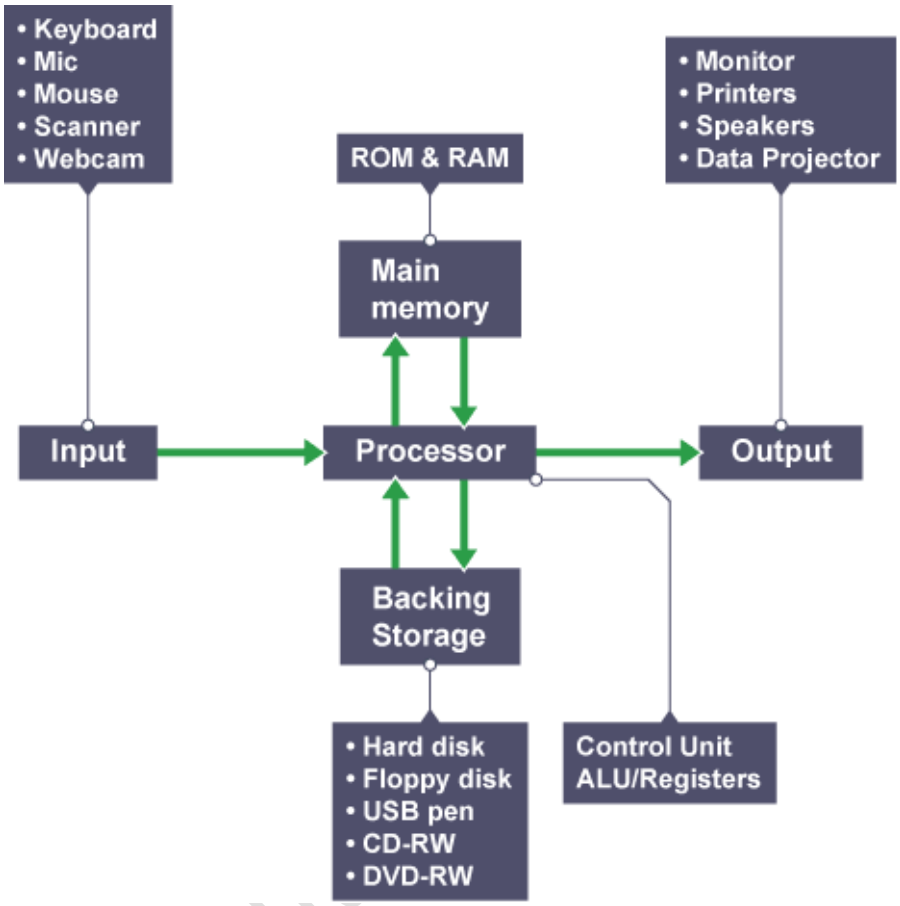
Introducing peripherals

Peripherals are devices that are *not* the computer's core architecture involved in **memory** and processing. Peripherals include input hardware, output hardware and storage devices.

A typical desktop computer could include:

- **Inputs** - mouse, keyboard, webcam, games controller etc.
- **Outputs** - screen, printer, speakers, headphones etc.
- **Storage** - hard drive etc.

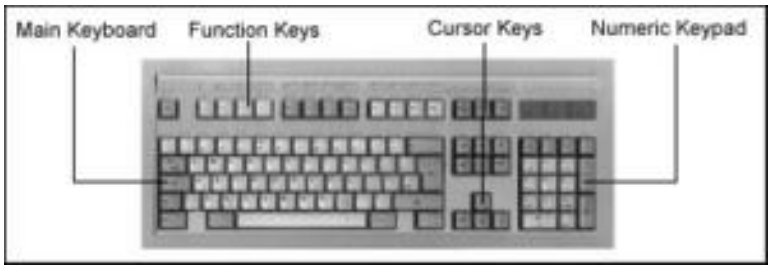


Input Devices:

In computing, an **input device** is a peripheral (piece of computer hardware equipment) used to provide data and control signals to an information processing system such as a computer or information appliance.
Input devices are hardware that allows data to be input into computers. Input devices send signals into the computer that have to be interpreted by the **operating system** using drivers.
Some of the most common input devices include: keyboards, mice, scanners, digital cameras and joysticks etc.

Keyboards: -

The keyboard is the most common and widely used input device. It is made up of buttons called 'keys'. The keys are arranged into sections:



- Alphabet keys
- Function or F keys (F1, F2, F3)
- Numeric keys
- Arrow keys
- Command keys (insert, delete, home, end, page up/down)

Most keyboards are called **'QWERTY'** keyboards. This name comes from the first six letters on the top row of the alphabet keys.

QWERTY

DVORAK

Uses: - Keyboards are used to enter characters and data into computers. A QWERTY keyboard uses the standard layout for English-speaking countries.

