Input Device: Scanner (2D)

CSE 315

Peripherals & Interfacing

Input Device : Scanner

An input device, that digitizing an image

It has a light source and a set of optical sensors

Reflected light is sensed by the sensors & converted into digital signal

Scanners : Classification

On Scan Technology

- Flatbed Scanners
- Sheet-fed Scanners
- Handheld Scanners
- Drum Scanners

On Dimension

- 2D Scanners
- 3D Scanners

Scanner : Flatbed

- Also known as desktop scanner
- The most commonly used scanner
- Document is stationary
- Head is movable

Scanner : Sheet-fed

Desktop scanner

Document is movable

Head is stationary

Scanner : Handheld

Movable scanner	Can be hold by hand	Can be used for quick scan	Scan quality is not much better	E.g. Barcode reader

Scanner : Drum

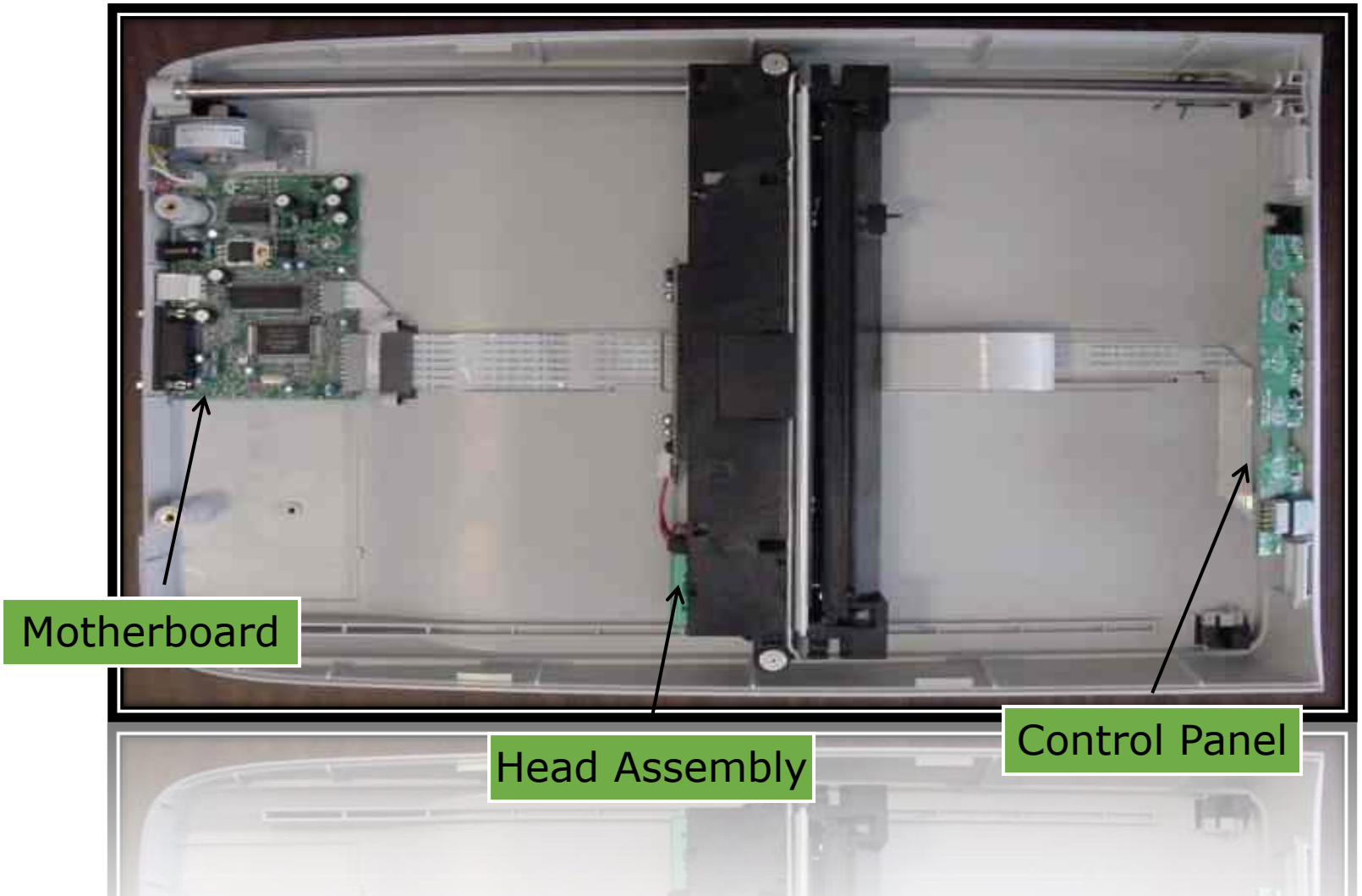
Used in graphics production houses

Used for scanning a large size of image

Anatomy : Flatbed Scanner

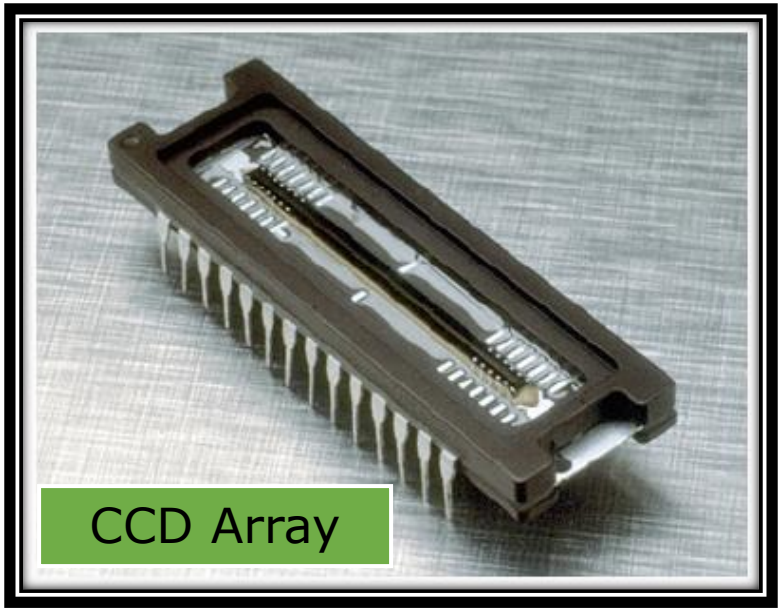
- Basic components of a flatbed scanner are:
  - **C**harged **C**oupled **D**evice (**CCD**) Array
  - Mirrors
  - Lamp
  - Lens
  - Filter
  - Scan Head assembly
  - Mother board
  - Control Panel
  - Frame

Anatomy : Flatbed Scanner



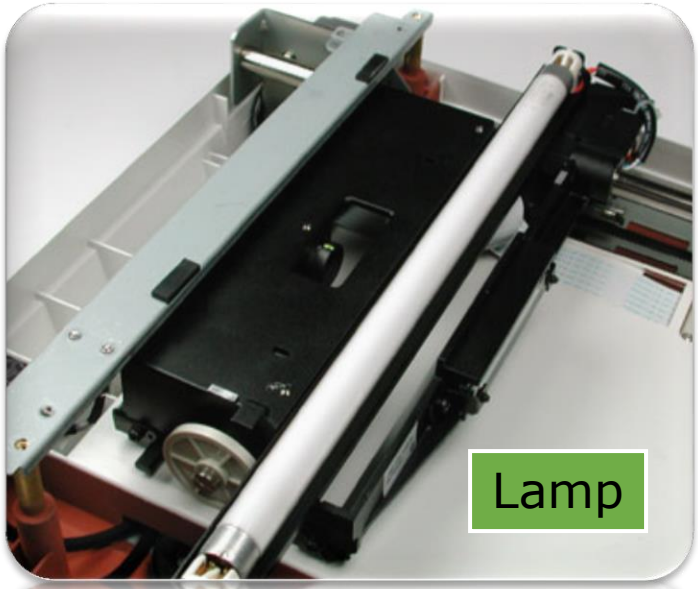
Anatomy : Flatbed Scanner

- CCD Array (image sensor) is the main component of a scanner
- CCD is a set of light sensitive diode known as photosites
- CCD converts photons into electrons



