I.G.C.S.E. SECTION

INFORMATION & COMMUNICATION TECHNOLOGY 0417

Paper 1

New Topics

June 2016

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Chapter One

1.1 Hardware:

Internal Computer Hardware:

Central Processing Unit (CPU): The CPU interprets and executes the commands from the computer hardware and software. It is part of the motherboard.

A **microprocessor** is a single integrated circuit found in PCs and many household devices.

The CPU is made up of:

- a Control Unit: controls the input and output devices

- an Arithmetic and Logic Unit (ALU): carries out calculations and make logic decisions

- Immediate Access Store (RAM)

Motherboard:

The motherboard is a printed circuit board found in all computers. The motherboard allows the processor and other computer hardware to function and communicate with each other. It acts as a kind of 'hub' that other computer devices connect to. It contains several sockets and slots to connect the other components.

Video Card

Video cards are usually made up of:

- a processing unit

- memory unit (usually RAM)

- a cooling mechanism

- connections to a display unit

Sound Card

Sound cards translate digital data into analogue signals needed for speakers.

1.2 Software:

Software is a general term for the programs that control the computer system. There are two types of software: application and system.

a) Application Software: Programs that allow the user to do specific tasks. For example:

- **Apps** (short for Applications) refers to the type of software that runs on mobile phones or tablets.

b) System Software: Programs that allow the hardware to run properly and allow the user to communicate with the computer. For example:

- **Utilities** help to manage, maintain and control computer resources. Examples:
    - antivirus
    - anti-spyware
    - backup of files
    - disk repair
    - screensavers

- **Device drivers** allow hardware devices to communicate with the operating system.

- **Compiler** translates a program written in high-level language into machine code to be understood by the computer.

- **Linkers** are used to put all the modules together to form a final program.

1.3 Operating systems:

Tasks for a typical operating system:

- control the operation of the input, output and backing storage devices
- supervising the loading, running and storage of application programs
- maintaining security of the whole computer system
- maintaining a computer log (which details computer usage)
- allowing communication between the user and the computer system (user interface)

1.4 Types of Computers:

1.4.3 Tablets

Internet access is usually through Wi-Fi or 3G/4G (mobile phone) connectivity.

Features of tablets:

- high-definition, anti-glare displays
- front- and back-facing cameras
- lower weight and longer battery life than laptops
- Bluetooth connection to printers and other devices
- flash (solid state) memory and cloud storage facilities to backup and synchronise data sources

- sensors to carry out the following functions:
  - proximity sensors to detect if a device is close to the ear to block unintended touches
  - accelerometer, which detects movement and orientation of the device
  - can use speech-recognitions systems.

Phablet: A hybrid between tablet and smartphone.

Advantages of tablets compared to laptops:

1. very fast to switch on.

2. fully portable.

3. touch-screen technology means they are simple to use and don't need any other input device.

4. don't generate any heat - they use solid state technology.

5. 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 are received

Disadvantages of tablets compared to laptops:

1. They often have limited memory or storage compared to a laptop.

2. They can be expensive to run if the internet is being accessed frequently via 3G/4G mobile phone networks.

3. Typing on a touch screen can be slow and error-prone compared to a standard keyboard.

4. Transferring of files often has to be done through an 'Apps store'.

5. Laptops support more types of file format than tablets, and also run more types of software.

1.4.4 Smartphones

Internet access is either by using Wi-Fi or 3G/4G (mobile phone) connectivity.

Advantages of smart phones:

1. They are very small in size and light in weight.

2. Can use them to make phone calls as well as connect 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 hundreds of Apps – this is similar to tablets but it is an advantage over compared to laptops.

5. They have a reasonable battery life compared to laptops.

1.4.5 Smartwatches

Whatever is available on a smartphone is available on a smart watch.

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Advantages of a smartwatch over a smartphone:

1. notifications are delivered straight to the user's wrist

2. easy to use for monitoring fitness and health regimes

Disadvantages of a smartwatch over a smartphone:

1. large and bulky which can make them uncomfortable to wear

2. unattractive in design

1.5 Impact of emerging technologies:

1.5.1 Artificial intelligence (AI) biometrics:

AI biometrics uses dynamic profiling so a person doesn't have to worry about getting their finger in exactly the right place every time on the scanner. The system learns from the different alignments and is therefore still able to match the fingerprints to those stored on a database.

Computerised facial-recognition systems are confused by soft biometric changes like growing facial hair or wearing glasses. New systems use AI to learn from scanning a number of faces and pick out these soft biometric features.

1.5.2 Vision enhancement:

Low-vision enhancement systems (LVES) use video technology through a headset connected to a computers. The system allows images to be projected inside the headset in front of the eyes. This brings the objects closer for examination by the user of the system.

