Applied ICT
9713
AS Level

The sections for the AS Level examinations are:

- Chapters 1—4 cover the theory work
- Chapters 8—14 cover the practical work.

For the A2 Level examinations:

- Chapters 1—7 cover the theory work
- Chapters 8—17 cover the practical work.

CHAPTER 1

Section 1: A2 level

Chapter 1 ICT Systems

You should be able to:

(a) identify the following input devices:

keyboards, pointing devices (including mouse, touchpad and tracker ball), video digitisers, remote controls, joysticks, magnetic stripes, scanners, digital cameras, microphones, sensors, MIDI instruments, graphics tablets, MICR, OMR,
OCR, barcode readers, video cameras, web cams, light pens;

(b) identify suitable uses of the input devices ,stating the advantages and disadvantages of each;

Hints: for the advantages and disadvantages you should take in your mind the following

1. Accuracy.
2. speed
3. disability people
4. space and size
5. ease of use
6. comparing with other similar devices
7. security in some cases

1. Input devices:

These are devices that are used to input data into the computer. There is a variety of such devices like keyboard and mice , as well as the type of input devices used in computer control (sensors) .

So Input devices can be classified according to:

The input is manual or automatic.

Manual Input Devices:

- Keyboard
- Mouse
- Touchpad
- Joystick
- Scanner
- Touch screen
- Digital Camera
- Microphone
- Graphics Tablet

Automatic Input Devices:

- M.I.C.R
- O.M.R
- O.C.R
- Barcode Reader
- Magnetic Stripe Card
- Sensors

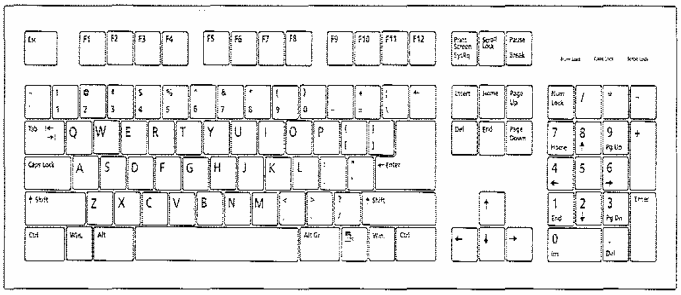
Computer Keyboard:

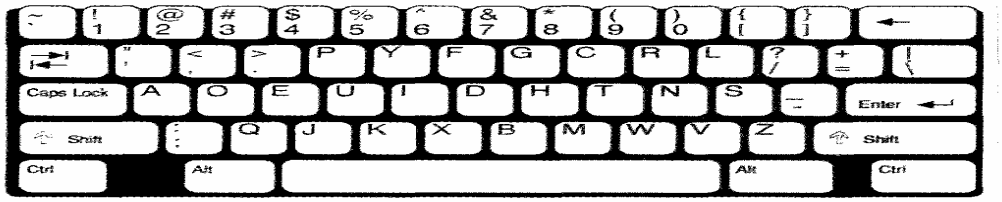
The computer keyboard is the most common input device. It is used for inputting text and instructions using a number of software applications. As well as symbols that are entered using the keyboard, there are some very important keys such as the Control (Ctrl), Alt, Shift, Tab, Enter, Function and cursor arrow keys.

There are four kinds of keyboard:

- 1. The QWERTY keyboard (so-called because these are the first letters along the top line of letter keys).

- 2. The DVORAK keyboard, named after its inventor. It is much easier to use than the QWERTY version but because the vast majority of computer users are used to using the QWERTY keyboard the DVORAK is unlikely to increase in use.

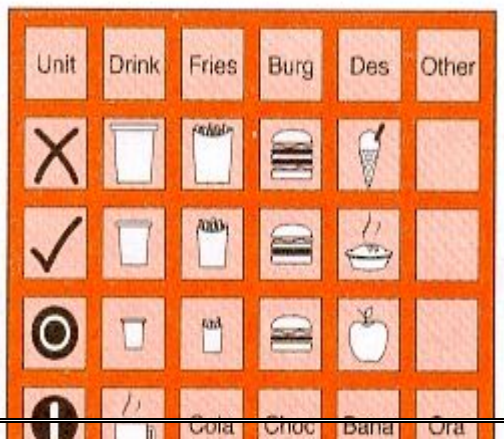




- 3. An **ergonomic keyboard** or (ergonometric) is a computer keyboard designed with ergonomic considerations to minimize muscle strain and a host of related problems.(Using a keyboard for too long can lead to health problems such as repetitive strain injury (RSI)).

- **4. Concept Keyboards**

A concept keyboard is a flat board that contains a grid of buttons. Each button can be programmed to do whatever you want (no pre-set keys).



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. Primary schools often use them with young children. (Pressing on an animal would cause the computer to make the right animal noise.)

- **Advantages of Concept Keyboards**:

It is used by people who may have disabilities, as it is easier to press a large symbol than to press the key on the keyboard..

Keyboards Uses:

• Keyboards are used to input text, for example into a word-processed document.
• Keyboards are also used to type commands into a computer, for example pressing the control (Ctrl) key at the same time as pressing X (to cut selected text) or C (to copy the selected text) or V (to paste the selected text).

• They are also used to type in unusual selections of characters, such as passwords.

Advantages:
• They allow accurate entry of data, in combination with a monitor to check accuracy
• They allow quick entry of original text.
• They are robust devices.
• Concept keyboards are helpful to people with disabilities.

Disadvantages:
• Conventional keyboards can be difficult for people with disabilities to use.
• They are not very quick for inputting data compared with direct data entry devices such as barcode readers, and magnetic ink character recognition (MICR) and optical mark recognition (OMR) devices.
• They take up more space than other input devices.

