceptability, reliability, resistance to counterfeiting, acceptable storage requirements, and fast enrolment times should all be considered.

CONCLUSION

Biometric systems and especially multi biometric systems have a huge potential of growth. By using biometric technologies, access procedures should be made simpler, faster and more secure. Especially governments, law enforcement agencies, military and industrial companies, already make partial use of this technology. In the future biometric devices will surely become more involved in many civil areas. Maybe in a couple of years access to ones private home or car will be granted upon a successful iris scan, thus making the traditional house or car keys obsolete. Maybe money, credit cards and cheques will become obsolete by leaving ones fingerprint instead of a certain amount of monetary value. But in spite of all the advantages coming along with the broader usage of biometric technology in our everyday lives, this technology also brings up a whole new range of difficulties and problems. So it will not sufficient to study factors like cost versus performance tradeoffs, or usability and security issues before deploying biometric systems. Very special care must be taken what may be done with the acquired biometric data and who may use it for a certain purpose.

Biometrics technology is a new technology for most of us because it has only been implemented in public for short period of time. There are many applications and solutions of biometric technology used in security systems. It has many advantages which can improve our lives such as: improved security and effectiveness, reduced fraud and password administrator costs, ease of use and makes live more comfortable. Even though the biometrics security system still has many concerns such as information privacy, physical privacy and religious objections, users cannot deny the fact that this new technology will change our lives for the better.

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