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SMART DOOR APPLICATION USING IRIS RECOGNITION

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Abstract - *The conventional methods like ID card verifcation or signature does not provide perfection and reliability. Identifcation by biological features gets tremendous importance with the increasing of security systems in society. Various types of biometrics like face, fnger, iris, retina, voice, palm print, ear, and hand geometry, in all these characteristics, iris recognition gaining attention because iris of every person is unique, it never changes during human lifetime and highly protected against damage. This unique feature shows that iris can be a good security measure. Iris recognition is an automated method of biometric identifcation that uses mathematical pattern recognition techniques on video images of one or both of the irises of an individual's eyes, whose complex patterns are unique, stable, and can be seen from some distance. The iris recognition systems have recently shown very high accuracy in verifying an individual's identity. The function of the iris is to control the amount of light entering through the pupil, and this is done by the sphincter and the dilator muscles, which adjust the size of the pupil. The complete iris recognition system can be split into four stages: Image acquisition, segmentation, encoding, and matching.*

***Key Words*: Biometric, Iris Recognition, Localization,Normalization,Pattern Matching, Iris Recognition Applications.**

1. INTRODUCTION

The human iris is regularly depicted as a standout amongst the most appropriate attributes for biometric verifcation because of a few alluring qualities. The iris has an unpredictable surface that is interesting for every person and all the more imperatively is likewise profoundly discriminative. As an inward organ, it is very much ensured against wounds and is sensibly steady after some time dissimilar to diferent biometrics traits, which frequently experience signifcant age-incited changes, e.g., faces.

Iris acknowledgment is a standout amongst the most dependable biometrics.Iris flter biometrics utilizes the remarkable qualities and highlights of the human iris so as to check the personality of a person. Iris acknowledgment is a technique for recognizing individuals dependent on one of a kind examples inside the ring-formed district encompassing the understudy of the eye through footfalls on the ground amid each progression.

Human iris on the other hand as an internal organ of the eye and as well protected from the external environment. It is the annular part between pupil and sclera and has distinct characteristics such as freckles, coronas, stripes, furrows, Crypts, and so on. It is an inner organ visible outside; hence, the iris image can be captured without physical touch. running text should match with the list of references at the end of the paper.

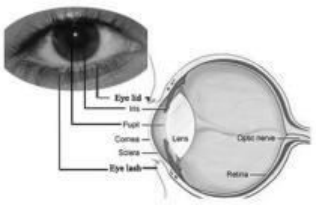

Fig-1: Human Eye Structure

An iris based biometric framework, comprises of two stages, (I) enrolment stage and (II) identifcation stage. In enrolment stage, eye pictures are procured and fragmented to get iris district of intrigue (ROI), highlights are removed

and put away as highlight vectors in databases. In identifcation stage, an inquiry picture to be identifed is divided to get Iris ROI, trailed by highlight vector creation. A coordinating stage is incorporated to coordinate this identifed include vector against those put away to recognize the person.

2. LITERATURE SURVEY

The idea of iris acknowledgment was frst proposed by Dr. Forthright Burch in 1939 who use iris designs as a technique to perceive an (individual biometric: iris examine, 2002). In 1985, Leonard Flom and Aran Safr proposed the idea that no two iris are indistinguishable, and granted a patent for the iris recognizable proof idea in 1987 (individual biometric: iris check, 2002). Leonard Flom and Aran Safr moved toward John Daugman to build up a calculation to robotize recognizable proof of human iris. From that point forward a great deal of work has been done in the feld of iris acknowledgment and generally acknowledgment calculations need a blend of diferent systems.

Daugman proposed an Integra-diferential operator that fnds the circles in image where the intensity is changing most rapidly with respect to changes in the radius. Once located, the iris image is converted to a Cartesian form by projecting it to onto a dimensionless pseudo-polar coordinate system. The features of iris are encoded and a signature is created using a 2-D complex valued Gabor flter, where the real and imaginary parts of each outcome are assigned a value of 0 or 1 according to whether they are negative or positive. Hamming distance (Hd) equals number of mismatching bits divided by number of compared bits.

