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Human Identification Using IRIS Recognition

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ABSTRACT

Identification and verification of a person today is a common thing; which may include door-lock system and vehicle control or even at accessing bank accounts via ATM, etc. which is necessary for securing personal information. The conventional methods like ID card verification or signature does not provide perfection and reliability. Identification by biological features gets tremendous importance with the increasing of security systems in society. Various types of biometrics like face, finger, 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 good security measure. Iris recognition is an automated method of biometric identification 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 accuracies 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 pupil. The complete iris recognition system can be split into four stages: Image acquisition, segmentation, encoding and matching.

Keyword: Biometric, Iris Recognition, Localization, Normalization, Pattern Matching, Iris Recognition Applications.

I. INTRODUCTION

The recent advances of information technology and the increasing requirement for security have led to a rapid development of intelligent personal identification system based on biometrics. Biometrics is the art of science and technology of measuring and analyzing biological data. Biometrics refers to technologies that measure and analysis human body characteristics, such as DNA, fingerprinting, eye retina and irises, voice pattern, facial pattern and measurement for authentication purposes. Basically concentrate on two function one is for identification and other verification. Face recognition and speaker recognition have also been widely studied over the last 25 year, whereas iris recognition is a newly emergent approach to personal identification. Iris recognition is one of the most reliable biometrics. Iris scan biometrics employs the unique characteristics and features of the human iris in order to verify the identity of an individual. Iris recognition is a method of identifying people based on unique patterns within the ring-shaped region surrounding the pupil of the eye. The iris-scan process begins with a photograph. A specialized camera, typically very close to the subject, no more than three feet, uses an infrared imager to illuminate the eye and capture a very high-resolution photograph. This process takes only one to two seconds and provides the details of the iris that are mapped, recorded and stored for future matching/verification. Iris's are composed before birth and, except in the event of an injury to the eyeball, remain unchanged throughout an individual's lifetime. The fact that an individual's right and left eyes are different and that patterns are easy to capture, establishes iris-scan technology as one of the biometrics that is very resistant to false matching and fraud. Biometrics involve various technology

II. METHODS AND MATERIAL

A. Fingerprint verification: In this technique, Bank customer's finger matching a minutiae and straight pattern and unique marks in fingerprint.

B. Hand geometry: Hand geometry is a biometric solution that reads a person's hand and/or fingers for

access. This technique concerned with measuring the physical characteristics of the customer hand and fingers.

C. Voice verification: This techniques followed some types of word, key, number sought by the customers at the front of ATM machines and Biometric ATM machines recognition voice and identify the customers voice next process has been done.

D. Retinal scanning: This technique used to identify the unique patterns of the retina of the customers. Retinal scanning devices are the most accurate physical biometric available today since there is no known way to replicate a retina.

E. Iris scanning: Iris scanning is eye related biometric systems, Iris scans analyze the features that exist in the colored tissue surrounding the pupil of an eye, it is utilized a conventional camera element and requires no intimate contract between user and reader.

F. Facial recognition: Facial recognition analyzes the characteristics of a person's face. Access is permitted only if a match is found. The process works when a user faces a digital video camera, usually standing about two feet from it, where the overall facial structure, including distances between eyes, nose, mouth, and jaw edges are measured.

G. Signature verification: The technology examines such dynamics writing speed of the persons, directions of writing, and pressure of ball point writing.

H. Vascular patterns: Vascular patterns described a full picture of the veins in a person's hand or face. The thickness and location of these veins are believed to be unique enough to an individual to be used to verify a person's identity.

