Introduction

An input device is a piece of hardware that is used to enter data into a computer.

Keyboard

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 (one set above the alphabet keys and a numeric keypad on the right)
- 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.

Using a keyboard for too long can lead to health problems such as repetitive strain injury (RSI). To try to overcome this, different styles of keyboard have been developed, for example, the ergonomic keyboard. They are supposed to put your hands into a much more natural position than a traditional keyboard.

Advantages

- Most computers come with a keyboard supplied
- People are used to using keyboards to enter data, they need very little training
- A skilled typist can enter data very quickly
- Specialist keyboards are available e.g. ergonomic, gaming keyboards

Disadvantages

- It is easy to make mistakes when typing in data
- If you can't touch type, it can be time consuming to enter data
- Keyboards are not suitable for creating diagrams
- Disabled people often find keyboards difficult to use
- Excessive use can lead to R.S.I.

Mouse

Everyone is familiar with a computer mouse; along with the keyboard, it is one of the mostcommon 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 three or four 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.

Advantages

- Ideal for use with desktop computers
- Usually supplied as part of a new computer system
- Most computer users are familiar with them and require little training
- Works well in conjunction with a keyboard for data entry

Disadvantages

- They need a flat space close to the computer
- The rollers in mice that use balls can become clogged with grease and grime and lose their accuracy until cleaned.
- Overuse can lead to RSI

Touchpad

A touchpad is an input device which is usually found on a laptop computer.

Because a laptop is meant to be portable, people aren't always able to attach a traditional mouse, it might be too much hassle or there might not be enough room to use one. A touchpad can be used in place of a mouse.

By dragging your finger over the surface of the touchpad, 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

- Useful for laptops when using a mouse isn't practical
- The pad's position is fixed compared to the keyboard, unlike with a traditional mouse
- Very short finger movements are required to move the cursor

Disadvantages

- Takes practice and skill to control the position of the cursor using the touchpad
- Gloves cannot be worn i.e. in a cleanroom environment
- Moist, sweaty or calloused fingers can disrupt the signals picked up by the sensors.

Joystick

Joysticks were originally used by pilots as part of an aeroplane's controls and the technology wasdeveloped 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

- They give a better gaming experience for racing or flying styles of computer games

Disadvantages

- 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 Ink Reader

Hardware input device.

A magnetic stripe reader is used to read the information on a magnetic stripe card The magnetic stripe is read by swiping it past a reading head. Magnetic stripes are commonly used on credit cards, identity cards and train tickets.

Magnetic stripes are being phased out and replaced by smart cards where the possibility of fraud is high, e.g. In credit cards.

A Magnetic Ink Character Reader is designed to read the numbers at the bottom of a typical cheque. The numbers are specially designed and are printed with magnetic ink. The result is that the error rate for scanning the numbers is smaller than with an Optical Character Reader (OCR) system.

The reader contains a device similar to the reading head of a tape recorder or magnetic stripe reader. It picks up the magnetic signature of the numbers and is not affected by them being written over in ordinary pen or pencil. The magnetic signature is converted to computer usable form by Magnetic Ink Character Recognition (MICR) software.

Optical scanner, OMR and OCR

Hardware input device.

An optical scanner is a device that takes an object, such as a photograph or page of a book and produces a digital image of it. Most scanners are desktop (or flatbed) scanners.

A flatbed scanner has a glass panel under which there is a moving arm holding an array of optical sensors and a bright light. The object to be scanned is placed face down on the glass and the sensor array and light source move along the length of the scanner, reading the entire area.

The quality of the image depends on:

The Colour Depth of the scanner, measured in bits per pixel in the same way as the colour on a monitor.

The Resolution of the scanner, measured in Dots per Inch (dpi).

(OCR) software and a microprocessor built in. It can convert typed and / or handwritten text into a **An Optical Character Reader** is a scanner or digital camera with Optical Character Recognition computer usable format.

Optical Character Readers have been put into pen drives and mobile phones.

