Section 03.1 - Computers and Their Components

Layer 3: ISA Machine

Syllabus Content Section 03: Hardware

S03.1.1 Show understanding of the need for input, output, primary memory and secondary (including removable) storage.

`Hardware`: A physical component of a computer
`Input Devices`: Hardware that gives a computer data
`Output Devices`: Hardware that a computer can give to you
`Primary memory(storage)`: Kept inside in computer itself, with super super quick speed, The CPU can access this memory directly
`Secondary Memory(storage)`: Holds data until you delete it, Slower than Primary, The CPU can't access directly, Large amount of storage
`Offline storage`: nothing to do with the internet, Means sotrage you can remove form a computer(USB,CD/DVD)

S03.1.2 Show understanding of embedded systems

Including: benefits and drawbacks of embedded systems

`Embedded system(computer)`: Contain a processor, memory and an I/O capability. it has special-purpose, Can only do one thing(Calculator, air conditiner)

> Advantages:

- They are very compact in size, with high speed.
- Embedded Systems are very reliable.
- They consume less power and electricity, and they also perform task and operations assigned to them with great accuracy.
- They are built to perform special task and operations given to them.

- They can be customized for producing more enhanced results.
- They are comparatively cheaper.
- They concentrate on single operation at single time therefore they can process at very high speed with quality outputs.
- The Embedded system can be easily incorporated with small and large devices to perform dedicated jobs.
- Due to their silent features they are all used in modern devices and equipment's for improved performance.

> Disadvantages:

- The Embedded Systems are very tedious and difficult to upgrade and update.
- Requires lot of time and energy to maintain these systems.
- Embedded system errors are very difficult to rectify and resolve.
- They are very hard to backup.
- Huge modification cannot be implemented on these systems.
- Embedded system performs a specific operation assign to them and does the same task repeatedly.
- They are not associated microprocessor or microcontroller for processing.
- If system get damage or corrupt they are completely changed and removed.

S03.1.3 Describe the principal operations of hardware devices

Including: Laser printer, 3D printer, microphone, speakers, magnetic hard disk, solid state (flash) memory, optical disc reader/writer, touchscreen, virtual reality headset

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> Laser printer

Uses a laser to put a positive charge on a roller
The powder toner gets attracted to the positive areas
The paper then touches the roller
The toner get transferred to the paper
Then heat is applied to make the toner stick to the paper

> 3D printer

Prints a thin layer, then another one on top of it, then another and another
Uses different materials(Plastic,Metal,Concrete,Human cells)