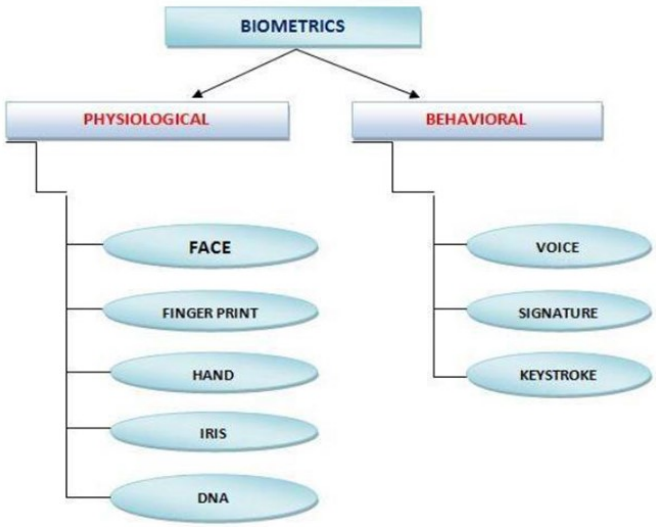

Figure 1. Type of Biometrics

1. Literature Review

The concept of iris recognition was first proposed by Dr. Frank Burch in 1939 who use iris patterns as a method to recognize an individual (individual biometric: iris scan, 2002). In 1985, Leonard Flom and Aran Safir proposed the concept that no two iris are alike, and awarded a patent for the iris identification concept in 1987 (individual biometric: iris scan, 2002). Leonard Flom and Aran Safir approached John Daugman to develop an algorithm to automate identification of human iris. Since then a lot of work has been done in the field of iris recognition and usually recognition algorithms need a combination of various techniques. This work will review different substantial methods.

Daugman proposed an Integra-differential operator that finds 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 filter, 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 [2][12][5]. This algorithm has been essentially error-free when applied to a very large database (Daugman, 2003)[12].

Boles and Boashash proposed an algorithm that locates the pupil center using an edge detection method, records grey level values on virtual concentric circles, and then constructs the zero-crossing representation on these virtual circles based on a one-dimensional dyadic wavelet transform. Corresponding virtual circles in different images are determined by rescaling the images to have a common iris diameter. They create two dissimilarity functions for the purposes of matching, one using every point of the representation and the other using only the zero crossing points. The algorithm has been tested successfully on a small database of iris images, with and without noise[3]. Xu et al. proposed an improved system deals with eyelids and eyelashes detection and an alternative image enhancement method because the eyelids and eyelashes detection affects the iris image and produce noise which degrades the system performance. Sub-block of eyelids/eyelashes models compared for detection purpose. To enhance the iris

image, they subtract background and then filter the image by histogram equalizing and viener filtering. Derivation used for eyelids/ eyelashes detection. The iris location finding rate is 98.42% in case of CASIA database (G.Xu, Z. Zhang , & Y. Ma, 2006)[13].

2. Structure of IRIS

Iris is distinct for every person, even the twins have different iris patterns and it remains same for whole of the life. Thus this technology is now considered as providing positive identification of an individual without contact and at very high confidence levels. The very front of the eye is essentially made up of two parts: the sclera or "white" portion of the eye, and cornea. The sclera consists of closely interwoven fibers and a small section in the front and center known as the cornea. The cornea consists of fibers arranged in regular fashion. Conveniently this makes the cornea transparent, allowing light to filter in. Behind the cornea is the anterior chamber filled with a fluid known as the aqueous humor. A spongy tissue, the ciliary bodies, arranged around the edge of the cornea, constantly produces the aqueous humor. Immersed in the aqueous humor is a ring of muscles commonly referred to as iris. The word iris is most likely derived from the Latin word for rainbow. It appears that the term was first applied in the sixteenth century, making reference to this multicolored portion of the eye [l]. The iris itself extends out in front of the lens, forming a circular array, with a variable opening in the center, otherwise known as the pupil [2]. The iris, which is made up of two bands of muscles, controls the pupil, the dilator, which contracts to enlarge the pupil, and the sphincter, which contracts to reduce the size of the pupil.

The ridges tend to vary with the state of the pupil (contracted or dilated). Other striations can be seen as an effect of the blood vessels beneath the surface. Crypts, nevi and freckles make up the other main source of variation on the iris. A crypt is an irregular atrophy of the border layer. Nevi are small elevations in the border layer. Freckles are local collections of chromataphores. The pupillary zone, on the other hand tends)to be relatively flat. The iris has been found to be incredibly unique from person to person, in both color and structure. In fact, it has been discovered by both ophthalmologists and anatomists, examining large numbers of eyes, that even the left and right eye of and individual exhibit differences in their iris pattern. Also, the patterns appear to vary little after childhood. Developmental biology further suggests that, while the general structure of the iris is genetically determined, the particular aspects of its details are dependent upon circumstance, like the conditions in the embryonic precursor to the iris. Developmental biology also supports the lack of variance through life idea, noting that the iris is most fully developed and grows little after childhood. The only marked exceptions are the pigmentation, which does not fully mature until adolescence, and the size of the pupil, which is also not fully determined until puberty. However, once out of the teenage years, it is likely a person's iris variations will likely remain the same for the rest of their life. Thus there is enormous interest in utilizing iris variation in a biometric system.

