3.2.4 – HARDWARE DEVICES

- Input methods & devices
- Output methods & devices

Learning Objectives

By the end of this topic you should:

- Know the main **characteristics** of contemporary devices - **input and output**
- Understand the **principles of operation** of input & output devices
- Explain the **need for secondary storage** within a computer system
- Know the main **characteristics and principles of operation** of contemporary **storage devices**
- Compare **capacity and speed of access** of various media and make a judgement about their suitability for different applications

Input Methods & devices

- Mouse
- Keyboard
- Bar code reader
- Scanners
  - Flatbed
  - Fingerprint
  - Retina
  - Iris
  - Optical Mark Reader
  - Optical Character Reader
- Magnetic stripe reader
- Smart card reader
- RFID (radio frequency identification) reader
- Touch-sensitive screen
- Graphics tablet
- Voice recognition
- Digital still camera

Mouse

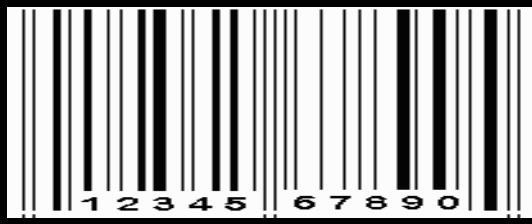
- 1964 - First prototype computer mouse, Douglas Engelbert
  - Wooden shell with 2 metal wheels; the patent describes it as "an X-Y position indicator for a display system"
  - Nicknamed "mouse" because the tail came out the end.
- Today – still detecting movement in 2 axes
- Trackpad / touchpad – position of the finger over the pad
- Wireless, optical, etc

Keyboard

- The QWERTY keyboard layout was devised and created in the early 1870s by Christopher Sholes
- The electronic components continually scan the rows of keys to detect the pressing of a key or key combination
- Identify & send key scan code to the computer
- Software in the computer interprets the scan code & converts it into ASCII / Unicode
- More detailed description

Bar code reader

- A bar code is a pattern of thin and thick bars and spaces between bars
  - Product identifier
  - Can be scanned in either direction



- A bar code reader:
  - Light source
  - Lens
  - Photoelectric detectors (photodiodes)
  - Decoder circuitry to analyse the bar code' image data & generate character codes.

