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# Generated Dataset For Recognition System With Fewer Artifacts Using Iris

**M. Roshini[1], Dr. G. Vasanth[2], Dr. G. N. Kodandaramaiah[3]**
**Author(s) Name(s)**

*[1]Department of Computer Science & Engineering, Research Scholar in VTU, Belgaum, Karnataka, India, roshini.mohammed@gmail.com.*

*[2]Department of Computer Science & Engineering, Professor & HOD Government Engineering College, KR PET, Karnataka, India, gvasanth_ss@yahoo.co.in*

*[3]Department of Electronics and Communication Engineering. Professor & HOD Kuppam Engineering College, Kuppam, AP, India, gnk.ramaiah@gmail.com*

***Abstract***

*Based on the human characteristics the accurate identity of a person can be accurately possible through iris recognition. The iris enjoys a few benefits like uniqueness, dependability, high acknowledgment rate, and non-contact etc. The iris technology though contains many advantages but still facing some challenges which is stopping it for adopting by many people. There are still certain improvements that can be made to improve their accuracy in areas with poor lighting, long stand-off distances, and moving targets. For doing research in iris recognition,can make use of generated datasets of many subjects under different conditions were made public and with no cost are available as well as contains private databases which are limited to the organizations. In this paper presenting anatomy of eye, the past study about iris recognition, step by step process of iris recognition, available datasets and also introducing a new generated dataset to implement the segmentation algorithm in the iris recognition process.*

***Keywords:*** *Iris, Databases, Segmentation, Non-contact.*

## 1INTRODUCTION

In iris recognition systems the vital role is played by the publicly available databases.The bulk datasets are acquired with certain properties NIR spectrum to match with John Daugman's standard recognition method [1].Though it is said that many datasets are available for research in iris recognition for free and publicly available but still some constraints have to followed to make it possible like should gothrough a legal procedure for using databases. In this paper, presenting a preview on the properties of possible datasets of human irises for research use. Because of the forgeries in psychological characteristics, a strong and accurate security providing authentication is needed. A biometric framework gives programmed distinguishing proof of a person for making a decision about an individual is verified or not in that climate. Biometrics alludes to the acknowledgment of a person based on physiological and social characteristics of an individual [2].Typical biometric advances incorporate unique mark distinguishing proof, face acknowledgment, iris acknowledgment and soon. Among all, Iris is viewed as utmost trustable, precise technology because of its properties. Utilizing dataset for iris recognition is an essential work .Review of available iris image datasets provided to select the appropriate dataset for performing tests. Statistical information about the available databases are provided.



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### 1.1 Introduction to Biometric

The term Biometrics means calculating, computing and analyzing biological data. It is a combination of two words the meaning of 'bio' refers to life and 'metrikos' refers to measure. This is an automated and accurate method used for identity purpose along with authorization. The stable features like palm print, fingerprint, facial features,thermal emission, iris pattern etccomes under physiological category. Under behavioral category considers one's signature reflection, speech pattern, gait, gesture etc.[5] Biometric methodology works by capturing the specific information needed using sensorsand software to store the biometric pattern in repository in template form.This is reliable and provides high security. Iris identification system was introduced by John Daugman[4] whose success highly depends on segmentation.

### 1.2 Types of Biometrics

Biometric recognition is an efficient method for a person's identity. The following are discussed here.

(a) DNA Identification is the means of selecting a person by testing Nucleic acids.
(b) Ear identification is done using the shape of the ear.
(c) Iris identification is possible using the uniqueness in the pattern of iris inindividuals.
(d) EyesRetina process uses the veins patterns.
(e) Face recognition methodology works by facial feature analysis.
(f) Fingerprint recognition works with the unique patterns of ridges and valleys.
(g) Gait depends on a person style of walking.
(h) Hand recognition works by matching the dimensions of hand and fingers.
(i) Signature recognition done using a person signature.
(j) Voice identification usesthe variation in the pitch of the voice for control.

