SECTION 2AB
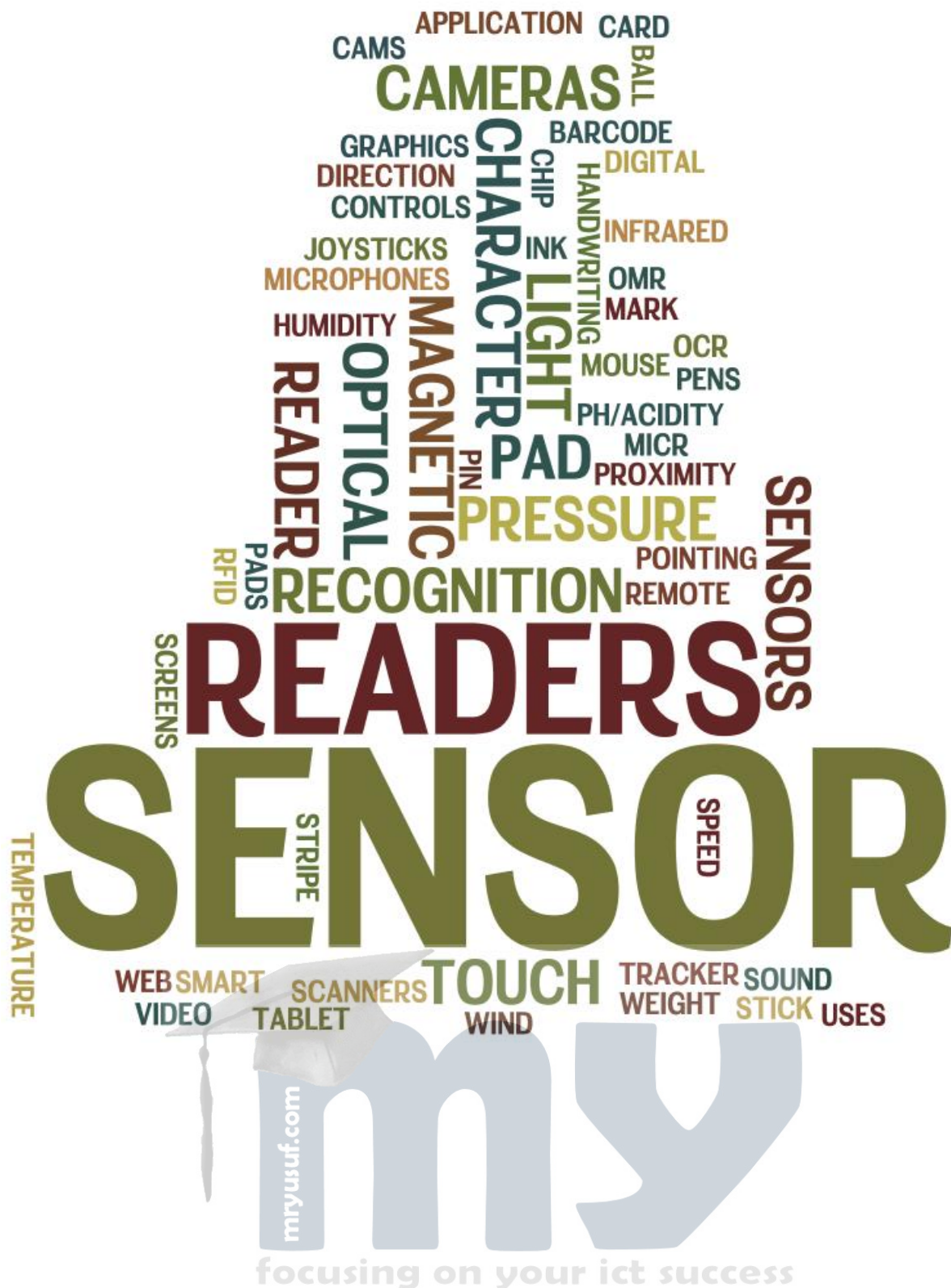
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SECTION 2AB – Input Devices

All computers need to be told what to do – there is no point having a powerful computer unless you can make it do something. In order to tell it what to do you have to have a device that lets you input data and commands. This is called an input device. There are almost as many different types of input device as there are applications that computers can be used for. Some of the more common input devices are described below. The important thing to think of when considering an input device is what it needs to input to the computer.