Night vision enhancement (NVE) amplifies infrared light and visible light so that an image can still be seen in apparent darkness. The military use this technology to carry out surveillance at night.

1.5.3 Robotics:

Drones are unmanned flying devices that are used by both military and civilians. The military have used drones in reconnaissance missions for a number of years. Civilians use include surveying the landscape in 3-D for use with GPS, investigating weather phenomena or search and rescue /fire fighting in natural disasters.

Robotic surgery allows surgeons to perform complex procedures with more precision. With this technique, surgeons use robotics equipped with a camera arm and several interactive mechanical arms.

1.5.4 Quantum cryptography:

Cryptography (encryption) is the science of making a message not understood by hackers.

Quantum cryptography is based on the use of photons (light) and their physical quantum properties to produce a virtually unbreakable cryptography system. This helps protect the security of data being transmitted over fibre-optic cables. It is based on the laws of physics rather than mathematics.

1.5.5 Computer-assisted translation (CAT):

CAT uses two tools:

- terminology databases – linguistic databases that grow and 'learn' from translations being carried out.
- translation memories – these automatically insert known translations for certain words, phrases or sentences.

While not perfect, they are certainly more accurate than existing free online translators.

1.5.6 3-D and holographic imaging:

Holography is a technology that allows 3-D images (known as holograms to be produced).

The technology involves the use of:

- a source of laser light
- interference of light
- light diffraction, and
- light intensity recording.

As a holographic image is rotated, it appears to move in the same way as the original object, thus appearing to be in three dimensions (3-D).

Holograms have the following applications:

- engineering design (CAD)
- architecture (ability to rotate design through 360 degrees)
- simulations
- cinema (special effects)

- gaming (special effects)

- advertising

- holographic televisions (expected by around 2025, these should give a full 3-D experience without the need of special glasses)

- optical computers (these will operate at speeds that are trillions of times faster than current technology computers).

1.5.7 Virtual reality:

Virtual reality is an artificial environment created by software. The user makes use of data goggles, sensor suits, data gloves or helmets to get a feeling of reality.

Virtual is used in:

- military applications (e.g. training to use a new tank)

- education (e.g. looking inside an ancient building as part of a history lesson)

- entertainment (e.g. games where gloves, goggles or helmets are worn to give realism to the scenario)

- engineering (e.g. seeing how new designs will look)

- media (e.g. special effects in films)

- scientific visualisation (e.g. looking at molecular structures in chemistry).

Chapter 2

2.1 Input devices and their uses

Driving wheel

Uses of a driving wheel:

    1. Used in video/computer games (for example, car racing games)

    2. Used in simulators (for example, car-driving simulators) to mimic actual controls.

Advantages:

    1. Easier than a keyboard or joystick to control steering movements; it is more natural

    2. The driving experience is nearer to how an actual steering wheel operates in real life.

Disadvantage:

    1. more expensive than a mouse or joystick.

    2. movements in the steering can be too sensitive, giving an unrealistic feel.

2.2 Direct data entry (DDE) Devices

Contactless card readers:

Contactless debit or credit cards allow customers to pay for items worth up to $25 without entering their PIN.

Advantages:

    1. Faster transaction

    2. Customers do not have to worry about incorrectly typing the PIN.

    3. Retailers no longer have access to the customer's credit/debit card information.

Disadvantages:

    1. They are more expensive than normal credit/debit cards.

    2. Can take money twice if the customer uses it as a chip and PIN card.

    3. Transactions are usually limited to a small maximum value.

    4. Transactions have been carried out without the card holder being aware of this while they were just standing in the payment queue.

Radio frequency identification (RFID) readers

The RFID tag is made up of two components:

- A microchip that stores and processes information

- An antenna that is used to receive and transmit data.

Uses:

    1. Livestock tracking

    2. Retail – several tags can be read at the same time, thus speeding up the checkout process.

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3. Admission passes

4. Libraries – books can be tracked in and out automatically by readers at the library entrance.

Advantages:

1. The tags can be read from a distance.

2. It is a very robust and reliable technology.

3. Very fast read rate.

4. Bidirectional data transfer.

5. Bulk detection is possible.

Disadvantages:

1. Tag collision

2. Radio waves are easy to jam or interrupt.

3. It is easy to hack into the data.

4. RFID is more expensive than barcode system.

Quick Response (QR) codes

Normal bar codes can hold up to 30 digits, QR codes can hold over 7000 digits.

Advantages:

1. There is no need for a user to write down or key in a website address.

2. QR codes can store URLs that appear in magazines, trains, buses or even business cards,

providing a very effective method of advertising.

2.3 Output Devices

IPS (In-Plane Switching)/LCD monitors:

IPS technology is the highest performance panel technology available for LCD displays. The specifications and details of IPS panel technology are considered best for high accuracy in colour, contrast, and wide viewing angles.