Anatomy : Flatbed Scanner

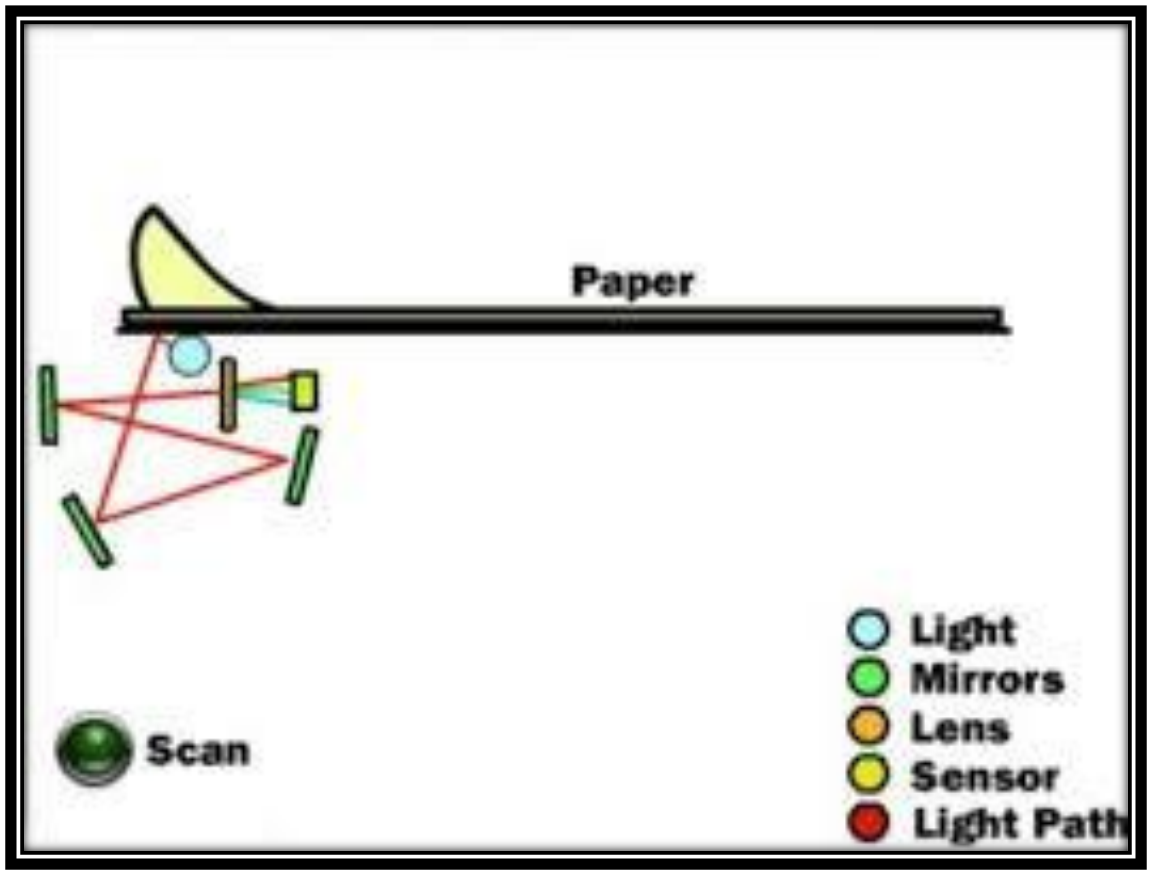
- The document is placed and cover is closed
- A lamp is used to illuminate the document
- The scan head is moved slowly across the document



Anatomy : Flatbed Scanner

- The image of the document is reflected by a mirror (1st one)
- That reflected image, is reflected by two other mirrors
- The last mirror reflects the image onto a lens
- The lens focuses the image through a filter on the CCD Array
- The purpose of three mirrors in a scanner to reduce extra light intensity

Anatomy : Flatbed Scanner



Scanner : 3D

- A 2D scanner with **Z** dimension
- It is able to analyze a real world object in all the (X, Y, Z) dimensions
- This type of scanner is specially used in entertaining industries (movie & gaming)

3D Scanner : Functionality

- To create a **point cloud** of geometry samples
- These points are then used to redraw the object
- As like as camera, a 3D scanner can only collect information of an object that is obscured

3D Scanner : Classification

- Depending on the technology
  - Contact 3D Scanner
  - Non-contact 3D Scanner
    - Non-contact Active
    - Non-contact Passive

3D Scanner : Contact

- Scan through physical touch
- This is basically a scanner with **CNC** (**C**omputer **N**umerical **C**ontrol)
- There is a mechanical system available that holds the scan unit
- This system can move in any direction
- E.g. **C**o-ordinate **M**easuring **M**achine (**CMM**)

3D Scanner : Contact

- Contact 3D Scanner is used in manufacturing industries
- Cons: Need physical contact

