



# **Working with Biometric Devices and Data Quality**

**UIDAI**

**Unique Identification Authority of India**

**Version: 2.1.0.0**

**Release date: 13-12-2012**



## Preface

This training manual introduces you to various types of devices that will be used by Enrolment Agencies during the enrolment process. The devices have been divided into two categories, Biometric and Non-Biometric. This module covers the devices in terms of function, type and operations and most importantly the factors that will help you ensure that the data captured is of the best possible quality.

### Target Audience

- Enrolment Operators
- Enrolment Agency Supervisors
- Technical Support staff

### Dependent or Related Modules

There are no directly related or dependent modules, but Enrolment Agency staff deployed at Enrolment centres should be familiar with the details given in this book.



## Table of Contents

<b>Introduction.....</b>	<b>3</b>
<b>Objectives .....</b>	<b>3</b>
<b>Hardware Devices.....</b>	<b>3</b>
Devices Used to Capture Biometric Data.....	4
Facial Image.....	4
Digital Camera.....	4
Steps to Capture Facial Image.....	5
Guidelines for Capturing Facial Image.....	7
Fingerprints.....	12
Fingerprint Scanner.....	12
Steps to Capture Image of Fingerprint.....	12
Guidelines for Fingerprint Scanning.....	16
The Iris.....	22
Iris Capturing Device.....	22
Steps to Capture Image of Iris.....	24
Guidelines for Iris Scanning.....	26
Non-Biometric Devices.....	27
Computer.....	27
Desktop.....	27
Laptop.....	28
Software.....	29
Printer.....	29
GPS Dongle.....	30
Storage Devices.....	30
CD.....	30
DVD.....	30
Pen Drive.....	31
Portable Hard Disk.....	31
Scanner.....	31
Photocopier.....	32
UPS.....	32
USB Hub.....	33
Electrical Generator.....	33
<b>Summary .....</b>	<b>34</b>



## Introduction

To overcome the deficiencies of systems introduced for identification of individuals, the entire approach of Aadhaar is based on technology.

Aadhaar avoids errors and duplications which was the bane of earlier systems, by linking an individual's identity to biometric information which is unique to the individual. Various devices and software are used to capture and store biometric information.

This module will introduce you to the devices which are used in gathering both, demographic and biometric information at an Aadhaar Enrolment Centre. Biometric data will be captured using biometric devices and the Aadhaar Enrolment Client software.

It will also introduce you to the other devices which help in storing the captured information and in generating the necessary documents to complete the enrolment process and transfer the information to the CIDR.

Most importantly this module will focus upon the need for excellent quality of biometric information and how to get the best of the devices used.

## Objectives

At the end of this module, you will learn about:

- Biometric data
- Different types of Biometric devices
- Process of capturing image of face
- Steps involved in capturing fingerprint data
- Handling the iris image capturing device
- Non-biometric Devices in the enrolment process

## Hardware Devices

The hardware devices used for the enrolment of resident can be classified into two categories:

1. Biometric Devices
2. Non-Biometric Devices

**Biometric Devices** are used to capture biometric details such as fingerprints, iris patterns and facial photograph for each Enrollee. These devices are as follows.

1. Fingerprint Scanner
2. Iris Capturing Device
3. Digital Camera

**Non-Biometric Devices** are used to enter, read, store, print, scan and photocopy the data. The devices such as UPS and electric generator are used to deal with power related issue. These devices are as follows.

1. Computer
2. Printer
3. Storage Devices (CD/DVD/Pen Drive/Portable hard disk)

4. GPS Dongle
5. Scanner
6. Photocopier
7. UPS
8. Universal Serial Bus (USB) Hub
9. Electrical Generator

You will learn about these Non-Biometric Devices later in this module.

## Devices Used to Capture Biometric Data

Biometrics is used to establish the identity of an individual based on the physical, chemical or behavioral attributes of the person.

**Table 1: Biometric Devices and their uses**

Biometric Devices	Uses
Digital Camera	Facial image capture
Iris Capturing Device	Image of the Iris
Fingerprint Scanner	Fingerprint capture

## Facial Image

Photographs of face are commonly used in various types of identification cards and it is widely accepted as a biometric identifier. Face recognition systems are the least intrusive type of biometric sampling system, requiring no contact or even awareness of the subject. The facial biometric can be extracted from photographs, videotapes or other image sources.

A face needs to be well lit, using controlled light sources, for automated face authentication systems to work well. Facial information is not adequate for ensuring de-duplication. Even a smile can alter the features sufficiently and affect the system. Hence, neutral facial expression is required for correct verification. It is used for verification purposes but does not comply with the accuracy level required for authentication.



**Figure 1: Digital Photograph**

Figure1 shows the digital photograph captured using a digital camera for face authentication.

## Digital Camera

A Digital camera is used to capture facial photograph in a digital format. It is connected to a laptop/desktop computer through the USB (Universal Serial Bus) port. The digital camera consists of an auto-focus lens and the mounting base. The lens is able to focus the person's face automatically. The mounting base helps to fix the camera on the laptop/desktop. It displays images immediately after capturing them.

A Digital Camera has the following specifications:

- **Resolution** – A photograph is made up of a large number of 'dots' or 'pixels'. Resolution depends upon the number of 'pixels'. Higher number of pixel means greater detail view and therefore better quality of photographs.

- **Aperture** – It is the size of the opening which permits light to enter the camera and fall on the image sensor. The aperture size can be adjusted manually or automatically depending upon the type of camera. The adjustment will depend upon the amount of light falling on the person or the object being photographed.
- **Shutter Speed** – It determines the time duration for which the aperture is open.
- **Focal Length** – It is the distance between the lens and the surface of the image sensor. The focal length determines the magnification or 'zoom' of the image.



Figure 2: Digital Camera

### Steps to Capture Facial Image

Enrolment Operator should capture the facial image of an Enrollee or a Resident by using a digital camera.

