HOW DEVICES WORK?

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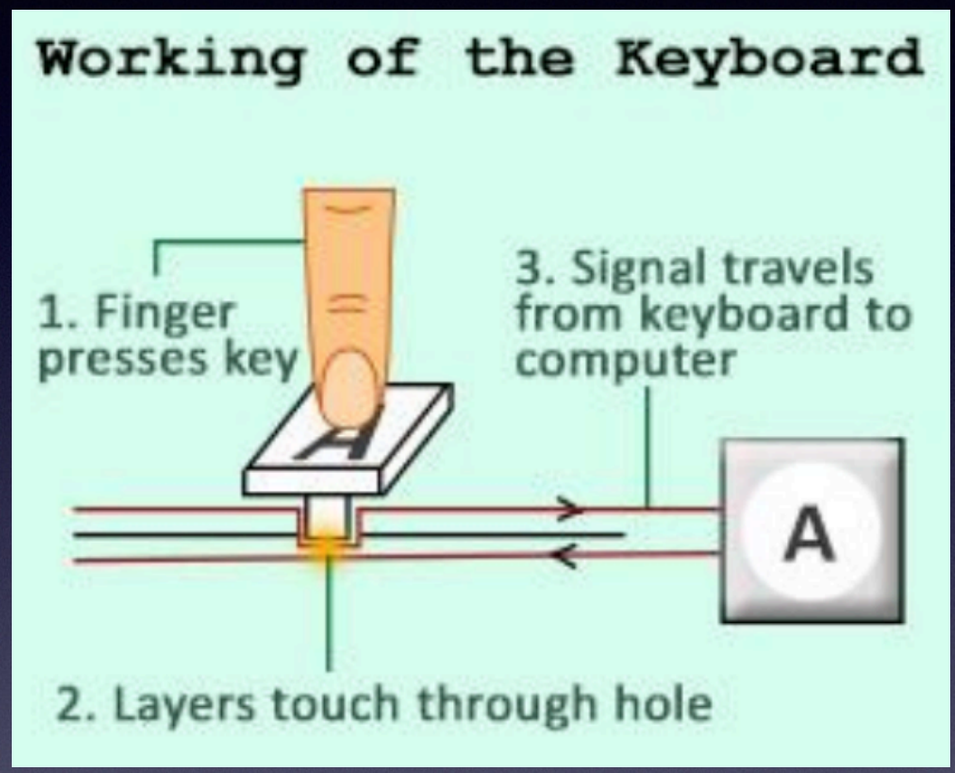
DEVICES INCLUDE:

- KEYBOARD
- TRACKERBALL MOUSE
- OPTICAL MOUSE
- SCANNER
- INKJET PRINTER
- LASER PRINTER
- 3D PRINTER
- HARD DISK
- SOLID STATE(FLASH) MEMORY
- OPTICAL DISCS
- MICROPHONE
- SPEAKER
- TOUCHSCREEN

KEYBOARD

- Inside the keyboard, there are <u>electrical circuitry</u> <u>together with its own microprocessor and a ROM chip</u>.

- Keys are positioned above a key matrix which consists of a <u>rows</u> of wires and another set of <u>columns</u> of wires.



KEYBOARD

- First step: finger presses key
- Pressing a key causes contact at a specific intersection. Microprocessor continuously test to see if any electrical circuit involving a row wire and a column wire has become closed. If recognises, the intersection will be found.
- Second step: converting
- The key press has to be converted to a character code which is transmitted to the processor. The processor ensures that the text character is displayed on the screen.

TRACKERBALL MOUSE

- The ball touches horizontal and vertical rollers
- When the ball rotates / moves , one or both of the rollers rotate as well
- Each roller connects to a shaft which spins a disk with holes
- Infrared beams shine through the holes in the disks
- As the ball moves the roller the beam is broken by the space between the holes which creates pulses of light
- The distance and/or speed of the mouse is determined from the rate of the pulses by an on-board processor chip // by driver software in the computer

OPTICAL MOUSE

- The mouse shines a light beam from a light emitting diode down onto the surface the mouse is resting on
- The light is reflected back on to a sensor flitted to the underside of the mouse
- As the mouse is moved along the surface the sensor acts like a camera taking successive images of the surface
- Image processing software then interprets these images to establish the movement that has taken place and this data is transmitted to the computer as before

SCANNER

- Reverse the printing process in that it takes an image and created from it a digital representation,

- The sheet of paper is held in a fixed position and a light source covering the width of the paper over fin ice bed if the sheet to the other.

- The reflected light is directed by a system of mirrors and lenses on to a charge-coupled device(CCD).

SCANNER

- CCD
  - It consists of an array of photo-sensitive cells.
  - It produces for each cell an electrical response proportional to the light intensity,
  - It needs an analogue-to-digital converter to create a digital value to be stored.