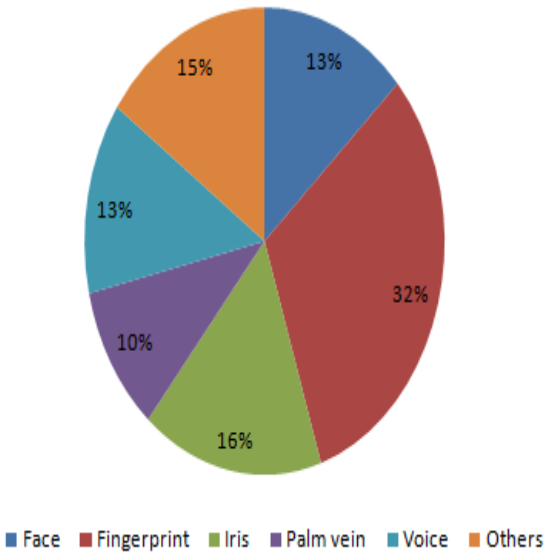


Fig. No 1: Contribution of different biometric methods for authentication



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- This picture shows the contribution of different physical and behavioral features used for authentication.
- Though the Iris biometric authentication contribution in percentage is less than the fingerprint, iris biometric authentication is more accurate and secure because of its non contact feature and can be widely used easily in different applications.
- The special non-contact feature of iris biometric systems is gaining lot of popularity in the present scenario of pandemic situation.
- During this pandemic situation all government policies are reaching the population only through fingerprint authentication. This system takes more time because the functioning depends on the network issues and many times the system will be slow which makes the people to stand in the line for a long time and which increases the chance of spreading the disease among the people.
- The fingerprint rubber stamps creations are now possible in the market which is making forgery of authentication.
- Particularly for the old people the fingerprint pattern will get changed because of folding and for such kind of people this authentication is not valid which means recognition is not possible.
- The fingerprint systems is also not very suitable for the people who will use their hands for hard works like laborer's and here the fingerprint technology is a failure.

All the above mentioned drawbacks with fingerprint technology can be overcome with the iris authentication system as iris is non-contact, internal protected organ, the pattern is stable throughout the life span, and particularly forgery is not possible without the knowledge of the person.

### 1.3 Anatomy of iris

The iris is a texture that stays constant from birth till death[2], making it a perfect onefor use as an identity measure. Iris acknowledgment is a technique for individual recognizable proof dependent on high-goal pictures of natural eyes.As represented in picture the iris lies between the pupil and the sclera. Not only do identical twins' irises differ, but so do the both eyes. There are no two irises alike. During the first year of life, the iris pattern is created, and the stromal layer is pigmented for the first few years.Iris pattern formation is completely random and unrelated to any hereditary elements. Iris patterns are totally independent due to their biological nature. Iris patterns alter even amongst identical twins.Iris has a 12mm average diameter. Iris is made up of two layers. The epithelium, which is the lowest layer, includes abundant pigmentation cells. "The stromal layer, which includes blood vessels, pigment cells, and iris muscles, lies above the epithelium".[23] The iris color is influenced by the level of pigmentation and the quantity of melanin available.Because melanin is practically non-absorbing beyond 700nm, Iris cameras employ near infrared light (NIR) between 700 and 900 nm. The visible wavelength (VW) ranges from 400 to 700 nm, which can create reflections due to freckles. The ciliary area, hueus, and annular region of the iris are soft and loosely woven tissues. With the NIR, Iris is more evident. The changes in the size of the eye when it expands or contracts are caused by illumination of the eye.



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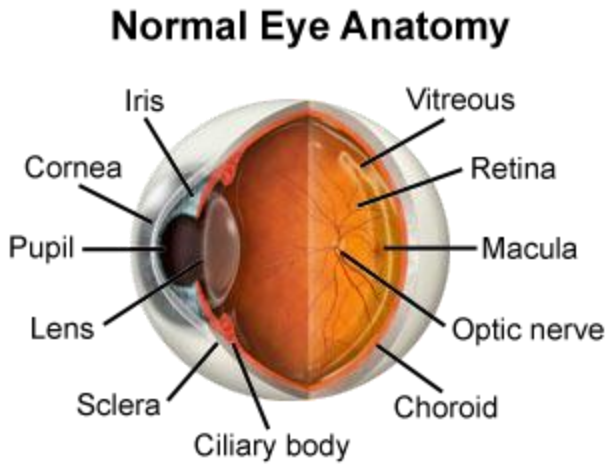


Fig. No. 2 Anatomy of eye

### 1.4 Comparison between NIR and WV

When capturing images of iris in the Near Infrared wavelength, pupil's color is almost black and it is very easy to segment if no occlusions are present like specular and difuse reflections are not present in the images. The reflections are not captured under NIR because of pigmentation.

For acquisition using VW, difficult to locate the region of interest than NIR and moreover, the pupillary zone becomes more difficult to segment because of the reflections that are present in the image.

### 1.5 Application areas using iris

- The iris is treated as a living passport for border movements.
- It can be treated as a password for login to desktops or mobiles or laptops.
- Can be used for secure bank transactions.
- More useful to travel without ticket.
- To authenticate entry at home, offices and other places.
- In hospitals during history of treatment process.
- For tracing criminal background,
- For vehicle operating and unlocking etc.

