

UPDATED TO 2023-2025 SYLLABUS

CAIE IGCSE

ICT

SUMMARIZED NOTES ON THE THEORY SYLLABUS

Prepared for Santoshi for personal use only.

1. Types and Components of Computer Systems

1.1. Hardware & Software

Hardware

- the electronic, physical components that make up a typical computer system. These may include input and output devices as well.
- Internal Hardware Devices:**
 - Central processing unit
 - Processor
 - Motherboard
 - Internal memory consisting of RAM & ROM
 - Graphics & Sound Cards
 - Internal Storage devices like Hard disk drives (HDD) and solid-state drives (SSD)
 - Network interface card (NIC)
- External Hardware Devices:**
 - Monitor
 - Keyboard
 - Mouse
 - Printer
 - External Storage Devices

Software

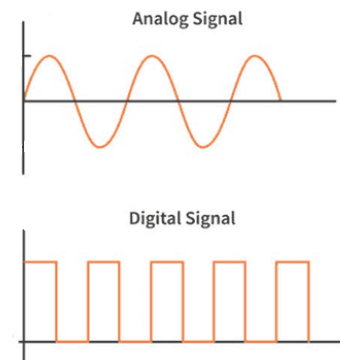
- The techniques, methods, commands, and instructions tell the device what to do and how to do it.
- They are the programs which control the computer system and process data.
- Relates to ideas & instructions for using physical objects.

Two types of software:

- Application software:**
 - Provides services that allow the user to do specific tasks.
 - It can be general-purpose software or custom-made software. (Specialist software)
 - E.g., Spreadsheets, databases, and word processors.
- System Software:**
 - The software is designed to provide a platform all other software to run on. For example:
 1. Compilers: The software translates the High-level language into Machine code (Language Processor).
 2. Linkers: A Software that creates the links between Language processors into workable solutions (Data definition language).
 3. Device drivers: A software that enables the device to work with another, externally connected device.
 4. Utilities: A system software that provides the necessary facilities (Antivirus, Scan Disk, Disk Defragmentation, etc.)
 5. Operating systems: To enable computer systems to function and allow users to communicate with computer systems, special software, known as operating systems (OS), have been developed.

Analogue and Digital Data

Computers can only understand data in the form of binary digits (0,1); this is commonly known as digital data. However, data in the real world is analogue, not limited to two specific values.



- The figures show how data changes in analogue and digital forms; analogue data forms smooth curves, whereas digital data changes in discrete steps.
- So, for a computer to process real-world data, it first needs to convert the received data into digital form. This is done by hardware known as ADC (analogue to digital converter), and its output is given back in analogue form using DAC (digital to analogue converter).

1.2. The Main Components of Computer Systems

Central Processing Unit (CPU)

- The component of the computer that understands and executes hardware and software operations. Nowadays, it's also known as a microprocessor. It is a single integrated circuit at the core of most PCs and is also present in many household gadgets and equipment where some control or monitoring is required.
- It consists of a control unit (CU) that manages the input and output devices, an arithmetic and logic unit (ALU) that performs computations and makes logical judgments, and tiny memory regions known as registers.
- It processes the input and produces the outcome of the processing in the form of output.

Internal Memory

1. Random access memory (RAM): temporary memory storage, lost after power is shut down, performs read and write functions, is used to store data that are currently in use, and can be increased in size to improve operational speed.
2. Read-only memory (ROM): permanent memory storage, non-volatile, can only be read from, used to store computer's configuration data, such as BIOS.

N.B: The BIOS (basic input/output system) stores the date, time and system configuration on a non-volatile chip called a CMOS (complementary metal oxide semiconductor) – this is usually battery powered.

Differentiating between Internal memories:

1. RAM is a temporary memory device, whereas ROM is a permanent one.
2. RAM is volatile, ROM is non-volatile.
3. RAM can be written to and from, but ROM can only be read from.
4. RAM is used to store data, files, programs, and parts of OS that are currently in use. However, ROM is used in storing start-up data,

Input & Output Devices

Input devices	Output devices
An input device is any hardware that enables data entry.	An output shows the result or solution of the input <i>after</i> it has been processed.
An input device can only send data.	An output device can only receive data.
Input devices are necessary for a computer to receive commands from the user for processing to be permitted.	Output devices are needed in order to display the outcome of the processing that took place to the user.
Input devices are complex as they must ensure proper communication between the computer and the user.	Output devices are simpler as they only need to display the finale.

- Input devices are pieces of hardware that allow users to enter data into computers.
- An output device displays the computer's output in a human-readable format. For example, words on a printer or moving graphics on a monitor.

Backing and Secondary Storage

- Required to store significant amounts of data permanently.
- Most commonly in the form of Hard disk drives and Solid-state drives.

Differentiating between internal memory and backing storage:

1. RAM contents are lost when power is lost, ROM is read-only, and backing storage is permanent even without power.
2. RAM and ROM are much smaller than backing storage.
3. RAM and ROM are significantly faster in accessing data than backing storage.
4. Backing storage is much cheaper than internal memory.
5. Internal memories are fixed, and backing storage can be fixed or portable.
6. Internal memories can be directly read by the CPU, while backing storage needs to be moved into the RAM before being read by the CPU.

1.3. Operating Systems

- Controls operation of input, output & backing storage
- Supervises loading, running & storage of application programs.
- Deals with errors in application programs.
- Maintains security of the whole computer system
- Maintains a computer log.

Operating systems offer various types of user interfaces, for example:

1.4. Types of Computers

Desktop Computers

- Desktop usually refers to a general-purpose computer that is made up of a separate monitor, keyboard, mouse, and processor unit. It is distinguished from, for example, a laptop computer by the fact that it is made up of several separate components, which makes it not very portable.
- **Uses:**
 1. office and business work
 2. educational use
 3. general entertainment
 4. gaming device
- **Advantages:**
 1. They are easier and less costly to upgrade and expand.
 2. Spare parts are standardized, which makes them cheaper.
 3. They tend to have better specifications for a given price.
 4. No critical power consumption because they plug into a wall socket.
 5. Due to fixed positions, they are less likely to be damaged or stolen.
 6. As they usually have wired connections, they have more stable internet access.
- **Disadvantages:**
 1. They are not particularly portable because they are made up of separate components.
 2. More complicated because all the components need to be hooked up by wiring, which also clutters up the desk space.
 3. Because they aren't portable, files must be copied to another portable storage device to take work elsewhere.

Mobile Computers

1. Laptop computer:

- (Or notebook) refers to a type of computer where the monitor, keyboard, pointing device and processor are all together in one unit. This makes them extremely portable. lightweight (to aid portability). Low power consumption (and also long battery life). Low heat output (cooling is very important).
- **Uses:**
 1. office and business work
 2. educational use
 3. used as a gaming device.
 4. general entertainment
- **Advantages:**
 1. Portability: all components are in a single unit, so they can be taken anywhere.
 2. Because of one single unit, there are no trailing wires and desk clutter.
 3. take up much less room on a desk, so they can be easily used in public spaces.
 4. portability allows them to take full advantage of Wi-Fi features.
- **Disadvantages:**
 1. portability makes it easier for them to be stolen.
 2. limited battery life means the user needs to carry a charger at all times.
 3. keyboards and pointing devices may be awkward to use.
 4. not easy to upgrade, like adding more RAM.

2. Smartphones:

- Allow normal phone calls to be made, but also have an operating system (such as iOS, Android, or Windows), allowing them to run a number of computer applications (known as apps or applets). Smartphones communicate with the internet either by using Wi-Fi hot spots or by using 3G/4G/5G mobile phone networks.
- **Uses:**
 1. They allow users to send/receive emails.
 2. They allow users to use a number of apps.
 3. They allow users to use a camera feature (to take photos or videos).
 4. They allow users to use an MP3/4 player (for music and videos).
- **Advantages:**
 1. very small in size and lightweight, makes them portable.
 2. connecting to the internet while on the move.
 3. because they use Wi-Fi and mobile phone networks, they can be used almost anywhere.
 4. they have apps which can tell instant location, which is a feature that isn't available in either desktops or laptops.
 5. they have reasonable battery life.
- **Disadvantages:**
 1. small screens and keyboards make pages difficult to read.
 2. more difficult and slower when typing things in.
 3. Web browsing and photography can quickly drain the battery.
 4. Memory size in most phones is not very large when compared to laptops and desktops.
 5. Not all website features are compatible with smartphone operating systems.
 6. Because of their small size, it is much easier to lose a smartphone or for it to be stolen compared to laptops or desktops.
 7. The data transfer rate using mobile phone networks can be slower than with Wi-Fi.

3. Tablets:

- They work similarly to a smartphone. The only main difference is that they are somewhat bigger in size as compared to a smartphone.
- **Uses:**
 1. They allow users to send/receive emails.
 2. They allow users to use a number of apps.
 3. They allow users to use a camera feature (to take photos or videos).
 4. They allow users to use an MP3/4 player (for music and videos).
- **Advantages of tablets compared to laptops:**
 1. very fast to switch on (no time delay waiting for the operating system to load up).
 2. fully portable – they are so lightweight that they can be carried anywhere.
 3. touch screen technology means they are simple to use and don't need any other input devices.
 4. not much heat, they use solid-state technology.
 5. The battery life of a tablet is a lot longer.
 6. when the power button is pressed, it goes into standby but remains connected to the internet so the user still hears alerts when emails or other 'events' are received.
- **Disadvantages of tablets compared to laptops:**
 1. tend to be rather expensive when compared to laptops.
 2. they often have limited memory/storage when compared to a laptop.
 3. typing on a touch screen can be slow and error-prone compared to a standard keyboard.
 4. laptops tend to support more file formats than tablets.

4. Phablets:

- Some of the latest smartphones have been designed as a hybrid between a tablet and a smartphone, referred to as a phablet. They have much larger screens than a smartphone but are smaller than a tablet.



- **Uses:**
 - Entertainment (streaming of music, videos, and television programs).
 - Gaming (including group games).
 - As a camera or video camera.
 - Internet use (online sales, social networks, using QR codes, and so on).
 - Sending/receiving emails.
 - Global positioning system (use of maps to navigate to a location).
 - Calendar functions.
 - Telephone banking (sending and receiving money using banking apps).
 - Voice over Internet Protocol: telephone network using the internet, which also allows video calling.
 - Instant access to social networks (social contact with friends no matter where you are in the world).
 - Instant messaging.
 - Office and business management (allows rapid voice and video communication).
 - Education use (using interactive software to teach or learn from).
 - Remotely control devices.

Laptops are the most expandable of these devices, while smartphones are the most portable. Tablets and phablets fall somewhere in between, offering a balance of portability and expandability. The choice of device will depend on your specific needs and use case.

1.5. Impact of Emerging Technologies

- **Artificial Intelligence (AI):** There are many definitions of artificial intelligence (AI). Essentially, AI is a machine or application which carries out a task that requires some degree of intelligence.
 - The use of language
 - recognizing a person's face, the ability to operate machinery, such as a car, aeroplane, train, and so on,
 - and analyzing data to predict the outcome of a future event, such as weather forecasting. Impact:
 - Whenever AI is mentioned, people usually think of science fiction fantasies and think of robots. The science fiction writer Isaac Asimov even went as far as producing his three laws of robotics: » Robots may not injure a human through action or inaction. » Robots must obey orders given by humans without question. » A robot must protect itself unless it conflicts with the two laws above. Everyday uses:
 - An autonomous (driverless) vehicle – we already have driverless trains and autopilots on aeroplanes, but future developments include driverless cars.
 - Robotic research is leading to improvements in technology to help amputees and people with disabilities.
 - Robots are used to help people carry out dangerous or unpleasant tasks – for example, bomb disposal.

Negative impacts of AI

- Unemployment, robots are capable of doing tedious human tasks with much more efficiency and excellence than humans.
- Dependency on technology could lead to problems in the future.
- De-skilling: Tasks that used to be considered a talent are now part of general, tedious processes that are done on a regular basis by machines.
- **Extended Reality** refers to combined real and virtual environments. The two most common examples at the moment are:
 - **Augmented reality (AR)** is a merger between the virtual and physical (real) world; it lays objects onto pre-existing objects. e.g., Pokémon GO! Impact: safety and rescue operations' training, shopping and retail (getting a better look at a car before the purchase), healthcare (better understanding of a patient's body)
 - **Virtual reality (VR)** enables an entirely new world to be created, unlike AR, which has no link to the actual surroundings of the user. It requires the user to be specially equipped with a VR headset, joystick, and headphones.
 - **Impact:** Military applications, educational purposes (looking at ancient buildings), healthcare, media (interactive special effects in a movie), scientific visualization (part of molecular structures/cells).

2. Input & Output Devices

2.1. Input Devices and Their Uses

- An input device is any hardware device that allows a user to enter data or instructions into a computer directly.
- An input device can send data to another device, but it cannot receive data from another device.
- Input devices are necessary for a computer to receive commands from its users and data to process; they are under the user's control or can be direct data entry.

Input devices can be complicated because they must ensure the user can interact with the computer correctly.

1. Keyboards:

Uses:

- Input of data into applications software
- Typing in commands to the computer

Advantages:

- Fast entry of new text into a document.
- Well-known method.
- Easy to use for most people.
- Easier to do verification checks as data is entered (can immediately compare the source document with typed data on the screen).

Disadvantages:

- It can be difficult to use if the user has limited arm/wrist use.
- Slow method when compared to direct data entry.
- It is a fairly large device that uses up valuable desk space.

**2. Numeric keypads:****Uses:**

- Automatic teller machines (ATMs), where the customer can key in their PIN, amount of money, etc.
- Mobile phones allow phone numbers, etc., to be keyed in.
- Point of sale terminals (POS) in case the barcode reader fails to read the barcode – the number has to be keyed in manually by the operator.
- Chip and PIN devices when paying by credit/debit cards.
- Fast entry of numeric data into a spreadsheet.

