TYPES OF COMPUTER

Computers come in all sorts of shapes and sizes. You are all familiar desktop PCs and laptops, but did you know that computers can be as small as your mobile phone (in fact your phone *is* a computer!) and as large as a room?!

Mainframe Computer

A **mainframe** computer is a large computer, often used by large businesses, in government offices, or by universities.

Mainframe computers are typically:

- **Powerful** - they can process vast amounts of data, very quickly
- **Large** - they are often kept in special, air-conditioned rooms
- **Multi-user** - they allow several users (sometimes hundreds) to use the computer at the same time, connected via remote terminals (screens and keyboards)

From their invention back in the 1940s until the late 1960s, computers were large, very expensive machines that took up the whole of a room (sometimes several!) These were the only computers available.

*The circuit-boards of these computers were attached to large, metal racks or frames. This gave them the nickname **'mainframe'** computers.*

*Some of the most powerful mainframe computers can process so much data in such a sort time, that they are referred to as **'supercomputers'***

Personal Computer (PC)

The early **1980s** saw a revolution in computing: The creation of computers that were **small** enough to fit on a desk, and **cheap** enough that everyone could have their own, personal computer, instead of having to share access to a mainframe.

These computers came to be known as **desktop** computers, or **personal computers** (PCs).

A typical PC contained the same basic components as a mainframe computer (CPU, RAM, storage, etc.) but at a fraction of the size and cost.

Early PCs were quite unlike the PCs that we all use today:

- *Displays were black and white, and only displayed text (no graphics)*
- *No hard-drives (way too expensive)*
- *Just a few 100 kB of RAM (not MB or GB!)*
- *Slow - a typical speed would be 5MHz (not GHz!)*
- *No mouse (no pointer to move!)*
- *Light brown case (for some reason every early PC was brown!)*

Because PCs were so much smaller than mainframe computers, they were called 'microcomputers' for a while

Laptop Computer

A 'laptop' computer is a **light**, **compact** and **portable** PC.

Laptops contain a **rechargeable battery** so that they can be used even when not plugged in to a mains power supply. They also have a built-in LCD **monitor**.

To make them as portable as possible, most laptops try to avoid any sort of cable or wire. Instead of a mouse, a **trackpad** is used. Instead of a wired connection to a network or printer, '**wireless**' radio connections are used.

Early portable computers were far from being 'laptops' - you would have crushed your legs if you'd tried to put these beasts on your lap!

Palmtop Computer

A **palmtop** computer is similar to a laptop computer, but smaller. It's **small** enough to fit in the **palm of your hand** (hence the name!)

Palmtops are usually not very powerful since fast CPUs require a large battery and get hot - both problems in a small device.

A typical palmtop have a very **small keyboard** - too small to type on normally. Instead the user types using both thumbs. Also there is no room for a trackpad, so a **touchscreen** or tiny **joystick** is used instead.

Palmtops are **extremely portable**, but the small keyboard and screen make the devices tiring to use for long periods.

Early palmtop computers were pretty basic by today's standards

*Palmtops are often called ultra-mobile PCs (**UMPC**)*

Personal Digital Assistant (PDA)

A PDA is similar to a palmtop computer, except it is even more **compact**, and typically has **no keyboard**, using a **touchscreen** for all data input. Since the screen is so small, many PDAs have a small stylus (plastic stick) that is used to press things on the screen.

Most PDAs use some sort of **handwriting-recognition** system to allow the user to write on the screen, and have their writing converted into text.

PDAs tend to be used a 'digital diaries' allowing users to take their **e-mail**, **documents**, **appointments**, etc. with them wherever they go.

Note: You never see PDAs any more since modern 'smart' phones can do all of this, and work as a phone too!

Early PDAs, like early palmtops, were pretty basic. But they were a revolutionary way to take digital data with you on the move.

In the 1990s every business person either had, or wanted one of these!

*PDAs are often called **Pocket-PCs** (for obvious reasons!)*

INPUT DEVICES

Input - Keyboards

Alphanumeric Keyboard

A very common, general purpose, input device that allows text (abc...), numbers (123...) and symbols (%$@...) to be entered into a computer.

A keyboard is simply a set of buttons. Each button has a symbol assigned.

Numeric Keypad

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.

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.

ERGONOMIC KEYBOARD

An ergonomic keyboard is a computer keyboard designed with ergonomic considerations to minimize muscle strain and a host of related problems.