Types of Input devices

Keyboards

In computing, a keyboard is an input device partially modelled after the typewriter keyboard.

Physically, a keyboard is an arrangement of buttons, or keys. A keyboard typically has characters engraved or printed on the keys; in most cases, each press of a key corresponds to a single written symbol. However, to produce some symbols requires pressing and holding several keys simultaneously or in sequence; other keys do not produce any symbol, but instead affect the operation of the computer or the keyboard itself.

A majority of all keyboard keys produce letters, numbers or signs (characters) that are appropriate for the operator's language. Other keys can produce actions when pressed, and other actions are available by the simultaneous pressing of more than one action key. There are various shapes of keyboards. An ergonomic keyboard (see below right) is a computer keyboard designed with ergonomic considerations to minimize muscle strain and a host of related problems. These symptoms are discussed in section 6.

Application use

- Entering text into a word processing document.
- Applications where text has to be created rather than copied.

Advantages

- They allow accurate entry of data, in combination with a monitor to check accuracy.
- They allow quick entry of original text.
- Specialised keyboards are available to people who (for example) have their vision impaired.
- They are robust devices.
- Concept keyboards (like for the blind) are helpful to people with disabilities.

Disadvantages

- Easy to make typing errors.
- They are not quick for inputting data compared with direct data entry devices such as barcode readers, and magnetic ink character recognition (MICR) and optical mark recognition (OMR).
- Constant use can lead to 'Repetitive Strain Injury' (see Section 6).
- Must learn how to type if high input speeds are to be achieved.

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Numeric keypads

A calculator-style block of keys, usually at the right side of a keyboard, which can be used to enter numbers. In addition to keys for the digits 0 through 9 and keys for indicating addition, subtraction, multiplication, and division, a numeric keypad often includes an Enter key (sometimes the same as the **Enter** or **Return key** on the main part of the keyboard).

On Apple keyboards, the numeric keypad also includes a Clear key that usually functions like the Backspace key for deleting characters. In addition, many of the keys can serve dual purposes, such as cursor movement, scrolling, or editing tasks, depending on the status of the Num Lock key. See the illustration.

Application use

- Applications where only numeric data is to be entered.
- Inserting pin numbers for chip and pin credit/debit cards, or when using an Automated Teller Machine (ATM) to withdraw money from a bank or check a bank balance.
- Found on mobile phones.
- Used when a barcode is damaged

Advantages

- They are easy to cover up when entering a PIN.
- They are small and compact and can be carried around easily.
- Very widely used device, e.g. mobile phones, burglar alarm systems, entry systems.

Disadvantages

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

Pointing devices

A pointing device is an input interface (specifically a human interface device) that allows a user to input continuous and multi-dimensional data to a computer. CAD systems and graphical user interfaces (GUI) allow the user to control and provide data to the computer using physical gestures — point, click, and drag — for example, by moving a hand-held mouse across the surface of the physical desktop and activating switches on the mouse. Movements of the pointing device are echoed on the screen by movements of the pointer (or cursor) and other visual changes.

While the most common pointing device by far is the mouse, many more devices have been developed.

Application use

- Applications which require selection from a graphics user interface. For example: the selection of data from a predefined list or menu.

Touch pad

A touchpad (also trackpad) is a pointing device consisting of specialized surface that can translate the motion and position of a users finger to a relative position on screen. They are a common feature of laptop computers and also used as a substitute for a computer mouse where space is limited for a mouse or suitable resting surface. Touchpads vary in size but are rarely made larger than 20 square centimeters (about 3 square inches). They can also be found on personal digital assistants (PDAs) and some portable media players.

Application use

- To select options from a menu or from a set of icons.
- To position the cursor when editing text or using a design package.
- To select an object in a drawing or a piece of text to be copied, moved or deleted.

Advantages

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

Disadvantages

- Takes time to learn the techniques of using.
- They can be difficult to use for entering data other than choices on a menu, radio buttons or by means of hyperlinks.
- Some prefer using an additional mouse to help them.