Numeric keypads:

A numeric keypad is used specifically to enter numbers, although alphabetic characters can be entered by using the function key.

Uses:

They are used in situations where only digits have to be entered, for example:

• At electronic point of sale (EPOS) terminals
• With automated teller machines (ATMs)
• On mobile phones
• When delegates at a conference need to record their responses to questions
• When inserting personal identification numbers (PINs), such as for chip and PIN credit/debit cards.

Advantages:

• They are small and compact and can be carried easily.
• Many devices can be connected to the same computer at conventions.
• They are easy to cover up when entering a PIN.

Disadvantages:

- It is difficult to enter text.
- They can be too small for the numbers to be used effectively.

Mice:

A mouse is a pointing device. It is moved by the user in order to control the position of a pointer on the computer screen.

	Optical mouse	Mechanical mouse(ball)
Movement	reflected light	movement of a ball
Quality	less damage	can fail easily
surface	do not require a special surface	require a special surface

Also there are cordless mice, which need a transmitter and a receiver. The transmitter is based in the mouse, while the receiver is usually a separate device that is sometimes similar in appearance to a memory stick and fits into a universal serial bus (USB) port on the computer.

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Uses:
• Mice are used to move the pointer on the screen as well as for selecting items such as check boxes, radio buttons and options from a drop-down menu.
• They can be used to draw objects in drawing and art packages.

Advantages:

• They allow faster entry of the chosen option, compared with typing on a keyboard.
• They allow fast navigation through slideshows/ websites.
• They are smaller and more compact than keyboards.

Disadvantages:
• They can be difficult to use for people with disabilities.
• They can be damaged fairly easily.
• They can be difficult to use for entering data other than choices on a menu, radio buttons or by means of hyperlinks.

Touchpad:

A touchpad is incorporated into most laptops and is meant to simulate the use of the mouse.

Advantages:

• They allow faster entry of the chosen option compared with typing on a keyboard.
• They allow fast navigation through slideshows/ websites.
• They are integrated within the laptop computer and don't have to be plugged in.

Disadvantages:

• People with disabilities can find them difficult to use.
• Many users find them difficult to control compared to a mouse.
• They can be difficult to use for entering data other than menu choices, radio buttons or by means of hyperlinks.

Tracker ball
Is an upside- down mouse-like device. It has been designed for users who have limited ability regarding movement of their fingers or hands.
There are a number of buttons, depending on the application. There are usually three, left-and right-click buttons on a mouse, while the third button is usually used instead of a double click.

Uses:

- They can use for any application by people with disabilities or RSI where the use of a mouse would be too difficult.

- They are used in control applications where objects on a screen are used to control a process.
- Pilots on fast ferry ships and air traffic controllers use them to control the appearance of radar screens and their contents.

Advantages:

• They do not require the fine control that a mouse does.
• They are easier for people with disabilities or RSI to use.
• They can be more accurate when positioning the pointer on a screen.
• They are fixed, so they cannot be knocked accidentally (for example, onto the floor, where a disabled person could have problems retrieving them).

Disadvantages:
• It is difficult to enter data that the button has not been programmed for.
• They can be slower for selecting options compared with using a mouse.

Video digitisers:

A video digitiser is used to input video to a computer from a television or video camera.

In order for the computer to be able to handle the resulting images the video has to be converted from analogue to digital using the digitiser.

Video digitisers are usually video cards that are fitted into your computer.

Remote controls
A remote control is used to control other devices remotely by emitting an infrared signal to the external device.

. Remote controls are small, so that they can be held in the hand, and wireless, communicating with the device by means of infrared signals.

Uses:

They are mainly used with home-entertainment devices such as televisions, satellite boxes, video / digital versatile disk (DVD) recorders and stereo systems.

Advantages:
• They can be any distance from the device and still operate it.
• People who have difficulty walking find it easier to control devices.
Disadvantages:
• People with disabilities or RSI can find it difficult to use.
• If somebody or an object comes between the remote control and the device, the device can no longer be controlled remotely.

Joystick:

Joystick carries out similar functions to the mouse and tracker ball. It consists of a stick that is gripped by the hand and moved around and buttons Joysticks that can be used to select options.
The stick is used to control the cursor, pointer or other objects on the screen.

Uses:

• They are used with video/computer games.
• They are used in the training of airline pilots to control various aspects of flying an aircraft.

Advantages:
• They allow faster entry of the chosen option compared with typing on a keyboard.
• They can be used to control objects in three dimensions.

Disadvantages:
• They can be difficult to use for entering data other than menu choices, radio buttons or by means of hyperlinks.
• It is more difficult to control the pointer than other windows, icons, menu and pointer (WIMP) input devices.

Touch screens:

Despite their appearance, these are input devices. The user can choose from options on the screen simply by pressing the option on the screen with a finger or a stylus. There are normally icons on the screen representing buttons as well as arrows to move backwards and forwards through screens.

Uses:
They are used in many applications, including:
• ATMs by bank customers
• EPOS terminals, with buttons on the screen representing prices for products
• Personal digital assistants (PDAs), for choosing options and handwriting recognition
• Interactive whiteboards in education.

Advantages:
• They allow faster entry of the chosen option compared with typing on a keyboard.
• It is easier to select options than by using a mouse.
• People with disabilities can find them easier to use.
• There is less likelihood of selecting a wrong option.
Disadvantages:
• It can be difficult to enter data other than from a list/set of options.
• The screen is fairly firm, so RSI could result from continual use of a finger to select options.

Magnetic strip readers

As the name implies, a magnetic strip (or stripe) reader is used to read information from magnetic strips found on plastic cards.