This algorithm has been essentially error-free when applied to a very large database (Daugman, 2003).Footwear embedded harvesters is another common mechanism for generating power. It consists of electrodes coated in dielectric flm. These electrodes contain liquid droplets and this is then connected to electric circuit. Movement of droplets within the electrodes will release an electric charge which goes back to the circuit that later generates electric current. This method has limitation due to high maintenance cost and life time of droplets. Boles and Boashash proposed a calculation that fnds the understudy focus utilizing an edge identifcation technique, records dark dimension esteems on virtual concentric circles, and afterward builds the zero-intersection portrayal on these virtual circles dependent on a one-dimensional dyadic wavelet change [2].

Comparing virtual circles in distinctive pictures are controlled by rescaling the pictures to have a typical iris breadth. They make two diference capacities for the reasons for coordinating, one utilizing each purpose of the portrayal and the other utilizing just the zero intersection focuses. The calculation has been tried efectively on a little database of iris pictures, with and without noise. Xu et al. proposed an improved framework manages eyelids and eyelashes discovery and an elective picture upgrade technique since the eyelids and eyelashes discovery infuences the iris picture and produce clamor which corrupts the framework execution. Sub-square of eyelids/ eyelashes models thought about for discovery reason. To upgrade the iris Universal Journal of Scientifc Research in Science, Engineering and Technology (ijsrset.com) 580 picture, they subtract foundation and after that channel the picture by histogram leveling and viener sifting. Deduction utilized for eyelids/eyelashes discovery. The iris area discovering rate is 98.42% if there should arise an occurrence of CASIA database (G.Xu, Z. Zhang , and Y. Mama, 2006)

3. OBJECTIVE

The main goal of the work is to create a security system features for users. In this paper we describe our eforts on building a low-cost iris recognition system at home using of-the shelf components.

4. PROPOSED SYSTEM

Our model, comprises complete hardware and software solutions. The equipment part of our model includes a self-conceived base, a Raspberry PI 3, an eyepiece and a camera like completely fedged iris acknowledgment frameworks. The product part of the model uses the segmentation, feature extraction and coordinating calculations initially proposed by Daugman. While contending programming arrangements dependent on connection flters,

Haar wavelets or nearby parallel patterns could likewise have been chosen for this part, Daugman's methodology was picked, as it is very much reported and a standout amongst the most generally utilized [3].

Components Required

RASPBERRY PI 3:

The Raspberry Pi 3 Model B is the earliest model of the third-generation Raspberry Pi. It replaced the Raspberry Pi 2 Model B in February 2016.

- Quad Core 1.2GHz Broadcom BCM2837 64bit CPU
- 1GB RAM
- 4 USB 2 ports
- Full size HDMI
- CSI camera port for connecting a Raspberry Pi camera
- Micro SD port for loading your operating system and storing data
- Upgraded switched Micro USB power source up to 2.5A.

Fig-2: Raspberry Pi 3

RASPBERRY PI CAMERA:

The Raspberry Pi Camera v2 is a high quality 8 megapixel Sony IMX219 image sensor custom designed add-on board for Raspberry Pi, featuring a fxed focus lens. It attaches to Pi by way of one of the small sockets on the board upper surface and uses the dedicated CSi interface, designed especially for interfacing to cameras. The board itself is tiny, at around 25mm x 23mm x 9mm. It also weighs just over 3g, making it perfect for mobile or other applications where size and weight are important. It connects to Raspberry Pi by way of a short ribbon cable.

Fig-3: Raspberry PiCamera

ELECTROMAGNETIC DOOR LOCK:

An electromagnetic lock, magnetic lock, or maglock is a locking device that consists of an electromagnet and an armature plate. There are two main types of electric locking devices. Locking devices can be either "fail-safe" or "fail secure". A fail-secure locking device remains locked when power is lost. Fail-safe locking devices are unlocked when de-energized. Direct pull electromagnetic locks are inherently fail-safe.

Typically the electromagnet portion of the lock is attached to the door frame and a mating armature plate is attached to the door. The two components are in contact when the door is closed. When the electromagnet is energized, a current passing through the electromagnet creates a magnetic fux that causes the armature plate to attract to the electromagnet, creating a locking action. Because the mating area of the electromagnet and armature is relatively large, the force created by the magnetic fux is strong enough to keep the door locked even under stress.

Fig-4: Electromagnetic door

Methodology

The iris recognition is a method of authenticating a person by extraction and comparison of the textural pattern of iris of his/her eyes. The useful information from the unique iris patterns can be extracted using image processing techniques and then the results can be encoded into a biometric template that can be stored in a database for future comparisons. For authenticating a person his biometric template is compared with all the other pre-existing templates in the database using a matching algorithm [1].