The **Dvorak** keyboard layout is an alternative and was designed to avoid awkward key combinations.

Did You Know?

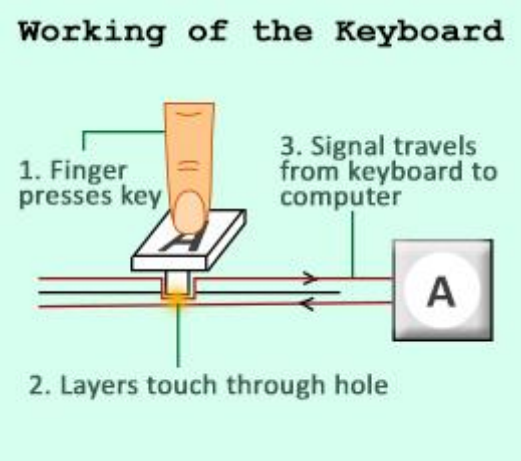
The current keyboard layout, or the QWERTY layout, which is based on the layout of the typewriter, was designed not to increase the speed of typing, but to slow it down in order to avoid typewriters from jamming.

Keys on a keyboard send information into the computer which is interpreted using the **ASCII** or **Unicode** character sets. Most people find the QWERTY arrangement best as they have had some practice using it, but users trained on the new keyboards can type faster than the fastest typists can on QWERTY keyboards.

Advantages	Disadvantages
Most computers come with a keyboard supplied	It is easy to make mistakes when typing in data
People are used to using keyboards to enter data, they need very little training	If you can't touch type, it can be time consuming to enter data
A skilled typist can enter data very quickly	Keyboards are not suitable for creating diagrams
Specialist keyboards are available e.g. ergonomic, gaming keyboards	Disabled people often find keyboards difficult to use
	Excessive use can lead to health problems such as repetitive strain injury (R.S.I.)

Operation of Keyboard:

A computer keyboard is a hardware device that functions in accordance with the instructions provided by the user. It comprises circuits, switches, and processors that help in transferring keystroke messages to the computer.



The working of a computer keyboard can be compared to a miniature computer. Inside the keyboard, there are metallic plate, circuit board (key matrix) and processor, which are responsible for transferring information from the keyboard to the computer. Depending upon the working principle, there are two main types of keys, namely, capacitive and hard-contact. Let's discuss in brief about the functioning of capacitive and hard contact key.

Capacitive Key

On the underside of a capacitive key, a metal plunger is fixed, which helps in activating the circuit flow. When a capacitive key is pressed, the metal plunger applies a gentle pressure to the circuit board. The pressure is identified by the computer and the circuit flow is initiated, resulting in the transfer of information from the circuit to the currently installed software.

Hard Contact Key

A hard contact key is attached with a metallic plate that helps in connecting the circuit board. When the hard contact key is pressed, it pushes a metallic plate, which in turn touches the metallic portion of the circuit plate. This overall process of completing a circuit results in a circuit flow, allowing the transfer of the message to the central processing unit (CPU), which is further transmitted to the software.

In both the key types, the circuit signals the processor to read and/or identify the character that has been pressed. For example, in a hard contact key, the processor reads that pressing 'shift' and 'a' keys at the same time corresponds to 'A'. Hence accordingly, the letter, sign or symbol is displayed on the screen. Releasing the pressed key breaks the circuit flow, after which the key retains its original position. The communication between a computer keyboard and main computer is bi-directional, meaning that message or information can be sent within each other

Concept keyboard: - is a flat board that contains a grid of buttons. Each button can be programmed to do whatever you want. Concept keyboard uses icons or phrases instead of standard letters.

An overlay sheet with pictures or symbols is placed on the grid so that the user can tell what pressing on different areas will do. Concept keyboards are used when fast input is needed and are ideally suited to selecting from a limited range of choices such as fast food restaurants.

- **Checkout tills** such as McDonalds use symbols to make ordering faster and easier.

- **In Primary schools Games for young children**: The overlay image could be a picture of a farmyard. Pressing on an animal would cause the computer to make the noise that the animal does.

- **For disabled people** concept keyboards are particularly useful who would find using an ordinary keyboard difficult.

It is also very handy in locations where an ordinary keyboard might be damaged e.g. by spillage or dust. Concept keyboards are excellent where there is a limited set of things to select and it needs to be done fast e.g. fast food store, pub, skating and other recreation events.

Advantages of concept keyboards	Disadvantages of concept keyboards
Much faster for making non-text selections such as menu choices on the till of a fast-food outlet.	Poor for text or numeric input - although some keyboards do include a numeric keypad so the operator can enter the amount sold.
The keyboard is waterproof which can be useful where there is dirt or the risk of splashes	Limited to the options shown on the keyboard.