Advantages

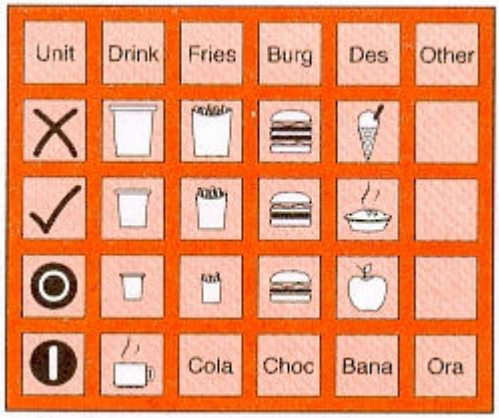
An ergonomic keyboard reduces muscle strain and reduces risk of Carpal Tunnel syndrome. After a user takes the time to adjust to this style of keyboard, these keyboards can make typing easier, faster and less awkward.

Disadvantages

Some ergonomic keyboards are highly priced, though not necessarily so. They may take a little practice to get used to, and many people don't want to go to the trouble of adjusting. These keyboards may take more space on your computer table and force the mouse to be farther away.

CONCEPT KEYBOARD

- A concept keyboard is a flat board that contains a grid of buttons. Each button can be programmed to do whatever you want. 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 where 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.



Input - Pointing Devices

These devices are used to move an on-screen pointer or cursor (usually an arrow). They are commonly used with **graphical user interfaces (GUIs)**

Mouse

A **pointing** device found on most PCs. Sensors on the bottom of the mouse detect when the mouse is moved. Data about this movement is sent to the computer.

Often used to control the pointer in a **GUI**.

Touchpad / Trackpad

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**.

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.

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.

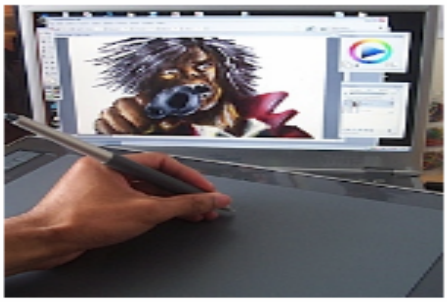
Because they are so intuitive to use, and now they are getting cheaper to manufacture, touch screens will probably become the most common hardware interface for our electronic gadgets.

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.



Joystick / Joypad

Used mainly for playing games. The user moves the joystick left/right, forward/back and data about these movements are sent to the computer.

Small joysticks can also be found on some mobile phones.

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.

Input - Audio / Visual Devices

Scanner

A device that 'scans' **images**, book pages, etc.

Scanning is basically taking a close-up photograph (just very slowly and with great detail). The scanned image data is passed to the computer.

The most common type of scanner is the **flat-bed** scanner which has a glass plate on which the item to be scanned is placed. The item is illuminated and an image of it is captured by a moving scan 'head'.

Scanned images can be further processed once inside the computer, e.g. **OCR** of printed text.

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 10 Megapixels or more per photograph - that's 10,000,000 coloured dots (pixels) in every photo!

*A digital camera in fact contains a small **computer** that controls camera focus, stores images, etc.*

The camera's computer runs a very simple operating system (stored on ROM) and usually provides a menu-based GUI for the user.

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.

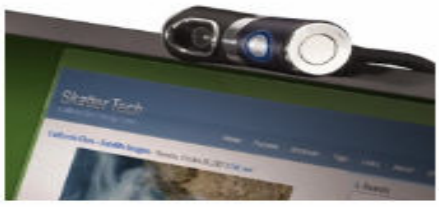
However, there are some situations where video cameras do feed video data directly into a computer: **television production** and **video-conferencing**. In these situations the video data is required in real-time.

Web Cam

This is a very **basic video camera** used to feed **live video** into a computer.

The video data from a web cam is **low quality** compared to a full video camera. However it is good enough for **web chats** (e.g. using a messenger application such as MSN Messenger or Skype).

Usually a web cam is clipped to the top of a monitor, but many laptops now have web cams built into the edge of the screen.



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

Input - Card Readers

Magnetic Strip Reader

Many plastic cards, such as credit cards, have a **strip of material that can be magnetised** on the back. Data can be stored here in the form of **magnetised dots**.

Usually the **data stored on this strip** in the same **data shown on the front** of the card (e.g. the credit card number, expiry date and customer name).

The stripe allows this data to be input to a computer system **faster** and **more accurately** than by typing it in.

A magnetic strip/stripe reader is used to read the data from the stripe. This is usually done by '**swiping**' the card through a slot on the reader.

Smart Card / 'Chip' Reader

Modern credit cards and ID cards don't use a magnetic strip. Instead they have a tiny '**chip**' of computer **memory** embedded inside them. (These cards are often referred to as **smart cards**.)

Data can be **stored** in this memory and **read back** using a 'chip' reader.

