

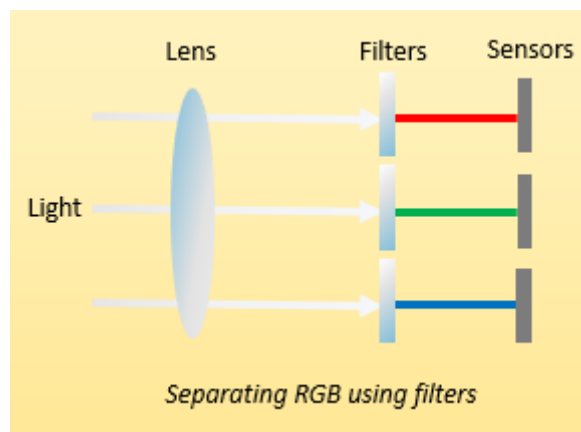


4.7.4 External Hardware Components

Digital Camera

A digital camera is a device for creating digital images of photographs, which can be printed or transferred onto a computer to be manipulated and stored.

- When a photograph is taken the shutter opens and lets light in through the lens
 - The light is focused onto a sensor, usually a charge coupled device (CCD) or a complementary metal oxide semiconductor (CMOS).
 - The sensor contains millions of photosensitive elements, each corresponding to a pixel.
 - The amount of light detected at each pixel is converted into an electrical signal and represented digitally.
 - The sensor uses red, green and blue colour information to represent the colours in the image.
 - The data is typically stored on a removable storage device.
- Images can be stored in formats such as JPEG, PNG and TIFF.





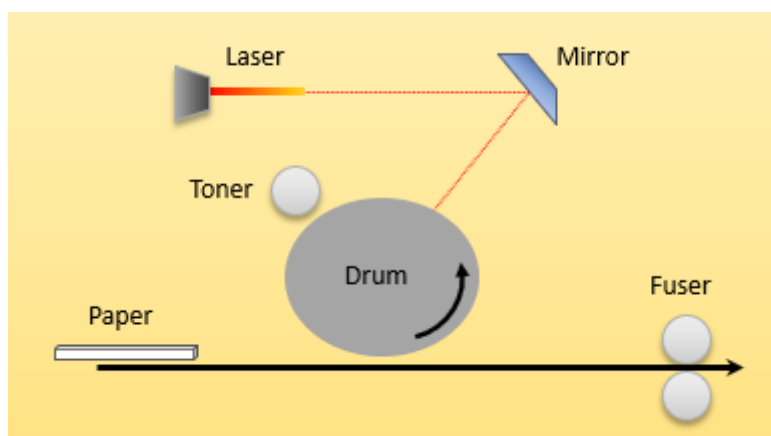
Laser Printer

A laser printer is a device that uses lasers and toner to create mono and colour prints.

- A rotating drum inside the printer is coated in a chemical which holds an electrical charge.
- The laser beam is reflected onto the drum and where the light hits the drum, the drum loses charge.
- This draws an image on the drum of electrical charge, which then attracts the toner as drum rolls over it.
- Paper is charged with the opposite charge to the toner and is then passed over the drum.
- The toner is attracted from the drum to the page.
- The paper is then heat treated to fuse the toner to the paper.
- To achieve colour printing, four different coloured toners are used
- The process is repeated for each colour.

Advantages

- Fast print speeds.
- Lower cost per page than inkjet printers.
- High-quality text output.

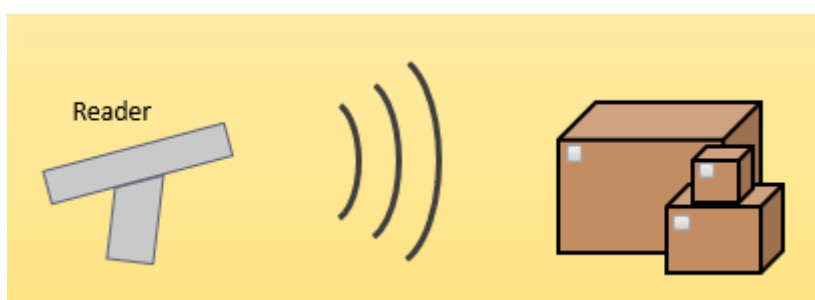




RFID

Radio frequency identification, RFID, is a technique where a small wireless device stores data and transmits it using radio waves. It is usually used in tags to track items.

- The tag, which can be microscopically small, contains a chip containing data about the item.
- It also has an antenna to send and receive signals.
- There are two types of tags:
 - **Active** – where the tag has its own power source in the form of a small battery.
 - **Passive** – where the tag will pick up electromagnetic power when they are in range of a RFID reader.
- The RFID reader and tag can communicate using radio waves.
- The range depends on the tag and how they are powered but is typically between 1-100 metres.
- The tag may be used simply to track the physical location of the tag, or the tag may transmit data back.