Most systems use a normal scanner or digital camera to form an image which is then sent to a computer running Optical Character Recognition (OCR) software.

An Optical Mark Reader is a scanner or digital camera with Optical Mark Recognition (OMR) software and a microprocessor built in. It can recognise marks made in specific places on an object. The object usually has a flat surface with a known orientation, e.g. a piece of paper or card which is fed through the reader. But it can be irregularly shaped and randomly orientated, e.g. on a parcel being carried on a conveyor belt .

Most systems use a normal scanner or digital camera to form an image which is then sent to a computer running Optical Mark Recognition (OMR) software

Touch Screen

A touch screen is the only device which works as both an input and an output device.

You viewthe options available to you on the screen (output) and you then use your finger to touch the option that you have chosen (input).

Touch screens work particularly well with a menu driven interface. For example, a cashpoint (ATM) at a bank would first of all ask which service you want. You touch the option 'withdraw cash' on the screen. You are then presented with another choice, 'how much cash do you want to withdraw?'. Once you have chosen how much, you then get other options such as 'do you want a receipt?'.

Touch screens are easy to use and are often found in public places such as cashpoints at banks, ticket collection terminals at theatres or airports, information centres at museums.

Touch screens are not commonly used to input large amounts of data because they are not very accurate and they would be tiring on the hands to use for long periods of time.

Advantages

- Easy to use - intuitive, don't need much training
- No extra peripherals such as a mouse are needed
- Software can alter the screen while it is being used, making it more flexible than a concept keyboard which has a permanent overlay.

Disadvantages

- Not suitable for inputting large amounts of data
- Not very accurate - selecting detailed objects can be difficult with fingers
- Tiring to use for long periods
- More expensive than alternatives such as a mouse
- Not robust - can soon become faulty if misused.

Scanner

Scanners can be used to convert images or text on paper into a digital format that can be usedby 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 two types of scanner:

- Flatbed scanners
- Handheld scanners

The most popular type is the flatbed scanner. 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.

Advantages

- Flatbed scanners are very accurate and can produce reasonably high quality images
- Any image which is digitised by the scanner can then be included on electronic documents
- Images once digitised can be enhanced with a graphics application

Disadvantages

- Images can take up a lot of memory space
- Images lose some quality in the scanning and digitising process
- The quality of the final image is dependent on the quality of the original image

Digital Camera

A digital camera records images electronically on a memory card rather than on film as did theolder models of camera. The images can be downloaded from the memory card onto a computer and then printed, stored or manipulated with a photo editing application.

Most digital cameras let you view the image as soon as you have taken the picture; if you don't like what you see, it can be deleted.

The quality of the image is dependent on the resolution or the number of pixels. Most digital cameras range from 4 - 12 Megapixels (millions of pixels in the image). The more pixels, the better the quality and clarity of the image.

Many digital cameras are now capable of taking short video clips along with sound.

Advantages

- No film is needed, no developing costs to view the pictures
- Images can be viewed immediately and unwanted images can be deleted
- Images can be edited, enlarged or enhanced
- Images can be incorporated into documents or added to web sites
- Extra memory sticks can be purchased to store images

Disadvantages

- Digital cameras are generally more expensive than ordinary cameras which use film
- Images often have to be compressed to avoid using too much memory
- When the memory is full, the images must be downloaded to a computer or deleted before any more can be taken.

Graphics Tablet

Graphics tablets are often used by graphics designers and illustrators.

Using a graphics tablet, a designer can produce much more accurate drawings on the screen than they could with a mouse or other pointing device. Drawings created using a graphics tablet can be accurate to within hundredths of an inch.

a graphics tablet consists of a flat pad (the tablet) on which you draw with a special pen. As you draw on the pad, the image is created on the screen.

Advantages

- It is much more natural to draw diagrams with a pencil type implement (the stylus) rather than with a mouse
- A great level of accuracy can be achieved

Disadvantages

- Not really suitable for general selection work such as pointing and clicking on menu items
- Graphics tablets are much more expensive than a mouse

Microphone

A microphone can be used to input sound.