The system consist of the following stages:

1. Image Acquisition

2. Iris Segmentation/Localization

3. Normalization

4. Feature Extraction

5. Matching/Comparison

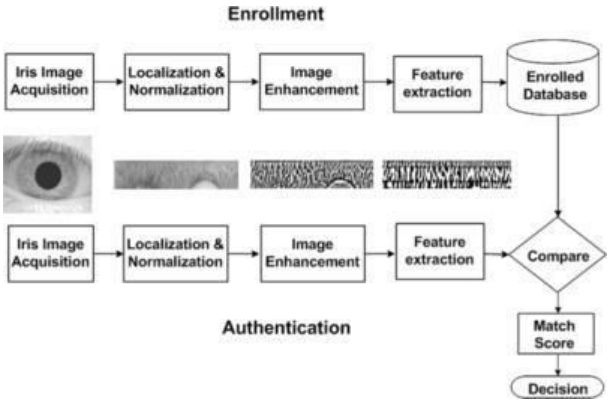

Fig-5: Methodology

IMAGE ACQUISITION

Acquiring the images of Iris is the most important stage in the recognition system because accurate recognition depends on the quality of the image. Images with good resolution and sharpness are needed with the required intensity.

IRIS SEGMENTATION

The process of detecting the iris region in eye image is called segmentation. Here we have used a circular Hough transform which is a standard computer vision algorithm used to identify simple geometric objects (lines, circles) in the image. The image is segmented by frst detecting the edges in the image. For this canny edge, detection is used. Gradients are biased in the vertical direction for the iris-sclera boundary, and for iris-pupil boundary, Vertical and horizontal gradients were weighted equally. Then hough transform is used to detect circles in the eye image.

The Hough transform for the iris-sclera boundary is performed frst then for the iris-pupil boundary since the pupil is always within the iris region, to make the circle detection process eficient and accurate. From the edge map, votes are cast in Hough space for the parameters of circles (center coordinates X and Y, and the radius R) passing through each edge point. Any circle can be defned according to the equation

$$X2+Y2=R2 \quad (1)$$

A maximum point in the Hough space will represent the radius and center coordinates of the circle defned by the edge points. We have to set the maximum and minimum value of radius in Hough transform. For the CASIA database, iris radius values range from 90 to 150 pixels, while the pupil radius ranges from 28 to 75 pixels. The output of segmentation is an image with circles on inner and outer boundaries of iris.

NORMALIZATION

The iris which is circular in shape can vary in dimensions from person to person. This is due to diferent factors such as pupil dilation caused by diferent illumination levels, head tilt, rotation of eye within the eye socket, diferent distance from which image is taken and rotation of the camera. Normalization is a process of converting the iris image into a fxed dimension image for comparison. The normalization process will convert all the images into a fxed dimension by unwrapping it from circular coordinates to polar coordinates.For this Daugman's Rubber sheet model is the best method. This model maps all points within the iris region to polar coordinates (r, θ), where θ is the angle [0, 2π] and r is on the interval [0, 1].

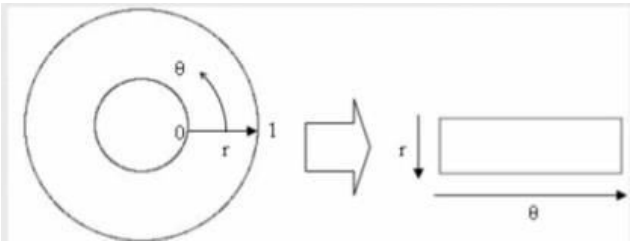

Fig-6: Normalization

FEATURE EXTRACTION

The most important task in any biometric system is the extraction of the most discriminating information for accurate recognition of an individual. Here we have used the Haar wavelet as a feature extraction technique. The Wavelet transform breaks an image into four sub-sampled images. The results consist of one image that has been low-pass fltered in horizontal and vertical both directions (cA) called approximation coeficients, one that has been high-pass fltered in both directions (cD) called diagonal coeficient, one that has been low-pass fltered in the vertical and high-pass fltered in the horizontal (cH) called horizontal coeficient and one that has been low-pass fltered in the horizontal and high pass fltered in the vertical (cV) called vertical coeficient. We obtain the 5-level wavelet tree showing all detail and approximation coeficients of one normalized image.