The above mentioned are some of the applications which are possible through iris recognition. But among them only few are available still many needs to be implemented in future. In abroad countries home, offices and other premises authentication is available and passport free immigration can be seen, and few mobiles are having iris unlock features but if it considered in India only for providing unique identity to every individual iris is used for authentication in Aadhar Card registration.

## 2 CHALLENGES IN IRIS RECOGNITION

1. Dilation – change in size of pupil due to sunglasses, drugs, light variations etc
2. Eye cataract
3. Time difference between enrolment and verification



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4. Camera not in angle
5. Tilt of head
6. Eye movement
7. Blinking
8. Changes in imaging distance

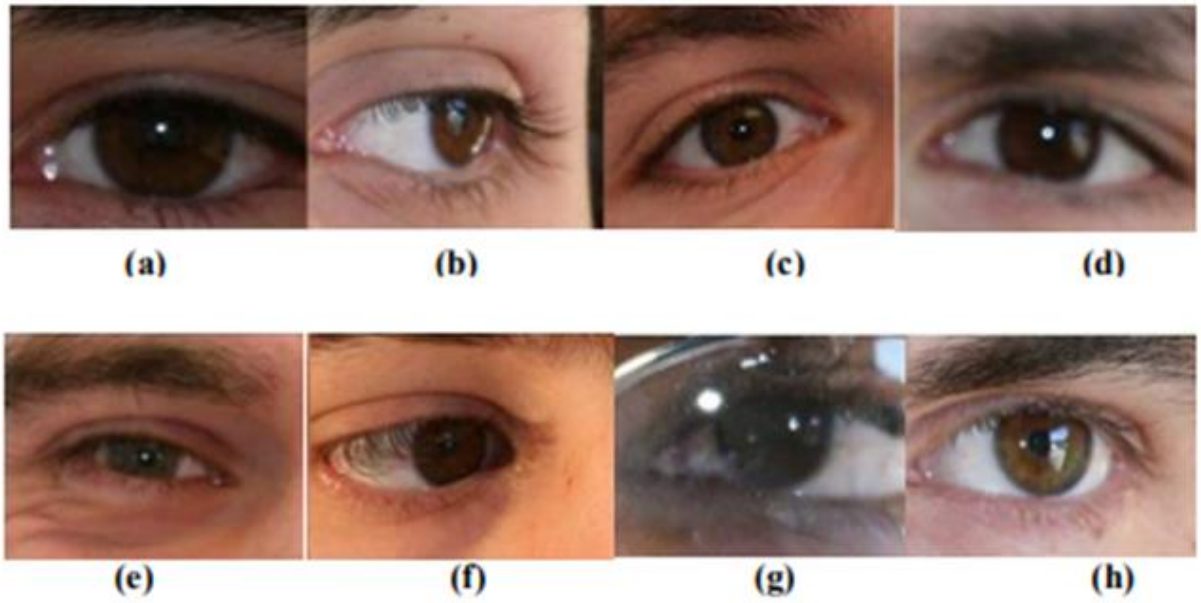


Fig. No. 3 (a) Illumination is low, (b) angle in-proper (c ) Movement
(d) Blur (e) Eyelids noise (f) Eyelash noise
(g) Noise with glass (h) Reflections

3**Iris recognition procedure**

A biometric recognition system working using iris is mainly considered in five stages:

1. Capturing image of eye
2. Segmentation
3. Normalization
4. Extracting features
5. Enrolment / verification

3.1 **Capturing image of eye**

The picture is caught byutilizing a gadget in VW or NIR by a person or automatically. In manual methodology the camera position is adjusted to get the iris by the user, and it particularly depends on the camera used for capturing purpose, the distance selection even differs with the choice of the camera. In



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the robotized strategy the camera [9]automatically detect the iris from the person though located far from the subject and is user comfortable.

### 3.2 **Segmentation**

Depending on the light source's orientation brightness, for finding suitable iris boundaries it must be improved, noise-removal techniques are applied[8]. Exact circles are pointed and eyelids and eyelashes disturbances were segmented.

### 3.3 **Normalization**

The variation arises while capturing the Irises for different people and also for the same person due to some factors. To extract the common features under different scenarios this phase is useful.

### 3.4 **Extracting features**

Between pupil and sclera the iris resides. Maximum noise with the eyelid or eyelash is possible in the upper region. The bottom region of the pupil, on the other hand, is rarely influenced by eyelids or eyelashes. Different approaches to iris recognition can extract the features of the iris. Here iris image is turned into a unique representation using some concepts. These characteristics are preserved as Iris code in database for next step.

### 3.5 **Enrollment or Verification**

Here contains two approaches, during enrolment for an iris image a template code in binary form is measured and stored in the database for later use. During verification process again after capturing the image and generating the code it is matched with the database code to make the person authorized or un-authorized.