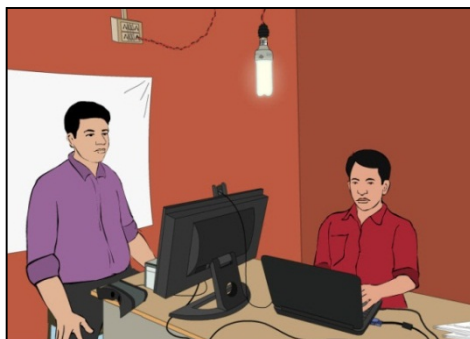


Figure 3: Position of the Enrolment Operator and Enrollee

#### Exercise 1: Answer the following.

1. In Figure 3, the person on the left is the \_\_\_\_\_, while the person on the right (seated) is the \_\_\_\_\_
2. Can you identify the Camera?
3. What is the need for the light bulb suspended above the Enrolment Station?
4. The laptop has a screen, so why have another monitor?
5. What is that white screen behind the person who is standing used for?

The steps to capture Face Biometric Data are as follows:

1. **Checking the Enrollee's Position:** The photograph should be taken with the resident directly facing the camera. No head rotation or tilt is acceptable.
2. **Adjusting the Camera:** It is advised that the Operator should adjust the camera instead of changing Enrollee's position for the right distance and posture.

3. **Checking the Enrollee's Expression:** The Operator must ensure that the Enrollee has a neutral expression. For example, the Enrollee should not be smiling while being photographed. During the capture the resident's mouth should be closed and both the eyes must be open.
4. **Checking the shadow/reflection:** There should be sufficient light to get a proper image of the face. The Operator must ensure that there is no shadow on the Enrollee's face and no reflection in his/her eyes. Additional light source should be placed in front of the Enrollee so that there are no shadows under the eye.
5. **Checking the visibility of iris and pupil through Eye Glasses:** If the Enrollee is wearing glasses, the photograph must be taken with the glasses on. But the Operator has to ensure that the iris and the pupil are clearly visible and that Enrollee is not wearing dark/coloured sun glasses.
6. **Manually Capturing the photograph:** The Operator has to click a button in the Aadhaar Enrolment Client application software to capture the facial image. There is no auto capturing mechanism in case of photograph.

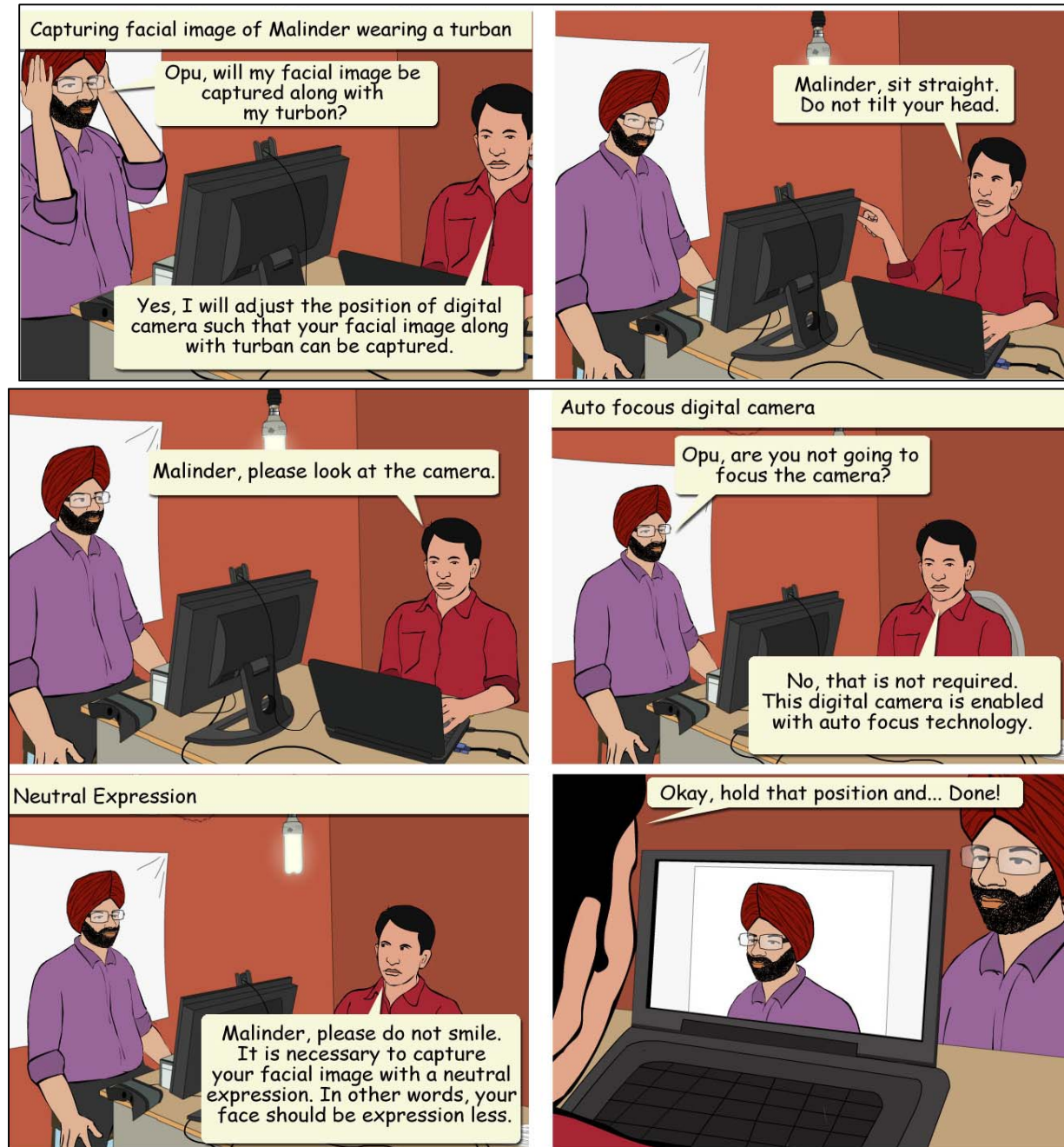
### Exercise 2: Facial Image

- List the steps to capture the facial image of an Enrollee.
- Choose the correct statement.
  - a) Operator should adjust the position of digital camera instead of adjusting position of Enrollee.
  - b) Operator should adjust the position of Enrollee instead of adjusting position of digital camera.