LCD (Liquid Crystal Diode) and LED (Light Emitting Diode) monitors:

Modern LCD monitors are backlit using LED technology. This gives the image better contrast and brightness.

LEDs have become popular because:

1. LEDs reach their maximum brightness almost immediately.

2. LEDs give a whiter light, which sharpens the image and makes the colours more vivid.

3. Monitors using LED technology are very thin.

4. LEDs last almost indefinitely.

5. LEDs consume very little power.

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3-D Printers:

3-D printers are primarily used in CAD applications. 3D printing is regarded as being possibly the next 'industrial revolution' since it will change the manufacturing methods in many industries. They are based on inkjet and laser technology and can produce solid objects which actually work. The solid object is built up layer by layer using materials such as powdered resin, powdered metal, paper or ceramic powder.

The following describes some of the features of 3D printing:

- Various types of 3D printers exist; they range from the size of a microwave oven up to the size of a small car.

- 3D printers use **addidtive** manufacturing (i.e. the object is built up layer by layer.

- **Direct 3D printing** uses inkjet technology; a print head can move left to right as in a normal printer. However, the print head can also move up and down to build up the layers of an object.

- **Binder 3D printing** is similar to direct 3D printing. However, this method uses two passes for each of the layers; the first pass sprays dry powder and then on the second pass a binder (a type of glue) is sprayed to form a solid layer.

- Newer technologies are using lasers and UV light to harden liquid polymers; this further increases the diversity of products which can be made.

Uses:

    1. prosthetic limbs made to exactly fit the recipient

    2. items to allow precision reconstructive surgery (e.g. facial reconstruction following an accident); the parts made by this technique are more precise in their design since they are made from exact scanning of the skull

    3. in aerospace, manufacturers are looking at making wings and other parts using 3D technology; the bonus will be lightweight precision parts

    4. in fashion and art – 3D printing allows new creative ideas to be developed

    5. making parts for items no longer in production, e.g. suspension parts for a vintage car.

Chapter 3

Solid state storage media:

Solid State Drives (SSD)

Solid state drives (SSD) are rapidly taking over from HDDs.

Advantages:

1. They are more reliable (no moving parts to go wrong)

2. They are lighter (which makes them suitable for laptops)

3. They have a lower power consumption.

4. They run much cooler than HDD

5. They are very thin.

6. Data access is faster than HDD.

Disadvantage:

Most solid state storage devices are rated at only 20GB write operations per day over a three-year-

Chapter 4

Network devices:

Modems

A modem (**mod**ulator **dem**odulator) is a device that converts a computer's digital signal into an analogue signal for transmission over an existing telephone line and back again.

Dial-up modems operate at transmission speeds of about 60 kilobits per second, which is extremely slow.

Modem broadband or **ADSL** (asymmetric digital subscriber line) modems operate at up to 100 Mbits/second when using fibre-optic cables and 20 Mbits/second when using copper cables.

ADSL modems allow telephone conversations and internet traffic to occur at the same time because of the of the wide bandwidth signal used.

Cable modems allow cable television providers to offer internet access as well as receiving television signals.

Internet Protocol (IP) and Media Access Control (MAC) addresses:

Each device on the internet is assigned for each internet session by the ISP a unique address known as IP address.

The IP address gives the location of a device on the internet whereas the MAC address identifies the device connected to the internet.

Accessing the Internet:

Mobile phones and tablets:

Advantages of using mobile phones:

- Very portable
- A person is more likely to have a mobile phone all times
- It is easy to use a mobile phone while on the move

Network issues and communication:

Authentication:

Some forms of authentication include:

- digital certificates

  A digital certificate is a pair of files stored on a user's computer – these are used in the security of data sent over the internet. Each pair of files is divided into a public key and a private key.

Data Protection Act (DPA):

1. Data must be fairly and lawfully processed.

2. Data can only be processed for the stated purpose.

3. Data must be adequate, relevant and not excessive.

4. Data must be accurate.

5. Data must not be kept longer than necessary.

6. Data must be processed in accordance with the data subject's rights.

7. Data must be kept secure.

8. Data must not be transferred to another country unless they also have adequate protection.

Network Communication:

Electronic faxing:

Electronic faxing makes use of computer technology and the internet.

Audio conferencing:

Audio conferencing refers to meetings held between people using audio equipment. The equipment used can be the telephone , a computer, (with built-in microphones and speakers) or an internet phone. **Phone conference** is audio conferencing done over the telephone network.

Web conferencing:

Web conferencing (webinar) uses the internet to permit conferencing to take place. Multiple computers are connected to the internet. As with video conferencing it is carried out in real time and allows the following type of meetings to take place:

- business meetings to discuss new ideas
- presentation
- online education or training

Web conferencing links into video conferencing and audio conferencing through the use of webcams and built in microphones and speakers.