The strip normally has three tracks containing information, such as account number, sort code, expiry date and issue number or start date.

Uses:

• They can be used anywhere a payment is made using a bank or credit card, such as: in bank ATMs ‘ as part of electronic funds transfer at point of sale (EFTPOS) terminals in supermarkets and other types of shops and restaurants.

• In security, they are used to prevent unauthorized access to restricted buildings or hotel rooms.

Advantages:
• They allow faster entry of data compared with typing on a keyboard.
• Data entry is more accurate than with a keyboard.
• Data entry is more secure than with a keyboard.
• Their use prevents entry to restricted areas without a card.

Disadvantages:

• If the strip is damaged, data has to be entered manually, resulting in loss of speed at EFTPOS terminals.
• If the strip is damaged or the card is lost, the holder cannot gain access to the building or hotel room.

Smart card readers:

Smart cards are often referred to as chip cards. They are similar in appearance to a magnetic strip card, but information is stored on a chip on the card. This can be used for storing a PIN and/or other personal data.

The chip can be updated and so, in the case of a payment card, can be used to store the amount of money left on the card.

- These cards have greater memory storage and security of data than a magnetic strip card.
- They can also process data on the card.
- can be used without a reader

Uses

• Smart cards are used as payment cards (e.g. phone cards), loyalty cards, identification cards and public transport tickets.
• They are used with satellite broadcasters to decode television programmes.
• They are used with subscriber identification modules (SIMs) in mobile telephones.
• They are used as electronic passports and in driving licences,

Advantages:
• They allow immediate updating, thereby preventing fraud.
• The cards do not need to be in immediate contact with the reader and so receive less damage through regular use.
• Their use prevents entry to restricted areas without a card.

Disadvantages:
• If the card is lost the owner loses a proportion, if not all of the money value of the card.
• There is a lot of information on some cards — if the card is stolen, hackers can use it for fraudulent purposes and identity theft.

Chip and PIN readers:

These are a type of smart card reader, but tend to be used only at EFTPOS terminals. There are a number of versions of these readers.

For example, the combined PIN pad and chip reader does not have a magnetic strip reader.

This device has a slot for inserting the chip card manually, a keypad for entering the PIN and a small display to show instructions and indicate progress of the transaction.

. The data on the chip contains much the same information as is to be found in the strip on a magnetic strip card. It contains account information, but, more importantly, contains the PIN (personal identification number).

- The card cannot be used unless the person knows the PIN.

Uses
Chip and PIN readers are used wherever a payment needs to be made; for example, in restaurants, supermarkets, shops of all descriptions, travel agents and banks.

Advantages:
• They allow secure transactions to take place, as without the PIN the transaction cannot proceed.

• They save time in the transaction compared with using cash or cheques.
• Chips are more robust than magnetic strips.

Disadvantages:
• If the customer forgets their PIN, the transaction has to be cancelled.
• The card holder needs to be very careful to protect their PIN when using their card.

Scanners:

Scanners are used to enter hardcopy images into a computer. The most common type is the flatbed scanner, where the user places the document flat on a glass panel and closes the lid. An array of sensors and a light source move underneath the document, producing a scanned image that can then be manipulated using drawing packages.

If the document being scanned is text, the scanner can also be used with optical character recognition (OCR) software. This produces text suitable for use in other software packages.

. Another type of flatbed scanner is that used in supermarkets for reading barcodes. There are also handheld scanners.

Uses:
• Scanners are used to scan documents that can be converted into text-based documents using OCR software.
• They are used to scan old documents for keeping records; for example, birth, death and wedding certificates.
• They are used to scan images that can be transferred as faxes.
• Photographers use scanners to obtain digital images of photographs.
• They are used as barcode readers.

Advantages:
• Scanners allow images to be stored for further editing.
• Using OCR on printed documents saves time compared with typing the text in again.
• Using a barcode scanner is quicker than typing in the barcode.

Disadvantages:

• The accuracy of reproduction is limited.

Digital cameras:

Digital cameras are now being used far more frequently than traditional cameras.

The major difference is that the camera can be connected directly to a computer and photographs uploaded to a photo library on the user's computer. Alternatively, software packages such as photo-editing packages are used to manipulate the photographs; for example, cropping, resizing or coloring them.

Many digital cameras can also be connected directly to photo printers for immediate printing.

Most cameras have the capacity to store many photos and the number can be increased by adding an additional memory card.

Uses

• They are used by professional photographers in their work and by any one for personal use.

• They are used to insert photographs directly into all types of software, including presentation software, word processors, desktop-publishing software and database software.

Desktop publishing software is a tool for graphic designers and non-designers to create visual communications.

Main Companies

The main players in the field are Adobe, Quark, Microsoft, Nova Development and others.

- Adobe FrameMaker
- Adobe InDesign
- Adobe PageMaker
- Microsoft Word,
- Excel,
- PowerPoint
- QuarkXPress

Advantages:

• Digital cameras produce better quality photographs than a traditional camera.

• It is quicker to upload a number of images than to scan them in.

• It is quicker to upload images than to have a film developed.

• A memory card can hold more images than a roll of film.

Disadvantages:

• They are more expensive than traditional cameras.

• Batteries need changing more often than with traditional cameras.

Microphones

Microphones can be connected directly to the computer. They are used to input sounds, which can then be stored and manipulated. The sound input to the microphone is converted into an analogue electrical signal, which has to be converted in turn into a digital signal so that the computer can process it.

This is usually done by the computer's sound card, which acts as an analogue-to-digital
converter.

Uses

• Microphones are used most often to input speech for incorporation as a voiceover in slide shows or in web pages.

• They are used to input dictated text for use with voice recognition software.

The software is used to convert the speech into text so that it can be used with other software packages such as word processors.

