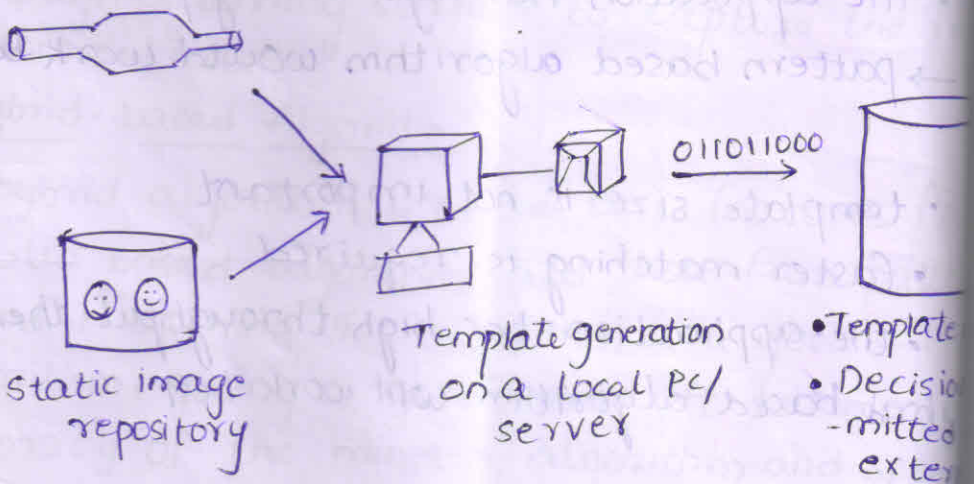
UNIT-II

Facial scan:

Aim: Facial scan technology utilizes distinctive features of human face inorder to verify or id individuals.

* Facial scan currently plays a role in the biom market place in 1:N identification applications
* Facial scans most successful implementations place in environments where camera's and imaging systems are already present

Components:



Images acquired through closed circuit tel cameras full pledged acquisition and processing system including cameras, mobiles, work station and back end processors in some facial scan s the core technology is optimised to work with specific cameras and acquisition devices. fac scan template matching generally takes plac a local or central PC. The core technology ha been embedded with in the devices such a personal digital assistants and mobile phones

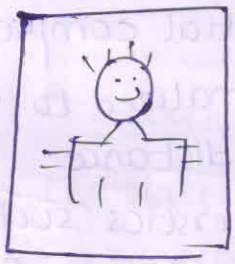
How facial scan Technology works:

Facial scan technology is based on the standard biometric sequence of

1. Image Acquisition
2. Image Processing
3. Location of distinctive characterstics
4. Template creation
5. Template Matching

1. Image Acquisition:

* Facial scan technology can acquire faces from almost any static camera or vedio system that generates of sufficient quality and resolution.
* Images acquired for facial scan through high resolution ~~im~~ cameras, with users directly facing the camera and moderate lighting of the face
* High quality enrollment is assumptial to verification and identification



* Distance from camera reduces facial size and therefore image resolution, through the technology is capable of imaging smaller faces to increase the possibility of template creation
* Users not looking directly at the camera - positioned more than approximately 15° - either vertically or horizantally are less likely to have images acquired by some technologies

* To overcome the acquisition angle problem, m
facial scan methods required that the user l
left, right, up and down inorder to acquire imag
from various angles
* In certain facial scan technologies, the proble
lighting is more severe
* Systems with automatic gain control, able t
for different lighting conditions.
* Black and white individuals can be more diff
enroll and verify in some facial scan systems
because acquisition devices are not always c
to acquire darker faces.
* Generally, speaking 1:N public sector identific
system are more likely to have controlled a
consistent enrollment environments, user can be
required to stand at fixed distance

2. Image Processing:

* Color images are normally converted to black
white. Inorder to facilitate initial comparisons
* Facial images are then normalized to overco
variation in orientation and distance
* For this, the basic characterstics such as the
of the eyes are located and used as a frame o
reference
* Once, the eyes are located, the facial image
rotated clock wise or anti clockwise to straig
the image along a horizontal axis
* The face can be magnified, if necessary, so
the facial image occupies a maximum pixel

3. Distinctive characterstics:

* Some features used in facial scan systems are not significantly changed over time.
* Upper ridges of the eyes sockets, areas around the cheekbones, sides of the mouth, nose shape and the position of major features relative to each other
* Areas that are very likely to change, are areas of the face, immediately adjacent to hairline, are usually not relied upon for verification
* Faces can be changed enough to reduce a systems matching accuracy
* A user who smiles during enrollment and grimaces during verification/identification is more likely to be rejected.
* Behavioural changes such as alteration of hairstyle changes in makeup, growing or shaving facial hair, adding or removing eye glasses are behaviours that impact the ability of facial scan systems to locate distinctive features