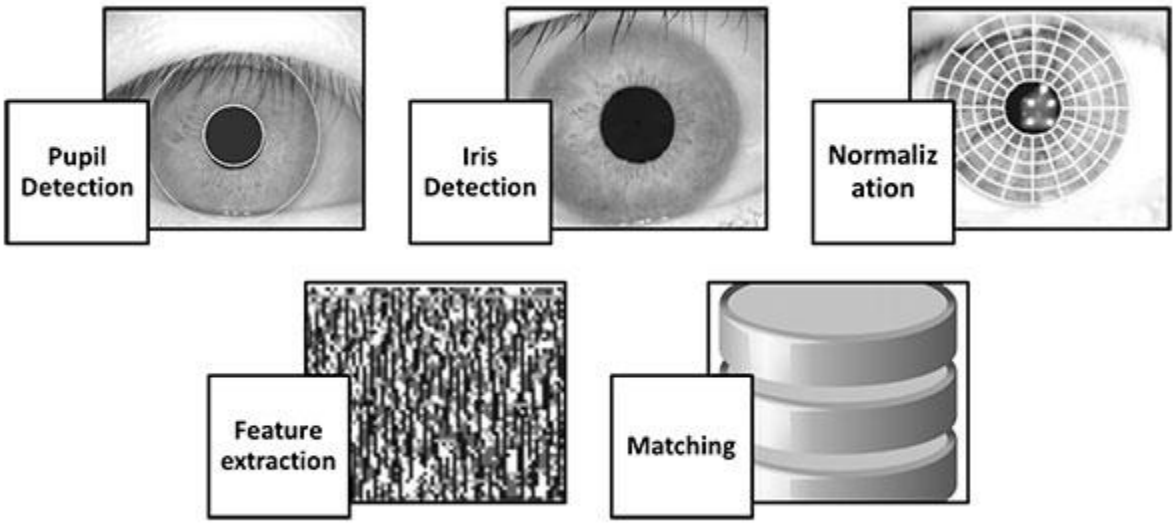


Fig. No. 4Working of Iris recognition system



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## 4**DATABASES**

The robustness of segmentation algorithms was assessed by using different private or public available databases.

### 4.1 **Literature review**

Early iris recognition research used their own created databases by research organisation. When using the UAE database, John Daugman produced results using CASIA v. 1 [1], released in 2003, was the first publicly available dataset.Since then, the CASIA database became often used baseline for iris recognition methodology assessment. With the growing popularity of iris identification in a variety of applications, there has been a demand for more benchmarks. Each data set usually makes use certain properties which are exclusively divided into two groups. One is Intrinsic considers characteristics that are built into acquisition framework. The wavelength at which the iris is collected, size etc. The other is extrinsic, have nothing to do with technology and usually have something to do with the use case. For example, the effects of ageing, photographs taken in unrestricted situations.

### 4.2 **Databases measuring metrics**

Few properties are considered here that makes the databases as useful resource for conducting tests include:

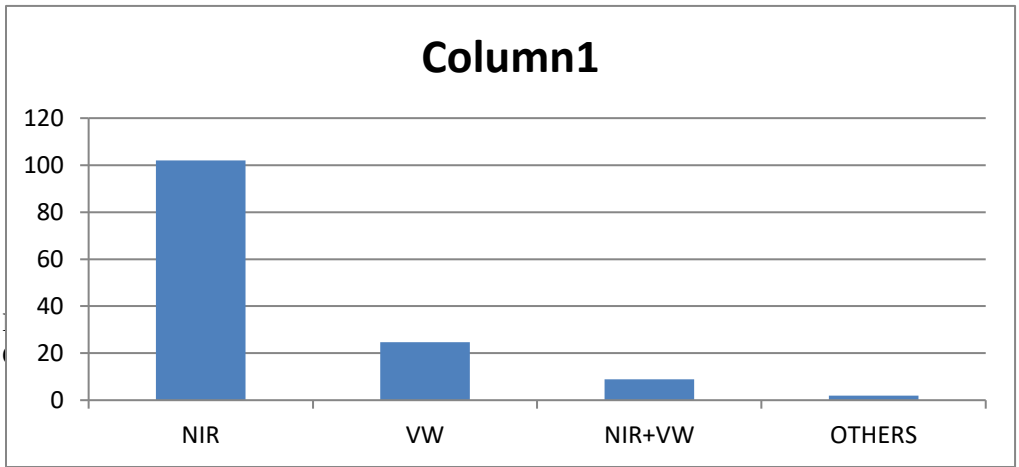
1. Lifespan - databases have existed for a very long period. The CASIAIris-V1[10] database, for example, is the most mentioned database and has been constantly available since its inception in 2003.