Advantages:

- Faster than standard keyboards when entering numeric data.
- Because many are small devices, they are very easy to carry around.

Disadvantages:

- Sometimes, they have small keys, which can make input more difficult.
- Sometimes, the order of the numbers on the keypad is not intuitive.

**3. Mouse:****Uses:**

- Opening, closing and minimizing software
- Grouping, moving and deleting files.
- Image editing, for example, controls the size and position of a drawing pasted into a document.
- Controlling the position of a pointer on the screen to allow selection.

Advantages:

- It is a faster method for choosing an option than a keyboard.
- It's a very quick way of navigating through applications and the internet.
- Does not need a large desk area when compared to a keyboard.

Disadvantages:

- It can be more difficult for people with restricted hand/wrist movement than using a keyboard for data entry.
- Easy to damage, the older type of mouse quickly becomes clogged up with dirt.
- Difficult to use if no flat surface is readily available.

**4. Touchpad:****Uses:**

- Opening, closing and minimizing software
- Grouping, moving and deleting files.
- Image editing, for example, controls the size and position of a drawing pasted into a document.
- Controlling the position of a pointer on the screen to allow selection.

Advantages:

- Faster than a keyboard for choosing options.
- Used to navigate applications and the internet.
- Because the touchpad is integrated into the laptop computer, there is no need for a separate mouse; this aids the portability and is a big advantage if no flat surfaces are available.

Disadvantages:

- People with limited hand/wrist movement find the device difficult to use.
- It can be more difficult to control the pointer when compared to a normal mouse.
- Drag and drop operations are more complicated using a touchpad.

**5. Tracker ball:****Uses:**

- A good alternative to a mouse for people with conditions such as RSI.
- Used in an industrial control room environment.
- Used in some luxury cars to select functions such as radio.

Advantages:

- Does not need the same fine control as a mouse.
- It is easier to use than a mouse if the operator has problems with their wrist.
- More accurately position the pointer on the screen.
- They are more robust than a mouse.
- Needs less desk space than a mouse or keyboard.

Disadvantages:

- It is not supplied with the computer as a standard; therefore, it is more costly.
- Users may need training because it is not standard equipment.

**6. Remote Control:****Uses:**

- Televisions, satellite systems, DVD/Blu-ray players and Hi-Fi systems, to alter controls such as volume, on/off, etc.
- Used to control multimedia systems.
- Used in industrial applications to remotely control processes.

Advantages:

- It can be operated from any reasonable distance.
- In some conditions, e.g., in chemically hazardous environments, we can control and measure from safe distances.

Disadvantages:

- Difficult to use for people with limited hand/wrist movements.
- Physical obstacles can easily block the signal.



7. Joysticks:

Uses:

- Used in video games.
- Used in simulators to mimic the actual controls.

Advantages:

- It is easier than keyboards for screen navigation.
- In some applications, the control is more realistic than using a mouse.

Disadvantages:

- The on-screen pointer is more difficult to use.



8. Driving wheel:

Uses:

- Used in video games, especially car racing games.
- Used in simulators to mimic actual vehicle controls.

Advantages:

- It's a more realistic experience than both mouse and joystick.
- Easier than a keyboard or joystick to control steering movements.

Disadvantages:

- It is a rather expensive input device as compared to a mouse or joystick.
- Steering movements tend to be over-sensitive, which gives an unrealistic feel.
- Unless it is an expensive simulator, feedback to the steering wheel is non-existent.



9. Touch screen (as an input device):

Uses:

- Automatic teller machines (ATMs) to choose from on-screen options.
- Point of sale terminals such as in restaurants.
- Interactive whiteboards in education.
- Computer-based training (CBT) where answers are selected during on-screen testing.

Advantages:

- Faster entry of options than using a keyboard or mouse.
- Very easy method for choosing options.
- User-friendly method – no training necessary in its use.
- Option to expand the size of the display if necessary.

Disadvantages:

- A limited number of input options are available.
- This can lead to problems if an operator uses the system frequently (straining of arm muscles, RSI, etc., are all possible).
- The screen can get very dirty with constant touching.



10. Scanners:

Uses:

- Scanning documents and converting them into different formats
- Scanning in old documents to protect them in case the original is lost/damaged.
- Scanning in photographs for storage
- Scanning in barcodes at POS terminals.

Advantages:

- Images can be stored for editing at a later date.
- When used with OCR, they are much faster and more accurate than typing the documents in.
- It is possible to recover damaged documents by scanning and producing an acceptable copy.

Disadvantages:

- Limited quality, depending on how good the scanner's resolution is.
- Fairly slow input method, especially if color mode is selected.



11. Digital Cameras:

Uses:

- Taking photographs is still better than using smartphones and tablets.
- Data-capture device, e.g., as a reversing aid in cars.
- Dentistry, to help capture pictures for better diagnosis.
- The creation of virtual reality tours around houses, buildings, etc.

Advantages:

- Easier to produce better-quality photographs than with a traditional camera.
- Uploading photographs to a computer is faster than scanning hard copies.
- Memory cards can store many thousands of photographs.
- There is no need to develop film and printouts; it saves money and is more environmentally friendly.
- Unwanted images can quickly be deleted from a memory card.

Disadvantages:

- Need to be computer literate to know proper use.
- Loss of artistry due to clever software doing all the work.
- Images need to be compressed to reduce the amount of memory used.



12. Microphones:

Uses:

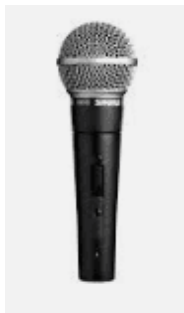
- To input speech to be used in various applications.
- Input in voice recognition software for authentication.
- As a sensor to pick up sound in an intruder alarm system.
- Used in audio conferencing or VoIP applications.

Advantages:

- It is faster to read text than it is to type it in.
- It is possible to manipulate sound in real time rather than working on a completed recording.
- It improves security if used as an authentication system.

Disadvantages:

- Sound files use up a lot of computer memory.
- Reading data is more error-prone than typing in.



13. Sensors:

Uses:

- Temperature sensors are used in automatic washing machines, central heating systems, ovens, and glasshouses.
- Pressure sensors are used in intruder alarm systems and washing machines.
- Light sensors are used in automatic glasshouses, doors, and street lighting control.
- Sound/acoustic sensors are used in intruder alarm systems, monitoring liquid and powder flow in pipes.
- Humidity/moisture sensors are used in automatic glasshouses, environmental monitoring, and in factories where moisture levels are crucial.
- pH sensors are used in automatic glasshouses, chemical processes and environmental monitoring.

Advantages:

- Readings are more accurate as compared to human operators.
- Readers are continuous, with no breaks in the monitoring.
- Because it is a continuous process, any action or warnings needed will be initiated immediately.
- Automatic systems don't need human intervention.

Disadvantages:

- Faulty sensors can give spurious results.
- Most sensors are analogue; therefore, they require conversion using Analogue to Digital Convertors.

14. Light pens:

Uses:

- Selecting objects on CRT screens
- Drawing on screens

Advantages:

- Greater accuracy than touch screens
- Small makes them portable and capable of being used in small spaces.
- Easy-to-use technology.

Disadvantages:

- Lagging problems while drawing on the screen.
- It only works with CRT monitors.
- Rather dated technology.



2.2. Direct Data Entry & Associated Devices

1. Magnetic Stripe Readers:

Uses:

- On credit/debit card for use at ATMs
- Security device to allow entry to buildings, hotels, etc.

Advantages:

- Faster than keying in data manually.
- Error-free, no human intervention needed.
- Secure information isn't in human-readable form.
- Robust, there are no moving parts.

Disadvantages:

- If the card is damaged, the data is lost.
- Doesn't work at a distance.
- As the information isn't human-readable, this can be a disadvantage in some cases.



2. Chip and PIN reader:

Uses:

- Where payments are made using cards

Advantages:

- It is more secure than contactless cards as the PIN acts as a second security layer.
- More robust system than Magnetic Stripe Cards

Disadvantages:

- Be very careful so the PIN isn't seen by anyone while being typed in.



3. Radio Frequency Identification (RFID) reader:

Uses:

- Livestock tracking
- Retail, instead of barcodes, as they don't need to be scanned in.
- Admission passes.
- Library books, to acknowledge the books which have been borrowed.

Advantages:

- No line-of-sight contact is needed.
- Very robust and reliable technology.
- Very fast read rate.
- Bidirectional data transfer.
- Bulk detection is possible.

Disadvantages:

- Tag collision
- As they use radio waves, they are easy to jam/interrupt.
- Easy to hack into the signal.
- RFID is more expensive than a comparable barcode system.

4. Optical Mark Reader/Recognition (OMR):

Uses:

- Used in MCQs checking.
- Used in reading voting papers.

Advantages:

- Very fast way of inputting survey results.
- It is more accurate because there is no human intervention.
- More accurate than OCR methods.

Disadvantages:

- Designing the forms can be complicated to ensure the marks are correctly positioned.
- If there are problems, they need to be manually checked, which can be time-consuming.

**5. Optical Character Recognition/Reader:****Uses:**

- Processing passports and identity cards.
- Converting hard copy documents into electronic form.
- Used in automatic number plate recognition (ANPR) systems.
- Digitizing historic hard copies for archiving.

Advantages:

- It is a much faster data entry system than manual typing.
- No human intervention, its error free.

Disadvantages:

- System has difficulty in reading different handwritings.
- Still not a very accurate technique.

**6. Barcode readers:****Uses:**

- Used in supermarkets for stock control.
- In libraries, to keep track of books.
- As a safety function to ensure checking of electrical equipment on a daily basis.

Advantages:

- Much faster than manually keying in data.
- Allow automatic stock control.
- They are a tried and trusted technology.

Disadvantages:

- Relatively expensive system to administer.
- Not fool-proof, barcodes can be swapped between items.
- Can be more easily damaged than RFID tags or magnetic stripes.

**7. Quick response (QR) code scanner:****Uses:**

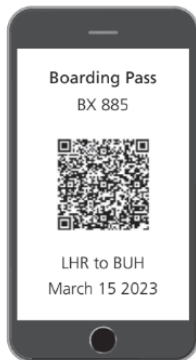
- used in advertising to contain information about the advertising company.
- Wi-Fi authentication
- Used in restaurants, you can see the menu by scanning.

Advantages:

- hold much more information than normal barcode.
- fewer errors than with barcodes.
- QR codes are easier to read because the cameras can even read them on a smartphone.
- It is possible to encrypt QR codes.

Disadvantages:

- More than one QR format is available.
- QR codes can be used to transmit malicious data.

**2.3. Output Devices and Their Uses****1. Cathode ray tube (CRT) monitors:****Uses:**

- Their large screens allow complex diagrams to be created in Computer-aided design.
- Used with light pens to allow designs to be created.

Advantages:

- Can be seen at a wider range of angles, unlike LCDs.
- Allow the use of light pens.

Disadvantages:

- They are very heavy and bulky.
- They run very hot and can cause fires if left unattended.
- They use a lot more power than LCDs.
- Their flickering can lead to headaches.
- Image burn-in is a common issue.

**2. Liquid Crystal Display (LCD) screens:****Uses:**

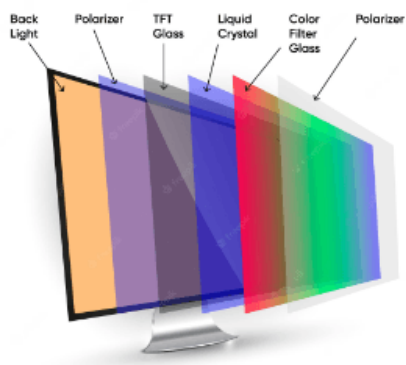
- Main output device for modern computers.
- Mobile phones, laptops, video games use LCD screens.

Advantages:

- Very efficient, low power consumption.
- Lightweight devices.
- Screens can be made in various sizes.
- No flickering images.
- Very sharp image resolution.

Disadvantages:

- Colour and contrast from different angles are inconsistent.
- Motion blur is a common issue.
- Lower contrast than CRT monitors.



3. Touch screen (as an output devices):

Uses:

- ATMs
- POS terminals
- Information kiosks.

Advantages:

- Don't need additional input devices.
- They are very interactive, and many functions, such as swiping, can be done.
- They add a high-tech feel to devices and interfaces.

Disadvantages:

- They tend to get dirty with frequent use.
- Frequent use results in straining of arm muscles, RSI, etc.
- If large amounts of data are input/output, they aren't very accurate, and the interface isn't very fast.



4. Multimedia projectors:

Uses:

- Training presentations to allow the whole audience to see images.
- Advertising presentations.
- Home cinema systems.

Advantages:

- More people can watch as they don't have to crowd around a laptop.
- Avoids the need for several networked computers.

Disadvantages:

- Images can be fuzzy.
- Expensive to buy.
- Set-up can be complicated.



5. Laser printers:

Uses:

- In uses where low noise is required.
- If fast, high quality, high-volume printing is required.

Advantages:

- Printing is fast.
- They can handle very large print jobs.
- Quality is consistently high.
- Toner cartridges last for a long time.

Disadvantages:

- They are only considerably fast if several copies are being made.
- Color laser printers are expensive to run.
- They produce ozone and volatile organic compounds because of their printing method and toner.

**6. Inkjet printers:****Uses:**

- Where low-output volumes are required.
- Where high-quality printing is required for single pages.

Advantages:

- High-quality output
- Cheaper than laser printers.
- Very lightweight
- Don't produce ozone and volatile organic compounds.

Disadvantages:

- Slow output if many copies are needed.
- Can't do large print jobs.
- Printing can smudge if user isn't careful.
- Can be expensive if used a lot.

**7. Dot matrix printers:****Uses:**

- Used in environments where noise isn't a major issue.
- Carbon copies or multi-part outputs can be produced.
- Widely used in till receipts.