Numeric Pad: -

A Numeric keypad is used to enter numbers only. (Although some have function key to allow input of alphabetic characters). A small keyboard that only has **numbers** Used to enter **numeric data** into computers such as those in ATMs. Most computer keyboards have a numeric keypad on the right side, and most mobile phones (there are also computers) have a one for entering phone numbers, etc

Advantages	Disadvantages
Faster than standard keyboards for entry of numeric data.	They can be difficult to use due to very small keys
Since many are small devices (e.g. mobile phones), they are very easy to carry around	Sometimes order of the numbers on the keypad isn't intuitive.

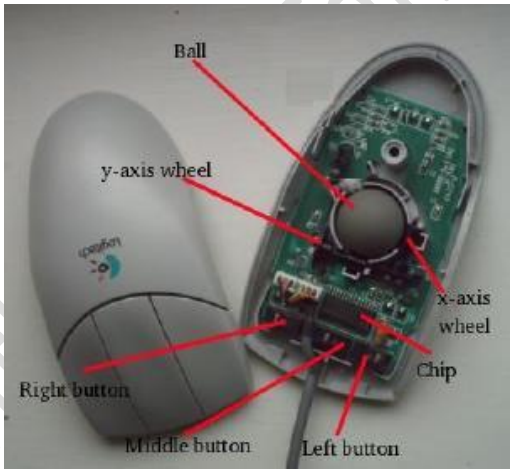
PIN Pad: -

This is a device with a **numeric keypad** used to enter a person's **Personal Identity Number** (PIN) e.g. when paying with a credit card. PIN pads are also found on electronic door **locks** – you enter a PIN to unlock the door.

Mouse:

Everyone is familiar with a computer mouse; along with the keyboard, it is one of the most common input devices you will use.
A mouse is also called a 'pointing device' because it enables you to control what happens on the screen by moving the mouse on your desk and pointing, clicking and selecting items on the screen.

A mouse usually has two buttons, a right and left one and also a central wheel which allows you to scroll up and down the page (some mice have up to five buttons). The left and right button have different functions. Left clicking usually lets you put your cursor at a certain point on the page or lets you choose a menu item. Right clicking brings you up a list of relevant menu items from which you can select a task.

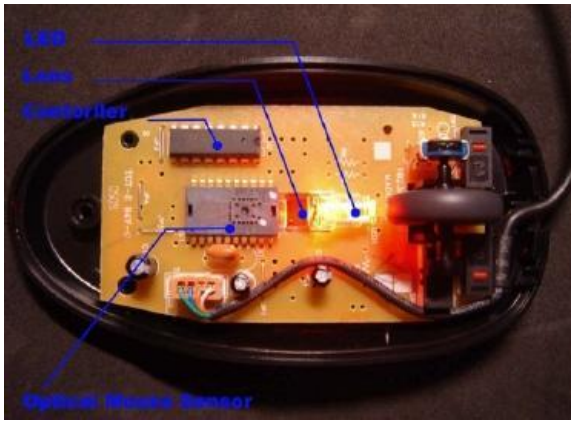


Many of the older styles of mice used a ball which moved against two internal rollers to record the direction that the mouse was being moved in. Recent versions of mice use 'optical' or 'wireless' technology to track mouse movement.

Turn over the mouse you are using right now, do you see a red light? If you do, then you are using an optical mouse.

Working Operation of mouse: With the previous ball-rolled mice, the movement of the pointer in the computer is decided by the ball inside the mouse. So, if the ball gets damaged, or if dust gets clustered, the operation of the mouse becomes problem. When dust gathers, it takes some time to clear it too. With these disadvantages, the ball mouse was slowly moved away from the computer technology leaving the optical mouse to fill its space.

Now, almost everyone tries to switch from ball/roller mouse to Optical mouse. As the cost of the mouse is also being decreasing, the replacement is quiet quicker. To connect this optical mouse, the necessity is PS/2 or USB plug, and windows, Macintosh or LINUX operating system installed in the computer.
The main components of the optical mouse are:



- Inbuilt optical sensor
- High speed camera which can take 1000 pictures at a time
- LED

These optical mice do have an in bulit optical sensor. The optical sensor reads the movements of the optical mouse (moved by the user) with the help of the light rays which comes out from the bottom. (The area in which a light glows). When the user moves the optical mouse, the LED (Light Emitting Diode) present inside the mouse emits the light according the minute movements. These movements are send to the camera as light rays. The camera captures the difference in light rays as images. When the camera captures the images, each and every picture and compared to one another with the digital technology. With the comparison, the speed of the

mouse and the direction of the movement of the mouse are rapidly calculated. According to the calculation, the pointer moves on the screen.