Advantages:
• Changes to the sound/voice can be done in real time rather than recording it and inputting the recording.
• It is quicker to input text by speaking into the microphone rather than typing it in.
Disadvantages:
• When inputting a voiceover, the computer cannot be used for any other purpose at that time.
• Voice recognition software is not as accurate as using a keyboard.

Sensors:

A sensor is a device used to input data about physical changes in an environment that is being monitored (measured) or controlled.
The most commonly used sensors are temperature, pressure, light, sound and humidity sensors.

Because physical variables are analogue in nature, i.e. they are continually changing, the data transmitted by the sensor has to be converted into digital (discrete) data, otherwise the computer would not be able to process it. The device used to convert analogue data from the sensor into digital data is called, naturally enough, an analogue-to-digital converter.

Uses:

- Temperature sensors are used in automatic washing machines.
  1. The temperature is input to the microprocessor, which compares it with a preset value.
  2. If the reading is lower than the preset value, the microprocessor switches on the heater.
  3. If the temperature is higher than the preset value, it switches off the heater unless the heater is already off, in which case the microprocessor takes no action.
  4. This process is continuous until the washing cycle has finished.

Temperature sensors are also used in a similar fashion with automatic cookers, central heating controllers and computer-controlled greenhouses.

- Pressure sensors can be used with burglar alarms, normally under carpets by doors and windows. The microprocessor is programmed with a preset value, normally low, although it cannot be zero — otherwise, if a piece of paper, for example, fell on the sensor, the alarm would sound.

The microprocessor monitors the readings, continuously checking that the preset value has not been exceeded. If it is, then a siren or loud noise is triggered by the microprocessor.

• Light sensors are used in computer-controlled greenhouses, with preset values input to the microprocessor. Unlike with most other sensors, there are at least two preset values: one is for a cloudy day, the other for night-time.

- The microprocessor continuously monitors the readings from the sensors.
- If the reading falls below the lower value, it must be night-time,
- So the microprocessor switches off the light (or if it is already off does nothing).

- If it is higher than this value but lower than the higher value, it switches on the light.
- If it is higher than the higher value the microprocessor switches off the light (or if it is already off does nothing).

• Light sensors are also used in burglar- alarm systems to see if a light beam has been broken by a burglar.

• It can be used in automatic washing machines where the amount of light passing through the water can be detected; if it is low, then the water is cloudy and the cycle should finish.

• They are also used as part of robotic arms and in production-line control.
• They can be used in street lights, where the microprocessor switches them on if the readings from the light sensor indicate that it is getting dark.

• Are sometimes referred to as humidity sensors and are used to detect the amount of humidity present. They are used in computer-controlled greenhouses,

where the microprocessor compares the readings of the sensor with a preset value. If it is lower than this value, the microprocessor switches on water sprinklers.

Advantages of using sensors:

• The readings are more accurate than those taken by humans.
• Readings are taken continuously and so the microprocessor can take immediate action.
• They facilitate automatic processes so that humans can do other tasks.

Disadvantages of using sensors:

• If there is a power cut, readings cannot be taken.

M1D1 instruments

These are musical instruments connected to a computer using a musical instrument digital interface (MIDI). The interface converts the output signals from the instrument into a digital form understood by the computer.

Uses
• A performance can be directly recorded onto a computer and stored as a MIDI file.
• MIDI files can in turn be used to supplement other instruments. For example, if a group of musicians are lacking a particular instrument, they can use a pre-recorded MIDI file.

Advantages:
• They allow files to be produced that can be manipulated.
• Any errors in performance can be removed.

Disadvantages:

• The music produced can sound manufactured rather than spontaneous.

Graphics tablets

Graphics tablets are used together with a stylus to trace round maps or hand-drawn images. As they are traced round, the resulting images appear on the computer screen. They can then be stored for further use.

Uses
• Graphics tablets are often used to create computer graphics.
• In East Asia, graphics tablets are widely used to write Chinese, Japanese and other language characters, as users find it easier than typing these characters on a keyboard.

• Tablets are used to produce technical drawings and in computer-aided design (CAD).
• In some situations, users prefer to use a graphics tablet rather than a mouse as a pointing device.

Advantages:
• They allow alterations to occur as the drawings are input, rather than later, as happens with a scanned image.
• They are a more accurate way of drawing than using a mouse.

Disadvantages:
• They are more expensive than mice.
• They can be difficult to use in choosing menu selections.

MICR devices

Magnetic ink character recognition (MICR) is the system used in the processing of bank cheques.

Information, such as bank sort code and customer account number, is printed in a special font at the foot of the cheque. Before the cheque is processed, the value of the cheque is printed on to it using the same special magnetic font. The cheques are then collected together in a batch for input and processing (usually overnight when the computer system is not so busy).

Uses:

They are used in banking applications for the processing of cheques. The customer accounts are updated after processing.

Advantages:

• They are more secure than OCR as they cannot he tampered with.
• It is a more accurate method than OCR or manually inputting the information.
• Cheques can be read even if they have been overwritten.

Disadvantages:

• There is a limit to the character set that can be used.
• It is an expensive method of data entry.

Optical mark recognition (OMR)

(OMR) is the use of a reader to input data from pencil or pen marks on a form. The computer stores the position of the mark as an item of data.

• They are used for the processing of many types of form; for example, registers and examination responses.
• A form of OMR is used to input barcodes.

Advantages:
• It is a quick method of data entry.
• These devices produce greater accuracy of input than using OCR.
• It is easy for the user to fill in the form or paper to be processed.

Disadvantages:
• Compared with manual methods of marking, it is an inaccurate method. Forms sometimes need to be manually checked prior to input.