Advantages:

- Can be used in varying environments unlike laser/inkjet printers.
- Carbon copies or multi-part outputs can be produced.
- Very cheap to run and maintain.
- Good for continuous printing.

Disadvantages:

- Very noisy
- Initial cost is more than an inkjet printer.
- Very slow, poor-quality printing.



8. (Graph) Plotters:

Uses:

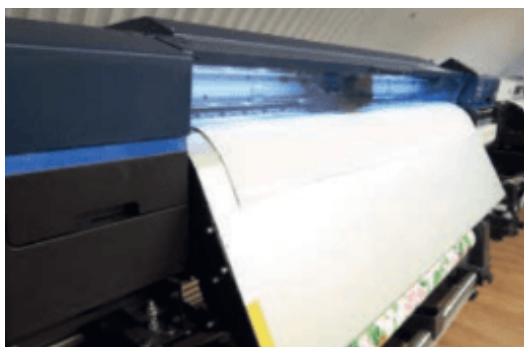
- Producing architectural drawings
- Producing engineering drawings
- Drawing animation characters.

Advantages:

- Very high-quality output.
- can produce large, monochrome and color drawings very accurately.
- Can print on a variety on materials.

Disadvantages:

- Very slow printing.
- Expensive equipment to purchase initially.
- Have a very large physical footprint compared to a printer.



9. 3D printers:

Uses:

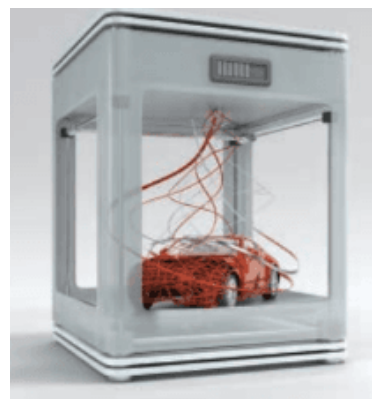
- Custom-made prosthetic limbs.
- In aerospace, if parts of the aircraft are made using 3d printers they can be very lightweight.
- Making spare parts for items that aren't now manufactured, e.g., parts of a vintage car.

Advantages:

- Manufacturing objects has become much easier.
- Even though the initial cost is high, it is still cheaper than the more conventional way.
- Parts for machinery that aren't available can be made.

Disadvantages:

- Potential to make counterfeit items.
- Could lead to manufacture of dangerous items by almost anyone.
- Job loss potential.



10. Speaker:

Uses:

- Used in all phones and most computers.
- Helps visually impaired people.
- Plays downloaded sound files.

Advantages:

- Amplified sounds can be much louder than the original sound.
- Amplified sounds can be enough to be heard by a huge crowd.
- Very simple technology.
- They are especially useful for blind people, for instance, reading e-books.

Disadvantages:

- Speaker output can disturb irrelevant people in the same area, e.g., an office.
- Sound quality is high only expensive speakers.
- They take up a lot of desk space.



11. Actuators:

Uses:

- Used to turn on motors, buzzers, and switches.
- Allow a computer to control physical devices,

Advantages:

- Allow remote operation of many devices.
- Relatively inexpensive devices.

Disadvantages:

- They are an additional device in the system that could go wrong.
- As analogue devices, signals need to be converted using a DAC.

3. Storage Devices and Media

3.1. Backing-Up Data

- Backing up refers to copying files or data into a different medium in case of damage or loss of original copy.

Why do we back up data?

- To safeguard against loss of data.
- To safeguard against damages caused by hackers.
- In case files need to be sent elsewhere, to protect the original format of files.

3.2. Magnetic Backing Storage Media

- Holds data magnetically.
- The surface area of the media is magnetised so that it can hold bits of data.
- The device that reads media can also read the bits held on the surface area

Magnetic tape drives

Uses:

- used in applications where batch processing is used.
- used as a backup media where vast amounts of data need to be stored.
- used in long-term archiving of data, they have huge data storage capacities and are known to be very stable.

Advantages:

- They are generally less expensive than hard disk drives.
- It is a very robust technology.
- They have a huge data storage capacity.
- The data transfer rate is fast.

Disadvantages:

- Prolonged data access times (uses serial access).
- When updating, another tape is needed to store the final updated version.
- They are affected by magnetic fields, a strong field can corrupt data stored on the tape.

Fixed Hard Disks/Drives

Uses:

- To store the OS, systems software and working data/files.
- Storing applications files.
- Used in real-time systems and in online systems.
- Used in file servers for computer networks.

Advantages:

- They have a very fast data transfer rate and fast access times to data.
- They have a very large memory capacity.

Disadvantages:

- It can be fairly easily damaged.
- They have many moving parts which affect overall reliability.
- Their read/write operation can be quite noisy when compared to solid-state drives.

Portable Hard Disk Drives

Uses:

- Can be used as a backup system to prevent data loss.
- It can be used to transfer data/files/software between computers.

Advantages:

- Data access time and data transfer rate are very fast.
- It has a very large memory capacity.
- It can be used as a method of transferring information between computers.

Disadvantages:

- They can be easily damaged if user accidentally drops it or doesn't correctly shut down the drive after use.
- The data transfer rate is not as fast as for fixed hard disk drives.

3.3. Optical Media and Optical Storage Devices

- Holds data by burning 'dots' onto the surface with a high-powered laser.
- The data that reads the media can read the data by shining a lower-powered laser over the dots.

CD-R/DVD-R ~ Write Once Only

Uses:

- Home recordings of music and (CD-R) and films (DVD-R).
- Used to store data to be kept for later use to be transferred to another computer.

Advantages:

- Cheaper medium than RW disks.
- Once burned (and finalised), they behave like a ROM.

Disadvantages:

- It can only be recorded once; if an error occurs, then the disk has to be thrown away.
- Not all CD/DVD players can read CD-R/DVD-R.

CD-RW/DVD-RW ~ Read and Write

Uses:

- Used to record television programs which can be recorded over, time and time again.
- Used in CCTV systems.
- It can be used as a backup device for files and data.

Advantages:

- It can be written over many times.
- You can use different file formats each time it is used.
- It is not as wasteful as the R format because the files/data can be added later.

Disadvantages:

- It can be relatively expensive media.
- Possible to accidentally overwrite data.

CD-ROM/DVD-ROM ~ Read Only

Uses:

- These are read-only memory (ROM), which means they can't be written over and can only be read. Permanent storage method.
- CD-ROM is used to store music files and to store software, computer games and reference software.
- DVD-ROM has much larger storage and is used to store films.
- Used in applications where there is a real need to prevent deletion or overwriting of important data.

Advantages:

- They are less expensive than hard disk drive systems.
- They are very portable as they are small and light.
- Data stored on them is read-only, so it cannot be accidentally overwritten.

Disadvantages:

- Hold far less data than hard disk drives or memory sticks.
- Very slow data transfer rate and data access times, as compared to hard disk drives.
- You cannot add your files to the disks because they are both read-only.

Blu-Ray Discs

The main differences between DVD and Blu-ray are:

1. Blu-ray uses a blue laser rather than a red laser. (The wavelength of blue light is 405nm, much smaller than the 650nm red laser) This makes pits and lands much smaller, so they store five times more data than DVDs.
2. Blu-ray disks automatically come with a secure encryption system, which helps to prevent piracy and copyright infringement.
3. The data transfer rate for a DVD is 10 Mbps, and for a Blu-ray disc, it is 36 Mbps.

Uses:

- Home video consoles.
- Storing and playing back movies.
- Computers can use this technology for data storage or backing hard drives.
- Camcorders can use this media to store movies.

Advantages:

- Very large storage capacity.
- Very fast data transfer rate.
- The data access speed is also greater than with other optical media.
- Blu-ray discs automatically come with a secure encryption system.

Disadvantages:

- Relatively expensive discs.
- Encryption problems when used to store videos.
- The introduction of HD (high definition) DVD players has reduced the advantages of using Blu-ray technology.

3.4. Solid State Backing Storage

- Holds data on devices that don't have any moving parts.

Solid-state drives (SSD)**Uses:**

- Storage device to store files, applications, OSs, and so on.

Advantages:

- They are more reliable as they have no moving parts.
- They are considerably lighter and suitable for laptops.
- They do not have to 'get up to speed' before they work correctly.
- They have lower power consumption.
- They run much cooler than HDDs.
- Because they have no moving parts, they are very thin.
- SSD data access time is only 0.1 milliseconds compared to 10 milliseconds for HDD.
- Data transfer speed for SSDs is also much faster than for HDDs.

Disadvantages:

- SSD endurance - SSDs are conservatively rated at only 20GB write operations per day over three years.
- More expensive than magnetic hard disks.
- Smaller storage capacity than magnetic hard disks.

Pen drives (Memory sticks)**Uses:**

- Transporting files between computers or using them as a backing store.
- Used as a security device to prevent software piracy (known as a dongle).

Advantages:

- Very compact and portable media.
- Very robust.
- Does not need additional software to work on most computers.
- They are not affected by magnetic fields.

Disadvantages:

- Cannot protect the data/files by making it 'read-only'.
- Easy to lose (due to the small physical size).
- The user needs to be very careful when removing a memory stick from a computer - incorrect removal will corrupt the data on the memory stick and make it useless.

Flash Memory cards

Different types of memory cards:

- » SD cards (secure digital card)
- » XD cards (extreme digital card)
- » CFast card (compact, fast card).

Uses:

- Storing photos on digital cameras.
- Used as mobile phone memory cards.
- Used in MP3 players to store music files.
- Used as a backing store in hand-held computer devices.

Advantages:

- Very compact.
- Because they have no moving parts, they are very durable.
- They can hold large amounts of data.
- Compact cameras and smartphones can read and write memory cards, allowing users to transport extensive collections of photographs, songs, etc.

Disadvantages:

- Expensive per gigabyte of memory when compared to HDDs.
- Have a lower storage capacity than hard disks.
- Have a finite life regarding the number of times they can be read from or written to.
- Memory cards, specifically the micro SD card, are the smallest sized devices available, making them more likely to be lost, stolen or damaged. The storage should be sized cause the amount of storage does not prevent the drive from being stolen
- Users must often purchase a card reader or USB converter to view the data.

4. Networks & the Effects of Using Them

4.1. Networks

Routers

A device that enables data to be sent between *different types of networks*. It can be connected through cables or wirelessly to connect a LAN to the internet.

It can be used for:

- connecting networks and devices to the internet,
- storing computer addresses,
- routing data packets.

When a data packet is received, the router checks if the packet is intended for it or another network. The data packet is routed to the local switch/hub if it's meant for its network. If not, the data packet is sent to the relevant router, which sends it to the relevant device.

- They consult routing tables to know where to send the data.

Common Network Devices

1. **Network Interface Cards (NIC):** These are needed to allow a device to connect to a network. Turns binary data into an electrical signal that allows network access. Usually integrated into the motherboard.

- Each NIC is given a unique hardwired media access control (MAC) address.
Media access control (MAC) address: a number that uniquely identifies a device when connected to a network.
- The first six hex digits identify the manufacturer's code, and the next 6 identify the device's serial number.

2. **Hubs:** they are hardware devices that can have several other devices connected to them. They are used to connect devices together to form a local area network (LAN). It takes a data packet received by one of its ports and sends it to all relevant or irrelevant devices that are connected to it.

- It is not very secure to broadcast data to all devices.
- Unnecessary network traffic.

3. **Switches:** intelligent hubs. Used to connect devices to form a LAN. Unlike hubs, the switches store the MAC addresses of all devices on a lookup table. So, it only sends data to the relevant device.

In summary:

- Both are used to connect devices in LAN.
- Both use data packets.
- Hubs send data to every device on the network.
- Switches send data to a relevant device only.
- Switches have better security.
- Switches use lookup tables to determine the destination for a data packet.
- Switches use MAC addresses for relevant device locations.

4. **Bridges:** Devices that connect one LAN to another LAN that use the same protocol. Unlike routers, they can't communicate with external networks, such as the Internet.

Comparison:

- Bridges connect LANs together; routers connect various types of networks together.
- Bridges scan MAC addresses while routers scan the IP addresses.
- Both send out data in the form of data packets.
- Bridges connect networks with the same protocol; routers can connect networks with different protocols.
- The router uses routing tables to direct data packets, but bridges don't.
- Bridges have only two ports; routers have multiple ports.

Wi-Fi & Bluetooth

Both are used for wireless communication between devices. They both use electromagnetic radiation as the carrier of data transmission.

Bluetooth uses:

- When transferring data between 2 or more devices that are very close together.
- When the speed of data transmission isn't crucial.
- For low-bandwidth applications.

Wi-Fi uses:

- Full-scale networks.
- When the data transfer rate is crucial.
- For uses where a higher range and better security are required.

Differences and similarities:

- Bluetooth uses a transmission frequency of 2.4 GHz, whereas Wi-Fi uses a 2.4 – 5.0 GHz range.
- Wi-Fi has a much faster data transfer rate.
- Wi-Fi has a higher geographical range in which it is effective.
- Bluetooth only allows up to 7 devices to be connected simultaneously, whereas the number of devices connected to a Wi-Fi network depends on the router/routers used.
- Bluetooth uses key-matching encryption. However, Wi-Fi uses WPA (Wi-Fi protected access) and WEP (wireless equivalent privacy).

Cloud Computing

This method is where data is stored on remote servers accessed online.

The three types of cloud storage are:

1. Public Cloud - The customer and the cloud storage provider are different companies.
2. Private Cloud - The customer and the cloud storage provider are a single organization.
3. Hybrid Cloud - Combines public and private cloud options and allows sensitive data to remain private while providing public cloud services for less sensitive information.

- Cloud data is duplicated and stored on other servers to ensure availability during system failures, upgrades, and maintenance.