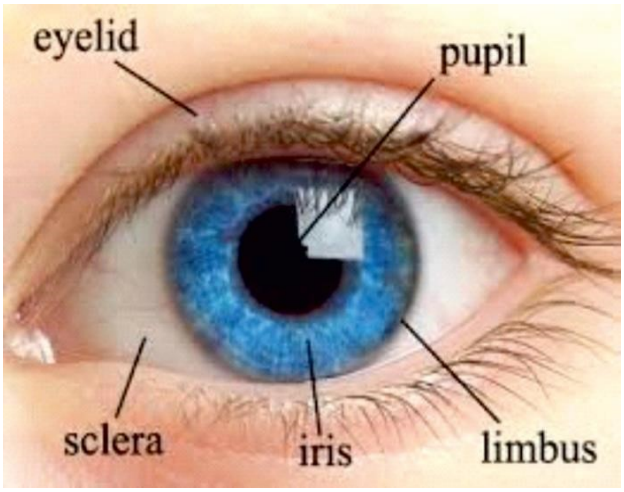

Figure 2. A front view of human eye

3. IRIS Recognition System

Iris recognition system mainly consists of four steps as shown in figure 3.

- ✓ Image acquisition-capturing eye image.
- ✓ Segmentation – locating the iris region in an eye Image.
- ✓ Normalization – creating a dimensionally consistent representation of the iris region.
- ✓ Feature encoding – creating a template containing only the most discriminating features of the iris.

1. Enrollment: The enrollment phase creates a user profile for subsequent authentication activities. Typically, a new user provides multiple biometric reading samples that are combined to form one stored record.

2. Image acquisitioning: The first step of the iris recognition system is image acquisition. This step is very complicated because of differences in size and color of the iris from one person to another. The acquisition distance for average capturing is 2 to 3 feet and the average time is 1 to 2 seconds. Sometimes the acquisition process produces different results for the same person due to the different environmental conditions like lighting effect, positioning and different separation of distance.

3. Pre-processing: Image pre-processing is a very important step in iris recognition system in order to get rid of the image noise, and prepare the iris image to better feature extraction. The captured image contains many parts of the eye not only the region of interest (iris) for that its necessary to implement main step which is localization of iris to isolate the iris region from the rest of the acquired image. Furthermore, the distance between camera and eye may be altered. The brightness also plays an important role, as it may have non-uniform caused by the position of the light source. These may impair the result of the texture analysis, for that it is necessary to pre-process the image and localize the iris to extract the important features to perform matching.