2. Access restrictions - Publicly available datasets that do not need researchers to sign a license, such as the UPOL iris dataset, is more popular. A license is necessary for access to a few databases in order to conduct research.

3. Robustness - The amount of subjects and photos in a dataset also has an impact on its popularity. In order to facilitate statistically[22] relevant research, a dataset must have more samples. More observations on databases are far more helpful.

4. Durability –This feature specifies when the datasets are available.“The CASIA-Iris-V1 dataset was the first publicly available iris dataset, followed by the UBIRIS v.1 dataset, which was the first database to offer unconstrained imaging, and the UPOL database[24], which was the first to feature high-resolution visible-spectrum images”.[6]

### 4.3 **Databases available based on acquisition framework**




As we know for capturing the iris image if VW[16] is used reflections cannot be avoided and also

can use NIR. The iris can also be capture using VW+NIR and also the other techniques used. In others include non visible and non NIR spectrum like near ultraviolet of thermal spectrum.This graph shows the contribution of different wavelengths used for capturing the image of the eye.

Fig No. 5 Different wavelengths contribution for capturing iris in different databases.

## 5. PUBLICLY AVAILABLE IRIS DATABASES[4]

### 5.1 CASIA

"The Chinese Academy of Sciences - Institute of Automation"[17], has created the first openly available iris database for academics. They created the CASIA picture database after concluding that there was a dearth of information for research.

CASIA –Iris V1 iris repository used 108 eyes to capture 756 images, resulting in 108 classifications. Seven photos are acquired for each eye in sessions. This version's photos were obtained with an iris camera created from scratch and eight circularly fitted BIR 850nm illuminators[18].

CASIA – Iris V2

There are 2400 photos in this database, separated into two subsets acquired by individual devices. The first 1200 photographs were obtained using an OKI Irispass-h device, and the last 1200 photos were recorded using a Chinese Academy of Science-developed CASIA-Iris cam. Each iris image stored in bit map image format with 640*480 resolution.[20]

CASIAv3

This is the first time noise factors have been included in a CASIA database. "It has a maximum of 22,034 iris scans from 700 people. The database creation is split into three sections. The Interval data subset contains 2,639 photos with extremely rich texture taken at a close range and illuminated by an array of LED NIR light sources; all images are saved in jpg format with 320*280 dimensions.The Lamp subset



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comprises 16,212 image data with a visible light on-off factor, which causes pupil dilation and non-linear deformation in the collected photos; files are saved in jpg format with a dimension of 640*480 pixels.Last, the twins data subset, which comprises 3,183 photos taken from 100 pairs is stored in jpg format with 640*480 dimensions".[10]

CASIAV4

Early identification systems dealt with iris photographs recorded with human participants under certain strict constraints. Whereas CASIA-Iris V4, database that holds poor quality photographs because of acquisition on move in 3 groups. First is referred to as CASIA-Iris Distance. The iris photos in this collection were taken from a distance of 3 metres although the subject was moving. There are 2576 photos in the database, each having 2352*1728 pixels resolution. "The CASIA-Iris-Thousand dataset uses an IKEMB-100 dual sensor with a user-friendly environment, and the output image displays texture as "what you see is what you get"[19]. The bounding box is an eye configuration that instructs human beings to alter their postures in order to obtain sharper images. There are 20,000 photos in this database. Next collection, CASIA-Iris-Syn, holdssynthesized pictures of count ten thousand from CASIA-Iris V1 with a resolution of 640*480.

**5.2UBIRISV1IRIS**D**ATABASE**

In the year 2004 this database was released. The environmental setup for capturing images was well set and as the subject just positions eye at the sensor the image is captured. This dataset provides photos acquired from 241 people during group of two semesters in the visible spectral region. Nikon E5700 cameras with E5700v1.0 technology, 0.71 mm maximum aperture, 4.2F-Number, 1/30s extraction time, RGB colour format, and ISO-200 ISO performance.The acquired image is 1,704*2,560 pixels in size, with a vertically and horizontally resolution of 300 dpi and a depth of 24 bits, stored in jpeg format. In two sessions, a total of 1,337 photographs were acquired. With a value scale of high, moderate, and poor, the images were divided into three parameters: focusing, reflections, and noticeable iris.