Advantages:

- Services can be scaled up or down according to changing requirements.
- Cloud storage eliminates the need for a business to purchase expensive equipment for infrastructure and maintenance.
- Readily available globally, allowing both remote working and data sharing.
- Providers offer high levels of ensuring that services are always available.
- It can offer an almost unlimited amount of storage.
- A backup of the data from the cloud will allow full data recovery in case of incidents.
- Files can be synced across multiple devices.
- There is no need to carry storage devices around.

Disadvantages:

- A stable internet connection is always required.
- Data storage in clouds may be vulnerable to security breaches.
- The user depends on the storage provider for reliability and availability of services.
- The services may become expensive as the amount of storage or bandwidth required increases.

Common Network Environments

1. Internet:

- The **Internet** is a very large global network that consists of many other **interconnected** networks
- The **World Wide Web** is a vast collection of web pages that can be accessed using a web browser.
- The **World Wide Web** allows you to access information by using the internet

Characteristics:

- It is an open network, meaning everyone can access the same resources and information as everybody else.
- People from all over the world can communicate with each other in real-time.
- Available to anyone who has a suitable device and access to any one of the interconnected networks.

Uses:

- Education and training
- Social Networking
- Online shopping
- Entertainment

2. Intranet:

- Usually private and are used to send information securely and safely.
- Access to an organization's Intranet is restricted and only accessible to authorized users such as employees.
- Intranets have many advantages over the internet, such as:
 - better bandwidth than the internet,
 - data is kept within the organization,
 - less chance of hacking and attacks,
 - administrators can manage access to external sites and links.

Characteristics:

- A private network that is accessible to employees within a company or organization.
- Usually behind a firewall to ensure security.
- Allows for document sharing and the use of collaboration tools between users.
- It can be customized to meet the specific requirements of the business.
- Users will require a username and password to access the Intranet.

3. Extranet:

- Private Intranet that also allows access by selected parties that reside outside of the organization. These parties, for example, maybe customers, key stakeholders or clients.
- Users will have an authorization level once they have successfully logged in, which will determine which resources they may access.
- Similarities between the Internet, Intranet and extranet are as follows:
 - They are all web-based technologies
 - They allow users to access information remotely
 - They all use client-server architecture
 - They all use security measures such as authentication and encryption
 - They all promote and facilitate information and resource sharing
- Differences between the internet, intranet and extranet are as follows:
 - The internet is a global network, whereas an intranet/extranet is a private network contained within an organization
 - The use of the internet covers a wide range of purposes, whereas an intranet/extranet is designed for specific users and purposes.
 - Much information is publicly available, whereas an intranet/extranet is not.
 - The Internet is not owned solely by one person or organization, whereas the organization usually owns intranets/extranets.

Network Types

1. **Local Area Network (LAN):** networks usually contained within a single building or small geographical location. It is made up of hubs and/or switches, which will connect several devices together. One hub or switch commonly connects to a router, allowing LAN connectivity to other outside networks such as the Internet.

Advantages:

- Allows centralized management of updates, backups and software installations.
- Can secure its devices with the use of **firewalls**, antivirus software and other security features to prevent unauthorized access.
- A LAN allows users on the network to share resources such as printers and other peripherals.

Disadvantages:

- The network may not function correctly in case of hardware failure.
- They are more prone to attacks than standalone computers.
- Data and peripheral accessing can be slow, based on network traffic.
- LAN networks require maintenance to ensure the software is up-to-date.

2. **Wireless Local Area Network (WLAN):** Local Area Networks allow devices to connect wirelessly rather than using physical cables. Wireless Access Points (WAPs) are connected to an existing wired network, which provides wireless connectivity. Support a vast range of devices, such as smartphones and laptops, are very popular in public areas such as shopping malls.

Advantages:

- Allows users to connect anywhere in the range of a Wireless Access Point (WAP).
- They can be used in various indoor and outdoor environments, making them highly flexible.
- As the requirements change, additional WAPs can be added relatively easily.
- Printer access can be given to wireless devices.

Disadvantages:

- The strength of their signals can be affected by obstacles such as walls.
- Speeds can be affected by high-traffic areas.
- It can sustain interference from other devices which can affect performance and connectivity.
- Can be vulnerable to security threats due to signal interception.

3. **Wide Area Networks (WAN):** is formed by several LANs connected through a router. It is expensive. However, it comes with a more enhanced security. Additional hardware is needed for a WAN: Routers, modems, and proxy servers.

Advantages:

- Provide the ability to connect geographically dispersed locations, such as offices in different cities or countries.
- Offer the flexibility to scale up or down based on the organisation's needs.
- Administrators can monitor and manage the network infrastructure from a single location.

Disadvantages:

- Setting up and maintaining a WAN can be expensive, especially compared to LANs.
- Cover larger distances and rely on public networks or leased lines, which can introduce latency and affect performance.
- WANs are subject to the reliability and availability of external service providers.

4.2. Network Issues and Communication

- Connection to a network exposes a user to:
 - **Hacking:** Unauthorized access given to the computer. This can lead to identity theft or the misuse of personal information.
 - **Phishing:** Phishing involves getting sensitive information, such as usernames, passwords, and credit card details, for malicious reasons by mimicking a reliable webpage on the network
 - **Pharming:** This is malicious code installed on a user's computer or a web server; the code will redirect the user to a fake website without their knowledge (the user doesn't have to take any action, unlike phishing).
 - **Viruses:** Program code that replicates (copies itself) to delete or corrupt files and cause the computer to malfunction

Passwords

It is a common form of security often accompanied by a username or email address.

- There are many ways to enhance the security of your password, such as the following:
 - Ensure that the password is changed regularly in case it has been obtained illegally or accidentally
 - Ensure that the password uses a combination of uppercase, lowercase, numbers and special characters to make the password more difficult to guess.
 - iloveict is a weak password
 - 1lov3ICT# is a strong password
- Anti-spyware software can be run regularly to ensure that your information, including your password, is not passed to an unauthorized third-party user.

Other Authentication Methods

1. **Zero login:** A security concept that eliminates traditional login methods, such as usernames and passwords, using biometrics or other authentication factors for seamless and password-less access.
2. **Biometric Recognition:** These authentication methods use unique physical or behavioural characteristics, such as fingerprints, iris scans, or voice recognition, to verify a person's identity.
3. **Magnetic Stripes:** These are authentication features on cards storing data magnetically. They enable secure identification and authorization by containing encoded information that magnetic stripe readers can read.
4. **Smart Cards:** Smart cards are portable devices with integrated circuits to store and process data. They are used for authentication, identification, and secure transactions in various applications such as banking, telecommunications, and access control.
5. **Physical Tokens:** It is a type of authentication that takes the shape of a solid object. The user demonstrates ownership of the token through interaction with a login system. Physical tokens have embedded clocks that create one-time passwords (OTPs) when a PIN and other authentication information are entered.
6. **Electronic Tokens** are applications that users install on their hardware, such as smartphones. Say a person wants to access a website on a tablet computer. To access this website, users must first authenticate themselves using electronic tokens. The user has already set up the electronic token app with their smartphone. The user launches the app on their smartphone when the website asks them to verify their identity. The program creates an OTP that is only good for a short period of time.

Anti-malware Software

- Anti-malware software is designed to protect devices against viruses and malicious software. It has 3 primary purposes: detect, prevent and remove malicious software. It is installed onto a computer system and will operate in the background.

Standard features of Anti-Malware software include the following:

- Comparing the scanned files against an extensive **database** of known threats
- Real-time scanning
- Regular updates to gather an up-to-date list of known threats
- Quarantine of infected files
 - Quarantining files allows threats to be automatically deleted.
 - Allows the user to determine if the file is a legitimate threat and not a false positive.

Heuristic Checking: Instead of relying solely on a database of known viruses, this method looks for behavioural patterns and other features in a file to identify possible risks.

Electronic Conferencing

1. **Video Conferencing:** It is a form of audio and video communication. It serves as a stand-in for face-to-face meetings between several persons who may reside abroad or in another region of the country. It utilizes a network in some way and is done in real-time.

The basic hardware includes:

- webcams,
- large monitors/television screens,
- microphones,
- speakers.

The software used are:

- Webcam and microphone software drivers
- CODEC (coder and de-coder)
- Echo cancellation software

Advantages:

- It is much easier to access important documents or bring in 'experts' at key parts of the conference.
- It is possible to hold conferences at short notice.
- Reduced travelling costs.
- There is no need to pay for hotel accommodation or venue hire.
- Reduces the cost of taking people away from work for two or three days to travel.
- Using video conferencing is better than having delegates travel to potentially unsafe places worldwide.

Disadvantages:

- Potential time lag in responses/delays when talking.
- Images can jerk.
- It is very expensive to set up in the first place.
- Problems if the delegates live in different countries with large time zone differences.
- Requires IT knowledge to some extent.
- It's not the best for people who consider travelling a job perk.
- Completely reliant on stable internet connections.

2. **Audio Conferencing:** Meetings held using audio (sound) technology are called audio conferencing. The normal telephone network can be used for audio conferencing, frequently called a phone conference.

The hardware required is:

- a computer (with built-in microphones and speakers)
- external microphone and/or speakers
- an internet phone
- a standard phone.

Advantages:

- Allows participants to join meetings from any location.
- Eliminates the need for travel expenses, such as transportation, accommodation, and meals.
- Saves time by eliminating travel time and allowing meetings to be scheduled and conducted quickly.

Disadvantages:

- Lacks the visual aspect of face-to-face meetings, which can hinder communication.
- It can limit interaction and engagement compared to in-person or video conferencing.
- Heavily relies on technology, and technical issues such as poor audio quality, background noise, or connectivity problems are common.

3. Web Conferencing:

Web conferencing, often known as webinars or webcasts, makes use of the Internet to enable conference calls. This system makes use of numerous computers that are interconnected over the internet. It operates in real-time, just like video conferencing, and enables the following meeting types:

- » business meetings to discuss new ideas
- » presentations
- » online education or training.

Advantages:

- Allows participants to see each other through video, providing a more immersive and engaging experience than audio conferencing.
- Often offer screen sharing capabilities, enabling participants to share presentations, documents, or other visual content in real-time.
- Often provide features like chat, polling, hand raising, and Q&A sessions, fostering interactivity and engagement among participants.

Disadvantages:

- Heavily relies on internet connectivity and technical infrastructure.
- They can be susceptible to distractions and multitasking.
- It often has various features and settings that participants need to familiarize themselves with, especially if they are new to the platform.

5. The Effects of Using IT

5.1. Microprocessor-Controlled Devices

- A microprocessor-driven labour-saving machine enables users to focus on other activities while the machine completes its work. The second generation of devices containing microprocessors is more user-friendly and has more functionality, such as "intelligent tuning" in television sets.

Advantages of microprocessor-controlled labor-saving devices:

- no need to do manual tasks at home
- more time for leisure activities
- no need to stay home while chores are being done
- web-enabled devices allow devices to be switched on or off while the owner is out
- automated burglar alarms give a higher sense of security and well-being
- smart fridges and freezers prevent food waste by keeping track of products' expiry, availability, etc.

Disadvantages of microprocessor-controlled labor-saving devices:

- unhealthy lifestyle due to inactivity caused by devices doing all tasks
- tend to make people lazy
- potential deskilling
- any device containing a microprocessor and can communicate using the internet displays a threat of cybersecurity breaches

General advantages of using a microprocessor-controlled device:

- save energy due to being efficient, as well as turning off after inactivity
- can be easier 'programming' these devices to perform tasks rather than turning knobs and pressing buttons manually

General disadvantages of microprocessor-controlled devices:

- lead to more wasteful devices
- can be more complex to operate for technophobes
- leaving devices on standby is wasteful

Data Security Issues

Any home appliance managed remotely could provide hackers access to your personal information. These devices frequently have default (or no) password settings, which makes it simple for attackers to get sensitive information. For instance, it is easy to discover holiday dates by hacking into a central heating controller (or the software used to interface with it), making a home an obvious target for break-ins. It is likely for a hacker to obtain important information, such as credit card numbers, if the refrigerator or freezer automatically orders goods from a retailer.

Social Interactions

The positive aspects include:

- easier to make new friends using chat rooms
- easier to find people who share similar interests/hobbies
- less expensive to keep in touch using VoIP technology.

The negative aspects include:

- people do not meet face-to-face as much (social isolation)
- a lack of social interaction may make people more anxious about meeting people in real life
- When communicating online, people can act less politely or more harshly, and cybercrime is a serious issue, especially for teenagers.

Monitoring and Controlling Transport**Uses:**

- monitoring traffic on motorways
- congestion zone monitoring
- automatic number plate recognition (ANPR)
- automatic traffic light control
- air traffic control systems
- railway signalling systems

Advantages of transport monitoring and control systems:

- smart motorways keep updating according to changing traffic conditions
- more efficient
- traffic offences can be remotely penalized using ANPR
- car thefts can be spotted using ANPR
- minimizes human errors, reducing the rate of accidents

Disadvantages:

- If a hacker breaches security, the vehicle could be controlled by them.
- The system might come to a halt if it malfunctions.
- Systems with a poor design could compromise safety.
- The easy tracking of harmless people's movements is made possible by ANPR equipment. Who can access such data?

Autonomous vehicles in transport

To properly execute their activities, autonomous cars require sensors, cameras, actuators, microprocessors (along with very complex algorithms). Automobile control systems can accomplish essential tasks by sensing information from cameras and ultrasonics.

Consider an autonomous vehicle approaching a set of red-lighting traffic signals.

- The vehicle's control system must first recognize the road sign before consulting the database to determine the appropriate action.
- The CPU must instruct the actuators to apply the brakes and put the gear in "park" since the traffic light is red.
- The light must be continuously watched until it turns green.
- After that, the CPU will again tell the actuators to engage first gear, let go of the brakes, and open the throttle (accelerator).