Advantages of mice	Disadvantages of mice
Ideal for use with desktop computers	They need a flat space close to the computer
Usually supplied as part of a new computer system	Older style mice which have roller balls can become clogged with grease and grime and lose their accuracy until cleaned.
Most computer users are familiar with them and require little training	Excessive use can lead to health problems such as repetitive strain injury (R.S.I.)
Works well in conjunction with a keyboard for data entry	If the battery wears out in a wireless mouse, it cannot be used until it has been replaced

Touchpad / Track pad

A **pointing** device found on most **laptops**. Used instead of a mouse since it takes up **less space**. The user moves a finger across the touch pad and this movement data is sent to the computer. Usually used to control the pointer in a **GUI**. Sensors underneath detect the movement direction and speed. The sensors only react to a fingertip and not a pencil or other object. There are usually two buttons next to the touchpad which are used to replace the left and right mouse button.

Advantages of touch pads	Disadvantages of touch pads
Useful for laptops when using a mouse isn't practical	Takes practice and skill to control the position of the cursor using the touchpad
The pad's position is fixed compared to the keyboard, unlike with a traditional mouse	Gloves cannot be worn i.e. in a clean room or industrial environment where gloves need to be worn.
Very short finger movements are required to move the cursor	Moist, sweaty or calloused fingers can disrupt the signals picked up by the sensors.

Trackball / Tracker Ball

This **pointing** device is not moved about like a mouse, instead it has a **large ball** that the user spins. Data about which direction the ball is spun is passed to the computer.
It can be used to control a **GUI** pointer.
Tracker balls are often used by people with **limited movement** (disabled) or by the **very young** since they are **easier to use** than a mouse.

Trackball - similar to a mouse, this is used where extreme accuracy is needed - for example, in **CAD**, sound and video editing, and some medical imaging applications (such as **MRI** scans).

Touch Screen

A touch screen is an alternative to a separate pointing device. With a touch screen the user selects items on the screen by **touching** the surface. This makes touch screen systems very **intuitive** and **simple to use**.

Often used for **information terminals** in public places e.g. libraries or museums where mice or keyboards may be stolen or damaged.

Because they are so intuitive to use, and now they are getting cheaper to manufacture, touch screens will probably become the most common hardware interface for our electronic gadgets.

Another major use of touch screens are on smart phones and modern tablet computers. Each 'app' is accessed by an icon on the touch screen.

Advantages of touch screens	**Disadvantages of touch screens**
Easy to use - intuitive, don't need much training	Not suitable for inputting large amounts of data
No extra peripherals such as a mouse are needed	Not very accurate - selecting detailed objects can be difficult with fingers
Software can alter the screen while it is being used, making it more flexible than a concept keyboard which has a permanent overlay.	Tiring to use for long periods
Touch screen is the main interface on smart phones and tablet computers	More expensive than alternatives such as a mouse (unless it is part of the computer \ smartphone in any case)
Can make use of finger gestures to make sophisticated actions such as zooming and selecting.	Less useful as a control input to a standard computer that makes use of the mouse \ keyboard combination e.g. laptop, desktop pc
Excellent for selecting and controlling 'apps' (applications) that have been designed with a touch screen in mind.	

Remote controls

A remote control is a hand-held device which is used to control a machine from a short distance away. Remote controls need line-of-sight in order to send their signals to the receiving device, obstacles such as furniture or walls can block the signal.

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Email: majidtahir61@gmail.com

Some remote controls allow text to be typed, for example, making a note of the name of a TV program which has been recorded.

Examples of use for remote controls:

- Televisions
- Music systems
- Lighting systems
- Heating systems

Joystick

Joysticks were originally used by pilots as part of an aeroplane's controls and the technology was developed to let computer gamers experience a more realistic game environment.

You can move joysticks in many directions and the joystick tells the computer which direction it has been moved into. They also have one or more buttons whose position when pushed can be read by the computer.

Joysticks can also be used for controlling machines such as cranes, trucks and powered wheelchairs.

Advantages of joysticks	**Disadvantages of joysticks**
They give a better gaming experience for racing or flying styles of computer games	Some people find joysticks more difficult to control than a traditional mouse.
	Joysticks are not particularly robust and can break easily if too much force is used on them.

Magnetic Stripe Reader

Magnetic strips are usually found of the back of most credit cards, cheque guarantee cards, loyalty cards, membership cards etc.

The magnetic strip can hold personal details such as account number and name. The strip can contain up to 60 characters, stored magnetically.

To read the data on the card, it is 'swiped' through a Magnetic Stripe Reader machine and the data is read and fed back to the computer.