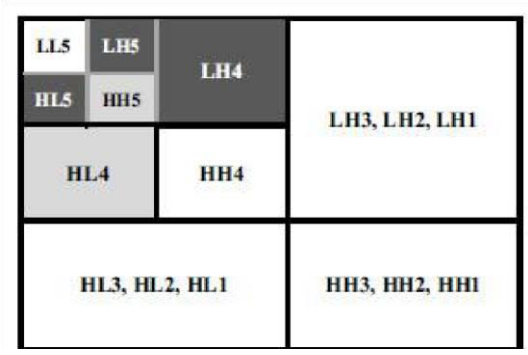

Fig-7: Gabor Wavelet Transform

When comparing the results using the Haar transform with the wavelet tree obtained using other wavelets we found that the Haar wavelet gave slightly better results. First, we have applied 2D DWT with Haar (up to 5thlavel).

Then to construct the feature vector we have used 4^{th} level, 5^{th} level decomposition details. The feature vector is then converted in binary form using two and four level quantization, form because it is easy to compare two binary codes as compared to numbers. After this, we will get a binary template of the iris image which is stored in the database and compared at the time of authentication.

MATCHING

While authenticating a person we have to compare his iris data with the codes stored in the database to fnd out if they represent the same person or not. For this Hamming distance is used which gives the diference between two binary codes using EX-OR operator. The hamming distance between two binary words

The iris template is shifted right and left by 8 bits to avoid rotation inconsistencies. It may be easily shown that scrolling the template in polar coordinates is equivalent to iris rotation in Cartesian coordinates. John Dougman tested a large iris database and conclude that maximum hamming distance exists between two iris codes of the same person is 0.32 which is used as a threshold in the matching process.

5. RESULT AND DISCUSSION

Benefits of IRIS Recognition

Iris biometrics is only one of the biometric advances that are accessible today. Despite the fact that usually mistook for the retina flter, it is altogether diferent, concentrating on the iris rather than the retina of the eye. Albeit other biometric security choices are more mainstream than biometric iris investigation, an iris sweep or retinal checking ofers exactness that some diferent procedures can't give or even approached.

(I) **No contact required:** Another beneft of iris analysis is that no contact is required to scan the iris, as is required for fngerprint or biometrics hand geometry scanning. You can stand close to a scanner or even a few feet away, which makes it extremely convenient.

(II) **The iris doesn't change after some time:** It fnds that the iris itself doesn't change after some time.

Concentrates on iris flters have had the capacity to distinguish a solitary individual for longer than 30 years utilizing individual biometrics. This implies even as you age, the iris continues as before, with the exception of when surgeries and ailments change the shading or shape. Be that as it may, even after a medical procedure or a therapeutic issue the real surface of the iris is as yet the equivalent.

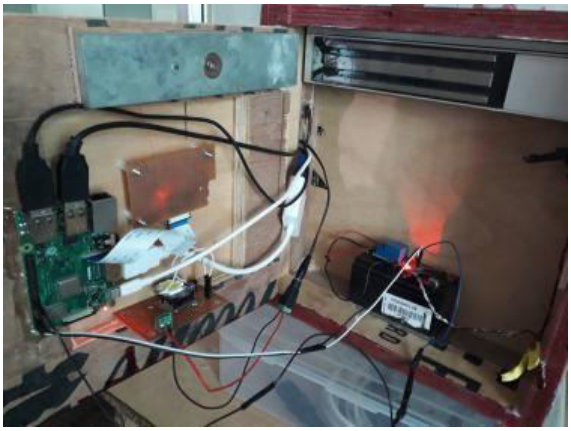

Fig-8: Model Design

6.FUTURE SUGGESTIONS

In order to increase both accuracy and robustness; multimodal biometric systems could be used. This confusion may be a combination of iris and fngerprint biometrics. This allows the integration of two or more types of biometric recognition and verifcation systems in order to meet stringent performance requirements. Such systems are expected to be more reliable due to the presence of multiple, independent pieces of evidence. These systems are also able to meet the strict performance requirements imposed by various applications.

7. CONCLUSION

The iris recognition system proves to be a very eficient and promising technique as it gives accurate and reliable results to verify the identity of a person. Hough transform with canny edge detector is best suited for segmentation of the iris because of eficient localization. The Gaber wavelet transform which is used for feature extraction has a number of advantages, it is simple, fast, memory eficient and reversible compared to other wavelets and the feature vector is small. The Iris recognition system can efectively diferentiate various persons by identifying their irises and provide very good security against intruders.

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