A card is inserted into the reader where metal contacts connect to the **metal pads** on the front face of the card. The reader can then **access the memory chip** and the **data** stored on it.

Smart cards can **store much more data** than magnetic strip cards, e.g. an ID smart card would store not only the owner's name and card number, but might also have a digital image of the person.

Satellite TV decoders use smart cards to store which channels a user has paid for. The data is **encrypted** so that it is not easy to alter (you can't add new channels without paying!)

Many types of card use this system: **id** cards, **phone** cards, **credit** cards, **door security** cards, etc.

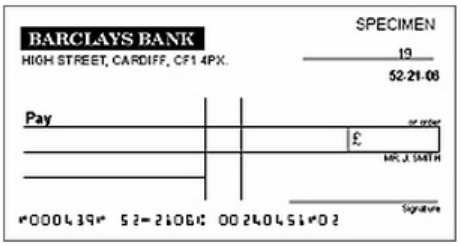
Input - Reading Text / Codes

All data could be input to a computer using a **keyboard**, but this would often be a **slow** process, and **mistakes** would be made.

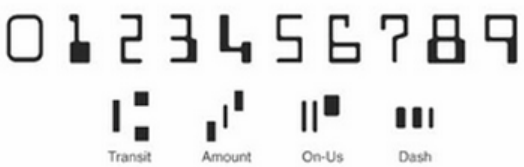
Sometimes **speed** and **accuracy** is required...

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**.

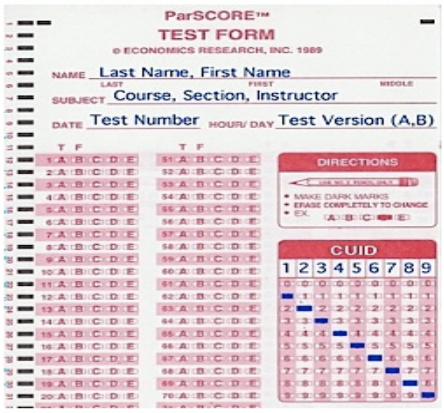


OMR Scanner

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.

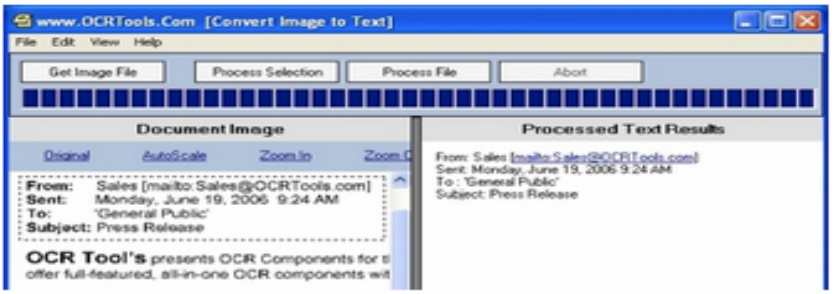


OCR Scanner

Optical Character Recognition (**OCR**) is a software technology that can **convert images of text into an actual text file** that can then be edited, e.g. using word-processing software). The result is just as if the text had been typed in by hand.

OCR is typically used after a page of a book has been **scanned**. The scanned **image** of the page is then **analysed** by the **OCR software** which looks for recognisable **letter shapes** and generates a matching text file.

Advanced OCR software can recognise normal **handwriting** as well as printed text - this is usually called **handwriting recognition**.



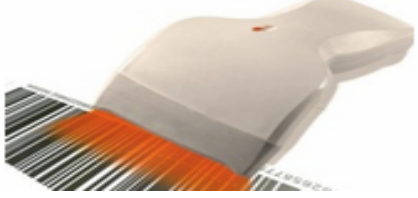
Barcode Reader / Scanner

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 cards.



Input - 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
Light	Light / dark
Pressure	Pressure (e.g. someone standing on it)
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**.

Input - Remote Control

These devices are very common. They **send data signals** each time a **button** is pressed using **infrared light** or **radio signals**.

The signals can **control** a **computer** (or a system that contains a small computer such as a DVD player) from some **distance**.

Often used to **control a presentation** slideshow.

Output - Audio / Visual

CRT Monitor

A monitor displays **text** and **image** data passed to it by the computer.

A **cathode-ray tube** (CRT) monitor is the type that has been around for years and is **large** and **boxy**.

CRT monitors are **heavy** and they take up a **lot of desk space**. They have largely been **replaced** by flat-screen monitors. However some are still used in the design industry since the **colour accuracy** and **brightness** of CRT monitors is excellent, and designers need to see true-to-life colours.

Also, CRT monitors are generally **cheaper** than flat-screen monitors.