Advantages of Magnetic Stripe Readers	Disadvantages of Magnetic Stripe Readers
Simple for people to use - little or no training	Very limited storage capacity for data
Cards are inexpensive to produce	Data can be easily destroyed by strong magnetic fields
Data on the cards can be altered if necessary	Not always secure as thieves can obtain the readers (machine that reads the stripe) and read the data on card.
Security is improved by the use of PIN numbers to confirm that the person is the rightful card owner	

Smart Card

A **smart card** is a device that includes an embedded integrated circuit that can be either a secure microcontroller or equivalent intelligence with internal memory or a memory chip alone. The **card** connects to a reader with direct physical contact or with a remote contactless radio frequency interface.

A **smart card** contains more information than a magnetic stripe **card** and it can be programmed for different applications. Some **cards** can contain programming and data to support multiple applications and some can be updated to add new applications after they are issued.

Advantages of Smart Cards	Disadvantages of Smart Cards
Some smart cards (e.g. transport tickets) are used instead of money, reducing the need to carry cash.	Very limited storage capacity for data
Chip on card does not to be in contact with reader, so there is less damage as compared to Magnetic stripe reader.	Data can be easily destroyed by strong magnetic fields

Scanner

Scanners can be used to convert images or text on paper into a digital format that can be used by the computer.

A scanner works by shining a beam of light onto the surface of the object that you are scanning. This light is then reflected back onto a sensor that detects the colour of the light. This is then used to build up the digital image.

Items that are scanned are usually stored in an image format. However, special software - Optical Character Recognition - can be used to convert text on the paper into text which can be edited with a word processor. However, the text doesn't always get converted very well and you could end up with a lot of mistakes.

There are three types of scanner:

- Flatbed scanners
- Handheld scanners
- Specialist scanners

Flatbed scanner: The most popular type is the flatbed scanner. This is shown in the picture above that has its lid raised to show the glass surface where you place the item to be scanned. This is probably the one that you use at school. They can scan larger images and are more accurate than handheld scanners.

Handheld scanners are usually only a few inches wide and are held in the hand whilst they are rolled across the document to be scanned. The images produced are generally not as large or as high quality as those captured with a flatbed scanner.

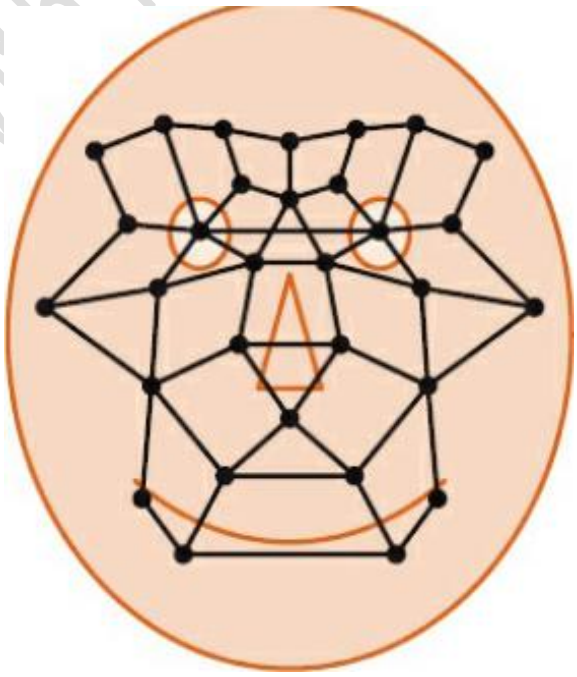
Specialist scanners: If you are a photography enthusiast with a large collection of pre-digital 35mm negatives, then there are specialist scanners that can scan older 35mm film. In theory a standard scanner could do it but the film itself is relatively tiny and will result in very poor scans. The 35mm film scanner is exactly the same technology but the scan is set to go accurately over the 35mm range of the negative.

Another aspect of scanning is emotional - say you can scan the perfect reproduction of a loved family photograph. Question - do you then throw away the original photo? Only you can answer this question. But it does imply that there is something important about original documents - something that all the leading archive libraries in the world have to deal with despite the state-of-the-art scanning process.

Advantages of scanners	Disadvantages of scanners
Flatbed scanners are very accurate and can produce reasonably high quality images.	Images produced by the scanner can take up a lot of memory space.
Any image which is digitized by the scanner can then be included on electronic documents.	Images lose some quality in the scanning and digitizing process.

Advantages of scanners	Disadvantages of scanners
Images once digitized can be enhanced with a graphics application.	The quality of the final image is dependent on the quality of the original image .
Specialist scanners can convert old material such as 35mm negatives into digital files.	Emotional value - is there value in the original image?
Can accurately capture an image, but the original source may be more important than the scanned image.	