### Scenario 1: Capturing the photograph of a person wearing a turban







### Guidelines for Capturing Facial Image

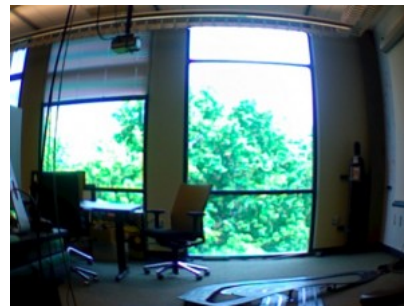
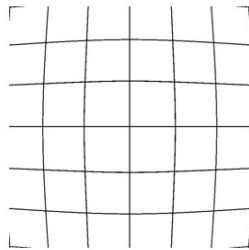
1. The digital camera used for capturing the image is enabled with auto focus technology. So it does not require any focusing adjustment by the Operator.
2. The Operator must ensure that the output image is not blurred because of jerks or movements of the camera. The image should neither be too dark nor too bright.
3. If there is insufficient light due to low voltage, then Operator can ask the Enrolment Agency Supervisor to use generator backup.



If the lighting condition is not sufficient in a particular room, then Operator can ask the Enrolment Agency Supervisor to shift the Enrolment Station to a different room having proper light.

In either of the above conditions, Operator should not use flash light to capture a photograph.

4. It is preferable to place the backdrop (a white background behind the resident) against an opaque wall/partition.
5. The Operator can capture facial image of a resident wearing a turban or scarf or any other garment. He/she must ensure that the entire face of the resident is visible. The Operator has to adjust the position of the camera to get the full coverage of residents face.
6. Use of accessories that cover any region of the face is not permitted. However, accessories like eye patches due to medical conditions are allowed.
7. While enrolling a lady resident, the lady volunteer should help the resident wherever necessary
8. In case the Enrollee is a child, it may be allowed to sit on its parent's lap. But the Operator must ensure that parent's face is not captured along with the child's face. The background may get rejected due to non-white screen in this case but two faces should not get captured in one picture.
9. The image should not contain any kind of radial distortion i.e., distortion of a straight line. The radial distortion is illustrated in the following figures, Fig. 4.



**Figure 4: Radial Distortions in an Image**

10. The Operator must ensure that the Enrollee has a neutral expression i.e., unsmiling, mouth closed and eyes open.
11. The Operator must ensure that there is proper and equally distributed lighting and that there are no shadows on resident's face and eyes.
12. The eye glasses of resident should be clear and transparent so that both the iris and the pupil are clearly visible. If Enrollee is wearing tinted glasses then the direct and background lighting sources should be tuned accordingly.

### Exercise 3: Remember...

Neha has come to Enrolment Centre to enroll herself. Kiran is a new operator at the Enrolment Centre what are the things he should keep in his mind while capturing the facial image.

Scenario 2: Burkha Clad Lady - Facial Image Capture





**Exercise 4: Issues related to Photography**

What are the various issues tackled by Supriya while photographing Fatima? Tick on the list given below:

- Issues related to focusing
- Issues related to light
- Issues related to resident's facial expression
- Background image problems
- Resident position problems
- Cultural issues



Scenario 3: 5 Year Old



Exercise 5: Issues related to photographing a child

What are the various issues tackled by the operator while photographing Chintu? Tick on the list given below:

- Issues related to focusing
- Issues related to light
- Issues related to resident's facial expression
- Background image problems
- Resident position problems
- Cultural issues

## Fingerprints

The lines that you see along each of your fingers, caused by raised areas of the skin, can leave their impressions on certain types of surfaces. Such an impression is called a fingerprint.

Fingerprint is used as one of the most traditional methods for identifying an individual. Fingerprints can be easily scanned through digital fingerprint capturing device, also known as Fingerprint Scanner, with a low-cost and an effective method. The images of fingerprints are scanned through a transparent glass plate, called the Platen, on which the fingers are placed. The resulting image is stored in the computer.



Figure 5: Fingerprint Samples

### Note

The appearance of a person's fingerprint and therefore the digitization process depends upon,

- Age - Fingerprints of a person may change as a person grows old.
- Presence of foreign matter on the fingers – like oil, dust, mud
- Cuts and wounds on the fingers
- Prominence of the patterns depending upon the occupation and the lifestyle of the person

## Fingerprint Scanner

At the enrolment station the fingerprints are captured through digital slap Fingerprint Scanner which is connected to a laptop/desktop computer through the USB port. It comprises of a flat glass plate known as platen which helps to capture the fingerprints when fingers are placed on it while the indicators guide the user to keep the fingers in proper place. In case of Slap Fingerprint Scanner, all the four fingers of the hand are captured, at a time. The fingerprints of both the thumbs are then captured, simultaneously.



Figure 6: Slap Scanner for Fingerprint

## Steps to Capture Image of Fingerprint

The Enrolment Operator should obtain the fingerprints of all five fingers of each hand i.e., ten fingers of two hands. There are certain procedures which need to be followed if the person has more or less than ten fingers.

The following steps illustrate how to capture the fingerprint image of the Enrollee (Resident):

1. **Left Hand Fingerprint:** Firstly, the fingerprints of the four fingers of the left hand except the thumb are captured simultaneously. The fingers to be scanned are illustrated in the Figure 8.

The Operator would ask the Enrollee to place the four fingers of the left hand on the platen and to apply some pressure with the right hand to have good contact with the surface.



Figure 7: Finger position on the platen



Figure 8: Figure showing the fingers to be scanned

2. **Right Hand Fingerprint:** Secondly, the fingerprints of the four fingers of the right hand except the thumb are captured simultaneously. The fingers to be scanned are illustrated in the following Figure 10.

Then the Operator would ask the Enrollee to place the four fingers of the right hand on the platen and to apply some pressure with the left hand to have good contact with the surface.



Figure 9: Finger position on the platen



Figure 10: Figure showing the fingers to be scanned

3. **Two Thumb Prints:** Thumbprints of both the hands are captured simultaneously. The thumbs are scanned as illustrated in the following Figure 12.

The Operator asks the Enrollee to place the thumbs of both the hands on the platen and to apply some amount of pressure to have good contact with the surface.