Bar code reader

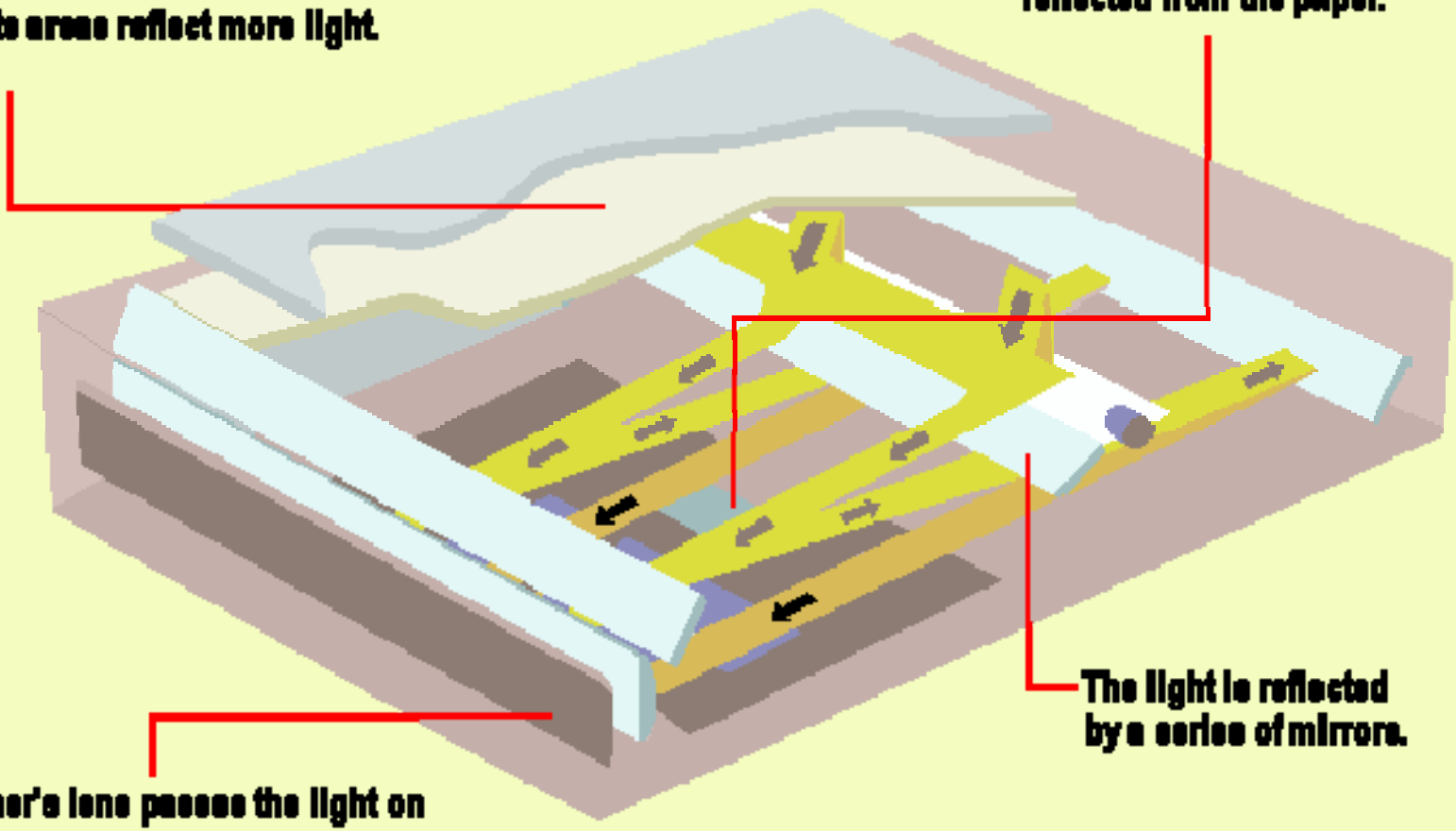
- Scanner uses the light source to illuminate the bands
- The pattern of reflection from the black & white bands is converted from optical to electrical form
- The electrical form is analysed and decoded into character form
- Used in supermarkets, libraries, warehousing, banking, insurance

Scanners

- Captures an electrical equivalent of a picture, printed text, handwriting, a solid object, etc.

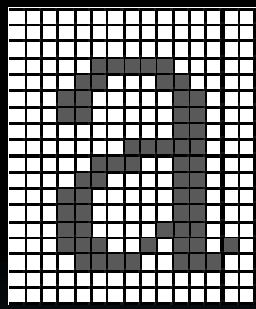
- Flat-bed scanner
  - Glass pane illuminated from beneath by the a bright light
  - An array of light-detecting sensors (with RGB filters) moves slowly with the light source along the length of the glass pane
  - Reflected light is converted into electrical signals which are then interpreted into a digitised image

Flat Bed Scanner



Scanners

- The resolution of a scanner refers to have many pixels per inch it can detect and reproduce in the final bitmap image.
- Scanners are often used with Optical Character Recognition to interpret text, and with Optical Mark Reader to interpret & record marks on a form.



- **OCR**
  - Input images of text
  - Analyse the resulting digitised images to recognise the characters (by matching sets of pixels with character templates it already knows)
  - Used in processing various forms (eg gas bills); automatic postal sorting

Scanners

- **OMR** – optically senses marks placed in predefined positions on a form
  - The form is passed under a light source
  - The intensity of the reflected light is measured and converted into an electrical equivalent (pencil marks do not reflect as much light as the background) which is then interpreted and recorded
  - Registration marks placed along the edge of the form enable the rows to be identified
  - Used in:
    - Multiple choice answer grids, lottery, customer response forms, school attendance