**UBIRISV2 DATABASE**

"UBIRIS.v2 iris database, and that is a multisession iris database that incorporates photographs collected at a range of 4 to 8 metres, on the move, and lighted with a visible wavelength. Introduced by the University of Beira in the year 2010. The successor version was made available with a VW framework. The Canon EOS 5D sensor was utilised, with a shutter speed of 1/197, a focal length of 400mm, 800 x 600 pixels, with 72 dpi vertical/horizontal resolution and 24-bit colour depth, and is saved as a tiff file. Unlike UBIRIS.v1, UBIRIS.v2 photos were taken from a distance of 4 to 8 metres"[13]. For capturing the users move with a limit of speed lower to normal walk. They were forced to turn their heads as a result. There were 261 individuals who contributed 522 (left and right) irises, resulting in 11,102 pictures. The photos were taken in two separate sessions, separated by two weeks, just like UBIRIS.v1. As the images are captured while asking the subject to move it contains many noise factors like focus was not good, eye rotation observed, blurriness, disturbances due to eye-lids and eye-lashes, glasses, hair, reflections etc, this made the database suitable for testing algorithms in unconstrained environments.



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5.3 **Bath Database**

The iris picture archive at the University of Bath (BATH) is steadily developing, with around sixteen thousand iris photos obtained from 800 eyes of 400 subjects[20]. It's the result of an attempt to create a "excellent iris image repository." The majority of the database consists of photographs shot by University of Bath students and staff members. Images taken with a professional camera possess good quality making it less suitable for testing.

5.4 **Iris Challenge Evaluation (ICE)**

This is a competition that aims to assess the precision of iris identification. First the researchers faces challenge issues then will be part of large-scale and independent projects[14].The ICE database has 2954 photographs, with the amount of images per subject varying. Its photos, like those in the other public iris datasets, were shot with quality in mind and clearly replicate assess client satisfaction in the image capture contains noise factors as importance was given to user rather than support from the user.

5.5 **MMU Database[11]**

A tiny data collection of 450 iris images has been created by the Multimedia University. LG Iris Access 2200 is a semi-automated device that works between the range 7-25 cm. MMU2 with 995 photos by a panasonic camera[25] was released. The iris photographs were taken by 100 volunteers of various ages and countries. The pictures, evidently quite uniform, contain eyelids and eyelashes noise.

5.6 **UPOL** (The University of Palacky and Olomouc)

Its photos are unique in that they were collected using an optometric infrastructure (TOPCON TRC50IA), making them exceedingly high-quality and ideal testing in entirely noise-free conditions. There are 384 photos in the repository, collected by both eyes of 64 people contains homogeneous pictures[12]. These qualities clearly render this database unsuitable for non-cooperative studies.

5.7 **WVU**

Created by the West Virginia University 5 and contains 1852 pictures from distinct eyes of 380. The acquisitions equipment employed an hand held OKI IrisPass-H device. [21]The images contain a variety of noises. The most typical source of noise in natural light imaging situations. This is a newer, noisier iris image database from which the UBIRIS database arose.

5.8 **IIT Delhi Database**

The majority of the Database subject were students and staff of IIT Delhi. During the months of January to July 2007, this database was collected in the [20]“Biometrics Research Laboratory using JIRIS, JPC1000, and a digital CMOS camera in indoor environment with precision of 320*240 pixels”[15]. The database currently accessible consists of 224 bitmap (*.bmp) photos submitted by 224 individuals. All of the subjects in the database are between the ages of 14 and 55, with 176 and 48 of male and female gender.

**5.9 Introduction to a newly generated dataset**

**(a) Iris Image acquisition Framework:**



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Presenting my experience on the creation of a newly generated local dataset that can serve as a publicly accessible open database of iris photographs for the purpose of conducting research. I've done my best to create local database for the purpose of research.

(b) **Camera:**

Iris is acquired using a camera with the help of the subject. A set-up was devised to accurately locate iris in a short amount of time while also providing sufficient features. Between the pupil and the sclera of the eye the iris resides. After utilizing the gadget for acquisition a total of 788 pictures were collected for both eyes. The subject count for this collection of images is fifty. The age groups that were taken are from eight years old to forty years old. The both gender images are available in the database.The database provides a few photos with noises such as reflection, eyelids, eyelashes, and eye blink. However, this dataset can be utilised for biometric research employing iris for authentication. The photos are in .bmp and have a resolution of 240*480 pixels.