Chapter 6

The effects of ICT on working patterns:

The introduction of ICT into the workplace has led to a number of changes in working patterns for staff.

Part-time working:

Staff work between 1 and 30 hours a week (for example); or someone who works fewer hours per week than full-time staff – this can be either fewer hours per day or fewer days per week.

Flexible working (flexi-time):

Flexi-time is the ability to choose the start and finish times, but they must complete a full day's work.

Job sharing:

With job sharing, a full time job is divided between two part-time workers. Both workers are doing the same job; one picks up the work where the other left off.

Compressed hours:

In compressed hours, an employee works their full hours for the week but works fewer days.

Different work patterns leads to more contented staff because:

- They can work hours that suit their lifestyle or home circumstances.
- It can allow them to avoid rush –hour commuting in the morning and evening.

Employers see advantages in these work patterns because:

- a contented workforce is more likely to stay in the job thus reducing training cost for new staff.
- flexi-time allows them to remain open for longer hours
- job sharing ensures the company has more than one person with a particular skill set
- compresses hours often lead staff to be more focused in their work
- varied work patterns give more flexibility during busy times and during staff sickness.

Chapter 7

E-safety:

E-safety refers to safety when using the internet, i.e. keeping personal data safe and applies to any of the following devices:

- mobile phones
- computer or tablet
- game console
- wireless technology

Examples of personal data include:

- name
- address
- date of birth
- medical history
- banking details.

Some personal data is often to as **sensitive personal data** and includes:

- ethnic origin
- political views
- religion
- sexual orientation
- criminal activity.

Some e-safety issues:

- don't give out any personal information to people who are unknown to you especially online.
- don't sent people photos of yourself – either online or via a mobile phone - unless a person is known to you.
- always maintain your **privacy settings** on whatever device is being used online or during communications.
- when accessing the internet make sure the websites being visited can be trusted by looking for https or the padlock sign. When using search engines, always make sure the device settings are set to 'safe search'.
- only use websites recommended by teachers and only use a learner-friendly search engine.
- only open emails from known sources.
- only email people you know.

- it is extremely important to be vigilant when using social networking sites, instant messaging or chat rooms:
    - block or report anybody who acts suspiciously or who uses inappropriate language
    - be very careful with the language used in chat rooms
    - always use nickname and never use real name
    - keep private and personal data secret
    - don't enter private chat rooms – stay public
    - never arrange to meet anyone for the first time on your own
    - always tell an adult first and meet in a public place
    - avoid misuse of images
    - always use appropriate language
    - always respect people's confidentiality

It is also important to be careful when using online gaming since it carries its own risks. Some of the known risks reported over years include:

- violence in the game itself, which can lead to violent behaviour in reality
- predators
- cyber bullying
- use of webcams
- voice-masking technology
- viruses, phishing or spyware are examples of problems associated with certain online gaming.

Security of data:

Smishing uses the SMS system of mobile phones to send out fake text messages.

Vishing uses a voice mail message to trick the user into calling the telephone number contained in the message.

Moderated and unmoderated forums

A moderated forum refers to an online discussion forum in which all the posts are checked by an administrator before they are allowed to be posted.

The internet is essentially an unmoderated forum. No one owns the internet, and it is essentially not policed. However, most social forums or networking groups on the internet have a set of rules or protocols that members are requested to follow or they will be deleted.

Additional security of data online:

Security protocol

Secure Socket Layer (SSL) is a type of protocol that allows data to be sent and received securely over the internet.

When a user logs on to a website, SSL encrypts the data. A user will know if SSL is being applied when they see https or the small padlock in the status bar.

Digital certificates

A digital certificate is a pair of files stored on a user's computer. Each pair of files is divided into:

- a public key
- a private key

When sending an email, the message is more secure by attaching a digital certificate made up of six parts:

- the sender's email address
- the name of the digital certificate owner
- a serial number
- expiry date
- public key
- digital signature of certificate authority (CA)

Operating systems and web browsers maintain lists of trusted CAs.

Cloud security

Several computer manufacturers encourage customers to store or backup their files on a medium known as the cloud. Users purchase cloud storage and can then access all their files from any device anywhere in the world.

Advantages:

- no need to carry memory sticks
- no need to pay for large storage capacity on your computer
- cloud companies ensure that your files are backed up
- the ability to synchronise (sync) files ensures they are automatically updated across all devices
- allows several users to edit and collaborate on a single file

Data security:

Companies that transfer vast amount of confidential data from their own systems to a cloud service provider are relinquishing control of their own data security.

Data loss:

There is a risk that important and irreplaceable data could be lost from cloud storage facilities.