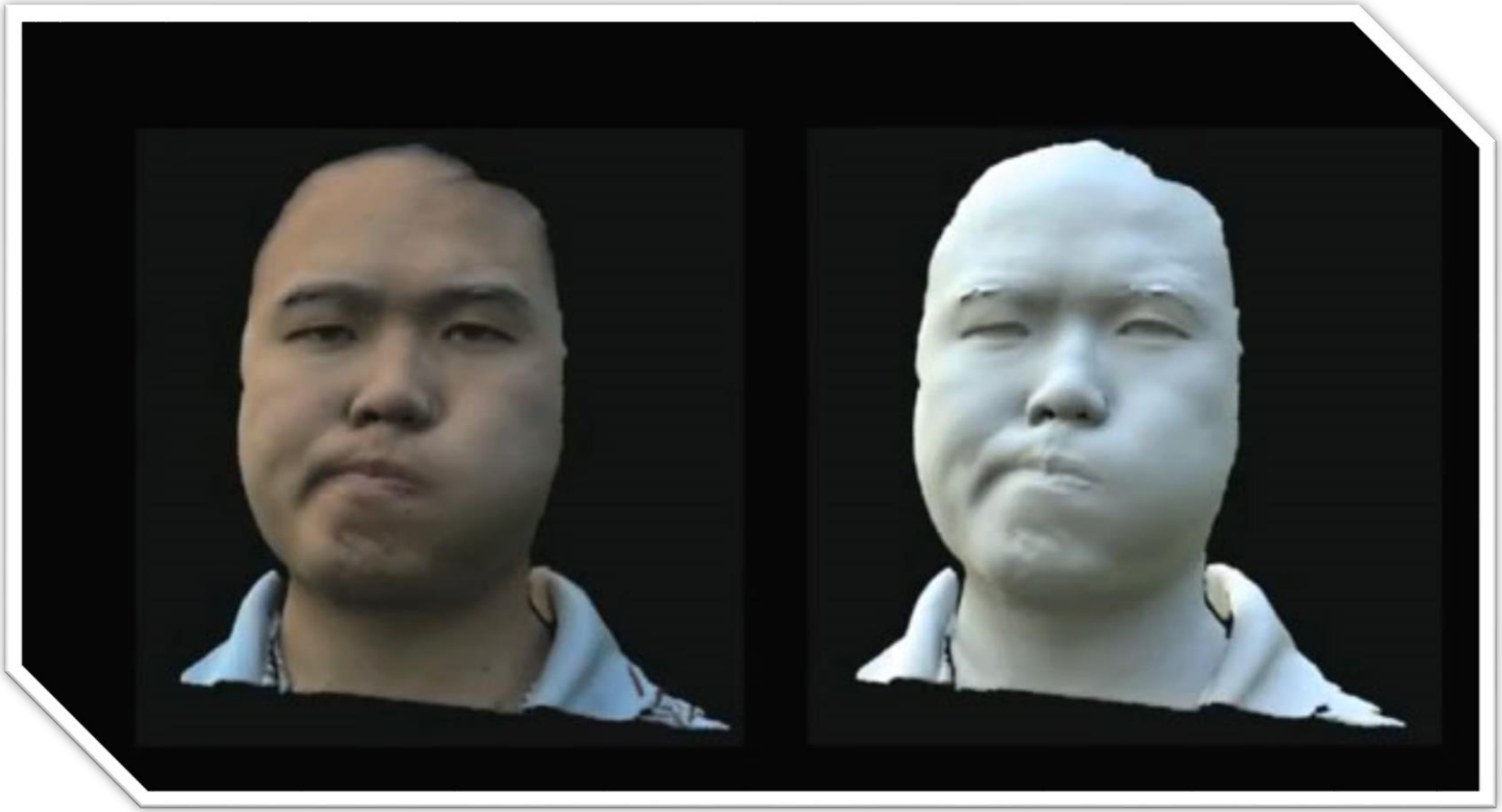
3D Scanner : Non Contact

- This type of scanner do not need any contact with the target object
- Instead of Physical contact, radiation is used
- Radiation could be LASER, IR or VR
- Depending on the radiation these are
  - Active (NCA): Uses external light resource
  - Passive (NCP): Uses the reflected light