> microphone

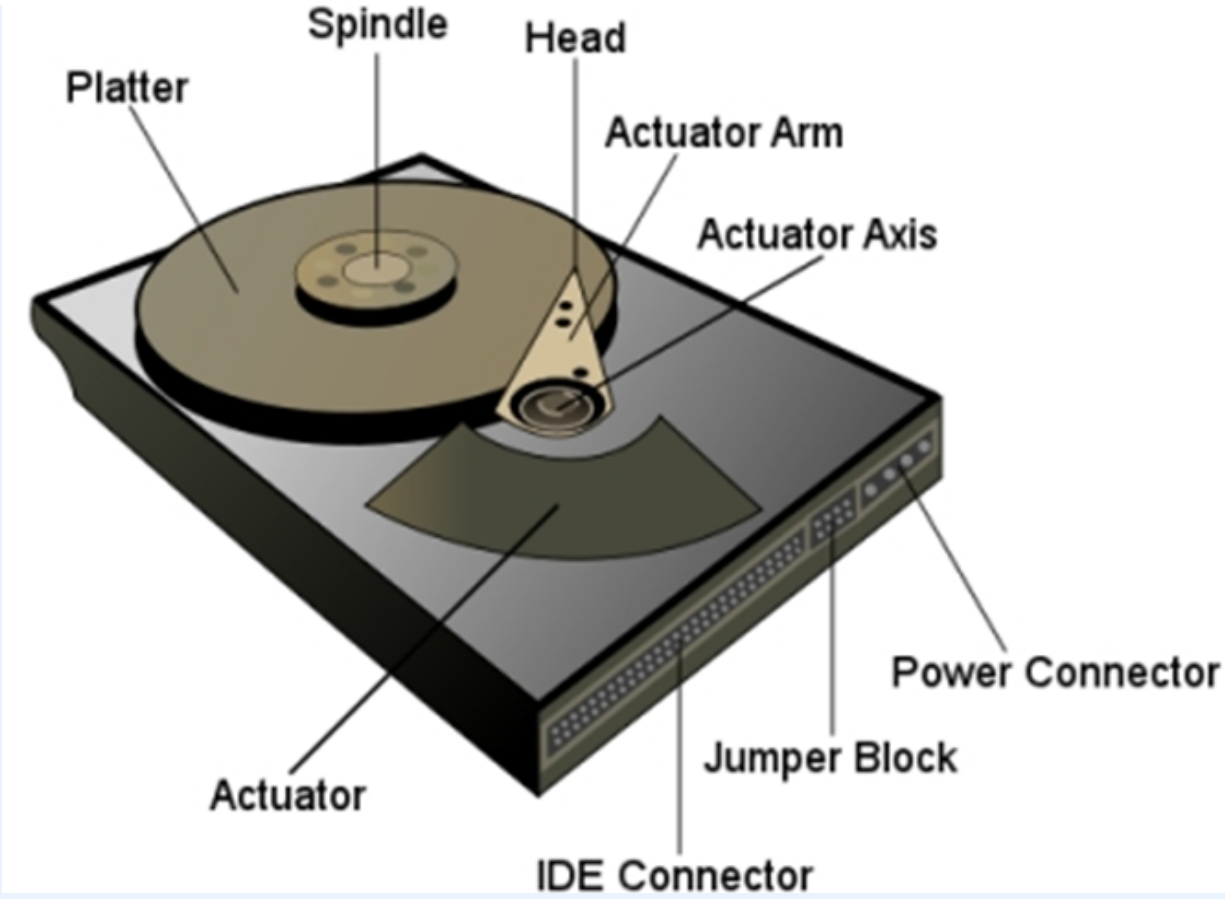
A microphone is a transducer, it is something that converts one energy into another
A microphone converts sound energy into electrical. It uses an ADC(Analogue to digital converter) to convert the electrical signals into binary