4. Feature extraction: Feature extraction identifies the most distinct features for

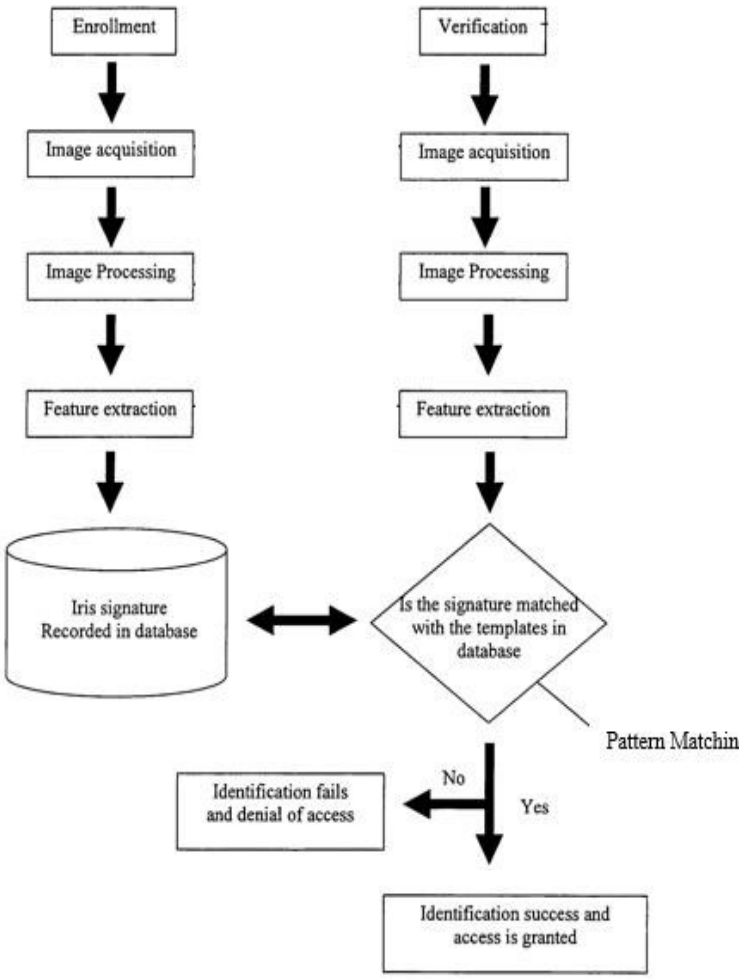

Figure 3. Block diagram of Iris recognition system

classification. Some of the features are x -y coordinates, radius, shape and size of the pupil, intensity values, orientation of the pupil ellipse and ratio between average intensity of two pupils. The features encoded to suit a format for recognition.

E. Pattern matching: In the matching process, the extracted features of the iris are compared with the iris images in the database. If enough similarity is found, the subject is then identified. The matching process between two templates aims to maximize the probability of a true match for authentic identification tries and minimize false matches for impostors. In other words, images of the same iris taken at different times should be identified as being from the same person and images from different irises should be marked as coming from different persons.

F. Storing and comparing the image: The set pixels which cover the iris on the image are then transformed into a bit pattern that preserves required information for template comparison but allows faster and statistical meaningful comparison. Dr. Dousman's algorithm, referred to as IrisCode™, translates the visible characteristics from the image into a 512 byte code, the template, which allows extremely quick searches and a very low false acceptance rate. When a subject tries to authenticate or identify himself, the generated Iris code is compared with templates stored in the database. A test of statistical independence determines whether the Iris Code resulting from the scan and a stored IrisCode template are from the same iris.

Iris code generator

IrisCode ™ is based on an algorithm developed and patented in the nineties by Dr. Dougman**.** This is nowadays the most used algorithm in commercial devices, thanks to its speed of matching with very low

false match rates. With Iris Code the visible characteristics of the iris are transformed into a phase sequence, which contains information on the orientation, spatial frequency and position of segments in the iris. The phase is not affected by contrast, camera gain or illumination levels.

1. The result of the algorithm is an Iris Code, 256 bytes of data which describe the phase characteristics of the iris in a polar coordinate system.

2. During recognition the difference between iris codes is determined; this difference is called the hamming distance**.** If the hamming distance indicates that less than one third of the iris codes is different from each other, then it is concluded that there is no statistical significant difference in between the Iris Codes and they are considered to come from the same iris.

3. Using 256 byte templates for all scanned irises allows matching up to 500.000 templates per second using IrisCode.

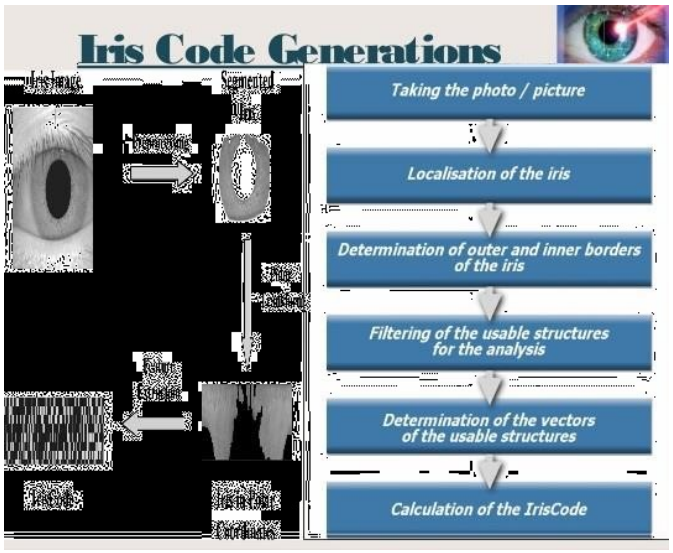

Figure 4. Iris code generation

III. RESULTS AND DISCUSSION

1. Benefits of IRIS Recognition

Iris biometrics is just one of the biometric technologies that are available today. Although it is often confused with the retina scan, it is very different, focusing on the iris instead of the retina of the eye. Although other biometric security options are more popular than biometric iris analysis, an iris scan or retinal scanning offers accuracy that some other techniques cannot provide or even come close to.

1. High accuracy: One of the main benefits of using eye biometrics is the high accuracy that this iris biometric technology provides. Everyone has an iris pattern that is distinct - even twins. Both the left and right irises differ from one another as well. In theory, the accuracy of this technology should be at close to 100%.