Barcode Reader

A barcode reader is an input device that scans a barcode and converts the pattern into digital data that can be processed by a computer.

- A light source illuminates the barcode.
- A sensor detects the reflected light from the bars and spaces.
- The reader converts the pattern into an electrical/digital signal.
- Software decodes the signal into the barcode's numerical or alphanumeric value.
- The data can then be sent to a computer system, such as a point-of-sale system.
- Commonly used in shops for identifying products and retrieving their price and other information.
- Also used for stock control, libraries and tracking items.





Secondary Storage

Secondary storage provides non-volatile storage for programs and data. Unlike main memory, its contents are retained when the computer is switched off.

Secondary storage is used because main memory has limited capacity and is volatile.

Hard disk drives and **solid state drives** are types of secondary storage.

HDD

A hard disk drive (HDD) is a secondary storage device made up of metallic disks that stores data magnetically.

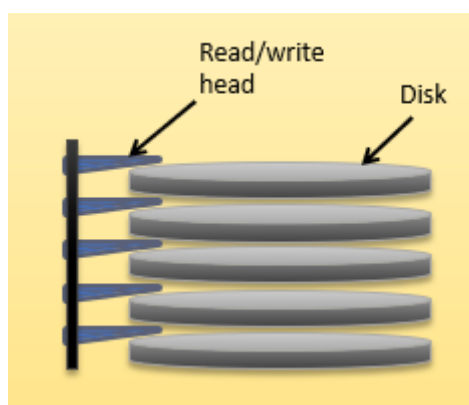
- The metallic disks, which are coated with a thin film of magnetic material, are stacked on top of each other.
- Changes in the direction of magnetisation on a disk are used to represent binary data.
- The disks spin at high speed between 3600 and 12500 rpm (rotations per minute)
- A series of heads are used to read and write data to the disk.
- The surface of the disks are organised into concentric tracks and each track is split into sectors.

Advantages

- It is cheaper than a SSD for an equal amount of memory capacity.
- Can have very large storage capacity.
- It is faster access than optical disks

Disadvantages

- Because HDDs contain moving parts, they are more susceptible to physical damage than SSDs.
- Slower access than SSDs.





SSD

A solid state drive (SSD) is a secondary storage device which stores data electronically.

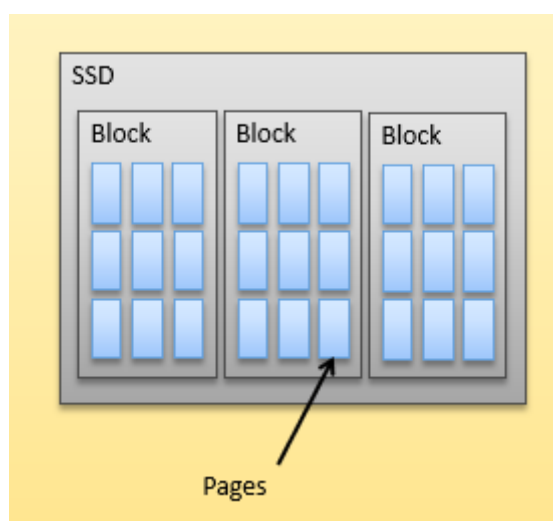
- An SSD organises data into blocks and pages (sets of bits and bytes of fixed length).
- A controller is used to manage the blocks of data.
- Data is stored electronically using flash NAND memory.
- Floating gate transistors are used to 'trap' and store charge.
- Data cannot be directly overwritten in a NAND flash page.
- Before a page can be rewritten, the entire block containing the page must be erased.

Advantages

- Because they have no moving parts, SSDs are generally more reliable than HDDs.
- Operation is noiseless.
- SSDs have much faster access speeds than HDDs.

Disadvantages

- Have less storage capacity available than HDDs.
- Typically offer less storage capacity for the same cost than HDDs.





Optical Disks

An optical disk is a generic term for all variations of CDs, DVDs and Blu-Rays that use laser technology to read and write data.

- An optical disk is made up of one single spiral track that starts in the middle and works its way to the edge of the disk.
- The tracks contain pits and lands which are used to represent the data.
- When read, a laser runs over the pits and lands, and the light is reflected back onto a photodiode.
- This is converted into a digital signal which is interpreted as binary code of 1s and 0s.

Advantages

- They are small and lightweight, so good for distributing small volumes of data.

Disadvantages

- Optical disks have low access speeds.
- They have very low storage capacity.
- Can be damaged by dirt and scratches