The sound is detected by the microphone and an

electrical signal is transmitted to the computer. Special hardware is used to convert this analogue data into digital data so it can be stored and manipulated.

In the last few years a number of voice recognition systems have been developed. These packages let the user dictate the text into a computer and then convert the speech to text.

Dictating like this can be much quicker than typing but the software isn't perfect and it can interpret a word incorrectly.

RFID Technology

Long checkout lines at the grocery store are one of the biggest complaints about the shopping experience. Soon, these lines could disappear when the ubiquitous Universal Product Code (UPC) bar code is replaced by **smart labels**, also called **radio frequency identification** (RFID) tags. RFID tags are intelligent bar codes that can talk to a networked system to track every product that you put in your shopping cart.

Imagine going to the grocery store, filling up your cart and walking right out the door. No longer will you have to wait as someone rings up each item in your cart one at a time. Instead, these RFID tags will communicate with an electronic reader that will detect every item in the cart and ring each up almost instantly. The reader will be connected to a large network that will send information on your products to the retailer and product

manufacturers. Your [bank](#) will then be notified and the amount of the bill will be deducted from your account. No lines, no waiting.

Advantage 1: Efficiency

☐ RFID tags do not require line-of-sight to be deciphered They can be read through cardboard, plastic, wood and even the human body. RFID tags can easily track moving objects and send the required information back to the reader. This eliminates human errors, reduces labor and provides quick access to a wealth of information.

Advantage 2: Return on Investment (ROI)

☐ RFID costs more to implement than a barcode system, but provides a good return on investment in the long run, since RFID is significantly more efficient.

Advantage 3: Less Vulnerable to Damage

☐ RFID tags are less susceptible to damage. An RFID tag is securely placed within an object or embedded in plastic, enabling the system to be used in a variety of harsh environments, such as areas of high temperature or moisture, or with exposure to chemicals or the outdoors.

Disadvantage 1: Expense

☐ RFID systems are typically more expensive than alternatives such as barcode systems. While passive tag reading is similar to (and generally less expensive than) barcode reading, active tags are costly due to their complexity. Active tags consist of an antenna, radio transceiver and microchip, increasing the overall cost of an RFID system.

Disadvantage 2: Collision

☐ Tag collision and reader collision are common problems with RFID. Tag collision occurs when numerous tags are present in a confined area. The RFID tag reader energizes multiple tags simultaneously, all of which reflect their signals back to the reader. This results in tag collision, and the RFID reader fails to differentiate between incoming data. RFID reader collision results when the coverage area managed by one RFID reader overlaps with the coverage area of another reader. This causes signal interference and multiple reads of the same tag.

Disadvantage 3: Security

☐ RFID technology gives rise to numerous security concerns. Since the system is not limited to line-of-sight, external (and malicious) high-intensity directional antennas could be used to scan sensitive tags. Fraud is always a possibility when the technology is used for high-security operations, such as payment verification.

RFID technology has been referred to as invasive technology. Consumers are apprehensive about their privacy when they purchase products with RFID tags. Once the radio chips are installed in the product, the customer can be tracked and his personal information can be collected by the RFID reader. However, many stores have a facility that deactivates the RFID tags after the product has been purchased.

Web Cameras

Web cameras are a relatively modern technology that can be an extremely valuable tool when combined with <u>the Internet</u>. The first known usage of a web camera was in 1991 at Cambridge University; it actively recorded the <u>computer</u> science department until the web camera was switched off in 2001. Web cameras have become integrated into many people's lives---modernizing <u>business</u>, education, and communication.

Location

☐ One of the most advantageous aspects of web camera operation is that they can be used from any location with a reliable Internet connection for easy communication. Web cameras allow people to have the sensation that they are in close contact with another person, and allows for a deeper and more satisfying level of visual and verbal communication.