INKJECT PRINTER

- A sheet of paper is fed in
- The printhead moves across the sheet depositing ink on to the paper
- The paper is moved forward a fraction and the printhead carries out another traversal and so on until the sheet has been fully printed

INKJECT PRINTER

- Printhead: consists of nozzles that spray droplets. Number of nozzles in one printhead runs into thousands.
- Ink is supplied to the printed from ink cartridges. Black and white printing needs only one cartridge; simplest technology for colour printing uses three colour cartridges: cyan, magenta and yellow.

INKJECT PRINTER

- REMIND
- FACTORS governing the quality of the printing
  - The precision of the mechanical operations
  - The accuracy of the process of applying the ink to the paper

LASER PRINTER

- The drum is given an electric charge
- The drum starts to resolve step by step
- At each step a laser beam is directed by the mirror and lens assembly to a sequence of position across the width of the drum
- At each position the laser is either switched off to leave the charge or switched on to discharge the position
- The process repeats until a full page electrostatic image has been created

LASER PRINTER

- The drum is coated with a charged toner which only sticks to positions where the drum has been discharged
- The drum rolls over a sheet of paper which is initially given an electric charge
- The sheet of paper is discharged and then his passed through heated riskers ti fuse the toner particles and seal the image on the paper surface
- The from us discharged before the process starts again for the next page

LASER PRINTER

- <u>REMIND</u>
- For colour printing, separate toners are required for the colours and the process has to take place for each colour.
- The technology produces dots
- Quality depends on the number of dots per inch
- Software can control the number of dots per pixel

3D PRINTER

- A plotter uses pens to write on a large sheet of paper constrained by sprockets along one pair of side.

- The sprockets move the paper forwards or backwards and pens are parked or in use at any given time.

- The controlling circuitry and software can create the drawing directly from the original vector graphic file.

3D PRINTER

- Design is deploy into layers.
- The data for the first layer is transmitted to the 3D printer.
- 3D printer uses a nozzle to squirt material on to the printer bed to create a physical layer to match the design.
- Process is repeated for successive layers.
- When the whole object has been formed it has to be cured in some way to ensure that the layers are, in effect, welded together and the material has been converted to the from required for the finished product.

SOLID STATE(FLASH) MEMORY

- Flash memory is a semiconductor technology with no moving parts,
- The circuits consist of arrays of transistor acting as memory cells.
- Uses NAND logic gates to build up circuits.

SOLID STATE(FLASH) MEMORY

- Blocks of memory cells can have their contents erased all at once “in a flash”.
- Before data can be written to a block of cells in the memory the data in the block first has to be erased.
- When data is read, a whole block of data has to be read in one operation.
- Most frequently used in a memory card or in a USB flash drive.

OPTICAL DISCS (CD-ROM)

- The reflective surface is manufactured with indentations, called “pits”, separated by “lands”.
- When the disc is being read, the travel of the laser beam to a pit causes a difference, in phase compare to reflection from a land.
- The phase difference is recognised by the photodiode detector and attached circuitry and interpret as 1 or 0.

OPTICAL DISCS (CD-RW AND DVD-RW)

- The reflective surface is a special alloy material.
- When data is being written to the disc(the burn process) the heat generated by the absorption of the laser light changes the material to liquid form.
- Depending on the intensity the laser light the material reverts to tether a crystalline or an amorphous solid form when it cooks.
- When the disc is read, the laser light is reflected from the crystalline solid but not from amorphous solid allowing the coding of a 1 or 0.

OPTICAL DISCS

- While the disc is spinning the optical head that directs the laser beam is made to move so that the point of contact of the laser beam with the disc follows a single spiral path from the centre of the disc to the periphery.

OPTICAL DISCS

- Spinning speed
- The disc is spinning at constant revolutions per second the outer part of the disc travels faster than the inner part.
- Keeping the bit density constant along the spiral path.
- Wavelength and Focus
- Infrared diode > red laser light > blue laser light
- Infrared diode < red laser light < blue laser light

Microphone

- INPUT section
- Diaphragm
- If the diaphragm is connected to suitable circuitry the vibration can cause a change in an electrical signal
- A condenser microphone uses capacitance change as the mechanism; or to use a piezoelectric crystal
- The electrical signal has to be converted to a digital signal by ADC before it can be processed by a sound card.

SPEAKER

- OUTPUT section
- The sound card produces a digital signal which is converted to analogue by DAC converter.
- The analogue signal is fed to the speaker.
- The current flows through a coil suspended within the magnetic field provided by a permanent magnet in the speaker.
- As the direction of the current keeps reversing, the coil moves backwards and forwards.
- This movement controls the movement of a diaphragm which causes sound to be created.

TOUCHSCREEN

- Resistive (screen) consists of two charged plates
- Pressure causes the plates to touch
- Completing the circuit
- Point of contact registered
- Coordinates used to calculate the position
- Capacitive (screen) made from materials that store electric charge
- When touched charge transferred to the finger
- Sensors at the (screen) corners detect the change
- Point of contact registered
- Coordinates used to calculate the position