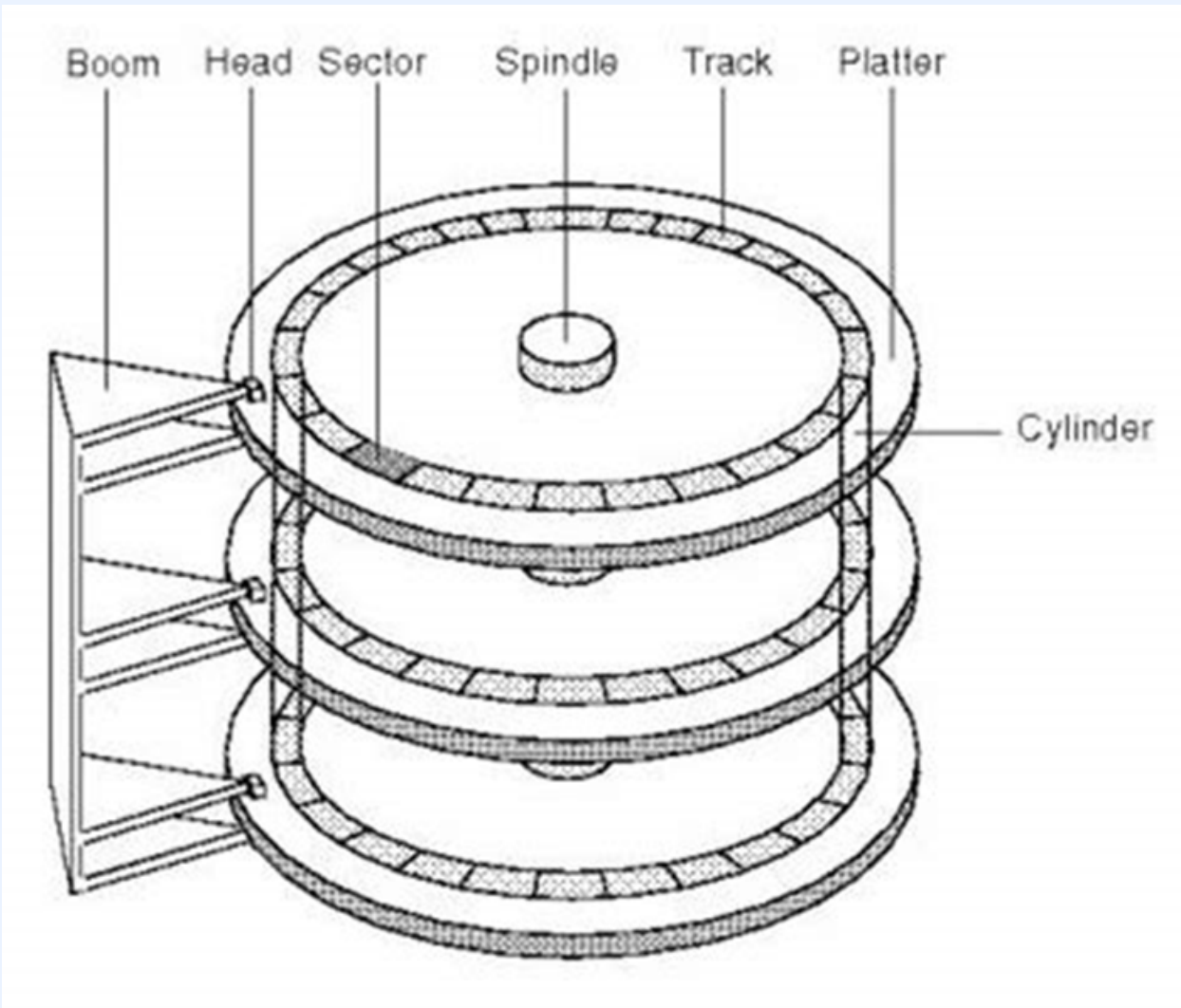
> speakers

They work as the reverse of microphones, have DAC(digital to analogue converter)

> magnetic hard disk

Uses magnetic platters
Uses a read/write head to change the magnetic polarity
The platter spins and the head reads the surface of the platter



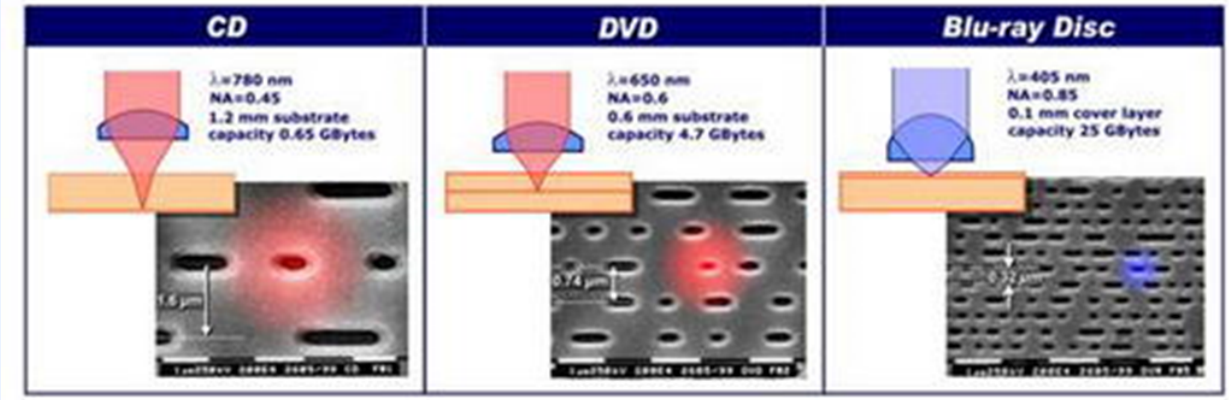


> solid state (flash) memory

+More modem
+No moving parts, so more reliable
+Faster because you don’t have to wait for a head or platter to move
+Less power consumption
+Lighter in weight so laptops can be lighter
-Becoming cheaper but still a bit expensive
-Lifespan is still a concern.
USB sticks
Solid State Drive (SSD)
SD Card