Figure 11: Thumb position on platen



Figure 12: Scanning of Thumbs



The Operator must ensure that the Enrollee uses the maximum area of the surface to get a proper scanned fingerprint image.

4. **Auto capture:** The application software automatically captures the fingerprint when the fingers are placed on the platen. It does not require any click of the mouse or pressing of any button.

When the scanner indicates successful grab of the image, the application software captures the image of the fingerprint. Unless the scanner shows successful indication for each finger the image is not captured by the software. If the fingerprint does not get captured automatically then the Operator has to capture fingerprint manually. The software allows forced or manual capture by clicking Force Capture button. This is possible after at least one failed attempt during automatic capture.

5. **Visual Checking:** Finally, the Operator should check the images of the fingerprints visually in the application software for quality and typical problems.

In case there are some problems, repeat the steps given above.

### Exercise 6: Fingerprinting

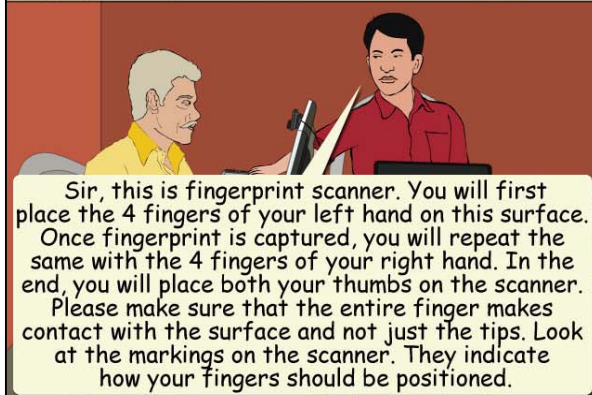
How will you know that the quality of the captured fingerprints is good?

[Hint: Have you used the Aadhaar Enrolment Client?]



### Scenario 4: Capturing the Fingerprints of a Senior Citizen

Fingerprint Capture of a senior citizen, Sengupta.





### Exercise 7: Do you know the fingerprint capture sequence?

Arrange the fingerprint capture in sequence.

- Capturing fingerprint of two thumbs.
- Capturing fingerprint of left hand fingers.
- Capturing fingerprint of right hand fingers.

### Guidelines for Fingerprint Scanning

- If the image of fingerprints for an Enrollee is not proper in spite of repeated attempts, the Operator should ask the Enrollee to wash his/her hands. The Operator can provide a wet sponge or towel available at the Centre.
- The Operator must demonstrate the way to place the fingers on the platen but he should not touch the Enrollee while demonstrating the process. The following Figure 13 demonstrates the procedure.

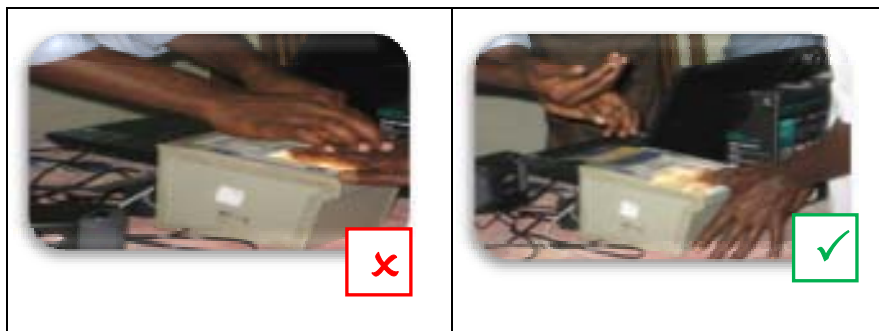


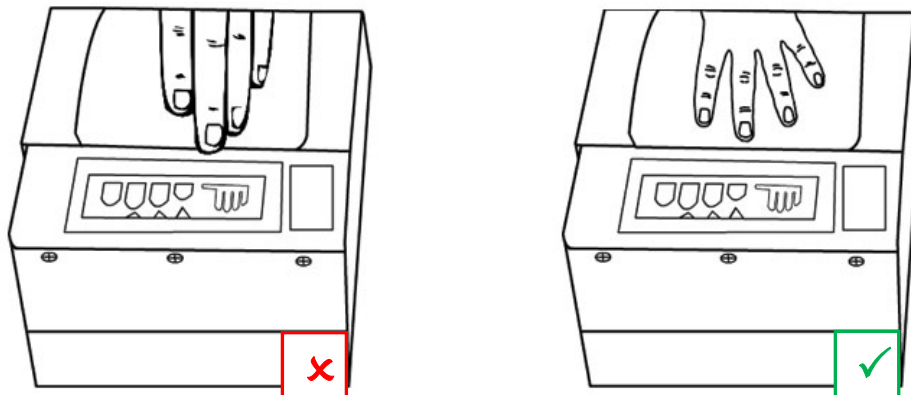
Figure 13: Helping the resident during Fingerprint scanning

The proper way of placing the fingers on the platen are illustrated in Figure 14.