Enhanced Communication

☐ The reason a web camera is more effective than phone conversation is that it allows for people to include non-verbal communication into their interactions. According to HelpGuide.org, a non-profit health group, "research shows that the majority of our communication is non-verbal." Web cameras---especially modern, high-definition web cameras---provide clear images of the person or people on the other end of the camera. This allows non-verbal signals, gestures, and mannerisms to be communicated as well.

Organization

☐ Web cameras allow for more organized, effective and personal communication---which can be extremely effective in educational institutions and business settings.

Anyone giving a presentation or lecture can use visual aids via web camera for added impact. You can include any type of visual cues desired, from graphs and charts to data on whiteboards and more.

Casual

☐ If you are on a one-sided web camera, where you're not projecting an image of yourself, then you can attend a conference, classroom lecture, or business presentation in casual wear. This can make the atmosphere much more relaxed and casual for the people on the viewing end of the web camera.

Disadvantages

☐ There are some downsides to reliance on web camera technology. Since web cameras rely on an Internet connection, and the connection quality can vary drastically, this can result in poor transfer or streaming of the video. With big conferences, this can be very troublesome if it is very important that everyone sees the presentation at the same time.

Another downside is age. Older people sometimes have trouble using modern technology, like web cameras, which can make using them a challenge.

Another potential disadvantage is relying too much on web cameras for communication. Those who rely solely on web cameras to communicate with others may find their interpersonal skills suffer as a result. From doing business to talking with a friend or relative, there are times when there's just no substitute for an old-fashioned face-to-face conversation.

Tracker ball

A **tracker ball** is used in the same way as a mouse but it is useful where desk space is limited.

It is like an upside down mouse because the user rotates the ball and the main body part stays still. It has buttons like a standard mouse.

Advantages:

- Ideal for use where flat space close to the computer is limited.
- Can be useful with laptops as they can be built into the computer keyboard or clipped on.

Disadvantages:

Not supplied as standard so an additional cost and users have to learn how to use them.

Magnetic Stripe Reader

Magnetic stripes are thin strips of magnetic tape which are usually found on the back of plastic credit and debit cards.

When the card is inserted into a reader (*in an Automatic Teller Machine or ATM for example*) the tapes slides past a playback head similar to that used in a tape recorder. This reads the data from the stripe and passes it to a computer.

Advantages:

- Simple to use and cheap to produce. The data can be altered if necessary.

Disadvantages:

- Very limited storage capacity. Data easily destroyed by strong magnetic fields.
- Not very secure as thieves can obtain the readers and alter the data.

MIDI instruments

MIDI stands for Musical Instrument Digital Interface. These are normal musical instruments which have a MIDI port for input into a MIDI interface in the computer.

The notes are converted into digital data and saved as a file on the computer. This data can be converted back into notes or edited by computer software.

The software often has a wide range of special effects or stored sound data from real instruments.

Advantages:

- Data from a musical instrument is easily captured and edited with a computer.
- MIDI files are small.
- MIDI files can be recorded on one type of instrument and played back on another.

Disadvantages:

- Audio cannot be recorded directly as an audio files such as MP3.
- The playback depends on the instrument/computer sound card so may not sound the same as the original.
- Only the note and the timing are stored.

Sensors
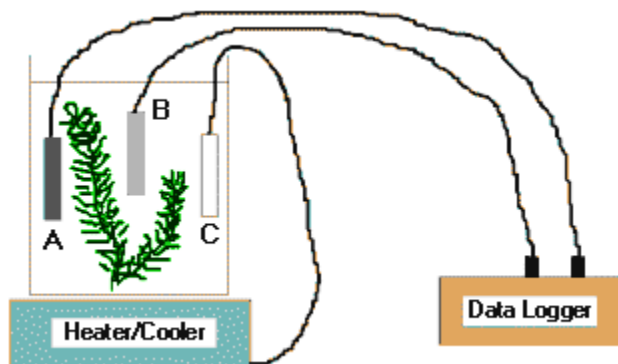
These detect changes in the physical or chemical environment and convert them into electrical signals. These signals can then be digitised and used by the computer.

Sensors are often used when data logging.