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

3. The iris doesn't change over time: It find that the iris itself doesn't change over time.

Studies on iris scans have been able to identify a single person for longer than 30 years using personal biometrics. This means that even as you age, the iris remains the same, except for when surgical procedures and medical conditions change the color or shape. However, even after surgery or a medical problem the actual texture of the iris is still the same.

4. Safety and security measures in place: Iris recognition involves nothing more than taking a digital picture of the iris pattern (from video), and recreating an encrypted digital template of that pattern. Iris recognition therefore affords high level defense against identity theft, a rapidly growing crime.

2. IRIS Localization Steps

Localization of the boundaries of the iris is very important so as to remove the pupil, sclera, and other occlusion such as upper and lower eye lids of the subject.

A. Iris localization: Image acquisition of the iris cannot be expected to yield an image containing only the iris.

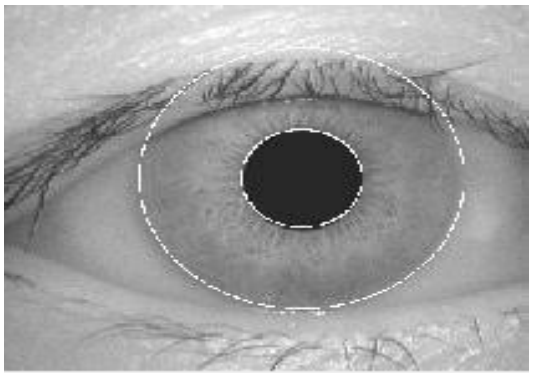

Figure 4. Segmented Iris

Therefore, prior to iris pattern matching, it is important to localize that portion of the iris derived from inside the limbos (the border between the sclera and the iris) and outside the pupil.

B. Adjusted gamma value: For this process Edge strength image is use. In that image it use to going to increase the gamma value. Gamma value must be a positive. Values in the range 0 - 1 enhance contrast of bright regions, values >1.

C. Non maxima suppression: After the edge directions are known, non-maximum suppression now has to be applied. Non-maximum suppression is used to trace along the edge in the edge direction and suppress any pixel value (sets it equal to 0) that is not considered to be an edge. This will give a thin line in the output image.

D. Hysteresis thresholds: Here comparison of non maxima suppressed image pixels with two threshold levels. If current pixel value is greater than two threshold levels means that current pixel & 8 neighbor pixels also marked as edges. If that current pixel value is greater than only one threshold means that current pixel only marked as an edge.

E. Hough transform: The Hough transform is a standard computer vision algorithm can be used to determine the parameters of simple geometric objects, such as lines and circles, present in an image. The circular Hough transform can be employed to deduce the radius and centre coordinates of the pupil and iris regions. From the edge map, votes are cast in Hough space for the parameters of circles passing through each edge point.

F. Iris image normalization: As the iris is captured under different conditions like non-uniform illumination, eye blink, pupil radius change due to varying lighting etc., it is possible for the output of iris images to be in different sizes. These variations may affect the results of iris matching. To overcome this issue, iris image has been converted to standard size with width and height as 360 and 48 pixels respectively. Iris dilation or erosion process is also carried out to extend or squeeze iris strip size when fewer/higher amounts of data are obtained in the iris portion. This process is called iris normalization.

Canny edge detection: Edges characterize boundaries and are therefore a problem of fundamental importance in image processing. Edges in images are areas with strong intensity contrasts a jump in intensity from one pixel to the next. Edge detecting an image significantly reduces the amount of data and filters out useless information, while preserving the important structural properties in an image. The Canny edge detection algorithm is known to many as the optimal edge detector.

H. Iris image enrichment: Image enrichment process is based on spatial domain approach. The original iris image has low contrast and may have non-uniform illumination caused due to the irregular position of the light source. These problems may affect subsequent feature extraction and iris matching process. In order to obtain a well-distributed texture image, the iris image is enriched using local histogram equalization.