**Figure 14: Correct way of placing fingers on the fingerprint scanner platen**

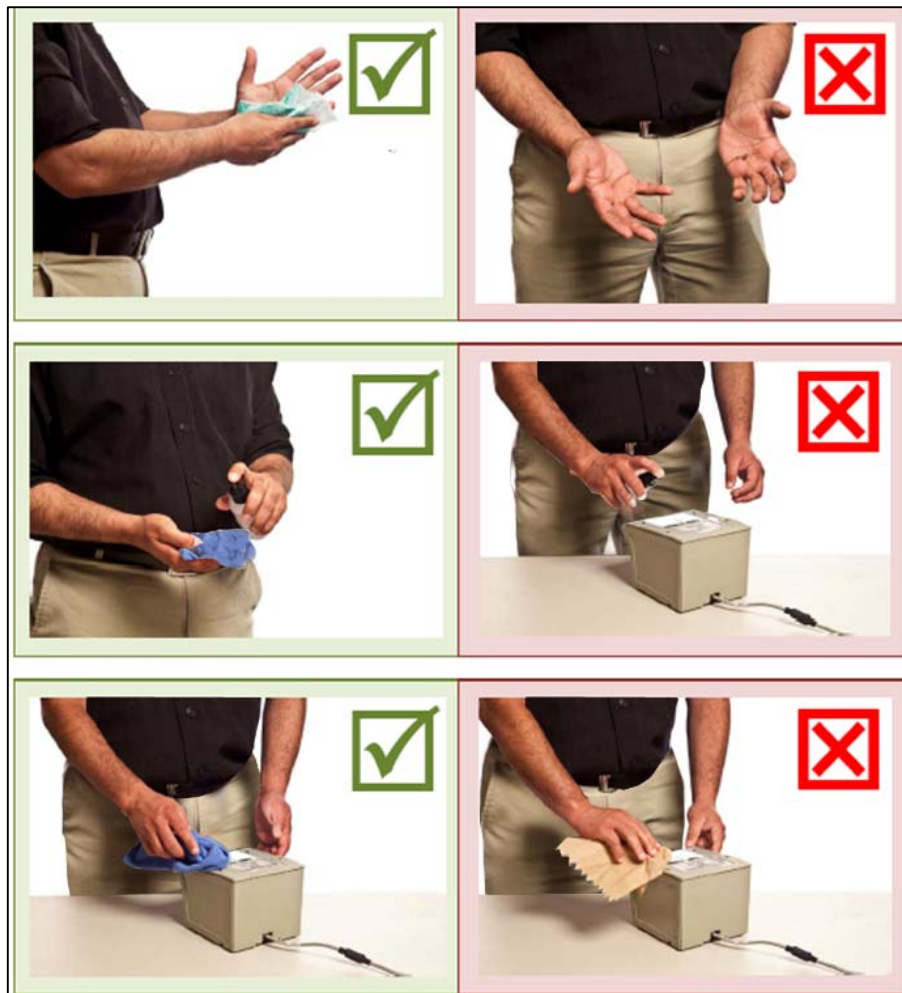
3. The Operator must ensure that the fingers do not touch the edge of the platen (glass surface of the fingerprint scanning device). There should be space between the fingers to capture the fingerprint image properly. No portion of the fingers should touch the edge of the platen as shown in Figure 15.



**Figure 15: Correct position of fingers on the platen**

4. The Operator should request the Resident to apply some pressure on the platen to increase the area of contact and thereby obtain the requisite image quality.  
For applying pressure, first the Operator has to rely on the efforts of the Resident. If he is not successful, the Operator may take the permission of the Resident and then assist him. If the Operator is enrolling a lady then he has to take the assistance of a lady volunteer present in the Enrolment Centre.
5. If the Enrollee/resident is unable to flatten his/her fingers on the platen, the enroller/Operator can assist the resident after taking his/her permission.  
If this is not successful, the Operator may try to obtain fingerprints to the extent that the Enrollee is able to flatten and place his/her fingers on the platen.  
The Enrollee can then be made to move to the next set of fingerprints of the other hand or the two thumbs.
6. In case the enrollee has *Mehendi* on her hands, the Operator should follow the normal procedure to capture the fingerprint image. In case of worn out ridges in Enrollee's hand, the Operator may ask to rub his/her hands to get the proper image of fingerprint.
7. The Operator must ensure that the fingers are placed flat and till the top joint of the finger is placed well on the scanner. There should be no direct light shining on the platen. Use the indicators on the fingerprint device for positioning of fingers. The fingers should be placed in right direction on the device.
8. The Operator should use lint free cloth to clean the platen periodically. The procedure for cleaning the device is illustrated in Figure 16.





**Figure 16: Cleaning the fingerprint scanner**

9. The Operator should periodically check the devices for scratches on the platen. During the time of enrolment the Operator should also check for out of focus or partial images of fingerprints getting captured.
10. Fingerprints are best captured in standing position.
11. In case the resident has additional finger(s), the Operator should ignore them and capture the main five fingers of each hand during the time of fingerprint image capture.

**Exercise 8: Knowledge check...**

List at least 5 points to be remembered while capturing the fingerprint of an Enrollee.

### Scenario 5: Capturing the fingerprint of a boy





### Exercise 9: Fingerprint Issues

What are the challenges faced by the operator while fingerprinting Boman? Select from the list given below:

- Child is unable to follow the operator's instructions
- Child's fingers are unclean
- Child's hands are excessively wet
- Child is unable to apply the required amount of pressure or force
- Child's fingerprints are not well formed
- Child's fingers are covered with *Mehendi*



## The Iris

The iris is a coloured and most visible part of human eye which surrounds the pupil. The iris controls the amount of light that enters into the eye. It is the ring-shaped region of the eye, bounded by the pupil and sclera on either side.

The iris has a distinct structure that forms a pattern which can be photographed. The patterns form randomly and are highly complex. The salient features of iris recognition and pattern matching are as follows:

- The patterns do not change with time except may be due to injuries.
- No two individuals' iris patterns are similar; not even those of an individual's left and right eye.
- Spectacles and contact lenses rarely affect the quality of image capture.
- This method covers a large number of people as compared with other biometric technologies.
- The comparison of patterns with existing patterns is the fastest.

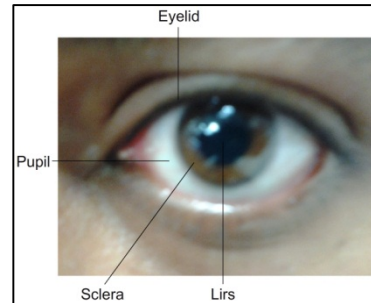


Figure 17: The Iris

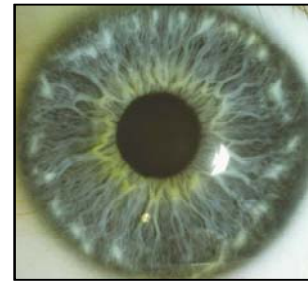


Figure 18: Iris Patterns

The iris is an inner part of our eye. Therefore the iris faces very little chance of damage. So it can be used as an 'always available' proof for verification for most individuals over their lifetime.

The capture of the iris image is the same as taking a regular photograph, except that it operates using the infrared light, nearly invisible to our eye. The iris capturing device captures the image of the iris and it generates an image which can be stored in a computer.

The iris is widely believed to be the most accurate biometric. Also the iris pattern of each eye is not correlated; so it gives two independent biometric feature sets.