Pointing stick

The pointing stick is an isometric joystick used as a pointing device. It is present on many brands of laptop. It has also been observed on computer mice and on some desktop keyboards. On a QWERTY keyboard, the stick is embedded between the 'G', 'H' and 'B' keys, and the mouse buttons are placed just below the Spacebar. The mouse buttons are usually operated by the right thumb, but some people use both left and right thumbs, for buttons 1/3 respectively. The pointing stick operates by sensing applied force (hence it is also known as an isometric joystick), by using a pair of resistive strain gauges. The velocity of the cursor depends on the applied force.

Advantages

- Some people find it easier to finely position the pointer than when using a touchpad.

Disadvantages

- Because the user has to apply pressure, it can cause hand cramps and it may lead to Repetitive Strain Injury injuries.
- A finger slipping off of the stick can lead to accidental pressing of one or more keys in immediate proximity (area).

Joysticks

A joystick is an input device consisting of a stick that pivots on a base and reports its angle or direction to the device it is controlling. Joysticks are often used to control video games, and usually have one or more push-buttons whose state can also be read by the computer. A popular variation of the joystick used on modern video game consoles is the analogue stick.

The joystick has been the principal flight control in the cockpit of many aircraft, particularly military fast jets, where centre stick or side-stick location may be employed. Joysticks are also used for controlling machines such as cranes, trucks, underwater unmanned vehicles and zero turning radius lawn mowers. Miniature finger-operated joysticks have been adopted as input devices for smaller electronic equipment such as mobile phones.

Joysticks can be used within first-person shooter games, but generally provide less accurate control than a combination of mouse and keyboard input.

Application use

- Used by a pilot to fly an airplane or flight simulator.
- Used in car driving simulators and for playing games.

Advantages

- Can be used to control objects in three dimensions.
- Provides a full range of movement.
- Great fun to use.
- With practice very good control can be achieved.

Disadvantages

- Can be difficult to control movement in WIMP environment.
- They can be difficult to use for entering data other than choices on a menu, radio buttons or by means of hyperlinks.
- Cheaper models are easily broken or damaged.
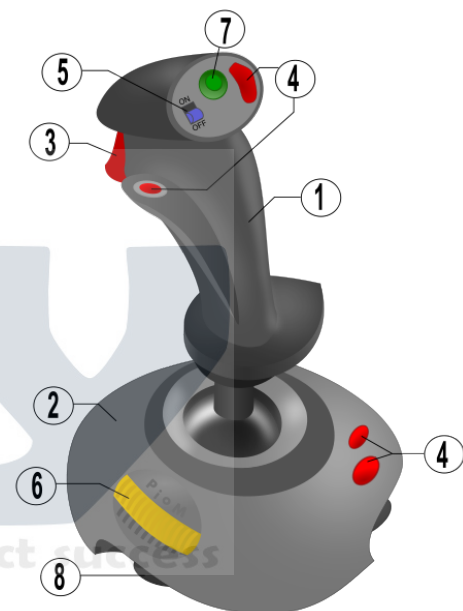
Joystick elements: 1. Stick 2. Base 3. Trigger 4. Extra buttons 5. Autofire switch 6. Throttle 7. Hat Switch (POV Hat) 8. Suction Cup

Other variants of the joystick

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Magnetic stripe readers

A magnetic stripe card is a type of card capable of storing data by modifying the magnetism of tiny iron-based magnetic particles on a band of magnetic material on the card. The magnetic stripe is read by physical contact and swiping past a reading head. Magnetic stripe cards are commonly used in credit cards, identity cards, and transportation tickets. They may also contain an RFID tag, a transponder device and/or a microchip mostly used for business premises access control or electronic payment.

Magnetic stripes following these specifications can typically be read by most point-of-sale hardware, which are simply generic general-purpose computers that can be programmed to perform specific tasks. Examples of cards adhering to these standards include ATM cards, bank cards (credit and debit cards including VISA and MasterCard), gift cards, loyalty cards, driver's licenses, telephone calling cards, membership cards, and nearly any application in which value or secure information is *not* stored on the card itself. Many video game and amusement centers now use debit card systems based on magnetic stripe cards, which might offer credit.