Chapter 8

8.1 Audience appreciation

When planning and creating ICT solutions the following should be considered:

- The age of the target group
- The experience of the audience
- The expectations of the audience
- Knowledge of the audience

Research needs to be done first to find out about the target audience. This could be done by:

- Interviewing a cross section of the target group to find out how to engage the audience
- Giving out questionnaires to people in the target group to find out their background, interests, etc.
- Carrying out market research – this could involve the two techniques described above, but would involve a more sophisticated and in-depth analysis of the data received.

8.1.1 Giving a sample presentation to an audience

Language used:

- No vulgarity or use of inappropriate language since this can easily offend people.
- The use of technical terms should be reserved for experienced or technical audience.

Multimedia used:

- Use of sound, video and animation will always catch the attention of the audience but it is important not to overdo it in case the message gets hidden because of too many distractions in the presentation.
- A young audience is more likely to respond o loud music and embedded video clips.
- Complicated descriptions are often better explained using graphs and/or animations.

Length of presentation:

- Long presentations will only work if they are interesting and engage audience.
- A very young audience would quickly get bored and start to become restless.

Interactive presentation:

- Asking questions or getting the audience to 'try things is always a good strategy but always be aware that not everyone wants to take part.

Examples used:

- When using examples to illustrate ideas, remember to be understanding.

The audience may be the actual users of the ICT solution. Considerations to meet the audience requirements in this case include:

- how skilled is the workforce

- how old is the workforce

- are any of the staff disabled

8.3 Legal, moral, ethical and cultural implications

- **Legal** covers the law; whether an action is punishable by law. Example, copying software and then selling it without permission of the copyright holders.

- **Morality** governs the private and personal interactions between people and is usually determined by the person concerned. Creating fake websites is not illegal provided the person who carries out the act doesn't try to gain from their actions – it is simply an immoral act since it can cause distress o others.

- **Ethics** governs professional interactions, for example, codes of behaviour practised by a society or group of people sometimes going against an individual's own sense of morality. If somebody works for a software company and passes on some of the ideas to a rival company, this would be regarded as unethical behaviour. Unless the software passed on is part of national security, then it isn't actually illegal to do so.

- **Culture** refers to the attitudes, values and practices shared by a society or group of people. Writing software games that make fun of religion could be seen by certain people as unacceptable behaviour but some cultures would find it funny and wouldn't understand why it was seen as offensive.

Chapter 9

9.1 Communication applications:

Flyers, posters, brochures and newsletters

Steps to produce such a document:

1. open word processor, DTP or presentation application

2. create frames, boxes and/or text boxes

3. take photos if necessary using a camera

4. upload the images from the camera or from a CD/DVD, scan photos, or download photos from the internet.

5. save the photos to a file

6. import or copy and paste the photos into the document

7. edit the photos and import from a file or type any text required.

Brochures are usually printed on glossy paper.

Posters are eye-catching and usually very difficult to miss. Posters are usually placed in strategic positions to target certain people rather than the general public. Renting an advertising area is expensive. Posters are subject to weather conditions.

Newsletters are often produced by companies or clubs. They contain local information which is read by the company employees or club members. Example:

- marriages, deaths, and births of employees, club members or their families

- advertising by outside companies

- news events, such as fundraising, etc.

Cartoons:

With 3-D animation, objects are designed on a computer and a 3-D skeleton (framework or basic structure) produced. The parts of the skeleton are moved by the animator using key frames (these frames define the start point and end point to give a smooth animation effect). The difference in the appearance of the skeleton in these key frames is automatically calculated by the software and is known as **tweening** or **morphing**. The final stage is to make a realistic image by a technique known as **rendering**.

Business cards and letterheads

Many IT companies offer to produce business cards and letterheads to any design. The user connects to an appropriate website and they will be given a number of business card templates. The user chooses a template and keys in data such as:

- name of company

- contact details

- image wanted on the business card.

Advantages to a company in using corporate letterheads produced by a printing website:

- professionalism

- brand/company awareness

- advertising – the letterhead can contain many useful pieces of information to advertise the company

- helps to make the company stand out

- can make the company appear larger than it is

School management system

registration and attendance records of student

Method 1:

Issue each student an ID card containing a magnetic stripe. The student would have to sign the card and also write his unique student ID on the card.

Each morning and on leaving the school, the student swipes the ID card through a magnetic card reader.

Use of a PIN stops another student swiping in with the wrong card.

Use of GPS tracking helps in knowing the exact whereabouts of a student. This would require the addition of a chip in the ID card.

Method 2: Use of biometrics – fingerprints.

Advantages:

- Fingerprints are unique

- ID cards could easily be lost

- ID cards could be affected by magnetic fields

- It is easy to make copies of ID cards

Disadvantages:

- It would take a long time to collect the initial fingerprints for every student in the school.