4. Template Creation:

* Enrollment templates are normally created from a multiplicity of processed facial images
* These templates can vary in size from 100 bytes to 3k. These templates cannot be used to recreate original images

5. Template Matching:

* Vendor's employ properietary methods to compare match templates against enrollment templates, assaigning confidence levels to the strength of each match attempt. If the score meets a predefined level, the comparison is deemed a match

* In most 1:1 biometric systems a rejection
defined as a failure to match after a g
of attempts, a rejection in a facial scan sys
often defined as a failure to match after a
mamount of time
* A leading facial scan systems can perform l
of identification, comparisons per second throug
standard pc's

Competing Facial Scan Technologies:

There are four facial scan technologies employe
vendors to identify and verify. They are
1. Eigen face
2. Feature analysis
3. Neural Network
4. Automated face processing

Other technology based on kernal patterns pr
under the skin - yet to proven comercially viab

1. Eigen face:

It is translated as "one's own face" is a tec
patented at MIT that utilises a database of
dimensional, gray scale facial images (Eigenfa
from which templates are created during enro
and verification.

The eigen face technology, faces are reconstructe
locating distinctive features from approximate
hundred eigen faces

In case of enrollment, facial image is represent
using a combination of various eigen faces. This
reconstruction is then mapped to a series of
numbers for 1:1 authentication, in which an
tive template is compared against the enroll

template to determine coefficient of variation for 1:many identification, the same principle applies but with a much larger comparison set

2. Feature Analysis:

It is the most widely utilised facial recognition technology. This technology is related to eigen face, but is more capable of accomodating changes in appearance. Feature analysis derives enrollment and verification templates from dozens of features from different regions of the face and also incorporates the relative location of these features. It anticipates the relative location that the slight movement of a feature located near one's mouth will be accompanied by relatively similar movement of adjacent features. It can accomodate angle upto 25° in the horizontal plane and 15° in the vertical plane. A straight-ahead facial image from a distance of 3 feet will be the most accurate

3. Neural Network:

These systems employ algorithms to determine the similarity of the unique feature of live versus enrolled faces, using as much of the facial image as possible. Neural systems are designed to learn which features are most effective within the body of users that the system is intended to solve. This method leads to an increased ability to identify faces in different conditions.

4. Automatic face Processing (AFP):

AFP is a technology using distances and distance ratios between easily acquired features such as eyes, end of nose and corners of mouth etc. It is often used in booking station applications

Facial scan Strengths:

1. Ability to leverage existing equipment and i processors:

Unlike many other physiological biometrics, f scan is a software based technology that can deployed without the addition of properito hardware. The technology is capable of using e imaging systems such as standard vedio ca mobile phones etc.,

2. Ability to operate without physical contact o complicity:

Facial scan is the only biometric capable of identification at a distance without subject complicity or awareness. Police and governm agencies have also installed facial scan system various public faces to prevent and deter crim

3. Ability to enroll static images:

One of the major challenges of a large scale system is initial enrollment. Projects involving than one million users, it can take years to e target population. If an individual has one o high quality photographs, this can serve as enrollment in facial scan systems

facial scan Weaknesses:

1. Acquisition environment effect on matching

The accuracy of facial scan solutions drops significantly under certain enrollment and ve conditions. Facial scan systems are ineffect when users are enrolled in one location and

verified in another. Factors such as direct and ambient lighting, camera position and quality, angle of acquisition and background composition can dramatically reduce accuracy

2. Changes in physiological characterstics that reduce matching accuracy:

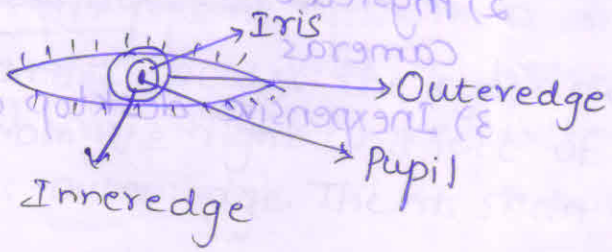
Changes in hairstyle, makeup, facial hair, addition or removal of eyeglasses and even hats can cause users to be falsely rejected. Advances in the core technology that enables acquisition at sharper angles and can model and verify faces in three dimensions should help reduce the technologies false non-matching

3. Potential for privacy abuse due to non-cooperative enrollment and identification:

A facial scan system capable of 1:N operations, able to acquire images without consent, could become the tracking system feared by many opponents of biometrics. Certain facial scan deployments have met with public objections

Iris scan:

* Iris scan technology utilises the distinctive features of human iris inorder to identify or verify the identity of individuals. This technology is used in high security physical access applications
* Successfully implemented in kiosks for banking and travel applications



Components:

Iris scan systems comprised front end acq
hardware along with local or central proces
software. Also requires camera technology
specialised devices that provide necessary
illumination. In desktop cameras with vedic
functionality along with iris scan function
The software components are the image pr
engine and matching engine

The results of iris scan matches are
tied directly into logical or physical acce
resulting in access to protected resources b
granted or restricted

How iris scan technology works:

There are five steps in the iris scan techno

1. Image Acquisition
2. Image Processing
3. Identification of distinctive features
4. Template creation
5. Template Matching

1. Image Acquisition [competing iris scan tech
available here]

Iris scan technology requires the acquisitio
high resolution image of the eye, illuminated
infrared imager. The three major types of iris
systems are 1) Kiosk-based systems

2) Physical access devices using
cameras

3) Inexpensive desktop cameras

Each system does rely on infrared imaging using wavelength of 700-900 nm range

Kiosk-based system requires that users scanned approximately 2-3 feet from the camera, which is positioned at the height of a typical users eyes The user must remain still. When faced the user in its field view, the kiosk based camera searches for eye shapes (user need to remove eye glasses) From this, the acquisition is automatic- the system normally locates the iris and acquires the image within 1-2 seconds.

Physical access require slightly more user effort A small camera mounted behind a mirror acquires the image, the user locates his eyes in the mirror, centering the eyes with in a square. The user may also be vocally prompted to move slightly forward or backward to enable image capture. The proper distance from the mirror is approximately 3 inches A high quality camera focuses on the eye, acquiring a series of images

Desktop camera, used for logical access, are the newest type of iris scan device. Acquiring the image at distance of approximately 18 inches, the device requires the user to align his line of sight with a guidance light. When the user is positioned correctly, the camera acquires the image

2. Image Processing:

After the camera locates the eye, an algorithm narrows in from the right and left of the eye to find the iris outer edge. The iris scan algorithm

then locates the inner edge of the iris at th
A black and white image of the iris is used f
feature extraction. The core technology can a
pupil duration, occlusion due to eyelids and
due to acquisition camera, the area used for
extraction is a horizantal band extending fro
far left to the far right of the eyes.

3. Identification of Distinctive Features.

Patterns that constitute the visual compo
the iris are surprisingly distinctive. A primar
characterstic is trabecular mesh work - A t
that gives the appearance of dividing the ir
radian fashion

Other visible characterstics are furrows, r
freckles, and the carona. Iris patterns are f
before birth and remained stable throughc
individuals life time. Tests have shown that in
left and right eyes has different iris patte
that even identical twins iris have almost
similarity. Not all of the iris is used - a por
the top as well as 45° of the bottom are unus

4. Template Generation:

The rectors located by the iris scan alg
are used to form enrollment and match temp
These templates are generated in a hexa de
format. One to four images may need to
captured for enrollment template generation.

The use of multiple images ensures that
data extracted to form a template is cons
and that there are no reflections being
misinterpreted as iris features

5. Template Matching:

Iris scan solutions generally perform identification that the match template is compared against all enrollments to find the best match. Iris scan technology is capable of searching lakhs of records per second.

Iris Scan Strengths:

1. Resistance to False Matching.

There is a tremendous amount of distinctive data in an iris and this data differs substantially from user to user, even between a users left and right eyes. The algorithm that convert these characterstics into templates generate the most distinctive templates in the biometric industry

2. Stability of characterstics over life time:

The iris is unique and it does not change over a person's life time. Other technologies may require reenrollment after a period of time. The distinctiveness of the iris, when acquired at high resolution, could make iris scan stable for use of a large scale civil ID applications in which both identification and verification are necessary

3. Suitability for Logical and Physical access:

Iris scan technology was used for physical access and the occasional ATM solutions. Advances in capture technology have reduced the size of iris capture devices to that of a standard video camera.

Iris scan Weaknessess

1. Difficulty of usage:

Users feel difficulty the manner in which t interact with the system as enrollment an verification requires fairly precise positio the head and eyes. Users with poor eye sigh those capable of lining up their eye with t technologies guidance components have diff using the technology.

2. False non-matching and failure to enroll:

The difficulty of acquiring acceptable iris im are the problems of false non-matching an failure to enroll

3. User discomfort with eye-based technology

A good percentage of users are uncomfort with the idea of using an eye-based biometr is the concern that exposure to technology damage eye sight

4. Need for properitory acquisition devices:

The need for a specialized acquisition devic limit the technologies growth