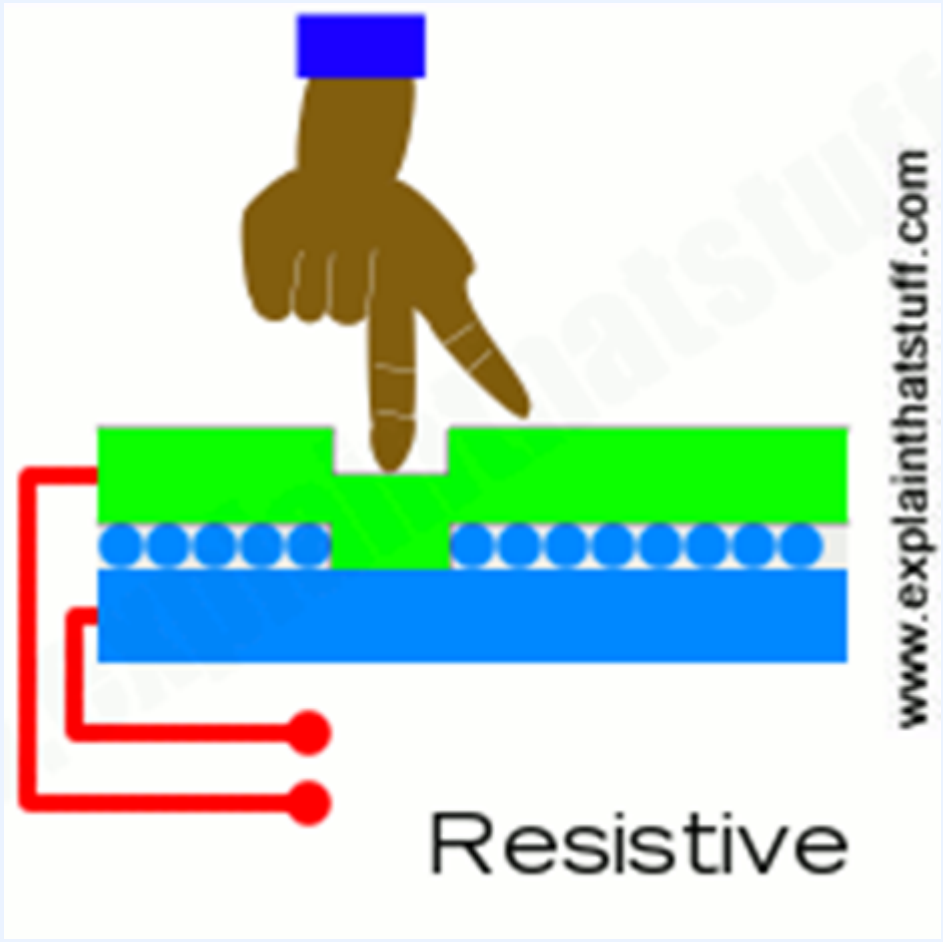
> optical disc reader/writer

CD - Compact Disc
DVD – Digital Versatile / Video Disc
Blu-ray Disc

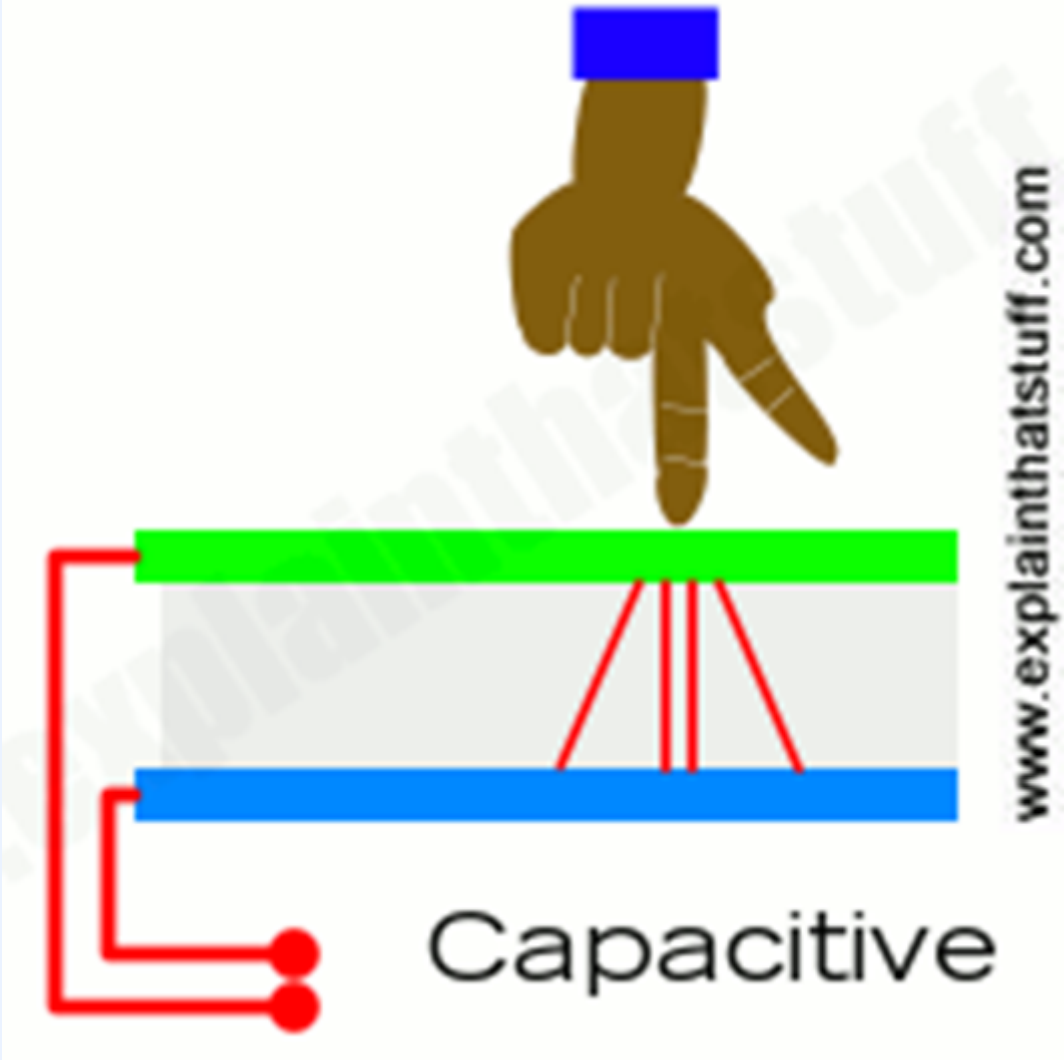