Flat-Screen Monitor (TFT or LCD)

Over the past few years, as they have come down in price, flat-screen displays have **replaced** CRT monitors.

Flat-screen monitors are **light in weight** and they take up very **little desk space**.

Modern flat-screen monitors have a **picture quality** that is as good as CRT monitors.

*TFT and LCD are two of the technologies used in flat-screen monitors: **TFT** is Thin-Film-Transistor, and **LCD** is Liquid-Crystal Display.*

*Another technology that may replace these is **OLED**, or Organic Light-Emitting Diodes.*

Digital / Multimedia Projector

Digital projectors are used in situations when a **very large viewing area** is required, for example during **presentations**, for **advertising**, or in your home for **watching movies**.

A projector connects to a **computer**, a **DVD player** or a **satellite receiver** just like a ordinary monitor.

The image is produced inside the device and then projected out through a large lens, using a **powerful light source**.

Loudspeaker

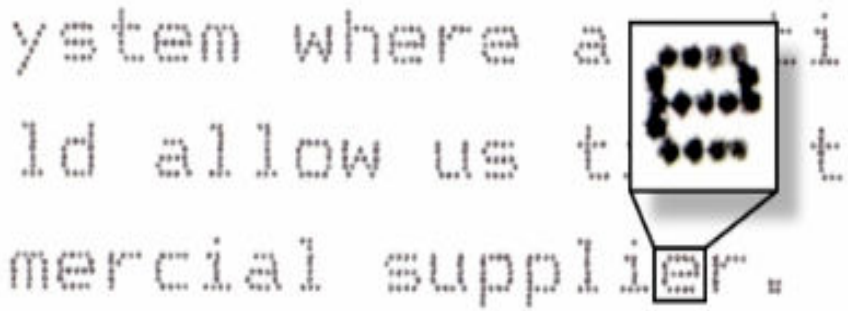
If you want to hear **music** or **sounds** from your computer, you will have to attach loudspeakers. They convert electrical signals into **sound waves**.

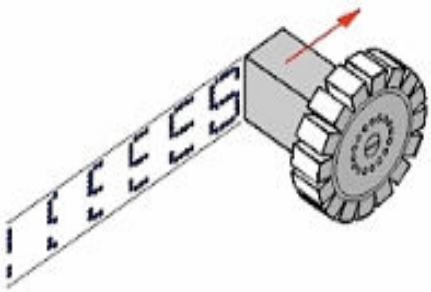
Loudspeakers are essential for applications such as **music editing**, **video conferencing**, watching **movies**, etc.

Dot Matrix Printer

A dot-matrix printer is named after the pattern (a grid or 'matrix') of dots used when creating the paper printout.

These dots are formed by tiny **pins** in the printer's print head that **hit** an inked ribbon against the paper leaving marks. As the print head moves along it leaves a pattern of **dots** behind it which can form letters, images, etc.





Dot matrix printers often use **continuous stationary**: long, continuous strips of paper (rather than separate sheets of A4 like ink-jet and laser printers use).

After printing, the printout is torn off from the long strip.

Dot-matrix print **quality is poor**, the printers are **noisy**, and there are much better printing systems available today. However, the dot-matrix printers are still used in certain situations:

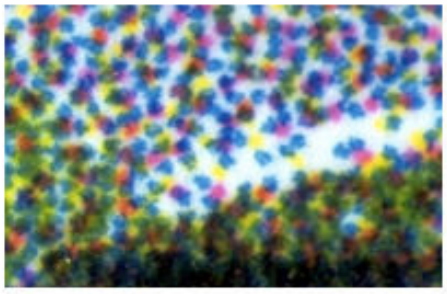
- Since the pins actually hit the paper, several '**carbon-copies**' can be printed in one go. An example of this is **airline tickets** which have several **duplicate pages**, all printed in **one go**
- The print mechanism is **very cheap**, and the inked ribbons last for a **long time**. So, where cheap, low-quality printouts are required, dot-matrix printers are used. An example is **shop receipts**.

InkJet Printer

Cheap, **high-quality**, **full-colour** printing became available during the 1980s due to the development of ink-jet printers.

These printers have a similar print-head mechanism to a dot-matrix printer. The print-head passes left and right across the paper. However, instead of using pins to hit inky marks onto the paper, the ink-jet **squirts** tiny **droplets** of ink onto the surface of the paper. Several coloured inks can be used to produce **full-colour** printouts.

The droplets of ink come from tiny holes (the **jets**) which are less than the width of a human hair in size. Each droplet creates a tiny dot on the paper. Since the dots are so small, the quality of the printout is excellent (1200 dots-per-inch are possible). This is perfect for **photographs**.