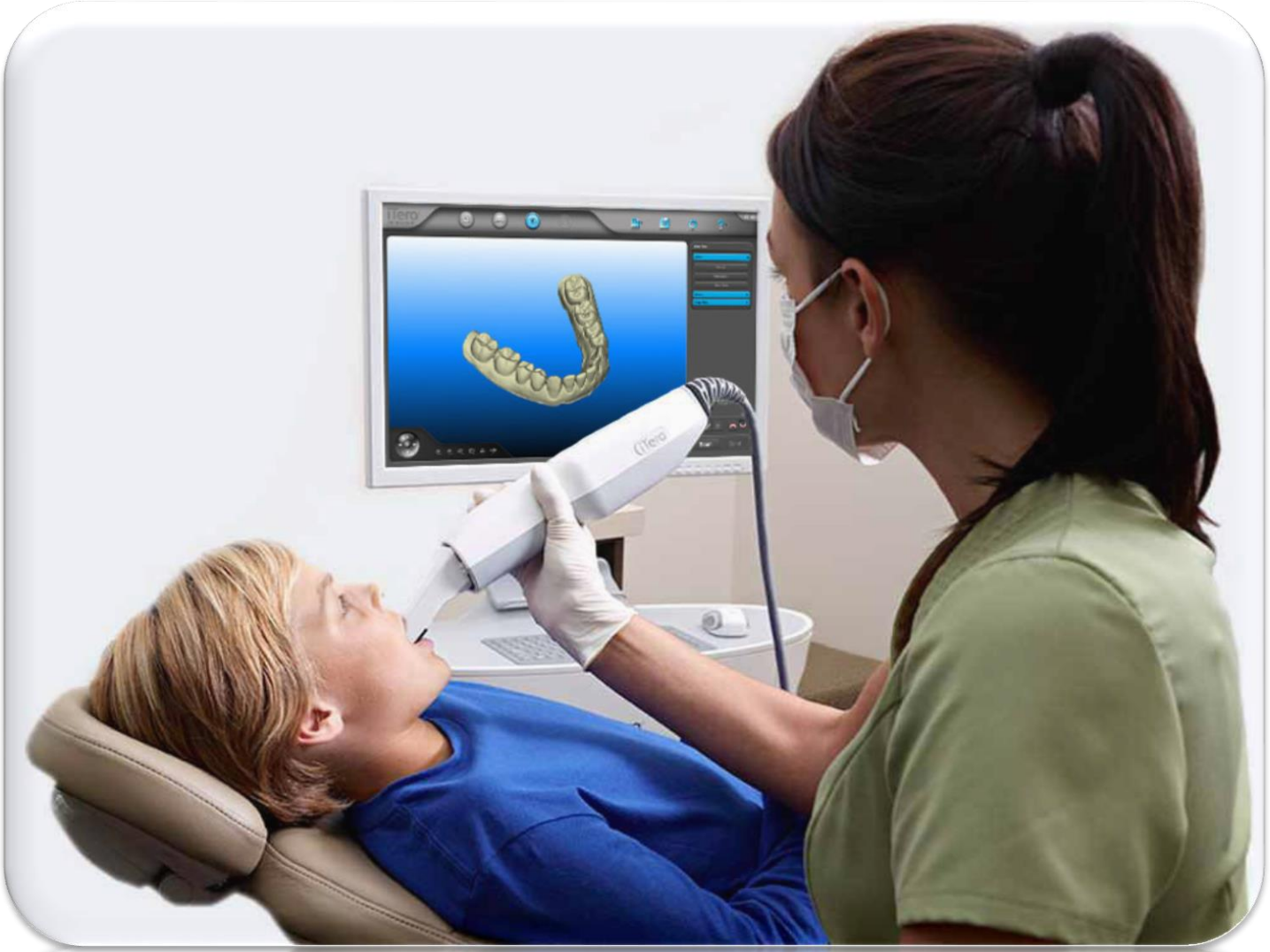
3D Scanner : NCA & NCP

- Name of some NCA
  - Time-of-flight: Uses LASER
  - Triangulation: Uses LASER
  - Conoscopic Holography: Uses LASER
  - Hand held: Uses LASER
  - Structured light: Uses VL
  - Modulated light: Uses VL
  - Volumetric: Uses X-Ray
- NCP uses reflected light from the target object

3D Scanner : Screenshot



3D Scanner : Screenshot



3D Scanner : Screenshot

3D Scanner : Applications

- Creating **CAD** (**C**omputer **A**ided **D**esign) models of real object
- Building (house) modeling
- Product quality assurance
- In dentistry
- In cancer
- In gaming

Camera Vs Scanner

Key Point	**Camera**	**Scanner**
Dimension	Creates an image from 3D to 2D	Creates an image from 2D to 2D or 3D to 3D
Portability	Portable	Non-portable
Resolution	Higher	Lower
3rd Party software	Not Necessary	Necessary
On system monitor	Available	Not Available

Thank You