Application of 2D scanners at an airport



2D scanners are used at airports to read passports. They make use of OCR technology to produce digital images which represent the passport pages. Because of the OCR technology, these digital images can be manipulated in a number of ways.
For example, the OCR software is able to review these images, select the text part and then automatically put the text into the correct fields of an existing database. It is possible for the text to be stored in ASCII format (see Chapter 1) – it all depends on how the data is to be used.

At many airports the two-dimensional photograph in the passport is also scanned and stored as a jpeg image. The passenger's face is also photographed using a digital camera (a 2D image is taken so it can be matched to the image taken from the passport). The two digital images are compared using face recognition/detection software. Key parts of the face are compared.

Working of Two-dimensional scanners:

These types of scanner are the most common form and are generally used to input hardcopy (paper) documents. The image is converted into an electronic form which can be stored in a computer.

A number of stages occur when scanning a document:

The cover is first raised

... then the document is placed on a glass panel ...

... and then the cover is closed.

A bright light then illuminates the document – modern scanners use a type of xenon lamp which produces a very bright white light.

A **scan head** moves across the document until the whole page has been scanned. An image of the document is produced which is then sent to a lens using a series of mirrors.

The lens focuses the document image.

The focused image now falls onto a **charge couple device (CCD)**; which consists of a number of integrated circuits etched into silicon.

Essentially the CCD is made up of thousands of light-sensitive elements (or **pixels**). Each element creates an electric charge when light falls on it. This means that the scanned image is now turned into an electronic form.

Software produces a digital image from the electronic form.

3D Scanner:

A **3D scanner** is a device that analyses a real-world object or environment to collect data on its shape and possibly its appearance (e.g. colour). The collected data can then be used to construct digital three-dimensional models.

Many different technologies can be used to build these 3D-scanning devices; each technology comes with its own limitations, advantages and costs. Many limitations in the kind of objects that can be digitised are still present, for example, optical technologies encounter many difficulties with shiny, mirroring or transparent objects. For example, industrial computed tomography scanning can be used to construct digital 3D models, applying non-destructive testing.

Collected 3D data is useful for a wide variety of applications. These devices are used extensively by the entertainment industry in the production of movies and video games. Other common applications of this technology include industrial design, orthotics and prosthetics, reverse engineering and prototyping, quality control/inspection and documentation of cultural artifacts.

Technology[edit]

There are a variety of technologies for digitally acquiring the shape of a 3D object. A well established classification divides them into two types: contact and non-contact. Non-contact solutions can be further divided into two main categories, active and passive. There are a variety of technologies that fall under each of these categories.

Contact:

Contact 3D scanners probe the subject through physical touch, while the object is in contact with or resting on a precision flat surface plate, ground and polished to a specific maximum of surface roughness. Where the object to be scanned is not flat or can not rest stably on a flat surface, it is supported and held firmly in place by a fixture.

The scanner mechanism may have three different forms:

A coordinate measuring machine with rigid perpendicular arms.

- A carriage system with rigid arms held tightly in perpendicular relationship and each axis gliding along a track. Such systems work best with flat profile shapes or simple convex curved surfaces.
- An articulated arm with rigid bones and high precision angular sensors. The location of the end of the arm involves complex math calculating the wrist rotation angle and hinge angle of each joint. This is ideal for probing into crevasses and interior spaces with a small mouth opening.
- A combination of both methods may be used, such as an articulated arm suspended from a traveling carriage, for mapping large objects with interior cavities or overlapping surfaces.

Non-contact active

Active scanners emit some kind of radiation or light and detect its reflection or radiation passing through object in order to probe an object or environment. Possible types of emissions used include light, ultrasound or x-ray.

. The main advantage with conoscopic holography is that only a single ray-path is needed for measuring, thus giving an opportunity to measure for instance the depth of a finely drilled hole.

Hand-held laser scanners

Hand-held laser scanners create a 3D image through the triangulation mechanism described above: a laser dot or line is projected onto an object from a hand-held device and a sensor (typically a charge-coupled device or position sensitive device) measures the distance to the surface. Data is collected in relation to an internal coordinate system and therefore to collect data where the scanner is in motion the position of the scanner must be determined. The position can be determined by the scanner using reference features on the surface being scanned (typically adhesive reflective tabs, but natural features have been also used in research work [6][7]) or by using an external tracking method. External tracking often takes the form of a laser tracker (to provide the sensor position) with integrated camera (to determine the orientation of the scanner) or a photogrammetric solution using 3 or more cameras providing the complete Six degrees of freedom of the scanner. Both techniques tend to use infra

red Light-emitting diodes attached to the scanner which are seen by the camera(s) through filters providing resilience to ambient lighting.

