

E-content By:

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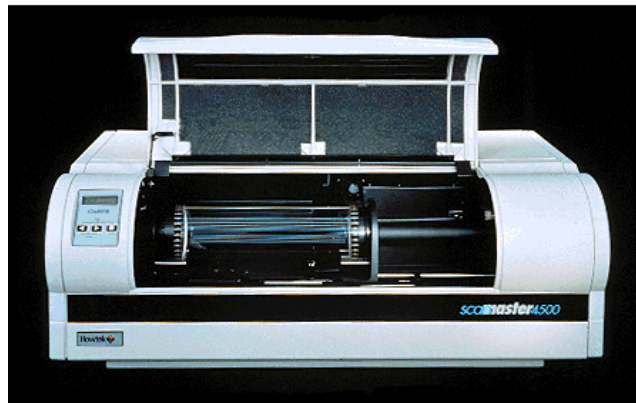
Topic: Fundamental of Input Device Scanner and WebCam

A scanner is a device that is used for producing an exact digital image replica of a photo, text written in paper, or even an object. This digital image can be saved as a file to your computer and can be used to alter/enhance the image or apply it to the web. The most commonly used scanner is the flatbed scanner, in which you keep the object on top of the glass window. The scanned output will be obtained in your computer. The image and text are obtained exactly through the process of optical character recognition [OCR].

The historical precedence of scanners originates from the telephotography input devices, which was mainly used by the printing press. It mainly consisted of a rotating drum, which rotated at a maximum speed of 240 rpm. The signal used was analog in nature and were sent through telephone lines to the receptor end. The receptor recognizes the signal synchronously and a proportional output is printed on special paper.

Types of Scanners

1. Drum Scanners



Drum scanner was the first ever image scanner to be developed. It was made in the year 1957 at the US National Bureau of Standards. The first image was black and white with a resolution of 176 pixels. This scanner finds its application in publishing field because of its ability to capture the smallest details out of film negatives. It also has an advantage in its ability to control sample area and aperture size independently. This feature helps in clearing the grains in negative films as well as colour films while scanning it. Thus, they also help in producing scans that are high in resolution, colour gradation and value structure.

2. Flatbed scanners

Flatbed scanner is the most commonly used scanning machine nowadays. They are also called desktop scanners. The detailed working of flatbed scanners will be given below. They use Charge-coupled device (CCD) to scan the object.

Any flatbed scanner will have the following devices.

- Charge-coupled device (CCD) array
- Scan head
- Stepper motor
- Lens
- Power supply
- Control circuitry
- Interface ports
- Mirrors
- Glass plate
- Lamp
- Filters
- Stabilizer bar
- Belt
- Cover

3. Hand-Held Scanners

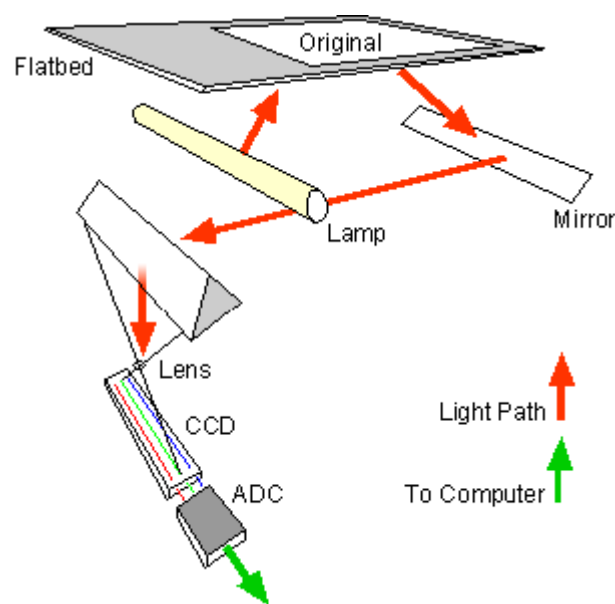
This device found popularity during the early 90's. Hand-held scanners are used to scan documents by dragging the scanner across the surface of the document. They are available as document scanners as well as 3-D scanners. This scanning will be effective only if with a steady hand technique, or else the image may seem distorted. They have sensors to detect the distortion rate and an indicator will be provided to alert if the motion of the scanner is too fast.

They also have a START button, which has to be on during the scan duration. They are synchronized with the computer and also have an automatic optical resolution. The scanner also has LED's which light up the image to be scanned. As the image can be distorted most of the time there are special reference markers available in the device which helps in compensating the distortion.

Though poor image quality is obtained, fast scanning of texts can be done with this device.