> touchscreen

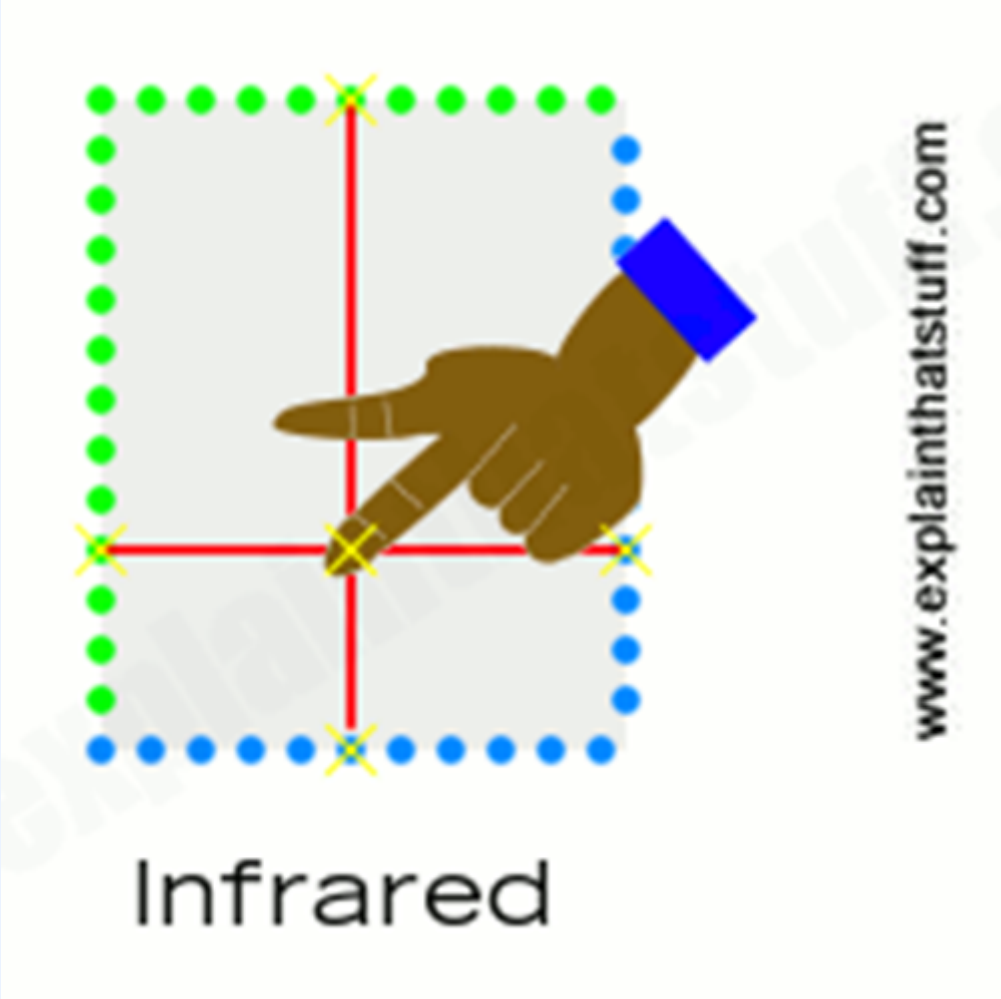
- Resistive



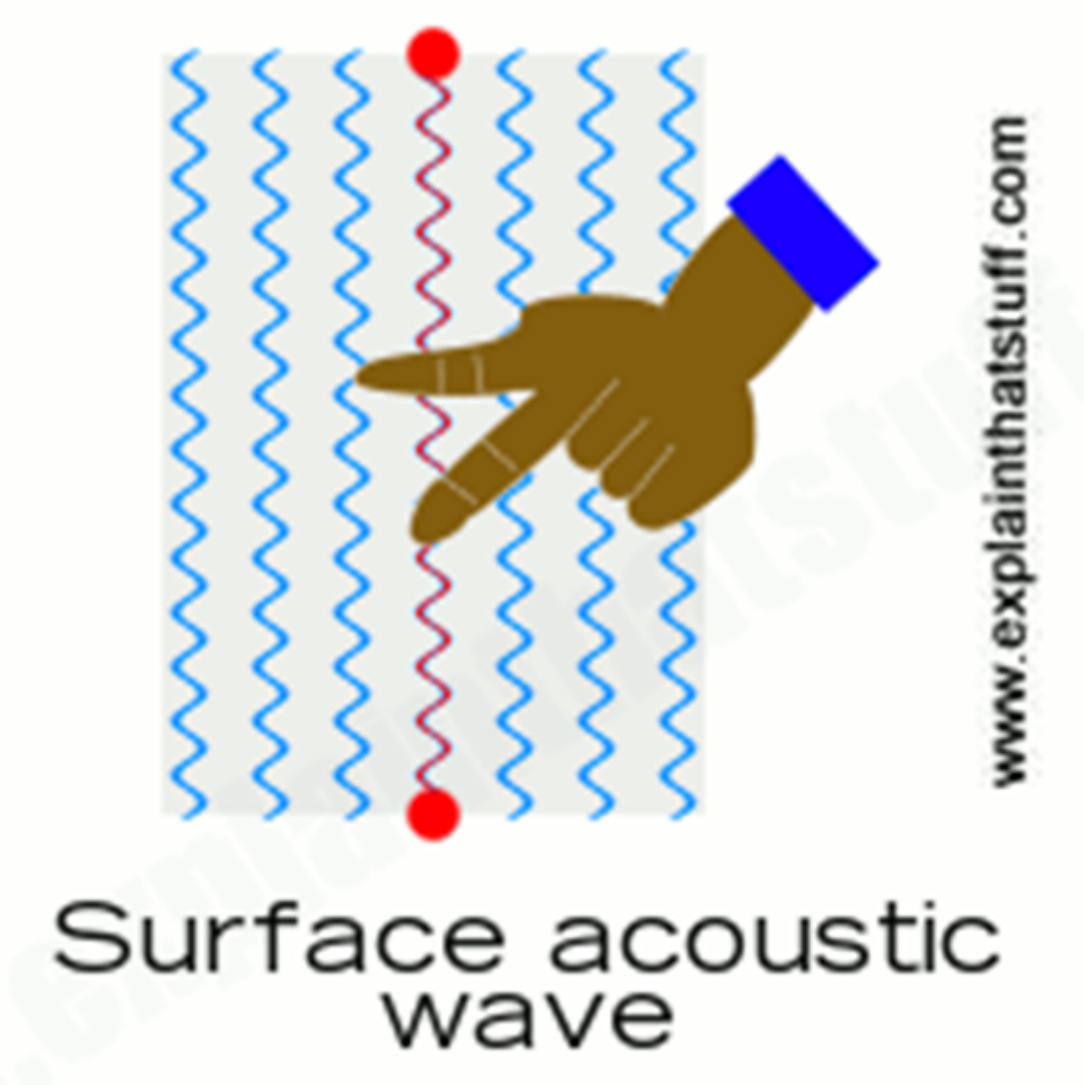
- Capacitive



- Infrared



- Surface Acoustic



> virtual reality headset
> These are fed paired images from the controlling system which, when looked at together, give the eyes the sensation of being in a 3D environment.