Data is collected by a computer and recorded as data points within Three-dimensional space, with processing this can be converted into a triangulated mesh and then a Computer-aided design model, often as Non-uniform rational B-spline surfaces. Hand-held laser scanners can combine this data with passive, visible-light sensors — which capture surface textures and colours — to build (or "reverse engineer") a full 3D model.

Digital Camera

A device that captures **digital photographs**.
Most digital cameras do not directly input data into a computer - they store photographs on **memory cards**. The photographs can later be **transferred** to a computer.
A modern digital camera can capture 20 Megapixels or more per photograph - that's 20,000,000 colored dots (pixels) in every photo!

Video Camera

A device that captures **moving images**, or **video**.
Like a digital camera, most video cameras do not directly input data into a computer – the captured movies are stored on **video-tape** or **memory cards** and later **transferred** to a computer.
However, there are some situations where video cameras do feed video data directly into a computer: **television production** and **video-conferencing**. In these situations the video data is required in real-time.

Webcam

A webcam is short for 'web camera'.

A webcam is an input device because it captures a video image of the scene in front of it. It is either built in to the computer (e.g. laptop) or it is connected through an USB cable.

The video signal is made up of a series of individual 'image frames' which are an instant snapshot of the scene in front of it. Each image frame is sent to the computer for further processing by webcam software. If the 'frame rate' is fast enough (more than 25 frames per second) it appears as motion video.

Many webcams are also used to catch an image frame every now and then, perhaps every minute or even every hour.

Common uses of webcams include:

Chatting

Webcams are commonly used to allow people to see each

other whilst chatting over the internet. Formally this is called 'teleconferencing'

Tourists

There are hundreds of webcams dotted around the world that are pointed to an interesting scene such as the outside view of a lab in the Arctic or maybe the Niagara Falls. The web cam is attached to a computer which sends an image to a server on the internet on a regular basis. People then connect to the server to see the latest image.

Security

Webcams can also be used to capture an image only if movement is detected in the scene in front of it so they are widely used in burglar alarm and other security equipment

Microphone

An input device that converts **sound** into a signal that can be fed into a computer. The signal from a microphone is usually **analogue** so, before it can be processed by a computer, it must be converted into digital data. An **Analogue-to-Digital Convertor (ADC)** is used for this (usually built into the computer's sound card)
Many headphones now come with microphones to allow them to be used with chat and phone applications

MIDI Instruments and Controllers

There are two basic types of devices that generate MIDI data:

- MIDI musical instruments
- MIDI controllers.

MIDI musical instruments, also known as **synthesizers**, come in all different shapes and sizes. Their chief characteristic -- or what differentiates them from MIDI controllers -- is that they generate sound as well as MIDI data.

The classic MIDI synthesizer is the electronic keyboard, resembling a small piano. When you press a key on the keyboard, you hear a tone. Most new keyboards come with hundreds of different preset instrument sounds and effects from which to choose.

But when you press a key on a MIDI synthesizer, in addition to creating an audible tone, you also create MIDI data. If you connect the keyboard to a computer, you can record that MIDI data onto a sequencing program. Or you can connect that keyboard to another device, like a drum machine or sampler, and control that device through MIDI commands.

MIDI controller: A MIDI controller looks just like a MIDI synthesizer, except it doesn't emit any sound by itself.

Think of it like a joystick or a mouse. A MIDI controller only generates pure MIDI data that's interpreted by either a computer or an audio-enabled MIDI synthesizer.

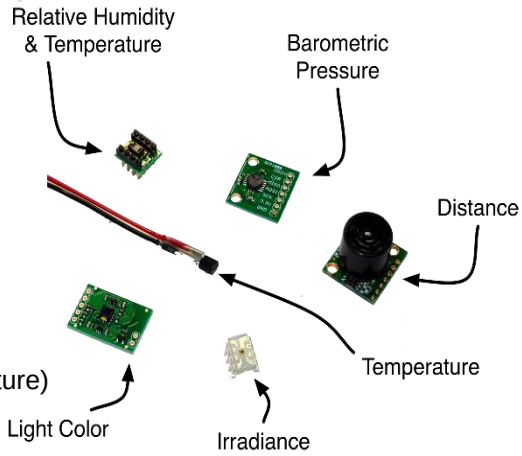
Let's use an example. As we mentioned earlier, the original motivation for inventing MIDI was that musicians wanted to be able to control multiple electronic instruments from one device. This device, usually a keyboard, is called the controller. Different sections of the keyboard can be assigned to control different instruments. Perhaps the lower register controls the drum machine, the middle register controls a Moog synthesizer, and the upper register plays an electronic flute. The controller itself doesn't generate any sound. It just sends out the MIDI messages telling the other instruments what to play.