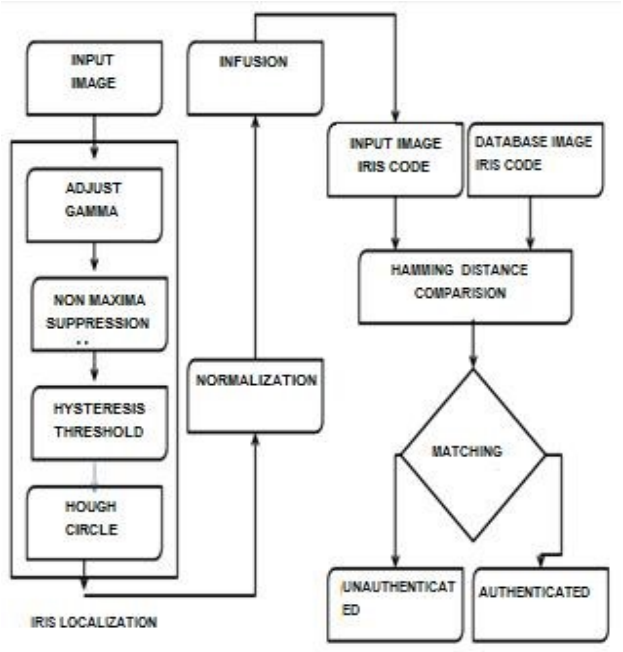

Figure 5. Flow chart of iris recognition

IV. APPLICATIONS OF IRIS RECOGNITION

Today's e-security is in critical need of finding accurate, secure and cost-effective alternatives to passwords and personal identification numbers (PIN) as financial losses increase dramatically year over year from computer-based fraud such as computer hacking and identity theft. Biometric solutions address these fundamental problems, because an individual's biometric data is unique and

cannot be transferred and therefore can be used for identifying a person or verifying the identity of a person.

1. For an enterprise, biometrics provides value in two ways. First, a biometric device automates entry into secure locations, relieving or at least reducing the need for full-time monitoring by personnel. Second, when rolled into an authentication scheme, biometrics adds a strong layer of verification for user names and passwords.

2. Biometrics adds a unique identifier to network authentication, one that is extremely difficult to duplicate. Smart cards and tokens also provide a unique identifier, but biometrics has an advantage over these devices.

3. It is being implemented and substituted for passports (automated international border crossing), aviation security and controlling access to restricted areas at airports, database access and computer login, premises access control.

4. Enterprise applications are also being worked on in the areas of e-commerce, healthcare applications for medical records protection, insurance and brokerage transactions. Another area iris recognition is useful with is physical security to data centers or computer rooms.

6.Iris recognition is also being utilized or considered in other areas of daily life. ATMs are a major area where iris recognition is being trial led. The use of this technology with ATMs means that customers can discard their plastic cards and PINs thus eliminating the possibility of having cards and/or PINs stolen or lost. The banking industry is also involved in looking at implementing the technology in over the counter transactions with customers.

V. CONCLUSION

Iris recognition has proven to be a very useful and versatile security measure. Iris recognition is widely used in the transportation industry and can have many applications in other fields where security is necessary. Iris was found to be the perfect biometric for authentication purposes as it is highly distinctive, stable with age, is well protected and the morphogenesis of the iris occurs during gestation which leads to patterns and colors which are random and unique to each person, hence making it difficult to forge and imitate the actual person. This randomness of iris pattern is used for authentication purposes. The pattern of the iris was the feature extracted for matching and decision making for authentication. Iris recognition will prove to be a widely used security measure in the future

VI. REFERENCES

[1]. Wildes, Richard P, Iris Recognition: An Emerging Biometric Technology, Proceedings of the IEEE. Vol. 85, NO. 9, (1999), pp.1348-1363.

[2]. Daugman J. G., High coifidence visual recognition of persons by a test of statistical independence, IEEE Transactions on Pattern Analysis and Machine Intelligence, Volume: 15, No. 1 I, (l993), pp. 1148-1 161.

[3]. Boles W.W, Boashash B., A human identification technique using inzages of the iris and wavelet transform, IEEE Transactions on Signal Processing, Vol.85, NO. 9, (1999), pp.1348-1363. 46, NO. 4, (1998), pp. 1185-1188.

[4]. K. Laxmi Narshima Rao, Vikram. Kulkarni and C.Krishna Reddy" Recognition Technique for ATM based on IRIS Technology" International Journal of Engineering Research and Development Volume 3, Issue 11 (September 2012), PP. 39-45

[5]. Jain AK, Ross A and Prabhakar S, "An introduction to biometric recognition", IEEE transactions on circuits and systems for video technology, vol.14 (1); 2004.

[6]. Tisse, L. Martin, L. Torres, and M. Robert. "Person identification technique using human iris recognition. In Proceedings of ICVI'02, pages 294–299, 2002.

[7]. Dal Ho Cho, Kang R. young Park, and Dae Woong Rhee. Real-time iris localization for iris