Magnetic stripe readers

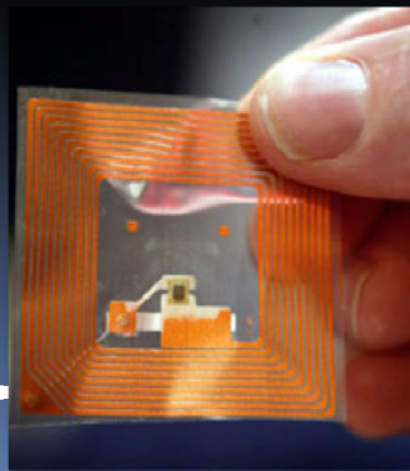
- Read info encoded magnetically in a stripe composed of magnetic particles
- Credit cards, debit cards, library cards, railway tickets, bus tickets, hotel keys
- Cards have to slowly & steady be swiped through the magnetic stripe reader to induce a current in the reader.
- Problem is that the characters are much too easy to copy. In 1996 card fraud cost the banks £97.1 million, with £13.3 million of it from fake magnetic stripe cards.

Smart card reader

- Smart cards
  - Contain a small microprocessor instead of magnetically sensitive area, as well as a small amount of ROM (storing relevant applications), RAM (used for temp data when applications are executed) and a computer bus system.
  - Can be used as electronic purse
  - Used as credit/debit cards, Oyster card, leisure cards as electronic cash.
- The reader reduces the amount of e-cash recorded on the card, and increases the amount in the shop's smart card
- The shop connects to his bank at the end of the day to upload the e-cash to its account.

RadioFrequencyID reader

- Uses radio frequencies to transmit data
- An RFID system has:
  - A transponder – located on the object to be identified
    - Has a small RF antenna & circuitry for transmitting & receiving data
    - Data capacity can be as small as 1bit – enough to transmit presence (used to protect goods in shops)
  - A reader
    - Can raise an alarm
- RFID smart cards (London Oyster card)
- Can be used as contactless security badges
- Electronic immobilisers for cars

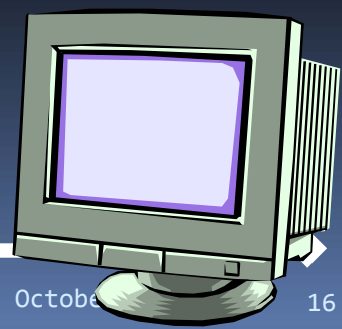


Output Methods & Devices

- VDU
  - ☞ CRT
  - ☞ Flat screen
  - ☞ Plasma screen
- Speech output
- Electronic paper
- Impact printer
- Non-impact printer
  - ☞ Inkjet printer
  - ☞ Laser printer
  - ☞ Bitmap and TrueType fonts
- Plotter

Visual Display Unit

- CRT (cathode ray tube)
  - Vacuum tube with a narrow neck and a flat rectangular base
  - The screen is coated on the inside with phosphor which emits light when struck by an electronic beam
  - The neck is surrounded by electromagnets; inside there is an electron gun.
  - The electron beam produced by the electron gun is dragged across the screen one line at a time, covering the entire screen
  - This is done many times per second



Visual Display Unit

- LCD Flat screen
  - Liquid crystal can change the polarisation state of light when an electric field is applied to them
  - LCD is a matrix of liquid crystal cells (each cell = one pixel)
- LCD with TFTs (thin film transistors)
  - Each pixel = one TFT + a capacitor + the liquid crystal
  - The transistor acts as a switch
  - The capacitor acts as a reservoir for the electrical field that changes the polarisation of the light passing through the liquid crystal
- 30% lower power consumption
- No flicker

Visual Display Unit

- Plasma screen
  - Ideal for large displays
  - Each pixel is controlled by a miniature fluorescent light
  - **plasma** = a gas made up of free-flowing **ions** (electrically charged atoms) and **electrons** (negatively charged particles).
  - When the control voltage is applied, the gas becomes plasma and releases ultraviolet light, which strikes phosphors on the front of the screen to emit visible light.

Input/Output Devices – assignment1 (part 1)

Moodle

Module 2

Hardware device folder

3.2.4 – hardware devices assignment.pdf