Advantages of an autonomous car, bus, or van:

- safer due to the removal of human error
- due to the more efficient operation of vehicles, it is better for the environment
- reduced traffic congestion
- increased lane capacity
- reduced travel times
- stress-free parking for motorists

Disadvantages:

- very high installation prices
- driver and passenger reluctance of the new technology
- reduction in taxi requirements could lead to unemployment
- maintenance of the sensors and cameras is crucial
- the ever-present fear of hacking into the vehicle's control system

Advantages of an autonomous train:

- improved punctuality
- reduced running costs due to fewer staff
- no human error
- minimized energy consumption
- possible to increase the frequency of trains as the possibility of delays is removed
- more straightforward to update changes in train schedules

Disadvantages:

- fear of the system being hacked into
- initial instalment costs are very high
- ensuring passenger behaviour is vital, especially during rush hours.
- human reluctance to new technology
- without drivers, CCTV monitoring will be continuously required

Advantages of autonomous aeroplanes:

- improvement in passenger comfort
- reduced running costs, fewer staff
- as most accidents are due to pilot-induced errors, safety is improved
- improved aerodynamics as an outcome of the removal of the cockpit

Disadvantages:

- security aspects due to the absence of pilots
- emergencies may be challenging to deal with
- hacking into the system
- passenger reluctance
- software glitches can be catastrophic

5.2. Potential Health Problems related to the Prolonged use of IT Equipment

Long-term exposure to computing devices may affect user well-being.

Mentioned below are some of the health issues, accompanied by their causes and prevention tactics:

1. Repetitive strain injury (RSI): A condition affecting the muscles and nerves

Cause: repetitive movements and overuse of muscles, such as wrists

Minimizing health risks: regular breaks, ergonomic equipment, correct typing techniques.

2. Back and neck strain: Back pain and other related issues.

Cause: due to prolonged use of monitors

Minimizing health risks: use adjustable chairs, footrests, and tiltable screens.

3. Eyestrain: strain and fatigue, unwanted harm to vision.

Cause: due to bad lighting and prolonged screen usage.

Minimizing health risks: use LCDs instead of CRTs, take regular breaks, use anti-glare screens, and do regular eye testing.

4. Headaches: pain or discomfort in the head or face area. Cause: incorrect lighting, screen reflections, flickering screens, etc.

Minimizing health risks: use anti-glare screens, take regular breaks, regular eye-testing.

5. Ozone irritation: inflammation and irritation of the tissues lining human airways

Cause: inhalation of ozone released by laser printers in an office.

Minimizing health risks: proper ventilation, laser printers should be housed in a separate room, replace laser printers with inkjet printers, if possible.

6. ICT Applications

6.1. Communication

Newsletters and posters

- Paper-based communication is used to inform people about their interests
- Schools use these to inform parents about events/dates
- **Advantages**
 - Released regularly
 - The recipients have a permanent copy
- **Disadvantages**
 - Requires distribution
 - There are no special effects, sound/video/animation
 - There are printing costs, paper/ink
 - The targeted audience may or may not receive the information

Websites

- Collection of webpages, text, graphics, video, and sound
- Hosted on a web server on the internet
- Need to write code or use a web authoring application
- Hyperlinks to other pages can be added
- Interactive websites require programming knowledge
- Can use a camera, scanner, and microphone to input data
- Usually, hire space from the web hosting company
- **Advantages**
 - Ability to add sound/video/animation
 - Links to other websites/hyperlinks
 - The use of hot spots
 - Buttons to navigate/move around the website
 - Hit counters to see who has visited the websites
 - worldwide advertising capability
- **Disadvantages**
 - Can be hacked and modified, or viruses introduced
 - Need for a computer and internet connection
 - Lack of portability compared with the paper-based system
 - Need to maintain the website once it is set up

Multimedia Presentations

- Uses a mixture of media to present information: animations, video, sound, transitions, hyperlinks
- Produced using software packages
- Used with a projector so a large audience can view
- **Advantages**
 - Use of sound and animation/video effects
 - Interactive/hyperlinks built into presentations
 - More likely to hold the audience's attention
- **Disadvantages**
 - Need for special equipment – expensive
 - It may require internet access
 - Distracts the audience from the sole content of the presentation
 - It is very easy to make a presentation with too many features

Media streaming

- Real-time transition of audio and video files over the internet
- allows users to access content without downloading it to their devices
- popular services include Spotify, YouTube, and social media websites
- uses buffering, which makes sure the video plays back smoothly without freezing. While the buffer receives data packets, it sends previously received ones to the playback device so that there are no gaps in the played data
- **Advantages**
 - Users can access any information at any time and from any location
 - Offers an extensive library of content
 - Compared to traditional cable or satellite TV subscriptions, media streaming can be more cost-effective
- **Disadvantages**
 - Heavily relies on a stable and high-speed internet connection.
 - Not all content is available on every streaming platform due to licensing agreements and exclusivity deals.
 - You don't own the media when streaming media, so if the streaming service removes a movie or a TV show from its library, it may no longer be accessible to you.

ePublications

- digital versions of printed materials, such as eBooks, eMagazines, and eNewspapers.
- It can be read on electronic devices.
- **Advantages**
 - aid portability
 - they are often more affordable than paperback books.
 - Offer interactive elements that enhance the reading experience.
- **Disadvantages**
 - reading from an electronic device for a prolonged time can cause eyestrain
 - ePublications lack the tactile experience and physical presence that some readers enjoy
 - compatibility issues can arise if the ePublications is in a format that is not supported by the reader's device or software

Mobile Communication

Mobile devices support many forms of communication, such as:

- 1. Short message service (SMS) messaging:** permits extremely quick communication with another person via typing on a keyboard (a mobile phone or tablet's keyboard is frequently virtual). Its benefit is that the recipient can get the text whenever they choose without being available.
- 2. Phone calls:** Making calls while on the go is among the most fundamental applications of a mobile phone. Mobile phones are the perfect method to stay in correspondence anywhere there is a network signal because they are compact and have an independent battery.
- 3. Voice over Internet Protocol (VoIP):** a communication technique for Internet users. VoIP transforms sound captured by the built-in mic of the cell phone into individual data packets that may be transmitted via the internet to their intended recipient.
- 4. Video calls:** enables real-time video conversing between multiple participants with a camera-enabled device. Uses an internet connection or cellular data. Software that may be used for video calling includes FaceTime, Skype, and Zoom.

5. Accessing the Internet: Another helpful feature is accessing the net from a mobile device. Any mobile device with a wireless broadband connection or a mobile phone network can link to the internet.

6.2. Modelling Applications

Advantages of using models:

- using models is less expensive than having to build the real thing
- safer to use a computer model
- allows you to try out various different scenarios in advance
- nearly impossible to try out some tasks in advance in real life due to high risk
- faster to use a computer model than to do the real thing

Disadvantages of using models:

- a model can't be completely reliant as the output is entirely based on the input
- frequently, computer modelling can be a very costly option
- human reluctance is a common problem in this technology

Some of the applications of computer modelling include:

- 1. Personal finance:** Computer modelling involves using mathematical algorithms and data analysis to simulate various financial scenarios, such as investment strategies, retirement planning, and risk assessment, aiding individuals in making informed decisions and optimizing their financial goals.
- 2. Bridge and building design:** Computer modelling is crucial in bridge and building design. It allows engineers to simulate and analyze structural behaviour, assess load capacities, and predict the response to external forces. It aids in optimizing designs, ensuring structural integrity, and minimizing potential risks before construction begins.
- 3. Flood water management:** Computer modelling plays a vital role in flood water management by simulating water flow behaviour, predicting flood extents, and assessing potential flood risks. It helps design and optimise flood mitigation measures, such as levees and floodplain zoning, allowing authorities to make informed decisions, develop effective emergency response plans, and minimize the impact of flooding on communities.

4. Traffic management: Computer modelling simulates and analyses traffic flow, predicts congestion patterns, and optimises traffic control strategies. It aids in designing efficient road networks, optimizing signal timings, and evaluating the impact of transportation infrastructure projects. This enables authorities to make informed decisions, alleviate congestion, and improve overall traffic efficiency for better urban mobility.

5. Weather forecasting: Computer modelling plays a pivotal role in weather forecasting by simulating the Earth's atmosphere, oceanic conditions, and other environmental factors. These models use complex algorithms to predict weather patterns, including temperature, precipitation, wind speed, and storm systems. By assimilating real-time data, computer models provide forecasts that aid meteorologists in predicting weather conditions, issuing warnings, and helping society prepare for potential hazards.

- **Advantages of using computer modelling rather than humans:**

- It can provide more precise and accurate results than human-based methods, minimizing errors and increasing reliability.
- Can analyze large amounts of data and perform complex calculations faster than humans
- It can be reused and updated easily, reducing the need for repetitive manual analysis and potentially lowering costs in the long run.

- **Disadvantages of using computer modelling rather than humans:**

- It may overlook nuanced factors or intangible elements that humans can consider, leading to potential gaps or inaccuracies in the analysis.
- Based on assumptions and simplifications, introducing a level of uncertainty.
- Their programmed algorithms and data inputs bind models. They may struggle to adapt to unforeseen circumstances or rapidly changing conditions that humans can more readily navigate and respond to.

6.3. Computer-controlled Systems

6.4. School Management Systems

Computer-controlled School Management Systems:

Comprehensive software applications that automate administrative tasks, such as attendance tracking, grading, scheduling, and student information management, improving educational institutions' efficiency, accuracy, and organization.

6.5. Booking Systems

These web-based platforms and applications allow users to reserve and purchase tickets or services for various events and industries. Some of the applications for online bookings include:

1. Travel industry: Booking flights, hotels, and holiday packages provides a convenient platform for travellers to plan and book their trips.

2. Concerts: Reserving tickets for live music events allows music fans to secure their spot at popular concerts.

3. Cinemas: Booking movie tickets in advance enables cinema-goers to reserve seats and avoid queues.

4. Sporting events: Purchasing tickets for sports matches and competitions offers sports enthusiasts an easy way to attend their favourite events.

• **Advantages:**

- convenience and accessibility
- instant confirmation and ticketing
- ability to compare prices and options
- promotions and personalized offers
- faster to change/update
- automated reminders via email/text
- repeated bookings can be easily made
- cost-saving as there are fewer wages due to reduced staff requirements

• **Disadvantages:**

- potential for technical issues
- possible security and privacy concerns
- transaction and booking fees
- impersonal customer service
- dependent on a stable internet connection
- can lead to unemployment

6.6. Banking Applications

- Online banking systems depend on the ability to update files instantly to avoid double scheduling, which might occur if the system reaction time is slow.
- The use of computer technology has revolutionized how we do our banking transactions, for example:
 - Internet banking
 - The use of automated teller machines (ATMs)
 - Chip and PIN technology

Automated Teller Machines (ATMs)

Automated teller machines (ATMs) are places where customers can get cash (or carry out certain other banking activities, such as ordering a statement) using their credit or debit card.

Sequence at ATM	What goes on behind the scenes
Customer puts card into ATM	Contact is made with bank's computer
PIN is entered using the keypad	PIN is checked to see if it is correct Card is checked to see if it is valid The transaction is closed if the card is stolen or the number of PIN attempts allowed is exceeded.
Several options are given: change PIN, pay in cheques, pay a bill, see balance, get money	
The customer selects the cash option & several cash options are shown	
The customer accepts one of the options or types in a different amount	The customer's account is accessed to see if they have sufficient funds, it is checked to see if they are withdrawing more than their daily limit. If the limit is not exceeded and all other checks are OK, then the transaction is authorized, and the machine then counts out the cash
The customer is asked if they want a receipt	
The card is returned	
Money is dispensed	Customer's account is updated

- **Advantages:**

- possible to withdraw at any time of the day
- offer many banking services without having to go to the bank
- possible to access an account from anywhere in the world
- usually provides quicker service than waiting in a queue at a bank

- **Disadvantages:**

- often in places where theft can take place at night
- potential for shoulder surfing
- some banks charge customers for using ATMs
- cash withdrawal limits are often imposed on people

Electronic Funds Transfer (EFT):

It is possible to send money transfer instructions directly to a bank's computer system via electronic funds transfer (EFT) technology. The system depends on electronic money transfers between accounts; no cash is moved. The computer system automatically moves the requested amount from one account to another when it receives an EFT command.

- **Advantages:**

- very secure payment method
- very quick payment method
- less expensive than cheques
- the customer has the right to dispute an EFT payment for up to 60 days

- **Disadvantages:**

- the bank transaction can't be reversed without full dispute investigations
- customer needs to have funds available immediately
- cannot guarantee the recipient's identity

Credit/debit card transactions

Several credit/debit cards come with a magnetic stripe and a chip; the chip houses essential data like the PIN. This technique is intended to increase security because it is superior to a signature. A chip and PIN card to make purchases is an example of an electronic funds transfer (EFT).

- **Advantages of credit cards:**

- customer protection if ordered goods don't arrive
- internationally accepted payment method
- interest-free loan if money is paid back within the agreed time period
- can make purchases online

- **Disadvantages of credit cards:**

- can be charged high interest rates
- annual fees often apply
- easy to end up with credit damage
- security risks in online transactions

- **Advantages of debit cards:**

- money comes from the user's current account, there is no interest
- safer than carrying cash
- can make online purchases

- **Disadvantages of debit cards:**

- less customer protection if goods don't arrive
- no credit allowed; funds are needed at the time of purchase
- security risks in online transactions

Cheques

Individuals and organizations use cheques as a form of payment. When issuing a cheque, the payer writes the recipient's name, the payment amount, and the date on the cheque. The recipient then deposits or presents the cheque to their bank for processing. The payer's bank verifies the fund's availability, and upon clearance, the specified amount is transferred from the payer's account to the recipient's account, completing the transaction.