- The equipment needed to take and read fingerprints is more expensive than magnetic stripe reading equipment.

- If a student cuts a finger, the fingerprint may not be identified by the system.

- There are 'invasion of privacy' issues and some parents may object to having the fingerprints of their children stored on a database.

Exam timetables, Subject timetables and teacher substitution

Many factors have to be taken into account when producing timetables for each student:

- availability of teachers

- availability of rooms for each subject

- subject clashes

- number of hours for each subject

When using software to create timetables, it is easy to try 'what it' scenarios to ensure the most efficient use of time is utilised.

Timetables can be produced to cover classes when teachers are absent.

Banking applications

Telephone banking

The customer calls the bank using a telephone. Then

- the customer keys in their account number

- they are then requested to enter a four-digit PIN or selected numbers from PIN

- the customer will then hear various options

- the customer chooses one of the options

With this system, there is no need to have a computer and it's possible to talk to an actual human being.

However, compared to internet banking, it can be much slower (there may be a long queue before you can talk to somebody) and the options can be a little more complex to navigate. But it can also be quicker if your computer isn't switched on at the time and you only want a balance enquiry.

Clearing of cheques

Banks clear cheques using a centralized clearing centre.

Suppose John uses a bank called Hodder bank and pays a cheque for $50 to a company called H&S Ltd who bank with Smith Bank.

1. The cheque is sent by the Smith Bank to a centralised clearing centre.

2. The cheque is processed by the clearing centre by first passing it through a reader/sorter machine. The machine reads:

   - the amount on the cheque

   - the code line (containing account number, sort code and cheque number).

3. All the cheques are then sorted using their sort codes (unoque, six-digit numbers), ready for sending to an exchange centre.

4. The data from the cheque which has been read is then converted into an encrypted file known as IBDE (Inter-Bank Data Exchange) file.

5. Every IDBE is 'signed' with a digital signature so that the receiving bank can be sure that the data hasn't been tampered with.

6. Smith Bank delivers the cheque to an exchange centre.

7. The exchange centre then passes the cheque back to the paying bank (Hodder Bank in this case) which then sends it to its own clearing centre.

8. At the paying bank's clearing centre, the digital signature is first checked and then the cheque is passed through their own reader/sorter machine to make sure data matches with that on the IBDE file. It also sorts the cheques into branch order (using the sort code).

9. The paying bank checks to see if John has enough money in his account, etc. Based on this information, Hodder Bank decides whether to pay John's cheque to H&S Ltd or return it unpaid to the Smith Bank.

A cheque may be returned unpaid if:
- the customer has not got enough money
- the cheque has not been signed, dated, or written correctly
- the cheque is fraudulent for some reason.

The whole process takes three working days.

Using 3-D printers in medicine:

Surgical and diagnostic aids

It is possible to print out anatomical parts using 3-D printers. These are used as an aid towards diagnosis and surgical procedures. The patient is scanned using:

- CT (computed tomography)

or

- MRI (magnetic resonance imaging)

A 3-D printer can then reproduce a solid object showing the exact internal organs of the patient. The doctor or surgeon can then show the patient exactly what is wrong and then show them what procedures are required. They also help the surgeons in planning surgical procedures.

3-D printers produce hard nylon objects which are used in certain surgical planning. Tis reduces the chance of any errors when the actual procedure is carried out.

Prosthetics

3-D printers are used to print out prosthetics (false arms, hands and legs) at a fraction of the cost compared to existing methods.

Tissue engineering

Recent advances have allowed the 3-D printing of bio-compatible materials, cells and supporting structures. 3-D bio-printing is used to produce multilayered skin tissue, bone tissue, heart/artery grafts and tracheal splints.

The procedure involves making biological materials by diffusing cells into a bio-compatible scaffold. The bio-printed tissue is then put into an incubator and the cell structure held within the scaffold grows to form actual cellular tissue.

Design of medical tools and equipment

Medical equipment/tools produced using 3-D printers are produced much faster and much cheaper than using traditional methods.

3-D printers create injection-moulding tools which allow several prototypes to be made within a short time.

Traditional methods require aluminum moulds to be made which is slow and expensive process.

Recognition systems:

Automatic Number Plate Recognition (ANPR) System

ANPR systems are used to read the number plates on cars in a number of applications including car parks to enable entry and exit to be automatically controlled by a computer system.

1. A sensor detects a vehicle and sends a signal to a microprocessor to instruct a camera to capture an image of the front of the vehicle.
2.
    i. An algorithm is used to locate and isolate the number plate from the image taken by the camera.
    ii. Each character on the number plate is then segmented.
    iii. Each character is then recognised using OCR software.
    iv. This text string is then stored on a database.
3. The car park barrier is raised and a ticket showing the date and time of entering is issued.