• Forms have to be carefully designed, and this can be expensive.

OCR readers
Optical character recognition (OCR) is the software used after documents have been scanned and saved into the computer, converting the image into understandable text.

Uses
OCR is used with purpose-built readers such as multiple line OCR readers to process passports and identity (ID) cards and to sort mail.

Advantages:
• It is a faster method of data entry compared with manually typing in the document.
• It is an easier method of entering data for people with disabilities.

Disadvantages:
• A lot of errors are produced.
• They cannot read handwriting very well.

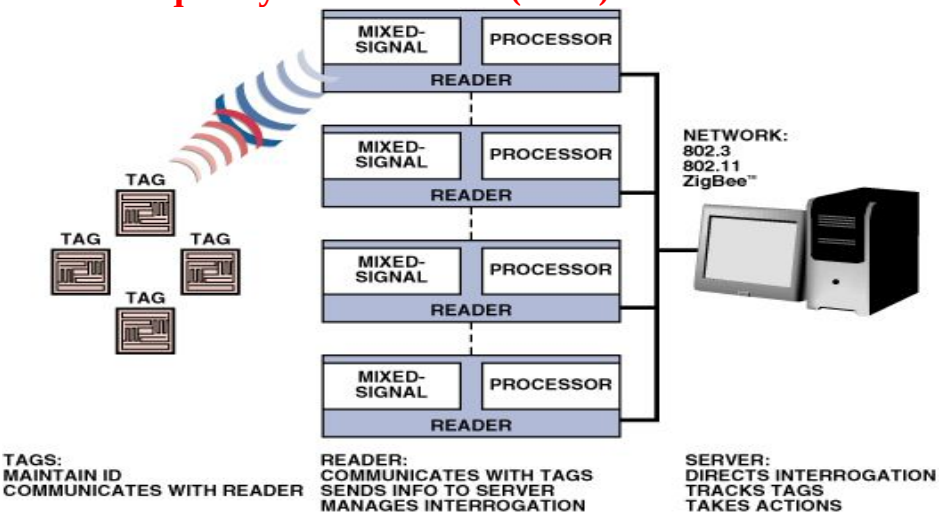
Barcode readers
Barcodes are used to represent information about products. A barcode is normally a pattern of thick and thin, dark and light lines.
A form of scanner called a barcode reader is used to read them. Some are handheld and some are built into the EPOS terminal. The different thicknesses of lines are converted by the computer into a number.

Uses:
• They are used in all kinds of shops, wherever the details of products represented by code numbers need to be input.
• In libraries, they are used to input the book number and library-card number.

Advantages:
• They are faster than typing the number in using a keypad.
• It is a more accurate method of data entry compared with typing the number in.

Disadvantages:
- They can be expensive.

Radio Frequency Identification (RFID) readers



Radio frequency identification (RFID) tags are attached to objects so that the object can be identified through the use of radio waves.

The tag consists of two parts: an integrated circuit storing information about the object, and a miniature aerial for transmitting and receiving radio signals.

The reader is used to transmit a radio signal in order to communicate with the RFID tag. It then uses the data it receives to identify the object.
Some are handheld and some — called portals — are used at doors to detect objects passing through the doorway or entrance or exit to a building.

Uses

• They are used in passports in a number of countries.
• They are used by companies to track movements of their products and for stock taking.
• They are used in pet identification for animals.
• In some libraries, they are replacing the use of barcodes on books.

Advantages:

• Unlike barcode readers, they can cope with objects between the tag and the reader.
• They can be read from and written to.
• They are more difficult to copy than a barcode.

• Tags are very robust.

Disadvantages:
• They are more expensive than other methods of input.
• When used to hold personal data, people's movements can be tracked easily, leading to lack of privacy.

Video cameras:

Video cameras are used to take moving pictures. These can then be input to a computer using a video digitiser. The resulting files are stored using a variety of media

Uses
• They are used by both professional film-makers and by people making home movies.
• They are used for security purposes in closed circuit television (CCTV).
• They are also found in mobile phones.

Webcams
Webcams are similar to video cameras but are connected directly to the computer. They have no storage capability but instead transmit directly to the computer. Another major difference is that they tend not to be used as portable devices.

Uses
High-quality webcams are used by businesses in videoconferencing to input moving pictures from a fixed position into a computer.

Advantages:
• They can be online constantly.
• They provide disabled people with the opportunity to stay in touch visually with friends and relatives without leaving their home.

Disadvantages:
• A webcam has very limited features, for example no zoom facility.
• They are not portable, as they must be connected to a computer.
• The software is fairly limited, often failing to include video-editing facilities.

---- 1.2 Output devices

These are devices that are used to obtain output from the computer. Some of these devices hold temporary output (e.g. monitors and speakers), while others produce hard copy (e.g. printers and plotters). There is also the type of output device used in computer control. These will all be described in this section.

CRT monitors:
Cathode ray tube (CRT) monitors are the cheapest type of monitor but are gradually becoming less popular because of their bulk. They work by an electron gun firing against phosphor particles.

Monitors come in different sizes, usually starting at 14 inch (36 cm) and going up to usually 24 inch (61 cm). This is the length of the screen measured diagonally from corner to corner. Larger size monitors, which are needed for higher resolutions, are more expensive than smaller ones.

Uses
• They are used in environments where space is not a problem.
• They are used when more than one user may need to view the screen simultaneously.

Advantages:

• They are cheaper than thin film transistor (TFT) monitors.
• They produce better quality images than TFT monitors, in terms of colour display and refresh time.
• The screen display can be viewed from a number of angles.

Disadvantages:
• They are difficult to lift and manoeuvre.
• They emit harmful radiation in very small quantities.
• They can have a flickering screen, so prolonged use can cause headaches and eyesight problems.