- **Advantages:**

- more convenient and safer than cash
- can be post-dated
- can be traced if they are lost

- **Disadvantages:**

- aren't legal tender and can be refused
- slow method of payment
- easier for fraudsters than other methods
- relatively expensive payment method

Internet Banking

Enable online access to banking services via a secure website or app, allowing for transfers, bill payments, account management, and more.

- **Advantages:**
 - convenience and availability
 - easy account management
 - branch visiting won't be a requirement
 - interest rates may be better
 - more accessible to shop around for the best account
- **Disadvantages:**
 - security of transactions
 - requires a reliable internet connection
 - More risk of fraud
 - Easier to make errors
 - Physical cash can't be deposited/withdrawn

6.7. Computers in Medicine

Information Systems in Medicine

- **Patient records:** Healthcare professionals maintain databases to communicate information between them and pharmacists (for instance, to guarantee no medications are administered that interact dangerously with one another).
- **Pharmacy records:** Pharmacy records maintain a comprehensive record of patient prescriptions. This includes details like the prescribed medication, dosage, quantity dispensed, prescribing physician's information, and the date of dispensing. These records help track medication usage and can be used to verify prescription accuracy and detect potential drug interactions or allergies.

3D Printers

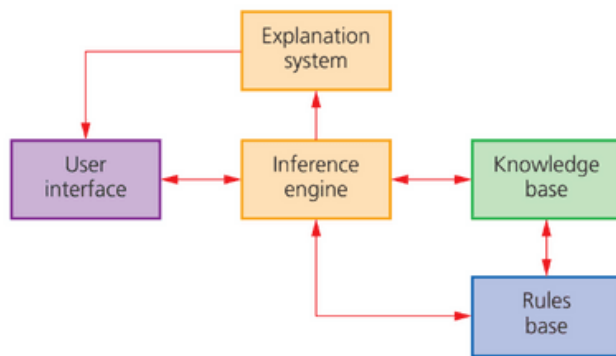
- Using 3D printers in medicine:
 - **Prosthetics:** 3D printers print out artificial body parts such as false teeth, artificial limbs, hearing aids, etc. This is a less expensive method of replacing body parts.
 - **Tissue engineering:** it is the field of combining cells, biomaterials, and engineering principles to create functional tissues or organs, aiming to repair or replace damaged or diseased tissue in the human body.
 - **Artificial blood vessels** are synthetic structures designed to mimic the function of natural blood vessels, facilitating the flow of blood and nutrients throughout the body to support tissue repair and regeneration.
 - **Customized medicines** are personalized drug formulations tailored to individual patients' specific needs. They utilize advanced technology and precise measurements to create medications with accurate dosages and unique compositions, optimizing treatment outcomes.

6.8. Expert Systems

It is an AI-based computer program that emulates the decision-making capabilities of human experts. It uses knowledge and rules to provide accurate advice or solutions in a specific domain.

Examples include:

- Diagnostics
- Mineral prospecting
- Tax and financial calculations
- Strategy games
- Identification of plants, animals and chemical compounds
- Route scheduling for delivery vehicles



Components of an Expert System

1. User Interface

- This is the only thing that the end user sees
- Allows the user to interact with the system
- Often requires training to operate effectively

2. Explanation system

- Informs the user of the reasoning behind the expert system's conclusions
- It will supply a conclusion and any suggested actions to take
- It will also give the percentage probability of the accuracy of its conclusions

3. Inference engine

- The main processing element of the system
- It acts like a search engine examining the knowledge base
- Responsible for gathering information
- This is the problem-solving part of the system
- Attempts to use information gathered from the user to find a matching object

4. Knowledge base

- It is a repository of facts
- stores all the knowledge about an area of expertise
- a collection of objects and their attributes

5. Rules base

- The rules base is a set of inference rules.
- Used by the inference engine to draw conclusions
- They follow logical thinking

How an expert system is used to produce possible solutions

Below is an example of how an expert system works to diagnose a medical issue:

- The interactive screen asks questions for the doctor to answer using a keyboard or a touch screen.
- The inference engine compares the symptoms with the knowledge base, using the rule base to find matches.
- The system suggests the possible illness with a probability of each, cures, and recommendations on the next step.
- The explanation system will explain how that particular diagnosis was suggested.

6.9. Computers in the Retail Industry

Point of sale (POS) terminals: Computerized systems used at checkout counters to handle purchases and oversee stock. It is extensively used in retail stores to process sales transactions. They enable quick and secure payment processing through various methods, including cash, credit/debit cards, mobile payments, and digital wallets. POS terminals calculate totals, generate itemized receipts, update inventory, and provide real-time sales data for effective business management.

- Some features include:
 - update stock files immediately
 - track inventory levels in real-time
 - prevent stock discrepancies and ensure accurate records
 - monitor inventory levels and reorder when stock is lower than a predefined value
 - streamline supply chain management and minimize stockouts

Electronic funds transfer at Point of sale (EFTPOS)

terminals: Devices for processing electronic payments; they allow customers to make payments using debit or credit cards by securely transferring funds from their bank accounts. EFTPOS terminals authenticate and authorize transactions in real-time, providing convenience and security for customers and businesses during retail purchases.

The process of checking credit and debit cards at a supermarket EFTPOS is much the same as was described for paying a restaurant bill in Section 6.6.

Some functions of EFTPOS include:

- Use of chip and PIN cards:
 - Enhance security with two-factor authentication
 - Require customers to enter a personal identification number (PIN)
- Use of contactless cards:
 - Allow for faster transactions
 - Enable customers to tap their card on the terminal
- Use of Near Field Communication (NFC):
 - Facilitate payments through smartphones and other devices
 - Increase convenience for customers
- Communication between supermarket computers and bank computers:
 - Share transaction details securely
 - Enable instant payment processing and verification

Internet Shopping

Characteristics of Internet Shopping:

- Online stores accessible through web browsers
- A wide variety of products and services are available
- Convenient and often open 24/7

Advantages (To customer):

- access to the global market
- comparison between different products effortlessly
- can shop from anywhere in the world
- able to avoid queues and busy stores

Advantages (To business):

- can target prices and services based on buying data
- can update stock availability and prices more quickly than a physical store
- cheaper to publicize special offers
- international customer base
- increased profits due to lower staff

Disadvantages (To customer):

- security concerns
- can't correctly examine products before purchase
- occasionally, products may take weeks before being delivered
- additional shipping and handling costs
- lack of face-to-face interaction with staff

Disadvantages (To business):

- increased competition
- digital fraud and security concerns
- technical issues and downtime
- costs of delivery and return
- fake negative reviews can lead to a lousy company reputation

6.10. Recognition Systems

1. Optical Mark recognition (OMR) media in schools:

- **School registers:** Paper-based registers are fed into OMR to be scanned and stored in a database.
- **Multiple-choice examination papers:** The position of a mark is stored in a computer's memory after being read by the OMR, a device using a template that maps out the X-Y coordinates of each tablet (pen/pencil mark).
- Used at POS terminals for scanning and reading the information stored in barcodes.
- Many digital devices have OMR scanners, which may be used to scan QR codes.
- **Advantages:**
 - very fast way of inputting the results of a survey
 - more accurate than keying in data
 - more accurate than OCR methods
- **Disadvantages:**
 - designing the forms is a very complex job
 - there can be problems if they haven't been filled correctly
 - often only work with black pens or pencils

2. Optical Character Recognition (OCR)

3. RFID in tracking stock:

4. Near Field Communication (NFC):

- Enables short-range wireless communication between devices.
- Allows payment using a smartphone.
- **Advantages:**
 - Convenient and secure method of payment
 - allows for contactless transactions
- **Disadvantages:**
 - Limited range
 - compatibility issues with some devices

5. Biometric recognition:

- Usually refers to automated technologies for authenticating and verifying human body characteristics such as face, iris, retina, finger, thumb, hand and voice.
- **Advantages:**
 - very high accuracy
 - very easy to use
 - very fast verification time
 - non-intrusive method
 - relatively inexpensive technology
- **Disadvantages:**
 - it can make mistakes if the skin is dirty or damaged
 - very expensive to install and set up
 - uses a lot of memory for the data to be stored
 - a person's voice can be quickly recorded and used for unauthorized access
 - an illness, such as a cold, can change a person's voice, making absolute identification difficult or impossible

6.11. Satellite Systems

Global Positioning Systems (GPS)

- Used to determine the exact location of several modes of transport
- Cars usually refer to GPS as satellite navigation systems
- Satellites surrounding the Earth transmit signals to the surface
- Computers installed in the mode of transport receive and interpret these signals
- Knowing their position on the Earth depends on very accurate timing – atomic clocks are used in the satellites, which are accurate to within a fraction of a second per day
- Each satellite transmits data indicating its position & time
- The computer on board the mode of transport calculates its exact position based on the information from at least three satellites

Satellite Navigation (satnav):

- Used to determine the exact location of a car.
- The computers onboard can be used to show directions to a destination.

Advantages:

- Better focus as there isn't a need to constantly check paper maps.
- Reduces fines by warning drivers about upcoming speed changes.
- The system shows an Estimated Time of Arrival (ETA).
- It is possible to program in the fastest route to avoid towns.
- The system can also give helpful information such as the location of petrol stations.

Disadvantages:

- If the maps are not updated, they can give incorrect instructions.
- Road closures due to accidents or roadworks can cause problems.
- The loss of satellite signals can cause problems.
- The system will give incorrect information if an incorrect start-point or end-point is keyed in.

Geographic Information Systems (GIS)

- Used to capture, manage, analyze, and display geographically referenced information.
- Use to determine the distance between two places.
- Used to find the nearest petrol station or restaurant, etc.
- To protect animal and plant life in certain vulnerable places.
- It can be used in geography, science, or engineering lessons.

Advantages:

- Allows geographical and thematic data of any kind to be combined to show how they are connected to each other.
- It allows the handling and exploration of vast amounts of data.
- It allows data to be integrated from a wide range of very different sources.

Disadvantages:

- The learning curve on GIS software can be very long.
- GIS software is very expensive.
- GIS requires enormous amounts of data to be input.
- It isn't easy to make GIS programs that are both fast and user-friendly.

Media Communication Systems

- Using satellite signals for communication.
- Used by media companies when sending stories/videos/pictures from remote locations.

Advantages:

- They have good global coverage.
- They are cheaper, faster, and safer than laying cables in difficult or treacherous terrain.
- They have very high bandwidth.
- It is relatively easy to expand the network.
- Security in satellite transmission is very good because data is coded, and the receiver requires decoding equipment.
- During emergency situations, it is relatively easy to move stations on the ground from one place to another.
- They are well-suited for broadcasting.
- Enable mobile communication in very remote locations.

Disadvantages:

- There is a time delay in receipt of the signals.
- The signals received can be affected by bad weather.
- Sunspot activity can affect the performance of a satellite.
- They must be monitored and controlled regularly to remain in the correct orbit.

7. System's Life Cycle

7.1. Stages of Sytem's Life Cycle:

1. Analysis
2. Design
3. Development & Testing
4. Implementation
5. Documentation
6. Evaluation

Analysis of the Current System

The current system is studied using four different methodologies. These are the four techniques:

- **Observation:**
 - involves watching users interact with the system to figure out its workings
 - it is used for understanding how users interact with the current system
 - Advantages: provides first-hand, unbiased information
 - Disadvantages: can be time-consuming, may not reveal all issues
- **Interviews:**
 - direct one-to-one conversations with users on their experience with the current system
 - used to gather comprehensive information about individual users
 - Advantages: allows for in-depth exploration of issues
 - Disadvantages: relatively expensive, time-consuming, no user-anonymity, which may affect the response
- **Questionnaires:**
 - set of predetermined questions is given to the users to complete and give their opinion on the current system
 - it is majorly used in collecting data from a larger group of people
 - Advantages: allows for quantitative analysis, efficient data collection, questions can be answered quickly
 - Disadvantages: limited by predetermined questions, may suffer from low response rates, users may exaggerate answers due to anonymity
- **Examination of existing documents:**
 - reviewing system documentation, user guides, or reports
 - understanding the current system's design and any known issues
 - Advantages: provides insights into the system's history, can reveal previously unknown issues
 - Disadvantages: it may be outdated, incomplete, time-consuming, and rather expensive.

Record and Analyse Information about the Current System

Identifying key aspects of the current system

- Data inputted, processed, and outputted into the system are identified.
- Problems with the current system are identified. What could be improved?
- The requirements of the user and the potential new system are identified. What is the new system meant to do?
- Problems: issues that users face with the current system
- User requirements: what needs to be added to the new system
- Information requirements: data or information the new system must process

New System Requirements Specification:

- Once the systems analysts have completed the systems life cycle analysis stage, they should be fully aware of the current system's limitations.
- The next step will be to design a new system (normally computer-based) to resolve the problems identified by the users and the systems analyst.
- The Requirements Specification will be created, outlining the required improvements and expectations for the new system.

System Specification

Hardware and Software Selection

- It is vital to identify the suitable hardware needed for the new system
 - contemplating system requirements, compatibility, costs
 - justifying choices based on user needs and system performance
- **Hardware that needs to be considered:**
 - barcode readers,
 - scanners,
 - touch screens,
 - 3D printers,
 - monitors,
 - speakers.
- Identifying suitable software needed for the new system
 - considering functionality, compatibility, and ease of use
 - justifying choices based on user requirements and system efficiency
- **Software that needs to be considered:**
 - operating system,
 - applications software,
 - size of storage,
 - type of storage.

7.2. Design

Once the analysis has taken place and the systems analyst has some idea of the scale of the problem and what needs to be done, the next stage is to design the critical parts of the recommended system.