**(c) Image of an eye:**

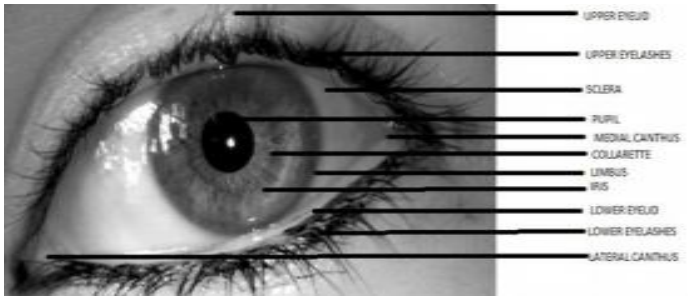


Fig. No. 6 Eye image

| S.No. | Part of the eye | Description |
|---|---|---|
| 1 | Eyelids | secures the human eye with a light slender |
| 2 | Eyelashes | Contains hair at the edge of eyelids, act as a shield |
| 3 | Sclera | Front of eyeball visible white layer of the eyeball |
| 4 | Pupil | Allows light to strike retina |
| 5 | Retina | Acts as “coat”, the images send to brain for visual insight. |
| 6 | Medial/Lateral Canthus | The meet point of upper and lower eyelids |
| 7 | Iris | Is a stable unique pattern inside the eye |



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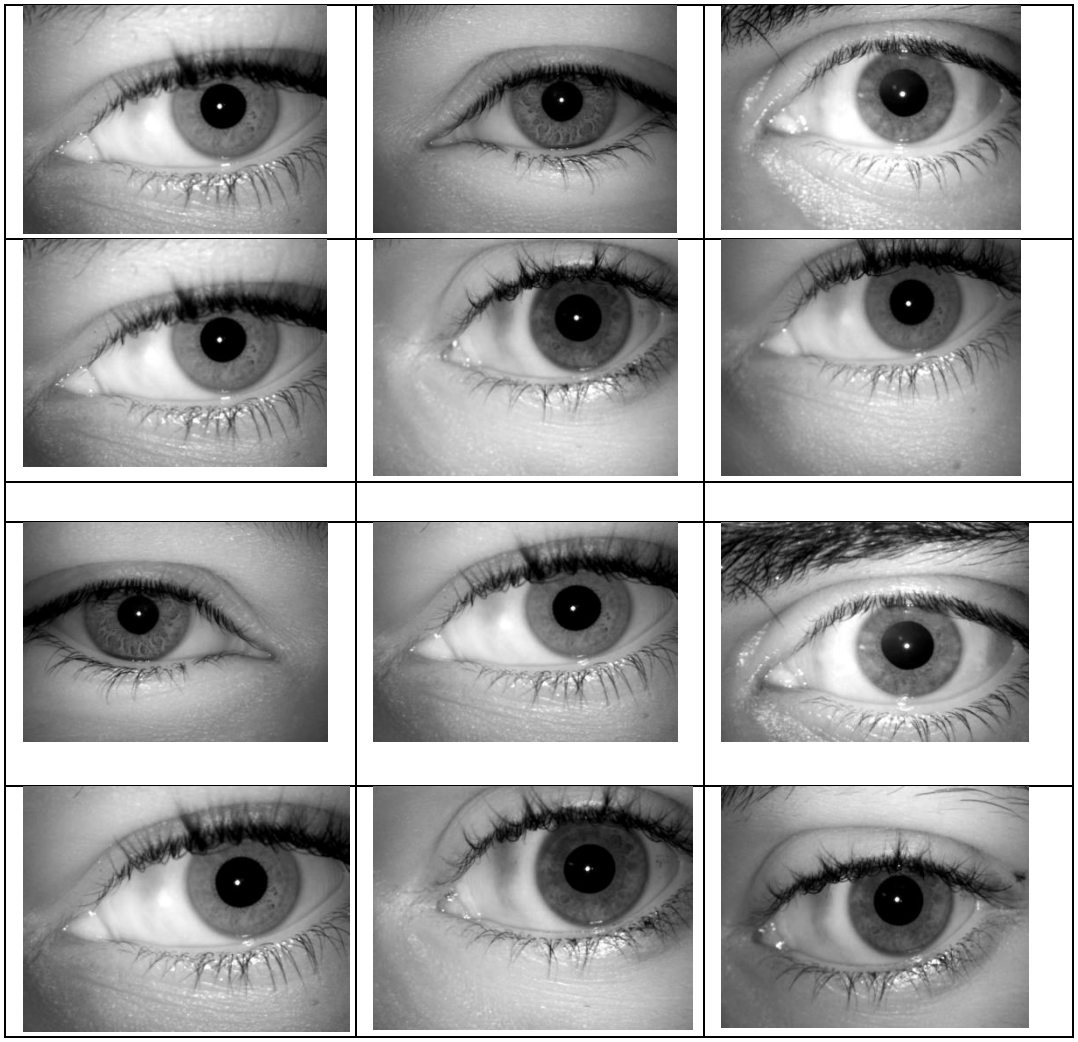
| | | |
|---|---|---|
| 8 | Collarette | The middle layer between the brighter and lighter parts of iris |
| 9 | Limbus | Border between cornea and sclera. |

Table 1. Parts of eye and its functionalities

NIR illumination used for capturing image, distance at which the images were collected are from 5cm to 10cm, the sensor used for capturing is Irishield[7].