Today, there are special MIDI controllers -- still mostly keyboards -- that come equipped with multiple knobs and faders to manipulate the instruments they're emulating or controlling. These MIDI controllers don't come with hundreds of preloaded sounds and effects because they generate all of their audio through third-party hardware and software.

MIDI controllers, like MIDI synthesizers, come in all shapes and sizes. There are MIDI controllers that look like guitars, clarinets and drums. Plus there are special foot pedals and elaborate control consoles with dozens of knobs and faders for professional quality mixing. There are even special MIDI consoles to control stage lighting during a show [source: Keith Gemmell's Music Studio].

Sensors

A normal PC has no way of knowing what is happening in the real world around it. It doesn't know if it is light or dark, hot or cold, quiet or noisy. How do we know what is happening around us? We use our eyes, our ears, our mouth, our nose and our skin - our **senses**.



A normal PC has no senses, but we can give it some: We can connect **sensors** to it...

A **sensor** is a device that **converts** a **real-world property** (e.g. temperature) into **data** that a computer can **process**.
Examples of sensors and the properties they detect are...

Sensor	What it Detects
Temperature	Temperature (used in automatic cookers, washing machines, green houses, central heat controllers and environmental monitoring etc.)
Light	Light / dark (used in computer controlled greenhouses, burglar alarm systems, robotics, production line control, scientific experiments and environmental monitoring etc)
Pressure	Pressure (e.g. someone standing on it, used in burglar alarms, robotics, automatic washing machines, production line control and environmental monitoring etc)

Moisture	Dampness / dryness
Water-level	How full / empty a container is
Movement	Movement nearby
Proximity	How close / far something is
Switch or **button**	If something is touching / pressing it

A sensor measures a specific property data and sends a signal to the computer. Usually this is an **analogue** signal so it needs to be converted into **digital** data for the computer to process. This is done using by an **Analogue-to-Digital Converter** (ADC).

Sensors are used extensively in **monitoring / measuring / data logging systems**, and also in **computer control systems**.

Graphics Tablet

A **pointing** device often used by **designers** and **artists** to allow **natural hand movements** to be input to **graphics** applications.

A stylus is held like a pen and moved over the surface of the tablet. Data about the stylus movements are sent to the computer.

Since it is so like using a pen, it is very easy to create '**hand-drawn**' sketches.

A graphics tablet consists of a flat pad (the tablet) on which you 'draw' with a special pen. As you draw on the pad an image is created on the computer monitor from within the application that the tablet is connected to.

The pen is usually radio controlled rather than touch control. This is very useful should you want to trace out an existing line drawing on paper, as you can simply place the paper over the pad and start tracing it out. Some pens have a pressure sensitive tip to allow the artist to draw heavier or lighter lines.

Advantages of graphics tablets	**Disadvantages of graphics tablets**
It is much more natural to draw diagrams with a pencil type implement (the stylus) rather than with a mouse	Not really suitable for general selection work such as pointing and clicking on menu items

Advantages of graphics tablets	Disadvantages of graphics tablets
A great level of accuracy can be achieved	Graphics tablets are much more expensive than a mouse

MICR Reader

Magnetic Ink Character Recognition (**MICR**) is a technology that allows details from **bank cheques** to be read into a computer **quickly** and **accurately**.

The **cheque number** and **bank account** number are printed at the bottom of each bank cheque in **special magnetic ink** using a **special font**. These numbers can be detected by an **MICR reader**.

OMR **Optical Mark Reader**

Optical Mark Recognition (**OMR**) is a technology that allows the data from a **multiple-choice** type form to be read **quickly** and **accurately** into a computer.

Special OMR forms are used which have spaces that can be **coloured in** (usually using a pencil). These **marks** can then be **detected** by an **OMR scanner**.

Common uses of OMR are **multiple-choice exam** answer sheets and **lottery number** forms.

Barcode Reader / Scanner

A barcode is simply a **numeric code** represented as a series of **lines**. These lines can be read by a **barcode reader/scanner**.

The most common use of barcode readers is at Point-of-Sale (**POS**) in a shop. The **code** for each item to be purchased needs to be entered into the computer.

Reading the **barcode** is far **quicker** and more **accurate** than **typing** in each code using a keypad. Barcode can be found on many other items that have numeric codes which have to be read quickly and accurately - for example ID

Light Pen

A light pen is a device used as a **pointing** device or to '**write**' on the **screen** of a computer.
Light pens are **rarely used** today since graphics tablets and high-quality touch screens provide similar functionality.

References:
http://www.buzzle.com/articles/computer-keyboard-functions-how-does-a-keyboard-work.html