TFT monitors
TFT or LCD monitors can be used in applications where space is limited, such as small offices. They are, however, becoming more and more popular for normal use, as prices fall. The screen contains thousands of miniature transistors that are activated by the processor. Each pixel is formed by three separate color transistors: red, green and blue.

A transistor is a semiconductor device used to amplify and switch electronic signals.

Uses:

• They are often used when only one person needs to view the screen at a time.
• A TFT screen is an integral part of a laptop.

Advantages:

• They are easy to carry and manoeuvre.
• They produce less glare than CRT monitors.
• They emit less radiation than CRT monitors.

Disadvantages:

• The angle at which they can be viewed is limited.

• There is an inconsistency of color tones when viewed from different angles.
• Videos can have slight blurring.
• They are more expensive than CRT monitors.

Laser printers

This type of printer produces very high-quality hard copy. It consists of a drum that is electrically charged.

Mechanism of Laser Printers

1. Transfer of Data

The first step in laser printing is the transfer of data from a computer to the printer's buffer.

2. Writing Data

Now, once the data is transferred to the printer's memory, it is written to the printer's drum with the help of a laser by changing the charge on the drum for each dot of the output to be produced.

3. Inserting the Paper and Pickup Process of the Toner

Once the writing process is over, you need to add papers to the printer.

.As the drum keeps on rotating, the toner settles down in an area which is at a charge of about -100v and remains attached to the drum till the paper comes in.

3. Transfer of the Toner to the Paper

Now, the complete toned image is created on the drum. The moment you apply the paper to the printer, the toner transfer process starts. The transfer corona applies a charge of about +600v to the paper and when the paper passes through the drum, the toner which is at a charge of about -100v gets transferred to the paper.
Further, the paper passes through a static charge eliminator that decreases the positive charge in the paper, with the help of its negative charge.

Summary

A laser is used to change the charge on the drum for each dot of the output to be produced.
Electrically charged toner is then attracted to the oppositely charged dots .
The paper presses against the toner-coated drum and is output with the pattern of dots required.

Uses

• They are used in applications where low noise is essential, for example most networked systems.
• They are essential in applications which require fast, high-quality; high-volume output, for example in most offices and schools.

Advantages:
• Fast output is achieved.
• Running costs are cheaper than for inkjet printers.
• Large printout jobs can be carried out quickly.
• The quality tends to be higher than other printers.
• Toner cartridges last much longer than inkjet cartridges and so laser printers can be used on longer print runs than inkjet printers.

Disadvantages:
• They are limited in the paper size that they can take.
• Initial costs are high as they are expensive.
• The first page can be slow to print.

Inkjet printers

Microscopic droplets of ink are forced out of a nozzle directly onto the paper.
Signals are sent from the computer to the printer and the printout is produced little by little.
There can often be pauses in the printing process as the printer doesn't have a buffer capable of storing a whole page at a time in the way that a laser printer does.
Uses:
• They are used where there are low output volumes; the need to change cartridges at regular intervals renders them unsuitable for high-volume output processes. They therefore tend to be used in small offices and stand-alone systems.

• They are very good when applications require very high-quality output and where speed is not an issue, for example digital camera applications.

Advantages:
• They produce high-quality output.
• They are fast for printing one-page documents.
• They are cheaper to buy than other printers.
• They are easier to move than other printers.

Disadvantages:
• They are slow to print more than one page.
• They are more expensive to run because inkjet cartridges do not last as long as toner cartridges.
• In very long print jobs, the printing could stop due to the need to change an ink cartridge.

Dot matrix printers
These are impact printers. They work by a printhead comprising several pins (usually a matrix of 24 by 24) pressing against a carbon ribbon onto paper. The ink from the ribbon then appears on the paper.

It is particularly suited to applications that involve the use of multi-part or continuous stationery and when carbon copies are required like (bills).
Uses :

They are used in noisy industrial environments, such as garages and car servicing, car sales and car repair services.

• They can work in environments which would cause problems for laser and inkjet printers, as dirt and oil

• They produce carbon copies.
•Running costs are low.
• Continuous print jobs using pre-printed stationery are more easily managed.

Disadvantages:
• They are very noisy and so unsuitable for most office environments.
• They are now more expensive than inkjet printers.
• They are much the slowest type of printer.

Plotters
A plotter is a device that can produce hard copy like a printer can. However, it is not limited to paper size. There are three types of plotter. The most common used to be a pen plotter, which prints to paper using a number of different colour pens.
The other two types that are commonly used are electrostatic and inkjet plotters (using the same technology as in laser and inkjet printers, respectively).

Uses:
• Plotters are still used to produce printouts of graphs, but are more frequently used to produce blueprints, such as plans for the construction of a building, since these can be very large. They are also used in other technical drawing and CAD applications.

• They are sometimes used to produce billboards.

Advantages:
• Extremely large printouts can be produced.
• The graphic output is of very high quality.

Disadvantages:
• They are very slow to produce output.
• Filled areas of color are difficult to produce using pen plotters.
• They are very expensive.

Speakers
Speakers can be either connected directly to the computer or inbuilt into the monitor. They output sounds that are produced by, or have been stored on, the computer.

The digital data from the computer is converted into analogue signals by a digital-to-analogue converter, and are then amplified and output using the speakers.

Uses
• Speakers are required to play sound files attached to multimedia presentations and websites.

• Computers and MP3 players are used to play music from CDs and DVDs.
• Speakers are an integral part of home entertainment systems.

1.3 Control output devices

This section of the book examines a limited number of output devices associated with computer control.

Actuators

Actuators are used to convert computer signals into movement. Some devices such as motors are considered to be actuators in their own right.