The iris sample acquisition is done without physical contact and without much inconvenience to the person whose iris image is being acquired. Also, the capture time is very small.

## Iris Capturing Device

Iris Capturing Device is a biometric device. Two types of Iris Capturing Device are available, viz., Single Iris Capturing Device and Double Iris Capturing Device. Single Iris Capturing Device can capture any one eye at a time while Double Iris Capturing Device can capture both the eyes at a time. Based on make and model, these devices can be hand-held or tripod-held.

At the enrolment station the iris capturing device is connected with laptop/desktop computer through USB (Universal Serial Bus) port. No separate power supply is required to run this device. The iris capturing device gets power from the laptop/desktop computer through USB port.



Figure 19: Double Iris Capture Devices



**Figure 20: Single Eye Iris Scanner**

Based on the functionality, there are different types of Iris Scanner. They are as follows:

- Double Iris Scanner scans the images of two eyes at a time. The scanner is held by the Operator and he gradually moves the scanner towards the Enrollee's eyes. The iris is auto scanned when the scanner is sufficiently close to the eyes.
- There is another type of double iris scanner which is held close to the eyes. The scanner scans the iris one after another. But there is no need to move the scanner.
- Single Iris Scanner looks like a digital camera. This type of scanner scans one eye at a time. The scanner should be held by the Enrolment Operator and captures the image of one eye of the Enrollee at a time.

Iris Capturing Device scans the intricate patterns (as discussed in previous section) in the iris and produces a digital image. Most of the modern Iris Capturing Devices use infrared light, which is not visible to the human eye, to illuminate the iris without causing any harm to the eyes.

Based on make and model, these devices can be,

- Hand-held
- Tripod-mounted

Iris Capturing Device is a lightweight device. When the device is placed properly, it is able to automatically focus the iris. It can also adjust to various lighting conditions automatically.

It has a USB connector cable which connects the device to a computer. The device gets power supply from the computer through the same USB connector.

Iris Capturing Device is fast and accurate. It can capture picture automatically without any user intervention. But, its accuracy can be affected by the objects obscuring the eye. Also it may not be appropriate for persons having cataract.



**Figure 21: Iris image capture and resulting image**

## Steps to Capture Image of Iris

To capture iris biometric using Iris Capturing Device perform the following steps:

1. **Checking the existence of Enrollee's eyes:** If capturing the iris image is not possible due to non-existence of one or both the eyes or bandage across one or both the eyes / any other deformity or disease, the same has to be recorded in the Aadhaar Enrolment Client application software.
2. **Checking the Enrollee's position:** Request the Enrollee to sit in a fixed position. The posture should be like taking a portrait photograph.
3. **Aiming the Iris Capturing Device:** Aim the Iris Capturing Device towards the eye of the Enrollee. The device should be held steady. In case, if the device is required to be held by the resident, the Enrolment Operator may help the Enrollee to hold the device steady.
4. **Checking the light in the room:** The iris capture process is sensitive to lighting condition present in the room. Make sure that no direct or artificial light directly reflects off the Enrollee's eyes. Light source used for facial image capture should be switched off during the iris capture.
5. **Checking the image quality:** After capturing the iris image, the Aadhaar Enrolment Client application software is able to measure the iris image quality. An initial image quality assessment would be done to provide feedback to the Operator during the capture process. The device alerts the Operator if the captured iris image is of poor quality. If the captured iris image is of poor quality then try again to capture a good quality image.

### Scenario 6: Capturing Iris Image





## Guidelines for Iris Scanning

1. If Enrollee is squint eyed and the capture of both eyes at a time is not possible, Operator may attempt recapture.
2. If Enrollee is unable to open the eyes properly for iris scan, then gently guide him/her using mimicry / play act to open the eyes wide. If that does not work, then do the best you can to capture a good quality image by using recapture.
3. Iris Capture Device uses auto focus and auto-capture functions. So it does not require any focusing or capturing adjustment by the Operator.

### Note

In few cases it is possible to capture iris patterns for a blind person. The iris recognition technology used by the Iris Capturing Device captures details based on iris pattern. As long as the iris pattern is visible in a blind eye, its details can be captured.

### Exercise 10: Check your understanding.

After reading through the preceding content,

- What are the different types of devices used for capturing the Iris image?
- Think of reasons that would hamper proper capture of Iris image.
- What are the best practices that you could follow to ensure excellent Iris images?
- How would you handle the following:
  - Physical deformities in the resident's eye(s)
  - Inability of the resident to handle the Iris scanner
- How would you know whether the image captured is of a good quality



## Non-Biometric Devices

Non-biometric devices are Computer, Printer, Scanner, Photocopier, Barcode Reader and Storage Device like CD, DVD, Hard disk and Pen Drive. The Aadhaar Enrolment Client software is installed on the computer for collecting the demographic and biometrics data. Biometric Devices such as finger print scanner, iris capturing device and digital camera are connected to the computer through the USB port. The data captured using biometric devices is stored on computer. This data can then be transferred from the Enrolment Centre to Central Identities Data Repository (CIDR).

## Computer

There are two types of computers that can be used in an Enrolment Centre. They are,

- Desktop
- Laptop

It is used for entering demographic data of the resident which is to be further used for linking the resident's biometric information. It is used to store the data temporarily until successfully transferred to CIDR.

## Desktop

The desktop computer is suitable for a permanent setup, where the machine need not be moved around frequently.

It consists of separate units including,

- Cabinet consist of Power Supply Unit, Motherboard and Storage Devices
- Video Display Unit or Monitor
- Keyboard
- Mouse



Figure 22: Desktop Computer

## Laptop

A laptop functions like a desktop computer, but it is compact, light-weight and suitable for mobile use. Laptop gets power from a rechargeable battery placed inside the laptop. Hence the laptop can be used even in the absence of an external power source.