4. When the driver returns to the car park, the ticket is inserted into a machine which calculates the car park charges. The payment is registered on the database. If the number plate is recognised and payment has been made, the exit barrier is raised.

Monitoring and tracking systems:

Monitoring/tracking a member of the public

There are a number of reasons why a person may need to be tracked:

- the person may be an offender who is released from prison and his whereabouts is to be known at all times
- an elderly person may need to be tracked to ensure their safety
- somebody taking part in a marathon to determine their position and their time to complete the race.

An ankle monitor makes use of RFID technology by inserting a microchip into the device which is strapped to the ankle.

It sends out at timed intervals radio frequency signals. These signals contain the person's location and the other data. The signals are picked up by a device in the person's home. This unit uses either landline or mobile phone network to rely the information back to a computer in the control room. GPS monitoring is also used so that the person can be tracked outside their home.

CCTV cameras are also used to monitor people in streets and shopping malls in case of crime or aby suspect activity.

Employee call monitors

Employee call monitoring allows managers to listen in to employees' telephone calls for the following reasons:

- to improve the employees performance (e.g. at a call centre)
- allows the manager/supervisor to join in a call where necessary
- can be used as a training tool
- it allows a company who are concerned about security to monitor all calls

Types of call monitoring:

1. monitor: allows the manager to listen in on calls. The line is muted.
2. whisper: allows the manager to speak to employees to help them with a call. Only the employee can hear the manager's voice.
3. barge: allows the manager to be heard by both the employee and the other person in the call.

Satellite systems:

Global positioning satellite (GPS) systems and satellite navigation

- At least 24 satellites in operation at a given time.
- Satellites transmit signals including distance and time to the computers installed in the mode of transport.
- Computers receive and interpret these signals.
- Knowing their position on Earth depends on very accurate timing using atomic clocks.
- The computer in the mode of transport calculates its exact position based on the information from at least three satellites.
- Position of vehicle is within 1 metre.
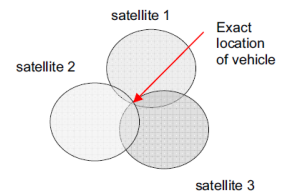
Uses:

- cars to calculate routes
- walkers to locate position on hills/mountains
- runners to calculate distance run
- farmers for tractor navigation/soil evaluation/livestock control/yield monitoring
- satellite navigation systems for ships
- tracking aircraft

Advantages:

- The driver doesn't have to consult paper maps, so it is safer.
- Can warn drivers about one way streets, street closures, etc.
- The system can estimate the time of arrival.
- The system can give useful information such as location of petrol stations.
- It is possible to program in the fastest route, route to avoid towns, etc.

Disadvantages:

- If the maps are not kept up to date, they can give incorrect instructions.
- Loss of satellites signals can cause problems.
- Road closures due to accidents or road works can cause problems.
- If an incorrect start point or end point is keyed in the system will give incorrect information.

Geographic information system (GIS)

The technology combines maps with computer graphics and databases.

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GIS enables the following:

- combination of information into easily understood maps

- performance of complex analytical calculations and then presentation of the results in the form of maps, tables and/or graphics

- Geographers, scientists and engineers are able to see the data in several different ways in order to see patterns and relationships.

Carrying out queries on GIS systems (in a method similar to internet searches) will produce the data which matches the query in the form of diagrams, maps, or set of tables.

Uses:

- Emergency services to send the closest emergency personal to a location.

- Biologists and environmentalists to protect animal life and plans in certain areas

- Teachers in their geography, science or engineering lessons.

Media communication systems

Communication media refers to methods of delivering and receiving data/information using telecommunications, e.g., fibreoptics, copper cable and Wi-Fi. The global communication method is the use of satellites. Satellites contain antennas, transponders (to allow receiving and sending of data), solar panels (for power from the sun) and propulsion (to ensure the satellite is in the correct orbit at all times). Satellites systems are used to transmit television, telephone and internet data around the world. Cables would be too costly and there is the problem of signal deterioration.

Chapter 10

10.1 Communication with other ICT users using email:

10.1.1 Constraints:

Laws

Most countries require companies and individuals to abide to the following rules when sending out emails:

- many countries require senders of emails to obtain 'opt-in' permission before emails are sent out

- a company or individual must have a clear way for recipients to 'opt-out'

- subject lines should not be false or misleading

- a valid postal address must accompany emails from companies or organisations

- companies must provide subscribers with a very clear way to unsubscribe from their listings

- companies and organisations must make their privacy policy very clear to subscribers

- many countries don't allow companies or organisations to harvest email addresses (capture lists of email addresses)

Acceptable language

List of unacceptable content to be used in emails, text messages and online forums:

- obscene images

- language that is regarded as abusive, profane *(offensive)*, inflammatory (*form of speech that is used with the intent to stir up emotions*), coercive *(to make someone do something by using force or threats)*, defamatory *(say false things in order to make people have a bad opinion of someone or something)* or blasphemous *(profane **words** and actions, especially when they are connected to something religious)*

- racist, exploitative, violent messages

- use of illegal materials in messages

Copyright

Emails are subject to copyright laws. It is important that the recipient checks before printing, copying or forwarding an email if the sender has indicated that the message is confidential.