Motors

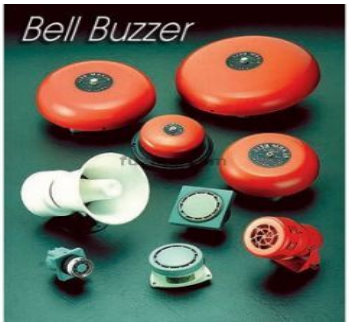
Instructions are input to the computer. After processing these, the computer sends electrical signals to the motor to cause it to operate.
The most common form of motor used with computers is the stepper motor. As its name implies, it moves in steps that can be very tiny, enabling precise control because of these small steps.

Uses

Motors are used in many computer control applications.
• In the home they are used in automatic washing machines to make the drum go round. •They are used in automatic cookers to switch on the heating fans. They cause water pumps to come on in central heating systems.

• They are also used in computer- controlled greenhouses to open the windows and switch on fans.
•They cause dishes that are being cooked to go round in a microwave.
• In industry they are used to move robot arms and on production lines they cause the conveyor belt to go round.
• In computers themselves they are used to cause moving parts to work in disk drives, both optical and magnetic, as well as in scanners, printers and plotters.

Buzzers
An actuator is connected from the computer to the buzzer. The actuator is set to switch the buzzer either on or off.



Uses
• Buzzers are used in automatic cookers and microwaves to tell you when the cooking process has been completed.
• They are used in mobile phones designed specifically for young people.

Lights
An actuator is connected from the computer to the light bulb and set to switch the light either on or off.
Uses
• Lights are used in computer-controlled greenhouses to increase the amount of light for the plants.

Heaters
An actuator is connected from the computer to the heater and set to switch the heater either on or off.

Uses
• Heating elements are needed in automatic washing machines to heat the water to the required temperature.
• In automatic cookers they are needed to heat the hotplates and the oven.
• They are an integral part of central heating systems as they are needed to heat the water before it is pumped to the radiators.
• They are required in computer-controlled greenhouses to increase the temperature of the greenhouse.

1.4 Backing storage media and devices:

All computer systems require some form of backing storage. When a computer user is typing in data, the data is temporarily stored in random access memory (RAM). When the computer is switched off the data disappears. However, it is important that the data is saved permanently. This is why backing storage is needed.

Memory is measured in bytes.
A byte represents one character. 1 MB is about a million bytes and 1 GB is about a billion bytes.

Magnetic tapes

Magnetic tapes are very thin strips of plastic that are coated with a magnetic layer and are fed through a read/write head mechanism.

Data, as with any magnetic medium, is stored on the tape in the form of magnetised bits. The data is stored sequentially, i.e. record by record, file by file, and so is a relatively slow method of retrieving data. You cannot go straight to the data you want; all the data before the item you want has to be read in sequence.

Uses
They are used in any application that requires an extremely large storage capacity and where the speed of accessing data is not an overriding requirement, such as:
• batch-processing situations, for example updating bank accounts with cheques
• utility billing systems, where all customer bills are produced at the same time and every customer record has to be processed
• payroll applications, because all records have to be read in sequence, so direct access has no advantage in this case
• making backups.

Advantages:
• They are cheaper than using disks.
• They are very robust as they are encased in a cartridge.
• The data transfer rate is fast.

Disadvantages:
• Access is slow so uses are limited.
• Updating files requires a new tape to be created.

Fixed hard disks

This is the industry standard for storing data on any computer. A hard disk drive in a PC usually consists of one fixed disk.
They are mounted on a spindle which is operated by a motor to spin the disk very quickly There is usually one read/write head for each disk surface being used — normally one with PCs. These write data to the disk as well as reading data from it. The disks are used in PCs to store the disk operating system as well as software programs and data files.
Any application that requires very fast access to data for both reading from and writing to will require a hard disk drive system.

Uses

Fixed hard disks are essential in any system that requires fast data access times and fast data transfer rates.

• They are used in real-time system such as robotics, rocket launching, etc.
• They are essential in any online system such as booking systems, EPOS stock control and electronic funds transfer.
• They are used in file servers in computer networks.

Advantages:

• The data transfer rate is fast.
• Data access times are fast.
• They have a very large capacity.

Disadvantages:

• They are easily damaged.

Portable hard disks

These are used to store data in exactly the same way as a fixed hard disk but, as their name suggests, they can be easily disconnected from a computer. They are used to transfer large files from one computer to another. They often have a capacity in excess of 1000 GB and so can store much larger files than an optical disk.

Uses

They are used as backup media and for transferring large files from one computer to another. They are particularly useful for transferring server software from one network to another.

Advantages:

• Data access times are fast.
• The data transfer rate is fast.
• They have a large capacity.

Disadvantages:

• If dropped, they are easily damaged.
• The transfer rates are not as fast as with fixed drives.
• They are more expensive than other forms of removable media, such as CDs or DVDs.

Optical backing storage media such as CDs and DVDs

The next few devices all rely on the use of optical devices to read them.
All optical devices operate using a laser beam.

The laser, a beam of focused light radiation, reads from and writes to the disk.

CD ROMs/DVD ROMs

This form of optical disk is read only memory (ROM), which means it can only be read from. It cannot be recorded over.
The main difference between CDs and DVDs are their capacity. DVDs can hold up to ten times the amount of data that a CD can store

Uses

They are used for applications which require the prevention of deletion of data, accidental or otherwise.
• CD ROMs are used to store music albums and to provide audio output in home entertainment systems. They are also used to store software, computer games and reference books such as encyclopedias.
• DVD ROMs are mainly used for storing films, but are increasingly being used for data storage.