S03.1.4 Show understanding of the use of buffers

`Buffer`: a temporary storage created for data transmitted from one part of the system to another whichi function as a queue.
We can get data from memory very quickly, but we have to wait for our hard drive to spin. So even though we can read/write data to memory quickly, we cannot do the same for hard drive

> Example:

The CPU tells memory “I want this file”
Your memory says “ok”
But the memory is too fast for our hard drive.
So the memory puts SOME of the data into another location, called the buffer.
Once the buffer is full, an interrupt is sent to the CPU to say “Stop adding things to buffer for now”
Now everything pauses.
Now the hard drive reads from the buffer. Once the buffer is almost empty, the CPU gets an instruction to start once more.
The memory puts data into the buffer, when the buffer is full, everything pauses, the hard drive reads from the buffer until empty and so on and so on.

S03.1.5 Explain the differences between Random Access Memory (RAM) and Read Only Memory (ROM)

Including their use in a range of devices and systems

`Random-access memory (RAM)`: volatile memory that can be read from or written to any number of times. Stores data that to be processed by programs
`Read-only memory (ROM)`: non-volatile memory that cannot be written to but can be read from any number of times. You can only Read from this memory

S03.1.6 Explain the differences between Static RAM (SRAM) and Dynamic RAM (DRAM)

Include their use in a range of devices and systems and the reasons for using one instead of the other depending on the device and its use

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DRAM = Dynamic Random Access Memory
SRAM = Static Random Access Memory

Both DRAM and SRAM are volatile. Which means when the power goes off everything is gone. But SRAM keeps your data until you overwrite it. DRAM forgets your data unless you continue to send it a signal.

SRAM is much faster than DRAM and is used for a CPU's cache memory (Cache memory is around 1MB – 2MB and is located next to the CPU for super super quick access.

DRAM is a few GB and is what I've been showing you.
When people say RAM, they usually mean DRAM

S03.1.7 Explain the difference between Programmable ROM (PROM), Erasable Programmable ROM (EPROM) and Electrically Erasable Programmable ROM (EEPROM)

ROM – Read Only Memory
Comes from the factory already has a program on it. You cannot change it

PROM – Programmable Read Only Memory
ROM arrives to you empty. You use electricity to write to it. Once its written it stays forever. You can only program it once.

EPROM – Erasable Programmable Read Only Memory
Can let you erase and reprogram your ROM. You program with electricity but you erase with Ultraviolet (UV) light

EEPROM – Electrically Erasable Programmable Read Only Memory
Can let you erase and reprogram your ROM. You can write and erase with electricity.

S03.1.8 Show an understanding of monitoring and control systems

Including:

- difference between monitoring and control
- use of sensors (including temperature, pressure, infra-red, sound) and actuators
- importance of feedback

`Sensors`: A input device, which records fata about the physical environment around it. It takes that data and sends it to a computer. The computer will then do something. A sensor can do it automatically, no need for a human

> sensors:

- Light Sensors
  Looks at how much ambient light there is

- Infrared sensors
  Infrared sensors is a temperature sensor
  It detects infrared radiation from an object or person.

- Temperature sensors
  Contact temperature sensors need to actually touch / make contact with the object they are are measuring
  Non-contact temperature sensors measure the energy that is radiated from an object.

- Magnetic field sensors
  A magnetic field sensor detects changes in a magnetic field.

- Gas
  These sense gas levels, like the consentration of Carbon Monoxide

- Pressure
  pressure sensor measures the pressure of a liquid or gas, usually in a pipe

- Moisture
  Moisture measures how wet something is. It measures the something directly

- Humidity(hygrometer)
  Humidity measures how wet the air around something is and the temperature around it.

- pH
  pH sensor = Potential of Hydrogen sensor

Measures how acidic or alkaline something is.