The information which can be found on the magnetic stripe on the back of the card is;

- credit card/account number
- sort code
- expiry date

- verification/security number
- issue number
- start date

Note: The customers PIN and their name would not be on the stripe.

Application use

- At POS terminals, ATMs and in security.
- Applications where a person needs a card with their picture to enter a secure building.

Advantages

- Helps to speed up financial transactions.
- Easy to use.

Disadvantages

- They can be forged.
- Data can be deleted by strong magnet.
- Easily stolen.

There are other types of cards called Smart cards (see next page). These are a newer generation of card containing an integrated circuit chip. The card may have metal contacts connecting the card physically to the reader, while contactless cards use a magnetic field or radio frequency (RFID) for proximity reading.

Hybrid smart cards include a magnetic stripe in addition to the chip — this is most commonly found in a payment card, so that the cards are also compatible with payment terminals that do not include a smart card reader.

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Sensors

A sensor is a device that measures a physical quantity and converts it into a signal which can be read by an observer or by an instrument. For example, a mercury thermometer converts the measured temperature into expansion and contraction of a liquid which can be read on a calibrated glass tube. Sensors are used in everyday objects such as touch-sensitive elevator buttons and lamps which dim or brighten by touching the base. There are also innumerable applications for sensors of which most people are never aware.

Advantages

- Sensors are a necessary element of any control system and can also be used for data logging.
- Data can be captured and with very little human effort.
- Many types of sensors are available.

Disadvantages

- They are limited in the type of data they can collect.
- They can misread environmental changes, e.g. a car alarm activated by a strong gust of wind.

Temperature sensor

- Automatic washing machines, automatic cookers, central heating controllers, computer-controlled greenhouses, medical diagnosis, scientific experiments and environmental monitoring.

Pressure sensor (Weight sensor / Pressure pad)

- Burglar alarms, automatic washing machines, robotics, production line control, scientific experiments and environmental monitoring.

Light sensor (or Infrared)

- Computer controlled greenhouses, burglar alarms, robotics, production line, scientific experiments and environmental monitoring.

Sound sensor

- Burglar alarm systems, robotics, production line, medical diagnosis, scientific experiments and environmental monitoring.

Humidity sensor

- Computer controlled greenhouses, automatic washing machines, scientific experiments and environmental monitoring.

Proximity sensor

- Burglar alarms, robotics, production line, scientific experiments and environmental monitoring.

Ph/Acidity sensor

- Computer controlled greenhouses, automatic washing machines production line, scientific experiments and environmental monitoring.

Wind speed & Direction sensor

- Scientific experiments and environmental monitoring.

Scanners

In computing, a scanner is a device that optically scans images, printed text, handwriting, or an object, and converts it to a digital image. Common examples found in offices are variations of the *desktop (or flatbed) scanner* where the document is placed on a glass window for scanning. Mechanically driven scanners that move the document are typically used for large-format documents, where a flatbed design would be impractical.

Application use

- Entering hard (paper) copy images into a computer.
- Can be used to scan old documents for keeping records; for example, birth, death and wedding certificates.
- They are used as barcode readers e.g. supermarkets.

Advantages

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

Disadvantages

- The original document has to be in a good condition.
- The accuracy of reproduction is limited.

Microphones

A microphone, sometimes referred to as a mike or mic, is an acoustic-to-electric transducer or sensor that converts sound (analogue) into an electrical (digital) signal. Microphones are used in many applications such as telephones, tape recorders, hearing aids, motion picture production, live and recorded audio engineering, in radio and television broadcasting and in computers for recording voice, VoIP (voice over internet protocol), and for non-acoustic purposes such as ultrasonic checking.

Application use

- Recording of voices for presentation software, used to input dictated text for use with voice recognition software.

Advantages

- Changes to sound/voice can be done in real time rather than recording it and inputting the recording.
- Ideal for disabled people who need to speak commands to a computer
- Suitable for hands-free applications

Disadvantages

- Can only be used for sound
- Can be very expensive depending on the requirements i.e. concert halls

Barcode readers

A **barcode reader** (or **barcode scanner**) is an electronic device for reading printed barcodes. Like a flatbed scanner, it consists of a light source, a lens and a photo conductor translating optical impulses into electrical ones. Additionally, nearly all barcode readers contain *decoder* circuitry analyzing the barcode's image data provided by the photo conductor and sending the barcode's content to the scanner's output port.