File/Data Structures

- Field length: number of characters allowed in a field
- Field name: an identifier for the field in the data structure
- Data type: specifies the kind of data that can be stored in a field, e.g., text, numbers, dates
- Coding of data: using codes to represent data, e.g. M for male, F for female

Input Formats

- **Data capture forms:** These are designed to collect data from users in a structured format. They come in two types: paper-based and electronic-based. Paper-based data-capturing forms must be carefully designed with headings, concise instructions, character and information fields, checkboxes, and enough writing space. Text boxes, on-screen help, drop-down menus, radio buttons, automatic validation, and control buttons for data entry are all features of computer-based forms. Consider a user-friendly layout, clear instructions, and appropriate data fields.

Output Formats

- **Screen layouts:** how information is presented to users on a screen
- **Report layouts:** how information is organized in a printed or digital report
- Consider readability, visual appeal, and efficient use of space

Validation Routines

It is a method of examining data submitted to a computer to determine if it meets specific requirements. It is a routine check that the computer does as part of its programming.

1. **Range check:** ensures data is within a specified range of values
2. **Character check:** ensures data contains only allowed characters
3. **Length check:** ensures data is of a specified length
4. **Type check:** ensures data is of the correct data type
5. **Format check:** ensures data conforms to a specific format
6. **Presence check:** ensures data is present and not left blank
7. **Check digit:** a digit added to a number to verify its accuracy

7.3. Development and Testing

- Guarantees the system's functionality before it is put into use.
- Identification and removal of errors, thus improving system reliability and performance.

Test Designs

- Test data structures, file structures, input formats, output formats, and validation routines
- Ensure all components function correctly and interact seamlessly

Test Strategies

- Test each module: verify individual components function as intended
- Test each function: ensure all features work correctly
- Test the whole system: confirm overall system performance and integration

Test Plan

- Test data: specific data used for testing purposes
- Expected outcomes: predicted results based on test data
- Actual outcomes: results obtained from testing
- Remedial action: steps taken to fix identified issues

Test Data Types

The following data types will be explained using the example of months in a year.

- **Normal data:** valid and expected data values within the range of acceptability have an expected outcome. E.g., any whole number between 1 and 12.
- **Abnormal data:** invalid or unexpected data values. This can either be:
 - Data outside the range of acceptability or
 - Data that is the wrong data type
 - In this case, examples could be...
 - any value less than 1 (i.e. 0, -6, etc.)
 - any value greater than 12 (i.e. 13, 15, etc.)
 - letters or non-numeric data (i.e. July, etc.)
 - non-integral values (i.e. 3.5, 4.2, etc.)
- **Extreme data:** values at the limits of acceptability (E.g. 1 or 12)

What is live data?

- Data that has been used with the current system
- Hence, the results are already known

7.4. Implementation

The system must then be fully implemented after it has been thoroughly tested.

We will now think more carefully about switching to the new system. Four popular techniques are utilized to transition from the old system to the new one.

Before selecting the approach best suited for a given application, the pros and cons of each must be carefully considered.

4 Methods of Implementation

1. Direct changeover:

- The old system is replaced by the new system immediately
- Used when quick implementation is necessary
- **Advantages**
 - fast implementation
 - cost-effective as only one system is in operation
- **Disadvantages**
 - High risk of failure
 - no fallback
 - users can't be trained on the new system

2. Parallel Running

- Both current and new systems run simultaneously for a period before the old system is phased out
- Used when a smooth transition with minimal risk is required
- **Advantages**
 - Lower risk
 - easy system comparison
- **Disadvantages**
 - Time-consuming
 - resource-intensive

3. Pilot Running

- The new system is implemented in a small, controlled environment before full-scale implementation
- Used when testing the new system in a real-world setting
- **Advantages**
 - Low risk as only trialled in one department/centre/branch
 - allows for fine-tuning
 - staff have time to train with the new system
 - few errors as it's fully tested
- **Disadvantages**
 - Slower implementation
 - potential inconsistencies
 - confusion as there are two systems in use
 - There is no backup for the department/center/branch using the new system

4. Phased Implementation

- The new system is implemented in stages, with each stage replacing a part of the old system
- Used when a gradual transition is preferred to minimize disruption
- **Advantages**
 - reduced risk
 - easier to manage
- **Disadvantages**
 - Takes longer
 - potential compatibility issues

7.5. Documentation

- In the life cycle of a system, documentation enables the correct recording of design, implementation, testing, and maintenance data, facilitating effective communication, troubleshooting, and potential future improvements.
- **Technical documentation:** detailed information on the system's inner workings and programming for developers and IT staff

Used to maintain, repair, and update the system with improvements

- **Purpose of the system/program:** Explanation of the system's intended function and goals
- **Limitations:** Known constraints or issues with the system
- **Program listing:** The code or scripts used in the system
- **Program language:** The programming language used to develop the system
- **Program flowcharts/algorithms:** Visual representations or descriptions of the system's logic and processes
- **System flowcharts:** Visual representations of the interactions between system components
- **Hardware & software requirements:** Necessary equipment and software to run the system
- **File structures:** Organization and layout of the system's files and data
- **List of variables:** Collection of variables used within the system, including their names and purposes
- **Input format:** Structure and format for entering data into the system
- **Output format:** Structure and format for presenting data generated by the system
- **Sample runs/test runs:** Examples of system operation, including input and expected output
- **Validation routines:** Techniques used to check and confirm the accuracy of data entered into the system

User Documentation

Instruction and guidance for end-users on how to operate the system. Used to help users effectively use the system and overcome problems

- **Purpose of the system:** Explanation of the system's intended function and goals
- **Limitations:** Known constraints or issues with the system
- **Hardware & software requirements:** Necessary equipment and software to run the system
- **Loading/running/installing software:** Instructions for setting up the system on user devices
- **Saving files:** Procedures for storing data within the system
- **Printing data:** Steps to produce hard copies of system data
- **Adding records:** Instructions for creating new entries in the system
- **Deleting/editing records:** Guidelines for modifying or removing existing entries in the system
- **Input format:** Structure and format for entering data into the system
- **Output format:** Structure and format for presenting data generated by the system
- **Sample runs:** Examples of system operation, including input and expected output
- **Error messages:** Explanations of system warnings and error notifications
- **Error handling:** Steps to resolve issues and errors within the system
- **Troubleshooting guide/helpline:** Assistance for diagnosing and addressing common problems
- **Frequently Asked Questions:** Answers to common user inquiries
- **Glossary of Terms:** Definitions of key terms and concepts related to the system

7.6. Evaluation

It measures a system's productivity, efficiency, and compliance with its goals to identify its strengths, shortcomings, and potential development areas. This assessment informs decision-making and improves overall performance over the course of a system's life cycle.

Assess the Efficiency of the Solution

- Analyse the system's efficiency in time, money, and resource use. Examine whether the system is performing at its best or if its efficiency could be increased.
 - Provide examples of specific aspects that contribute to the system's efficiency
 - Identify areas that may be consuming excessive resources or time and suggest ways to optimize them
- Questions to ask:
 - Does it operate quicker than the previous system?
 - Does it operate by reducing staff time in making bookings?
 - Does it operate by reducing staff costs?

Evaluate the Ease of Use

- Look at the solution's usability and accessibility for the target market. Check to see if the system is simple to understand and use and if users have no trouble completing their jobs.
 - Describe the user interface and how it facilitates interaction with the system
 - Mention any feedback from users regarding their experience with the system and address any issues they encountered
- Questions to ask:
 - Are all the users able to use the system and make bookings easily?
 - Are all the users able to change and cancel bookings easily?
 - Can all staff understand how to use the system with minimal training?

Determine the Suitability of the Solution

- Examine how well the implemented solution satisfies the desired outcome by contrasting it with the original task criteria.
 - Outline the initial objectives of the system and discuss how the solution addresses each one
 - Highlight any requirements that may not have been fully met and discuss possible reasons for this
- Questions to ask:
 - Is the system suitable for each of the departments?
 - Does it meet the needs of the customers?
 - Does it meet the needs of the staff?
 - Does the solution match the original requirements?

Collect and Examine User's Feedback

- Collect users' responses to the results of testing the system. Their feedback can provide insights into potential issues and improvements and help determine overall user satisfaction.
 - Summarise the testing process, including test data expected and actual outcomes.
 - Discuss users' reactions to the system, addressing any concerns or suggestions they may have

Identify Limitations and Suggest Necessary Improvements

- Based on the analysis of efficiency, ease of use, appropriateness, and user feedback, identify any limitations in the system and suggest necessary improvements
 - List the limitations and provide explanations for each one
 - Recommend specific changes or enhancements for these issues

8. Safety & Security

8.1. Physical Safety

1. Electrocution: ICT devices require **electrical power** to charge or run; the electrical device can cause electrocution, caused by the electric current moving through a body, causing fatal injuries and/or death.

There are multiple causes for electrocution, including:

- **Contact between liquid substances and electronic devices:** Keep liquids away from electrical equipment.
- **Open cables:** Ensure that cables are entirely insulated and packed, and use circuit breakers or fuses to prevent electrical overload.

2. Fire: ICT devices require electricity to charge or run; too many devices using a single socket can cause the plug socket to overload, and heat is generated by too much electricity, causing the wiring to degrade and ignite a fire.

The causes and reduction tactics for fire include:

- **Socket overload:** Ensure enough plug sockets in the room, don't plug too many devices into the same socket, and don't leave devices plugged in and unattended.
- **Overheated equipment:** Ensure that equipment is properly ventilated and not obstructed, keep flammable materials away from heat sources, regularly check equipment for signs of wear or damage, use fire extinguishers in case of emergencies, turn off or unplug devices when away from the location, do not cover any air vents on devices.

3. Trailing cables: Devices can be plugged in using cables. Cables that are protruding can cause an accident; you can trip over a cable left out in a location, and body damage can occur during a fall, for example, breaking bones, ligament damage, bruising, sprains, etc. depending on the area fell on. Trailing cables causes and prevention strategies:

- **Unorganized/insecure cables:** use cable ties to secure cables, keep cables packed correctly in, let's say, a table, therefore not coming in the way of walking paths, use wireless devices where possible, and regularly inspect cables for signs of wear or damage.

4. Heavy falling equipment: Devices have varying levels of weight, and if a device falls on you, it could cause injury; any device should be placed in a secure location, like a PC on a solid desk and not near the edge.

Causes and reduction tactics for falling equipment:

- **Improperly secured equipment:** Ensure that equipment is properly secured and stable. Regularly check the stability of locations containing devices.
- **Equipment on unstable surfaces:** Keep equipment away from edges and other potential hazards, and regularly inspect equipment and locations containing devices for signs of wear or damage.

8.2. eSafety

Data Protection

The Data Protection Act (DPA) controls personal data collection, storage and processing.

- In the UK, the European Union's General Data Protection Regulation (GDPR)
- Protects personal data, whether stored on paper or a computer system

Principles of the Data Protection Act

- Data must be processed lawfully, fairly, and transparently, with clear consent from the individual.
- Data should only be collected for specific, explicit, and legitimate purposes.
- Organizations should only collect and retain the minimum personal data necessary for their stated purpose.
- Data should be accurate and up-to-date, and reasonable steps must be taken to rectify or erase inaccurate information.
- Personal data should not be kept longer than necessary and should be securely deleted when no longer needed.
- Organizations must protect personal data against unauthorized or unlawful processing, accidental loss, destruction, or damage.

Why is data protection legislation required?

- **Protecting Individual Rights:** Data protection legislation safeguards individuals' right to privacy and control over their personal information.
- **Preventing Misuse of Personal Data:** It helps prevent unauthorized access, identity theft, fraud, and other forms of data misuse.
- **Promoting Trust:** Data protection laws build trust between individuals and organizations by ensuring their personal information is handled responsibly.
- **Encouraging Responsible Data Handling:** Legislation promotes responsible data collection, storage, and processing practices among organizations.
- **Enabling Data Subject Rights:** Legislation grants individuals rights such as access to their data, right to rectification, erasure, and objection to processing.

Personal Data

- Refers to information that can be used to identify an individual
- **Examples**
 - Personal Name
 - Address
 - Date of birth
 - A photograph in school uniform
 - Medical history
- **Threats that can be avoided by protecting personal data:**
 - Identity theft
 - Privacy breaches
 - Misuse of the information
 - Data be sold to third-party companies
 - Individuals could be held to ransom over personal data gathered
 - could be used to commit a physical crime
- **How to avoid inappropriate data disclosure:**
 - Personal data must be kept confidential and protected through privacy settings on websites such as social media or strong passwords on websites where personal data is held or used
 - Access to personal data should be limited to authorized individuals
 - Think before you post - consider what information could be gathered from your image or content
 - Check website details about the collection, storage, and use of personal data
 - Only access websites where personal data is used or viewed when on a secure, encrypted connection

eSafety

- E-safety is knowing about and using the internet safely and responsibly.
- It refers to when an individual is using the internet, email, social media, or online gaming.
- E-safety refers to the individual knowing how to protect themselves from potential dangers and threats.

The Need for eSafety

- Awareness that personal information should not be shared freely
- Awareness of how to act online and avoid falling victim creates a safe and respectful environment.
- Identify and avoid online scams, phishing attempts, and fraudulent websites that may try to trick them into sharing personal or financial information.
- Mindful of online behaviour and interactions, protecting your digital reputation, which can have long-term consequences in your personal and professional life.
- Control privacy settings on social media platforms, limiting who can access/view personal information and posts.
- Avoid encountering explicit or harmful content online, reducing the risk of exposure to inappropriate material or online predators.
- Engage in online gaming responsibly, avoid sharing personal details, and behave respectfully towards other players.
- Protecting devices from malware, viruses, and other online threats, preventing data loss, privacy breaches, or device damage.
- Develop responsible online behaviours, promoting respectful conduct while interacting with others online.
- Maintain a healthy balance between online and offline lives, reducing the risk of addiction, mental health issues, or negative impacts on relationships and self-esteem.