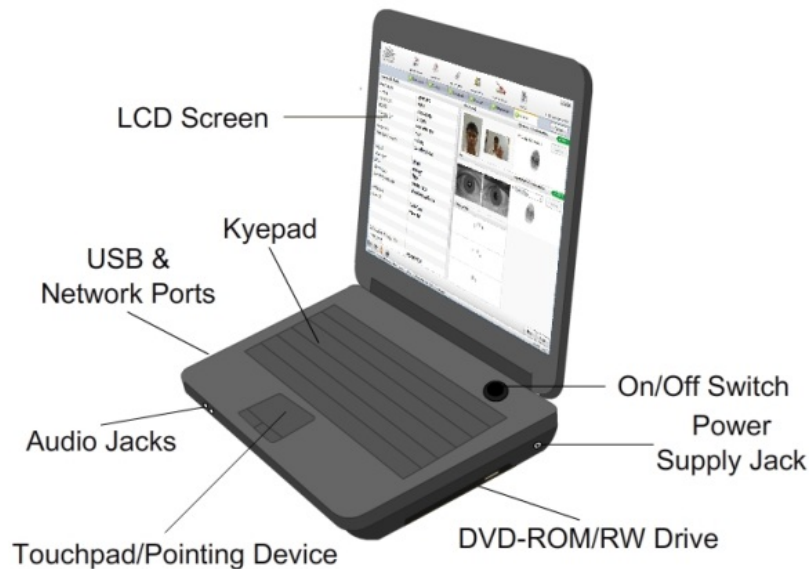


Figure 23: Laptop Computer

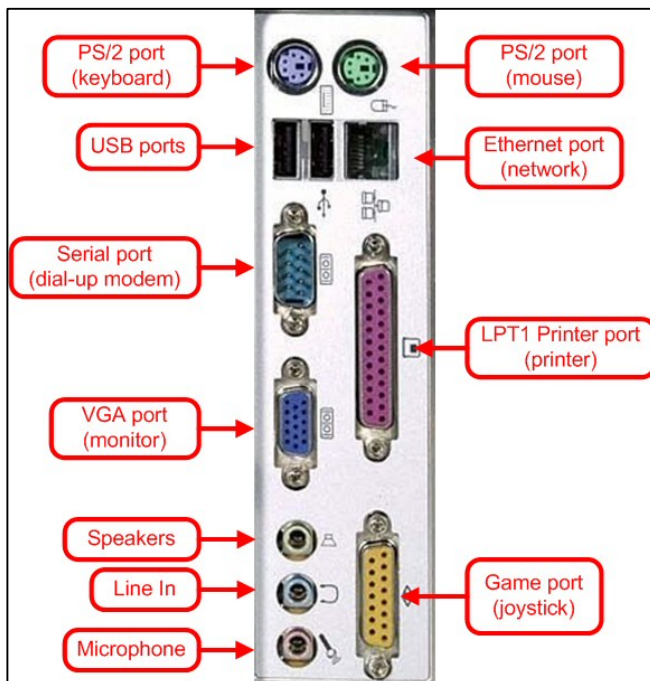


Figure 24: Typical Connectors



Figure 25: Laptop Charger



## Software

A computer consists of hardware and software. Typically the following software are installed on a computer.

**Operating System (OS)** – It manages the hardware and hides the complexity of the machine from the user. The user interacts with the computer directly or by using Application software (like the Aadhaar Enrolment Client) which in turn use the services provided by the OS.

**Example** – Windows XP, Windows Vista, Windows 7, UNIX, MAC OS

**Antivirus** – Viruses disturbs the normal operations and functions of a computer. They can slow down the operations of a computer, corrupt data, destroy information stored on the computer and cause the entire system to ‘crash’ (become unusable). To prevent such ‘virus’ from infecting the system, Anti-virus software is used.

**Example** – McAfee, Symantec, Quick Heal

**Anti-spam** – Spam is unwanted messages that are received when the computer is connected to the Internet. Spam can slow down the enrolment operations in an Enrolment Centre.

**Example** – McAfee Anti-spam, Comodo

**Application Software** – Computer does not understand our language it has got its own language. Application software works as the bridge between computer and user. It is designed to perform the specific task.

**Example** – MS Word, MS PowerPoint, Aadhaar Enrolment Client Software

## Printer

A Printer is a peripheral device connected to a computer and is used to generate a paper copy or hard copy (permanent readable text and graphics). Generally, printer is connected to a computer by USB cable. Printer is powered from an external power outlet.

The following Figure 26 shows the different components of a printer.



**Figure 26: Printer**

The printer is used to print an Acknowledgement Slip (Enrollee’s copy) and Consent for Enrolment Slip (Office copy) after successful completion of the entire enrolment process.

## GPS Dongle

GPS or Global Positioning System is used to identify the location of any person or object equipped with a GPS device. The GPS dongle can be connected to the USB port of a computer and once activated the position of that computer in terms of Latitude, Longitude and Altitude can be precisely determined.

On a computer with Aadhaar Enrolment Client the GPS Dongle is used as follows:

- GPS dongle must be attached to the system before starting the GPS operation using the “Start GPS” and “Stop GPS” buttons.
- GPS co-ordinates must be captured once in every 24 hrs, preferably at the beginning of each day.



**Figure 27: GPS Dongle**

## Storage Devices

Storage Devices are used to store data from a computer, externally. The various types of storage device differ in terms of data storage capacity, data access time and its physical shape. CD, DVD, Pen Drive are some of the examples of storage device.

These storage devices can then be used to transfer the data from the Enrolment Centre to Central Identities Data Repository (CIDR).

### CD

CD stands for Compact Disc. It is used for long-term storage of data. CDs are available as read-only or CDR and CD Re-Writable or CD-RW. CDRs allow data to be written only once. This data can only be read. It cannot be deleted or modified. CD-RWs allow data to be written and read, deleted and modified whenever required.

Data access time for CD Drives is considerably slower than for a hard drive. CDs normally hold 700 MB of data.

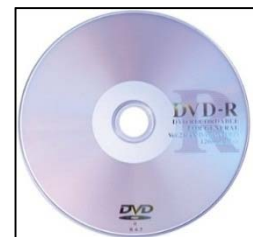


**Figure 28: CD**

### DVD

DVD stands for Digital Video Disc or Digital Versatile Disc. The data storage mechanism of DVD is different from CD. DVD can store much more data than a CD. A normal DVD can store up to 4.7 GB of data.