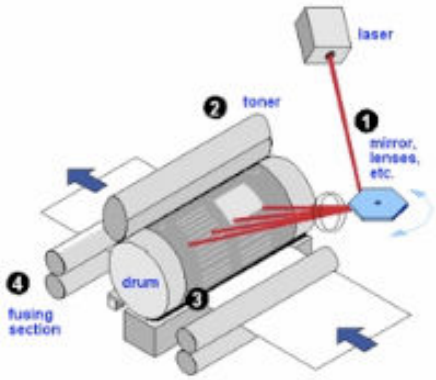
This is a close-up of the tiny ink dots on a page. The dots combine to form light and dark areas.

Ink-jet printers are **very quiet** in use. Since they have so few moving parts they are also **cheap** to manufacture and thus cheap to purchase. However, the **ink** is very **expensive** to buy (this is how the printer companies make their profits!) so the printers are **expensive to use**.

Laser Printer

Laser printers are very **complex** devices, and thus **expensive to buy**. However they are very **cheap to use**. This is because they produce marks on paper using a fine dust called **toner** which is relatively cheap to buy. A single toner cartridge will often last for 5,000-10,000 pages of printing.

The laser printer uses a complex system, involving a **laser**, to make the toner stick to the required parts of the paper. (This system is very different to a dot-matrix or ink-jet, and you don't need to know the details.)



The laser and toner system allows **very fast printing** compared to other printers (just a few seconds per page).

Laser printers are very common in **offices** since they print very quickly, are cheap to use and are reasonably quiet.

Plotter

Plotters create hard-copy in a very different way to printers. Instead of building up text and images from tiny dots, plotters **draw** on the paper using a **pen**.

*Plotters are only suitable for producing **line drawings**. They cannot produce the kind of text and images that an ink-jet or laser printer could. (So you cannot use a plotter to produce photos for example)*

The pens are held in an arm which can lift the pen up or down, and which can move across the paper. The arm and pen create a drawing just like a human could, but much more **accurately** and more **quickly**.

Different **coloured pens** can be used to produce coloured line drawings.

Plotters are often used by **designers** and **architects** since they work with **huge pieces of paper**, far bigger than anything a normal printer could work with...

Plotters have been largely superseded by large-format ink jet printers that can produce more detailed printouts and in full-colour

Output - Control Actuators

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A normal PC has no way of **affecting** what is happening around it. It can't turn on the lights, or make the room hotter. How do we change what is happening around us? We use our **muscles** to move things, press things, lift things, etc. (and we can also make **sound** using our voice).

A normal PC has no muscles, but we can give it some. In fact we can give it the ability to do lots of things by connecting a range of **actuators** to it...

An **actuator** is a device, controlled by a computer, that can **affect the real-world**.

Examples of actuators, and what they can do are...

Actuator	What it Can Do
Light bulb or LED	Creates light
Heater	Increases temperature
Cooling Unit	Decreases temperature
Motor	Spins things around
Pump	Pushes water / air through pipes
Buzzer / Bell / Siren	Creates noise

*Note: some of these devices require an **analogue** signal to operate them. This means that they need to be connected to the computer using a digital-to-analogue convertor (DAC)*

Actuators are used extensively in computer control systems.

Motor

Motors can provide **movement**.

For example, the motor in a **washing machine** can be controlled by a computer - it is **switched on** when the clothes are loaded for washing and **switched off** at the end of the wash.

Computer-controlled motors are also found in **microwave ovens** (to turn the food around) and **air-conditioning units** (to drive the fan)

Pumps

A pump is basically a motor attached to a device that can **push water or air along pipes**. When the motor is switched on, water or air flows along the pipes to places it is needed.

Pumps are used in many places: as part of **watering systems** in greenhouses, in **factories**, etc.

Buzzer

Buzzers can provide **noise**.

For example, the buzzer in a **microwave oven** can be switched on by the controlling computer when the food is cooked.

Louder noises can be made using a **siren** or an electric **bell**, for example in a burglar **alarm system**.

Lights

Lightbulbs and **LEDs** can by used to provide **light**, or to **indicate** something.

For example, computer-controlled lights are used in **traffic lights**, at **music concerts**. Lights are used in **car** dashboards to show if the any of the systems in the car have problems.

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Heaters / Coolers

Heaters can provide **heat**, and coolers can **cool** things down.

A computer can switch a heater on or off when needed to keep a **room** or a **greenhouse** at the correct temperature during winter.

A computer can switch a **cooling unit** on or off to keep a **room** at the correct temperature during hot weather, or to keep food **fresh**.