Advantages:

- There are a huge range of possible sensors and they include: heat; light; sound; movement; magnetism; pressure; strain; acidity (pH); oxygen levels; liquid levels; humidity; pulse rates; salinity; water flow; speed and acceleration. Switch sensors can detect angles of tilt or whether something is open or closed.

Disadvantages:

- Most sensors need an interface to convert analogue signals into the digital signals that a computer can understand.

Remote control

These emit a beam of infra-red light which carries digital data signals. They are often used to control TV's and VCR's.

More advanced models can be programmed to transmit a series of commands with one button press.

Advantages:

- Each function can have its own button making them very simple to use.

Disadvantages:

- Only advanced models can be have the buttons reprogrammed so they cannot be used to control anything other than the device they were designed for.

OUTPUT DEVICES

Introduction

This section will introduce you to the most common output devices, ranging from computer monitors to lights.

Monitors

A monitor (or screen) is the most commonly used output device.

They come in many different shapes, sizes and forms. In an exam question, you will need to be able to choose the best type of monitor and then explain your reasons.

The picture on a monitor is made up of thousands of tiny coloured dots called pixels. The quality and detail of the picture depends on the number of pixels that the monitor can display. The higher the number of pixels, the better quality the output.

Larger monitors make working at the computer much easier on the eyes, but the larger the monitor, the more money it costs! Typical monitor sizes are 19 inches.

The two types of monitor that you need to know about are Cathode Ray Tube monitors (CRT) and Thin Film Transistor monitors (TFTs).

Cathode Ray Tube

CRT monitors are becoming outdated, although you will probably remember using them at school not very long ago.

They are large and bulky and have a glass screen which makes them fairly robust and difficult to damage.

They produce quite a lot of heat so when you have an office with lots of them it could get quite warm. They are also fairly noisy compared to newer TFT monitors.

Thin Film Transistor

TFT monitors used to be very expensive but now the price has come down they are beginning to replace all of the old CRT monitors. Not only do they look much nicer they take up a lot less space. They are quieter than CRT monitors and also create less heat.

On the down side they are easier to damage than CRT screens. A few sharp pokes at the screen with a pencil can cause lasting damage. Another disadvantage is that unless you have a very high quality TFT monitor, the colours and contrast are not so good as a CRT monitor and so the picture can look a bit dull.

Printers

Printers are another common output device. They are used to create a 'hard' copy of your work i.e. something that you can hold, hand to someone else or file away.

Most printers produce their output on paper

However, paper isn't the only thing that you can print things onto:

Teach-ICT.com

Laser Printer

Laser printers are used in many workplaces because they are quiet, they print a large number ofsheets very quickly and they produce high quality documents.

They print in the same way as photocopiers. Powdered ink, called 'Toner', is fused onto paper by heat and pressure.

You can purchase a laser printer which prints black and white copies only or you can pick a colour laser printer. Black and white versions are relatively cheap to purchase and you only need to buy one toner (which is also expensive). Colour laser printers are still a little too expensive for most people to purchase for home use although many offices now have at least one colour laser printer.

Advantages

- High quality printouts - better than ink-jet or dot-matrix
- Fast printouts - faster than ink-jet or dot-matrix
- Prints very quietly - quieter than ink-jet or dot-matrix
- Cost per page is low - cheaper than ink-jet or dot-matrix

- Most expensive printer type to buy, especially colour lasers
- Toner is more expensive than ink-jet cartridges
- Expensive to repair - lots of complex equipment inside
- Fairly bulky - larger than ink-jet printers
- Can't use continuous or multi-part stationary to create carbon copies like you can with a dot-matrix printer

Ink-Jet Printer

Ink-jet printers have been popular for a long time because they are relatively cheap to buy and most of them can combine both black and white and colour printing at the same time.

These printers use cartridges which contain ink. They operate by heating the ink as it flows through the nozzle. The heating process causes a small droplet of ink to form. This is then released as a single dot which forms part of a letter or image. This is why the printouts often come out of an ink-jet printer still slightly wet.