Types of technology: The reader types can be distinguished as follows;

Pen type readers consist of a light source and a photodiode that are placed next to each other in the tip of a pen or wand. To read a bar code, the tip of the pen moves across the bars in a steady motion. The photodiode measures the intensity of the light reflected back from the light source and generates a waveform that is used to measure the widths of the bars and spaces in the bar code.

Laser scanners work the same way as pen type readers except that they use a laser beam as the light source and typically employ either a reciprocating mirror or a rotating prism to scan the laser beam back and forth across the bar code.

CCD Readers (also referred to as **LED scanner**) use an array of hundreds of tiny light sensors lined up in a row in the head of the reader. The important difference between a CCD reader and a pen or laser scanner is that the CCD reader is measuring emitted ambient light from the bar code whereas pen or laser scanners are measuring reflected light of a specific frequency originating from the scanner itself.

Housing Types: The reader packaging can be distinguished as follows;

Handheld scanner: with a handle and typically a trigger button for switching on the light source.
Pen scanner (or **wand scanner**) : a pen-shaped scanner that is swiped.
Stationary scanner: wall- or table-mounted scanners that the barcode is passed under or beside. These are commonly found at the checkout counters of supermarkets and other retailers.
Fixed position scanner: an industrial barcode reader used to identify products during manufacture or logistics. Most often used on conveyor tracks to identify cartons or pallets which need to be routed to another process or shipping location.
PDA scanner: a PDA with a built-in barcode reader or attached barcode scanner e.g. Grabba.
Automatic reader: a back office equipment to read bar-coded documents at high speed (50,000 per hour) e.g. Multiscan MT31

Application use

- To input code numbers from products at a POS (Point of Sale) terminal, library books, membership numbers and video/CD rental shops.

Advantages

- Very fast and accurate method of data capture.
- Barcodes can be read in any direction.
- Easy to use for checkout attendants.

Disadvantages

- Relatively expensive to install.
- If the barcode is misread or damaged, it will need to be re-scanned or manually entered.
- The data can only be read by machine.

Web cams

Webcams (web cameras) are small cameras (usually, though not always, video cameras), whose images can be accessed using the World Wide Web, instant messaging, or a PC video conferencing application. The term webcam is also used to describe the low-resolution digital video cameras designed for such purposes, but which can also be used to record in a non-real-time fashion.

Web-accessible cameras involve a digital camera which uploads images to a web server, either continuously or at regular intervals. This may be achieved by a camera attached to a PC, or by dedicated hardware. Videoconferencing cameras typically take the form of a small camera connected directly to a PC. Analogue cameras are also sometimes used (often of the sort used for closed-circuit television), connected to a video capture card and then directly or indirectly to the internet.

Application use

- To input moving pictures from a fixed position (e.g. top of the monitor) into a computer.

Advantages

- Relatively cheap.
- Easy to setup.
- Some (with software) can be used as surveillance cameras.

Disadvantages

- Moving images can be output very slowly depending on speed of the internet and computer processor.
- Cannot be used independent of the computer.

Digital cameras

A digital camera is a camera that takes video or still photographs, or both, digitally by recording images on a light-sensitive sensor. Many compact digital still cameras can record sound and moving video as well as still photographs. Digital cameras can include features that are not found in film cameras, such as displaying an image on the camera's screen immediately after it is recorded, the capacity to take thousands of images on a single small memory device, the ability to record video with sound, the ability to edit images, and deletion of images allowing re-use of the storage they occupied.

Application use

- Used by professional photographers in their work and by amateur photographers for personal use. Taking photographs for input to various software's, for input to Photo printers.

Advantages

- No film or film developing needed.
- Pictures can be transferred to PC easily.
- Files created can be emailed.
- Compact and portable.

Disadvantages

- Image files can take up a lot of memory.
- Quality of output will depend on printer and paper.
- Should not be dropped (fragile).