Safety Suggestions

8.3. Security of Data

Threats

There are multiple methods by which data can be threatened, including:

- **Hacking:** Unauthorized access to computer systems or networks to gain control, steal information, or cause damage, thus leading to identity theft, privacy breaches, and misuse of data
- **Phishing:** Deceptive emails or messages that are received from trusted sources to trick individuals into revealing personal data
- **Pharming:** Manipulation of DNS (Domain Name System) to redirect users to fraudulent websites, often to steal personal data
- **Smishing:** Phishing attacks carried out through SMS or text messages
- **Vishing:** (aka voicemail phishing) Phishing attacks carried out through voice messages to trick users into calling the telephone number contained in the message
- **Viruses and malware:** Viruses are program codes that can replicate/copy themselves to cause data loss or corruption. Malicious software designed to disrupt, damage, or gain unauthorised access to computer systems or networks
- **Card fraud:** Unauthorized use of credit or debit card information for fraudulent purposes caused by shoulder surfing, card cloning, or keylogging.

Protection of Data

Multiple techniques are implied for the protection of data, inclusive:

1. Biometrics:

- Individuals' distinctive physical or behavioural traits, such as fingerprints, faces, or irises, can be used for access control and verification. Since biometric data is hard to fake or duplicate, it offers a more secure form of identification.

2. Digital certificate:

- A digital record that attests to a website's reliability and integrity. A digital certificate is used to provide safe communication and to build confidence between parties. Identifier data, the entity's public key, and a third party's digital signature are frequently found in digital certificates.

3. Secure Socket Layer (SSL):

- A protocol that creates a secure connection between a client computer and a server. SSL ensures that information communicated between a server and client stays private and cannot be intercepted or changed by unauthorized parties. A website's identification for it is the S at the end of HTTP.

4. Encryption:

- It is creating data in a format that cannot be read without a decryption key. Data on hard drives, emails, cloud storage, and secure websites (HTTPS) are all protected by encryption. Without a decryption key, it assures that even if unauthorized people obtain data, it cannot be decoded.

5. Firewall:

- A firewall is a network security device that monitors and manages incoming and outgoing network traffic. Its goal is to separate an internal network from other networks by filtering data according to established criteria. It assists in preventing malware, unauthorized access, and other network risks.

6. Two-factor authentication:

- A security mechanism that requests two different kinds of identification from users to confirm their identity. To provide additional protection outside of just a username and password, 2FA was created. Typically, it combines something that uniquely identifies a user, like biometric data, with something the user has, like a smartphone and a token or something they know, like a password.

7. User ID and password:

- A typical authentication technique uses a password plus a secret code (user ID) to identify. To strengthen data security, user IDs and passwords restrict access to only authorized users. Using secure passwords and changing them frequently is critical to ensure security. When creating passwords, it is advised to utilize a mix of uppercase, lowercase, digits, and special characters.

9. Audience

9.1. Audience Appreciation

To express gratitude and value for the users by providing helpful and relevant information, fostering positive experiences, and contributing to their understanding and learning.

Planning ICT Solutions

- The first step to building effective ICT solutions is identifying and understanding the intended audience's needs. These needs can be functional, like processing information, or aesthetic, like a visually appealing interface.
- After identifying the needs, select the appropriate technology and tools to create a solution. This choice depends on factors like the complexity of the task, the budget available, and the technical expertise of the users.
- An essential aspect to remember while designing ICT solutions is to ensure they are user-friendly. This means they should be intuitive to use, require minimal training, and have easy-to-understand instructions.
- Additionally, ICT solutions should be accessible to all users, including those with disabilities. This could involve adding features like voice commands, larger text options, or compatibility with assistive devices.
- Once the solution is created, it is crucial to test it to ensure it functions as expected and fulfils the users' needs effectively.

Analysing Audience Requirements

- Designing an ICT solution requires an understanding of the target audience. The study should consider elements affecting the audience's capacity to use the solution, like age, technical proficiency, and expertise.
- The solution creator should know the audience's requirements for information. This could serve as a design cue for the data processing elements and the information architecture.
- How the audience utilizes and consumes the content also influences the design. For instance, the answer should be mobile-friendly if the audience accesses it mostly through mobile devices.
- Finally, the designer should consider any unique requirements of the audience, such as visual or auditory impairments. These requirements should be taken into account when designing the solution ensuring inclusivity.

9.2. Copyright

What makes Copyright Necessary?

- Copyright regulation is crucial to safeguard the rights of developers and innovators.
- It stops software piracy, which is unauthorised use, replication, or distribution.
- It guarantees developers receive compensation for their efforts, fostering additional innovation and development.

Principles of Copyright in a Computer Software

- Copyright law prohibits the unauthorized copying, distribution, or modification of software.
- It also includes the End-User License Agreement (EULA), which outlines what the software can and cannot be used for
- Violations of these principles, such as software piracy, can lead to legal consequences.

Preventing Software Copyright Violation

- Software developers employ various copyright protection strategies, such as Digital Rights Management (DRM).
- Due to DRM methods and systems, copyrighted works are subject to usage, modification, and distribution restrictions.
- Other techniques include software product activation, which needs a unique code to be fully functional.
- Given that pirated software frequently cannot receive automatic upgrades, which renders it less effective and secure over time, automatic updates may also serve as a kind of copyright protection.

10. Communication

10.1. Communication with Other ICT users Using E-mail

E-Mail

Uses:

- Email is a technique of sending and receiving messages and files via the Internet.
- It is employed in personal communication, business communications, and marketing.
- Acceptable language must be used based on the email's recipient, for example, professional when composing a work-related email.
- Employers frequently establish requirements for professional language, substance, and email frequency.
- Email security is critical to preventing sensitive data from being accessed or manipulated.
- **Netiquette** is the proper conduct and politeness when using email.
 - Don't be abusive
 - Don't send spam
 - Be clear and concise with your message
 - Remember that posts are usually public and can be read by anyone.
 - Always check your spelling and grammar.
 - Respect people's privacy and do not discuss or publish information that might embarrass somebody.
 - Forgive people's mistakes
 - Do not use CAPITAL LETTERS to highlight comments
 - Do not plagiarize
 - Do not use too many emoticons, as they might annoy your readers.
- Email groups enable mass communication to a specific group of subscribers.

Guidelines set by employers:

- It is up to companies to decide if personal emails should be permitted on their systems
- Companies may specify which company devices are allowed to be used
- There needs to be a company standard style when sending emails
- It must be made clear what email content is not permitted
- Employees should be told only to use their accounts when sending emails
- There must be clear rules regarding the confidentiality of information
- Staff need to be aware of the method and duration of storing emails
- Incoming emails should only be read by the recipient
- Company policy on how to deal with and prevent viruses must be laid out
- Monitoring of emails may be carried out, and staff must be aware that the company has the right to read all emails
- Suitable ongoing training will take place to ensure staff follow company policy at all times

Carbon Copies (Cc) and Blind Carbon Copies (Bcc)

- Carbon copies are used to send the email to multiple recipients.
- Blind carbon copies are made to send the email to multiple recipients without them acknowledging that it has been sent to other recipients.
- Forward enables users to send an already existing email to a new recipient.
- To attach files to be sent with an email, we make use of Attachments.

Spam

It is defined as any unwanted email delivered via the Internet. These can range from annoying to genuinely harmful, as they may contain viruses.

The main disadvantages are:

- wasting time
- annoying people
- using up valuable bandwidth on the internet, thus slowing it down
- may have viruses or be a part of a phishing scam
- can take up significant space in user inboxes

To minimize the spam you receive:

- use spam filters
- avoid disclosing your email address publicly
- don't click on links in spam emails or reply to them

10.2. Effective Use of the Internet

Characteristics of the Internet:

- Allows individuals from all around the world to connect and chat with one another instantaneously
- It runs on a distributed network design, which means a single central authority does not control it.
- It is mainly used for transmitting data in a variety of formats, such as text, photos, audio, and video.

Uses of the Internet:

- A vital communication tool that allows people to communicate via emails, instant messaging, and other means.
- It acts as a massive database of information on almost any subject
- The Internet has transformed business by offering a platform for online purchasing, electronic payments, and digital transactions, allowing enterprises to reach global consumers.

Advantages of the Internet:

- users have access to an incredible amount of information, empowering them to learn
- enables individuals and businesses to connect and communicate with people from different parts of the world in real-time
- the Internet has made many things easier to complete, thus providing simplicity and effectiveness

Disadvantages of the Internet:

- Raises data security and personal privacy hazards through the possibility of identity theft, data breaches, and online monitoring.
- The spread of propaganda, fake news, and misinformation due to the simplicity with which content can be created and distributed online.
- The digital divide resulting from unequal Internet access threatens to widen existing disparities.

The differences between the internet, intranet, and extranet:

- **Definition:**

- The Internet is a vast network of linked computer networks and gadgets that communicate with one another using the Internet Protocol Suite (TCP/IP).
- The intranet is a secure network that operates within an organization using internet technologies and protocols, such as TCP/IP.
- Extranets are managed private networks that can give access to third-party users and give users, such as partners, suppliers, or clients, safe access to a portion of the intranet.

- **Accessibility:**

- The Internet is open and accessible to the public, allowing users to access a wide range of information, services, and resources worldwide.
- Intranets are restricted to internal users and typically secured by firewalls and other security measures to maintain the security of critical corporate data.
- Extranet provides authorized external users only limited access, in contrast to the internet, which is public, or the intranet, which is entirely restricted. To access the extranet, these users need a secure login.

- **Purpose:**

- The Internet acts as a hub for intercultural dialogue, the sharing of knowledge, and access to a range of Internet resources, including websites, email, social media, online shopping, and more.
- An intranet's main goal is to make it easier for employees to communicate, work together, and share information.
- Extranets make it easier for external stakeholders to collaborate and communicate with a company. It enables the organization and its reliable clients or partners to share information, documents, and resources securely.

Many use the terms "Internet" and "World Wide Web" interchangeably. However, they can't be used in the same context:

- **The internet** refers to the global network of computers and other devices connected through routers and servers. However, the **World Wide Web** is a collection of websites and webpages accessed **via** the Internet.

The Functionality of the Internet

- **Internet service providers (ISP):** A company that provides internet access. Typically, a monthly fee is charged for this service. Users' accounts are created when registering with an ISP and acquiring login information such as user ID and password.
- **Uniform Resource Locator (URL):** The address of a web page on the [WWW](http://www.igcse.com). It is a text-based address that uniquely identifies the location of any resource available on the internet. The three main components are:
 - Protocol:
 - It is the communication protocol used to transfer data between the client and the server
 - E.g. HTTP, HTTPS, FTP, and others
 - Domain:
 - it is the name of the server where the resource is located
 - it can be a name or an IP address
 - Webpage/file name:
 - it is the location of the file or resource on the server
 - it can contain the name of the file or directory where the resource is located
- A URL looks like this:
 - protocol://domain/path/filename
 - E.g. <https://www.hoddereducation.co.uk/IGCSE/ICT> is a URL that consists of the HTTPS protocol, the domain name "www.hoddereducation.co.uk", the path is "IGCSE" and the filename is "ICT"
- A hyperlink is a word/phrase/image which references data that the reader can follow by clicking or tapping, usually taking you to another web page
- A web browser is a software application used to locate, retrieve, and display content on the WWW, including web pages, images, video, and other files

Use of Search Engines

There are two fundamental methods for obtaining information via the Internet. The first method is to enter the URL if you know the website's address. If you don't know where to look, the second option is to employ a search engine to locate the information you seek.

- **Advantages of using the Internet to find information**
 - information tends to be up to date because it is quicker and easier to amend
 - The Internet has vast amounts of information
 - searching for information using a search engine is fast and easy
 - people can look for information in the comfort of their own home
 - information on the internet is essentially free of charge
 - webpages may have multimedia elements, making learning more interesting
- **Disadvantages of using the Internet to find information**
 - it isn't regulated; anything can be posted
 - always the risk of accessing inappropriate websites
 - too easy to be distracted by the many distractions available on the internet
 - Some research skills are lost when using the internet, as search engines do all the work for you.

Speed of Searching

- Search engines may scan billions of online pages to locate matches to your search query in a fraction of a second.
- Your internet connection and the effectiveness of the search engine's algorithms influence the speed.

Amount of Information

- Because search engines can deliver a deluge of information, utilising particular and relevant search phrases is critical.
- Adding quotation marks for specific phrases, "+" signs for required terms, and "-" signs for omitting terms can help narrow the search.

Finding Relevant and Reliable Information

- The search engine algorithm determines the relevancy of information by considering parameters such as keyword frequency & page quality.
- Reliable information is often obtained from recognized sources such as educational, government, or well-known industry websites.

Evaluating Information Found on the Internet

- Although the internet provides much information, not all are genuine or dependable.
- Consider the source's reputation and trustworthiness when determining the information's dependability.
- Check the accuracy of information by comparing it to other reliable sources.
- Assess whether the information is skewed, keeping an eye out for views pushing a particular point of view.
- Check if the material is current, as obsolete information might be deceptive.

Internet Protocols

Protocols are rules on which the sender and recipient agree when data is exchanged between devices.

1. Hypertext transfer protocol (HTTP): when a web page is being accessed, entering http:// at the front of an address tells the web browser that 'HTTP rules' for communication are to be obeyed.

2. Hypertext transfer protocol secure (HTTPS): A secure version of HTTP that encrypts data for security.

3. File transfer protocol (FTP): network protocol used when transferring files from one computer to another over the internet. It is similar to HTTP, but the protocol specifically transfers files.

4. Secure sockets layer (SSL): a protocol that allows data to be sent and received securely over the internet.

Risks of Using the Internet

- Inappropriate and unlawful content: The internet may attract people to potentially dangerous or illegal materials.
- Data restriction: Parental, educational, and ISP restrictions can all be used to restrict access to specific information or websites.

CAIE IGCSE

ICT

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These notes have been created by Bisma Hammad for the 2023-2025 syllabus.

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