Colour ink-jet printers are ideal for use at home where only a few documents need to be printed and the quality of the printout doesn't need to be perfect.

Advantages

- Cheap to buy - cheaper than a laser printer
- More compact than a laser printer
- Cartridges cost less to replace than toners
- Produce good quality printouts better than a dot-matrix but not as good as a laser
- Speed - faster than a dot-matrix but not as fast as a laser

Disadvantages

- Noisier than a laser printer (but not as noisy as a dot-matrix)
- Colour printing can be extremely slow
- Cost of printouts per page are more expensive than a laser printer
- Cartridges need to be replaced more often than a laser printer
- Ink will smudge while it is still wet
- Colours can become saturated and often don't look the same as on the screen
- If not used for a while, the cartridges can dry out

Dot-Matrix Printer

These were the first type of printers to be used in homes and schools but they are not usedmuch nowadays.

They are also called 'impact printers'. The print head contains a grid of pins and different combinations of pins are pushed out to form different characters. The print head then hits a carbon ribbon leaving an imprint on the paper. This makes them fairly noisy as you can hear the pins striking the paper.

Dot-matrix printers are ideal when you need carbon copies. This is because the print head hits the paper with enough force that when carbonised paper is used, the impact makes a copy on the second sheet.

They are also useful when continuous paper needs to be used for example printing large quantities of invoices or bills. They can be printed onto paper with perforations and then separated by tearing once the printing is complete.

Advantages

- Relatively cheap to buy
- Low operating costs
- Can print on continuous stationary
- Create carbon copies using carbonated paper
- Robust and will work perfectly well in harsh or dirty conditions such as garages or factories.

Disadvantages

- Print quality is poor and important documents are not suitable to give to managers or customers
- Very slow - slowest out of all three printers
- Noisy - you wouldn't want one of these printing all day in the office
- Cannot produce colour copies

Plotter

Plotters are a specialist type of printer which is able to draw high quality images on very largepieces of paper, for example 3 foot wide by 10 foot long.

They are used by engineers, architects and map-makers to draw plans of buildings, diagrams of

machines or large scale maps. They can also be used for many other similar tasks.

A plotter differs from a printer in that it draws images using a pen that can be lowered, raised and moved across the paper to form continuous lines. The electronically controlled pen is moved around the paper by computer controlled motors.

There are plotters now which are 'pen-less'. these are used for creating high density drawings such as the one shown in the image above.

There are three different types of plotter:

Flatbed plotters - These hold the paper still while the pens move

Drum plotters - These roll the paper over a cylinder

Pinch-roller plotters - These are a mixture of the two types above

Advantages

- Drawings are of the same quality as if an expert drew them
- Larger sizes of paper can be used than most printers can manage

Disadvantages

- Plotters are slower than printers because each line is drawn separately
- They are often more expensive than printers
- They do not produce very high quality text printouts

Speakers

Most computers are fitted with a small internal speaker which can produce beeping sounds toalert you if you make an error.

Computers can also be fitted with a sound card (or chip) which will enable sound to be output through external speakers. These usually produce a much higher quality sound than the internal speaker.

Advantages

- Everyone in the room can hear the output from the computer.
- They can help create an atmosphere or ambiance to accompany a presentation
- They help blind people to use the computer because text can be converted into sound

Disadvantages

- The output from speakers can disturb others who are trying to work
- High quality external speakers can be expensive

Lights

Lights such as LEDs (Light Emitting Diodes) can be connected to a computer and respond toelectrical signals which tell them to switch on and off.

Control devices such as lights, buzzers and motors are used when the computer is controlling a situation such as traffic lights.

Advantages

- They can be used in a computer control simulation and help provide evidence that the simulation is working correctly
- They can provide a warning for users with hearing loss who might not be able to hear the error beeps produced by the internal speaker.
- They come in a large range of different colours

Disadvantages

- The bulb may break or wear out and need replacing
- There may be a loose connection which means the light doesn't switch on even if the circuit or control program is correct