Netiquette

Netiquette is shortened from the phrase inter**net** et**iquette**, which refers to the need to respect other users' views and display common courtesy when posting views in online discussion groups or when sending out emails.

Rules of netiquette:

1. Don't be abusive – don' threaten people or use personal violence

2. Don't send spam

3. Be clear with your message

4. Remember that posts can be read by anyone

5. Always check your spelling and grammar – have a good impression

6. Respect people's privacy

7. Forgive people's mistakes

8. Don't use CAPITAL LETTERS to highlight comments – this is seen as shouting

9. Don't plagiarise – always acknowledge quotes used in messages you write

10. Don't use too many emotions as they might annoy the reader

10.1.2 Email groups:

Email groups are used for a number of purposes:

- it is easier for a user mails if the addresses are all grouped together under a single name.

- companies and organisations can group people together for marketing purposes.

- 'spammers' can create email groups by buying addresses of people from certain companies.

- Companies use email groups to set up meetings to ensure that everybody is invited to attend.

10.2 Effective use of the Internet:

10.2.1 General Internet terms:

Hypertext transfer protocol (hhtp and https)

http is a set of rules that must be obeyed when transferring data across the internet. If http is omitted from the address, most web browsers default to http.

When some form of security (e.g. SSL or TLS) certification or encryption is used then the protocol is changed to https. https is slower than http.

Web browsers and URLs

A web browser is software that allows a user to display a web page on their computer screen. They translate the HTML from websites and show the result of the translation. Most web browsers share the following features:

- 'home' page

- ability to store a user's favourite websites/pages

- keep a history of the visited websites

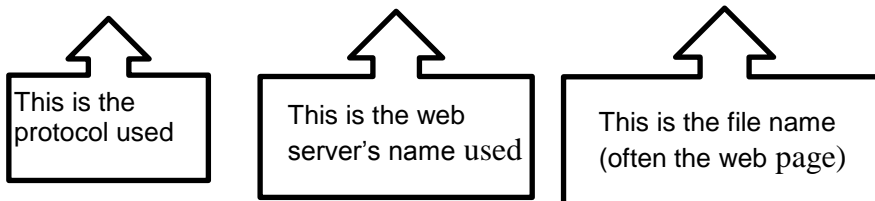- ability to go backward and forward though websites opened

- have hyperlinks

Web browsers use uniform resource locator (URLs) to access websites and retrieve file. The web browser breaks up the URL into three parts:

Protocol://website address/path/filename

Example:

http://www.hoddereducation.co.uk/igcse_ICT

| This is the protocol used | This is the web server's name used | This is the file name (often the web page) |

The web browser translates the web server name into an IP address. The HTML is returned and is shown as a correctly formatted page on the screen.

File transfer protocol (ftp)

FTP is a network protocol used when transferring files from one computer to another computer over the internet.

10.2.2 Blogs:

Microblogs are similar to blogs but are most often used on social networking sites to make short, frequent posts. The posts can be done using instant messaging, emails or other social networking vehicles (such as tweets).

b-blog –short for business blogs – is used by business to promote themselves on the internet.

10.2.3 Searching the Internet for information:

To locate the information:

1. type the URL if you know the name of the website
2. use a search engine if you don't know the name of the website

Once the information is found it can then be saved or used as follows:

- saved as a favourite and accessed when required
- by adding hyperlinks in a document, so that this web page can be accessed when required
- by using 'Print Screen' and then pasting the saved information into a word processor page

- copy and pasting the information into another document

It is important to acknowledge your sources of information to avoid plagiarism and because the information may be subject to copyright.

Why are internet searches to find relevant information not always fast?

It is possible for millions of sites to be found matching a given criteria. Unless the user narrows down their search criteria it can take a long time to find out exactly what they are looking for.

While search engine companies deny it, certain websites are also placed at the top of their lists. These websites in the list always show up first in the search results and may not contain exactly what the user is looking for. Search engines also rank the time it takes to load up pages from websites – the fastest are given priority when the results appear on the screen. So a user may not find exactly what they are looking for when using the search engine.

Why isn't it always easy to find reliable information on the internet?

Anybody is able to set up a website and write whatever they like without it having to be first verified. Unlike books, the material posted on websites doesn't have to be checked by other people to ensure it is factually correct. It is also possible for search engines to suggest websites that are completely out of date.