D. Sample Images:





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### 5.9 COMPARISION TABLE FOR THE AVAILABLE DATABASES AND NEWLY GENERATED DATASET

| Database | CASIA V1 | CASIA V2 | CASIA V3 | UPOL | BATH | UBIRIS V1 | UBIRIS V2 | MMU | WVU | Newly generated dataset |
|---|---|---|---|---|---|---|---|---|---|---|
| Total images | 756 | 1200 | 22034 | 384 | 1600 | 1187 | 1000 | 450 | 1852 | 788 |
| Wavelength | NIR | NIR | NIR | VW | NIR | VW | VW | NIR | NIR | NIR |
| Varying distance | NO | NO | NO | NO | NO | NO | YES | NO | NO | NO |
| Acquisition device | CASIA camera | CASIA camera | OKI Irispass-h | TOPCON TRC50IA | ISG Lightwise 3-s-1394 | Nikon E5700 | Canon EOS 5D | LG EOU2200 | OKI Irispass-h | IriShield |
| Observation | Previous filling of the pupil region turns segmentation easier | Subset of the subsequent database version | Manual pupil filling is the difference with version 1 | Noise free images under high constrained environment | Contain eyelids and eyelashes not suitable for iris testing | Several reflection observed | Several reflection observed | Noises avoided | Contains blur, off-angle and occluded images | Noise free images undue constrained environment |

Table 2: Comparison table with the existing databases

## 6. Discussion

Available databases have improved during the past couple of years, even though there are still flaws to be worked out. The main constraint is their accessibility, which means that many of the datasets are only available for a limited period of time.On data sets created in the last eight years, the effect of ageing has been explored. The general data protection standards, which safeguard people's privacy, have created a fairly young challenge. Similar restrictions may be enacted in the future as a result of recent concerns



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involving the sharing of personal data.Many datasets also lack of sensing kind, spectrum range, length etc. Furthermore, many databases provide only photos in compressed format, decreasing the amount of data captured by the sensor. Because of the diversity in visualizing options for specific research topics, a full explanation of the methodology and capture setup is essential. While publicly accessible cameras disclose its characteristics by default, many aspects of custom hardware are hidden from other database developers. In iris identification research, synthetic picture datasets have not gained favour.

## 7. Summary

In terms of number of samples, gadgets employed, pixel density, and other factors, accessible datasets are almost uniformly heterogeneous. Because of this variety, there is a database available for many research issues, but that's not always straightforward for scholars to choose the optimal alternative. The databases from CASIA are the most popularly used though not recommended because of noises followed by database created at University of Beira Interior. Furthermore, a license is required to get these datasets. It's best to use datasets developed for specific challenges for comparative research because they provide standardized evaluation methodology. In addition to CASIA and UBIRIS, there are so many publicly accessible biometric datasets (including human iris data). The afore mentioned two sources are highly suggested. It is a significant barrier for new researchers to choose among accessible databases, thus they will instead develop their own database, as described in this work. A productive resource should assist users in coming up with new research outcomes.

## 8. Conclusions

Biometric records are designed to aid in the assessment of biometric processes. The public databases, which serve as references, allow for achieving objective and research. Most of those databases labelled readily accessible are not accessible due to variety of factors. The existing iris image datasets were reviewed in this article. Latest datasets are constantly being produced, while few are becoming unreachable. This article covers the basics of iris recognition, as well as uses and the technique for iris biometric security. During the iris identification process, a brief explanation of each phase is defined. Various databases are listed, along with their features. Also presenting a new publicly accessible database that would be used to identify and authenticate people. The researchers can use the provided photos to establish an appropriate verification system.

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[13] Ubiris Iris Database: http://iris.di.ubi.pt/

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## Authors Profile

**NI,** Research Scholar in VTU, Belgaum, and Karnataka, India. She is working as an Associate n the Department of Computer Science and Engineering, Mother Theresa Institute of and Technology, Palamaner, Andhra Pradesh. She has 10 years of experience and has 2 research papers in journals.

**Dr. G. VASANTH** was obtained a Ph.D. from SK University, Anantapur, A.P. He is working as a Professor & HOD in the Department of Computer Science and Engineering, Government Engineering College, KR Pet, Mandya District, Karnataka. He has 20 years of experience. He published more than 72 research papers in journals.

**Dr. G. N. KODANDARAMAIAH** was obtained a Ph.D. from JNTUA University, Anantapur, A.P. He is working as Professor& HOD in the Department of Electronics and Communications Engineering, Kuppam Engineering College. Kuppam. He has 22 years of experience. He published more than 90 research papers in journals.



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