There are various types of DVDs available in the market. They have different storage capacity as shown in the following Table 2.



**Figure 29: DVD**

**Table 2: Types of DVD and their storage capacity**

DVD Type		Format Name	Storage Capacity (in GB)
Single-sided,	single-layered	DVD-5	4.7
Single-sided,	dual-layered	DVD-9	8.5
Double-sided,	single-layered	DVD-10	9.4
Double-sided,	dual-layered	DVD-18	17

### Pen Drive

Pen drive is a data storage device integrated with a USB (Universal Serial Bus) interface. They are very small in size and weight. Pen drives are available in various shapes and in various storage capacities (1 GB, 2 GB, 4 GB etc). Pen drives can store huge volume of data as large as 256 GB.

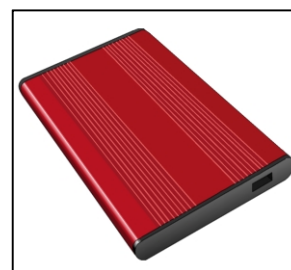


**Figure 30: Pen Drive**

Once they are plugged into a USB port of a laptop / PC they show up like another hard drive on your laptop / desktop computer. You can copy files to and from the Pen Drive to your computer.

### Portable Hard Disk

Portable Hard Disk is a data storage device integrated with USB (Universal Serial Bus) interface. They are very small in size and weight. They have various storage capacities like, 320 GB, 500 GB, 1 TB etc.



**Figure 31: Portable Hard Disk**

Once they are plugged into a USB port of a laptop / PC, like pen drives, they also show up like another hard drive on your laptop / desktop computer. You can copy files to and from the portable hard disk to your computer.

## Scanner

A scanner is a device that captures images from photographs, posters, magazine pages, and similar sources. The captured image can be displayed and edited. Scanners can be used to scan black-and-white and color documents.

### Types of Scanner

- Drum Scanner
- Flatbed Scanner
- Film Scanner
- Hand Scanner
- Document Scanner



**Figure 32: Scanner**

## Photocopier

A photocopier is a machine that makes copies of documents and other visual images quickly and cheaply. It is also known as a copier or copy machine.

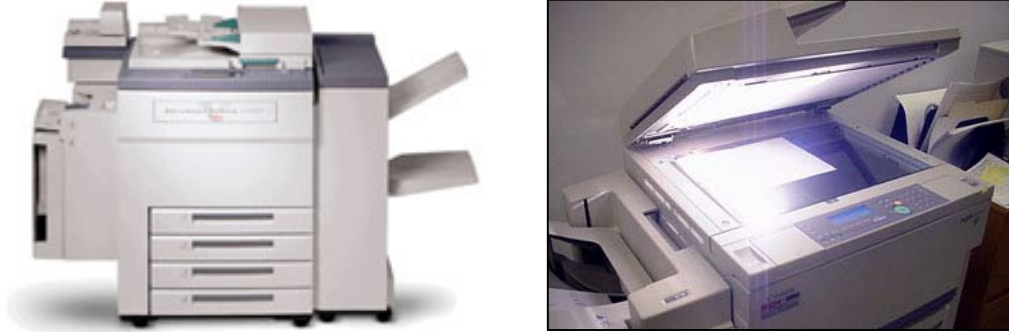


Figure 33: Photocopying Machine

## UPS

In case if there is a power failure, an Uninterruptible Power Supply (UPS) can be used to provide an instant backup power source to the computer system. Typically, a UPS keeps a computer running for several minutes after a power failure, enabling you to save data and shut down the computer gracefully.

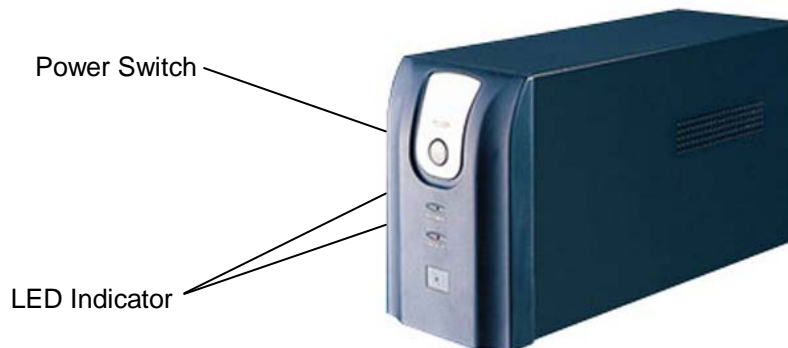


Figure 34: UPS

Basically there are two types of UPS,

- Standby power systems (SPS)
- On-line UPS systems

**Standby Power Systems (SPS):** An SPS monitors the power line and switches to battery power as soon as it detects a problem. The switch to battery, however, can require several milliseconds, during which time the computer is not receiving any power. Standby Power Systems are sometimes called Line-interactive UPS.

**On-line UPS System:** An on-line UPS avoids these momentary power lapses by constantly providing power from its own batteries, even when the power line is functioning properly. In general, on-line UPS is much more expensive than SPS.

## USB Hub

A USB hub is a device that expands a single USB port into several, so that there are more ports available to connect devices to the system. When there are many devices using USB ports, there is a need for USB hub since, laptop and computer have limited USB ports.



Figure 35: USB Hub

## Electrical Generator

An electrical generator is a device that generates electricity from a motor which runs on fuel like petrol or diesel. If there is a power failure in Enrolment Centre, generator can be used to provide a backup of electricity. Electricity might not be available in Enrolment Centre in some remote locations. Hence, generator can be used to provide electricity to carry out the enrolment process.



Figure 36: Electrical Generator

### Exercise 6: Biometric and Non-Biometric Devices

List the uses of the following Biometric and Non-Biometric devices.

- a. CD
- b. Fingerprint Scanner
- c. Desktop
- d. Software
- e. Pen Drive
- f. Iris Scanner
- g. UPS
- h. Digital Camera



## Summary

This module helped you to:

- Understand what is Biometric Data
- Identify the different types of Biometric Devices
- Explain the process of capturing image of face
- List the steps involved in capturing fingerprint data
- Handle the iris image capturing device
- Explain Hardware Devices (Non-Biometric)