Working of Flatbed Scanner

The main difference in the old scanners and modern scanners is the type of image sensor used. In old scanners, a photomultiplier tube [PMT] was used. For modern scanners a Charge-coupled device [CCD] is used. A CCD sensor is used to capture the light from the scanner and then convert it into the proportional electrons. The charge developed will be more if the intensity of light that hits on the sensor is more.



Applications of Scanner

1. Applications vary according to the type of scanner used. Flatbed scanners are mostly used for scanning documents. But, for large format documents a mechanical scanner will have to be used.
2. There are hand-held scanners which are used for scanning an object according to the movement of our hand [the scanner does not move by itself]. This scanner helps in 3-D scanning of materials and is applicable in industrial designs, test and measurement of devices, gaming applications and so on. 3-D scanning can also be done with the help of planetary scanners. There are also developments going on in producing a combination of 3-D scanners with digital cameras so that realistic photos with true colour can be obtained in the 3-D mode.
3. A new concept called reprographic cameras has paved their way for digital camera scanners. This type of scanner has many advantages like easy digitalization of large format documents, high processing speed, and portability and so on. They also produce high resolution images with anti-shake features. Studies are still going on to remove the main disadvantages like shadow and reflection interference, image distortion and low contrast.
4. Scanners also find high end application in field like bio-medical research. High resolution scanners with a resolution of almost $1 \mu\text{m}/\text{pixel}$ are used to detect DNA microarrays. Here also, the charge coupled devices are used for detection.

Webcam

A simple Webcam setup consists of a digital camera attached to your computer, typically through the USB port. The camera part of the Webcam setup is just a digital camera -- there's really nothing special going on there. The "Webcam" nature of the camera comes with the software. Webcam software "grabs a frame" from the digital camera at a preset interval (for example, the software might grab a still image from the camera once every 30 seconds) and transfers it to another location for viewing. If you're interested in using your Webcam for streaming video, you'll want a Webcam system with a high frame rate. Frame rate indicates the number of pictures the software can grab and transfer in one second. For streaming video, you need a minimum rate of at least 15 frames per second (fps), and 30 fps is ideal. To achieve high frame rates, you need a high-speed Internet connection.

Webcam is a compact digital camera which works same as conventional digital camera but is designed to interact with the web pages and other internet pages. It captures the real time images through a tiny grid of light-detectors, known as charge-coupled device (CCD) from the location where it is placed. The CCD converts the image into digital format so that computer can access this data. Webcams don't have

the internal memory to store the images so it transmits the data immediately to the host device through the USB or other analog cable. Some of these devices also come with built in microphone for video calling.

Webcam does two things, capturing the image or video and to transfer it to the predestined device. Along with the digital camera these also come with the appropriate software to interact with the host device. Software allows the user to edit the images and to record the videos for particular duration. This software grabs the digital data from the camera at certain intervals of time. Depending on the frame rate, the number of pictures or video streaming is displayed on the computer or other display systems. Software receives the image frame from digital camera, converts it into JPEG file and finally sends it to the web server using the file transfer protocol (FTP). So before using this webcam, while working with the web, we need to do some configuration steps to upload the images and videos.

- **Megapixels**

It decides the quality of the picture or image. Most of the cameras provide the reasonable quality image. It is good if we use 320*240 or 640*480 pixels. For better quality webcam should have 1280*720 resolutions.

- **Frames Per Second**

This decides the speed at which the image moves on the screen. The minimum rate is 15 frames per second. The ideal rate is 30 FPS to have the better video streaming. This requires the speed of the internet to be enough.

- **Face Tracking**

It allows the various options like digital zoom, side-to-side and up-to-down movements, always facing straight towards the screen. This is the advanced feature of the webcams.

- **Microphone**

This feature offers voice recording along with the corresponding motion appearance. This is helpful while doing the video chat. Types of microphone depend on the required quality of the data or video.

- **Portable**

The webcam should have facility to be placed at convenient places like walls, top of the screen on the desktop/PC. Simple construction allows the user to use conveniently in well-suited places.

- **Type of Lens**

Modern webcams comes with the glass lens and plastic lens. Compared to the glass lens, plastic lens types are of high cost.

- **Low Light Quality**

If the webcam is used for the capturing the images or videos during the night time or low light conditions, it should have the features of optimized image quality in poor light conditions.

Applications of the Webcam

- **Buildings, Offices and Shopping Malls**

Webcams are used to monitor the unauthorized entries and motion detection of the authorized things to improve the security. These are also improves the communication over the various clients in the offices through online chatting.

- **Banking Sector**

Every section of the bank is monitored by the webcams. Video files are transferred and stored to the main server for future investigation purpose. This increases the security while identifying the people and mischief things.

- **Video Calling**

This adds advantage to the instant messaging by allowing visibility between the communicators. Webcams provide both one-to-one and conferencing communication features.