Advantages:
• DVDs hold more data than a CD.
• CDs are cheaper to buy than a DVD,
• Both hold much more data than a floppy disk.
• Both are cheaper than hard disks.
• Both are more robust than hard disks.

Disadvantages:
• Data transfer rates for both CDs and DVDs are slower than hard disks.
• Data access times are longer than for hard disks.

CD Rs/DVD Rs:

The 'R' in their names stands for recordable. They can only be written to once, and then they become CD and DVD ROMs.

Uses
• They are used for home recordings of music on CD and films on DVD.
• They are both used for storing and transferring data from one machine to another.

Advantages:
• They are cheaper than CD/DVD RWs.
• Once burned they cannot be accidentally written over.

Disadvantages:
• They can only be recorded on once. If a mistake is made, then the disk needs to be thrown away.
• If several versions of a file are written to the disk, there is less space available than on CD/DVD RWs.
• Not all CD players will read CD Rs.

CD RWs/DVD RWs
These are rewritable (RW) optical disks and can be written over several times. Unlike CD/DVD Rs they do not become CD/DVD ROMs after being written to once.

The recording surface of CD/DVD RWs is a metallic alloy layer.

Uses
DYD RWs are frequently used for recording a television programme that would otherwise be missed. This recording can then be erased after viewing, ready for recording another programme.

Advantages:
• They can be used more than once.

• Different versions of files can be overwritten, thereby virtually increasing capacity.

Disadvantages:
• Their cost makes them impractical for use as permanent backup media, unlike CD/DVD Rs.
• Files can be overwritten accidentally, unlike with CD/DVD Rs/ROMs.

DVD RAMs

The digital versatile disk random access memory (DVD RAM) is a newer technology The recording surface is an alloy coating, as with DVD RWs. However, the data is stored in concentric tracks like magnetic media, unlike the single spiral of a single track
that is used in other optical media.

They usually come in cases that have to be loaded into the DVD RAM drive. They have the same properties as DVD RW but have quicker access times. Writing and reading can occur simultaneously, so it is possible to record one programme whilst watching another. They are much longer lasting than other forms of optical media and can be rewritten approximately 100 times more than a DVD RW Writing to disk is more reliable because the drive has an inbuilt data check to ensure data is written to the disk accurately.

Uses
• DVD RAMs are used for general data storage.
• They are used for archiving, as they are longer lasting than other media.
• In some camcorders, they are used for recording video.

Advantages:
• They have a greater capacity than CD!DVDs.
• They are more durable than DVDs, in that they can be overwritten more times.

Disadvantages:
• They are not compatible with most DVD players.
• They are more expensive than other types of DVD media.

Blu-ray disks

These have the largest capacity of all optical disks: 25 Gb, 50 Gb and 100 Gb. The increased capacity is due to the fact that it uses a shorter wavelength for its laser beam,

using
light that is close to the blue/violet spectra (hence its name) rather than the red light used by other optical devices.
They are used for storing films (movies): 25 Gb equates to 2 hours high definition (HD) television, 13 hours standard definition television. It is possible to play back video on a disk while simultaneously recording high definition video.

Uses

• Their main use is in home video game consoles.
• Devices have been developed to facilitate the playing and recording of videos.
• PCs and laptops are being developed that use blu-ray disk drives for data storage as well as playing videos.
• They are used in many camcorders.

Advantages:

• They store more than other optical media.
• Data transfer rates are high.
• Access speeds are higher with blu-ray players than with other optical devices.

Disadvantages:

• They are very expensive compared with other data storage media.
• There have been problems with the encryption techniques used to prevent piracy.

Minidisks

This is a form of hybrid media, that is to say it uses both magnetic and optical methods to record data.
A laser is used to heat one side of the disk which makes it easy for the disk to be magnetised. A magnetic head is used to magnetise spots on the other side of the disk to record data.
The data is read using only the laser. Disks can be recorded over several times.

Uses

They are used in portable music players, but have been superseded by MP3 players. iPods, and so on.

Advantages:

• Minidisks can be recorded over more times than other media.
• They are more robust than other optical media.

Disadvantages:

• Minidisks have slower transfer rates than other disks.
• They hold less data than other music players.
• They are more expensive than other portable players.

Solid state backing storage

Solid state backing storage is basically a silicon chip consisting of a grid of columns and rows of cells, each cell comprising two transistors separated by a thin oxide layer.

The cell has a value of 1 or 0 depending on its charge. They have no moving parts and so are less likely to break down. They are used as removable storage in flash memory, in the form of either memory cards or memory sticks, as described below.

Memory sticks/pen drives

These can store up to several Gbytes. In order that the data stored on a memory stick can be used, the memory stick must be connected to a computer,
The memory stick draws power from the computer via the USB interface.

Uses

- They are used to transport files and backup data from computer to computer .
- They are used by system and network administrators carrying software fixes.
- They are more compact than equivalent optical or magnetic media.
- They are more robust than other forms of memory, even surviving being 'washed',
- They do not need software drivers to operate.

Disadvantages:

- They are more expensive per Gbyte than hard disk drives.
- The drives cannot be write protected.

Flash memory cards

Flash memory is a form of electrically erasable programmable read-only memory (EEPROM). It is solid state memory.

Uses

- They are used for storing photographs in digital cameras.
- They are used in mobile phones to store phone numbers, photographs, etc.
- They are used in MP3 players to store music.
- They are used as backing storage in many handheld computers.

Advantages:

- They are more compact than equivalent optical or magnetic media.

Disadvantages:

- They are more expensive per Gbyte than hard disk drives.
- They can only be used for a particular number of read/write operations.
- They have lower storage capacity than hard disk drives.

1.5 Portable communication devices

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From your book

DONE BY:

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